185th BIFAD Public Meeting (Virtual)

A Consultative Workshop on Systemic Solutions for Climate Change Adaptation and Mitigation in Agriculture, Nutrition, and Food Systems

Meeting Minutes

August 31, 2022, 10:30 AM–12:30 PM EDT

Board for International Food and Agricultural Development (BIFAD) Members in Attendance:

Laurence B. Alexander, BIFAD Chair and Chancellor of the University of Arkansas at Pine Bluff
Pamela K. Anderson, Director General Emerita, International Potato Center
Marie Boyd, Associate Professor, University of South Carolina School of Law
Rattan Lal, Distinguished Professor, The Ohio State University
Saweda Liverpool-Tasie, MSU Foundation Professor, Michigan State University
Henri G. Moore, Vice President/Head of Responsible Business, Haleon
Kathy Spahn, President and CEO of Helen Keller International

BIFAD Subcommittee on Systemic Solutions for Climate Change Adaptation and Mitigation in Agriculture, Nutrition, and Food Systems Members:

Eva (Lini) Wollenberg, BIFAD Subcommittee Chair, Research Professor, University of Vermont
Mauricio Benitez, Nature-Based Solutions and Food Systems Lead, responsAbility Investments AG
Daniela Chiriac, Senior Consultant, Climate Policy Initiative
Erin Coughlan de Perez, Research Director, Dignitas Professor, Tufts University
Juan Echanove, Associate Vice President, Food and Water Systems, CARE (Absent)
Chinenye Juliet Ejezie, Country Coordinator, Climate Smart Agriculture Youth Network
Jessica Fanzo, Bloomberg Distinguished Professor, Johns Hopkins University
Mario Herrero, Professor, Cornell Atkinson Scholar, Cornell University
Sophia Huyer, Gender and Social Inclusion Lead, International Livestock Research Institute (ILRI)
Andrew Muhammad, Professor and Blasingame Chair of Excellence, University of Tennessee
Carlijn Nouwen, Co-founder, Climate Action Platform for Africa (CAP-A)
Ishmael Sunga, Chief Executive Officer, Southern African Confederation of Agricultural Unions (SACAU) (Absent)
Angelino Viceisza, Associate Professor of Economics, Spelman College

BIFAD-commissioned Climate Change Study Coordinating Authors:

Rahel Diro, Disaster Risk Finance Associate, Tetra Tech
Edward Carr, Director and Professor, International Development, Community, and Environment, Clark University

Speakers:

Gillian Caldwell, Chief Climate Officer, U.S Agency for International Development (USAID)
Ana Maria Loboguerrero Rodriguez, Research Director of Climate Action, Alliance of Bioversity International and the International Center for Tropical Agriculture
Olaf Westermann, Senior Technical Advisor in Climate Change, Catholic Relief Services (CRS)
Sara Boettiger, Independent Advisor

Welcome and Introductions
Laurence Alexander, BIFAD Chair, University of Arkansas-Pine Bluff

BIFAD Chair, Dr. Laurence Alexander welcomed participants to the public meeting. He introduced himself and encouraged BIFAD members to introduce themselves in the ZOOM chat. Dr. Alexander acknowledged that there were registered attendees from 75 countries and from over 200 organizations.

Dr. Alexander noted that public engagement and deliberation are central to BIFAD's role in advising USAID. He invited all participants to actively engage by sharing comments and questions for panelists in the chat box and later in the meeting by joining one of the thematic breakout rooms. Dr. Alexander reminded participants that written or oral comments would be recorded for the public record and official minutes of the proceedings would be posted on USAID's BIFAD website following the event (www.usaid.gov/bifad).

Dr. Alexander explained that agriculture is both hard hit by—and also contributes significantly to—climate change. Climate change has reduced agricultural farm productivity by 21 percent globally. That is the same as losing seven years of productivity growth that would have been achieved through investments in agricultural research, development, and extension. Higher temperatures will lead to increased occurrence of pests, weeds, and diseases, and will negatively impact food safety. A changing climate poses an insurmountable threat to our global agriculture and food systems, thereby to health, food security, and peace and security. At the same time, agriculture and food systems are a major driver of climate change. They are responsible for one third of human-driven greenhouse gas emissions. Dr. Alexander explained that we cannot achieve the ambitions of the Paris Climate Agreement without the full participation of agriculture and the food system.

Further, Dr. Alexander explained that the contributions of land use to greenhouse gas emissions are significant in the low and middle income countries where USAID works. The urgency of responding to the accelerating climate change crisis is further underscored when evaluating the disproportionate impacts on women, youth, Indigenous Peoples, and other marginalized and/or underrepresented groups.

Dr. Alexander explained that when BIFAD met with USAID Administrator Samantha Power and senior USAID leadership earlier this year, she requested that BIFAD advise her on responding to systemic risks brought about by climate change in agriculture, food systems, and nutrition. As a Board, BIFAD took this call to action very seriously. Central to the Board's response was the establishment of the BIFAD Subcommittee on Systemic Solutions for Climate Change Adaptation and Mitigation in Agriculture, Nutrition, and Food Systems (subcommittee). Secondly, BIFAD commissioned a study, guided by the subcommittee, to organize transdisciplinary evidence gathering to support USAID's role in accelerating systems change and transformative climate change adaptation and mitigation approaches.

Today's workshop is intended to inform BIFAD, the subcommittee, and the author team as they begin their work.

Dr. Alexander then introduced Dr. Lini Wollenberg, Subcommittee Chair, Fellow in the Gund Institute at the University of Vermont, and Associate Scientist of the Alliance of Bioversity International and the International Center for Tropical Agriculture. He explained that Dr. Wollenberg would guide participants through the meeting and expressed appreciation for her leadership on the subcommittee and for the vision and thought leadership she and all members of the subcommittee bring to this important work.

Introducing the BIFAD Subcommittee on Systemic Solutions for Climate Change Adaptation and Mitigation in Agriculture, Nutrition, and Food Systems Members and Plan of Work

Lini Wollenberg, Subcommittee Chair, University of Vermont

Dr. Wollenberg welcomed all the participants. She explained that one of the most important objectives of this meeting is to introduce the work of the BIFAD subcommittee. The subcommittee is guided by USAID's climate strategy[1], which seeks to achieve systemic change to ensure both long-lasting and significantly large impacts. To advise USAID, BIFAD and USAID formed the subcommittee in June, 2022 and charged the 13 subcommittee members to identify, in the agriculture, food systems, and nutrition space, the following: (1) systemic solutions for climate change adaptation and mitigation and (2) solutions for innovative climate finance. The subcommittee seeks to provide BIFAD with independent evidence-based recommendations in both areas to support USAID's climate ambitions. To help generate these recommendations, the subcommittee is relying on five sources of information:

- Findings from the BIFAD-commissioned study;
- Inputs from USAID program leaders;
- Evidence submitted by subject-matter experts, including the participants of today's meeting;
- Evidence from the public, which includes the meeting participants; and
- The subcommittee members' own experience.

Dr. Wollenberg invited all the participants to share their most ambitious ideas and to challenge the subcommittee with their toughest questions. She explained that the subcommittee brings deep and diverse experience, including in crop and livestock production systems, agricultural trade and market systems, climate finance, private sector engagement, early warning and climate information systems, climate change mitigation and adaptation, gender, youth and social inclusion, behavioral change, and other topics. The subcommittee also represents diverse United States and international organizations. The members' names and affiliations were displayed on screen. Dr. Wollenberg explained that participants would also have an opportunity to meet directly with many of the members in the breakout groups.

Dr. Wollenberg outlined the meeting agenda before introducing Gillian Caldwell, USAID's Chief Climate Officer, to provide framing remarks. The agenda would include setting the context with an overview from the USAID Chief Climate Officer about USAID's Climate Strategy, followed by an introduction to the BIFAD-commissioned study by the study's coordinating authors. Next, a panel of three experts representing the research community, civil society/NG0s, and the corporate sector would provide feedback, followed by breakout groups in which participants could share their input, reflections from the BIFAD committee, and closing remarks by Drs. Alexander and Wollenberg.

Introduction and Framing Remarks Growing a whole-of-Agency approach to the Climate Crisis and the Agriculture, Nutrition, and Food System
Gillian Caldwell, Chief Climate Officer, USAID

Ms. Gillian Caldwell expressed her gratitude to BIFAD members and the subcommittee for the opportunity to share USAID's perspective on the critically important work that this workshop is going to inform. She explained that this body of work is powerful and enticing. It could have profound impacts on people's lives and their abilities to feed their families and communities, which, in the context of the global food security crisis, could not be more important. It could also improve USAID's ability to conserve vast tracts of land, and we desperately need to conserve that land to keep global carbon emissions in check and to preserve the diversity of plants, animals, and microbes that make our planet

[1] USAID Climate Strategy, 2022–2030: https://www.usaid.gov/climate/strategy

such a wonderful home. Ms. Caldwell expressed her gratitude to the USAID Administrator, Samantha Power, for asking BIFAD to address this challenge. She similarly thanked the BIFAD subcommittee for leading what she hoped would be a very vibrant dialogue about the systemic changes needed in the global food and agricultural systems to address the climate crisis, improve nutrition, and importantly, accelerate financial flows. She recognized that this work comes on top of subcommittee members' day jobs and is a public service, thanking Dr. Wollenberg for chairing the subcommittee.

Ms. Caldwell explained, from her perspective, why the subcommittee's work and their contributions today are so important and potentially influential. She explained that BIFAD and the subcommittee are giving USAID a very unusual opportunity by bringing a whole-of-agency perspective to the intersection of climate change, agriculture, and the food system, which, she emphasized, includes nutrition. Ms. Caldwell expressed her hope that staff from across USAID will voice their perspectives with candor and that stakeholders from outside USAID will speak to USAID as a whole-of-agency, because USAID is mounting a whole-of-agency response to this crisis. USAID has been connecting climate change, food systems, and agriculture across the agency. The new USAID Climate Change Strategy explicitly calls out the need to transform food systems to be more resilient, less wasteful, less environmentally destructive, and to contribute to climate change mitigation. The U.S. Government's Global Food Security Strategy[2] also elevates the interaction between the climate crisis and food security, as a cross-cutting intermediate result and addresses the urgent adaptation needs, as well as the mitigation opportunities. Yet, we really have a distance to go. What this committee is doing is so valuable, looking with breadth and rigor at where we can take bold action to drive potentially outsized impacts by looking closely at the intersection between the climate crisis and food and agriculture. This is the first step towards courageous action to have all the options in front of us, even if they might seem unusual and uncomfortable. Ms. Caldwell encouraged participants explaining that we need to take a fresh look at how we are doing things, at USAID and around the world given the scope of the challenge confronting us. She reminded participants that a third of Pakistan is underwater at this time due to completely unprecedented floods, which are directly attributable to the climate crisis. She expressed that "we have to take action".

Ms. Caldwell explained that when we talk about agricultural and food systems, it is a very big tent. Food systems include how we produce food and other agricultural goods, like cotton and palm oil, that go into food and non-food products. The system includes men and women who grow that food and the families and communities who cook and eat that food. The system includes food that is lost and wasted, which, of course, is a major driver of carbon emissions. It also includes the demand that loss in food creates to produce even more food, and the pressure this dynamic creates to clear forests for crop and livestock. The food system includes methane from cattle and flooded rice paddies and the carbon and biodiversity that we lose as agriculture expands into tropical forests. It includes what people eat, which impacts their nutrition and health, and how reliably they can grow or access food as the climate diverges further from what we have previously considered "normal". The food system includes wild foods, which provide essential micronutrients for the vulnerable communities living adjacent to forests, which can be havens for resilient food varieties. It includes how diets change as the world continues to urbanize, how diets are changing now, and what other directions those trajectories could take. Relatedly, Ms. Caldwell explained that USAID had a very interesting recent webinar on the potential for insects to contribute to food security, economic development, and nutrition in as little as two decades from now. The system

[2] U.S. Government Global Food Security Strategy, 2022-2026: https://www.usaid.gov/what-we-do/agriculture-and-food-security/us-government-global-food-security-strategy

also includes the companies that provide the inputs, like fertilizers and seeds, and the companies that produce grains, fruits, and animals. System actors range from smallholders and the companies that process and trade raw materials, the transportation systems that move crops from the farm, food processors, agricultural producers, retailers, and consumers. She explained that the food system relies on, and needs to embrace even further, the climate information services and early warning systems that help growers decide what, when, and where to plant and when to harvest, anticipating future droughts or other extreme weather events.

Ms. Caldwell reiterated the call from the opening remarks to focus attention on the need for equity and finance. Food and agriculture include institutions and practices that determine who can participate, who can access land, who can use inputs, like seeds and water. These systems include public policies, land governance that protects forests and grasslands from agricultural expansion, subsidies that favor some populations, production processes, practices, or companies over others, placing them at a disadvantage. As a core principle of the USAID Climate Strategy, 2022–2030, USAID is deeply committed to locally-led development, equity, and inclusion to achieve sustainable solutions and to engage and empower local organizations and traditionally under-represented and under-served populations. Ms. Caldwell underscored the importance of that focus to ensure USAID's efforts do not unintentionally burden or disproportionately impact already-vulnerable communities, Indigenous people, youth, religious minorities, and women. We need to increase our focus on equity in our own programming, and that's a core focus of the strategy.

Ms. Caldwell shared that there is a need for finance innovations in food systems to make these systems more resilient. With Russia's unprovoked invasion of Ukraine, we are seeing major shortages in food and fertilizers at just the moment when we are facing unprecedented drought in places like the Horn of Africa. We need to find ways through financial innovations to make these food systems more resilient and to help solve the climate crisis. We know that public development assistance and the assistance provided by governments and multilateral institutions are not sufficient on their own. Private finance, including from banks and credit unions, needs to be a part of the solution. A prominent feature of the USAID Climate Strategy, 2022–2030 is the goal to catalyze $150 billion in new public and private financing using USAID's capability to offer blended finance, reduce risk, and offer concessional finance to bring the private sector into the market to transform these shifts towards a net-zero emission and climate-resilient pathway. Ms. Caldwell expressed that the BIFAD subcommittee can help ensure that USAID gets this shift right.

Concluding, Ms. Caldwell expressed the urgency and necessity to maintain global mean temperatures within 1.5 degrees Celsius to avoid the havoc that would ensue beyond what can be anticipated. The impacts of climate change are already being experienced in a faster and more furious form than previously imagined. Ms. Caldwell thanked participants for their dedication and perseverance to discuss tough and complicated issues. She was inspired and excited by the work and eager to be a partner.

Dr. Wollenberg introduced the BIFAD-commissioned study coordinating authors Ms. Rahel Diro and Dr. Ed Carr. Ms. Diro is a Disaster Risk Finance Associate at Tetra Tech, as well as advisor to the subcommittee and coordinating author of the commissioned study. Dr. Carr is a professor of geography in the International Development Community and Environment Department at Clark University, as well as the Director of the Humanitarian Response and Development Lab. Dr. Carr was also an American Association for the Advancement of Science (AAAS) fellow in the Office of Global Climate Change at USAID.

Overview of BIFAD-commissioned Climate Change Study Approach
Rahel Diro, Coordinating Author, Tetra Tech
Edward Carr, Coordinating Author, Clark University

Ms. Diro thanked Dr. Wollenberg and introduced the contributing authors to the BIFAD-commissioned climate change study: Ed Carr, coordinating author, Ms. Lydia Mbevi, gender, youth and social inclusion expert, Mr. Dan Zook, Executive Director of ISF Advisors, who is leading the climate finance focus of the study, and Dr. Tyrone Hall, behavioral change and communications expert on the team. The study team is also supported by research assistants Ms. Katie Liming, Mr. Hayden Aldredge, Ms. Lauren Allognon and Mr. Tommy Crocker, and Ms. Mary Beggs and Ms. Carmen Benson from Tetra Tech, who will ensure the integration of the report. On behalf of the author team, Ms. Diro acknowledged the opportunity to conduct the study and to contribute to efforts to address the climate crisis.

The goal of the study is to provide recommendations on systemic solutions for climate change adaptation and mitigation in the agriculture, food, and nutrition systems. The study has three specific objectives:

- Estimate realistic targets and intermediate results to guide USAID program design;
- Identify priority leverage points for transformative system exchange and leverage points for scaling climate finance to achieve targets and intermediate results in the agriculture, food, and nutrition sectors; and
- Prioritize areas for USAID actions and recommend intervention.

The study will be based on a review of existing evidence and consultation with experts through key informant interviews. Recognizing that transformative systemic change is a dynamic and incredibly complex process, the author team will follow a "pathways framework", whereby transformations are aimed at moving people in systems and countries onto a climate-resilient development pathway. Ms. Diro concluded by inviting Dr. Carr to provide further detail on the conceptual framework of the study.

Dr. Carr explained that understanding how to bring about transformational change requires understanding what needs to be changed, what opportunities there are for such change, and what options we have for fostering or accelerating that change. He explained that the study team will work iteratively, starting with the identification of priority systems that, if transformed, would bring about significant positive impacts on food and nutritional outcomes. Within those systems, the study team will look for barriers to change or opportunities for change, from which to derive priority leverage points. Leverage points are processes, interactions, or elements of a system or systems where targeted actions could lead to transformational change. From these priority systems and leverage points, the study will seek to identify specific interventions that work on these leverage points. At each step, a rubric will be utilized to assess evidence to prioritize systems, leverage points, and interventions. At each step, we will give attention to marginalized and underrepresented groups, the impacts that the potential interventions might have on them, and the opportunities that we might create for them. With this approach, the study team will develop informed targets for USAID's work going forward.

Dr. Carr concluded the author team presentation and invited Dr. Wollenberg to moderate the panel discussion.

Panel Discussion: Opportunities for Systemic Change According to Recent Analysis
Moderated by Lini Wollenberg, Subcommittee Chair, University of Vermont

Dr. Wollenberg thanked Ms. Diro and Dr. Carr for the overview of the study and said that the next part of the meeting will be dedicated to receiving input. Dr. Wollenberg introduced the three panelists: Dr. Ana Maria Loboguerrero Rodriguez, Research Director of Climate Action at the Alliance of Biodiversity International and the International Center for Tropical Agriculture (CIAT), Dr. Olaf Westermann, Senior Technical Adviser in Climate Action at Catholic Relief Services, and Ms. Sara Boettiger, independent adviser, who was most recently head of public affairs for the Crop Sciences Division of Bayer Global. The speakers represent the research sector, NGO sector, and the finance/private corporate sector. Dr.

Wollenberg explained that panel remarks will be followed by a discussion with BIFAD members and a question-and-answer session with participants and panelists.

Dr. Wollenberg concluded and invited Dr. Loboguerrero Rodriguez to begin the panel presentations.

Panelist Presentation: Transforming Food, Land, and Water Systems in a Climate Crisis
Ana Maria Loboguerrero Rodriguez, Research Director of Climate Action, Alliance of Bioversity International and the International Center for Tropical Agriculture

Dr. Loboguerrero thanked the organizers for providing the opportunity to be part of a very relevant and interesting dialogue. She shared statistics on relevant challenges: around 1.4 billion people are living in poverty, and one billion people are hungry. Expected population growth will require an increase in food by at least 14% per decade to satisfy increasing demand [3]. In addition, reflecting on the soils required to produce that food, approximately 1.5 billion people depend on degraded land. These challenges, combined with climate extremes, climate variability, and climate change, require nothing less than a transformation in food, land, and water.

The CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS) has been working with a variety of stakeholders to identify the key levers to promote transformation in food, land, and water. Informed by extensive consultation, a comprehensive literature review, and commissioned background papers, transformative actions across 4 action areas were recommended[4]:

- **Rerouting** farming and rural livelihoods to new trajectories that can reduce greenhouse gas emissions, reduce inequality, address gender and social inclusion, and incentivize climate-resilient practices, and meet dietary needs;
- **De-risking** farming, value chains, and rural livelihood by reducing the impact of variable weather and extreme events through attention to inclusive early-warning systems, adaptive safety nets, and climate-informed advice;
- **Reducing** emissions from diets and value chains, involving significant dietary shifts and massive reductions in food loss and waste, considering that around one-third of the total greenhouse gas emissions come from food; and
- **Realigning** policies, finance, support to social movements to drive change, and research, development, and innovation to build more resilient and sustainable food systems. with attention to realigning subsidies to incentivize private sector investment while, addressing power inequities and marginalization, unlocking billions of dollars in private sector investment while addressing market failures, linking science to social movements addressing climate, livelihoods, and food systems, and linking research to societal needs and to deliver end-to-end solutions for actors in food systems. This action area cuts across the other three areas, as rerouting, reducing risk, and reducing emissions are also dependent on fostering an enabling environment and realigning policies, specifically those around finance.

Dr. Loboguerrero Rodriguez re-emphasized the need for and importance of thinking about gender, social inclusion, and equity into this transformative action and moving toward gender-transformative actions. From a research perspective, issues of the gender gap have been analyzed and are being addressed

[3] Met Office. 2022. Met Office Website. [online] Available at: https://www.metoffice.gov.uk/

[4] Transforming Food Systems Under Climate Change: Actions

through gender-transformative action. She presented four gender-equality dimensions that are integral to ensuring that climate-smart agriculture is empowering both women and men[5], including:

- Involvement in decision-making, ensuring that men and women have appropriate tools and capacities;
- Access to resources and agro-climatic information to vulnerable populations;
- Reduced workloads and drudgery; and
- Collective action for agency, for example, using women's groups as platforms for active agency and voice into this transformation agenda[6].

Dr. Loboguerrero further expressed that to develop truly transformative, inclusive, and sustainable food systems, gender equality must be combined with social and youth inclusion mechanisms and intersectionality. Women in the rural sector are very different, each with different and interacting characteristics, background, and social dimensions. The research arena has been successful at understanding how climate change is affecting vulnerable populations, but there remains a need to gain deeper insight into the processes and mechanisms that are enabling gender equality, including how to address power imbalances.

Dr. Loboguerrero concluded her presentation and shared a slide with relevant resources for the audience to view. Dr. Wollenberg thanked Dr. Loboguerrero for her presentation and invited Dr. Westermann to share the next presentation.

Panelist Presentation: Systemic Solutions for Climate Change Adaptation and Mitigation in Agriculture, Nutrition, and Food Systems
Olaf Westermann, Senior Technical Advisor in Climate Change, Catholic Relief Services

Dr. Olaf Westermann thanked the organizers and shared that in addition to serving as the Climate Change Advisor for Catholic Relief Services (CRS), he is also the Climate Change Advisor for Natural Resource Management and the co-lead of the Livelihood and Landscape Restoration Platform[7]. Dr. Westermann shared several examples of the work CRS is doing related to climate change adaptation and mitigation in agriculture. In 2020, CRS developed a new organizational strategy, with the goal of better understanding how to reach or expand reach by piloting a series of scaling efforts. One of these initiatives, called the Livelihood and Landscape Scaling Platform, is designed to improve livelihoods and build resilience to climate change. Concretely, CRS aims to put 1.4 million hectares of land under restoration by 2030. Even this goal, as Dr. Westermann explained, is not sufficient to go to scale. Dr. Westermann proposed that transformational change requires changes at systems level, mindset change, and building alliances with partners. The platform is currently operating in eight target countries to pilot approaches to go beyond project boundaries toward more systemic change. The eight target countries include:

- Guatemala, El Salvador, Honduras, and Nicaragua: Water Smart Agriculture program funded by the Howard Buffett Foundation

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[5] Tavenner, K., Crane, T. A., & Saxena, T. (2020). "Breaking Even" under Intensification? Gendered Trade-Offs for Women Milk Marketers in Kenya. Rural Sociology, 0(November), 1–29. https://doi.org/10.1111/ruso.12345

[6] Huyer, S., Gumucio, T., Tavenner, K., Acosta, M., Chanana, N., Khatri-Chhetri, A., Mungai, C., Ouedraogo, M., Otieno, G., Radeny, M., Recha, J., & Simelton, E. (2021). From vulnerability to agency: gender equality in climate adaptation and mitigation. In R. Pyburn & A. van Eerdewijk (Eds.), Advancing gender equality through agricultural and environmental research: past, present and future. IFPRI. https://www.ifpri.org/publication/vulnerability-agency-climate-adaptation-and-mitigation

[7] https://www.crs.org/our-work-overseas/research-publications/agriculture-landscape-restoration

- Niger: Girma, Dryland Regreening program funded by the USAID Development Food Security Activity (DFSA)
- Ethiopia: Regreening Africa and resilience and food security activity (RFSA) funded by the European Union (EU) and USAID
- Madagascar: Securing and Protecting Investments and Capacities for Environmental Sustainability (SPICES), Agroforestry program funded by USAID and private donors
- Lesotho: Integrated Catchment Management, Watershed program funded by the EU and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Dr. Westermann proposed that this requires changing mindsets internally within CRS, but also externally with donors, governments, and peers. This approach also requires investing in new capabilities and metrics for measuring success. Although CRS works through large anchor projects, the flexibility of the organization's private funds allows CRS to hire national coordinators to build this long-term relationship and mobilize the necessary resources for scale and systems change.

In Lesotho, for example, CRS is working with a government-led program on integrated catchment management. In collaboration with GIZ, CRS is working with the communities to develop catchment plans, leading to policy-level change and influence. In the first phase, CRS built a foundation for scaling with six priority sub-catchments, expanding to eighteen sub-catchments in phase two, with the goal of reaching the entire country by 2030. To enable the relationship-building and collaborative approach necessary for scaling, CRS facilitated a scaling workshop series with external partners that aimed to build an understanding of what scaling means, as scaling has many different interpretations. The workshop series also analyzed opportunities and barriers in the enabling environment, as Dr. Loboguerrero discussed, to scale up integrated catchment management in Lesotho. CRS and partners then developed multiple stakeholder strategies, combining a short-term time frame that fulfills the donors' project interests with a longer-term focus for a more transformational change. This strategy can be used to leverage support and alliances for integrated catchment management once the project cycle is over and under the leadership of the government of Lesotho.

Dr. Westermann remarked that as a faith-based organization, CRS views the Catholic Church as a particularly important action that can be leveraged for scaling restoration. Years ago, the Catholic Church published a policy document called *Laudato Si'*[8], which sought to operationalize environmental action. The Catholic Church also has vast land holdings and is a permanent local actor in many places with strong networks and reach. In Madagascar, CRS is implementing an agroforestry value chain program called SPICES, which works to support land restoration on church-held lands and the communities surrounding them. This is done through agricultural youth training centers, helping with landscape planning and supporting the parishes to become more safe and self-sustainable. To date, this program works with 12 dioceses, on over 5,000 acres, has established three youth training centers, and measured income generated from the land that is used to further fund the youth training centers.

In Central America, CRS is working with Water Smart Agriculture, which has launched a communication campaign to change behavior at scale. Based on a set of very clear messages, Water Smart Agriculture is using different social platforms to reach their target audience, including farmers and governments. Platforms include Facebook and the radio, and farmers can reach out to Water Smart Agricultural experts using WhatsApp and with iPhones. He presented results including:

[8] https://www.vatican.va/content/dam/francesco/pdf/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si_en.pdf

- 14,113 followers on Facebook;
- 1,993 followers on Twitter;
- Four million potential radio listeners in four countries;
- 780 inquiries from farmers using cellphones or WhatsApp; and
- 49,222 unique website visitors.

Based on these results, the CRS Central American team has seen that virtual extension is not only possible but also an important pathway to scale. With this proof of concept, CRS is embarking on a larger program, developing virtual training approaches hosted by national agricultural extension and research centers.

Dr. Westermann highlighted that engagement in regional and global coalitions is an important part of how CRS hopes to capitalize and sustain momentum for scaling. In Africa, CRS is collaborating with the Forum for Agricultural Research in Africa, which is a technical arm of the African Union, on the Soils Initiative for Africa. That initiative aims to establish a continental-level framework to guide restoration of degraded agricultural land. At the Biennial Climate-Smart Agricultural Conference in Accra, Ghana, in September 2022, CRS will work with experts and representatives from the 55 countries online thematic areas: 1) soil information systems, 2) landscape/plot-level soil and water management, 3) human and institutional capital for soil science, 4) scaling of the African system for soil management, 4) economics of soil degradation and soil management, 6) policy and regulatory frameworks, 7) fertilizer manufacture and use for soil management, 8) dashboard, metrics, and results framework, and 9) organizational architecture and management framework for the African system for soil management. CRS hopes to announce the framework at the 2023 Soil Health Summit.

CRS has six platforms, including on land restoration, youth, social cohesion, laws, and research. Through a series of case studies on programs and products that aim for scaling, CRS learned that the key leverage point for scaling from the CRS side is activism, advocacy, and lobbying to increase political will and support and make policy change possible. Other key leverage points include convening and intermediation to increase collaborative action, build relationships, and create stronger relations and coalitions; advising and awareness-raising to shift mindsets, to change attitudes, and improve evidence-based decision making; enhancing the business-enabling environment; increasing media queries; and mobilizing new resources or redirecting old resources toward land restoration for climate change adaptation and mitigation. Dr. Westermann concluded his presentation, and Dr. Wollenberg invited Ms. Boettiger to speak.

Panelist Presentation: Opportunities for Systemic Change According to Recent Analysis
Sara Boettiger, Independent Advisor

Ms. Boettiger reflected on the changing role of the private sector. Two questions often asked about the private sector by people working in the international development space are, first, whether the momentum for sustainability advances currently seen in large companies is durable and meaningful, and, second, assuming that the momentum is durable and meaningful, what that means for international development strategy. In other words, how should we be thinking about the role of the private sector? Ms. Boettiger offered a few highlights to address these deep questions.

Ms. Boettiger explained that the answer to the first question—if the momentum for sustainability advances that we see in large companies is durable and meaningful—is a strong “yes”. Sustainability in big companies has now moved well beyond the drivers of reputation and compliance. While those drivers are still critical, there are other drivers and support for these investments. Policy is a significant driver as we are legislating sustainability in many ways around the world, leading large companies to figure out how their costs, risks, and opportunities are changing. Changes in policies are also affecting

companies' access to finance, both in debt and equity. The litigation landscape is also changing. There are new tools in environmental litigation that are now part of many boardroom discussions. Consumer demand is changing, which is affecting how companies react. Sustainability issues are moving from the periphery of a company into a more integrated place in their corporate strategy. There is a significant diversity of how companies manage these changes. While "green washers" clearly still exist, overall, we are experiencing a profound shift. From Ms. Boettiger's perspective, to perceive sustainability as affecting corporate competitiveness and profitability is fantastic and will enable the durable momentum needed to tackle the urgency and scale of the climate crisis.

Ms. Boettiger remarked that the drivers of this momentum are evolving. With regard to consumer demand, for example, we can try to predict how diets might change or whether consumers will really pay for sustainability attributes in what they buy, but our predictions will be wrong. Climate policies have been radically changing, even in this past year since the invasion of Ukraine. Despite these twists and turns, we are moving in a very strong direction, which indicates that many organizations in the international development community are rethinking how they engage with the private sector and what that means for their organizations. For example, durable momentum for sustainability means that there is a larger and deeper pipeline for sustainability-related innovation. The capital pool is becoming more mature. We are seeing faster deployment and scaling down the cost curve of some of the clean technologies. Only some of these will be translatable into the markets in which USAID needs to have impact, but it is important to recognize that the speed of innovation is fundamentally changing, which should change how we strategically think about where we want to use our public money and how we partner with the private sector.

Ms. Boettiger explained that another example lies in the shifts we are seeing as companies move away from higher-carbon-intensity supply chains. This is one of those effects of all the drivers that was previously mentioned. Companies are making choices to reduce the carbon intensity of their supply chains. What happens to the countries that feed these global supply chains? One McKinsey report calculated that a million Africa jobs would be lost as the world transitions to net zero. We know that the countries targeted for impact by USAID already face profound physical and economic risks from climate change. We also need to consider what happens when the global private sector starts moving in this direction and how markets and growth will change in these countries. With regard to partnering, Ms. Boettiger argued that we are in a different era for public-private partnerships. When a company comes to the table with real strategic goals, they are not just there because there is one person in the company who is very passionate about this, or they are not there to get a reputational bump. They are actually there because it is important to their company strategy. Today, there are so many more possibilities for achieving social and environmental impacts. There is real power in strategic partnerships. Ms. Boettiger concluded her presentation with the following actionable priorities:

- Plan for volatility (e.g., prioritize digitization and modernization of strategic national food reserves; accelerate innovation with the insurance industry)
- Re-assess investment hypotheses: private capital is a different global landscape than last year; accelerate applications of outcome-based financing across public/private sectors
- De-silo ruthlessly: many times incentives only align when environmental impacts are stacked across (e.g., carbon, biodiversity, water); also, nothing works without integrating the energy-agriculture-water nexus
- Update private sector partner strategies: deeper, but selective, engagement is possible as sustainability takes root in company strategy; but challenging times are tightening belts

- Evidence-base for policy change: the very core of success; see latest policy innovations globally through private sector lens for driving green growth, investment, innovation; balance to promote practical, replicable policy playbook

Public Discussion and Questions for Panelists
Moderated by Lini Wollenberg, Subcommittee Chair, University of Vermont

Dr. Wollenberg highlighted that this portion of the session would be an opportunity for the panelists to respond to questions from the audience. She read a question from participant Edmond Totin for Dr. Loboguerrero: "How can we achieve climate information services in Africa, given essentially the lack of data and the lack of capacity? Where do you see the role of climate information services in being able to overcome that challenge?"

Dr. Loboguerrero responded that there are challenges in both areas: the lack of capacity to understand this primary information and the lack of infrastructure to collect the information. The CGIAR is working on projects in Africa to assess both of these challenges. Public-private partnerships are working to ensure we have the appropriate resources for weather stations. The CGIAR system is using many methods to fill gaps, e.g., time series of climate information for analysis, including work with Columbia University's International Research Institute for Climate and Society (IRI) to support this robust climate information. We handle this challenge through varied sources of funding, but private-public partnerships are a good way to address the challenge. On the issue of the capacity to use this information, there are many lessons learned from working on climate information services, not only in Africa, but also in Latin America, about how climate information is being produced from the meteorological offices in many of these countries. One of the main bottlenecks is the language used and the way this information is communicated to farmers to promote action. In most cases, the communication is not effective. CGIAR has been working with participatory processes which have proven to be very powerful in terms of empowering farmers so that climate information is not perceived as distant and unrelated to them. Farmers are also part of the production of this information, providing relevant insights and information. Farmers go into the field and see what is happening each day with their crops, making them part of the generation of climate information, and then translating this climate information into concrete action. They can use this information to decide when to plant and when to apply water. Dr. Loboguerrero proposed that transforming this information into concrete adaptation options is a huge opportunity for research and development organizations for collaboration and coordination. This is a way forward to make this primary information become a source of transformation in Africa and other regions.

Dr. Wollenberg read another question addressed to Dr. Westermann from Tom Opapa: "Climate change has both extremes of drought and flooding. How can irrigation help to improve the challenge of meeting our food security and nutrition needs?"

Dr. Westermann remarked that while he is not an irrigation expert, he believes that irrigation opportunities really depend on understanding long-term trends in rainfall, and whether or not to expect drought or extreme rainfall. We need to understand the climate risks that are related before we initiate irrigation systems, because otherwise, we can end up with maladaptation and creating irrigation systems as solutions where rainfall and precipitation will change. That said, where there are opportunities, for example, to do rainwater harvesting or where there is insufficient rainfall, irrigation can be a solution to either maintain productivity or increase productivity where there are fewer options. It is important to re-emphasize that irrigation systems require the focus of the landscape restoration platform that was mentioned during the presentation, because if you have degraded land and continue to create ecosystem services, it will also be very hard to maintain the water cycle, and thus, the availability of water and the flow of water in the landscape. A critical irrigation system will almost always have to go hand in hand with either conservation of natural resources or restoration of the degraded

landscape to maintain the flow of water resources. Finally, irrigation systems will need to be considered as an integrated approach with other needs as well, so domestic uses for potable water and for livestock. It is a complex issue, but it can be a solution in some places. In other places, we have to be careful given the climate risks that exist in terms of changing precipitation.

Dr. Wollenberg thanked the audience for these questions and the panelists for the responses.

Dr. Wollenberg introduced subcommittee member, Dr. Sophia Huyer, to frame the next part of the agenda and give instructions for the breakout groups. Dr. Huyer is the Social Inclusion Lead with the Accelerating Impacts of CGIAR Climate Research for Africa Project (AICCRA) and is based at the International Livestock Research Institute (ILRI). Dr. Wollenberg encouraged all participants to stay for these breakout groups and to participate actively as this is an opportunity for the audience to provide input to the panel and the subcommittee.

Framing Remarks and Instructions for Workshop Breakout Rooms
Sophia Huyer, Subcommittee Member, Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA), International Livestock Research Institute (ILRI)

Dr. Huyer explained that there are six breakout rooms and that the purpose of the groups is to allow participants to discuss what has been presented and to provide contributions and ideas for the subcommittee to consider. Specifically, the purpose of the breakout rooms is to seek expert public input to identify systems and leverage points in the agricultural, food, and nutrition sector for transformative systemic change and scaling climate finance to achieve climate adaptation and mitigation, as well as results outlined in the USAID Climate Strategy,2022–2030. Dr. Huyer encouraged participants to consider the inclusion of underrepresented populations, gender inequality, social inclusion, and the enabling environment. She reminded participants of some key definitions:

- **Transformative systemic change** is change that includes changes to fundamental attributes of systems in response to actual or expected climate change and its effects, often at scale and ambition greater than incremental activity, looking at the larger picture and the interaction of different systems, and how they can be coordinated, mobilized, and better understood in ways to address climate impacts. It also includes system changes towards a climate-resilient development pathway that addresses climate change over time scales as well as over physical scales.
- **Leverage points** are places in the system where targeted actions can lead to transformational change. Many of those leverage points were identified in today's presentations, which provided context for the discussions.

Dr. Huyer introduced each of the breakout room facilitators and reminded participants that there are about 30 minutes on the agenda for this session.

Participant Workshop: Identifying Priority Leverage Points
Facilitated by BIFAD Subcommittee Members

Participants are invited to join breakout room workshops for evidence-informed discussion to identify key systems and leverage points for transformative change to advance climate change adaptation and mitigation, considering gender equality and social inclusion, and the enabling environment.

Please see Annex A. for minutes from each of these breakout rooms:

- **Room 1**: Climate Finance, with Daniela Chiriac and Richard Choularton
- **Room 2**: Climate information advisories and early warning, with Erin Coughlan de Perez and Lini Wollenberg

- **Room 3:** Crop production, with Rahel Diro
- **Room 4:** Livestock and fisheries production, with Chinenye Ejezie and Mario Herrera
- **Room 5**: Resilient markets, Andrew Mohammed
- **Room 6**: Nutrition, with Jessica Fanzo

Summary and Synthesis of Key Points from each Breakout Room
Moderated by Sophia Huyer, Subcommittee Member, AICCRA, ILRI

Dr. Huyer welcomed participants back to the main room and invited Mr. Richard Choularton and Ms. Daniela Chiriac to provide an overview of the discussion from Room 1: Climate Finance.

Mr. Choularton said many comments emphasized the need to focus on the big picture systems around climate finance and points at which interventions can lead to change at scale. Comments identified several priority systems for climate finance, starting at the farm level—with farmer access to finance both to produce in today's climate and to start shifting practices and production systems to adapt in a more transformative way—and moving up the supply chain to finance at the small and medium enterprises (SMEs) level e as a leverage point for larger impact. Participants emphasized the importance of breaking down the finance system in the agriculture, food, and nutrition sector to look for leverage points. Another key point is the need for greater coordination and simplification of access to climate finance at multiple levels, especially recognizing the complexity of institutional access to funds, like the Green Climate Fund, Adaptation Fund, or Green Innovation Fund. Breakout group participants spoke about the need for more agile financing at the commercial level for private sector actors to respond to the needs in their supply chains and to support adaptation. There was also a significant focus on using financial risk management tools and improving access to insurance and government-level risk financing to deal with the impact of climate shocks on the food system. Participants shared ideas about the use of anticipatory action or forecast-based financing, which the humanitarian sector has been pioneering more broadly in the food and agriculture sector. However, these approaches require quality information—particularly climate information, climate services, and information on agriculture and production systems and their viability—to work, and Mr. Choularton said he hoped that the second breakout group on climate information and early warning systems had in depth these issues around quality of information to make climate finance work. Richard invited Ms. Daniela Chiriac to offer additional reflections from the breakout room.

Ms. Chiriac added that, in addition to farm-level production practices, food supply chains and financial risk management were mentioned as other priority systems. Participants also discussed the importance of the enabling environment and policies and regulations at the domestic level. A representative from Olam International noted that there is a desire and willingness from the private sector to be more involved in directing climate finance along supply chains and emphasized the need for more coordination and communication between the private sector and the donor community, which can provide concessional finance. Ms. Chiriac said participants also discussed the importance of building social awareness, developing capacity, and encouraging knowledge sharing, especially among vulnerable people, and she suggested that knowledge sharing and social awareness be considered additional leverage points by the author team.

Dr. Huyer then invited Dr. Erin Coughlan de Perez to share remarks from Room 2: Climate information advisories and early warning systems.

Dr. Coughlan de Perez highlighted three themes from the discussion. The first priority system was communication. Participants emphasized the need to ensure climate information and early warning systems are accessible to and reaching everyone. This can include leveraging existing structures, like agricultural extension, and incorporating pragmatic and creative communications methods to improve

connectivity. Participants shared several examples of this, including a call center that operates in 15 languages, the use of SMS and WhatsApp messaging, and animated content for low-literate learners who speak diverse languages. Interesting and creative approaches already exist for enhancing communication systems. A second theme was the information itself: what information is being pushed out to people? Coughlan de Perez mentioned, as key leverage points, participatory processes or co-designing climate information systems with people that integrate what they need to know, what information they can use, and what they want to know. Climate information systems should incorporate and value indigenous and local knowledge. The third theme is the need for improvements in data. This includes improvements in impact modeling and moving beyond data (e.g., rainfall data) to translate climate information into useful future impacts (e.g., the impact of changing rainfall on the distribution of agricultural pests). Dr. Coughlan de Perez concluded the breakout room summary and Dr. Huyer invited Ms. Diro to provide an overview of the discussion from Room 3: Crop Production.

Ms. Diro highlighted important systems in crop production: input systems, including improved seeds and fertilizers; improved agricultural extension advisory services, linking to the room 2 discussion; water management, including irrigation and water harvesting; land tenure; and education, including farmers' education, higher education, and research in improving crop production systems. Key leverage points included soil health; carbon sequestration; improved smallholder productivity through sustainable intensification; co-creation processes to engage and involve farmers; nutrition, including providing access to nutrition in urban centers; and finance and functioning markets. Ms. Diro concluded her remarks, and Dr. Huyer invited Ms. Chinenye Ejezie from breakout group 4, livestock and fisheries, to highlight the key takeaways from the discussion.

Ms. Ejezie identified priorities for transformation of livestock and fisheries systems, including management systems and grazing systems. The group emphasized the importance of adequate and up-to-date research, evidence, and data, especially on livestock methane emissions, to provide suitable solutions and identify sources of emissions. Aquaculture is another leverage point, considering the impact of climate change on fisheries, the high number of endangered fish species, and the nutritional importance of fish as a source of animal protein. Other leverage points included integrated crop–livestock efficiency for enhancing livestock productivity and private sector innovations. The group agreed that systems change and alternative innovations to unsuitable livestock approaches were vital for transformation, with emphasis on aquaculture as an important source of animal protein. Ms. Ejezie concluded her remarks, and Dr. Huyer invited Dr. Andrew Muhammad to share reflections from breakout room 5, resilient markets.

Dr. Muhammad market systems transformation needs to go beyond agricultural production and producers to changes across the entire supply chain, including improving the resilience of middlemen, traders, processors, distributors, wholesalers and strengthening the linkages among all the marketing system agents from production to consumption. The group discussed using digital technologies to link market actors, and to inform producers about disasters and risks. Another important approach is empowering local banks to support climate-smart production and to improve the carbon credit systems within developing countries. Linking information sources to producers, consumers, and all market actors in between via mobile technologies is an approach for strengthening market systems resilience. The group discussed promoting gender equity in agricultural value chains and empowering local marketing systems, going beyond larger marketing systems to consider the cultural and social dimensions of local marketing systems. The group also discussed strategic food reserves, both public and private, and digital processes to manage reserves more efficiently and effectively. Dr. Muhammad concluded his remarks, and Dr. Huyer invited Dr. Fanzo to share reflections from breakout room 6, nutrition.

Dr. Fanzo identified key priority systems, potential leverage points, and recommendations around agriculture, land use, and land management to ensure that the food we grow is climate resilient and nutrition- or nutrient-resilient. The group highlighted the promotion of nutrient-dense local, wild, or traditional foods that are neglected and underutilized species but important in the diets of many indigenous and marginalized populations around the world. Alternative proteins, including lab-grown foods, plant-based proteins, and insects, are potentially important for nutrition, the environment, and climate change. We need to further understand the production of alternative proteins across the entire chain from production and processing to precision nutrition, and also their impacts on nutrition across human life cycles, on the environment when produced at scale, and on disease, such as non-communicable disease. The group highlighted food loss and waste, and nutrient loss, as areas requiring priority innovation. Dr. Fanzo emphasized the importance of people in nutrition. We need to create safety nets for farmers to grow nutrient-dense foods, promote youth involvement across food systems and value chains, and increase youth education on consumption and nutrition. The group emphasized the importance of place and where people access food, including promoting physical, economic, and social access to healthy and nutritious foods and food environments. We need to better integrate nutrition into climate. Nutrition is often neglected in climate discussions, and there is hesitancy to discuss nutrition for fear of being perceived as paternalistic in dictating what people should eat, but there are many opportunities to improve nutrition with climate change, mitigation, and adaptation in mind considering the entire food system. Dr. Fanzo concluded reflections from this breakout room and welcomed Dr. Huyer to share any last comments.

Dr. Huyer thanked all participants for engaging in the discussions and highlighting key issues and leverage points to consider as the author team and subcommittee progress with their work. Dr. Huyer highlighted that this session has resulted in valuable content, concerns, recommendations, and key references. Dr. Huyer emphasized that the input shared by the participants would be captured in the public record. Dr. Huyer concluded her remarks and invited Dr. Wollenberg to lead the next meeting session.

BIFAD Comment Period
Moderated by Lini Wollenberg, Subcommittee Chair, University of Vermont

Dr. Wollenberg thanked Dr. Huyer for moderating the breakout room session and expressed appreciation for all those who participated. Dr. Wollenberg invited members of the BIFAD committee to comment on the directions of the subcommittee, including the study methodology, the panelists' presentations, the breakout room discussions, and any other points that have arisen during the meeting.

BIFAD Member Dr. Pamela Anderson thanked the subcommittee members and study team members for agreeing to take on this critical advisory role. Dr. Anderson highlighted that when BIFAD spoke to USAID Administrator Samantha Power, she said “We, USAID, are essentially a climate change organization.” Dr. Anderson explained that it was interesting and shocking to hear that, because it messaged to BIFAD that her vision is the lens we need to use for the whole-of-agency approach. This work will become crucial in guiding and giving BIFAD advice, but more importantly, guiding USAID and responding to Administrator Power’s call to dig into this area. Dr. Anderson reiterated her gratitude to the panelists for sharing their experiences and insights and highlighted that the framework for the study was very clear and compelling. Again, BIFAD and Administrator Power are looking for actionable advice because we all understand the problématique, but what are we going to do about it, and how do we take it forward? Dr. Anderson highlighted that the study’s focus on the underrepresented and marginalized population particularly resonates and connects back to BIFAD’s last public meeting in May 2022. During the last public meeting, BIFAD launched an inquiry around the Board’s focus area on resilient food systems and heard from the Chief Executive Officer of UN Women, who specifically emphasized that one of the five

priority areas for UN Women was gender-responsive climate actions. Dr. Anderson encouraged the study team, as they get specific in their work, to help us move beyond the generalities we are struggling with. It is important to get specific about gender-responsive climate actions and what needs to be done. Dr. Anderson also recommended that the study team reference BIFAD's most recent commissioned report, *Agricultural Productivity Growth, Resilience and Economic Transformation in Sub-Saharan Africa*. The report was launched and disseminated last year very widely, and it is already being taken up in Africa in some of the important policy work. That study found that sub-Saharan Africa, in particular, had consistently high agricultural growth since 2000 and is actually now the region with the highest agricultural growth in the world. However, 75% of that growth has come from land expansion, which is not sustainable. Dr. Anderson highlighted that it would be important for this author team to look at this evidence to help document why we need to evaluate our crop production systems and support productivity increases in sub-Saharan Africa. Dr. Anderson remarked that Ms. Boettiger's presentation and inputs on the private sector were welcoming and encouraging. Dr. Anderson hoped that the subcommittee and study team would be able to engage deeply with similar experts and actors in the private sector to identify, in a new area of opportunity, the engagement points that we can utilize to increase and intensify our work and pull in the private sector. Dr. Anderson concluded her reflection and comments. Dr. Wollenberg invited BIFAD Member Dr. Saweda Liverpool-Tasie to briefly share additional comments and reflections.

Dr. Liverpool-Tasie echoed Dr. Anderson's appreciation to the subcommittee and the work that went into producing the methodology and framework, in addition to organizing the public meeting. Dr. Liverpool-Tasie wanted to reiterate a point that the markets breakout group mentioned that she hoped the team would continue to explore. She highlighted that research has clearly shown that a majority of the food consumed globally comes from domestic supply chains. Within these domestic supply chains, a majority of activities take place post-production that are critical for the affordability, availability, safety, and nutritional quality of the food that is available to consumers. Dr. Liverpool-Tasie hoped the subcommittee could gather evidence about the impacts of climate-related shocks on actors beyond production, including how the behaviors of these actors in response to shocks can affect the quality, quantity, and price of food and their own welfare. She underscored the importance of understanding the coping strategies of market actors beyond production and how these coping strategies can support or undermine the resilience of food systems and their ability to continue or improve the delivery of safe, affordable, and nutritious food. Dr. Liverpool-Tasie recommended that the subcommittee interact with USAID Feed the Future Innovation Labs on the issue of climate finance. The Innovation Labs have done interesting work to understand how to bundle innovations that increase the adoption of climate-smart technologies alongside financial products in a way that encourages the adoption of these climate-smart technologies while minimizing their risks. Dr. Liverpool-Tasie stated her excitement for the subcommittee's work and thanked the participants for attending this event. Dr. Wollenberg transitioned to the next session, which discusses the key points of the meeting and next steps for the subcommittee and study team.

Key Points and Next Steps
Lini Wollenberg, Subcommittee Chair, University of Vermont

Dr. Wollenberg explained that the end result of the study is for the subcommittee to develop recommendations to BIFAD. The next step will be to assemble the information that was shared at this meeting and make it available to the study team, who will produce preliminary recommendations for October 2022 through another public meeting. Dr. Wollenberg then provided an overview of three themes that emerged during the meeting. First, it is important to acknowledge that we are not talking about business as usual, and we need to take courageous action to accomplish the immense level of

realignment that is necessary throughout the entire supply chain. Second is the level of partner involvement, coordination, and cooperation that will be needed in everything from finance to the vision for scaling. Lastly, a theme that was repeated by almost everyone is the idea that to achieve social inclusion and equity, we need to work at the local level and understand community needs and traditional practices. Dr. Wollenberg concluded the session and invited BIFAD Chair Dr. Alexander to provide closing remarks.

Closing Remarks and Notes of Appreciation
Laurence Alexander, BIFAD Chair, University of Arkansas-Pine Bluff

Dr. Alexander highlighted that this has been a wonderful and productive session today. On behalf of BIFAD, Dr. Alexander thanked Dr. Wollenberg, Gillian Caldwell, Dr. Huyer, all the subcommittee members, the panelists, the study authors, the BIFAD contract support team, and USAID colleagues for their support of today's meeting. Dr. Alexander thanked the meeting participants and emphasized that the advice and resources shared in the breakout rooms will inform the subcommittee and study team's next steps in prioritizing systems and leverage points for systemic change. Dr. Alexander invited all participants to join BIFAD's next public meeting on Wednesday from 7:00 am to 8:45 am Central Time in Des Moines, Iowa as a side event to the Borlaug Dialogues at the World Food Prize. The meeting, Fed *to Thrive: Accelerating Action on Nourishing Foods for Infants and Young Children*, will focus on the affordability, availability, and convenience of nutrient-dense foods for infants and children under two years of age. Additionally, there will also be a public meeting in late October, as a pre-meeting to the 27th Conference of Parties. By this time, the author team will have preliminary results to share for public comment and BIFAD deliberation. Dr. Alexander asked participants to watch the BIFAD website and their email inboxes for more details to come. The meeting concluded with a final message of thanks from Dr. Alexander.

Certification of Minutes:

We hereby certify that the foregoing minutes are an accurate and complete summary of the matters discussed and conclusions reached at the meeting held on August 31, 2022.

Laurence Alexander, BIFAD Chair and Chancellor, University of Arkansas at Pine Bluff

Clara K. Cohen, Executive Director, Board for International Food and Agricultural Development, Bureau for Resilience and Food Security, USAID

November 29, 2022

ANNEX 1: BREAKOUT ROOM MINUTES

Minutes of Breakout Room 1: Climate Finance
August 31, 2022 11:30–11:55 am EDT (Virtual)

Room Facilitator: Daniela Chiriac (BIFAD Subcommittee Member and Senior Consultant, Climate Policy Initiative, UK) and Richard Choularton (Tetra Tech Vice President of Operations, USA)

Co-Facilitator: Tommy Crocker (Tetra Tech Agriculture and Economic Growth Staff Associate, USA)

Number of Attendees: 74

The Board for International Food and Agricultural Development (BIFAD) Subcommittee Member and Breakout Room Facilitator Daniela Chiriac, Tetra Tech and Breakout Room Facilitator Richard Choularton, and Tetra Tech and Breakout Room Co-facilitator Tommy Crocker welcomed everyone to the breakout room, introduced themselves, and provided instructions for using the Jamboard to capture notes and share ideas and other meeting etiquette notes.

Daniela Chiriac introduced herself and her professional background. Chiriac explained that the purpose of this discussion is to identify priority systems and leverage points for transformative change to advance climate change adaptation and mitigation, while considering inclusion of underrepresented populations, gender equality, social inclusion, and enabling environment.

Gopal Krishina Debnath said that Bangladesh is vulnerable to climate change issues. Debnath shared the importance of raising social awareness about climate change and transmitting adaptation approaches to vulnerable populations facing climate-related disasters to enable livelihood adaptation, employment generation, gender mainstreaming, and social inclusion. Capacity development and knowledge sharing are important, low-cost means to enable communities to improve their lives and prepare for climate change, e.g., collecting safe drinking water, salinity intrusion, and disaster preparedness.

Responding to Debnath's comments, Richard Choularton said that adaptation occurs at the local level, and we need to find ways to help local communities understand the risks they face. This will allow and empower local communities to make decisions and take action to invest in their livelihoods and make changes needed under a changing climate. Choularton highlighted that finance is a critical component of this effort, and many are looking at ways to improve access to credit for households to switch or adapt their livelihoods. Choularton suggested that session participants dig into this issue more and think about which priority systems need to be focused and improved, so that communities get access to finance for adaptation and mitigation. He highlighted many opportunities for leverage points, taking into account lessons emerging from places like Bangladesh that have been proactive in shaping global climate finance institutions, setting up national climate finance funds, and other mechanisms. Digging into priority systems and leverage points will help advise USAID on where to focus.

Daniela Chiriac highlighted comments from Koko Warner alluding to three priority systems: food supply chains, farm-level practices, and financial risk management, which together foster regenerative and net-zero food production. Camilo Sanchez, who represents a coffee business unit of Olam International, agreed that the private sector is very committed in the long haul to implement measures to include sustainability in its core business. Transforming the system requires approaching both supply and demand systems. In spite of the substantial private sector investment, it is difficult to unlock the vast public sector resources of the donor community. Camilo believes that these constraints are preventing the private sector from advancing on the climate finance issue quickly and effectively. It is important that the private sector and donor community coordinate and collaborate on ways to enhance access to resources with a structured plan and strategy in place. It seems that the public sector and private sector

are competing for resources, which goes against the private sector role of implementing sustainable practices in supply chains. Although supply chain problems are widely understood generally, we need to be creative and propose proactive actions. Sanchez asked how communities and supply chains can have access to those resources faster, such that the private sector can implement programs and leverage around those supply chains with their own in-house experts on climate adaptation and resilient agriculture.

Daniela Chiriac highlighted that more discussions and communication between private companies and the donor community are needed to effectively structure finance. She encouraged participants to share additional ideas in the chat box and noted that comments would be recorded.

Following on Camilo Sanchez's remarks, Akin O. (family name not provided) spoke about an initiative in Nigeria that brings together the private sector to lean on the government to prevent food loss and waste. Government policy was one of the main challenges faced.

Daniela Chiriac invited Jen Cissé to elaborate on comments posted in the chat.

Jen Cissé highlighted two major issues. First, there is a lack of coordination around agricultural insurance, agricultural credit, and climate-friendly extension. Approaches to agricultural insurance and credit inputs are rarely coordinated to the extent that is needed at the smallholder farmer or producer level. A second major issue is the high cost of tracking accessible financial mechanisms by individuals working in ministries or agencies that support climate adaptation on the ground. The complicated processes to access financial mechanisms, which vary by mechanism, result in high costs. Greater coordination will ensure that country governments and accredited organizations have greater access to these financial mechanisms and international finance.

Zain Alabweh commented on forecast-based financing, which allows humanitarian agencies and governments to dispense finance in advance of, rather than after, a disaster. The effectiveness of forecast-based financing depends on the availability and accessibility of climate information. While this is improving, access and use of climate information by indigenous communities is a challenge. Investments are needed to translate climate information and services into indigenous languages and reach smallholder farmers.

Jen Cissé highlighted a concern about a tendency to focus on small, narrow matters in climate finance instead of high-level, impactful issues, e.g., in the area of climate information and services. Jen Cissé encouraged the subcommittee to take a systems view.

Camilo Sanchez agreed with Jen Cissé's comments.

Jamboard Comments:

**These comments are transcribed verbatim from the comments shared in the virtual whiteboard space, with the exception of minor spelling or grammatical edits.*

<u>Priority Systems</u>:

Koko Warner: Food supply chains; farm-level practices; financial risk management that fosters regenerative, net zero food production.

Unknown: Commercial lending in the agri-food sector. E.g., SME finance to transition into new crops or production systems, taking into account risks, opportunity costs, and time to productivity gaps.

Claude K, WFP: Some priority systems could include pro-smallholder farmers (crop/livelihood) insurance systems, pro-SHF climate financing schemes (levering on local community-driven initiatives).

Jagger Harvey, PHLIL, Kansas State University: Readily addressable food loss and waste (1/3 food lost/wasted globally), contributing 10% of anthropogenic greenhouse gasses.

Osman T. Damba, University for Development Studies (UDS), Ghana: The need for prioritizing climate financing among developing partners is critical, added to existing innovation financing options at the end-user levels.

Unknown: Market mechanisms for carbon footprint reductions of food products.

Unknown: Systems discussed by the Koronivia Joint Work on Agriculture under the UNFCCC.

Unknown: Microfinance system – better access to climate smart lending, and household level risk management tools including insurance, recovery lending, etc.

Alex Russell, Feed the Future Innovation Lab for Market, Risk and Resilience: Subsidy policy for rural households to adopt climate-resilient agricultural technologies and practices.

Unknown: Finance for farmers to build soil carbon.

Alex Russell, Feed the Future Innovation Lab for Market, Risk, and Resilience: Agricultural index insurance and other financial instruments that de-risk small-scale agriculture in an increasingly challenging climate.

JD Cisse, Abt Associates: Huge costs to tracking and accessing finance. Need high level coordination and simplification of processes, especially for bilaterals and MDTFs.

Leverage Points:

Piet van Asten (OFI): Technologies to improve labor productivity and diversify farming systems.

Unknown: Current climate financing business models in Africa are still too expensive for smallholder farmers. There is a need for innovation and social/economic engineering to develop and support pro-smallholder farmers climate finance business models. In some countries, for example, some private actors (e.g., Insurance companies) are simply not ready to cover agricultural risks.

Koko Warner, UNFCCC: Investments in agricultural extension services and multi-country initiatives that are relevant / respond to needs of farmers and food supply chains and which also are regenerative in nature. Ag extension often knows the stakeholders best and are trusted in relevant communities. Essential for large-scale change in food systems

JD Cisse, Abt Associates: Coordination of ag credit, insurance, and extension (climate-aware) - these are too often siloed.

Osman T. Damba, University for Development Studies (UDS), Ghana: Leveraging on sustainable financing as a take-off point for both adaptation and climate financing.

Unknown: Links between R&D and commercial applications of climate smart agriculture techniques.

Mark Wood, Tetra Tech: Utilizing climate finance that fosters restorative practices to meet the rapid demands of climate change, rather than incremental change.

Jagger Harvey, PHLIL, Kansas State University: Scale drying and storage innovations, including those developed by Innovation Labs, to reduce postharvest loss in Feed the Future countries.

Unknown: National climate policies (NDC, NAP, NAMA, LTS, etc) embedding agriculture clearly.

Unknown: Incentive models (e.g. Ibis Rice) to promote transformation and overcome current market disincentives towards non-climate smart and maladaptive systems.

Koko Warner, UNFCCC: Networks of farmers doing regenerative practices that achieve desirable results in regenerative food production; disseminating this information across networks.

Unknown: Build on the network, coalitions, initiatives dealing with Agriculture, and even better with climate finance, such as, The International Development Finance Club (IDFC), The Public Development Bank (PDB) Platform for Green and Inclusive Food Systems, and The Task Force on climate-related Financial Disclosures (TCFD).

Unknown: Climate Services Ecosystem to connect different actors and facilitate exchange of information for climate based action.

Camilo Sanchez, Olam: We need to find ways to speed up the process of allocating resources (from donors, governments) to develop private sector supply chains in developing countries. There is the perception that the private sectors have resources sitting somewhere waiting to be spent. This is not that case. For every sustainability intervention we need to present a business case that is aligned with the business purpose of the company and the sustainability goals. Companies like us, are the ones in the field with an in-depth understanding of the issues and how to tackle them.

George Asare, Ignitia: Send advisories in local languages and via SMS for easy comprehension for illiterate farmers.

Camilo Sanchez, Olam: Engaging with the private sector for long-term transformational changes to include sustainability as part of the core business; leveraging private sector resources effectively.

Alex Russell, Feed the Future Innovation Lab for Markets, Risk & Resilience: Disaster risk insurance (also called sovereign risk insurance) for countries that face wide swings in the cost of responding to climate-related disasters.

JD Cisse, Abt Associates: Coordination of ag credit, insurance, & climate-aware extension - these are too often siloed.

Alex Russell, Feed the Future Innovation Lab for Markets, Risk & Resilience: Quality standards for agricultural index insurance and support for private-sector providers to improve the products they offer in rural communities while reducing the chance households are worse off for buying coverage.

Unknown: Fostering avenues of dialogue for impacted countries to express their needs for support to enact specific practices at scale.

Unknown: Use a right-based approach to ensure a fair share for small scale farmers.

Unknown: It would be helpful to explore the evidence on innovations for finance such as innovations that bundle climate smart technologies and finance. At farm level for example, combining a form of index insurance (to reduce risk of technology adoption but which is very effective in years of severe drought) alongside a drought tolerant variety (that really works in a mild to medium level drought) can support the adoption of climate smart technologies- work by the feed the Future Innovation Lab for Markets, Risk and Resilience explores this.

Recommended References:

Unknown: Climate finance in the agriculture and land use sector - global and regional trends between 2000 and 2018: https://www.fao.org/3/cb6056en/cb6056en.pdf.

Unknown: https://www.fao.org/koronivia/en/.

Unknown: MRR Evidence Insight: Evaluating the Case for National Disaster Risk Insurance https://basis.ucdavis.edu/publication/evidence-insight-evaluating-case-national-disaster-risk-insurance.

Unknown: MRR Evidence Insight: Sparking Permanent Adoption of Resilience-building Agricultural Technologies https://basis.ucdavis.edu/publication/evidence-insight-sparking-permanent-adoption-resilience-building-agricultural.

Unknown: MRR Evidence Insight: Generating Resilience+ to Reduce Poverty and Spur Agricultural Growth https://basis.ucdavis.edu/publication/evidence-insight-generating-resilience-reduce-poverty-and-spur-agricultural-growth.

Unknown: MRR Evidence Insight: Making Fertilizer Subsides a Profitable Investment in Kenya https://basis.ucdavis.edu/publication/evidence-insight-making-fertilizer-subsides-profitable-investment-kenya.

Unknown: Who is contributing to the Koronivia Joint Work on Agriculture and how? A systematic analysis of actors' participation in the process: https://doi.org/10.4060/cc0122en.

Unknown: FAO Food loss and waste reduction, measurement and policy https://www.fao.org/platform-food-loss-waste/en/

Unknown: https://www.fao.org/climate-change/our-work/what-we-do/ndcs/research-tools/en/ (see publication section, below for NDC analysis to see gaps and opportunities for Ag).

Breakout Room Comments:

**Note: Comments related to meeting logistics were removed. Comments and commenter identities copied verbatim with the exception of minor grammatical and spelling corrections.*

Mary Beggs, Tetra Tech: For breakout rooms, please try the three dots at the bottom of your zoom screen. You will see a break out room option

Eric Hyman: Eric Hyman, USAID Center for Economics and Market Development

Richard Choularton: Richard Choularton @ Tetra Tech in Vermont, USA

Evan Notman: Evan Notman. USAID joining via phone in transit

Camilo Sanchez-Olam Food Ingredients: Hi Camilo Sanchez, Coffee Sustainability Manager at ofi (Olam Food Ingredients)

Jenn Cisse: Hi everyone - Jenn Cisse, Director of Climate Adaptation & Resilience at Abt Associates

Linda Loubert: Hello, Linda Loubert from Morgan State University. I will leave at 12 to teach my class.

Angelino Viceisza: Angelino Viceisza, Spelman College, Atlanta GA, Also: A Subcommittee member for this report

Alex Russell to Everyone: Hello everyone. I'm Alex Russell, Feed the Future Innovation Lab for Markets, Risk & Resilience.

Jagger Harvey: Jagger Harvey - Director Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss, Kansas State University

Steve Morin: Steve Morin, Center for Agriculture USAID

Henri Moore: Hello, Henri Moore from Haleon.

Tope Nwoseh: Tope Nwoseh- Tetra Tech ARD, Arlington VA

Oyediji Olubukola: Oyediji Olubukola Tolulope, Agricultural Economics, University of Ibadan, NigeriaOsmant Damba (UDS Ghana): Osman Tahidu Damba, an Agricultural Economist and a Senior Lecturer at the University for Development Studies (UDS), Ghana. I am also the AICCRA-Ghana Cluster Lead on Technology Identification and Upscaling

Claude Kakule: Hello everyone. WFP Burundi Deputy Country Director

Jonathan Cook (USAID): Jonathan Cook, Adaptation/Resilience, USAID

Ogolla John Martin: Ogolla John Martin, Makerere University

Zain Alabweh IRI: Zain Alabweh, International Research Institute for Climate and Society, Columbia University, [Email address removed]

Ann Vaughan (USAID): Hello, Ann Vaughan, Sr Advisor for Climate Change in Bureau for Resilience and Food Security, USAID

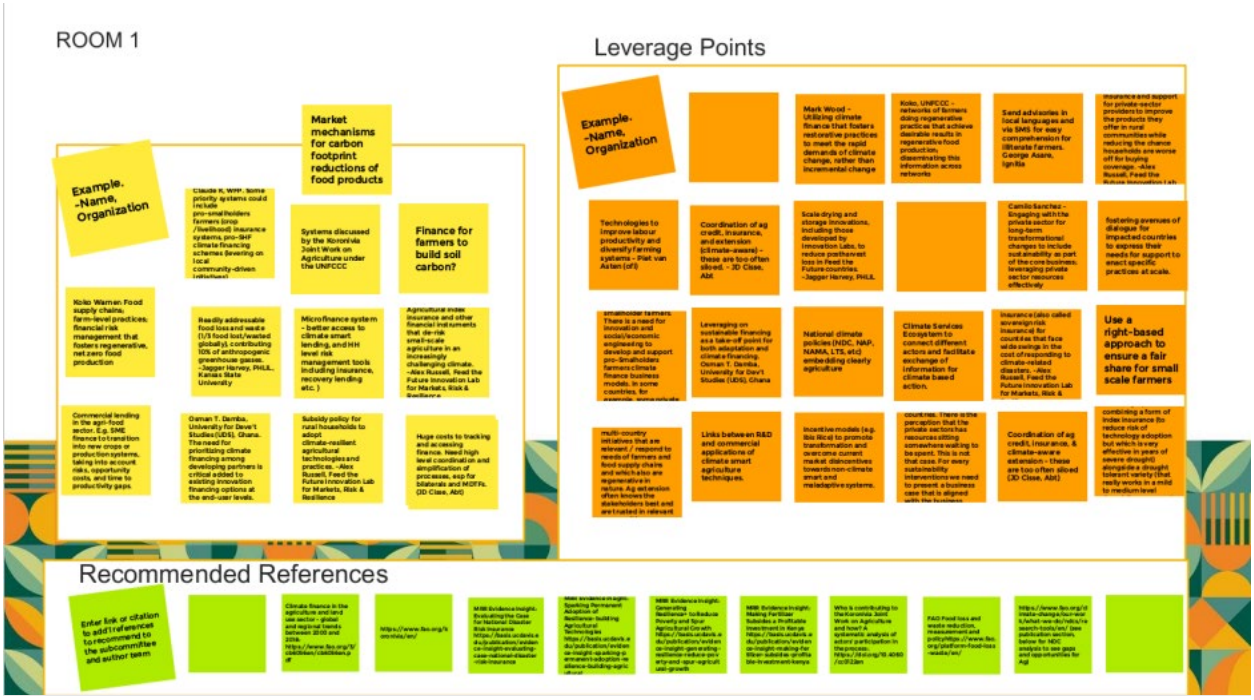
Camilo Sanchez-Olam Food Ingredients: Can you put the statement on the screen or copy it here?

David Tschirley, Michigan State University: Resilience in markets depends on the resilience of market actors. In addition to farmers, these crucially include millions of actors in the midstream - transporters, traders at assembly, wholesale and retail, processors, and others. So it's important to think in a broad value chain and food systems perspective when thinking about interventions. In doing so, need to put special attention on what Saweda Liverpool-Tasie referred to as the nano, micro, small, and medium scale enterprises that still dominate many of these systems -- David Tschirley, MSU

David Tschirley, Michigan State University: It seems that a potentially big black box - lack of information - relates to what is being done at community level to adapt to climate change. National initiatives need to be aware of the size and nature of these initiatives if they are to be effective. I note work by Laura Schmid-Olabisi generating some of the only evidence I know on this issue. - David Tschirley, MSU and Innovation Lab for Food Security Policy Research, Capacity, and influence (PRCI)

Olaf Westermann: Hi Robert Bob Tsutsu, on your question on the challenges of deforestation in Malawi....Deforestation is really a symptom of a system (exploitation) that perpetuates a problem, rather than a system that perpetuates the solution (restoration and sustainable land management). I hope this session and the initiative will give you ideas on how and where to intervene in the system in the land use sector in Malawi. CRS1 specifically, has been working for many years with watershed management through the WALA and UBALE projects and there is plenty of evidence from external research studies (including from USAID and US universities) that this is a sustainable approach to maintain ecosystems services like water flow and availability, as well as improving livelihoods and resilience to climate change. I will be happy to share the reports if interested.

Jamboard screenshot:



Minutes of Breakout Room 2: Climate Information Advisory Services and Early Warning Systems
August 31, 2022 11:30-11:55 am EDT (Virtual)

Room Facilitators: Lini Wollenberg (BIFAD Subcommittee Chair and Research Professor, Gund Institute, University of Vermont, USA); Erin Coughlin de Perez (BIFAD Subcommittee Member and Research Director, Dignitas Professor, Friedman School of Nutrition, Tufts University, USA)

Co-Facilitator: Lauren Allognon (Data and Analytics Associate, Tetra Tech, USA)

Number of Attendees: 38

The Board for International Food and Agricultural Development (BIFAD) Subcommittee Members and Breakout Room Facilitators Lini Wollenberg and Erin Coughlin de Perez welcomed everyone into the breakout room. Erin Coughlin de Perez introduced herself and explained that the topic of this discussion is climate information advisories and early warning systems. She highlighted that the purpose of this breakout room is to identify priority systems and leverage points for transformative change to advance climate change adaptation and mitigation, while considering inclusion of under-represented populations, gender equality, social inclusion, and the enabling environment.

Lauren Allognon introduced herself and provided instructions for using the Jamboard to capture notes and ideas. She discussed the different ways to share contributions on the Jamboard, chat, or unmuting and sharing verbally.

Erin Coughlin de Perez invited participants to share their thoughts on transformational opportunities and priority leverage points for climate information advisories and early warning systems.

Shawakat Begum, Country Director for Practical Action in Bangladesh, explained that Practical Action is implementing climate resilience and early warning advisories and working with the Ministry of Environmental Management to develop and program mobile apps for loss and damage assessments.

They recognized issues of gender and social inclusion, especially when discussing women's technology access. In Bangladesh, actively promoted mobile networks and advisory services are still not reaching women. Research and data analysis conducted by Practical Action showed that mobile devices and technologies are still largely controlled by the men in the household. Women lacked timely access to agromet advisories related to both climate change early warning and agricultural information. One leverage point is to offer training to both men and women so that women can also be seen as agents for early warning systems and can encourage others through their networks.

Coughlin de Perez said that Shawakat Begum's point of enhancing access to early warnings and advisory services is excellent and invited others to suggest ways to better reach people who tend not to receive adequate and necessary information.

George Asare, Project Manager at Ignitia, is developing climate-smart advisories for farmers in West Africa. An important lesson is that farmers often make decisions without considering accurate weather forecasts because they lack access to accurate weather forecasts. Instead, they often use traditional means to predict the weather. For example, farmers apply fertilizer, and within the next two hours, rainfall or runoff washes the fertilizer away, causing the farmers to lose the benefits of fertilizer applications. Although Ignitia has been trying to reduce this information deficit, a key obstacle is illiteracy among farmers. Climate information tends to include heavy and esoteric language; simple language will enhance knowledge dissemination. In addition, many farmers do not have smartphones. SMS should be used to send messages, keeping the text light and to the point so farmers with little educational background can understand and use this information.

Coughlin de Perez invited participants to build on leverage points for improving connectivity and to provide case studies where this has been done well.

Gordon Nikoi, from the organization Esoko in Ghana, explained that when trying to reach farmers and to provide last-mile, accurate early warning, weather advice, or information on climate-smart agriculture, illiteracy is also a major obstacle. Nikoi has observed that the best method to reach farmers is through voice, using local languages. Nikoi has built a farmer help line with a call center that can translate knowledge into 15 local languages. This method allows farmers to access and use needed information in a timely manner in a language they can understand.

Barry Pittendrigh explained that Purdue University's Scientific Animation Without Borders program takes expert knowledge on a given topic where there is a gap in a given system and then creates accurate, animated materials. Examples of knowledge gaps include reducing the use of firewood, reducing negative environmental impacts, and generating positive outcomes for farmers. This program translates information on these topics into local languages through a network approach. Currently, this can be done in about 280 different languages. This content is subsequently used by other groups in their scaling efforts and specifically targets low-literate learners who speak diverse languages. The program also works with country partners using many different approaches for deployment, including WhatsApp networks that will get a note to someone who has a device that can accept a message, and that device can in turn be used as an approach for working with people who are off-line. Pittendrigh underscored a tremendous need to identify the important gaps in these systems and what research-for-development innovations already exist from the Consortium of International Agricultural Research Centers (CGIAR), National Agricultural Research Systems (NARS) programs, universities, and other organizations where there is strong evidence that an intervention can have a positive outcome and can be scaled.

Chris Daudu argued that another key leverage point is translating climate information (e.g., weather forecasts) into recommendations for farmers. In Nigeria, some organizations are trying to translate

climate information into smaller domains, but this is largely ineffective because these attempts are not scaled out.

Erin Coughlin de Perez highlighted that there are several large climate-related disasters occurring throughout the world today, from drought in Somalia to flooding in Pakistan, and invited participants to share concrete ideas as to what priority systems and leverage points would have been helpful in these cases. Lini Wollenberg observed that a few patterns have emerged from this discussion. There is a pattern in the need to build on existing knowledge and to have participatory processes. Another pattern is the need to leverage existing structures of agricultural extension and advisories and linking information delivery to those. A third pattern is the need for greater investment in infrastructure, and a fourth is the need for greater coordination among donors on the demand and supply side. A fifth cluster of comments is on the data itself, building on historical data and getting more precise early warning systems. Erin Coughlin de Perez commented that coordination of advisories is critical, as conflicting advisories can be very damaging. She recapped session comments on reaching everyone who needs to be reached, methods to improve connectivity, pragmatic and creative communications, what information is being communicated, participatory processes to understand what people need and how to make that work and ensure coordination. She invited participants to add anything that might have been missed.

Edmond Totin highlighted the value of indigenous and local knowledge, mainly in African countries, noting that weather infrastructure is not available everywhere. Local and indigenous knowledge can strengthen the robustness and accuracy of climate information in African countries. In Kenya or in Burkina Faso, for example, traditional leaders known locally as rainmakers have been involved in a project to interpret climate information according to their local knowledge in tandem with a climate scientist. The final product is a bricolage of science and indigenous knowledge. The process can be time consuming and energy intensive, but it builds on what people need, their skills, and their expectations, and it enables local people to see themselves as both actors in and drivers of this process. In this way, we can design climate information not just for people, but with people.

Rehana Noor said that BRAC in Bangladesh is working to create a support center that can disseminate early warning information messages to the farmers. Attempts to utilize apps have been unsuccessful because many farmers are not digitally literate. Farmers have some hesitation to use apps because most farmers are middle aged and not comfortable with smartphones, and because smartphones and internet connectivity are not available in many remote places. Noor suggested that governments and nongovernmental organizations should collaborate and create support centers where farmers and field staff can connect and share information and early warning system information individually and in group discussion.

Erin Coughlin de Perez said many of the systems being suggested involving communication systems as a major priority for investment, in addition to another theme about collaborative, participatory processes to co-define what information gets pushed out through communication systems.

Jim Hansen commented that there is a lot of existing knowledge that is unfortunately fragmented. Hanson cited a need and opportunity for transformative change if we stop working in silos, build on existing knowledge, reduce information fragmentation, and balance a supply-side bias that is still prevalent in many countries.

Erin Coughlin de Perez assured participants that she would report back about communications systems as major priority systems and leverage points in terms of participatory processes.

Lini Wollenberg added other key points about data and modeling, building on historical data, and Ana Maria Loboguerrero's point on making sure early warning systems are applied to other agricultural issues, e.g., pests and diseases.

Erin Coughlin de Perez thanked breakout room participants and adjourned the session.

Jamboard Comments:

**These comments are transcribed verbatim from the comments shared in the virtual whiteboard space, with the exception of minor spelling or grammatical edits.*

Priority Systems:

Laura Sigelmann, USAID: Digital connectivity and literacy as a critical enabler.

Ana Maria Loboguerrero, Panelist and CGIAR: Using early warning systems for pests and diseases issues.

Edmond: Integration of IK/LK into CIS.

Unknown: Communication systems (needs investing).

Moffatt Ngugi, USAID: Institutional strengthening such as schools, polytechnics, universities e.g. with youth mappers, match human capacity development with strong institutions.

Rehana Noor, BRAC: Developing different climatic hazard models (heat stress model etc) for better decision-making for farmers' end.

Unknown: Scalable educational expert vetted videos/animations in their own languages. Content can be deployed through WhatsApp networks.

Erlich Zauisomue, UNAM, Namibia: Access to historical data at local level to be fed into early warning system prototypes.

Leverage Points:

Jim Hansen, IRI: Support funders to build on existing knowledge, incentivize good practice, strengthen supply-side and demand-side capacity in a balanced manner, and coordinate action.

Ana Maria Loboguerrero, Panelist and CGIAR: Need to build evidence of the ROI of early warning systems, and work on advocacy regarding early action approaches among key development and finance institutions and national governments.

Jim Hansen, IRI: Leverage strategic advantage of public and private sector actors, paying attention to what should be public goods and to equitability considerations.

Jim Hansen, IRI: Formally integrate climate services and agricultural extension at national level.

Jonelle Palmer, American University: Leverage local and traditional knowledge. Indigenous knowledge is often dynamic and is rooted in observing change. A great example of this is Hindou Ibrahim from the M'bororo community in Chad partnering with the Chadian government to create a map of climatic changes in the landscape.

Esoko, Ghana: Challenge with information systems: literacy --> voice messages are working.

Ana Maria Loboguerrero, Panelist and CGIAR: Climate information needs to target specific climate risks and different population sectors.

Edmond: Strategic investment in weather infrastructure is also critical to support effective warning systems.

Chris Daudu: Challenge: how to make forecasts helpful to farmers --> translate to recommendations, actionable.

Barry Pittendrigh, Purdue University: Identify gaps in systems, opportunities in existing programs/interventions --> how can we scale those interventions/scaling pathways.

Shampa, BUET, Bangladesh: 1. Need precise Early Warning System, its dissemination and people's faith in it for rapid on-set extreme events. 2. Need a strategic plan for slow onset events. 3.Finally-How decision-makers approach the climate/disaster crisis is also needed to consider.

Edmond: It is important not to design CI for people but to design information WITH them to meet their aspirations and needs.

Unknown: Leverage the existing structures of agricultural extension systems and advisory services.

Jim Hansen, IRI: Invest seriously in farmers' capacity to understand and use climate information, and to influence co-production of improved services.

Ana Maria Loboguerrero, Panelist and CGIAR: Participatory processes (e.g. PICSA).

Unknown: FEWSNET, NASA HARVEST.

Jim Hansen, IRI: Strategically combine communication processes (participatory, digital, media) to address different types and time scales of information and needs of different types of farmers and pastoralists. Beware of uncritical use of mobile phone channels as a sole channel and as a substitute for institutional channels.

Jim Hansen, IRI: Strategically combine communication channels to address different user needs (e.g., women vs. men), roles (e.g., dissemination vs. capacity strengthening) and types of information. Beware of promoting mobile phones as a sole channel, or as a substitute for institutional channels.

Laura Sigelmann, USAID: Understanding how critical enablers lead to uptake - i.e. connectivity, literacy, and delivery method.

Laura Sigelmann, USAID: Citizen science and participatory data governance.

Lauren Allognon, Tetra Tech: Equitable access to technology (including connectivity) to enable access to many of the services mentioned. Tied to infrastructure.

Recommended References:

Unknown: IRI, 2019. Scaling Climate Services to Enable Effective Adaptation Action. Global Commission on Adaptation, Rotterdam and Washington, DC. https://gca.org/wp-content/uploads/2020/12/ScalingClimateServices.pdf.

Unknown: Hansen et al., 2019. Climate services can support African farmers' context-specific adaptation needs at scale. Frontiers in Sustainable Food Systems 3:21. DOI: 10.3389/fsufs.2019.00021.

Unknown: Hansen et al. 2022. Impact pathways from climate services to SDG2 ("zero hunger"): A synthesis of evidence. Climate Risk Management 35. DOI: 10.1016/j.crm.2022.100399.

Unknown: Born et al., 2021. Data, Information, and Governance of Digital Climate-Informed Advisory Services. CCAFS. https://hdl.handle.net/10568/117449.

Unknown: Singh, C., Daron, J., Bazaz, A., Ziervogel, G., Spear, D., Krishnaswamy, J., Zaroug, M., Kituyi, E., 2018. The utility of weather and climate information for adaptation decision-making: current uses and future prospects in Africa and India. Climate and Development 10, 389-405.

Unknown: Steiner, A., Aguilar, G., Bomba, K., Bonilla, J. P., Campbell, A., Echeverria, R., ... & Zebiak, S. (2020). Actions to transform food systems under climate change.

Unknown: Loboguerrero AM, Boshell F, Leon G, Martinez-Baron D, Giraldo D, Recaman L, Diaz E, Cock J. 2018. Bridging the Gap between Climate Science and Farmers in Colombia. Climate Risk Management, 22:67-81.

Unknown: Hansen et al., 2022. Country-Specific Challenges to Improving Effectiveness, Scalability and Sustainability of Agricultural Climate Services in Africa. Frontiers in Climate, In press. DOI: 10.3389/fclim.2022.928512.

Breakout Room Comments:

**Note: Comments related to meeting logistics were removed. Comments and commenter identities copied verbatim with the exception of minor grammatical and spelling corrections.*

Dr. Christopher Mathis, Jr.: Dr. Christopher C. Mathis, Jr., UAPB, Associate Dean for Research/Associate Research Director, from a 1890 Land Grant University. LS

Simeon Onya: I am Simeon Onya. Lecturer department of Agricultural Economics, Michael Okpara University of Agriculture Umudike, Abia State, Nigeria

Elizabeth Asiimwe: Elizabeth Asiimwe form the Uganda Forum for Agricultural Advisory Services, and Program Manager at Makerere University

Dr. Christopher Mathis, Jr.: Inclusion of 1890 Land Grant University

Ramesh Kumar Singh- GPSVS: This is Ramesh Kumar Singh, from GPSVS based in Bihar,India; has been working on climate change adaptation and climate resilience with women and marginalized communities.

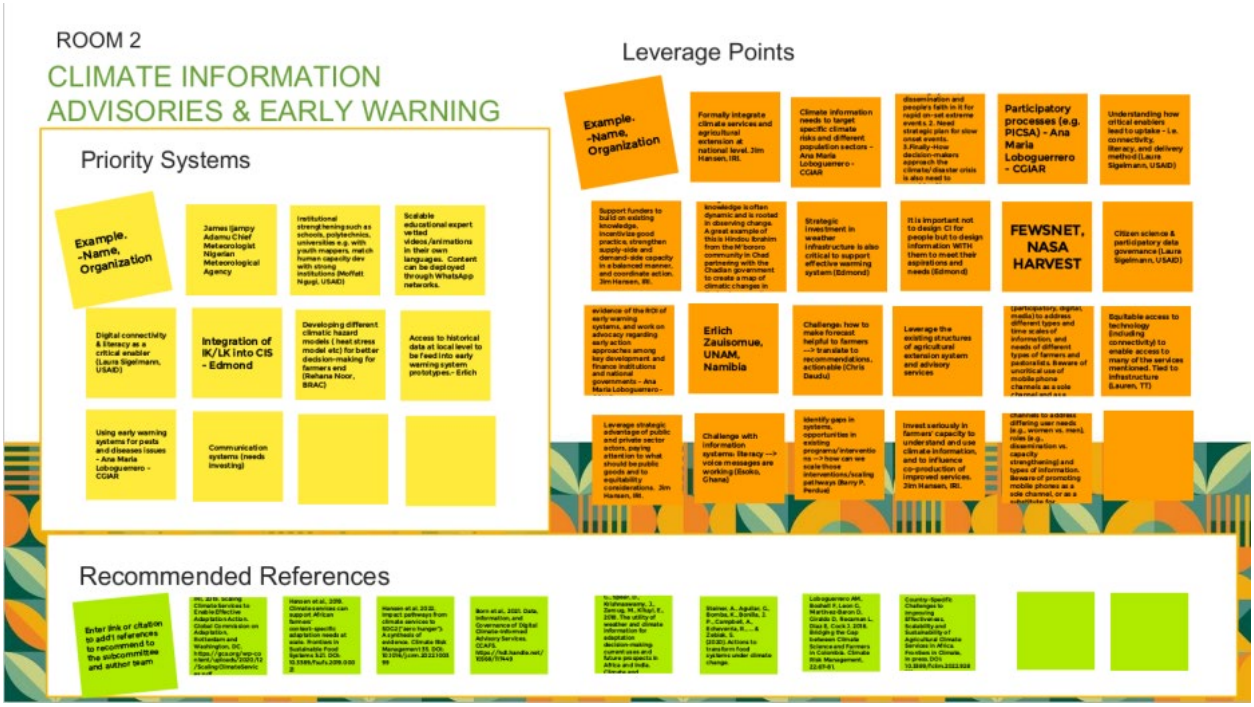
Mark Amadi: Mark Amadi Department of Agriculture (Economics and Extension) Alex Ekwueme Federal University Ndufu-Alike Ebonyi State, Nigeria

Caron Gala, APLU: I also upvote Barry's comments about his work

Hector Santos: There's a need to look at the perspective of the farmer and not only the big picture. The farmer needs to know if it will rain or not. Just like we can check in DC whether the next day there will be rain.

Ahmed Balogun: Hello Everyone, I am Ahmed Balogun, Department of Meteorology & Climate Science, Federal University of Technology, Akure (FUTA), Nigeria. [Contact Information Removed]

Jamboard screenshot:



Minutes of Breakout Room 3: Crop Production Systems
August 31, 2022 11:30–11:55am EDT (Virtual)

Room Facilitator: Rahel Diro (Co-Author of BIFAD Climate Change Subcommittee, Tetra Tech, USA)

Co-Facilitator: Emma Page (Administrative Specialist, Tetra Tech, USA)

Number of Attendees: 62

Room Facilitator and Board for International Food and Agricultural Development (BIFAD) Subcommittee Climate Change Subcommittee Co-Author, Rahel Diro, read the Jamboard comments as they appeared on the screen. She noticed the Jamboard comment, *Global genomics-assisted breeding networks,* and asked the comment creator to further expand on the idea. Benjamin Kohl's organization develops networks for genomics-assisted breeding in partnership with local organizations (farmers, users, etc.) in Ethiopia, Niger, and Senegal. Rahel Diro asked participants if the research system in general should be a priority system and what leverage points should be changed within the system.

Session participant and BIFAD member Rattan Lal suggested soil health as a priority system.

Rahel Diro clarified that leverage points are the key things that need to be changed in priority systems to bring about transformation.

BIFAD member Rattan Lal also suggested payments to farmers for carbon sequestration as leverage points under the soil health priority system.

Francesco Carnevale Zampaolo highlighted a Jamboard comment, *System of Rice Intensification (SRI),* and identified further research on context-specific implementation of this system as a leverage point the combination of SRI with other agro-ecological practices (e.g., conservation agriculture and agroforestry), and the results they can provide, are sometimes overlooked. To further increase the combination of

practices, we must look to policymakers with capacity to implement them at scale. Zampaolo identified an opportunity to include SRI in the nationally determined contributions (NDCs). If SRI is included in NDCs, it would help to scale practices that can mitigate and maintain greenhouse gas emissions and ensure both food and nutrition security. Zampaolo suggested building on previous SRI projects and supporting current SRI-based projects in countries with the focus on scaling these technologies through policy support and international institutions.

Rahel Diro returned to survey the Jamboard comments and requested elaboration on the comment, *Focus on nutrition rather than volume.* John Medendorp from Purdue University said that we focus on yields and producing more food, but nutrition is not as central to our planning as it ought to be. We need to focus on ensuring that diverse diets are available, especially in growing urban populations. There is a lack of sources of nutritional food in urban centers, and unless we start paying attention to supplying the entire nutritional spectrum, there will be deficiencies in diets and other problems such as obesity, even in the midst of hunger. Medendorp said focusing on nutrition rather than the production of food would be an important change in approach.

Kaganga John, a farmer in agroecology and a Nature-Based Actions Specialist at Kikandwa Environmental Association, Uganda, said that in Uganda, there are some areas of the country where people are dying of hunger, but other areas that have plenty of food. Kaganga John said that crop distribution is often overlooked and called for more research on crop distribution, marketing, and quantity and quality.

Phil Gaffney, based in the UK, said a key gap is fertilizers. Gaffney said that fertilizers are very expensive worldwide at the moment and that there are major worldwide issues of fertilizer availability. Fertilizer natural resources are running out. There is perhaps 50 years' worth of phosphorus left on the planet for mining. Gaffney argued that we need to find other ways to reduce fertilizer usage. Gaffney's company manufactures biostimulants and works in Africa, Latin America, and Asia, and there are natural fertilizers available that would help get away from chemical fertilizer. Education on proper fertilizer use is lacking and needs to be expanded.

Rahel Diro reviewed the ideas on the updated Jamboard: input-fertilizer systems are key in crop production, research education, including farmer education, soil health, carbon sequestration, a focus on nutrition rather than simply increasing production, system of rice intensification, and finance.

Alfredo Rueda from Honduras said that for farmers to make changes in production, they need secure land tenure. No farmers will invest in their land if they do not own it. Rueda also mentioned water harvesting technologies and irrigation systems to improve productivity and enhance resilience of systems.

Douglas Annor, Representative for Partners in Sustainable Development, Ghana, mentioned that in Ghana, the Ghana Cocoa Board buys cocoa products from each village where it has an office, but for other crop production, there is no marketing structure from the farmgate to the national level. If a chain of command or marketing strategy were established, production would increase, Annor said, and if farmers were equipped with opportunities to market, they could ship their products anywhere.

Jamboard Comments:

**These comments are transcribed verbatim from the comments shared in the virtual whiteboard space, with the exception of minor spelling or grammatical edits.*

Priority Systems

Momin, University of Arkansas Pine Bluff: Low-cost precision ag technologies

Phil Gaffney, UK: Fertilizers and cost and usage

Alfredo Rueda, Honduras: Land tenure

(No Name), Honduras: Water harvesting reservoirs

Jeff Seale, Regrow Ag: Sustainable Intensification to reduce land use change and restore ecosystems [Contact Information Removed]

[Contact Information Removed], Ghana: storage, processing and marketing is crucial to crop production

Benjamin Kohl, Organization Unknown: Global genomics-assisted breeding networks

Francesco CarnevaleZampaolo, Programme Director at SRI-2030: Our goal is to upscale SRI practices from the current 6.7 million up to 50 million hectares by 2030 to reduce methane emissions from rice paddies while increasing food

Comfort [family name unknown], Ministry of Food and Agriculture, Ghana: Seed systems for food security crops, agricultural financing, and women empowerment along the agricultural value chain

Angela Manjichi, Instituto Superior Politechnico de Manica: Maize and Legumes Cropping Systems

Unknown, Kansas State University: Collaborative research on sorghum and millet (translated from French to English) [original text: recerche collaborative sur le sorgho et le mil]

Unknown: Shorter supply lines/urban agriculture

Unknown: Inputs

Unknown: Integrating crop and livestock production systems as landscape level, with focus on restoring ecosystems services such as soil health and water availability and quality

Unknown: System of Rice Intensification (SRI)

Unknown: Availability of Sweet potato virus clean plants

Unknown: Farmer education and supports (colleges and associations)

Leverage Points

Comfort [family name unknown], Ghana: Strengthen market linkages and distribution channels in the seed and other input supply chain

Douglas Annor, Partners in Sustainable Development, Ghana: creating social enterprises can help crop production

Kaganga John, Uganda: Distribution and functioning markets

John Medendorp, USAID: Focus on nutrition rather than volume; nutritional spectrum is available esp. for urban centers. Focus on systems

Daniel Bailey, USAID: Improve seed systems, early seed production and last mile are the sticky points

Kansas State University: Technologies ready-to-scale

Francesco, Organization Unknown: SRI – context specific implementation; agroecology; agroforestry

Unknown: Subsidies for regen-friendly practices and inputs

Unknown: Invest in Biotech crops research, strengthen knowledge management systems

Unknown: Soil health – payment to farmers for carbon sequestration

Unknown: Incentives for producers to implement smart practices, educational and training programs for producers to encourage the adoption of climate smart practices

Unknown: Biodiversity

Unknown: Finance for farmers to support a transition to Regen Ag

Unknown: That access to best seed/inputs for smallholder farmers is critical to reducing land use in ag/food. Improving small-holder productivity is key lever in reducing land use change and driving a more sustainable food value

Unknown: Move away from animal proteins and toward plant-based proteins

Unknown: Intentional focus on urban diets

Unknown: Revaluing of ecosystem service and max output within ecological boundaries as opposed to simply max output/yield (including payments)

Unknown: AWD practice adoption to reduce carbon emission in rice fields

Unknown: Bring stakeholders together at different level, including from community to landscape level, and form sector to a multidisciplinary approach, to collaborate for a more systemic change

Unknown: Co-creation involving farmers and stakeholders throughout the research process

Recommended References:

Unknown, Kansas State University: Feed the Future Innovation Lab for Collaborative Research on Sorghum and Millet (SMIL)

Unknown: Integrating crop-livestock farmer practices, and focusing on circular and sustainable farming systems

Unknown: Farm income and production impacts from the use of genetically modified.

Unknown: https://www.sciencedirect.com/science/article/pii/50168180018312602 [link error]

Unknown: Feed the Future Global Supporting Seed Systems for Development activity (S34D) has generated and compiled resources on early seed production and last mile delivery.

Breakout Room Comments:

**Note: Comments related to meeting logistics were removed. Comments and commenter identities copied verbatim with the exception of minor grammatical and spelling corrections.*

Olaf Westermann: Hi Douglas, on your question on agroecology and GMO, CRS definitely works though regenerative approaches like regreening agriculture, water smart agriculture, watershed management, and multistory agroforestry as part of our land restoration approach. But we also for example use the 4Rs fertilization approach (right type, place, time and amount of fertilizer) to bridge the longer term benefits from land restoration with quick gains from improved fertilizations. This is critical to motivate farmers using a sequenced approach to land restoration.

From Alfredo Rueda: Land tenure is needed to install resilience measures in place, Alfredo Rueda, Honduras

Yien Bachuch: Yien Bachuch from Gambella Agricultural Research Institute, Ethiopia

Alfredo Rueda: Water harvest, for irrigation can increase productivity and resilience

Kaganga John: Kaganga John, a farmer agroecology and Nature based actions specialist from Uganda working with NGO known as Kikandwa Environmental Association; {Contact Information Removed]

Douglas Annor: creating social enterprises can help crop production.

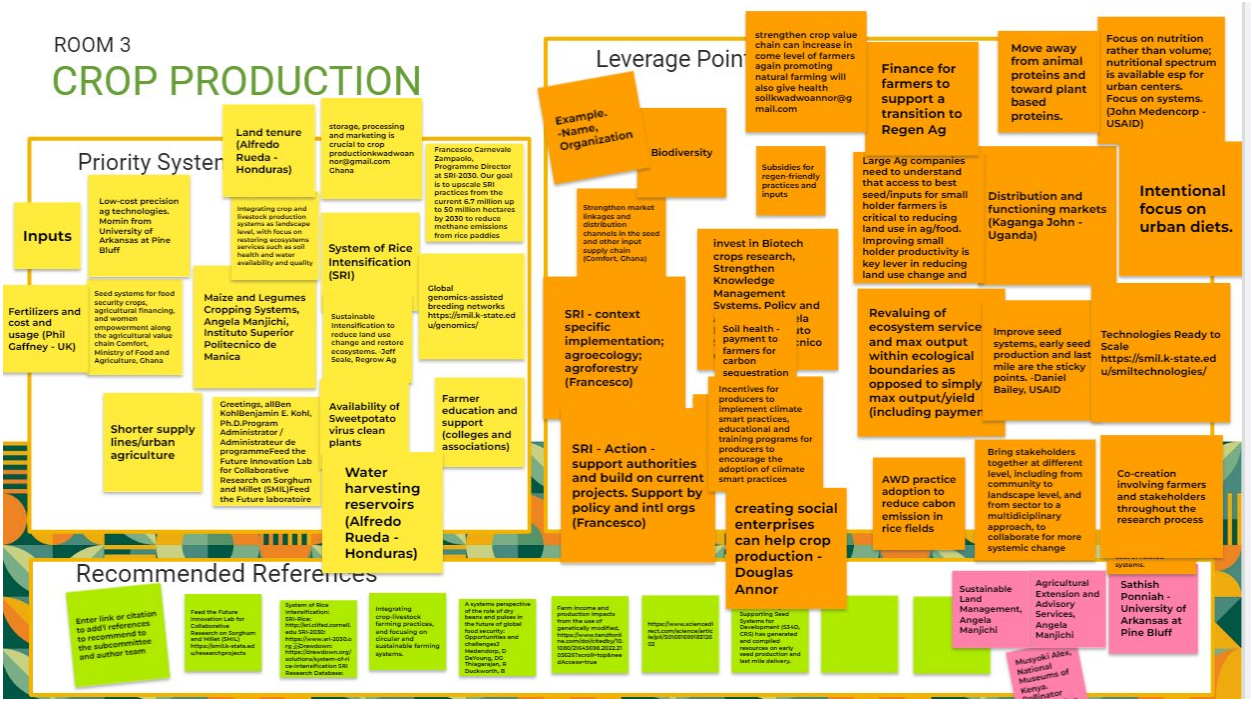
Ronald Walusimbi: Walusimbi Ronald, Makerere University, School of Agricultural Sciences, Department of Agribusiness and natural resource economics.

Douglas Annor: strengthening crop value chain can increase income level of farmers again promoting natural farming will also give healthy soil.

Franklin DJEDANEM: Organic farm post, Manager Objective: from collaboration with Climate Change and every organic farm. [Contact Information Removed]

Douglas Annor: Annor Douglas, partners in Sustainable Development, [Contact Information Removed] Ghana, storage, processing, and marketing is crucial to crop production [Contact Information Removed]

Jamboard screenshot:



Minutes of Breakout Room 4: Livestock & Fisheries Production
August 31st, 2022 11:30–11:55 am EDT (virtual)

Room Facilitator: Mario Herrero (BIFAD Climate Change Subcommittee Member and Professor, Cornell Atkinson Scholar, Department of Global Development, Cornell University, USA) & Chinenye Juliet Ejezie (BIFAD Climate Change Subcommittee Member & Founder and Chief Executive Officer of Dozliet Anim Farms, Nigeria; Country Coordinator, Climate Smart Agriculture Youth Network, Nigeria)

Co-Facilitator: Ed Carr (Co-Author on BIFAD Climate Change Subcommittee & Director and Professor, International Development, Community, and Environment Department, Clark University, USA)

Number of Attendees: 29

An unknown attendee commented that Uganda does not have concrete data that support government decision making on climate mitigation options for livestock emissions. Specifically, we do not know how much methane or nitrous oxide are emitted by specific kinds of livestock in specific production systems, so policymakers end up making guesses about mitigation options. The speaker called for more research to generate data on how much we are emitting, which systems are working better, the productivity of systems vis a vis emissions, and possible mitigation solutions, e.g., livestock feed. The speaker said that a case in point is the reporting on nationally determined emissions in Uganda, which are based on the Intergovernmental Panel on Climate Change (IPCC) Tier 1 Data. She said that some of those data points are not specific to our areas, and she hoped we can obtain data that reflects the actual points on the ground through improved research and data.

Walter Baethgen commented that we need to differentiate among livestock production systems. It's common for people, especially those not familiar with livestock production, to talk about livestock production systems as if they were homogenous when that is not the case. Whatever we propose as research actions and needs, Baethgen stated, we need to differentiate among different types of livestock systems, for example: livestock systems that destroy tropical forests for pasture, grazing systems in natural ecosystems that help to conserve those ecosystems, or industrial livestock production. Baethgen highlighted two priority systems. First, research on the sustainability of production systems in grasslands, which account for 20% of land, should be a priority mainly because grasslands are areas not competing to produce food for humans; these are areas where animals are transforming something inedible to humans into something that is nutrient rich. The second priority system is traditional pastoralist systems because some of the most vulnerable people involved in livestock production live in these areas.

Ed Carr thanked Walter Baethgen for detailing priority systems and leverage points. He said that a challenge of the author team is to distill what the priority systems should be. Carr agreed that we must narrow this down. Livestock production systems is too broad; we must talk about which livestock production systems. This is exactly the kind of input we are looking for.

There is something around grazing systems, focusing on key systems with serious constraints. Those seem to be important. Dairy is a quick win opportunity. Dairy has received a lot of attention in the past. It is one of the stories of success. The key is the feed provisioning for this.

Mario Herrero said that many participants have mentioned poultry, small-ruminant production for pastoralists, and grazing systems, focusing on key systems with serious constraints. Herrero read a Jamboard comment identifying dairy as a quick-win opportunity. Herrero mentioned that dairy has received a lot of attention in the past in low- and middle-income communities. It is a story of success from the ruminant sector, though the key is the feed provisioning for this. Herrero invited Ahmed Kablan to share remarks.

Ahmed Kablan, USAID, said that the focus of the discussion has been on large and small land animals. He brought up concerns surrounding the fisheries sector. Kablan stressed the importance of a sustainable source of feed for aquaculture, fishers, and aquaculture food system to advance productivity and reduce waste. Kablan observed on field visits that one challenge in aquaculture and fisheries is the feed or feed source, which is often low quality or imported. Referring to the Jamboard post, Kablan proposed sustainable production of feed using animal-source protein or circular economy as a potential solution to the issue.

Mario Herrero called on Aderonke Alamj for sharing insight. Alamj, as an academic, shared the priority system of funding research to solve problems in production and practice that farmers are carrying out in

the field. Another priority area is bridging the information gap between researchers and farmers. Alamj noted a possible leverage point is working with farmer associations, with the example of aquaculture associations, especially in Africa, to share findings.

Jamboard Comments:

**These comments are transcribed verbatim from the comments shared in the virtual whiteboard space, with the exception of minor spelling or grammatical edits*

Priority Systems

Uttam Deb, University of Arkansas at Pine Bluff: Policies and strategies to adapt to climate change

Unknown: Research and evidence-based data

Unknown: Improving the nutritional statuses of livestock especially, ruminant feed (improving feed and decreasing methane especially for Africa)

Unknown: Low productivity crop-livestock (ruminant) systems in LMICs

Unknown: Feed source is a limiting factor for both systems, either does not provide enough nutrition for the livestock, or not safe or depend on imports

Unknown: Circular economy for feed production as a way of reducing food loss and waste

Unknown: Capacitating infrastructure and human resources in the area of methane emission measurement

Unknown: Intersection of crop (feed) and livestock systems

Unknown: Poultry production systems (to permit a dietary transition which maintains diet quality but reduces environmental impact)

Unknown: Small ruminant production markets for vulnerable pastoralists

Unknown: Upgrading low productivity dairy systems – quick with opportunity

Unknown: Focus on key systems with serious constraints. Grazing systems

Leverage Points

Unknown: Strengthening existing higher education systems and agricultural institutions

Unknown: Private sector innovations

Unknown: Exploring aquaculture to ensure steady supply of fish as a good source of animal protein

Unknown: Integrated crop-livestock efficiency

Unknown: Shift back to pre-colonial indigenous food sources and intensify those

Unknown: Shortage in marine fisheries might be an opportunity to insert atl protein (crop waste, insects, etc.) into fish mill value chains

Unknown: Improved food environments for reducing food safety risks

Unknown: Fisheries is an essential entry point. Sustainable source of feed

Unknown: Private sector advisory services – notably improve ruminant nutrition

Unknown: Ensure livestock do not compete with arable land. Land use planning

Unknown: Livestock Master Plans/MDB Investments – include low emission approaches, at the least support stronger data systems to understand environmental impacts

Unknown: Innovative protein foods that mimic that taste and texture of and cost the same or less than ruminant meat (plant-based meats and cultivated meat) (Josh McBee, Climate Advisors)

Unknown: Animal Health Services; Current 20-25% mortality as well as morbidity represent huge system inefficiencies and deter investment to improve productivity

Unknown: National methane abatement plans (under development through the Global Methane Pledge)

Unknown: Food loss and waste could be used to shift to substitutes in feed-like insect farming

Unknown: Animal Feed Sector; Drive productivity gains and lower emission intensity

Recommended References

Unknown: de Preneuf, F., Sunjoyo, N. N., 2021. Insect and Hydroponic Farming Could Boost Food Security, Business, and the Circular Economy, Insect & Hydroponic Farming, https://www.worldbank.org/en/news/press-release/2021/12/08/insect-and-hydroponic-farming-could-boost-food-security-business-and-the-circular-economy.

Unknown: CCAFS catalogue of published research

Breakout Room Comments:

**Note: Comments related to meeting logistics were removed. Comments and commenter identities copied verbatim with the exception of minor grammatical and spelling corrections.*

Mayomi Taiwo- Afolabi: Dept of Food Science and Technology.; Federal University Dutsinma., Katsina. Nigeria

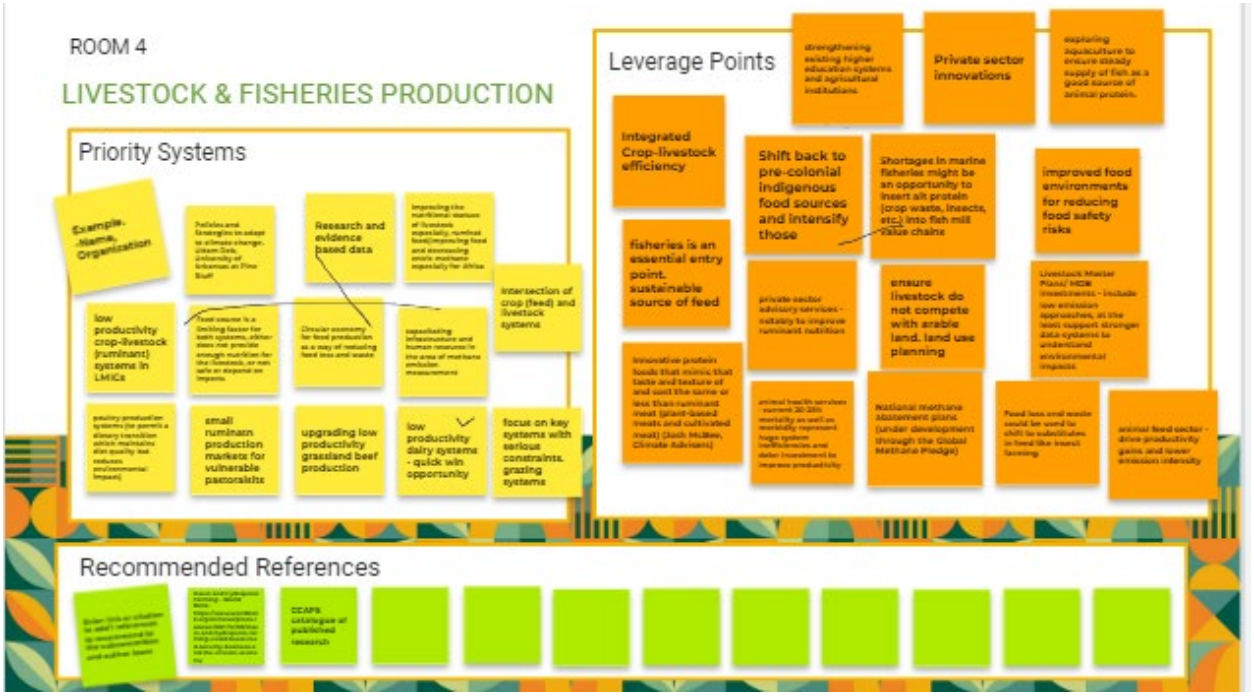
Ahmed Balogun: Hello Everyone, I am Ahmed Balogun, Department of Meteorology & Climate Science, Federal University of Technology, Akure (FUTA), Nigeria. Thank you.

Olawunmi Ilesanmi: Thank you everyone!

Walter Baethgen (IRI): Referring to Jam Board notes) 1. Ensure we differentiate what livestock production system we are referring to (based on deforestation, based on natural ecosystems (grasslands), industrial, pastoralism?

- Priorities: 1. Pastoralism (some of the most vulnerable populations involved in livestock production); 2. Based on natural grasslands (20% of the Earth) not competing with production of food for humans (non-arable lands)

Jamboard screenshot:



Minutes of Breakout Room 5: Resilient Markets
August 31, 2022 11:30–11:55 am EDT (Virtual)

Room Facilitator: Andrew Muhammad (BIFAD Subcommittee Member and Professor and Blasingame Chair of Excellence in Agricultural Policy, University of Tennessee, USA)

Co-Facilitator: Mary Beggs (Agriculture and Economic Growth Sector Director, Tetra Tech, USA)

Number of Attendees: 28

The Board for International Food and Agricultural Development (BIFAD) Subcommittee Member and Breakout Room Facilitator, Andrew Muhammad, and co-facilitator, Mary Beggs, welcomed participants to the breakout room. United States Agency for International Development (USAID) BIFAD Executive Director, Clara Cohen, and Panelist, Sara Boettiger, joined the meeting and welcomed participants.

After brief introductions, Andrew Muhammad explained the overall objective of the discussion, to gather feedback on ways in which governments, businesses, and other entities can intervene in markets to improve the livelihoods of smallholder producers in developing countries, and to brainstorm ways to reduce overall inefficiencies in markets to address issues, such as food waste. Mary Beggs explained that the study team is soliciting points on where we see potential for facilitating change within the wider system, leverage points within those systems where action may be able to achieve transformative change with climate change adaptation and mitigation, and specific interventions.

Muhammad encouraged participants to think about major areas for transformative systemic change. An example of transformative change, Muhammad offered, is translating price signals to smallholder producers through the use of digital and cell phone technologies to make linkages along the supply chain to smallholders for making use of efficient markets in terms of maximizing the value of sales. Sara Boettiger remarked that the focus on market resilience is especially important in our current situation. Our normally reasonably resilient global system has been broken in different ways. For instance, the

planting season for food for next year is worrying. This topic of resilient markets will be increasingly critical in the next couple of years. Boettiger's second point was the importance of strategic food reserves in countries. There are good practices of digitizing and modernizing these reserves. Helping country governments how to do this is a major lever. This is already happening in some, but not all, countries.

Michael Olabisi remarked that country governments alone may not be able to store enough food during a climate emergency. Therefore, we should also consider incentives and policies that encourage private sector actors and food aggregators to manage and improve that process. If we can reduce loss by private sector actors during the grain aggregation process, it could complement efforts to support and modernize government reserves, ensuring that food is available in times of crisis.

Diane Russell, USAID Bureau of Resilience and Food Security Natural Resource Management Advisor, has worked on market systems and tropical agriculture for three decades. Russell also works with very poor communities in Central Africa, mostly the Democratic Republic of Congo (DRC), where shifting cultivation is the major agricultural system and where markets are very poor. Russell mentioned sustainable intensification and its role in reducing climate stress because more can be produced in one area. Russell was curious how sustainable intensification would work in the weak markets of the DRC. When food production increases in one area, most of the food may go to those who can already afford to purchase it. Poor farmers do not have enough revenue to afford sustainable intensification. This market system is inextricably linked to sustainable intensification as a solution to climate change problems.

Tom Opapa from Kickstart International, which supports smallholder farmers with irrigation solutions across Africa, noted that one of the main challenges is that farmers are left on their own to deal with climate impacts and hazards, specifically droughts and floods. There is a need for a shift from rain-fed agriculture to irrigated agriculture for smallholder food security. Opapa suggested that the subcommittee work on a policy framework that could support low-cost irrigation at the bottom of the pyramid, especially in Africa, to ensure available food and nutrition. There are a lot of water sources in Africa that can be used in irrigation systems. Opapa believes that water-harvesting techniques would contribute to improving food security in Africa.

Mary Beggs read a chat comment from Arun Zakaria, of the College of Agriculture and Affiliated Science in Baramati, India: "What are the constraints that may arise when we establish market-integrated processing units, which may be a potential solution to avoid food wastage and [achieve] food security?" Beggs paraphrased that this comment focuses on bottlenecks around food waste that could contribute to food security and explained that the author team has identified these constraints as a key priority.

Andrew Muhammad asked for comments on different strategies for using digital technologies. Muhammad explained that marketing systems in developing countries do not have the resources to provide information to farmers and producers, in contrast to marketing systems in the United States, which provide substantial information. Muhammad believes that linking supply-chain participants through these small-scale digital technologies could be a solution to reduce food loss and food waste.

Co-Director of Cultural Practice, LLC, Deborah Rubin, said that in terms of resilient market systems, we need to spend more time on solutions to support women, youth, and other groups for social inclusion in entrepreneurial efforts that address climate change. We still tend to put too much emphasis on engaging women in lower levels of the market chains, in production and processing, which may be extractive or have other negative repercussions for addressing climate change. Rubin would like to see more attention —and more money, perhaps from USAID's new gender and climate change budgets— move in support for people with more innovative, broader visions in this area.

Cheryl Christensen's areas of expertise are in international agricultural development and food security and is retired from the United States Department of Agriculture's Economic Research Service (USDA ERS). Market integration through better price information and where possible, digital technologies, are incredible in their importance and potential impact. This involves the ability to harness growing mobile technologies in many African countries. In Kenya, Uganda, and other East African countries, mobile technologies have penetrated everywhere. People can use these technologies, and with that information, they can make informed local decisions. As we invest in more market information systems, we need to do this in partnership with other information platforms and their information links. Kenya, as a good example, has programs to assist people who are in danger as a result of climate change-related impacts, such as droughts. Relief from these climate impacts and hazards is often delivered through these mobile systems, which reduce time and effort compared to more cumbersome physical distribution processes.

David Tschirley leads the Feed the Future Innovation Lab on Food Security Policy, Research, Capacity, and Influence (PRCI) at Michigan State University. Building on several Jamboard comments about the private sector and "missing middle" actors, and an earlier comment from BIFAD Member Saweda Liverpool-Tasie on nano-, micro-, and small-scale enterprises, Tschirley said that markets are resilient to the extent that the actors in those markets are resilient. A hugely important component of these actors is the midstream, including transporters, assembly, wholesale, retail, traders, processors, storers, and other service providers. When we think about financing, information, and technological solutions, we should keep a firm eye on what is not the "missing middle", but the "invisible" or "hidden" middle, which is often overlooked despite its importance in the system. Tschirley asked Sara Boettiger about digitization of food reserves: what is involved and in what countries has it been done successfully?

Sara Boettiger agreed with David Tschirley's comments on small and medium enterprises (SME). In response to the question, there is work in Kenya on how to manage strategic food reserves at the national level, including how to move this inventory operationally, the capital expenditure (CAPEX) funding, what goes in it and what would be needed. While this is not the only answer to many major issues, it is an important piece to make the food reserves more efficient. The important questions are when, where, and how to intervene in markets. There has been significant work on best practices and lessons learned in different countries. The second part is digitization of the process to eliminate the use of paper and spreadsheets to capture information. In Kenya, a balance sheet was created, accessible by stakeholders, including politicians and policy makers, so that they knew what was in the food reserve in their country. While not a perfect solution, this made decision-making more transparent and easier in some ways.

Andrew Muhammad pivoted the conversation to leverage points and interventions for positive economic, social, and behavioral change.

Jean-Michel Voisard emphasized the notion of the "forgotten middle" and the importance of banks' involvement in trade and working with local banks to help them access carbon credit systems to back their commissions. The breakroom time limit was reached before Voisard completed sharing ideas around priority interventions.

Jamboard Comments:

**These comments are transcribed verbatim from the comments shared in the virtual whiteboard space, with the exception of minor spelling or grammatical edits.*

Priority Systems:

Meredith Jackson-deGraffenred, Helen Keller: Inclusive digital systems to link producers with buyers and input suppliers to allow negotiation and maximize profit. This can reduce waste and loss at the producer level and increase household resilience.

Arun Zacharia, College of Agriculture and Allied Science Baramati, Pune, Maharashtra, India: constraints that may arise when we establish a market integrated processing unit, which may be a potential solution to avoid food wastage and food security?

David Tschirley, Michigan State University, Resilience in markets depends on the resilience of market actors. In addition to farmers, these crucially include millions of actors in the midstream - transporters, traders at assembly, wholesale and retail, processors, and others. So it's important to think in a broad value chain and food systems perspective when thinking about interventions.

Isa Salaam, Florida A&M University, Interested in studying agricultural and environmental economics.

Deborah Rubin, Director, Cultural Practice, LLC.: Building on the handbook we wrote, 'Promoting Gender Equitable Opportunities in Agricultural Value Chains' for USAID some years back - I see we now need to focus on support for women entrepreneurs to engage in climate-smart businesses.

Unknown: Crop systems for local markets.

James Woolley, USAID Haiti: Improved cooperation between farmers, livestock holders and agribusinesses.

Unknown: The "Missing middle actors" and short supply chain trading need to be integrated in the solutions - not only focusing on large scale formal actors.

Unknown: My interest is how market systems support sustainable intensification. SI is critical but will not help poorer, more isolated farmers. Food may not flow to them. Also their returns will not be sufficient to afford intensification.

James Woolley, USAID Haiti: Livestock systems resilience.

Unknown: The problem of affordability of irrigation in very poor areas and how to sustain the infrastructure.

David Tschirley, Michigan State University: It seems that a potentially big black box - lack of information - relates to what is being done at a community level to adapt to climate change. National initiatives need to be aware of the size and nature of these initiatives if they are to be effective. I note work by Laura Schmid-Olabisi generating some of the only evidence I know on this issue.

Siyanbola Omitoyin: I am more interested in how rural women will key into the most productive node and be able to overcome the changes in the marketplace. Gender equality is also critical in addressing some of these issues.

Leverage Points:

Tom van Mourik, Helen Keller International: Improve efficiency in food supply chains through high tech (digital, solar cold chains) and low tech (drying technologies, processing).

Unknown: Development of financially backed trading systems that integrate small farmers can help local banks leverage carbon credits to support trade.

Unknown: There are also strong cultural and social dimensions to local market systems, which is rarely considered. Markets can be used to mobilize people and share information. Market actors move around

and can play a role in dissemination of ideas and technologies. Often we just focus on farmers, But traders and merchants are critical parts of the food system.

Sara Boettiger, Consultant, Public Meeting Panelist: Strategic food reserves. See recording. Notes from MB.

Dianne Russell: There are also strong cultural and social dimensions to local market systems, which is rarely considered. Markets can be used to mobilize people and share information. Market actors move around and can play a role in dissemination of ideas and technologies. Often we just focus on farmers, But traders and merchants are critical parts of the food system.

Unknown: We have heard over the past few years that with the consistent shocks to the market systems (especially from COVID but other shocks as well) that the markets have "broken down". It seems that harvesting the evidence on when/where markets are breaking down under shocks, would provide insights into leverage points for building (back or building new) more resilient markets.

Meredith Jackson-deGraffenried, Helen Keller International: Increase value and appreciation for local/indigenous foods to reduce transportation needs and excessive ag inputs, while increasing production by using native foods.

Unknown: Local banks and carbon credit systems.

Meredith Jackson-deGraffenried, Helen Keller International: Increase market value of nutritious indigenous/local foods.

David Tschirley, Michigan State University: A final comment is that climate shocks occur in an environment of multiple shocks from multiple sources - local conflict, unanticipated and disruptive policy changes either locally or among trade partners, public health events such as COVID and Ebola, and other sources. Oftentimes the source(s) of a particular shock cannot be clearly or uniquely identified. So we really need to place our thinking about climate shocks in this broader context of multiple shocks from multiple sources.

Meredith Jackson-deGraffenried, Helen Keller International: Increase human capital (skills, knowledge) for women farmers, and male farmers, to use and innovate climate-smart practices.

Meredith Jackson-deGraffenried, Helen Keller International: Educate non-producer market actors on the value of climate-smart products and practices to increase demand. Additionally, work with buyers and suppliers to create strategies to work with women, youth, and any producers applying climate-smart practices.

Recommended References:

Unknown: Markets and sustainable intensification linkages—creating food systems that work for poor farmers.

Jules Siedenburg: https://www.frontiersin.org/articles/10.3389/fsufs.2022.976946/full

Note from Mary: See comment in breakout group

Unknown: Rubin, D., B. Boonabaana, and C. Manfre. 2019. “Building an Inclusive Agriculture: Strengthening Gender Equality in Agricultural Value Chains” In A. Quisumbing, R. Meinzen-Dick, and J. Njuki. Gender Equality in Rural Africa: From Commitments to Outcomes. ReSAKSS Annual Trends and Outlook Report. Washington, D.C.: IFPRI.

Unknown: The KasuwaGo project is supported by USAID through the Legume Systems Innovation Lab.

Jean-Michel Voisard: Country led agriculture Insurance for small cereal farmers https://pdf.usaid.gov/pdf_docs/PA00TRQC.pdf

Deborah Rubin, Director, Cultural Practice, LLC: Building on the handbook we wrote, "Promoting Gender Equitable Opportunities in Agricultural Value Chains' for USAID some years back.

Jean-Michel Voisard: https://www.rti.org/rti-press-publication/senegal-farmer-networks-respond-covid-19-les-r%C3%A9seaux-de-producteurs-du-s%C3%A9n%C3%A9gal

Unknown: Integrated Credit systems to support inclusive trade bringing in the "less-formal" sector - developed by Feed the Future: https://pdf.usaid.gov/pdf_docs/PA00TRQJ.pd [link error]

Breakout Room Comments:

**Note: Comments related to meeting logistics were removed. Comments and commenter identities copied verbatim with the exception of minor grammatical and spelling corrections.*

Tom Van Mourik: Hello everyone, Tom van Mourik from Helen Keller Intl. here. Global Food Systems Advisor, based in Dakar, Senegal.

Tom.opapa: Thanks, I am already inside my preferred room.

Arun G Zacharia: What are the constraints that may arise when we establish market integrated processing units, which may be a potential solution to avoid food wastage and food security? Name - Arun Zacharia. From -College of agriculture and allied science Baramati, Pune, Maharashtra, India

Jules Siedenburg: I just published a paper that may be of interest as offering possible entry points. It summarized recent evidence on agri-food applications of microalgae, then explored how they offer promising options for both adaptation to and mitigation of climate change. Here's that link: https://www.frontiersin.org/articles/10.3389/fsufs.2022.976946/full

Mary Beggs, Tetra Tech: @jules - thank you for your comment. Can you please also say your affiliation?

Laura Schmid-Olabisi: I'm connecting from a mobile device so I may want to disconnect and reconnect from a pc. Permit me to self-promote a little bit in mentioning KasuwaGo an app and USSD phone system we put in place for farmers again sellers in West Africa

Mary Beggs, Tetra Tech: Thank you Olabisi - please also say your affiliation

Laura Schmid-Olabisi: In response to the comment advocating more accessible tech to help market participants. I am based at Michigan State University. The KasuwaGo project is supported by USAID through the Legume Systems Innovation Lab.

Mary Beggs, Tetra Tech: Thank you Olabisi.

Deborah Rubin: Deborah Rubin, Director, Cultural Practice, LLC. Building on the handbook we wrote, "Promoting Gender Equitable Opportunities in Agricultural Value Chains' for USAID some years back - I see we now need to focus on support for women entrepreneurs to engage in climate-smart businesses.

F- Siyanbola Omitoyin: I am more interested in how rural women will key into the most productive node and be able to overcome the changes in the marketplace. Gender equality is also critical in addressing some of these issues

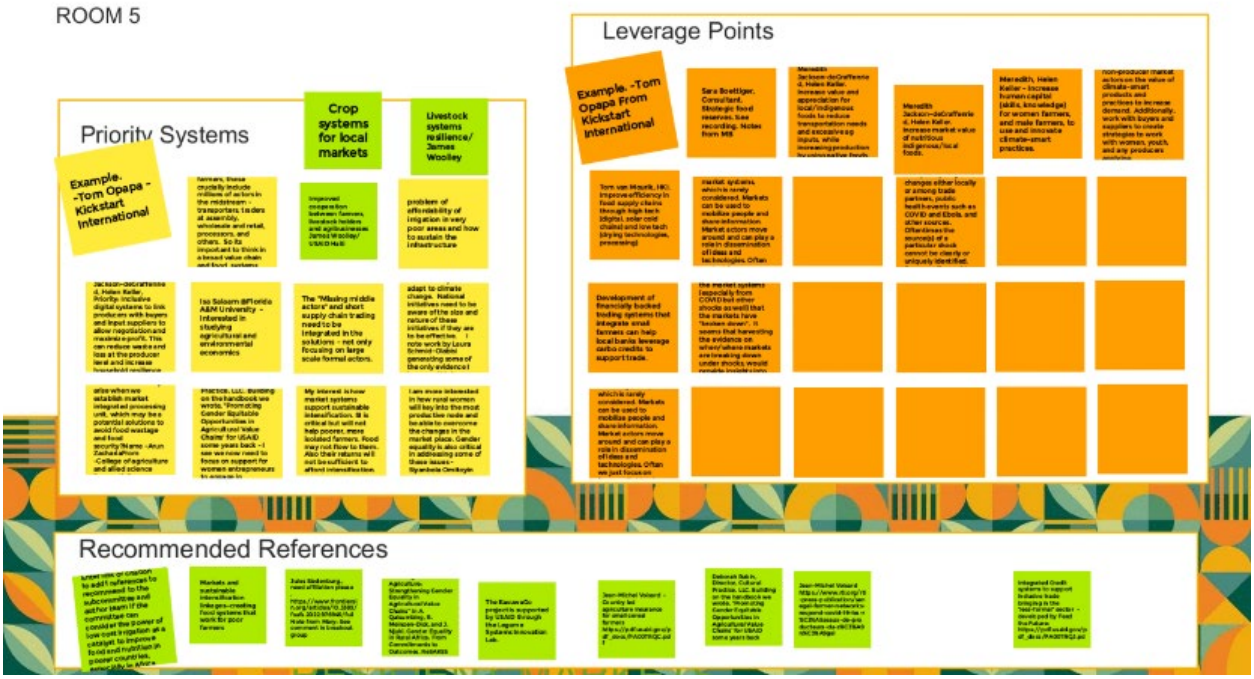
Diane Russell: There are also strong cultural and social dimensions to local market systems, which is rarely considered. Markets can be used to mobilize people and share information. Market actors move

around and can play a role in dissemination of ideas and technologies. Often we just focus on farmers, But traders and merchants are critical parts of the food system.

Mary Beggs, Tetra Tech: Diane - please provide your affiliation

Pamela Anderson, BIFAD Member, and Director Emerita, International Potato Center: We have heard over the past few years that with the consistent shocks to the market systems (especially from COVID but other shocks as well) that the markets have "broken down". It seems that harvesting the evidence on when/where markets are breaking down under shocks, would provide insights into leverage points for building (back or building new) more resilient markets.

Jamboard screenshot:



Minutes of Breakout Room 6: Nutrition
August 31, 2022 11:30–11:55 am EDT (Virtual)

Room Facilitators: Jessica Fanzo (BIFAD Climate Change Subcommittee Member and Bloomberg Distinguished Professor of Global Food Policy and Ethics, Johns Hopkins University, USA)

Co-Facilitator: Carmen Benson (Senior Counselor of BIFAD Support Contract, Tetra Tech, USA)

Number of Attendees: 29

Session Co-Facilitator Carmen Benson encouraged participants to outline priority systems, leverage points, and references in the Jamboard.

The Board for International Food and Agricultural Development (BIFAD) Climate Change Subcommittee Member and Room Facilitator, Jessica Fanzo, asked session participants to think about areas of priority for nutrition and its intersection with climate. She encouraged participants to think about interventions, activities, technologies, innovation, social innovation, and community cohesion for ensuring that

nutrition is not only included when thinking about climate change mitigation and adaptation but is central to it. Although the climate agenda is focused on the energy sector, food systems are also critically important: what people are eating and the kind of foods to which they have access.

Fanzo reviewed the definitions of key terms. Leverage points are places within a system where action could lead to transformational change. Leverage points within the food system include the type of food being grown, the type of subsidy policies in place, or how marginalized or disadvantaged communities can obtain better access to healthy foods. Fanzo encouraged participants to consider prioritizing under-represented, marginalized, or nutritionally vulnerable people and gender, social inclusion, and social justice. Fanzo noted that utilizing insects as alternative proteins was highlighted in the Jamboard as a priority system. The issue of food deserts, particularly in communities of color and under-served communities, was also listed as a priority system. Other Jamboard comments highlighted biofortification as a potential priority and circular economies for insects as a leverage point.

An attendee (name unknown) suggested that a potential leverage point or priority system is assisting youth to make healthful food choices while simultaneously educating them about how their food choices affect their carbon footprint. Several 1890 public land-grant universities received a grant from the National 4-H Council, Ag Innovators Experience, to teach students about the carbon cycle and how to choose foods from the different food groups to curb their carbon footprint (e.g., purchasing food from locally sourced vendors or using reusable and not disposable containers).

Noel Gurwick, Senior Climate and Land Advisor at USAID, circled back to the Jamboard comment about insect protein. Gurwick shared that when we talk about insect-based proteins—and also plant-based proteins and the growth of that market—a response we often get is that none of these alternatives can compete with animal-based proteins for child nutrition. It could be useful for the subcommittee to provide USAID, via BIFAD, guidance on what that balance needs to look like. For a child's diet, what percentage of protein needs to come from animals, and what does that need look like across the age spectrum? This is a confusing space, and since this subcommittee has strong research expertise, to flesh that out more might be very helpful.

Jessica Fanzo agreed that there has been a lot of work on different sources of alternative proteins, including plant-based, lab-grown, insects, and other wild sources. The health benefits and environmental impact of these alternative proteins is confusing. To synthesize the whole range of alternative proteins and to unpack the science on their contributions to nutrition throughout the lifecycle would be helpful.

Fanzo also noted comments in the Jamboard about wild foods, forest foods, and safety nets for farmers growing nutrient-dense crops.

Teresa Henson from the University of Arkansas Pine-Bluff, sharing findings on the benefits of precision nutrition on chronic disease from a recent conference, said evidence suggests that nutrients from insects can benefit those suffering from a chronic disease. Precision nutrition is a new term for many, but it would be useful to explore the role of insects, particularly for underserved populations where chronic diseases are more prevalent.

Fanzo mentioned that precision nutrition is a priority for the National Institutes of Health.

Brenda Oppert, from the United States Department of Agriculture Agricultural Research Service (USDA ARS) in Manhattan, Kansas, has expertise in insects and is part of USDA's Grand Challenges program. There are about 50 SYs (Scientist-Years) working in ARS on developing insects for specific applications, including work on improving the nutrient profile of insects for nutritional applications. Oppert noted that there are researchers working on improving insect nutrients for use in poultry feed and

aquaculture. In the area of human health, researchers are working on improving the fatty acid nutritional profile and the protein content of insects. Oppert's own research looks at the genomics and genetics of insect nutrient profiles.

Fanzo and Benson highlighted additional comments on the Jamboard, including promoting nutrient-dense, climate-resilient crops; better understanding nutrient content under the CO_2 fertilization effect; investing in nutrient-rich, under-developed supply chains in a climate-neutral manner; pushing agricultural systems to diversify; understanding the nutritional quality of crops being grown; connecting local farmers to underutilized biodiverse landraces; promoting local, traditional, underutilized species and wild foods; providing lower greenhouse gas emissions intensity, and reducing food waste.

Marilyn Bailey, of the University of Arkansas at Pine Bluff, spoke of herbs as a health benefit and alternative to chemical beauty products. Bailey was awarded an Evans-Allen project to build a demonstration garden site for preschool children to learn from their grandparents. Bailey has also been researching the effects of rosemary on hair loss. Fanzo said understanding traditional herbs and their impacts is an unexplored research area.

Noel Gurwick, Senior Climate and Land Advisor at USAID, said that his focus tends to be at the intersection of agriculture, food systems, climate change, and that he doesn't consider nutrition much. Gurwick asked how we can bring a nutrition lens to the broader trends in the agriculture–food systems–climate change space. Urbanization, for example, is a huge trend in development with carbon implications, one of which is diet. Intensification of agriculture is another trend, and what tends to go with it is homogenization of crops and deforestation. Gurwick asked what important nutrition questions or nutrition intervention points should be considered if we think about the world through that lens and what that means for the subcommittee's work. Gurwick asked what we need to do to integrate the nutrition challenge with these broader climate–agriculture–food systems trends.

Jessica Fanzo noted that land management, what we are growing, and encroachment of urban areas into biodiverse spaces are huge issues. She mentioned previous work on what avoiding land extensification might look like, from a nutrition perspective, and the policy questions that might raise (e.g., subsidies). Fanzo said that as countries grow, farms consolidate and concentrate, which leads to the loss of farming systems diversity. This is a significant debate in the agricultural community, and agronomists and nutritionists do not always align on how to best manage landscapes. Part of the BIFAD [subcommittee's] work is to take, from a nutrition perspective, what land management and land use should look like without extensifying.

A breakout room attendee (name unknown) shared that USDA has been implementing programs that promote no-till farming and water management. These programs will pay farmers to use the technologies.

Fanzo reflected on regenerative, agroecological, and alternative agricultural systems and the implications of this mosaic of systems for diets, nutrition, and feeding 10 billion people. Fanzo thanked participants for the session and their ideas.

Jamboard Comments:

**These comments are transcribed verbatim from the comments shared in the virtual whiteboard space, with the exception of minor spelling or grammatical edits*

Priority Systems

Peter [family name not provided], Kickstart International: We need to support small-holder farmers to make a shift from rainfed farming to irrigated farming; from growing traditional cereals to high value fruits and vegetables

Noel Gurwick, USAID: Alternatives can compete with animal-based proteins for nutrition for children. Potential useful for the subcommittees to give guidance to BIFAD on the balance for a child's diet, and what does this look like across the age spectrum

Unknown: Food environment protection is critical for sustainable food system

Brenda Oppert, USDA: Nutrient profile of insects to improve for specific applications (e.g. implementation in poultry, aquaculture)

Teki Hunt, University of Arkansas at Pine Bluff: Priority system – Targeting youth to eat healthy as well as choosing food from sources that will help to curb their carbon footprint

Jennifer Nielsen, Helen Keller International: Link food production to larger ecosystem restoration and protection to support nutrition and climate

- Strengthen regulation of the promotion of commercially produced non-nutritious foods which often out-compete locally produced nutritious foods
- Support smallholders to increase production of healthy animal and plant foods such as prices for local consumers come down without causing climate impact

Teresa Henson, UAPB: Precision nutrition and impact on chronic disease

Marilyn Bailey, Use of herbs as a health benefit and alternative for chemicalized beauty products (references Evans Allen Project for demonstration site with preschool students)

Unknown: Alternative Proteins

Unknown: Insects

Unknown: Animal waste, one of the causes of stunting in Africa. Sanitation is key to nutrition to prevent stunting and diseases

Unknown: Explore adaptation to changing nutrient content under elevated CO2 concentrations – e.g. shifting diets, biofortification

Unknown: Precision Nutrition

Unknown: a. reduce food waste/lost (contributing to climate change); b. provide access to healthier processed foods and fights NCDs; c. improved incomes and resiliency for those most at risk of climate change

Unknown: Reduce food loss and waste

Unknown: Safety nets for farmers growing nutrient dense crops

Unknown: Increase focus on agricultural production provided lower GHG emissions intensity

Unknown: A working knowledge of the UN's Sustainable Development Goal

Unknown: New technologies for food storage to mitigate effects of climate change

Unknown: Maternal and child health

Unknown: Subsidies – amount/direction

Unknown: Support policies incentivizing production of nutrient-dense crops that are resilient to climate change

Unknown: Real administrative support for the work faculty/staff/students/researchers and Extension professionals are doing land-grant campus agriculture farms

Unknown: What do urbanization associated with shifting diets, agricultural intensification, and associated land-use mean for nutrition? Do the business-as-usual trends have positive or negative implications for nutrition?

Unknown: Think about maternal health and nutrition; and how nutrition impacts outcomes on maternal health, etc.; and of course, the disparities in maternal health, particularly for Black women.

Unknown: Bio-fortification

Unknown: Community and family garden programs as well as teaching youth and adults how to

Unknown: Reduce food loss and waste

Unknown: Safety nets for farmers

Unknown: Food safety through reduction of aflatoxins in maize and groundnut

Unknown: Food deserts, particularly in communities of color, underserved communities, low-income and economically poor communities:

Unknown: Support policies incentivizing production of nutrient-dense crops that are resilient to climate change

Unknown: Promotion of nutrient-dense and climate resilient crops

Unknown: Local, healthy foods

Unknown: Wild foods – leverage points would be land governance to conserve land that otherwise might be cleared

Unknown: Encourage growing and consumption of traditional vegetables especially in the developing countries

Unknown: Investment in nutrient rich underdeveloped supply chains in climate neutral manners (e.g. thinking milk/dairy in Africa)

Breakout Room Comments:

**Note: Comments related to meeting logistics were removed. Comments and commenter identities copied verbatim with the exception of minor grammatical and spelling corrections.*

Caroline Gatobu-Kaimosi Friends University-Kenya: Hi Caroline Gatobu-Kaimosi Friends University-Kenya, capacity-building for farmers associations on matters climate change mitigation strategies

Nina Lyon-Bennett, Assistant Dean for Academics: Dr. Bailey, there has been quite a bit of discussion of herbalists and the use of herbs to treat various diseases as an alternative to traditional medicine.

Caroline Gatobu-Kaimosi Friends University-Kenya: What is the role of nutrition governance in developing countries?

Caroline Kasman she/her/hers: Sorry, who was the individual that said they are working in the genomics space? I would love to talk with you further after this session!

Ahmed Balogun: Hello Everyone, I am Ahmed Balogun, Department of Meteorology & Climate Science, Federal University of Technology, Akure (FUTA), Nigeria. [Contact Information Removed]

Jamboard screenshot:

ANNEX 2: CHAT TRANSCRIPT

Comments were slightly edited to redact any contact information or exclude logistics-related comments

10:31:08 From Carmen Benson, BIFAD Support to Everyone:
Welcome! Please feel free to introduce yourself in the chat.

10:31:43 From Mike Colby to Everyone:
Mike Colby, Arlington, Virginia, USA

10:31:47 From Aderemi Adewole to Everyone:
Aderemi Adewole from Nigeria

10:31:57 From Uttam Deb to Everyone:
Good Morning!

10:32:01 From Teki Hunt to Everyone:
Good morning. I am Teki Hunt from the University of Arkansas at Pine Bluff.

10:32:03 From Andre Shelby to Everyone:
Good morning everyone

10:32:07 From Jenn Cisse to Everyone:
Hi everyone - Jenn Cisse, Abt Associates

10:32:09 From Erin Coughlan de Perez to Everyone:
Erin Coughlan de Perez, Tufts University, Boston, USA

10:32:17 From Salma Bougouneto Everyone:
Hi everyone. Here is Salma from Togo. Last mile sustainable solar energy distributor

10:32:18 From Alex Russell to Everyone:
Hello everyone. I'm Alex Russell, Feed the Future Innovation Lab for Markets, Risk & Resilience

10:32:22 From Nicholas Romano to Everyone:
Nicholas Romano from University of Arkansas at Pine Bluff

10:32:23 From Jim to Everyone:
Hi Everyone. Jim Hansen, IRI, Columbia University.

10:32:26 From Jen McCallum_SRI-2030 to Everyone:
Great to be here, Jen McCallum from SRI-2030 here. https://www.sri-2030.org

10:32:28 From Kathy Spahn, Helen Keller to Everyone:
Kathy Spahn from Helen Keller Intl, and BIFAD

10:32:30 From tom.opapa to Everyone:

Hi everyone, its Tom Opapa here from KickStart based in Nairobi Kenya. Great to join you all in the discussion

10:32:31 From Shawkat A. Begum to Everyone:
Good morning, afternoon & evening All! this is Shawkat Begum, Dhaka - Bangladesh

10:32:32 From James Woolley to Everyone:
James Woolley from USAID Haiti

10:32:33 From Laura Schmitt Olabisi (she/her) to Everyone:
Hello everyone, Prof. Laura Schmitt Olabisi, Michigan State University

10:32:33 From EMMA.PAGE to Everyone:
Good Morning everyone! I'm Emma Page from Burlington Vermont.

10:32:33 From Cheryl to Everyone:
Cheryl Christensen, Richmond VA

10:32:33 From IICA - Gabriel Rodriguez Marqués to Everyone:
Gabriel Rodriguez-Marques from IICA, Representation in Paraguay

10:32:41 From John William Medendorp to Everyone:
John William Medendorp, FtFIL for Legume Systems Research

10:32:44 From Uttam Deb to Everyone:
Good Morning! I am Uttam Deb from the University of Arkansas at Pine Bluff.

10:32:44 From Amit Sinha to Everyone:
Good morning everyone. I am Amit Sinha, Associate Professor, Aquaculture and Fisheries, UAPB

10:32:45 From Pamela D. Moore to Everyone:
Good morning! I'm Pamela D. Moore, University of Arkansas at Pine Bluff, School of Agriculture, Fisheries and Human Sciences.

10:32:45 From Olawunmi Ilesanmi to Everyone:
Olawunmi Ilesanmi, Borlaug Institute for International Agriculture and Development, Texas A&M University.

10:32:46 From Nina Lyon-Bennett, Assistant Dean for Academics to Everyone:
Good morning everyone, Nina Lyon-Bennett, University of Arkansas at Pine Bluff! Welcome.
10:32:47 From ezauisomue to Everyone:
Erlich Zauisomue from, University of Namibia, Windhoek Namibia!

10:32:47 From Zain Alabweh IRI to Everyone:
Good morning, I am Zain Alabweh, International Research Institute for Climate and Society, Columbia University

10:32:49 From Annette Houtekamer to Everyone:
Hi Everyone, Annette Houtekamer from IBISA.network in Luxemburg

10:32:53 From Arun G Zacharia to Everyone:
Arun Zacharia (bsc agriculture student) from the College of Agriculture and Allied Science Baramati, Pune, Maharashtra, India

10:32:53 From Shampa to Everyone:
Shampa from BUET, Bangladesh

10:33:00 From Trent Wills to Everyone:
Trent Wills, SGA- Vice President, University of Arkansas Pine Bluff

10:33:01 From qtaishat to Everyone:
Tala Qtaishat-Jordan-Fulbright Post-Doctoral -in University of Northern Iowa

10:33:03 From East Arkansas Enterprise Community to Everyone:
Good Morning. East Arkansas Enterprise Community, Inc. EAEC. Director Robert L. Cole.

10:33:05 From Ogolla John Martin to Everyone:
Hello everyone, Ogolla John Martin, Makerere University

10:33:10 From Amtul Waris to Everyone:
Amtul Waris, Rice Research Institute, India

10:33:10 From Edmond Totin to Everyone:
Edmond Totin from Universite Nationale d'Agriculture (Benin)

10:33:10 From Benjamin Kohl to Everyone:
Greetings, everyone!
Ben Kohl
Program Administrator
Feed the Future Innovation Lab for Collaborative Research on Sorghum and Millet (SMIL)
Kansas State University [Address Redacted]

10:33:12 From Marie Boyd to Everyone:
Greetings, Marie Boyd, University of South Carolina School of Law, and BIFAD

10:33:13 From Clara Cohen, USAID to Everyone:
Good day everyone and welcome! Clara Cohen, BIFAD Executive Director, from USAID's Bureau for Resilience and Food Security. Looking forward to the meeting.

10:33:14 From Vietnam_Kien Nguyen Van to Everyone:
greeting everyone from plant resources center (prc), Hanoi, Vietnam. Mr. Kien Nguyen Van

10:33:15 From Jonelle Palmer to Everyone:

Hi everyone, Jonelle Palmer from Washington DC!

10:33:19 From Comfort Yelipoie to Everyone:
Good afternoon everyone, I am Comfort Yelipoie with the Ministry of Food and Agriculture, Ghana

10:33:19 From +Lini Wollenberg, Alliance of Bioversity and CIAT, UVM to Everyone:
Hello everyone! Lini Wollenberg, Alliance of Bioversity and CIAT and UVM

10:33:20 From EcoStim: Phil Gaffney to Everyone:
Phil Gaffney UK, www.ecostim.org

10:33:25 From Bruce McGowan to Everyone:
Good morning Chancellor Alexander and the BIFAD Team from the UAPB Family.

10:33:32 From Obadiah Njue, University of Arkansas at Pine Bluff to Everyone:
Hello Everyone! Obadiah Njue, University of Arkansas at Pine Bluff

10:33:37 From Willie Columbus to Everyone:
Good morning all!!! Willie Columbus, University of Arkansas at Pine Bluff.

10:33:41 From Alex Mutinda to Everyone:
Hello everyone, Alex Mutinda National Museums of Kenya

10:33:45 From Elizabeth to Everyone:
Hello from Kampala Uganda, the Uganda Forum for Agricultural Advisory Services

10:33:49 From Jonathan Cook (USAID) to Everyone:
Jonathan Cook from USAID (Climate Adaptation Team, Bureau of Resilience and Food Security)

10:33:49 From Bolatito Shobo to Everyone:
Hello everyone!
I am Shobo Bolatito A.
Babcock University, Nigeria

10:33:50 From Lydia Mbevi to Everyone:
Lydia Mbevi from Kenya

10:33:53 From Tom Van Mourik to Everyone:
Good afternoon everyone, Tom Van Mourik, global food systems advisor for Helen Keller International, calling in from Dakar Senegal

10:33:59 From Piet van Asten to Everyone:
Good evening everyone. Piet van Asten - Olam Food Ingredients (ofi) (Singapore)

10:34:03 From Lonnie Waller, Jr. to Everyone:

Lonnie Waller, Jr. University of Arkansas at Pine Bluff, Early Head Start Child Care Partnership.

10:34:05 From Jenny Vanyur, Helen Keller Intl to Everyone:
Jenny Vanyur, Helen Keller Intl, based in Washington, DC

10:34:05 From Pamela Bowen to Everyone:
Good day everyone. Pamela Bowen, Chief of Party USAID Private Sector Engagement Support (PSE) Mechanism. Washington DC.

10:34:09 From +Carmen Benson, BIFAD Support to Everyone:
Closed Captioning is available in the ZOOM platform using the icon "CC". Please let +TechSupport know if you have any trouble.

10:34:14 From Nuttapon Khongdee to Everyone:
Hello, Nuttapon Khongdee, Chiang Mai University, Thailand

10:34:28 From Gabe Laizer, IFAD to Everyone:
Good morning, good afternoon and good evening to all. This is Gabriel Laizer, IFAD Partnership Officer, Washington, DC.

10:34:41 From Anthony O Esilaba to Everyone:
Anthony O Esilaba from Nairobi Kenya

10:34:41 From Mary Beggs, Tetra Tech to Everyone:
Good day everyone! I am Mary Beggs, a Senior Associate at Tetra Tech, and the BIFAD Support Contract Project Manager. Looking forward to the conversation today!

10:34:48 From Christopher Mathis to Everyone:
Greetings from Arkansas

10:34:56 From Natalia to Everyone:
Good Morning, Natalia Ambrosio, SDG Fellow International Affairs at Bayer

10:34:58 From osmantdamba to Everyone:
Hello everyone, I am Osman Tahidu Damba from the University for Development Studies (UDS), Ghana and also AICCRA-Ghana Cluster Lead on Technology Identification and Upscaling

10:34:58 From Aderonke ALAMU to Everyone:
Alamu Aderonke
Department of Veterinary Medicine (Aquatic Unit)
Federal University of Agriculture, Abeokuta, Nigeria

10:35:04 From Kisito Gandji to Everyone:
I am Kisito Gandji, from University of Abomey-Calavi (Benin).

10:35:13 From F- Siyanbola Omitoyin to Everyone:

Good day everyone. Siyanbola Omitoyin from University of Ibadan, Nigeria

10:35:13 From EcoStim: Phil Gaffney to Everyone:
Phil Gaffneywww.ecostim.org

10:35:24 From Daginah to Everyone:
Hi everyone, I am Degineh from Hawassa University, Ethiopia

10:35:32 From +Carmen Benson, BIFAD Support to Everyone:
Greetings! I am Carmen Benson, Senior Counselor, BIFAD Support Team, Tetra Tech (Arlington, VA)

10:36:13 From Yilma to Everyone:
Yilma from King Saud University, here I go!

10:36:19 From Bob Tsutsu to Everyone:
Robert Bob Tsutsu

10:36:32 From George Asare to Everyone:
George Asare, a Project Manager at Ignitia-An Agritech company that provides weather forecast and climate smart agricultural advisories.

10:36:35 From Bob Tsutsu to Everyone:
Mangochi, Malawi.

10:36:45 From Ed Carr to Everyone:
Good morning everyone, I am Ed Carr, coordinating author of this report and a Professor and Director of International Development, Community, and Environment at Clark University.

10:36:47 From Mario Herrero, Cornell University to Everyone:
Hi Everyone, Mario Herrero from Cornell University. great to be at this event together with you.

10:37:01 From Tracey Duffey to Everyone:
Greetings, Tracey Duffey, OFI (Olam Food Ingredients)

10:37:43 From Diane Russell to Everyone:
Hi from Yonkers NY…Diane Russell, RFS NRM advisor

10:37:50 From Bennett LaFond, Abt Associates to Everyone:
Good morning all! Bennett LaFond, Economic Growth Manager at Abt Associates. Calling in from Seattle, Washington.

10:38:05 From Franklin DJEDANEM to Everyone:
Hello!
I'm DJEDANEM Franklin.
I'm a Manager of DONANG MADJI SOCIETY (sector of organic agriculture).

I'm from CHAD but I'm in SENEGAL now.
Thanks.

10:38:38 From Dr. Tariq Javaid to Everyone:
Hello Everyone
Its Dr. Tariq Javaid from Pakistan

10:38:45 From C Gatobu-Kaimosi Friends University-Kenya to Everyone:
Greetings all, Dr. Caroline Gatobu from Kaimosi Friends University-Kenya. Looking forward to a great conversation.

10:38:50 From Juliet Chinenye to Everyone:
Hello Everyone, I am Chinenye Juliet Ejezie from Climate Smart Agriculture Youth Network.

10:38:56 From Yien Bachuch to Everyone:
Hi everyone! I am Yien Bachuch from Ethiopia, Director of Natural Resources Management Research Directorate at Gambella Agricultural Research Institute

10:39:01 From Mana Farooghi to Everyone:
Hi all, Mana Farooghi, Climate change and Environment adviser for the UK FCDO in the Sahel. Based in Dakar.

10:39:15 From Meredith Jackson-deGraffenried, Helen Keller Intl to Everyone:
Good afternoon, Meredith Jackson-deGraffenried, Technical Advisor with Helen Keller Intl, joining from Malawi

10:40:07 From Liesl Hattingh to Everyone:
Hello all, I am Liesl Hattingh, representing ACTkit - a Food System Game Changers Lab solution to mainstream Regen Ag and Agroecology

10:40:08 From Janette Wheat to Everyone:
Good Morning, Everyone! Janette R. Wheat, Ph.D., University of Arkansas at Pine Bluff, Department of Human Sciences.

10:40:18 From +Carmen Benson, BIFAD Support to Everyone:
Learn more about the USAID Climate Strategy, 2022-2030: https://www.usaid.gov/climate/strategy

10:40:31 From Michael Ogunbiyi to Everyone:
Hi everyone, I'm Michael Ogunbiyi, the founder of SM Sunrise Global Visions. We are into the import and export business of agricultural commodities in Nigeria

10:40:32 From RABIU YAU to Everyone:
Hi Everyone
I am Rabiu Yau, Agricultural Meteorogist and Climate Change Specialist, Ahmadu Bello University Zaria, Nigeria

10:41:18 From EcoStim: Phil Gaffney to Everyone:
Phil Gaffney, UK, www.ecostim.org

10:42:08 From +Carmen Benson, BIFAD Support to Everyone:
Learn more about the subcommittee here: www.usaid.gov/bifad/climatechange

10:42:43 From +Carmen Benson, BIFAD Support to Everyone:
Today's agenda and speaker bios: https://bit.ly/3cvNyrh

10:42:43 From Caron Gala, APLU to Everyone:
Good morning, all. It is wonderful to join this insightful and action-oriented conversation. My name is Caron Gala and I serve as Director of Governmental Affairs in Agriculture and International Development at the Association of Public and Land-grant Universities.

10:42:55 From Chadrack ITSIA to Everyone:
Chadrack ITSIA, founder agritech startup BILANGA from D.R Congo. www.bilanga.pro

10:43:05 From Douglas Annor to Everyone:
Annor Douglas
Ghana
Partners in Sustainable Development
https www opsdgh.com

10:43:13 From Robert Beach to Everyone:
Hi everyone, I'm Robert Beach, agricultural and resource economist at RTI International joining from Raleigh, North Carolina

10:43:18 From Oyediji Olubukola T to Everyone:
Hi Everyone ! I am Oyediji Olubukola Tolulope from University of Ibadan, Nigeria.

10:44:11 From Dr. Abdiaziz Abdulahi Bashir to Everyone:
Hi Everyone

10:44:17 From Fernanda Zermoglio (USAID) to Everyone:
Greetings! Fernanda Zermoglio, USAID's Center for Resilience.

10:44:24 From Lakshmi Iyer, Grameen Foundation to Everyone:
Hi everyone! Great to be here. I'm Lakshmi Iyer, supporting Grameen Foundation's agriculture portfolio (innovations in agriculture). Based in London.

10:45:12 From Gordon Nikoi Esoko Ltd to Everyone:
Hi, I am Gordon Nikoi from Esoko LTD in Ghana. We provide solutions to the last mile in agtech and data collection since 2008

10:45:16 From Prof Chris Daudu to Everyone:
Compliments all, Prof. Christogonus K. Daudu,

National Agricultural Extension Research & Liaison Services,
Ahmadu Bello University, Zaria, Nigeria [Personal Information Redacted]

10:45:59 From Clement Oteng to Everyone:
I am Clement Oteng, Cheikh Anta Diop University, Dakar, Senegal.

10:46:45 From Victoria Olutunmogun to Everyone:
Hi everyone! Victoria Olutunmogun
Ahmadu Bello University, Zaria, Nigeria.

10:46:48 From +Carmen Benson, BIFAD Support to Everyone:
Learn more about the USAID Climate Strategy, 2022-2030:
https://www.usaid.gov/climate/strategy and the Global Food Security Strategy:
https://bit.ly/3Q5JQSN

10:46:53 From John Taylor USAID to Everyone:
Greetings everyone, John Taylor, USAID's Green Cities Team

10:49:17 From Pedro Sanchez to Everyone:
I am Pedro Sanchez, Professor Emeritus of Tropical Soils, recently retired from the University of Florida

10:49:23 From JOSEPH UKPONG to Everyone:
Hi Everyone! Joseph Aloysius Ukpong. Management Consultant in Agriculture. Founder Ceunitonc Farms. Nigeria.

10:50:12 From PETER JUMA LUGENDO to Everyone:
Hi everyone. Peter Juma here from KickStart International, Inc. Our mission is to lift millions of people in Africa out of poverty by equipping them with irrigation technologies to start profitable farming businesses, managing to do year-round farming of high value fruits and vegetables, to feed their families, neighbors and sell during offseason to earn a lot more money.

10:54:21 From Ramesh Kumar Singh- GPSVS to Everyone:
Hi Everyone, This is Ramesh Kr Singh from GPSVS, a NGO has been working on climate change adaptation, resilience building and women led climate change induced Disaster Risk Reduction in Bihar.

10:54:39 From Edward Asiedu to Everyone:
Hi everyone. I am Edward Asiedu a development economist currently based at the University of Ghana, Department of Finance.

10:55:18 From Steve Morin to Everyone:
Hello Everyone, I am Steve Morin, USAID, Center for Agriculture. Thank you.

10:55:46 From Boubacar T Assoumana/AGRHYMET to Everyone:
Boubacar from AGRHYMET. Hi everyone

10:56:47 From Henry Heilbroner to Everyone:
Hi folks. This is Henry Heilbroner from USAID's Bureau of Resilience and Food Security, Center for Ag-Led Growth

10:56:57 From EcoStim: Phil Gaffney to Everyone:
Phil Gaffney UK
www.ecostim.org Biostimulant Manufacturer

10:59:18 From Nkole Mwamba-, CEO-Savannah Zambia to Everyone:
Ambassador Nkole Mwamba, Executive Director Savannah Zambia.

10:59:53 From SALMA BOUGOUNE to Everyone:
You are welcome

11:00:04 From Moffatt Ngugi, USAID to Everyone:
Greetings, Moffatt Ngugi, USAID Environment Officer headed to Mozambique. Great to see the big crowd here and the rich agenda to address climate issues.

11:01:03 From +Carmen Benson, BIFAD Support to Everyone:
Today's agenda and speaker bios: https://bit.ly/3cvNyrh

11:01:41 From Ahmed Balogun to Everyone:
Hello Everyone, I am Ahmed Balogun, Department of Meteorology & Climate Science, Federal University of Technology, Akure (FUTA), Nigeria. Thank you.

11:02:14 From Erin Mcguire to Everyone:
Hello - Erin McGuire from the Horticulture Innovation Lab. Thank you for these wonderful presentations!

11:03:26 From SALMA BOUGOUNE to Everyone:
Our company OSMER build net zero insulated solar electric cooker to fight deforestation and climate change in collaboration with California polytechnic university. Country: Togo

11:06:16 From Séga Ndao (NZAGRC) to Everyone:
Hi, I am Séga Ndao, PhD GHG Inventory Improvement Programme (West & Central Africa)

11:07:20 From lamlihi mohamed to Everyone:
Hello lamlihi Mohamed from Benslimane Morocco

11:07:21 From SALMA BOUGOUNE to Everyone:
can Séga lives his contacts, please?

11:07:35 From Robert Bob Tsutsu to Everyone:
Robert Bob Tsutsu
Solar Powered Energy System for Fish Handling and Processing along Fisheries Value and Marketing for Reduction of Post - harvest losses and forestry dependence. Mangochi, Malawi.

11:08:03 From SALMA BOUGOUNE to Everyone:
ok Abdur

11:08:13 From Carmen Benson, BIFAD Support to Everyone:
Correct link to today's agenda and speaker bios:
https://www.usaid.gov/bifad/documents/185th-public-meeting-agenda

11:08:15 From James Ijampy-Adamu to Everyone:
James Ijampy Adamu

11:08:44 From James Ijampy-Adamu to Everyone:
James Ijampy Adamu, Chief Meteorologist Agrometeorology, Nigerian Meteorological Agency

11:09:02 From SALMA BOUGOUNE to Everyone:
thanks

11:10:55 From SALMA BOUGOUNE to Everyone:
yes. It is possible to send you a sample

11:11:07 From Dr. Tariq Javaid to Everyone:
Anyone interested in Collaboration on Climate Change Scenario on Potato Crop?

11:11:47 From SALMA BOUGOUNE to Everyone:
ok

11:12:18 From +Carmen Benson, BIFAD Support to Everyone:
For the upcoming Q/A session, please share your questions for panelists in the chat.

11:15:04 From SALMA BOUGOUNE to Everyone:
Q/A
How private sectors with projects can be supported?

11:15:46 From tom.opapa to Everyone:
Climate change has the two extremes associated with floods and long drought periods that affect both nutrition and food security. Don't you think irrigation could greatly help to improve the challenges of nutrition and food security?

11:17:19 From +Carmen Benson, BIFAD Support to Everyone:
For the upcoming Q/A session, please share your questions in the chat (adding your name and organization)

11:18:18 From Tom Van Mourik to Everyone:
Sara Biettiger

11:18:25 From Edmond Totin to Everyone:
@Maria – I agree that provision of climate information can lead to transformative change but it also important to consider that access to salient climate information in some

regions (for instance Africa, especially in central and north Africa) is a real challenge because of limited availability of and access to weather and climate data. In some places, the information offered is not consistent with what farmers needs and aspirations. Also, in Africa, the existing weather infrastructure remains suboptimal to enable the development of reliable early warning systems. The latest IPCC report shows that of the 1017 land-based observational networks in the world, only 10% are in Africa, and 54% of Africa's surface weather stations cannot capture data accurately. I wonder how CIS can be improved to support effective transformation in Africa?

11:18:27 From Tom Van Mourik to Everyone:
Boettiger

11:18:44 From SALMA BOUGOUNE to Everyone:
yes, I will do, Abdur!

11:19:18 From Franklin DJEDANEM to Everyone:
Name: DJEDANEM Franklin
Organism: DONANG MADJI SOCIETY
Sector: Organic agriculture
Post: Manager
Objective: from collaboration with Climate Change and everyone (organics farms)

11:19:43 From tom.opapa to Everyone:
Majority of smallholder farmers do not have disposable incomes to access capital intensive technologies. They need appropriate and low cost tools to enable them shift from Rain-fed agriculture to irrigated farming. At Kickstart, we ready to partner with interested partners in the space to promote irrigation.

11:20:04 From Shawkat A. Begum to Everyone:
Q/A - How can we make markets resilient for ensuring resilient food system? Food waste (from farm to fork) contributes to GhG as well. So how can we ensure net zero food waste

11:20:12 From Camilo Sanchez- Olam Food Ingredients (ofi) to Everyone:
Fully agree with Sara. How can the Private Sector unlock its resources and leverage more donor funding?

11:22:02 From Douglas Annor to Everyone:
what is the role of the peasant farmer who form the majority in Africa

11:22:41 From Lourdes Martinez to Everyone:
Dr. Loboguerrero, how do we address climate change and the effect on nutrition? A recent work from Cornell found that heat has negative effect on children growth. Climate is not just a shock, what would a transformation look like? Thanks (I always enjoy your presentations!)

11:22:53 From SALMA BOUGOUNE to Everyone:
Q/A
Salma from OSMER.
We have a holistic approach to fight deforestation, climate change and access to water for small holders here in Togo. How can this program support us to achieve this?

11:23:11 From Lourdes Martinez to Everyone:
Actually my question is for all panelists

11:23:31 From +Carmen Benson, BIFAD Support to Everyone:
Please continue to share questions or comments, and the panelists and author team will respond to as many as possible in the chat.

11:23:45 From Jean-Michel Voisard to Everyone:
So "extreme localization" of climate information production and use....

11:25:07 From Clement Oteng to Everyone:
Q/A from Clement Oteng. If Africa will be affected severely from transition. What can they do to reduce if not eradicate them.

11:25:36 From Douglas Annor to Everyone:
Ahat is the position of panel members on agroecology and GMO in Africa
what support is there for peasant farmers in Ghana or Africa

11:26:43 From Saweda Liverpool-Tasie, Michigan State University to Everyone:
For Sara. Thank you for sharing your thoughts about the momentum for sustainability advances in large companies being durable. What about small companies? Majority of firms in many developing countries are nano, micro, small and medium scale enterprises? what is their role and how can they be supported to contribute to sustainable food systems?

11:29:51 From Douglas Annor to Everyone:
For all penal members what is role for social enterprises for rural farmers and artisans

11:30:32 From Pamela Bowen to Everyone:
The event is being recorded. Will breakouts be recorded? Will the event be shared or must we request a copy?

11:30:45 From Laura Schmitt Olabisi (Michigan State University) to Everyone:
I have to leave shortly, but I would encourage the panel to consider the importance of traditional and indigenous knowledge in climate adaptation

11:30:58 From *Ana Maria Loboguerrero to Everyone:
Agroecological approaches can help address the climate crisis. Agroecology is gaining prominence as an approach to achieve a radical shift towards climate-friendly food systems. But scaling it up beyond the local level is difficult due to:
- a) insufficient evidence and lack of knowledge of what agroecological innovations work, where, when, and why;
b) insufficient capacities and resources;
c) lack of, or misaligned, policies, institutions, and governance practices; and
d) lack of financial mechanisms.
At CGIAR, we are ready to provide backstopping on this topic through our new initiative on agroecology

11:31:04 From *Sara Boettiger to Everyone:

Hi Saweda! That ecosystem you're talking about is the real power for locally-led transformations. 100% agree. Once you start understanding where the global private sector is going, you can derive some different opportunities to impact nano, micro and SMEs. There are a lot of learnings on policy - great work going on. Happy to connect off-line for more discussion.

11:31:35 From +Mary Beggs, Tetra Tech to Everyone:

Yes, the breakout sessions will be recorded, and form part of the public record for the meeting. Please provide your name and organization with your comments.

11:32:07 From Robert Bob Tsutsu to Everyone:

Q: here in Malawi we are having issues of high deforestation rate which has negative affected fisheries sector in loss of fish stocks in Lake Malawi waters and scarcity of sustain energy sources for reduction of food losses. how can this initiative help to address this challenge?

11:32:14 From Edmond Totin to Everyone:

Thanks @Laura, ILK is also important and needs to be part of the transformative agenda

11:34:02 From Julie Howard to Everyone:

Thank you for the very interesting presentations. I am wondering how the subcommittee will take into account the important background reports and discussions that took place during the UN Food Systems Summit last year? Quite a bit of consideration was given to climate change, its impact on food systems transformation - and what donors/investors can do to assist. Also interested in knowing how the BIFAD process may engage the transformation pathways work being undertaken at country level following the UNFSS? Thank you.

11:34:35 From lamlihi mohamed to Everyone:

Thanks all

11:35:10 From Lumbani Kaunda to Everyone:

Thanks all!

11:35:12 From Franklin DJEDANEM to Everyone:

Thanks

11:50:35 From Pamela D. Moore to Everyone:

This is a useful session! However, I must depart to address a student issue. We are still clearing international students for the fall semester. Thanks, Pamela.

11:59:32 From Ahmed Balogun to Everyone:

Hello Everyone, I am Ahmed Balogun, Department of Meteorology & Climate Science, Federal University of Technology, Akure (FUTA), Nigeria.

11:59:43 From Abdul-mumin to Everyone:

Abdul-Mumin Yussif the Executive Director of United Force for Development (UF4D) from Tamale Ghana

12:00:33 From MY to Everyone:
Public Private Partnerships at local regional and transboundary levels

12:03:25 From +Carmen Benson, BIFAD Support to Everyone:
Hi All- Thank you for your participation in the breakout rooms. There is a lot of information to share with the subcommittee! We will organize all written and verbal comments in the meeting minutes to send and post online.

12:03:56 From David Tschirley, MSU to Everyone:
Resilience in markets depends on the resilience of market actors. In addition to farmers, these crucially include millions of actors in the midstream - transporters, traders at assembly, wholesale and retail, processors, and others. So it's important to think in a broad value chain and food systems perspective when thinking about interventions. In doing so, need to put special attention on what Saweda Liverpool-Tasie referred to as the nano, micro, small, and medium-scale enterprises that still dominate many of these systems -- David Tschirley, MSU

12:05:03 From David Tschirley, MSU to Everyone:
It seems that a potentially big black box - lack of information - relates to what is being done at community level to adapt to climate change. National initiatives need to be aware of the size and nature of these initiatives if they are to be effective. I note work by Laura Schmid-Olabisi generating some of the only evidence I know on this issue. - David Tschirley, MSU and Innovation Lab for Food Security Policy Research, Capacity, and Influence (PRCI)

12:07:22 From *Olaf Westermann to Everyone:
Hi Robert Bob Tsutsu, on you question on the challenges of deforestation in Malawi....Deforestation is really a symptom of a system (exploitation) that perpetuate a problem, rather than a system that perpetuate the solution (restoration and sustainable land management). I hope this session and the initiative will give you ideas on how and where to intervening in the system in the land use sector in Malawi. CRS specifically, has been working for many years with watershed management through the WALA and UBALE projects and there is plenty of evidence from external research studies (including from USAID and US universities) that this is a sustainable approach to maintain ecosystems services like water flow and availability, as well as improving livelihoods and resilience to climate change. I will be happy to share the reports if interested.

12:15:30 From Dave Brown retired int'l ag econ prof to Everyone:
My thoughts turn more to an inside-outside approach to all this -- how things look to farming people in contrasting heartlands, hinterland and urban situations … what potentials they and their next-generations have … what constraints and disruptions they face … what helps they might have from relatives in other places via remittances and fresh insights … what specific roles can USAID, church and volunteer groups, int'l firms, etc. best have to buffer and enhance?

12:16:46 From David Tschirley, MSU to Everyone:
A final comment is that climate shocks occur in an environment of multiple shocks from multiple sources - local conflict, unanticipated and disruptive policy changes either locally or

among trade partners, public health events such as COVID and Ebola, and other sources. Oftentimes the source(s) of a particular shock cannot be clearly or uniquely identified. So we really need to place our thinking about climate shocks in this broader context of multiple shocks from multiple sources.

12:16:52 From +Carmen Benson, BIFAD Support to Everyone:
Thank you, Mike. We will compile all of the Jamboard comments and organize for easy reference after the meeting, and will share with all attendees. If you have other comments or resources to add, please use the Chat and our team will make sure those are also captured and shared.

12:17:24 From Mario Herrero, Cornell University to Everyone:
+1 to David Tschirley

12:17:30 From Diane Russell to Everyone:
My comment in the market group was the importance of market systems for the success of sustainable intensification, both to ensure that foods go to poor people and that poor farmers can afford to intensify and afford to buy food.

12:17:44 From Mike Colby to Everyone:
Thank you, Carmen!

12:18:43 From Edmond Totin to Everyone:
Sorry, I have to leave now. It was great being here and seeing many new faces. Thanks

12:19:10 From Jenn Cisse to Everyone:
Agreed on the issues of compound and cascading risks - would love to see USAID engage more in that space.

12:19:11 From +Carmen Benson, BIFAD Support to Everyone:
Thank you Edmond for joining.

12:19:36 From Diane Russell to Everyone:
CIFOR has done some great work on forests and food security, including nutrition. Amy Ickowitz is the PI.

12:20:05 From Teki Hunt to Everyone:
If Barbara from USDA is still on, would you mind sharing your contact information?

12:20:09 From Ben Lucas. Agriterra to Everyone:
would like to register my idea that "the more exposure to risk in crop production, the more they received more protection and gains from their value chains they participate"

12:20:13 From Jess Fanzo, Johns Hopkins University to Everyone:
Thanks Diane.

12:20:27 From Ahmed Kablan to Everyone:

Thanks @Dr. Fanzo, FLW was also discussed in the Livestock and fisheries group.

12:20:30 From Juliet Chinenye to Everyone:
Thank you Sophia

12:20:31 From Jean-Michel Voisard to Everyone:
An interesting locally led success in the Sahel https://pdf.usaid.gov/pdf_docs/PA00TRQC.pdf

12:21:02 From Mark Amadi to Everyone:
Kindly share the transcripts thereafter

12:22:25 From Alfredo Rueda to Everyone:
Very interested topics to consideration. ALFREDO RUEDA, HONDURAS.

12:22:36 From Douglas Annor to Everyone:
Africa population is going high land are being reduce is size through housing, road, mining, churches, sand mining and others. We need to look at the mention challenges in Africa

12:22:37 From Caron Gala, APLU to Everyone:
Thank you for hosting this excellent discussion. A dynamic, multi-dimensional vision was brought forward today. Congratulations on a wonderful event.

12:24:08 From Henri Moore to Everyone:
Thanks everyone! It was a great discussion! I have to jump to another call!

12:24:18 From +Carmen Benson, BIFAD Support to Everyone:
Here is a link to the full report BIFAD Member, Pamela Anderson is referencing: https://www.usaid.gov/bifad/documents/agricultural-productivity-growth-resilience-and-economic-transformation-sub-saharan-africa

12:24:19 From Jean-Michel Voisard to Everyone:
Integrated Credit systems to support inclusive trade bringing in the "less-formal" sector - developed by Feed the Future: https://pdf.usaid.gov/pdf_docs/PA00TRQJ.pd

12:25:38 From Diane Russell to Everyone:
Gender, youth, inclusion need to be considered within the context of particular societies and cultures. Also we have to look at the roles of the powerful and elites especially when it comes to land use decisions. Important to bring a deep sociological lens to this work.

12:27:39 From MY to Everyone:
Thank you very much. Interesting.

12:27:59 From +EMMA.PAGE to Everyone:
Thank you for a wonderful discussion.

12:28:04 From Everisto Mapedza (IWMI) (In-Person) to Everyone:
Thank you very much.

12:28:10 From Jonelle Palmer to Everyone:
Thank you all!

12:28:13 From Alexis Nzeyimana to Everyone:
Thank you, I am from Rwanda

12:28:20 From Isa Salaam to Everyone:
As a student studying agricultural business this workshop was very helpful, thank you all!

12:28:47 From Teki Hunt to Everyone:
The workshop was very informative.

12:28:59 From Aderonke ALAMU to Everyone:
Thank you very much for this robust discussion.

12:29:03 From +Carmen Benson, BIFAD Support to Everyone:
Thank you, Isa. I hope you will join future meetings and share the invitation with peers.

12:29:03 From *Olaf Westermann to Everyone:
Thank you all for the invitation, for all the interesting questions and for great sessions!

12:29:13 From John William Medendorp to Everyone:
Thank you all and especially BIFAD for a very insightful discussion today.

12:29:13 From Marie Boyd to Everyone:
Thanks to the subcommittee and panelists for their important work on addressing climate change in agriculture, nutrition, and food systems! Thanks also to the other participants and attendees! This was a great discussion.

12:29:25 From Dr. Christopher Mathis, Jr., Univ. of Arkansas at Pine Bluff to Everyone:
Great Session!

12:29:28 From +Carmen Benson, BIFAD Support to Everyone:
Watch for more information about upcoming BIFAD public meetings: www.usaid.gov/bifad

12:29:35 From Aderonke ALAMU to Everyone:
Quite productive!

12:29:36 From Marilyn Bailey to Everyone:
Thank you all very much for this interesting dialogue! Cheers to my colleagues at the University of Arkansas at Pine Bluff!!!

12:29:37 From Ghulam Sarwar to Everyone:
Very informative presentation..... Thanks

12:29:49 From Oyediji Olubukola T to Everyone:

Thank you for invitation

12:29:52 From Michael Ogunbiyi to Everyone:
Thank you all. The workshop was so insightful.

12:29:54 From *Ana Maria Loboguerrero to Everyone:
Thank you for a great session and for inviting me to participate in it.

12:29:57 From Janette Wheat to Everyone:
Thank you for this information. Great, excellent presentations!!!

12:30:08 From George Asare to Everyone:
Thank you. Hope the presentations will be shared with us

12:30:15 From Victoria Olutunmogun to Everyone:
Thank you all.

12:30:17 From M Olabisi to Everyone:
Thanks. Good conversations

12:30:19 From +Carmen Benson, BIFAD Support to Everyone:
Watch for more information about upcoming BIFAD public meetings: www.usaid.gov/bifad

12:30:32 From Kaganga John to Everyone:
Wonderful webinar!!!!!

12:30:34 From Mayomi Taiwo- Afolabi to Everyone:
Thank you all

12:30:35 From UNICEF WCARO - Lars Bernd to Everyone:
Thank you for the session. It'll be great if the presentations, incl. the one from CGIAR at the beginning could be made available on your website or by mail. Best wishes

12:30:37 From ZANNA ABDULSALAM to Everyone:
will be holding a training on Genome Editing and future of Agriculture, with OFAB, ALLIANCE FOR SCIENCE etc. this meeting and discussion is highly interesting and will be promoted in my discussion at the training. Thank you. ZANNA ABDULSALAM, RESEARCH SCIENTIST, NATIONAL BIOTECHNOLOGY DEVELOPMENT AGENCY NIGERIA.

12:31:15 From Vietnam_Kien Nguyen Van_Plant Resources Center to Everyone:
THANK ALL OF YOU. SEE YOU AGAIN SOON. COOPERATION SOON

12:31:15 From Carmen Benson, BIFAD Support to Everyone:
Thank you. All presentations, the recording, meeting minutes, and written or oral comments will be shared.

12:31:31 From Yvan Kwidja to Everyone:

Thank you very much. very informative session

12:31:32 From Juliet Chinenye to Everyone:
thanks everyone

12:31:35 From Saweda Liverpool-Tasie, Michigan State University to Everyone:
Thanks everyone!

12:31:46 From Douglas Annor to Everyone:
Thanks for your good

12:31:49 From PETER JUMA LUGENDO to Everyone:
Thanks everyone. Good day, good night

12:31:51 From Alicia Robinson-Farmer to Everyone:
Thank you

12:32:00 From Valeria TMK to Everyone:
Thank you for this informative session

12:32:01 From Douglas Annor to Everyone:
bye bye

12:32:04 From andre shelby to Everyone:
thanks for the information

12:32:04 From Jules Siedenburg to Everyone:
Thanks!

12:32:11 From Wilhelm Kruse to Everyone:
thanks für constructive discussion

12:32:12 From Yien Bachuch to Everyone:
thank you!

12:32:14 From Umesh Babu M S to Everyone:
Thank you

12:32:15 From Aalaa Sida to Everyone:
Thank you

12:32:15 From andre shelby to Everyone:
have a good day

12:32:20 From Clara Cohen, USAID to Everyone:
Thanks, everyone! Excellent session today!

12:32:35 From Samuel Matos to Everyone:
thank you

12:32:50 From ZANNA ABDULSALAM to Everyone:
@Carmen Benson we are looking forward to the presentation materials. Thank you, all organizers, for this great opportunity.

12:33:51 From Ghulam Sarwar to Everyone:
Thank all

12:34:28 From Isidro Matamoros to Everyone:
thanks to all

12:34:53 From Isidro Matamoros to Everyone:
ZAMORANO University

12:36:05 From Ibrahim to Everyone:
Join the meeting very late. I wanted to set the tone for circular economy by leveraging on Metal Organic Framework in Agriculture, Food Safety and Climate change.

12:36:12 From Janette Wheat to Everyone:
Please share this presentation recording with me. Thank you, Dr. Janette Wheat.

ANNEX 3: MEETING PARTICIPANTS

Number of Participants: 447

c	First Name	Last Name	Organization
1	Kedir	Abate Fentaw	Çukurova University
2	Md	Abdur Razzak	Dodo Enterprise
3	Zanna	Abubakar	NATIONAL BIOTECHNOLOGY DEVELOPMENT AGENCY
4	James	Adamu	Nigerian Meteorological Agency
5	Assefa	Adane Atinafu	University of Gondar
6	Aderemi	Adewole	FCT Agricultural Development Project
7	Peter	Ador	International Fertilizer Development Center
8	Mayomi	Afolabi	Federal University of Agriculture, Abeokuta
9	Margaret	Agyeman	MFA AGRITECH CONSULT
10	Raphael	Ahenu	No Response
11	Zain	Alabweh	International Research Institute for Climate and Society (IRI), Columbia Climate School
12	Aderonke	Alamu	Federal University of Agriculture, Abeokuta
13	Juan	Alberto De Pascuale	National University of Jujuy
14	Laurence	Alexander	University of Arkansas at Pine Bluff
15	Didier	Alia	University of Washington
16	Lauren	Allognon	Tetra Tech
17	Grace	Amadi	No Response
18	Mark	Amadi	Alex Ekwueme Federal University Ndufu-Alike, Nigeria
19	Natalia	Ambrosio	Bayer AG
20	Sabinus	Anaele	No Response
21	Pamela	Anderson	International Potato Center
22	Douglas	Andrés Gomez Latorre	AGROSAVIA
23	Johanna	Andrews Trevino	USAID
24	Douglas	Annor	No Response
25	Alex	Apotsos	USAID
26	Debbie	Archer	University of Arkansas at Pine Bluff
27	East		Arkansas Enterprise Community
28	Adisu	Asfaw	Hawassa University, Ethiopia
29	Emmanuel	Asiamah	University of Arkansas at Pine Bluff
30	Edward	Asiedu	University of Ghana
31	Elizabeth	Asiimwe	Uganda Forum for Agricultural Advisory Services (UFAAS)
32	Rainer	Asse	USAID
33	Sidik	Baba Sulemana	University for Development Studies

c	First Name	Last Name	Organization
34	Umesh	Babu	Institute for Social and Economic Change India
35	Yien	Bachuch Mayian	Gambella Agricultural Research Institute
36	Walter	Baethgen	Climate School - Columbia University
37	Jessica	Bagdonis	USAID
38	Carmelia	Bailey	University of Arkansas at Pine Bluff
39	Daniel	Bailey	USAID
40	Dr. Marilyn	Bailey	University of Arkansas at Pine Bluff
41	Marilyn	Bailey	No Response
42	Kushank	Bajaj	UBC
43	Arthur	Bakal	Voces Y Manos
44	Ahmed	Balogun	Federal University of Technology, Akure
45	Masoud	Barati	Amrita University
46	Bashir	Barau	Federal College Of Agricultural Produce Technology, Hotoro, Kano Nigeria
47	Robert	Beach	RTI International
48	Catherine	Beal	WRI
49	Mary	Beggs	Tetra Tech
50	Shawkat	Begum	Practical Action
51	Barituka	Bekee	University of Missouri
52	Frances	Bekele	The Cocoa Research Centre
53	Mauricio	Benitez	responsibility Investments AG
54	Carmen	Benson	Tetra Tech
55	Lars	Bernd	UNICEF
56	Martial	Bernoux	FAO
57	Rob	Bertram	USAID
58	Faithe	Best	USAID
59	Glora	Betancourth	No Response
60	Mary	Beth Desrosiers	USAID
61	Flannery	Bethel	Association of Public and Land-grant Universities
62	Jennifer	Billings	Corteva
63	Amy	Bills	CDP
64	Andrew	Bisson	USAID
65	Trent	Blare	University of Florida
66	Geoffrey	Blate	USAID
67	Robert	Bob Tsutsu	DMI St. John the Baptist University, Malawi
68	Sara	Boettiger	Independent Consultant
69	Assoumana	Boubacar	AGRHYMET
70	Salma	Bougoune	OSMER SARL
71	Pamela	Bowen	Washington Business Dynamics (WBD)
72	Marie	Boyd	University of South Carolina School of Law

c	First Name	Last Name	Organization
73	Patricia	Brandt	Princeton University
74	Lakesha	Branscomb	University of Arkansas at Pine Bluff
75	Melody	Braun	International Research Institute for Climate and Society (IRI), Columbia Climate School
76	Jan	Braunholz	Cafe Cortado
77	Calvin	Brophy	Tetra Tech
78	David	Brown	Retired from International Agri-Econ Professor, Advisor and Program Leader
79	Jonathan	Brown	Johns Hopkins University Center for Communication Program
80	Molly	Brown	University of Maryland
81	Bathsheba	Bryant-Tarpeh	USAID
82	Courtney	Buck	USAID
83	Doze	Butler	University of Arkansas at Pine Bluff
84	Gillian	Caldwell	USAID
85	Tess	Caldwell	No Response
86	Lila	Cardell	USDA ERS
87	Sara	Carlson	No USAID
88	Francesco	Carnevale Zampaolo	SRI-2030
89	Ed	Carr	No Response
90	Angela	Castaño	AGROSAVIA
91	Otto	Castillo	Tetra Tech
92	Carol	Chan	Tetra Tech
93	Juliet	Chinenye	CSAYN
94	Daniela	Chiriac	Climate Policy Initiative
95	Richard	Choularton	Tetra Tech
96	Cheryl	Christensen Bax	Retired from USDA's economic research service
97	Banki	Chunwate	University of York
98	Jennifer	Cisse	Abt Associates
99	Allan	Cledera	No Response
100	Clara	Cohen	USAID
101	Michael	Colby	USAID/AFR
102	Maressea	Collins	No Response
103	Shalean	Collins	No Response
104	Willie	Columbus	University of Arkansas at Pine Bluff
105	Jonathan	Cook	USAID
106	Kelley	Cormier	USAID
107	Caitlin	Corner-Dolloff	USAID
108	Erin	Coughlan de Perez	Tufts University
109	Paige	Cowie	No Response

c	First Name	Last Name	Organization
110	Eric	Crawford	Michigan State University
111	Tommy	Crocker	Tetra Tech
112	Pamela	D. Moore	University of Arkansas at Pine Bluff
113	Osman	Damba	University for Development Studies
114	Mohamed	Daramy	Sierra Rutile Limited
115	Omar	Dary	USAID
116	Christogonus	Daudu	National Agricultural Extension Research & Liaison Services, Ahmadu Bello University
117	Mariah	Davidson	Land O'Lakes Venture37
118	Tamsen	De Beer	SEED
119	Uttam	Deb	University of Arkansas at Pine Bluff
120	David	DeYoung	Michigan State University
121	Rahel	Diro	Tetra Tech
122	Franklin	Djedanem	DONANG MADJI SOCIETY
123	Tracey	Duffey	Olam Food Ingredients (OFI)
124	Rafael	E García	An der Isebek (Basic School)
125	Kris	Easter	USAID
126	Regina	Eddy	USAID Bureau for Resilience and Food Security
127	Karen	Edwards	ASA/WISHH
128	Rebecca	Egan	USAID
129	Mike	Eggleton	University of Arkansas at Pine Bluff
130	Mohamed	El Amrani	National School Of Agriculture of MEKNES MOROCCO
131	Chukwuemeka	Emenekwe	No Response
132	Jeremiah	Erasquin	We & Goliath
133	Anthony	Esilaba	Independent Consultant
134	Jess	Fanzo	Johns Hopkins University
135	Alicia	Farmer	University of Arkansas at Pine Bluff
136	Mana	Farooghi	Climate Advisor
137	David	Fernandez	University of Arkansas at Pine Bluff
138	Shaun	Francis	University of Arkansas at Pine Bluff
139	Fred	Frazer	University of Arkansas at Pine Bluff
140	Phil	Gaffney	EcoStim
141	Narcisse	Gahi	Ghent University (Posdoc), Belgium & Felix Houphouet-Boigny University (Researcher), CIV
142	Caron	Gala	APLU
143	Moussa	Ganame	No Response
144	Kisito	Gandji	Laboratory of Biomathematics and Forest Estimations, University of Abomey-Calavi
145	C	Gatobu-Kaimosi	AGRHYMET

c	First Name	Last Name	Organization
146	Amir	Geofrey Kachenje	Flying Dream Company Limited
147	Andrew	Gerard	USAID
148	Margaret	Gitau	Purdue University
149	Jerry	Glover	USAID
150	Suzzette	Goldmon	University of Arkansas at Pine Bluff
151	Helena	Gómez	CSIC
152	Arvil	Gonzalez	USAID
153	Greg	Grothe	Land O'Lakes Venture37
154	Noel	Gurwick	USAID
155	Sridhar	Gutam	ICAR-IIHR
156	Fabian	Gutierrez Oviedo	No Response
157	Malick	Haidara	USAID
158	Reid	Hamel	USAID
159	Petra	Hamers	Oxfam Novib
160	Qwamel	Hanks	USAID
161	James	Hansen	International Research Institute for Climate and Society (IRI), Columbia Climate School
162	Jim	Hansen	IRI
163	Elgeo	Harris	Bunge North America
164	Bobby	Hartwell	USAID
165	Jagger	Harvey	Kansas State University
166	Liesl	Hattingh	ACTkit
167	Henry	Heilbroner	USAID
168	Teresa	Henson	University of Arkansas at Pine Bluff
169	Mario	Herrero	Cornell University
170	Dave	Hoisington	University of Georgia
171	Annette	Houtekamer	IBISA SA
172	Julie	Howard	CSIS
173	Teki	Hunt	University of Arkansas at Pine Bluff
174	Sophia	Huyer	ILRI
175	Eric	Hyman	USAID
176	Aisha	Ibrahim	National Agricultural Extension Research & Liaison Services, Ahmadu Bello University
177	Olawunmi	Ilesanmi	No Response
178	Rebecca	Irvine	Institute for Research on Women and Gender, University of Michigan
179	Shahidul	Islam	University of Arkansas at Pine Bluff
180	Alhassan	Issahaku	No Response
181	Chadrack	Itsia	BILANGA SOLUTIONS
182	Kathryn	Ivancic	No Response
183	Lakshmi	Iyer	Grameen Foundation

c	First Name	Last Name	Organization
184	Meredith	Jackson-deGraffenried	Helen Keller International
185	Dr. Tariq	Javaid	Potato Research Institute,Sahiwal
186	Sajeela	Javed	Government
187	Ogolla	John Martin	Makerere University
188	Malay	Joshi	No Response
189	Vijaya	Joshi	University of Florida
190	Lonnie	Jr Waller	No Response
191	Peter	Juma Lugendo	No Response
192	Ahmed	Kablan	USAID
193	Irene	Kaburia	No Response
194	Ait	Kadi	No Response
195	John	Kaganga	Kikandwa Environmental Association
196	Claude	Kakule	Walden University - Student
197	Mwiza	Kamwambi	Better World Innovations
198	Caroline	Kasman	USAID
199	Dr. Caroline	Kathure Gatobu	No Response
200	Lumbani	Kaunda	Land O'Lakes Venture37
201	Asli	Kes	USAID
202	Amit	Khardori	USAID
203	Arun	Khatri-Chhetri	Save the Children
204	Nuttapon	Khongdee	ChiangMai University
205	Benjamin	Kohl	Feed the Future Innovation Lab for Collaborative Research on Sorghum and Millet (SMIL)
206	Sathish	Kota	ICRISAT
207	Edmond	Kposowa	Future In Our Hands Sierra Leone(FIOSL)
208	Gopal	Krishna Debnath	LGED
209	Wilhelm	Kruse	Freelance
210	Ramesh	Kumar Singh	No Response
211	Anke	Kwast	Yara International
212	Yvan	Kwidja	APADER
213	Eric	LaFary	Tractors for Africa
214	Bennett	LaFond	Abt Associates
215	Gabe	Laizer	Int. Fund for Ag. Dev (IFAD)
216	Rattan	Lal	The Ohio State University
217	Mahamadou	Laoualy	Secrétariat Exécutif du CNEDD au CABINET DU PM/NIGER
218	Aaron	Larsen	USAID/BHA
219	Asma	Lateef	SDG2 Advocacy Hub
220	Dr. Laté	Lawson-Lartego	Oxfam America

c	First Name	Last Name	Organization
221	Carole	Levin	USAID
222	Katie	Liming	Clark University
223	Omarious	Little	No Response
224	Saweda	Liverpool-Tasie	Michigan State University
225	Rebecca	Lochmann	University of Arkansas at Pine Bluff
226	Linda	Loubert	MORGAN STATE UNIVERSITY
227	Adetona	Luc	No Response
228	Rachel	Luckett	University of Arkansas at Pine Bluff
229	Ben	Luther Lucas	AgriterraPhils, Inc.
230	Nina	Lyon-Bennett	University of Arkansas at Pine Bluff
231	Surajo	M. Usaini Rimi	No Response
232	Cosmos	Magorokosho	No Response
233	Seema	Mahini	USAID
234	Katryna	Mahoney	No Response
235	Meredith	Mallory	Tetra Tech
236	Aissata	Mamadou Ibrahim	INRAN
237	Michael	Manella	USAID
238	Angela	Manjichi	Instituto Superior Politécnico de Manica
239	Everisto	Mapedza	IWMI
240	Diana	Marcela Guzman Lugo	UNIVERSIDAD CENTRAL
241	Rob	Marchant	University of York
242	Robert	Marchant	No Response
243	Chelsea	Marcho	USAID
244	Ana	Maria Loboguerrero	Alliance of Bioversity International and CIAT
245	Katriel	Marks	Land O'Lakes Venture37
246	Lourdes	Martinez	USAID
247	Itohan	Martins	Federal University of Agriculture, Abeokuta
248	Blessing	Masasi	University of Arkansas at Pine Bluff
249	Isidro	Matamoros	Zamorano University
250	Dr. Christopher	Mathis	University of Arkansas at Pine Bluff
251	Christopher	Mathis Jr	University of Arkansas at Pine Bluff
252	Samuel	Matos Xavier	Green Resources
253	Nipon	Mawan	Khon kaen
254	Lydia	Mbevi	Gender Consultant
255	Joshua	McBee	Climate Advisers
256	Jen	McCallum	SRI-2030
257	Mark	McDaniel	McDaniel and McDaniel, LLC
258	Karis	McGill	USAID
259	Bruce	McGowan	University of Arkansas at Pine Bluff
260	Erin	McGuire	University of California Davis

c	First Name	Last Name	Organization
261	Gineth	Melissa Trujillo Aristizabal	No Response
262	Ismael	Merlos	FUNDE
263	Patience	Mgoli Mwale	CARE international
264	Eric	Mitchell	Alliance to End Hunger
265	Aitkadi	Mohamed	No Response
266	Lamlihi	Mohamed	No Response
267	Lina	Mohammadi	Chemonics International
268	Abdul	Momin	University of Arkansas at Pine Bluff
269	Henri	Moore	Haleon
270	Steve	Morin	USAID Center for Agriculture
271	Stephanie	Morris	USDA
272	Hannah	Mosher	Tetra Tech
273	Ibrahim	Moshood	Commonwealth Youth Climate Change Network
274	Daniel	Moss	We & Goliath
275	Rachid	Moussadek	INRA/ICARDA
276	Corina	Mueller	Kreis Herzogtum Lauenburg
277	Andrew	Muhammad	University of Tennessee
278	Michelle	Muldoon	USAID
279	Willy	Mulimbi	University of Arkansas at Pine Bluff
280	Alex	Mutinda	No Response
281	Nkole	Mwamba	Savannah Zambia
282	Dorothy	Nampanzira	Makerere University
283	Mikel	Narbaiza	TechnoServe
284	Séga	Ndao	NZAGRC
285	Mame Balla	Ndiaye	No Response
286	Alikali	Ndong	Food Safety and Quality Authority
287	Rebecca	Nemec	USDA
288	Agnes	Ngondo	Agricultural Council of Tanzania
289	Moffatt	Ngugi	USAID
290	Kien	Nguyen Van	Plant Resources Center
291	Marcel	Nibasumba	Mercy Corps
292	Jennifer	Nielsen	No Response
293	Gordon	Nikoi	Esoko
294	Obadiah	Njue	University of Arkansas at Pine Bluff
295	Lilian	Nkengla	Oxfam America
296	Rehana	Noor	BRAC
297	Davis	Nordeen	International Medical Corps
298	Evan	Notman	USAID
299	Carlijn	Nouwen	Climate Action Platform for Africa
300	Mataa	Nyambe	No Response

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301	Alexis	Nzeyimana	No Response
302	Michael	Ogunbiyi	SM Sunrise Global Visions
303	Richard	Okundia	Rao Agrium and Agro Allied Services
304	Michael	Olabisi	University of Arkansas at Pine Bluff
305	Oyediji	Olubukola T	No Response
306	Victoria	Olutunmogun	Ahmadu Bello University, Zaria
307	Siyanbola	Omitoyin	University of Ibadan, Nigeria
308	Simeon	Onya	Michael Okpara University of Agriculture Umudike
309	Robert	Onyeneke	Alex Ekwueme Federal University Ndufu-Alike, Nigeria
310	Tom	Opapa	No Response
311	George	Opare Asare	Ignitia
312	Brenda	Oppert	USDA Agricultural Research Service
313	Bernardo	Ospina	Corporacion Clayuca
314	Clement	Oteng	Cheikh Anta Diop University of Dakar, Senegal
315	Souha	Ouni	No Response
316	Rachel	Owen	Agronomy, Crops, and Soil Science Societies of America
317	EMMA	PAGE	Tetra Tech
318	Jonelle	Palmer	No Response
319	Camilo	Pantoja	No Response
320	Yong	Park	University of Arkansas at Pine Bluff
321	Seng	Peng	Save the Children
322	Jen	Peterson	Tetra Tech
323	Gilbert	Phiri	International Federation of Red Cross Red Crescent
324	Barry	Pittendrigh	Purdue University
325	Keith	Poe	USAID - BHA
326	Alvaro	Ponce Lanza	ASBLatam
327	Sathish	Ponniah	University of Arkansas at Pine Bluff
328	Tracy	Powell	USAID/RFS
329	Luke	Pritchard	No Response
330	Tala	Qtaishat	UNI
331	Janette	R. Wheat, Ph.D.	University of Arkansas at Pine Bluff
332	Grace	Ramena	University of Arkansas at Pine Bluff
333	Juan	Ramos	EcoAgriculture Partners
334	Angela	Records	USAID
335	Megan	Rhodes	USAID
336	John	Ricketts	Tennessee State University

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337	Rodolfo	Rodríguez	Consultant
338	Gabriel	Rodriguez-Marques	IICA
339	Nicholas	Romano	University of Arkansas at Pine Bluff
340	Nicole	Rossi	Cornell University
341	Deborah	Rubin	Cultural Practice LLC
342	Alfredo	Rueda	UMH
343	Alex	Russell	Feed the Future Innovation Lab for Markets, Risk & Resilience
344	Diane	Russell	USAID
345	Gebre	S	No Response
346	Cam	Saint-Cyr	University-Kenya
347	Isa	Salaam	Florida A&M University
348	Michelle	Samuel-Foo	No Response
349	Yasser	Sanad	No Response
350	Camilo	Sanchez	Olam Food Ingredients (OFI)
351	Pedro	Sanchez	University of Florida-retired
352	Hector	Santos	No Response
353	Mousumi	Sarkar	No Response
354	Ghulam	Sarwar	Cotton Research Station
355	Laura	Schmitt Olabisi	Michigan State University
356	Jeff	Seale	Regrow Ag
357	Akoto	Sellassie	No Response
358	Dr.	Shampa	Bangladesh University of Engineering and Technology
359	Andre	Shelby	University of Arkansas at Pine Bluff
360	Kelly	Sheridan	U.S. Dairy Export Council
361	Bolatito	Shobo	Babcock University
362	Jules	Siedenburg	University of East Anglia
363	Laura	Sigelmann	USAID
364	Amit	Sinha	University of Arkansas at Pine Bluff
365	Ceaser C	Siwale	Pangaea Securities
366	Nkareng	Siwale	RainDance Asset Management
367	Alexa	Smith	Food Directions
368	Madeleine	Smith	USAID
369	Michael	Smith	NOAA
370	Amit	Smotrich	USAID
371	Anna	Snider	University of Illinois
372	Oumarou	Souleymane	INRAN (National Agricultura Research Institute)
373	Kathy	Spahn	Helen Keller International
374	John	Steward	No Response
375	Kyla	Stockdale	Helen Keller International

c	First Name	Last Name	Organization
376	Jeremy	Stone	Mercy Corps
377	Michael	Sullivan	USDA Natural Resources Conservation Service
378	Kur'an	Suluki	University of Arkansas at Pine Bluff
379	Boubacar	T Assoumana	No Response
380	Faith	Tarr	USAID/RFS
381	John	Taylor	USAID
382	Jeanetta	Terrell	No Response
383	Tebug	Thomas Tumasang	University of Dschang, Cameroon
384	Allison	Thomson	Foundation for Food and Agriculture Research
385	Allison	Thomson	No Response
386	Jennifer	Tikka	USAID
387	Valeria	TMK	No Response
388	Edmond	Totin	Université Nationale d'Agriculture (UNA)
389	Marlen	Trolp	GIZ
390	Sylwia	Trzaska	IRI
391	David	Tschirley	Michigan State University
392	Joseph	Ukpong	Ceunitonc Farms
393	Aalaa	Ullaah Sida	Ain Shams University
394	Corinne	Valdivia	University of Missouri
395	Piet	van Asten	Olam Food Ingredients (ofi)
396	Tom	van Mourik	Helen Keller International
397	Collin	VanBuren	USAID
398	Jenny	Vanyur	Helen Keller International
399	Ann	Vaughan	USAID
400	Angelino	Viceisza	Spelman College
401	Jean-Michel	Voisard	Chemonics International
402	Bhami	Vora	Consultant
403	Ronald	Walusimbi	Makerere University
404	Amtul	Waris	INDIAN INSTITUTE OF RICE RESEARCH
405	Koko	Warner	UNFCCC
406	Olaf	Westermann	Catholic Relief Services
407	Drew	Wheadon	Tetra Tech
408	Dameion	White	University of Arkansas at Pine Bluff
409	Tomekia	White	No Response
410	Suwimon	Wicharuck	Chiang Mai University
411	John	William Medendorp	Purdue University
412	Trenten	Wills	University of Arkansas at Pine Bluff
413	Carol	Wilson	USAID
414	Adam	Wolfensohn	Encourage Capital

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415	Lini	Wollenberg	University of Vermont and Alliance of Bioversity and CIAT
416	Mark	Wood	Tetra Tech
417	Shatisha	Woods	No Response
418	James	Woolley	USAID Haiti
419	Hailu	Wordofa	USAID
420	Lin	Xie	University of Arkansas at Pine Bluff
421	Rabiu	Yau	Ahmadu Bello University, Zaria
422	Comfort	Yelipoie	Directorate of Crop Services
423	Arun	Zacharia	International Crop Research Institute for the Semi-Arid Tropics
424	Fernanda	Zermoglio	USAID
425	Erlich		University of Namibia
426	Ebony		IICA
427	Rachid		ICARDA Morocco
428	A.O		No Response
429	AB		No Response
430	Abdoulayerabdo		No Response
431	AJAmador		No Response
432	Cereal		No Response
433	Claire.Cvitanovich		No Response
434	Dave		No Response
435	EEI/DDI/CCS		No Response
436	Ezauisomue		No Response
437	John-Philippines		No Response
438	KMAP		No Response
439	Lochmannr		No Response
440	Masasib		No Response
441	Mdesrosiers		No Response
442	Mjgimenez		No Response
443	MY		No Response
444	Neema		No Response
445	Nicholas		No Response
446	Qtaishat		No Response
447	Shampa		No Response

ANNEX 4: BRIEFER

These are the materials submitted to BIFAD on 8/31/22, it contains background literature relevant to the public meeting, shared by speakers and the BIFAD Support Team

BIFAD 185th Public Meeting

Recommended Pre-Reads for BIFAD Members

Meeting Title: A Consultative Workshop on Systemic Solutions for Climate Change Adaptation and Mitigation in Agriculture, Nutrition, and Food Systems

Date/time: August 31, 2022 10:30–12:30 EDT (Virtual)

Briefer Prepared by: Tommy Crocker, Rahel Diro, Carmen Benson (BIFAD Support at Tetra Tech)

Foundational Reports Recommended by Subcommittee and Author Team

Carter R, Choularton R, Ferdinand T, Ding H, Ginoya N, Preethan P. Food Systems at Risk: Transformative Adaptation for Long-term Food Security. World Resources Institute. LINK

Executive Summary: Climate change impacts are already reducing crop and livestock productivity and decreasing food security for millions of people around the world—and these impacts will intensify over the coming decades. Longer-term, systemic, transformative approaches to adaptation are needed to protect rural lives and livelihoods. This report explores how climate change is affecting agriculture and the benefits that transformative approaches to adaptation offer. Based on the evidence it presents, this report calls for funding entities, governments, and research organizations to better understand, plan for, and finance transformative approaches to adaptation for food systems. The report outlines three priorities to adequately factor climate change impacts and risks into key decisions through improved understanding, planning, and financing. 1) Understanding through expanded research and development: - research and development must be expanded to make climate risks visible over multiple timescales and geographies and engage farmers, fishers, and herders in identifying transformative solutions for building long-term resilience. 2) Planning (and implementation) to improve policy and investment decisions: - coordination must be improved among governments, adaptation funding entities, and research organizations to create and finance transformative pathways in a way that is coherent, inclusive, and participatory, and based on an understanding of existing political economies. This could be done by, for example, leveraging national development plans, United Nations Sustainable Development Goals, and readiness programs (Carter et al. 2018). 3) Finance to mobilize resources to accelerate transformative adaptation: - given the challenges that the global food system faces, a massive increase in funding for agricultural adaptation is urgently needed, for both incremental and transformative approaches. While the costs of transformative adaptation have not yet been calculated, its potential for averting and minimizing losses and damages makes it likely to pay off over the longer term.

International Food Policy Research Institute. (2022). 2022 *Global Food Policy Report: Climate Change and Food Systems*. Washington, DC: International Food Policy Research Institute. LINK

Foreword: This year's Global Food Policy Report on food systems transformation and climate change echoes the somber warning issued by recent IPCC reports: as we continue to degrade the environment and push beyond our planetary boundaries, we are entering a "Code Red for Humanity." Food systems are inseparably linked to this unprecedented crisis, which threatens the food security, nutrition, and health of billions of people. Our food systems are not only severely impacted by climate change,

requiring an urgent focus on adaption, but also play a role in causing about one-third of global greenhouse gas emissions, with two-thirds of that resulting from agriculture, forestry, and other land use. Investing in food systems transformation is a key piece of the climate change puzzle, yet it is vastly underfunded, with only a small part of climate finance directed toward this goal. In 2021, as the COVID-19 pandemic continued to trigger health and economic crises around the world, the international community came together to recognize the centrality of food systems for meeting development and sustainability goals. The first-ever United Nations Food Systems Summit advanced food systems to the top of the global policy agenda, and the UNFCCC COP26 commenced plans to truly incorporate agriculture into COP27 in 2022. But these developments fall far short of what is urgently needed: a wide range of investments in climate-positive research, development, policies, and programs rooted in food systems. The 2022 Global Food Policy Report highlights a range of evidence-based policies and innovations that should be prioritized and implemented now to tackle adaptation and mitigation in our food systems. Drawing on research from IFPRI and other CGIAR centers, it offers lessons that can help us better achieve food security, nutrition, and sustainability through climate-positive financing, innovation, and governance. Going forward, research on transforming food systems to deal with climate change will remain at the heart of the 2030 CGIAR Research and Innovation Strategy. This strategy guides science and innovation initiatives at IFPRI and One CGIAR to advance the transformation of food systems, as well as land and water systems, in a climate crisis. The COVID-19 pandemic as well as the current upheaval of global food markets, caused by a series of conflicts around the world, have made this research strategy even more essential and urgent. We hope that the 2022 Global Food Policy Report will support transformation by contributing to global policy discussions and to the many national and local policy discussions and reforms that will be essential to food systems transformation. We look forward to engaging and working together with many partners around the world to contribute to this transformation and thus to a better future.

Willet W, Rockstrom J, Loken B, Springmann M, Lang T, Vermeulen S, et al. (2019) Food in the Anthropocene: the EAT-*Lancet* Commission on healthy diets from sustainable food systems. *The Lancet Commissions*. LINK (Downloadable PDF)

Abstract: Food systems have the potential to nurture human health and support environmental sustainability; however, they are currently threatening both. Providing a growing global population with healthy diets from sustainable food systems is an immediate challenge. Although global food production of calories has kept pace with population growth, more than 820 million people have insufficient food and many more consume low-quality diets that cause micronutrient deficiencies and contribute to a substantial rise in the incidence of diet-related obesity and diet-related non-communicable diseases, including coronary heart disease, stroke, and diabetes. Unhealthy diets pose a greater risk to morbidity and mortality than does unsafe sex, and alcohol, drug, and tobacco use combined. Because much of the world's population is inadequately nourished and many environmental systems and processes are pushed beyond safe boundaries by food production, a global transformation of the food system is urgently needed.

Steiner, A., Aguilar, G., Bomba, K., Bonilla, J. P., Campbell, A., Echeverria, R., ... & Zebiak, S. (2020). Actions to transform food systems under climate change (No. 138-2021-1490). LINK

Why this report? Nothing short of a systemic transformation of food systems is required if we are to feed the world's current and future population sustainably under climate change. Furthermore, as a significant driver of deforestation and contributor of greenhouse gases, the agriculture sector cannot be excluded from climate action if we are to meet global climate targets like the Paris Agreement. We are not the first to argue that transformation is necessary. Others have demonstrated that it is needed to tackle a number of urgent issues —nutrition security, small-scale producer yields and incomes, poverty,

gender disparities and social inclusion, biodiversity conservation and ecosystem protection, and shifting power dynamics, among others. But where, in the complexity of food systems, are the best levers to achieve change? Through extensive research, analysis, and stakeholder consultation, we aimed to identify the high priority actions that we must collectively take now, for climate change adaptation and mitigation in food systems. Taken together, these actions are the basis of the systemic transformation that is needed in food systems.

USDA. (2022). USDA Announces Framework for Shoring Up the Food Supply Chain and Transforming the Food System to Be Fairer, More Competitive, More Resilient. Press Release No. 0116.22. LINK

About the release: On June 1, 2022 the U.S. Department of Agriculture (USDA) announced details of a framework to transform the food system to benefit consumers, producers and rural communities by providing more options, increasing access, and creating new, more, and better markets for small and mid-size producers. Today's announcement builds on lessons learned from the COVID-19 pandemic and supply chain disruptions caused by Russia's war in Ukraine. This announcement also provides additional details on the June 2021 announcement to strengthen critical supply chains and address longstanding structural challenges that were revealed and intensified by the pandemic. When the COVID-19 pandemic began, USDA made significant investments through its Pandemic Assistance Program, providing immediate relief to producers, businesses, food workers and others. As the pandemic has evolved and Russia's war in Ukraine has caused supply chain disruptions, it has become clear we cannot go back to the food system we had before: the Biden-Harris Administration and USDA recognize we must build back better and strengthen the food system across the supply chain, from how our food is produced to how it is purchased, and all the steps in between.

The goals of USDA's Food System Transformation framework include: 1) *Building a more resilient food supply chain that provides more and better market options for consumers and producers while reducing carbon pollution.* 2) *Creating a fairer food system that combats market dominance and helps producers and consumers gain more power in the marketplace by creating new, more and better local market options, and 3) Making nutritious food more accessible and affordable for consumers, 4) Emphasizing equity:* For too long, rural communities, underserved communities, communities that experience persistent poverty, and the people who live there have been left behind.

Webb P, Benton T, Berdegué J, Fanzo J, Haddad L, Myers S, Qaim M, Resnick D, Springmann M. (2020). Future Food Systems: For people, our planet, and prosperity. Global Panel on Agriculture and Food Systems for Nutrition. LINK

About the report: This report includes important recommendations and advice for leaders at the most senior levels in countries and international organisations. It is also of direct relevance to decision makers, professionals, actors in the private sector, experts and researchers with interests in food systems and diets. Many of these individuals will be directly concerned with the production, processing, trade, regulation, supply and safety of food. However, others may work in wider areas of policy and business, for example relating to: public health and well-being, education, economic development and investment, urbanisation, globalisation and demography. This report and executive summary are necessarily technical due to the nature of the subject matter. However, they set out the practical steps which are essential for food systems transformation, and the process of change.

Fanzo F, Rudie C, Sigman I, Grinspoon S, Benton T, Brown M, Covic N, Fitch K, Golden C, Grace D, Hivert MF, Huybers P, Jaacks L, Masters W, Nisbett N, Richardson R, Singleton C, Webb P, Willett W. (2021). Sustainable food systems and nutrition in the 21st century: a report from the 22nd annual Harvard Nutrition Obesity Symposium Oxford University Press. LINK

Abstract: Food systems are at the center of a brewing storm consisting of a rapidly changing climate, rising hunger and malnutrition, and significant social inequities. At the same time, there are vast opportunities to ensure that food systems produce healthy and safe food in equitable ways that promote environmental sustainability, especially if the world can come together at the UN Food Systems Summit in late 2021 and make strong and binding commitments toward food system transformation. The NIH-funded Nutrition Obesity Research Center at Harvard and the Harvard Medical School Division of Nutrition held their 22nd annual Harvard Nutrition Obesity Symposium entitled "Global Food Systems and Sustainable Nutrition in the 21st Century" in June 2021. This article presents a synthesis of this symposium and highlights the importance of food systems to addressing the burden of malnutrition and noncommunicable diseases, climate change, and the related economic and social inequities. Transformation of food systems is possible, and the nutrition and health communities have a significant role to play in this transformative process.

Ijjasz-Vasquez EJ, Sghir J, Noble I. (2021). State and Trends in Adaptation Report 2021: Africa. Global Center on Adaptation. LINK (LINK TO SYNTHESIS REPORT)

Abstract: State and Trends in Adaptation 2021 combines in-depth analyses, case studies, and viewpoints from those on the frontlines of climate change impacts in Africa. It presents a detailed blueprint for action: offering innovative adaptation and resilience ideas, solutions, and policy recommendations. The results are clear and compelling. Adaptation measures can be enormously cost effective and have the potential to start a positively reinforcing cycle of benefits. As these measures protect people and communities from floods, droughts, and others impacts, they also help lift people out of poverty, reduce hunger and undernourishment, raise incomes and living standards, fight diseases, create jobs, reduce inequality, mitigate the risk of conflicts, and give voice to the most vulnerable. These realizable results, in turn, further increase resilience to climate impacts.

Speaker-Recommended References

Food Systems Transformation for Climate Change Adaptation and Mitigation

Loboguerrero, A.M.; Thornton, P.; Wadsworth, J.; Campbell, B.M.; Herrero, M.; Mason-D'Croz, D.; Dinesh, D.; Huyer, S.; Jarvis, A.; Millan, A.; Wollenberg, E.; Zebiak, S. (2020). Perspective article: Actions to reconfigure food systems. ***Global Food Security*** **26, 100432.** LINK

Abstract: There is broad agreement that current food systems are not on a sustainable trajectory that will enable us to reach the Sustainable Development Goals by 2030, particularly in the face of anthropogenic climate change. Guided by a consideration of some food system reconfigurations in the past, we outline an agenda of work around four action areas: rerouting old systems into new trajectories; reducing risks; minimising the environmental footprint of food systems; and realigning the enablers of change needed to make new food systems function. Here we highlight food systems levers that, along with activities within these four action areas, may shift food systems towards more sustainable, inclusive, healthy and climate-resilient futures. These actions, summarised here, are presented in extended form in a report of an international initiative involving hundreds of stakeholders for reconfiguring food systems.

Loboguerrero AM, Campbell BM, Cooper PJM, Hansen JW, Rosenstock T, Wollenberg E. (2019). Food and earth systems: Priorities for climate change adaptation and mitigation for agriculture and food systems. ***Sustainability*** **11(5):1372.** LINK

Abstract: Human activities and their relation with land, through agriculture and forestry, are significantly impacting Earth system functioning. Specifically, agriculture has increasingly become a key sector for

adaptation and mitigation initiatives that address climate change and help ensure food security for a growing global population. Climate change and agricultural outcomes influence our ability to reach targets for at least seven of the 17 Sustainable Development Goals. By 2015, 103 nations had committed themselves to reduce greenhouse gas emissions from agriculture, while 102 countries had prioritized agriculture in their adaptation agenda. Adaptation and mitigation actions within agriculture still receive insufficient support across scales, from local to international level. This paper reviews a series of climate change adaptation and mitigation options that can support increased production, production efficiency and greater food security for 9 billion people by 2050. Climate-smart agriculture can help foster synergies between productivity, adaptation, and mitigation, although trade-offs may be equally apparent. This study highlights the importance of identifying and exploiting those synergies in the context of Nationally Determined Contributions. Finally, the paper points out that keeping global warming to 2 °C above pre-industrial levels by 2100 requires going beyond the agriculture sector and exploring possibilities with respect to reduced emissions from deforestation, food loss, and waste, as well as from rethinking human diets.

Loboguerrero AM, Birch J, Thornton P, Meza L, Sunga I, Bong BB, Rabbinge R, Reddy M, Dinesh D, Korner J, Martinez-Baron D, Millan A, Hansen J, Huyer S, Campbell B. (2018). Feeding the world in a changing climate: An adaptation roadmap for agriculture. Rotterdam, the Netherlands and Washington, DC, the United State of America: Global Commission on Adaptation (GCA). LINK

Executive Summary: The impacts of a warming world are affecting food production in every corner of the globe. From shifting rainfall patterns and growing seasons, to more frequent and extreme droughts and floods, to increasingly severe pest and disease outbreaks among crops and livestock, farming as we know it is under attack.

Globally, agricultural production has fallen by 1-5 percent each decade for the past 30 years, with tropical regions the hardest hit. In 2017, according to the UN Food and Agriculture Organization (FAO), droughts, floods and delayed growing seasons helped trigger food crises in Central America, East and West Africa, and parts of Asia. Yet far worse outcomes are likely ahead for vulnerable food consumers and producers as these climate change impacts intensify and the world's population climbs—if we persist with a business as usual approach.

The implication is clear. The agricultural development community must urgently come together around a comprehensive and accelerated adaptation roadmap for food production acknowledging that major transitions across the agriculture sector will be needed. This report seeks to lay the groundwork for a way forward. It brings together academic research, examples of proven adaptive technologies and practices, and lessons learned from practitioners including government, farming communities and the private sector. It then provides recommendations for the development of new technologies and practices and on how to scale what's already working to drive global climate-resilient transitions. The report focuses on agriculture, primarily in the developing world, recognizing that this is only a part of a larger and more complex set of issues related to food systems and their transformation for sustainability.

The report identifies a range of adaptive farming technologies and practices that are proven to work and suitable for scaling. These include stress tolerant crops and livestock breeds, sustainable forms of farming intensification, and better risk management through innovations like climate information systems and index-linked insurance. As policy makers, farmers, scientists, civil society organizations and others trial these and other adaptation practices around the world, important lessons for success are emerging that should inform future efforts.

It is critical to consider the social and economic context of farming communities in designing solutions. For example, policymakers have been more successful when they tackle the root causes of climate vulnerability, such as lack of income to invest in adaptive technologies, and empower participation by women, youth, and other especially vulnerable groups.

Collective action is often key to success. In countries ranging from Bangladesh and Cambodia, to Ghana and Uganda, for example, policymakers, communities, scientists and other stakeholders together developed resilience roadmaps suited to a range of future development scenarios. In other countries collective action between governments and the private sector has helped deliver results. In Colombia, for example, the Ministry of Agriculture and rice producers' federation strengthened the sector's resilience by providing farmers with timely climate information to support wise planting decisions.

Given the pressing threat to food security, scaling proven new adaptive technologies is an imperative. Here, governments were successful when they provided the right incentives and resources to attract major investment by private sector or international donors, or when they used communications media to spread the message to farmers. Finally, efforts around the world underscore that there is no single silver bullet for success. Instead, adaptation policies, technologies and tools must be tailored to suit each sector, regional or local context, and be designed to help farmers cope with both current and predicted climate change impacts.

Mogomotsi, P. K., Sekelemani, A., & Mogomotsi, G. E. J. (2020). Climate change adaptation strategies of small-scale farmers in Ngamiland East, Botswana. Climatic Change, 159(3), 441–460. LINK

Abstract: Climate change and variability threaten the sustainability of agricultural and food production, especially in agrarian communities. In Southern Africa, rainfall is expected to decline by almost 10% by the year 2050 and the largest increase in temperature can be experienced. Despite the potential risks of climate change on agricultural productivity, Botswana does not have a dedicated policy to respond to climate change. Furthermore, there is a dearth of research done in Botswana to provide an understanding of factors that shape farmers' adaptation to climate change and institutional link to the adaptive capacity of farming households. Therefore, the aim of this article is to analyse institutions that influence farmers' adaptation strategies of farmers in Botswana, using Ngamiland East as a case study. The paper relies on empirical data collected from purposively selected key informants and 300 households. The results show that the majority of farmers who have climate variability adaptation strategies in place are largely influenced by indigenous knowledge. Women and low-income earners are less likely to employ climate change adaptation strategies in order to improve their agricultural productivity. This article gives a better perspective of the strengths, weaknesses, opportunities and threats facing institutions designed to enable agricultural productivity. It recommends that macro-level and local government institutions should acknowledge the indigenous knowledge, community-level institutions and farmers' adaptive capacity in policy formulation processes.

Hellin, J., Fisher, E., & Loboguerrero, A. M. (2021). Reflections on Enhancing the Impact of Climate Risk Management Through Transformative Adaptation. Frontiers in Climate, 3. LINK

Abstract: Climate risk management is part of the response to the threat of climate change. Much effort has focused on the promotion on climate-resilient agriculture. There continues to be undue focus on technology solutions per se and not enough attention on the coupling of technologies and socio-economics and how they become embedded in ecological systems underpinning smallholder agriculture. In this perspective, we argue that an intertwined social–ecological–technological systems approach to climate risk management is needed to ensure that climate-resilient agriculture contributes more to the realization of goals of the Paris Agreement and the UN Framework Convention on Climate Change. Furthermore, in line with broader policy thinking on the need for transformative change toward

sustainably living on the planet and "leaving no one behind," a greater focus on transformative adaptation is required. Transformative adaptation tackles the root causes of vulnerability including unevenly distributed power relations, and extant networks of control and influence. There are, however, relatively few examples of moving from the theory of transformative adaptation to practice. Three recent practical examples of transdisciplinary approaches, that we have direct experience of as researchers, provide lessons for initial ways forward as part of climate risk management initiatives. Examples from Vietnam, East and Southern Africa, and Guatemala illustrate the importance of inter- and transdisciplinary responses whereby the inequalities underlying unequal power structures may be addressed, enabling farmers to pursue climate risk management pathways that contribute to climate resilience and human development, as epitomized by the Sustainable Development Goals.

Thornton, P. K., Jones, P. G., Alagarswamy, G., Andresen, J., & Herrero, M. (2010). Adapting to climate change: agricultural system and household impacts in East Africa. *Agricultural systems*, *103*(2), 73-82. LINK

Abstract: The East African region exhibits considerable climatic and topographic variability. Much spatial and temporal variation in the response of different crops to climate change can thus be anticipated. In previous work we showed that a large part of this variation can be explained in terms of temperature and, to a lesser extent, water effects. Here, we summarise simulated yield response in two crops that are widely grown in the region, maize and beans, and investigate how the impacts of climate change might be addressed at two levels: the agricultural system and the household. Regionally, there are substantial between-country and within-system differences in maize and bean production responses projected to 2050. The arid-semiarid mixed crop-livestock systems are projected to see reductions in maize and bean production throughout most of the region to 2050. Yields of these crops in the tropical highland mixed systems are projected to increase, sometimes substantially. The humid–subhumid mixed systems show more varied yield responses through time and across space. Some within-country shifts in cropping away from the arid–semiarid systems to cooler, higher-elevation locations may be possible, but increased regional trade should be able to overcome the country-level production deficits in maize and beans caused by climate change to 2050, all other things being equal. For some places in the tropical highlands, maize and bean yield increases could have beneficial effects on household food security and income levels. In the other mixed systems, moderate yield losses can be expected to be offset by crop breeding and agronomic approaches in the coming decades, while more severe yield losses may necessitate changes in crop types, movement to more livestock-orientated production, or abandonment of cropping altogether. These production responses are indicative only, and their effects will be under-estimated because the methods used here have not accounted for increasing weather variability in the future or changes in the distribution and impacts of biotic and other abiotic stresses. These system-level shifts will take place in a context characterised by high population growth rates; the demand for food is projected to nearly triple by the middle of this century. Systems will have to intensify substantially in response, particularly in the better-endowed mixed systems in the region. For the more marginal areas, the variability in yield response, and the variability in households' ability to adapt, suggest that, even given the limitations of this analysis, adaptation options need to be assessed at the level of the household and the local community, if research for development is to meet its poverty alleviation and food security targets in the face of global change.

Climate and Market Information Systems

Loboguerrero AM, Boshell F, Leon G, Martinez-Baron D, Giraldo D, Recaman L, Diaz E, Cock J. (2018). Bridging the gap between climate science and farmers in Colombia. *Climate Risk Management* 22:67-81. LINK

Abstract: Agriculture is highly sensitive to variations in both weather and climate. Farmers face uncertainty in the weather patterns over the short term, and climate over the longer term. The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) has promoted a system of Local Technical Agro-Climatic Committees (LTACs)4 in two Colombian regions to explore means of creating dialogue between researchers and farmers that would provide farmers with options in the face of both short- and longer-term variations in climate. The article uses a case study approach to describe how the original LTACs were established, the benefits obtained from the LTAC system, and the expansion of the system to areas outside Colombia.

The basic premise behind the LTAC approach is: If farmers and the local rural community at large can access and understand weather and climate forecasts and the responses of their crop production, processing, and marketing options under local conditions, they can make better decisions on how to manage their farms and businesses.

There are six basic components that are required to implement the LTAC approach to bridging the gap between climate science and farmers: (i) Establishment of the LTAC with alignment of local parties interested in managing variation in the climate and definition of their roles; (ii) local climate and monthly climate forecast; (iii) crop modeling and understanding of climate variation on crop production, processing and marketing and the impact this will have on management; (iv) dialogue between scientists, experts, and farmers; (v) dissemination and socialization of the dialogue; and (vi) local capacity building, which cuts across all the other five components.

The regular monthly meetings of the LTACs are the focal point of the overall process, bringing together information from various sources, organizing the ideas and thoughts, and then disseminating the information. A feature of the committees was their diversity. The committees required specific inputs, particularly on climate and the crop response before each meeting. Research organizations provided climate forecasts and crop response data. The forecasts proved closer to reality than long term means and the crops models that were used to predict crop response to changes in management and climate variation were relatively simple and unsophisticated. The committees gained confidence in these prognoses, which then formed the basis for dialogue on how best to manage climate variation. The production-side participants appreciated the opportunity to present their own points of view and the move from top-down recommendations, coming from the researchers and extension agents, towards a menu of options which they discussed. At the same time, it was evident in the early meetings that many of the participants came ill-prepared to grasp concepts related to managing climatic variation, thus highlighting the need for capacity building within the LTACs themselves.

LTACs actively promulgated their findings through bulletins, social networks, extension services, farmers' organizations radio, TV, and the press. In the dry El Niño year of 2015, many farmers used the information generated by the LTACs to better manage their crops, increasing yields, and reducing losses. More LTACs are now being established in Colombia, Honduras, Guatemala and Nicaragua. These countries have understood the value of creating mechanisms through which researches and farmers can exchange ideas, with the farmers choosing options to improve their management based on better weather and climate forecasts and an understanding of how the weather and climate affects their crops.

Coumou, D., Robinson, A., & Rahmstorf, S. (2013). Global increase in record-breaking monthly-mean temperatures. *Climatic Change*, *118*(3), 771-782. LINK

Abstract: The last decade has produced record-breaking heat waves in many parts of the world. At the same time, it was globally the warmest since sufficient measurements started in the 19th century. Here we show that, worldwide, the number of local record-breaking monthly temperature extremes is now on average five times larger than expected in a climate with no long-term warming. This implies that on

average there is an 80 % chance that a new monthly heat record is due to climatic change. Large regional differences exist in the number of observed records. Summertime records, which are associated with prolonged heat waves, increased by more than a factor of ten in some continental regions including parts of Europe, Africa, southern Asia and Amazonia. Overall, these high record numbers are quantitatively consistent with those expected for the observed climatic warming trend with added stationary white noise. In addition, we find that the observed records cluster both in space and in time. Strong El Niño years see additional records superimposed on the expected long-term rise. Under a medium global warming scenario, by the 2040s we predict the number of monthly heat records globally to be more than 12 times as high as in a climate with no long-term warming.

Lehmann, J., Mempel, F., & Coumou, D. (2018). Increased occurrence of record-wet and record-dry months reflect changes in mean rainfall. *Geophysical Research Letters*, *45*(24), 13-468. LINK

Abstract: Climate change alters the hydrological cycle, which is expected to increase the risk of heavy rainfall events and prolonged droughts. Sparse rainfall data, however, have made it difficult to answer the question of whether robust changes can already be seen in the short observational time period. Here we use a comprehensive statistical tool to quantify changes in record-breaking wet and dry months. The global-mean number of record-wet months has significantly increased over the recent decades and is now nearly 20% higher than would be expected in a stationary climate with no long-term trends. This signal primarily comes from pronounced changes in the northern middle to high latitudes where the occurrence of record-wet months has increased by up to 37% regionally. The tropics have seen opposing trends: More record-wet months in Southeast Asia in contrast to more record-dry months in Africa. These changes are broadly consistent with observed trends in mean rainfall.

Climate Smart Agriculture

Loboguerrero AM, Martinez-Baron D. (2017). Climate-smart agriculture across scales in Latin America. In: *Agriculture for Development*: Special issue on climate-smart agriculture (CSA) 30:10–11. LINK

The implementation of climate-smart agriculture (CSA) in Latin America presents interesting challenges and opportunities, especially when considering the region's agrobiodiversity, natural resources, and socioeconomic and cultural contexts.

Loboguerrero AM, Hansen J, Baethgen W, Martinez-Baron D. (2017). Climate services and insurance: scaling climate-smart agriculture. In: *Agriculture for Development*: Special issue on climate-smart agriculture (CSA) 30:31–34. LINK

Abstract: One of the main challenges of climate-smart agriculture (CSA) is finding ways to promote the adoption at scale *(Editor's note: 'scaling', 'at scale' or 'to scale' are used throughout this article to mean 'scaling-out')* of CSA practices and technologies. Climate services and insurance can constitute a tool to scale CSA by providing an enabling environment that can support the adoption of CSA practices while protecting against the impacts of climate extremes. By using a definition of climate services which includes the production, translation, transfer, and use of climate knowledge and information in climate-informed decision-making and climate-smart policy and planning, this paper aims to discuss how climate services and insurance can bring CSA to scale. Three case studies are presented. It is recognised that understanding the knowledge networks through which information flows, and affects the use of climate information, is critical for promoting CSA at scale.

Sain G, Loboguerrero AM, Corner-Dolloff C, Lizarazo M, Nowak A, Martínez-Barón D, Andrieu N. (2017). Costs and benefits of climate-smart agriculture: The case of the Dry Corridor in Guatemala. *Agricultural Systems* 151:163–173. LINK

Abstract: Central American countries, particularly Guatemala, are experiencing extreme climate events which are disproportionately affecting agriculture and subsequently rural livelihoods. Governments are taking action to address climatic threats, but they need tools to assess the impact of policies and interventions aiming to decrease the impacts of climate change on agriculture. This research, conducted with national policy makers and climate change and agriculture stakeholders in Guatemala, provides a comparative analysis of eight climate-smart agriculture (CSA) practices and technologies associated with the smallholder maize-beans production system in the Dry Corridor. The practices were identified as high-interest for investment by national stakeholders. CSA practices and technologies aim to improve food security, resilience, and low emissions development, where possible and appropriate. The paper assesses the cost-benefit profile of the introduction of CSA options into farm production systems. Indicators related to profitability and valuation of environmental and social externalities are used to assess options. Probabilistic cost-benefit analysis (CBA) is used to address field variability and high uncertainty around parameter values. All practices except one were profitable over their lifecycle, with some practices expected to be ideal for drought prone areas, presenting a higher risk for adoption. The results were discussed with national stakeholders who established best-bet CSA investment portfolios. This paper argues that a thorough understanding of the costs and benefits of potential CSA options is needed to channel investments effectively and efficiently towards both short- and long-term interventions and should be coupled with broader assessment of tradeoffs between CSA outcomes.

Osorio-Garcia AM, Paz L, Howland FC, Ortega LA, Acosta-Alba I, Arenas L, Chirinda N, Martínez Barón D, Bonilla-Findji O, Loboguerrero Rodriguez AM, Chia E, Andrieu N. (2019). Can an innovation platform support a local process of climate-smart agriculture implementation? A case study in Cauca, Colombia. ***Agroecology and Sustainable Food Systems*** **44(3):378–411. LINK**

Abstract: The main purpose of this work was analyzing how an innovation platform can foster and provide a basis for multi-actor collaboration in order to enable climate-smart agriculture (CSA) implementation at the local level. Using a mix of social (interactions between stakeholders, knowledge changes, adoption of practices) and technical indicators (income, fulfillment of caloric requirements of the household, farm resource use, planned biodiversity or greenhouse gas emission changes), we monitored the collaboration between an NGO, local civil authorities, associations, and farmers that aimed to achieve a common goal linked to the participatory and contextualized development of CSA in Colombia. We found that multiple stakeholder engagements led to improved interactions between members of the platform and their local environment, a proactive participation in the platform meetings and a significant increase in farmer knowledge levels on the challenges posed by climate change and the resultant extreme events. The platform also facilitated the adoption of best-bet practices that contribute towards CSA when farmers both diversify their production and decrease the use of mineral fertilizers. Our findings suggest that innovation platforms can facilitate the collective understanding and use of CSA options corresponding to local conditions and priorities.

Andrieu N, Howland F, Acosta-Alba I, Le Coq J-F, Osorio-Garcia AM, Martinez-Baron D, Gamba-Trimiño C, Loboguerrero AM, Chia E. (2019). Co-designing climate-smart farming systems with local stakeholders: A methodological framework for achieving large-scale change. ***Frontiers in Sustainable Food Systems*** **3(37). LINK**

Abstract: The literature is increasing on how to prioritize climate-smart options with stakeholders but relatively few examples exist on how to co-design climate-smart farming systems with them, in particular with smallholder farmers. This article presents a methodological framework to co-design climate-smart farming systems with local stakeholders (farmers, scientists, NGOs) so that large-scale

change can be achieved. This framework is based on the lessons learned during a research project conducted in Honduras and Colombia from 2015 to 2017. Seven phases are suggested to engage a process of co-conception of climate-smart farming systems that might enable implementation at scale: (1) "exploration of the initial situation," which identifies local stakeholders potentially interested in being involved in the process, existing farming systems, and specific constraints to the implementation of climate-smart agriculture (CSA); (2) "co-definition of an innovation platform," which defines the structure and the rules of functioning for a platform favoring the involvement of local stakeholders in the process; (3) "shared diagnosis," which defines the main challenges to be solved by the innovation platform; (4) "identification and ex ante assessment of new farming systems," which assess the potential performances of solutions prioritized by the members of the innovation platform under CSA pillars; (5) "experimentation," which tests the prioritized solutions on-farm; (6) "assessment of the co-design process of climate-smart farming systems," which validates the ability of the process to reach its initial objectives, particularly in terms of new farming systems but also in terms of capacity building; and (7) "definition of strategies for scaling up/out," which addresses the scaling of the co-design process. For each phase, specific tools or methodologies are used: focus groups, social network analysis, theory of change, life-cycle assessment, and on-farm experiments. Each phase is illustrated with results obtained in Colombia or Honduras.

Dinesh D, Aggarwal P, Khatri-Chhetri A, Loboguerrero AM, Mungai C, Radeny M, Sebastian L, Zougmoré R. (2017). The rise in climate-smart agriculture strategies, policies, partnerships and investments across the globe. In: *Agriculture for Development*: Special issue on climate-smart agriculture (CSA) 30:4–9. LINK

Abstract: Since the term 'climate-smart agriculture' (CSA) was coined in 2010, a growth in strategies, policies, partnerships and investments in the area has been observed. Here we have summarised key CSA efforts globally and in South Asia, Southeast Asia, East Africa, West Africa, and Latin America. We have interpreted CSA in the broad sense, including efforts which may not mention CSA but implicitly contribute to CSA pillars. We note that many international and regional organisations, and countries, are implementing policies and programmes promoting and upscaling CSA. While the growth in strategies, policies, partnerships and investments is positive and creates a favourable enabling environment for CSA, these need to be complemented with targeted implementation on the ground, sustainable financing, institutional coordination and metrics to measure the efficacy of interventions.

Climate Change Mitigation in Agriculture

Arango J, Ruden A, Martinez-Baron D, Loboguerrero AM, Berndt A, Chacón M, Torres CF, Oyhantcabal W, Gomez CA, Ricci P, Ku-Vera J, Burkart S, Moorby J, Chirinda N. (2020). Ambition meets reality: Achieving GHG emission reduction targets in the livestock sector of Latin America. *Frontiers in Sustainable Food Systems* 4(65). LINK

Abstract: Livestock production is a very relevant source of income and agricultural greenhouse gas (GHG) emissions in Colombia, Brazil, Argentina, Costa Rica, Uruguay, Mexico, and Peru. Several management and technological options with enteric methane mitigation potential have been evaluated and their scaling is anticipated to contribute toward achieving GHG emission reduction targets in the framework of the Paris Agreement. Yet, widespread adoption of promising mitigation options remains limited, raising questions as to whether envisaged emission reduction targets are achievable. Using findings from local studies, we explore the mitigation potentials of technologies and management practices currently proposed to mitigate enteric methane emissions from cattle production systems in the higher emitting countries of Latin America. We then discuss barriers for adopting innovations that significantly reduce cattle-based enteric methane emissions and the major shifts in policy and practice

that are needed to raise national ambitions in the high emitting countries. Using the latest science and current thinking, we provide our perspective on an inclusive approach and re-imagine how the academic, research, business and public policy sectors can support and incentivize the changes needed to raise the level of ambition and achieve sustainable development goals (SDG), considering actions from the farm to the national scale.

Gender Equality and Social Inclusion

Agarwal, B. (2018). Gender equality, food security and the sustainable development goals. Current Opinion in Environmental Sustainability, 34, 26-32. LINK

Abstract: This paper examines the potential and limitations of SDG 5 (Gender Equality) in helping to achieve household food security. The potential lies in the attention it pays to women's access to land and natural resources, which can significantly enhance women's ability to produce and procure food. Its limitations lie in a lack of attention to the production constraints that women farmers face; its failure to recognise forests and fisheries as key sources of food; and its lack of clarity on which natural resources women need access to and why. Moreover, other goals which bear on food security as important providers of nutrition, such as SDG 15 as it relates to forests and SDG 14 as it relates to fish resources, make no mention of gender equality, nor does SDG 13 (Climate action) recognise the vulnerabilities of women farmers. A bold interpretation of SDG 5 and establishing synergies with other SDGs could provide ways forward. This includes not only SDGs which recognise the importance of gender equality, such as SDGs 1, 2, and 13 on poverty, hunger, and climate change respectively, but also SDGs 14 and 15 whose silence on gender could prove detrimental not just to attaining food security, but also to furthering their stated objectives of resource conservation.

Assan, E., Suvedi, M., Schmitt Olabisi, L., & Bansah, K. J. (2020). Climate change perceptions and challenges to adaptation among smallholder farmers in semi-arid Ghana: A gender analysis. Journal of Arid Environments, 182, 104247. LINK

Abstract: Gender-sensitive climate change adaptation strategies can improve gender equality and women's development in agrarian communities. This study used both qualitative and quantitative research methods (focus group discussions, key informant interviews, and household surveys) to explore the perspectives of men and women on climate change, including climate change impacts on their farming activities and household well-being, and challenges faced in mitigating climate change impacts. The empirical data showed similarities in climate change perceptions between men and women, and rising temperatures, shortened cropping season, and increasing erratic rainfall as the main climatic stressors. Lack of money and inadequate access to labor among women and inadequate access to extension and old age/poor health among men were the major constraints to mitigating climate change impacts. Integrating gender needs in climate change adaptation planning and intervention development can help build resilient farm households.

Cole, S.M., Kantor, P., Sarapura, S., Rajaratnam, S. (2014). Gender-transformative approaches to address inequalities in food, nutrition and economic outcomes in aquatic agricultural systems (Working Paper: AAS-2014-42).

Executive Summary: Over the past few decades, scholars and practitioners working on gender and development issues have advocated for more in-depth analyses that explore and foster change in the social institutions that create and perpetuate gender inequalities. Gender integration approaches in a research and development context are thus not something new. However, mainstream agricultural research and development programs often apply a rather simple understanding of gender to the design of such approaches, resulting in poor implementation. The CGIAR Research Program on Aquatic

Agricultural Systems uses gender-transformative approaches to help achieve the goal of enhancing development outcomes of resource-poor women and men and their families in a sustainable manner. This paper details the approaches the program utilizes and is beginning to implement in its five learning hubs, which are located in areas where dependence on aquatic agricultural systems is high. The paper provides guidance on how other programs could prepare themselves to design and operationalize gender-transformative approaches and highlights some early learning on their application.

Glemarec, Y. (2017). Addressing the gender differentiated investment risks to climate-smart agriculture. AIMS Agriculture and Food, 2(1), 56–74. LINK

Abstract: This paper argues that closing the gender gap in land and other productive resources can provide a "triple dividend" of gender equality, food security and climate management, thereby offering a cost-effective approach to the pursuit of the Sustainable Development Goals. However, climate change compounds the structural barriers to gender equality that women farmers face, rapidly shrinking the window of opportunity to realize this triple dividend. Yet climate policies largely overlook the gender gap in agriculture. The growing literature on the gender gap aims to better quantify its implications for agricultural productivity but does not provide a framework to prioritize policy responses. To complement these econometric efforts, this paper proposes a three-step methodology to assist policy-makers in developing countries in disentangling the opportunities and trade-offs of different policies and interventions to close the gender gap that impedes climate-smart agriculture (CSA) for women.Barrier and risk analyses are increasingly used to identify public instruments that can catalyze climate smart investments. Building on this proven methodology, the paper first develops a table that clusters barriers to CSA into nine independent risk categories. Second, it overlays a gender analysis upon this gender-neutral barrier and risk table to identify gender-differentiated risks and barriers to CSA. Third, it maps identified gender-neutral and differentiated investment risks against possible remedial public policy instruments. The analysis suggests that about half of identified CSA investment risks have a higher probability of occurrence for women farmers than for men farmers. Furthermore, women farmers might face additional gender-specific barriers, mostly linked to their disproportionate responsibility for unpaid domestic and care work, the risk of violence and unequal power relations with men in the household and community. Targeted interventions will be required to address these gender differentiated investment risks and ensure that CSA market transformation efforts benefit men and women farmers equally.

Huyer, S., & Partey, S. (2020). Weathering the storm or storming the norms? Moving gender equality forward in climate-resilient agriculture. Climatic Change, 158(1), 1–12. LINK

Abstract: The articles in this issue grapple with how climate-resilient approaches including climate-smart agriculture (CSA) can more effectively promote gender equality and women's empowerment. How can CSA be implemented in ways that improve the situation and empowerment of women as well as men. CSA has the potential to provide a range of benefits for women in adapting to climate change, if they are able to take advantage of them (Jost et al. 2016), and in fact, research presented in this issue and elsewhere indicate that CSA can be a supporting condition for empowerment (see Farnworth et al. 2017; Hariharan et al. in this issue; Mittal 2016). This issue attempts to begin to answer the questions of what are the key issues, gaps, and constraints relating to gender equality in CSA? How can women be empowered to use CSA to improve the food security and resilience of their households and communities? At the same time, it is understood that gender equality may be a process rather than an immediate result (Gutierrez et al. in this issue).

Huyer, S., Gumucio, T., Tavenner, K., Acosta, M., Chanana, N., Khatri-Chhetri, A., Mungai, C., Ouedraogo, M., Otieno, G., Radeny, M., Recha, J., & Simelton, E. (2021). From vulnerability to agency: gender equality in climate adaptation and mitigation. In R. Pyburn & A. van Eerdewijk (Eds.),

Advancing gender equality through agricultural and environmental research: past, present and future. IFPRI. LINK

Abstract: Rising temperatures and more extreme weather associated with climate change are expected to exacerbate existing social and gender inequalities across the globe (Adger et al. 2014 , Dankelman 2010). The Intergovernmental Panel on Climate Change (IPCC) projects that the production of major crops such as wheat, rice, and maize will be affected across all regions and that climate change will progressively increase variability in crop yields. All aspects of food security are affected, including food access, utilization, and price stability. In rural areas, major impacts are expected on water availability and supply, food security, and agricultural incomes, with shifts in production of both food and non-food crops as growing zones change as a result of weather variability (Adger et al. 2014, Girvetz et al. 2017). Climate-influenced migration is seen to be an intensifying factor in the feminization of agriculture in some regions, particularly South Asia and Central America, where out-migration for employment is predominantly male. Women left behind are required to manage farms and households with fewer resources and less family labor, further increasing their vulnerability (Gumucio et al. 2019a, Khatri-Chhetri et al. 2020).

Jost, C., Kyazze, F., Naab, J., Neelormi, S., Kinyangi, J., Zougmore, R., Aggarwal, P., Bhatta, G., Chaudhury, M., Tapio-Bistrom, M.-L., Nelson, S., & Kristjanson, P. (2016). Understanding gender dimensions of agriculture and climate change in smallholder farming communities. Climate and Development, 8(2), 1–12. LINK

Abstract: In Uganda, Ghana and Bangladesh, participatory tools were used for a socio-economic and gender analysis of three topics: climate-smart agriculture (CSA), climate analogue approaches, and climate and weather forecasting. Policy and programme-relevant results were obtained. Smallholders are changing agricultural practices due to observations of climatic and environmental change. Women appear to be less adaptive because of financial or resource constraints, because of male domination in receiving information and extension services and because available adaptation strategies tend to create higher labour loads for women. The climate analogue approach (identifying places resembling your future climate so as to identify potential adaptations) is a promising tool for increasing farmer-to-farmer learning, where a high degree of climatic variability means that analogue villages that have successfully adopted new CSA practices exist nearby. Institutional issues related to forecast production limit their credibility and salience, particularly in terms of women's ability to access and understand them. The participatory tools used in this study provided some insights into women's adaptive capacity in the villages studied, but not to the depth necessary to address women's specific vulnerabilities in CSA programmes. Further research is necessary to move the discourse related to gender and climate change beyond the conceptualization of women as a homogenously vulnerable group in CSA programmes.

Kabeer, N. (2008). Paid work, women's empowerment and gender justice: critical pathways of social change. LINK

Abstract: This paper explores the contradictions and contestations that characterise debates about the relationship between paid work and women's empowerment. It suggests that this absence of consensus appears to reflect differences of context. It reflects other factors as well. It reflects changes in the social meaning of work over time. It reflects differences in the way that empowerment is conceptualised: the emphasis given to the personal and the political, to individual and collective action, and to agency versus structure in processes of change. Finally, contestations reflect the nature of the work in question, since varying terms and conditions of work hold out varying potentials for transformative change in women's lives. Evidence suggests that shifts in the balance of power within individual women's lives do not necessarily translate into shifts in underlying structures of constraint. The paper suggests that it is the

capacity of women to organise around their needs, interests and rights that is most likely to result in public recognition of their rights as workers, as women and as citizens.

Moser, C. O. N. (2017). Gender transformation in a new global urban agenda: challenges for Habitat III and beyond. Environment and Urbanization, 29(1), 221–236. LINK

Abstract: The 2016 Habitat III conference in Quito provides a challenging opportunity to address widespread, persistent urban gender inequalities through the elaboration of a New Urban Agenda (NUA). To achieve the identified radical paradigm shift calls for critical reflection and clarification of the meaning of gender transformation as against gender mainstreaming, and the elaboration of a conceptual and operational framework that identifies urban pathways not only to empower individual women but also to collectively transform fundamental gender power relations. This paper describes the gender asset accumulation framework as one such approach, and identifies the existing evidence base on urban transformative gendered interventions in land tenure and housing, safety in public spaces, and informal economy activities. In assessing gender-related contributions to the Habitat III process, it highlights a conjuncture in the identification of the same three gender-transformative interventions in the Transformative Commitments section of the Zero Draft NUA. However, these have been diluted in the Revised Zero Draft, which does not create optimism for the final NUA. The paper concludes by suggesting that a potential strategy for the global urban gender networks and multiple voices of civil society and grassroots groups is to reach a consensus on a priority agenda, and post-Quito to collectively contest and negotiate its implementation.

Nellemann, C., Verma, R., & Hislop, Lawrence, Eds. (2012). Women At the Frontline of Climate Change : Gender Risks and Hopes. UNEP/GRID-Arendal. LINK

Abstract: Women are often in the frontline in respect to the impacts of a changing climate. Globally the world is seeing increasingly frequent droughts and floods which are having economic but also profound social consequences. The women and people of Asia are currently at greatest risk with over 100 million people affected in this region annually. Adaptation, vulnerability and resilience of people to climate change depend upon a range of conditions. These vary from their degree of exposure and dependency upon weather patterns for livelihoods and food security, to varying capacities in adaptation, which are influenced by gender, social status, economic poverty, power, access, and control and ownership over resources in the household, community and society. Mountain peoples are especially vulnerable since climate impacts and changes are predominantly acute in mountainous regions. This is particularly true in the Andes, Africa and Asia.

Paris T, Rola-Rubzen MF (Eds.). (2018). Gender dimension of climate change research in agriculture (Case studies in Southeast Asia). Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). LINK

Abstract: This book presents the gender dimensions of the relationship between agriculture and climate change. It explores whether men and women farmers experience similar or different vulnerabilities and coping mechanisms or adaptation measures in response to climate change risks. It identifies gender gaps in access to resources, information, services, technologies, training, finance, etc., which enable or constrain men and women to adopt CSA and practices, as well as presents examples of Participatory Vulnerability Analysis and participatory action research, which incorporate a gender dimension.

Tavenner, K., Crane, T. A., & Saxena, T. (2020). "Breaking Even" under Intensification? Gendered Trade-Offs for Women Milk Marketers in Kenya. Rural Sociology, 0(November), 1–29. LINK

Abstract: Despite the commonly vaunted "win-win" prospect of combining intensified livestock production with greater gender equality, the benefits of formal marketization of livestock products are

generally skewed toward men. In response to this global trend, there is a growing impetus to better understand the gender dynamics underlying women's market participation to curtail the risk of worsening gender inequalities in agricultural systems transitioning to intensified production. This study analyzes the spectrum of women's informal milk market practices in two Kenyan Counties undergoing dairy system intensification. Qualitative data were gathered from dairy stakeholders and market traders to explore the localized system of gender relations mediating women's engagement with milk markets and current practices. Results indicate that increased dairy intensification and informal market use is challenging existing gender norms and disrupting the boundaries between hegemonic (socially acceptable) and pariah (socially disruptive) gender relations. While women are generally better able to control the proceeds from their dairy labor in informal markets, they also face high social culpability and danger from engaging in illicit activities that transgress local norms. These contradictory "win-lose" dynamics and trade-offs highlight the contested nature of gender market relations under agricultural intensification and commercialization currently being pursued under low emissions dairy development (LEDD) in Kenya. The risk of exacerbating existing gender inequalities has profound implications for LEDD and agricultural intensification more broadly.

Supporting Conditions and Related Systems

Arango-Aramburo S, Veysey J, Martínez-Jaramillo JE, Diez-Echavarría L, Calderón S, Loboguerrero A. (2020). Assessing the impacts of nationally appropriate mitigation actions through energy system simulation: a Colombian case. *Energy Efficiency* 13:17–32. LINK

Abstract: All countries, including developing ones, have set climate change and energy security as clear target goals. They have developed programs and policies to reach their energy security, emission reduction, and environmental mitigation goals. Colombia has notably developed programs to promote renewable energies and efficiency. However, there is still a need to quantify the impact that these policies could have in the future. The aim of this paper is to quantify the emissions prevented by the implementation of two proposed Nationally Appropriate Mitigation Actions (NAMAs), for which we built Colombia's energy system model in order to understand its effects on GHG emissions. The first NAMA replaces old refrigerators that continue using CFC compounds with efficient refrigerators that use HCFC compounds. The second NAMA seeks to secure new energy supplies through renewable sources for areas not connected to the grid. We also created a scenario that integrates both NAMAs to understand their combined effects on GHG emissions. The simulation shows that both NAMAs will allow to prevent the emission of 4.71 million tons of CO2 equivalent by 2040, and that the faster they are implemented, the more GHG emissions will be avoided. The model is a framework available for further research in climate change mitigation and energy efficiency policies.

Thornton P, Dinesh D, Cramer L, Loboguerrero AM, Campbell B. (2018). Agriculture in a changing climate: Keeping our cool in the face of the hothouse. *Outlook on Agriculture* 47(4):283–290. LINK

Abstract: The challenges facing agriculture in the coming decades are daunting. Recent research suggests that the impacts of climate change on agriculture and food systems may be wider-ranging than previously understood. Can feasible pathways to a food secure and sustainable future be identified? The scale of change required to meet the sustainable development goals, including those of no poverty, zero hunger and the urgent action needed to address climate change, will necessitate the transformation of local and global food systems. We identify eight elements of a theory of change to drive such transformation and highlight four pathways by which transformation may occur. We conclude with some suggestions for 'business unusual' for agricultural research for development.

Chirinda N, Arenas L, Katto M, Loaiza S, Correa F, Isthitani M, Loboguerrero AM, Martinez-Baron D, Graterol E, Jaramillo S, Torres CF, Arango M, Guzman M, Avila I, Hube S, Kurtz DB, Zorrilla G, Terra J,

Irisarri P, Tarlera S, LaHue G, Scivittaro WB, Noguera A, Bayer C. (2018). Sustainable and low greenhouse gas emitting rice production in Latin America and the Caribbean: A review on the transition from ideality to reality. *Sustainability* 10(3):671. LINK

Abstract: The burgeoning demand for rice in Latin America and Caribbean (LAC) exceeds supply, resulting in a rice deficit. To overcome this challenge, rice production should be increased, albeit sustainably. However, since rice production is associated with increases in the atmospheric concentration of two greenhouse gases (GHGs), namely methane (CH4) and nitrous oxide (N2O), the challenge is on ensuring that production increases are not associated with an increase in GHG emissions and thus do not cause an increase in GHG emission intensities. Based on current understanding of drivers of CH4 and N2O production, we provide here insights on the potential climate change mitigation benefits of management and technological options (i.e., seeding, tillage, irrigation, residue management) pursued in the LAC region. Studies conducted in the LAC region show intermittent irrigation or alternate wetting and drying of rice fields to reduce CH4 emissions by 25–70% without increasing N2O emissions. Results on yield changes associated with intermittent irrigation remain inconclusive. Compared to conventional tillage, no-tillage and anticipated tillage (i.e., fall tillage) cause a 21% and 25% reduction in CH4 emissions, respectively. From existing literature, it was unambiguous that the mitigation potential of most management strategies pursued in the LAC region need to be quantified while acknowledging country-specific conditions. While breeding high yielding and low emitting rice varieties may represent the most promising and possibly sustainable approach for achieving GHG emission reductions without demanding major changes in on-farm management practices, this is rather idealistic. We contend that a more realistic approach for realizing low GHG emitting rice production systems is to focus on increasing rice yields, for obvious food security reasons, which, while not reducing absolute emissions, should translate to a reduction in GHG emission intensities. Moreover, there is need to explore creative ways of incentivizing the adoption of promising combinations of management and technological options.

IPCC. (2014). Human Security. In and L. L. W. Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea (Ed.), Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A: Global and Sectoral Aspects, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. LINK

Preface: The Working Group II contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCCWGII AR5) considers climate change impacts, adaptation, and vulnerability. It provides a comprehensive, up-to-date picture of the current state of knowledge and level of certainty, based on the available scientific, technical, and socio-economic literature. As with all IPCC products, the report is the result of an assessment process designed to highlight both big-picture messages and key details, to integrate knowledge from diverse disciplines, to evaluate the strength of evidence underlying findings, and to identify topics where understanding is incomplete. The focus of the assessment is providing information to support good decisions by stakeholders at all levels. The assessment is a unique source of background for decision support, while scrupulously avoiding advocacy for particular policy options.

ANNEX 5: PUBLIC COMMENT AND MATERIALS PROVIDED TO THE BOARD

No.	First Name	Last Name	Organization	Date
1	Sophie	Javers	University of California Davis	8/25/22

Submitted Email:

"I'm reaching our on behalf of the FtF Innovation Lab for Markets, Risk and Resilience to express our interest in being involved in with this sub-committee and would like to be able to share our policy-relevant findings. Please let me know how we might best get involved."

Submitted Email:

"I'd like to pass along a document to you both that my colleague Alex Russell has put together specifically to be shared with the BIFAD Climate Change sub-committee. This document includes MRR Innovation Lab recommendations and resources based on our extensive research in this area. Please take a look and let me know if you have any questions or other follow up actions for us to take."

Attached Letter:
"**Recommendations to the BIFAD Climate Change Sub-committee**

> "The effects of climate change are not equal – they disproportionately impact the poorest and most marginalized communities we work to support every day."
>
> "We will work on the ground with partner governments and local actors to set the global trajectory toward our vision of a resilient, prosperous, and equitable world with net-zero greenhouse gas emissions."
>
> —USAID Climate Change Strategy 2022-2030

These two quotes are most directly relevant to the work of the Feed the Future Innovation Lab for Markets, Risk & Resilience (MRR). The MRR research program develops innovations and conducts randomized evaluations to build and rigorously test solutions to some of the greatest challenges of rural development. Our research is led by top agricultural and development economists from leading universities in the United States and host countries around the world.

Our work builds on a research program that reaches back nearly thirty years and has built a nuanced and thorough understanding of the challenges facing rural households as well as innovations that create new opportunities. The evidence base we have generated is particularly strong in the areas of agricultural risk and index insurance, poverty dynamics and resilience, technology adoption, market access, cooperative action and the broad field of behavioral economics.

Our base of evidence is most applicable to three of the Intermediate Results of the USAID Climate Strategy 2022-2030:

- IR 1.2 Build Resilience: Strengthen resilience of populations vulnerable to climate impacts
- IR 2.1 Transform Key Systems: Advance transformation of key systems and essential services to reduce emissions and enhance climate resilience

- IR 2.2: Shift Market Signals: Support a transition to climate-resilient, net-zero economies and financial systems

In addition, our evidence-based recommendations are consistent with all of the strategy's Embedded Principles:

- Locally Led Development
- Equity and Inclusion
- Private-Sector Engagement
- Nature-Based Solutions
- Evidence and Innovation

Summary of Recommendations

1. *Strengthen rural households financially to increase their resilience in advance of a weather-related or other shock.* [IR 1]
2. *Target a share of shock-responsive social protection to vulnerable households to reduce long-term need for humanitarian aid.* [IR 1.2, 2.1, 2.2]
3. *Target subsidies for climate-resilient agricultural inputs and practices proven to benefit small-scale producers to create learning opportunities.* [IR 1.2, 2.1, 2.2]
4. *Improve the quality and reliability of all forms of index-based insurance meant to safeguard small-scale agricultural households.* [IR 1.2, 2.1, 2.2]
5. *Prioritize tools to manage climate-related risk in contexts where risk is a primary cause of underinvestment in agricultural productivity.* [IR 1.2, 2.2]

Statement of Focus

In 2022, the IPCC estimated that approximately 3.3 to 3.6 billion people live in contexts that are highly vulnerable to climate change. Global hotspots of high human vulnerability are found particularly in West-, Central- and East Africa, South Asia, Central and South America, Small Island Developing States and the Arctic. Between 2010–2020, human mortality from floods, droughts and storms was 15 times higher in highly vulnerable regions, compared to regions with very low vulnerability.

Right now, countries across the Sahel and the Horn of Africa are in the midst of one of the most extreme drought emergencies in the past hundred years. At the same time, warmer oceans are generating more severe storms, such as the cyclones that have battered developing countries in South Asia and East Africa. Some countries have the compounded risk of both drought and devastating storms.

The countries most deeply affected by these kinds of climate-related shocks have some of the largest shares of their population working in agriculture. Some of these households are small-scale farming families while others make their living as pastoralists and rely on livestock. Others contribute to agriculture as laborers. In every case, agriculture-based livelihoods are especially vulnerable to the effects of climate change.

When catastrophic weather shocks occur, poor and vulnerable households have few options for coping with less. Some sell their productive assets, such as livestock or equipment, to maintain their consumption, but at the expense of future productivity. Others cut meals and other types of consumption, which compromises adults' ability to work or the long-term physical and cognitive

development of their children. Both coping strategies can create feedback loops that lead to poverty that lasts for generations.

Research has also shown that shocks have long-term negative consequences, particularly for children who are especially vulnerable. For example, undernutrition during a child's first four years of life can have irreversible damage on physical and cognitive development. For children in poor households, this means a drought can lead to stunting and no money for schooling that would otherwise provide a pathway out of poverty. This cycle of vulnerability and a resulting high likelihood of extreme poverty may be amplified by an increasing frequency of shocks predicted to result from increasing warming of the Earth.

As the negative effects of climate change continue to increase in frequency and severity, the financial burden of international humanitarian responses and the lasting harm to individuals and families will only increase. Rural households who are in a strong financial position and who also have the means to maintain that position in the event of a shock are less likely to need direct humanitarian assistance during a crisis.

Research has shown that the predictability of insurance can generate additional benefits beyond payments in the event of a disaster. When farmers know that they will be compensated in the event of catastrophic losses, they tend to increase investments in more productive inputs that lead to higher incomes. The combined benefits of resilience to shocks and increased investments in productivity are what the MRR Innovation Lab has called "Resilience+."

Resilience+ exists as an opportunity because of barriers to investments created by the presence of risk. Beyond risk, there may be other barriers, systemic or caused by an individual's unique circumstances, that need to be addressed in order to strengthen livelihoods and resilience.

However, increasing climate change increases the risk of disasters, both for rural households who already face climate-related risk and for households whose risk might have been low. The increase in climate-related risk increases the need for programming and interventions designed to generate Resilience+ because risk imposes barriers to agricultural investments that can improve people's lives.

Right now, there are more tested ways than ever to mount a proactive evidence-based effort to create and expand opportunities for rural households in developing countries to be resilient to an increasing risk of shocks and even to improve their agricultural livelihoods. Taken from over a decade of research supported by USAID and led from universities and international research institutions, we have field-tested evidence that can be used to address many of the goals in the *USAID 2022-2030 Climate Strategy*.

These are our five key recommendations.

Strengthen rural households financially to increase their resilience in advance of a weather-related or other shock. **[IR 1]**

Effective development programming in itself can increase a rural household's resilience to shocks by raising their income and assets. Financially and socially disadvantaged households are disproportionately vulnerable to the effects of climate change. A 2017 UN working paper described how climate change increases inequality by increasing the exposure of disadvantaged groups, increasing their susceptibility to damage and decreasing their ability to cope and recover.

Effective development programming that increases rural households' financial wellbeing can play a powerful role in increasing resilience to shocks caused by climate change. Two recent studies have shown that livelihood-building programs, also called poverty graduation programs, can provide rural

households a means of establishing or increasing a regular, independent income. Households that are in a stronger financial position before a shock are more able to rely on their own resources during a crisis.

In Nepal, the COVID-19 pandemic caused financial shocks during national lockdowns that closed markets, making it difficult to buy or sell food. A MRR Innovation Lab research team recently completed a project that tested whether women who took part in a livelihood-building program were more resilient than their neighbors during the pandemic.

Women who took part in the livelihood-building program borrowed substantially less than non-participants and were 9 percentage points less likely to use a loan to cope during the lockdown period. Participants were also twice as likely to sell livestock during lockdown to cope compared to non-participants. Relying less on loans can make it possible for households to more quickly recover from a financial shock that threatens their daily meals.

An ongoing MRR Innovation Lab study is testing a livelihood-building program for women in northern Kenya pastoralist communities paired with index-based livestock insurance. An analysis of midline data collected in 2020, before the COVID-19 pandemic and when the first cohort of women completed the full two-year program, showed significant improvements in financial wellbeing.

The benefits of this programming, not including the effect of the insurance, generated a reserve of funds for women to support their families during the combined shocks of both the COVID-19 pandemic and what would become a currently ongoing multi-season drought. By 2020, women who completed the program had, on average, 324% more in business assets, 32% more in total annual household cash income and 509% more in cash savings than non-participants in communities where no programming took place.

However, there are limitations with both programs, the first of which is that their financial benefits decline as the duration of the shock increases. This limitation is most visible in northern Kenya, where women who had tremendous financial gains have been drawing down their assets and even their businesses in order to cope with the compound shocks of covid-related market shutdowns and a prolonged drought.

The insights from these two field trails suggest that programming to strengthen a household's financial position meets only part of the challenge of an increasing risk of severe shocks caused by climate change. Only a contingent type of support that unlocks needed funds in the event of a shock will reduce a household's need to eat into the new financial reserves built with development programming before those reserves and the gains they represent are completely depleted.

Target a share of shock-responsive social protection to vulnerable households to reduce long-term need for humanitarian aid. **[IR 1.2, 2.1, 2.2]**

The goal of any limited social protection budget is to do the greatest amount of good for the most people possible. For social protection designed to respond to climate-related disasters, there are tradeoffs when deciding which households to provide support. These decisions have implications for the total number of households in poverty who will always require emergency assistance during the next crisis. However, targeting social protection to vulnerable household as well as those already in poverty can reduce the long-term number of households in dire need.

A recent study built advanced economic model of these dynamics with data from pastoralists in Kenya to explore the potential impact of three main types of government-based social protection. First of these was an in-kind transfer, such as food aid and school stipends, which protects human capital whether or not there are income shocks but does not increase household assets. Second was a

contingent transfer that targets households in the event of a catastrophic shock, such as a program that replaces livestock lost to drought. The third was insurance.

The economic model was based on dynamics and data from pastoralists in Kenya. In the model, a household begins with initial levels of productive assets and human capabilities that they manage the best they can over time, seeking optimal levels of consumption, saving and investment for the greatest wellbeing across multiple generations. The model also incorporated a feedback loop to capture how coping decisions, such as reducing meals or selling assets, impact households across generations

With these dynamics, insurance is a unique form of social protection in that it requires payment in advance for individual coverage, but payouts for covered losses are predictable. Research has shown that when farmers know that they will be compensated in the event of catastrophic losses, they tend to increase investments in more productive inputs that lead to higher incomes. This added benefit builds resilience among households who are most at risk of climate-related catastrophes.

The model showed that regular in-kind transfers targeted perfectly to the poorest households will eliminate all of their short-term shortfalls in consumption. However, with only this kind of transfer the extent and depth of poverty within the total population increase over time because the next catastrophic shock adds to the number of households in poverty.

A contingent transfer program targeted to vulnerable households does a better job of slowing the overall growth in the total number of poor households. Across four generations in the simulation, the total number of poor declined by about one fourth. However, because these payments increase with the severity of the shock, in years with the highest losses the smallest share of the social protection budget is dedicated to the poorest households.

Insurance is one way to bridge these tradeoffs between support for poor households on the one hand and vulnerable households on the other. Insurance payments are more predictable than emergency aid, which is subject to government budgets and the ability to get funds to those in need. Also, if vulnerable households pay at least a share of the premium payments, insurance also has the potential to be self-sustaining, reducing the burden on public budgets and increasing the total funds available to support the poorest households.

The research team stress-tested these three types of social protection with current pessimistic projections about increasing drought risk and found that only insurance-based social protection targeted to vulnerable households improved in its effectiveness. However, if drought risk increases beyond current climate change projections, then even insurance loses its ability to stabilize the extent and depth of poverty.

Right now, agricultural index insurance is widely available in most developing countries facing significant climate risk. One of the most advanced among these is Kenya, where the national government began purchasing Index-Based Livestock Insurance (IBLI) for pastoralist households in selected communities in its northern counties in 2015 through the Kenya Livestock Insurance Programme (KLIP). KLIP benefits from research investments since 2009 by USAID and the International Livestock Research Institute (ILRI) to create and establishing the IBLI product. The African Risk Capacity offers disaster risk insurance policies as sovereign insurance.

Target subsidies for climate-resilient agricultural inputs and practices proven to benefit small-scale producers to create learning opportunities. **[IR 1.2, 2.1, 2.2]**

Subsidies for unfamiliar productive agricultural inputs and practices can transform yields. This is true for conventional inputs, such as improved seeds and chemical fertilizers, and may also be true for climate-smart agricultural practices that make farming more sustainable. However, subsidies can also become a permanent cost for incentivizing decisions that do not improve farmers' livelihoods.

Subsidies can overcome some of the constraints that keep farmers from adopting an unfamiliar but potentially more productive input or practice. One of these is a liquidity barrier as in the case of a farmer who wants to purchase improved seed varieties but not have the available cash. A subsidy can also overcome an information constraint. A good example is chemical fertilizer, which is not guaranteed to address the unique nutrient limitations of an individual farmer's soil.

There are other technologies and practices that do not provide immediate or consistent returns, which can complicate effective subsidy policy. Resilience-building technologies often produce their only or strongest benefits in seasons with the greatest shocks. Index insurance is one example, as it is designed to release payments only infrequently but when the money is most needed.

If the main constraint to adopting a climate-smart input or practice is a lack of information or experience with it, research shows that a temporary learning subsidy can have profound benefits that reach both the individual who receives the subsidy as well as their neighbors who do not. A temporary subsidy clears the way for farmers to find out on their own whether permanently adopting the input or practice will benefit them.

A recent experiment, conducted in partnership with the Government of Mozambique and the International Fertilizer Development Center, tested a single-season subsidy for a package of improved maize seeds and inorganic fertilizer. During the subsidy year, farmers increased their fertilizer use by 33 kg/hectare and had 58 percent higher maize yields. These increases sustained for the two following seasons, with fertilizer at full price.

The program also had a surprising impact on nearby farmers who did not receive the subsides. During the subsidy year these farmers had no improvements in adoption or yields. However, in the two following seasons they substantially increased their use of fertilizer and had significant increases in both maize yields and overall agricultural production.

The temporary subsidy overcame a lack of information among whole communities of farmers who had limited experience with improved inputs. The yield increases were well worth the cost of the temporary subsidy. Every $1 spent on the subsidy returned $20 in benefits, the majority driven by farmers who did not receive a subsidy.

In an experiment in Malawi, learning from neighbors was the strongest driver of whether farmers adopted conservation agriculture practices in the Shire River watershed that is responsible for the nation's hydropower. Farms along the Shire River are subject to erosion, which sends silt downriver to block up the dam's generators. In that context, conservation agriculture could benefit both farmers as well as the nation's main source of electricity.

In that experiment, farmers received subsidies in exchange for adopting conservation agriculture practices on up to one acre with a bonus payment if those practices were adopted by their neighbors. The subsidy offset the costs of shifting their farming practices while reducing the financial risk of uncertainty over the outcomes. The bonus payments encouraged the network effects of unsubsidized neighbors learning about the unfamiliar practices at no cost to them.

By the end of the study, adoption rates for all conservation agriculture practices increased significantly. Drawing on machine learning tools, the team found that the most important factor that shaped the decision to adopt any of the three practices was whether neighbors had adopted them.

The importance of neighbors transcended both the availability and structure of a financial incentive. Farmers who observed the practices providing benefits to neighbors were more likely to adopt those practices themselves.

Many resilience-building technologies are different than common inputs and practices in that they do not provide benefits in every year. Stress-tolerant seeds have a yield advantage during a moderate drought but may have no advantage in normal years or during severe drought. Index insurance has benefits in a severe drought but in normal years a farmer pays premiums to receive no benefit at all. For these technologies, temporary subsidies and social networks on their own may not be enough.

Two recent large-scale field trials measured adoption rates for two of such technologies. One examined flood-tolerant rice in India, where flooding takes place one out of every five years. The other examined drought-tolerant maize in Mozambique and Tanzania, where mid-season drought happens roughly four out of every ten years.

In both studies, the experience of the named peril—either flood or drought—had the biggest impact on whether farmers sustained their adoption of the technology in the following year. In fact, farmers who experienced these perils later expanded their adoption and had even higher yields, while farmers who did not experience the peril reduced their adoption. In both cases, the varieties produced higher yields than local varieties even in normal years.

The same appears to be true with insurance, though experiencing first-hand how insurance works with payouts may not lead to permanent adoption. Index insurance is fundamentally different than an input like chemical fertilizers in that it provides no benefits in most years and is an unfamiliar technology that is much harder to understand.

A field study in China combined a subsidy with a learning intervention to improve financial literacy. The financial literacy training and the experience of receiving an insurance payout were both necessary to spark permanent insurance take-up. With the training, farmers learned how insurance works. The payouts reinforced that learning with their own experience and seeing neighbors also receive payouts. The subsidy was less important for permanent adoption. In fact, farmers who paid part of the cost of the insurance were more likely to purchase it in the second year.

A critical first step to promoting lasting adopting for resilience-building technologies is to build-in ways to maximize farmers' experience and learning. For productive inputs, farmer field days or other community events can reinforce individual experiential learning with a deeper understanding of how the technology works. Index insurance may require financial literacy or other training that gets reinforced by the experience of receiving a payout for losses.

Improve the quality and reliability of all forms of index-based insurance meant to safeguard small-scale agricultural households. **[IR 1.2, 2.1, 2.2]**

As the effects of climate change become more frequent and extreme, index-based insurance can be an important part of a broader set of strategies to support rural households in developing countries. Index-based insurance encompasses microinsurance designed as individual policies for sale to rural households, meso-level insurance designed for finance institutions and even major agricultural commodity buyers, as well as disaster risk insurance available to national governments.

Index-based insurance (also called agricultural index insurance and parametric insurance) releases payouts based on remotely sensed factors that predict agricultural losses. Some index insurance products base payouts on crop cuttings that estimate an area's average yields while others leverage

publicly available satellite data that reports vegetation growth in an area that predicts the productivity of rain-fed crops.

The evidence on the impacts of index insurance for individual households encompasses ex-ante impacts, meaning how the presence of insurance shifts agriculture-related decisions, and ex-post, meaning the impacts of insurance after a disaster. A handful of studies, mostly randomized controlled trails, have established that insurance leads to substantial increases in on-farm investment, usually in the range of 15-30% compared to uninsured, control households. The ex-post benefits include reduced reliance on meal reduction or asset sales as coping strategies and avoiding financial ruin after a shock.

In spite of these significant benefits, index insurance faces significant challenges. All forms of index insurance come with basis risk, which is the chance that the index used to predict loss events does not reflect actual conditions for those who are insured. High basis risk implies a high likelihood that the index does not release payouts in the event of an insured disaster. There are also implementation challenges for private-sector insurance businesses that don't have the funding to dedicate to a low-profit product that is expensive to market.

Disaster-risk insurance is a way for national governments to pre-finance support during crises, but until recently there has been no objective way to determine whether it is more effective than paying the costs as they arise. An MRR Innovation Lab research team developed tools to evaluate the case for disaster risk insurance and tested them with data from Kenya.

The analysis found that two factors most strongly determine whether disaster-risk insurance is the best use of funds. The first is the presence of accurate national-level data that makes it possible to build an accurate index. The second is the level of volatility in the costs of disaster response. For a country with disaster-related costs that are highly volatile, disaster-risk insurance smooths the national budget in years with high need, ensuring that any shortfalls do not impact long-term GDP by diverting funding from infrastructure investments that jumpstart or sustain economic growth.

The Minimum Quality Standard for Index Insurance (MQS), developed with support from USAID, established the world's only objective, reproducible measure of quality. An MQS analysis determines whether an existing or prospective contract at a minimum does not leave a purchaser worse off. MQS makes clear the cause of a product's failure, which could be caused by a low-quality index or geographic qualities that make it unlikely to build or market a high-quality index that accurately predicts losses.

Prioritize tools to manage climate-related risk in contexts where risk is a primary cause of underinvestment in agricultural productivity. **[IR 1.2, 2.2]**

In contexts where risk is the primary reason individual households are reluctant to make investments that increase their agricultural productivity, there may be an opportunity to strengthen resilience to shocks two ways by implementing effective risk-management tools alone. A growing body of research shows that reducing agricultural risk can unlock a willingness to make those investments if they are available.

The MRR Innovation Lab has called the combined ex-post and ex-ante effects of tools to manage risk "Resilience+." Field trials over the past decade have shown that it is possible to generate Resilience+ with development programming that effectively addresses risk for household who otherwise have the ability and means to make or increase their investments in agricultural productivity. Interventions include insurance, contingent lines of credit, stress-tolerant seed varieties, and even bundles of these interventions.

The type of programming needed to generate Resilience+ will depend on the risk that keep rural households from making investments that are likely to increase their productivity. The most tested of these is agricultural index insurance, which is a low-cost form of insurance that releases payouts in the event of remotely sensed and widely shared weather-related shocks. Field trials have shown that when farmers know they have index insurance coverage, they invest more in improved seeds and fertilizers.

Beyond index insurance, MRR Innovation Lab researchers have also tested other agronomic and financial tools that address risk. One of these was stress-tolerant seeds paired with index insurance for a seed-replacement guarantee in Mozambique and Tanzania. Another was an indexed loan that released funding in the event of flooding in Bangladesh. In both cases, these risk-mitigating instruments provided a measure of protection to keep households financially solvent after a disaster while also sparking increased investments in productivity.

The key opportunity for Resilience+ to contribute to the USAID Climate Strategy is that it leverages and strengthens existing markets to build systemic change that generates lasting resilience for vulnerable rural households. The types of programming that have shown evidence of having generated Resilience+ are private-sector driven and only require initial support to become self-sustaining."

2	Ibrahim	Oyemade	Beyond Profit Concept	8/29/22

Submitted Email:

"Further to the above event coming up on the 31st August, 2022, I hereby indicate interest to be one of the participates.

It is imperative for farm (African) owners to deploy recent innovative application in managing food loss emanating from infrastructural deficit and conventional practices in handling post harvest crisis, which has consistently led into food insecurity. Food sufficiency is highly possible if the various gaps within the food system is effectively overhauled.

Metal Organic Framework, High Pressure Carbon dioxide Pasteurization and Granular Droning are recent technologies and practices that have been proven to transcend beyond cold chain management in most cases of preservation techniques and shelf life management.

My recent speaking engagement in Nigeria on Food preservation brough this to fore, as I share with experts and attendees on World Food Safety Day, organized by Lagos State Safety Commission.

It will be of utmost interest for agriculturists, environmentalists, climate change actors and practitioners to deploying time proofing strategies on how to best apply this innovation in curbing food insecurity and climate change on the continent.

Look forward to hear from you."

3	Jean-Michel	Voisard	Chemonics International	8/31/22

Submitted Email:

"I was listening in on the BIFAD-185 webinar today and appreciated your concluding remarks on local market actors as the drivers of a scaled response. I am sharing with you a set of technical notes from a Feed the Future Senegal activities that emphasize actions that were scaled by local actors and often involved bundled solutions.

Note that the initial program ended in 2019 and the systems described has since expanded and diversified – with the leading local bank currently developing climate finance approaches to re-finance its growing small farmer and processor portfolio within its balance sheet.

Hope this will be useful"

Attached References:

- USAID. (2019). *Senegal Naatal Mbay Cereal Value Chains: Agricultural Insurance*. USAID.
- USAID. (2019). *Senegal Naatal Mbay Cereal Value Chains: Agricultural Leasing*. USAID.
- USAID. (2019). *Senegal Naatal Mbay Cereal Value Chains: Integrated Financing*. USAID.

4	Brenda	Oppert	USDA	9/1/22

Submitted Email:

"I really enjoyed the BIFAD public meeting yesterday, so many interesting people working on diverse projects. As a representative of our ARS Grand Challenges Synergies team, I wanted to provide more information on our project in the attached letter. We would be happy to provide more information.

Thank you for the opportunity"

Attached Letter:

"Thank you for the informative presentations and stimulating discussions during the Consultative

Workshop on Systemic Solutions for Climate Change Adaptation and Mitigation in Agriculture,

Nutrition, and Food Systems online today. I joined the Nutrition breakout group, and I thought it could

be helpful to follow the discussion with information about ARS research on the incorporation of insects

into sustainable food programs.

Insects offer many advantages over traditional livestock animals reared for protein, including:

- Insects provide an efficient source of protein and are widely consumed in many areas of the world
- Insects have a lower footprint (and can be raised vertically) with lower environmental impacts
- (can be reared in contained environments with near complete carbon capture)
- Insects require much lower water (<0.02%) and input feed than traditional livestock
- Insects can be incorporated into a circular economy to feed on food wastes and contaminated
- grain and developed as animal feed, recycling nutrients into food and feed
- Insects can be improved for downstream traits through genetics, similar to traditional livestock
- Insect food industries are rapidly expanding worldwide providing an alternate protein economy

I am part of a USDA Grand Challenges Synergy program entitled "Debugging a new mini livestock commodity: Developing a model of insect production to demonstrate their value as a safe solution for food waste and sustainable fish and livestock production," led by Kelsy Robinson, Research Biologist,

Poultry Research Unit, Starkville, MS, and Annie Donoghue, Ph.D., Research Leader, Poultry Production and Product Safety Research, Fayetteville, AR.

There are 42 scientists from across 11 ARS National Programs and 22 Research Units participating in various research projects under the umbrella of the Grand Challenges Synergy program that will enable the incorporation of insects into the US food chain, mostly via traditional livestock such as poultry and aquaculture. Some of these projects include:

- Development of insect production models based on using food waste
- Genetic research to improve insect nutrition for animal feed
- Food safety studies to identify and control potential pathogens in insects
- Optimization of insects to bioremediate grains contaminated with mycotoxins
- Understand diseases of farmed insects and develop therapeutics
- Harvesting insects found in agricultural landscapes (i.e., mosquitos and flies) for animal feed

We hope that the members of BIFAD will recognize the importance of insects as a solution to sustainable food. Our group would like to complement the work of USAID and assist in the development of targeted research to address immediate and long-term opportunities. Some of our members have enjoyed being part of USAID working groups related to insects as a protein resource (Insect Protein Working Group and FLWCoP).

Thank you for the opportunity to contribute to the mission of USAID."

5	Francesco Carnevale	Zampaolo	SRI-2030	1/2/22

Submitted Email:

"I am Francesco Carnevale Zampaolo, Program Director at SRI-2030. I contacted you on LinkedIn and shared the presentation on the Tetra Tech System of Rice Intensification (SRI) project in Nigeria (attached also here).

As agreed, I am attaching a selection of further information that can be included in the collection of evidence:

- A document we prepared at SRI-2030 that summarizes the benefits of adopting SRI methods with references
- Two one-pager documents presenting multinational SRI projects in SA Asia and Western Africa (I have and I can share more extensive documents on both of the projects if needed)
- A brief on SRI-2030 and SRI
- The brochure of an international conference we are organizing in Hyderabad this coming December.

If the infographic format is of help, I have multiple to share.

Further information can be found on our website SRI-2030 and on our partner's website SRI-RICE from Cornell University. **More than 2000 research papers on SRI** are compiled in the Zotero webpage.

I am available for any clarification and for any future queries on SRI-related issues. "

Attached References:

- Society for the Advancement of Rice Research. (2022). *International Conference on System of Crop Intensification (ICSCI 2022) for Climate-Smart Livelihood and Nutritional Security: First Circular* [Brochure]. Society for the Advancement of Rice Research.

- SRI-2030. (n.d.). *Benefits of the System of Rice Intensification (SRI) and associated practices*. SRI-2030.
- LINKS: Catalysing Economic Growth for Northern Nigeria. (Presentation, n.d.) *Climate Smart Agriculture*. Implemented by Tetra Tech International Development.
- SRI-2030. (n.d.). *SRI-2030: SRI Rice Methods Practiced on 50m Hectares by 2030*. SRI-2030.
- SRI-2030. (2017). *System of Rice Intensification: Path to Sustainable Rice Production*. SRI-LMB Celebrating World Environment Day.
- CORAF/WECARD, INSTITUT D'ECONOMIE RURALE, SRI-RICE. (2012 & 2013). *Improving and Scaling up the System of Rice Intensification in West Africa* [Poster presentation]. SRI-2030.
- Styger E, Traoré G. (2018). *50,000 Farmers in 13 Countries: Results from Scaling up the System of Rice Intensification in West Africa*; *Achievements and Regional Perspectives for SRI; SRI-WAAPP Project Summary Report, 2014-2016; West Africa Agriculture Productivity Program (WAAP).* The West and Central Africa Council for Agricultural Research and Development (CORAF/WECARD), Dakar, Senegal.
- SRI-2030. (n.d.). *Large-Scale Implementation of SRI*. SRI-2030.
- SRI-2030. (n.d.). *Improving and Scaling Up the System of Rice Intensification (SRI) in West Africa: Key Results of SRI-WAAPP Project's 1st Phase (2014-2016)*. SRI-2030.
- Sulaiman, R; Chuluunbaatar, D; Vishnu, S. (2018). *Upscaling Climate Smart Agriculture: Lessons for Extension and Advisory Services*. Occasional Papers on Innovation in Family Farming, Food and Agricultural Organization of the United Nations.

6	Jules	Siedenburg	University of East Anglia	9/6/22

Submitted Email:

"I attended and very much enjoyed last weeks BIFAD webinar. I was in the resilient markets' breakout room and was next in line to make a comment when the session ended. As such, I wanted to send my comment via email. Obviously BIFAD is looking to identify leverage points across agricultural, food and nutrition systems for transformative change. As it happens, my planned comments in the breakout group suggested a possible priority area for climate smart transformative change.

One of the presenters talked about a webinar on insects and how that raised intriguing opportunities. I wanted to note that there are other 'future foods' besides insects, such as seaweeds, microalgae, bacteria and fungi. As it happens, I just published a paper that explored how five agri-food applications of microalgae could boost both food supplies and agricultural livelihoods given climate change. One aspect of this is that microalgae production is potentially climate resilient, while another is that microalgal biomass can be used to boost the climate resilience of both crop and livestock production. Additionally, the agri-food applications of microalgae examined offer potential options to deliver climate mitigation.

Here is that link: https://www.frontiersin.org/articles/10.3389/fsufs.2022.976946/full

As it happens, I also published another paper recently that could perhaps be a useful case study. It was based on an empirical examination of 7 NGO projects in northern Kenya that were trialing different potential livelihood innovations. The paper drew out lessons from this body of empirical evidence, and highlighted several promising climate resilient livelihood pathways for pastoral communities facing climate change. Here is that link:

https://www.tandfonline.com/doi/full/10.1080/21665095.2021.196595 [link error]

Attached References:

- Siedenburg, J. (2022). *Could microalgae offer promising options for climate action via their agri-food applications?* Frontiers in Sustainable Food Systems. 6.976946, DOI: 10.3389/fsufs.2022.976946.
- Siedenburg, J. (2021). *Perils facing Kenyan pastoralists, livelihood innovations and wider impacts: learning from project experience.* Development Studies Research. 8:1, 218-235, DOI: 10.1080/21665095.2021.1961595.

7	Nkole	Mwamba	Savannah ZAMBIA	9/6/22

Submitted Email:

"Thankful for your office's quick response.

I am grateful for the message you sent. Savannah Zambia will wait to receive, materials, records and minutes of the BIFAD public meeting. I am humbled to hear that you even copied the BIFAD secretariat at USAID also to record your note in the public record.

The climate change is real. Our rural communities in Zambia are highly affected by this, highlighting the need for serous action with Savannah Zambia and the BIFAD secretariat at USAID. 80 percent of Zambia in rural areas will be affected with climate change by 2030. Most of the youth will suffer by the effects of climate change. This is a time to act together with Savannah Zambia. Savannah Zambia is committed and determined as a Youth, Young African Leaders and Women driven community based organization in 10 Provinces of Zambia.

With our Action plan of 10 years from 2022 to 2032, Savannah Zambia will make impact in communities of 10 provinces in Zambia. Always I will work with your office and the BIFAD secretariat at USAID to make impact in 10 Provinces of Zambia through community involvement.

Looking forward to your office and the BIFAD secretariat at USAID to work with Savannah Zambia."