TRANSFORMING FOOD SYSTEMS UNDER A CHANGING CLIMATE

The 5th Global Science Conference on

CLIMATE-SMART AGRICULTURE 2019

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ABSTRACT BOOK

ACIAR

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RESEARCH PROGRAM ON
**Climate Change,
Agriculture and
Food Security**

CCAFS

Ministry of Agriculture
Republic of Indonesia

Ministry of Agriculture, Nature and
Food Quality of the Netherlands

ABSTRACT BOOK

Since the term Climate-Smart Agriculture (CSA) was coined in 2010, the biannual global science conferences on CSA have emerged as the key global forum for scientific exchange to underpin CSA implementation. Building on the momentum generated by previous conferences, the 5th Global Science Conference on CSA endeavoured to support implementers with the latest science, under the theme, "transforming food systems under climate change".

Over the past few years, transformation in agricultural and food systems has emerged as a key issue in the global arena, with many initiatives, meetings and reports on the topic. It is now widely recognized that if we are to achieve the Sustainable Development Goals (SDGs), the way we produce and consume food needs to change, and a transformation is required. But, how can such a transformation be actioned by farmers, businesses, non-governmental organizations, and development institutions? This was the focus of the conference, and our International Advisory Committee identified six themes as crucial for a transformation, these were:

1.   Empowering farmer and consumer organizations, women and youth
2.   Digitally enabled climate-informed services
3.   Climate-resilient and low-emission practices and technologies
4.   Innovative finance to leverage public and private sector investments
5.   Reshaping supply chains, food retail, marketing and procurement
6.   Fostering enabling policies and institutions

An open call was launched for abstracts under these themes, resulting in over 600 abstracts being received. These abstracts were reviewed by experts and practitioners, and the most promising abstracts representing advances in science and potential to realise transformative actions in food systems were selected. These abstracts are presented in this e-book, as a resource for implementers seeking actionable solutions across the six themes of transformation.

We encourage readers to not only read this e-book, but also to connect with scientists who have submitted abstracts, to foster science-based action and catalyse partnerships with the scientific community, and to address the "implementation gap", for transformative action at scale.

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Empowering farmer and consumer organizations, women and youth

Collective actions by farmers and consumers are key to driving transformations change in food systems. At the same time, actions are needed to create conducive enabling environments that encourage producers, business owners, researchers, investors and policy makers to innovate in ways that promote gender equality and opportunities for youth.

This theme focuses on lesson learning from actions that build capacity and empower farmers, consumers, women and youth and their networks as part of the efforts to drive demand-driven solutions.

Oral presentations

Farmer organisations shaping entrepreneurial practices for resilience: Evidence from CSA models in Malawi and Zimbabwe

Author (s):

Domenico Dentoni (Business Management & Organisation Group, Wageningen University & Research, WUR), *Sera Gondwe* (LUANAR), *Rob Lubberink* (WUR), *Golden Mahove* (independent consultant), *Timothy Manyise* (WUR), Danlette Quashigah (WUR), *Todd Rosenstock* (ICRAF)

Description:

Despite the relevance of the debate on when and how farmers' collective action among may foster climate resilience, empirical evidence on this relationship remains thin and conflicting. To provide theoretical and methodological depth to this debate, this study empirically tests the relationships linking A) the structural elements of farmers' organizations and B) the member-farmers' entrepreneurial processes meant as processes of discovering and exploiting opportunities for recovering from and/or prepare for new climatic shocks). To test a set of hypotheses on these relationships, the study uses a combination of qualitative interviews and (so far) pilot quantitative survey data from 350 grain and legume farmers - across two case contexts (Ghana and Zimbabwe) to start building generalizability. Preliminary results suggest that A1) the intensity of the resource pooling, A2) the distribution of the decision-making rights over the pooled resources, and A3) a combination of formal and informal coordination mechanisms have a positive relationship with B1) farmers' effectual entrepreneurial logics, that is, a risk-averse, small-scale and experimental way of redeploying resources at hand in response to shocks. The research design and empirical results lead to implications on how to (de)structure farmers' organizations to stimulate novel, emergent ways to cope with climatic shocks.

Gender in Social Seed networks for climate change adaptation

Author (s):

Otieno Gloria, Zebrowki Wesley, Lavalle Nellie, Reynolds Travis, John Recha, Fadda Carlo

Description:

The study draws on original survey data from three communities in Kenya, Tanzania, and Uganda to examine the dynamics of men and women farmers' social networks and their resulting access to and exchange of seeds and information for climate change adaptation. Sampling was done using snowball technique involving 1001 farmers. Analysis of the social seed networks was done using UCINET by analyzing number of connections in the network, the closeness of the connections and the relative importance of these networks for accessing both information and seed.

From the findings, networks of female farmers have more connections and stronger networks for sharing and exchanging a wide range of diversity of seed, but they remain weak when accessing information related to seed especially of improved varieties. Men's networks also show a better access to a wider range of seed sources than women who tend to share seed among themselves.

Strengthening informal seed networks and building a connection between the formal (male dominated) and informal sectors (female dominated) seed sectors is crucial in providing farmers with a wide range of genetic diversity for climate change adaptation. Improving dissemination of information through formal and informal avenues will improve access to information.

Accelerating Gender Equity in Agricultural Research for Development

Author (s):

Dr Jayne Curnow, Research Program Manager, Social Sciences, ACIAR

Description:

Gender equality as an international norm remains a stretch target unlikely to be reached in the foreseeable future. In this context, the Australian Centre for International Agricultural Research (ACIAR) has taken unprecedented steps to facilitate gender equity. ACIAR has now created an environment that stipulates gender equity as a priority, directly influencing scientific research for development practice with Australian and overseas partners. This approach is based on my working hypothesis that from design to evaluation, only agricultural research for development (R4D) that addresses gendered social relations is thorough, comprehensive science.

Launched in December 2017, the ACIAR Gender Policy and Strategy encapsulates theory and practice that is translated into policy linked to action plans. The plans are designed along two integrated tracks; leadership in agricultural research for development and ensuring ACIAR is an exemplary R4D agency. The result has been to accelerate progress beyond expectations positioning this agency as a global leader within two years. However, great fear swirls around the discourses of gender – fear of saying and doing the wrong thing, fear of losing out in a zero-sum game. What are the steps and strategies that other institutions can emulate to leap structural hurdles to achieve transformative policies and practices?

Can membership in farmers' and rural producers' organizations be a pathway to cultivate gender equality?

Author (s):

Maria Fay Rola-Rubzen (University of Western Australia); *Rahma Adam* (CIMMYT); R*oy Murray-Prior* (University of Western Australia); *Michael Misiko* (CIMMYT); *Maria da Luz Quinhentos* (Instituto de Investigacao Agraria de Mozambique); *Rose Ubwe* (Tanzania Agricultural Research Institute); *Ram Datt* (Bihar Agricultural University); *Kalyan Das* (Uttar Banga Krishi Viswavidyalaya); *Thakur P. Tiwari* (CIMMYT); *Mahesh Gathala* (CIMMYT) and *Mamunur Rashid* (RDRS Bangladesh)

Description:

In this study, we examine the benefits of membership in Agricultural Innovation Platforms (AIPs), Farmer Groups (FGs) and Self-Help Groups (SHGs) among farmer-participants in the Sustainable Intensification of Maize-Legume Cropping Systems for Food Security in Eastern and Southern Africa (SIMLESA) project and the Sustainable Resilient Farming Systems Intensification (SRFSI) project in South Asia. Although continents apart, these projects share similar goals, i.e., to improve the livelihoods of smallholder farmers through conservation agriculture-based sustainable intensification. Using participatory audit tools (P-Audit), FGDs and Key informant interviews (KIIs), researchers evaluated the benefits of AIP membership in SIMLESA. In the SRFSI project, we conducted FGDs and KIIs with farmers in South Asia. Results showed that AIPs, FGs and SHGs are good platforms for reaching women. Benefits include better access to markets, credit, farming information, new technology and capacity development leading to yield increase, income increase and, hence, improved livelihoods. This has flow on effects on improved dietary nutrition and schooling. Thus, it was concluded that AIPs, FGs and SHGs can be a pathway to alleviate poverty and enhance food security while cultivating gender equality.

Bridging the Risk Management Information Gap for Smallholder Farmers Using Local Communities Networks

Author (s):

Muthithi Kinyanjui (ACRE Africa); *Stella Ndirangu* (ACRE Africa); *Reuben Gicheha* (AGRA)

Description:

Food security in Sub Saharan Africa remains a challenge despite multiple programs being implemented to enhance productivity and resilience. In Kenya, 75% of the food produced is for household consumption yet over 40% of the country's population depends on imported cereals (maize, wheat and rice). Successful improvements in the agriculture sector have included integration of services (credit and index insurance) with information (agronomy, climate information and financial literacy) to enable smallholder farmers improve their production. ACRE Africa's network of 650 rural change agents (champions) trained 362,050 farmers on good agricultural practices; financial literacy and insurance. The champions were enabled as agripreneurs to make incomes from commissions on crop insurance sales. The model leveraging on local communities' trusted social structures has attracted interest from research and private sector partners who are developing climate smart technologies. New and improved seed varieties with high nutritional content and high yield characteristics are being communicated to farmers through this model. The Government of Kenya is using the champions to educate farmers on Fall Army Worm management measures and as the distribution channel for the subsidized National yield index insurance product. The model is being improved to incorporate more climate resilient practices for sustainable food production.

Role of women farmer-led institutions in scaling out Climate Smart Agriculture in smallholder farming systems

Author (s):

Nitya Chanana (CCAFS South Asia/CIMMYT); *Arun Khatri-Chhetri* (CCAFS South Asia/CIMMYT)

Description:

The role of women-led institutions in enabling empowerment of its members is well established. However, there is limited evidence on how different kinds of women-led institutions can enable scaling out of improved climate risk adaptation of the agricultural community while empowering women farmers at the same time. This study therefore presents the process of institution building and its impact on strengthening the adaptive capacity and resilience of women farmers to climate risks. The study analysis the institution of Custom Hiring Centres, formed and managed by women farmers for renting climate-smart agricultural technologies, in three states of India. The institutional formation is a participatory process based on the role of women in agriculture, type of climate risks they face and assessment of their priorities with respect to technologies required in dealing with those climate risks. Initial results point to improved productivity and incomes as a result of climate-smart technology adoption for the overall village community. Additionally, rental incomes for group members aid women farmers' economic empowerment along with improved decision making in a social setting. The study also attempts to bring out the barriers to technology adoption, specifically for women farmers, along with the economic feasibility and social costs of sustaining these institutions.

Empowering Farmers to Meet the Growing Consumer Needs: A Study Case of Rikolto's Programme in Indonesia

Author (s):

Prima Interpares, Programme Desk Officer, Rikolto

Description:

There is a growing demand for healthy and sustainably-produced food in Indonesia, particularly in urban areas. Rikolto aims to trigger the change in the food system by supporting smallholder farmers to be more profitable in providing sustainably-produced food, promoting consumption of healthy food at the consumers and city government level, and creating linkage between producers and consumers. Rikolto focuses on five main commodities namely rice, cinnamon, cocoa, coffee, and seaweed, where it encourages farmers to adopt innovative agricultural practices, that are climate-smart (e.g. AWD, SRI, GAP, Agroforestry, Intercropping) in the Provinces of Jambi, West Java, Central Java, Bali, West Sulawesi, South Sulawesi, and East Nusa Tenggara. Pilots for consumer/city interventions concerning sustainable production and consumption are in the cities of Solo, Depok, and Bandung. Rikolto learned that promoting these innovative practices positively affect the livelihood of farmers due to relatively increased production, better price for quality products, and more assorted income sources from the farm. Additionally, consumers have information and access to quality food at a reasonable price, supported by a more enabling environment through city government policies and programs. Integrated interventions from the producers to the consumers' level are more effective to foster food system transformation.

Gender Transformation in Climate-Smart Agriculture: A Framework for Action

Author (s):

Huyer, S., CGIAR Research Program on Climate Change Agriculture and Food Security (CCAFS) / Women in Global Science and Technology (WISAT)/ International Livestock Research Institute (ILRI); *Gumucio, T*., International Research Institute for Climate and Society (IRI); *Campbell, B.,* CGIAR Research Program on Climate Change Agriculture and Food Security (CCAFS); International Center for Tropical Agriculture (CIAT)
Nitya Chanana, CGIAR Research Program on Climate Change Agriculture and Food Security (CCAFS); International Maize and Wheat Improvement Centre (CIMMYT)
Cramer, L. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), International Livestock Research Institute (ILRI)

Description:

Gender transformation needs to be an integral part of agricultural transformation if agriculture is to cope with major challenges related to climate, migration and continuing economic inequality. How can CSA support adaptation and resilience and build food

security while also building gender equality? What does current research say about how to promote gender equality and the potential for gender transformation through CSA? This analysis will assess strategies in CSA for capacity development, policy design, finance mechanisms and institutional approaches at community, national and global levels to promote gender equality and, potentially, gender transformation. It builds on three frameworks for women's empowerment in agriculture (focusing on agency, resources, capacities and institutional structures) integrating them with research on climate change and technology in order to identify gaps and opportunities for gender equality in CSA. The analysis addresses the following questions: How can we design CSA to empower women as well as men? What are the most effective strategies for community and national institutions, including women's organizations, to increase resilence of women and men farmers? What is the role of policy to promote gender equality and leadership of women in decision making; and How do finance and investment mechanisms effectively reach women?

Innovative approaches to gender mainstreaming for accelerating adoption of climate smart agriculture in smallholder systems

Author (s):

Tripti Agarwal (International Maize and Wheat Improvement Center), *ML Jat* (International Maize and Wheat Improvement Center), *Munmun Rai* (International Maize and Wheat Improvement Center), *Prarthna Agarwal Goel* (Guru Gobind Singh Indraprastha University)

Description:

Gender empowerment and equality emphasizing role of women in spheres of agricultural development, household food and nutritional security in smallholder systems is critical under growing complexity of climatic risks in South Asia. Women's role as change agents to influence uptake of climate smart agriculture practices (CSAPs) is very important. CCAFS-CIMMYT developed and validated innovative gender targeted approaches for scaling CSAPs in diverse ecologies of South Asia aiming to reduce climatic risks and sustainably farmer's profits by raising climate literacy for informed decision making by women farmers. We developed four innovative approaches and validated them in climate smart villages (CSVs). The case studies on these four approaches includes (i) farm budgeting instrument for enhanced role of women in agricultural decision making (ii) gender equality index for analysing gender equality gap in political, economic, social and agricultural activities in CSVs and non-CSVs. (iii) developing gender knowledge index of CSAPs to quantify out-migration, food & nutrition security for adopters and (iv) capacity development for accelerating CSAPs adoption. Our results highlights positive correlation of CSAPs adoption with improved gender knowledge and access & control over resources. Approaches embedded in policy design and delivery mechanisms is a way forward for gender mainstreaming routing agricultural transformation.

Speed talks

Empowering famers and consumer organizations to champion transformative adaptation to climate change

Author (s):

Rebecca Carter, WRI; *Tyler Ferdinand,* WRI, *Richard Choularton, Tetra Tech,* TBD

Description:

In many areas of the world, climate change will force transformations in agricultural systems with significant impacts on farmers and consumers. Despite the magnitude of the challenge, the majority of climate smart agricultural practice an implementation focuses on incremental adaptation. While incremental adaptation to the rapidly changing climate is essential today, so too is planning for shifting locations of agricultural production systems, introduction of substantially new production methods or technologies at scale, and other fundamental transformations of agricultural systems. Our presentation will provide an overview of two years of research into the state of transformative adaptation practices in agriculture and focus on how to empower farmers' and consumers' organizations to lead, implement and benefit from these transformations. We will take lessons from crop research and development, livestock production systems, irrigation and water management and climate information services and share recommendations for policy makers and funders to accelerate inclusive transformation in the face of climate change.

Social Learning Approaches in Climate Smart Village Development: Guinayangan Philippines case

Author (s):

Rene Vidallo (IIRR), *Julian Gonsalves* (IIRR), *Magnolia Rosimo* (IIRR)

Description:

The Guinayangan climate smart village (CSV) in the Philippines was developed to operationalize the CCAFS CSV approach with particular focus on building the evidence base for how local-level (subnational) outscaling of climate smart agriculture (CSA) practices can be undertaken relying on community-level interventions. This case study highlights the importance of social learning approaches as critical component in generating CSA effectiveness at local scales and facilitating scaling. Evidence-based outcomes accrue from testing climate smart technological options, done by farmer learning groups through structured participatory action researches (PAR: approach 1). The establishment of a community innovations/adaptation fund (CIF: approach 2) played an integral role in supporting and accelerating PAR. This fund provided small farmers access to a pool of financial resources to try new ideas while maintaining low risk of trying

unfamiliar production techniques. CIF allowed local extension workers objective basis for establishing community support systems (CSS: approach 3) for sustaining PAR and facilitate knowledge sharing through various types of planned scaling events (approach 4) targeted for multiple actors. These interlocking social learning approaches provides a model for building capacities of local development actors in facilitating community based adaptation and building resilience of rural agricultural communities.

Posters

Response to climate shocks through adoption of climate smart agricultural practices: A gender perspective

Author (s):

Caroline Mwongera - International Center for Tropical Agriculture (CIAT), *Chris Miyinzi Mwungu* (CIAT)

Description:

Gender roles are widely thought to affect decision-making patterns for adoption of agriculture technologies. This paper analyzes gender-disaggregated adoption of prioritized climate smart agriculture technologies by rural households in southern Tanzania and northern Uganda. We investigate the impact of gender differences in decision-making, roles, household headship, access to agriculture and climate information, asset ownership, perceptions to climate change and intra household dynamics on adoption of climate smart agriculture. We use data collected from an intra-household gender survey. Drivers of adoption disaggregated by gender are obtained using probit and poison models. Overall, there are significant differences between male and female household headship and decision making in access to agriculture information, extension services and climate information. Furthermore, we find positive impacts on how these influences the adoption of CSA technologies. For instance, access to information was a significant determinant of mulching adoption for women in northern Uganda. Our results suggest the importance of understanding gendered relations within households, and highlight potential problems in focusing separately on women and men in promoting climate smart agriculture.

Institutional innovations in Community Based Organizations influencing adoption and financing of climate smart agriculture

Author (s):

Seán Kelly(1), *Catherine Mungai*(2), *Maren Radeny*(2), *John Recha*(2), *Una Murray*(1), *Peter C. McKeown*(1), and *Charles Spillane*(1).
(1) MScCCAFS Program, Plant & AgriBiosciences Research Centre (PABC), Ryan Institute, National University of Ireland Galway, Ireland; (2) CCAFS Program, International Livestock Research Institute (ILRI), Nairobi, Kenya.

Description:

Accelerated uptake and scaling of CSA practices and technologies can be facilitated by different types of institutions and institutional innovations at different levels. Community based organisations have potential as partner institutions in CSA scaling. In Kenya, CCAFS is working with a range of CBOs in the Nyando CSVs to test a portfolio of CSA technologies and practices and explore the potential for CBOs (and institutional innovations) for scaling CSA practices and technologies (Kinyangi J, 2015). The CBOs are comprised of different types of groups (e.g. women only, men only, mixed, youth). Two types of institutional innovations are being explored for CSA scaling through CBOs, namely (i) revolving finance systems, and (ii) peer-to-peer learning platforms through various activities (training, learning events/field days, smart-farms/demonstration farms, and ASK shows). The goal of this research project is to investigate how the CBOs of the Nyando CSV site in Western Kenya use institutional and social innovations to accelerate the uptake and facilitate the upscaling of CSA technologies and practices. The data gathered can determine the effectiveness of CBOs in facilitating members access to credit, education and training, and uptake of CSA practices within the CSV site.

Implementation of the Climate-Smart Village Approach

Author (s):

Laia Nägeli Juan(1), *Peter C. McKeown*(1), *David Styles*(1), *Deissy Martínez Barón*(2), *Una Murray*(1), *Osana Bonilla-Findji*(2) and *Charles Spillane*(1).
(1) MScCCAFS Program, Plant & AgriBiosciences Research Centre (PABC), Ryan Institute, National University of Ireland Galway, Ireland; (2) International Center for Tropical Agriculture (CIAT), CGIAR Research Program on Climate Change Agriculture and Food Security (CCAFS)

Description:

Climate change is affecting global population and agriculture. Climate-smart agriculture practices in climate-smart villages promotes adaptation while building resilience to climatic stresses and ensures food security. The research aims to support planning and decision-making processes to promote and scale-out climate-smart agriculture amongst smallholder farmers in Colombia. The research analysed data from a Gender-sensitive Smart Household Monitoring instrument to assess climate-smart agriculture performance and outcomes in the Cauca climate-smart village. Data was analysed through different indicators tracked at household level disaggregated by gender, and examined climate-smart agriculture adoption and dis-adoption trends and related factors (financial, technical/operational and social) that enable its implementation. The study found that climate-smart practices related to water and ensuring food security during the year are the most preferred. The study highlights the importance of climate informatics services to promote a higher adaptation to climate change. Furthermore, the study led to a recommendation to improve future monitoring instruments to better meet the nees of smallholder farmers and practitioners to scale out climate-smart agriculture.

Inclusive Rural Youth Transformation

Author (s):

Tokelo Shai(1), *David Styles*(1), *Peter C. McKeown*(1), *Ana Maria Loboguerrero Rodriguez*(2,3), *Dhanush Dinesh*(3), *Una Murray*(1), *Ilaria Firmian*(4) and *Charles Spillane*(1).
(1) MScCCAFS Program, Plant & AgriBiosciences Research Centre (PABC), Ryan Institute, National University of Ireland Galway, Ireland; (2) International Centre for Tropical Agriculture (CIAT), Cali, Colombia; (3) Program Management Unit, CCAFS; (4) International Fund for Agricultural Development (IFAD), Rome, Italy

Description:

Rural transformation processes play a major role in influencing the empowerment and participation of rural youth. Young people are critical drivers of rural transformation. However, young people face challenges that constrain them from actively participating in economic activities. The achievement of rural transformation that is inclusive of young people requires concerted efforts from stakeholders and institutions to increase agricultural productivity, promote employment and entrepreneurial opportunities. This study assessed how the International Fund of Agricultural Development (IFAD) is addressing challenges of rural youth and types of approaches employed in driving youth inclusive rural transformation. A total of 45 projects were analysed from projects funded under the Adaptation for Smallholder Agriculture Programme (ASAP) and youth-related projects funded by IFAD. Furthermore, 8 of the 45 projects were chosen for an in-depth case study analysis. The results revealed that IFAD is making significant efforts in addressing challenges of rural youth. Irrespective of the transformative approaches employed, the research provided learnings for IFAD to strengthen the reporting of youth outcomes and to further develop the heterogeneity of youth in projects.

Delivering climate information services through public-private partnership in Ghana: gender analysis

Author (s):

Samuel Partey, CCAFS

Description:

Between 2011 and 2016, the CCAFS West Africa Regional Program tested the delivery of CIS to 1000 farmers through mobile phone platforms (Esoko platform). A PPP business model was developed in 2017 involving four private companies, three public institutions and farmers. This collaboration generated, transferred, translated and used CIS. Currently 274, 321 farmers from the Upper West Region of Ghana are now receiving CIS through the PPP by paying US$0.20 monthly fee. As part of regular impact assessment, a survey involving 900 farmers (50.2% women) was conducted at the study location to understand the role of gender in access and use of CIS. This revealed, men were more responsive in

adopting CIS for climate risk mitigation. This was attributed to their ability to easily access and use telephone devices compared with women. Men were also able to access more financial resources and had control of household income which allowed them to purchase mobile phones. Meanwhile both men and women found CIS beneficial for strategic farm decision making such as crop variety selection, when to plant or apply fertilizer etc. The study recommends the need to explore different CIS dissemination channels and design CIS that meet gender-specific needs.

Agroclimatic Risk Perception In Banana Chain Agents. Elements For The Construction Of An Adaptation Strategy Climate Change

Author (s):

Katia Contreras Valencia; Juan Carlos Martínez Medrano

Description:

In order to know the relationship between the perception of agroclimatic risk management and the design of strategies in the banana chain of Colombia, an investigation was carried out through a structured public opinion survey. The survey was applied to producers of the Banana and associated cooperatives. In the case of cooperatives, a semi-structured interview was conducted and through a focus group the factors that contribute to strategies for adapting to climate change were prioritized. The results show that the managerial staff of the cooperatives is willing to attend disasters caused by climate variability phenomena but without being involved in actions that lead to preventive measures and risk reduction. The producers are organized to claim against the losses due to the disasters associated with climatic variability but they participate little in spaces that lead to defining preventive measures that reduce the climatic risk. The perception is determined by the sensory effects, especially in small producers on changes in the atmosphere and on these sensations that interpret reality climate change. Institutional trust and participatory mechanisms to involve marketing supervisors can help in the dissemination and technical dissemination of social communication of the risks associated with climate change in the banana business.

Gendered local knowledge and resilient farming systems under rural transition

Author (s):

Elisabeth Simelton, World Agroforestry (ICRAF Vietnam); *Rachmat Mulia*, World Agroforestry (ICRAF Vietnam); *Nozomi Kawarazuka*, International Potato Centre (CIP)

Description:

Southeast Asia's rapid economic growth is changing rural farming households in different ways: labour availability, investments of off-farm incomes in agriculture, rural markets as well as gendered ecological knowledge, and changing needs for actionable agricultural information.

This presentation draws on research from three project sites in north and central Vietnam with different exposures to natural disasters, levels of ethnic diversity, and rural poverty and unemployment - and how this affects intrahousehold on/off farm labour distribution and decision making. The total surveyed number of households is approximately 1,200. First, we illustrate trends in how gender roles in farming systems are changing in response to economic and environmental changes. We explore the role of local knowledge about ecosystem functions, what aspects of the knowledge is gendered or generational, and to what extent this is used for, and may contribute to resilient farming situations. Finally, we discuss why these trends matter for designers (researchers, policy makers) of resilient climate-smart agriculture farming systems.

Gender Inclusive Livelihood Improvement through Climate Smart Village Program in Tribal Dominated Areas

Author (s):

Mahesh Maske (BISA-CIMMYT), *Prasun K Gangopadhyay* (BISA-CIMMYT), *Prakash Naik* (BISA-CIMMYT), *Arun K Joshi* (BISA-CIMMYT)

Description:

Involvement of women in agriculture is common in developing countries; though the priorities, responsibilities and access to resources are different from men to women. In agriculture, climatic change related uncertainty poses considerable threat to agricultural productivity. Particularly in knowledge and resource poor tribal dominated areas the issue is more severe. The present study discusses a gender inclusive climate smart village program in India that enables an environment to involve women as active stakeholders to improve their socio-economic status and decision making power. Climate resilient technologies and practices are introduced to a total of 7,500 tribal female farmers in 650 villages to improve livelihood and reduce human drudgery. Along with technologies and practices, relevant trainings provided to improve the self-sustainability of the program. Interventions such as kitchen garden and backyard poultry not only increased food and nutritional security of the households but also increased financial freedom of female farmers from the additional income generated by the interventions. It was observed that by using machineries such as threshers, the drudgery of female farmers are reduced about 30%. Extended over more than 1,000 villages, it is expected that additional 2,000 female farmers will be involved in this program by the end of 2019.

Young people as CSA promoters in remote rice-farming communities

Author (s):

Jaime A Manalo IV, Jayson C. Berto, Anna Marie F. Bautista, Frederick M. Saludez, Rommel T. Hallares, Argie M. Pagdanganan, Jennifer D. Villaflor, Teofilo C. Paulino, Katherine P. Balmeo, Development Communication Division, Philippine Rice Research Institute

Description:

Whilst there are technologies/strategies relating to climate-smart agriculture in the Philippines, in most rural communities, they are unheard of. There is plenty of work that needs to be done to promote these practices especially the simple ones as the opposite denies the rural farming population of the opportunity to better adapt to the impacts of climate change and earn more from their farming venture. This Speedtalk will discuss about the experience of the Infomediary Campaign of the Philippine Rice Research Institute in mobilising high school students in the Philippines to promote CSA technologies and practices. The Campaign was supported by the Consultative Group on International Agricultural Research Program on Climate Change, Agriculture, and Food Security and the Philippines' Department of Education. The talk will focus on successful information dissemination of the students that resulted in adapting certain CSA practices by their parents and other farmers in their community. Additionally, the key elements that contributed to the success of the infomediation initiative such as knowledge, trust, and empathy will be discussed. The Infomediary Campaign had more than 200 participating schools in the Philippines.

The Latin America Climate Change Mitigation Network (LAMENT): bridging regional knowledge gaps in climate change mitigation

Author (s):

Sandra Loaiza, Catalina Trujillo, Ngonidzashe Chirinda - International Center for Tropical Agriculture (CIAT) ; *Deissy Martinez-Baron* - Climate Change, Agriculture Food Security (CCAFS) ; *Laura Arenas* - University Leeds

Description:

Major barriers to advancing towards low C agriculture include limited awareness of the science, and the constrained capacity to conduct climate change (CC) mitigation research. To address this challenge, the Latin America regional CGIAR Research Program on Climate Change, Agriculture Food Security (CCAFS) and CIAT led the formation of LAMNET in 2015. LAMNET is a platform where young researchers contribute towards sustainable smallholder farming by developing context-specific strategies of mitigation. The network aims to 1) increase regional awareness of CC mitigation science and 2) support innovative research on CC mitigation, and 3) articulate regional efforts related to CC research needs in the region. LAMNET has conducted several awareness-raising webinars and a one-week summer school course. The course was attended by PhD students from 5 Latin American countries, farmer organizations and policy-makers. Post-course, the PhD students conducted a coordinated low-cost experiments on urine-based soil N2O emissions from low and adequately covered pastures in the different countries. Results were published in a peer-reviewed article and in over 50 news outlets. This work demonstrates that by harnessing limited finances, existing communication platforms, and scientific capacities, it is possible to simultaneously raise regional awareness and inform the discourse on CC mitigation science.

Inclusion of gender equality in monitoring and evaluation of rural climate services

Author (s):

Tatiana Gumucio (IRI), *Sophia Huyer* (CCAFS), *James Hansen* (IRI), *Elisabeth Simelton* (ICRAF), *Samuel Partey* (UNESCO), *Saroja Schwager* (Columbia University)

Description:

The paper aims to identify recommendations for gender-aware monitoring and evaluation (M&E) of rural climate services, highlighting system design and indicator development. Literature review and case study analysis highlight that it can be key to incorporate frameworks for measuring empowerment, use mixed methods and participatory tools, and follow gender-aware interview practices. Clearly incorporating gender equality objectives in the theory of change, facilitating gender support for M&E project teams, and carrying out a robust social assessment that includes gender analysis can be important practices to ensure that gender considerations are taken into account from the onset of M&E design. It is also critical to meet the minimum standards for sex-disaggregated data collection and analysis to ensure that gender trends can be accurately assessed.

Furthermore, the paper highlights that gender-aware M&E for climate services must collect datasets that represent key factors underlying gender inequalities in access and use of weather and climate information, particularly: i) access to group processes, ii) access to sources and formats, iii) relevance of weather and climate information, and iv) capacities to act on information. It can also be necessary to collect datasets that allow for assessment of how climate services contributes to women's participation in agricultural decision-making.

Oral presentations

Blockchain Applications for Climate-Smart Agriculture

Author (s):

Daniel Ortiz-Gonzalo, Department of Geosciences and Natural Resource Management, Faculty of Science, University of Copenhagen

Description:

Meeting the global food demand without further compromising the climate, among other planetary boundaries, is decisive to comply with the Sustainable Development Goals (SDGs). Given the current trends of growing population and affluence, disruptive technologies are sought to reduce the agricultural footprint. This paper investigates the potential of Distributed Ledger Technologies (DLTs) and smart contracts to enable environments for Climate-Smart Agriculture (CSA) adoption and upscaling. This involved the synthesis of evidence from literature review and blockchain case studies. Able to build trust and transparency among stakeholders without a third institution, blockchain technology allows for bottom up, decentralized instruments for agriculture development. Aligned to the CSA pillars, blockchain can enhance opportunities and safety nets for livelihoods by adding and transferring new forms of value (e.g. data rewards or access to new markets); disintermediating and lowering transaction costs; creating digital records (e.g. land titles); facilitating access to financial services; speeding up automatic payments from index-based insurance schemes through smart contracts; or monitoring emissions reductions, among others. Blockchain technology is still at an early development phase and, whilst success stories are emerging, there are no silver bullets for CSA but rather a collection of tailored, site-specific technologies.

Contrasting approaches to developing digital tools for enabling climate adaptation

Author (s):

Julie Ingram (University of Gloucestershire); *Yunita T. Winarto, Rhino Ariefiansyah, Adlinanur F. Prihandiani, Ghina Ulaya* (University of Indonesia); *Sue Walker* (ARC, South Africa)

Description:

This presentation highlights two contrasting approaches to developing digital tools for enabling climate adaptation. In Australia, there is a long tradition of crop modellers developing tools (DST) to support farmers' decision making in a context of highly variable rainfall. Despite the improvement of models, and increased availability nationally of soil and weather data, the extent of usage remains low and farmer learning for adaptation is limited. In Indonesia the process is essentially reversed in the Science Field Shops (SFS) initiative, where farmers build up their own capacity and learning by collecting their own data. Rice farmers in Java are subject to rainfall variability due to El Nino and climate change. In two regencies, rainfall observers in SFS record (daily) and share (monthly) rainfall and cropping data for their farms. At the same time, agrometerologists provide a monthly El Nino scenario. The observations and the scenarios trigger conversations and, drawing on past experiences, adaption strategies for the local context. The farmers' data, some going back 10 years, is now being digitised, to develop visual learning tools for farmers to support further learning and adaptation. This presentation is based on literature reviews, participant observation and key informant interviews in each country.

Nurturing Africa's Digital Revolution for Agriculture: agCelerant value chain orchestrators industrializing EO and IoT into smallholder agriculture

Author (s):

Pierre C. Sibiry Traore, Principal In-Business Researcher, ICRISAT

Description:

The NADiRA innovation action (Nurturing Africa's Digital Revolution for Agriculture) incorporates Copernicus, other Earth Observation products and in-situ IoT devices into agCelerantTM, a value chain orchestration platform connecting, in smallholder contract farming, producers with banks, insurers, input providers and agro-industries to control risks and improve the productivity, security, and welfare of African smallholder farmers.
By industrializing EO products, NADiRA reduces the operating costs, while increasing the timeliness, granularity and reach of agCelerantTM services, including: agricultural investment risk mapping, to reduce finance institutions cash-out and increase availability of input credit to smallholders; more robust, affordable agricultural insurance contracts, to reduce persistent climate risk; and improved smallholder tactical management of crop nutrient deficiencies and post-harvest losses to increase productivity, harvest quality and income.

NADiRA aims to demonstrate the economic and commercial viability of the combination of EO, IoT and mobile technology and its leverage on the new business model implemented by MANOBI AFRICA, credit, insurance institutions and agro-industries to improve smallholder productivity. Results from Nigeria and Senegal 2018-2019 seasons on irrigated rice and rainfed sorghum will be presented.

Improving climate risk management through smartphone camera data driven advisory and insurance: Evidence from India

Author (s):

Berber Kramer, Francisco Ceballos, Samyuktha Kannan, International Food Policy Research Institute

Description:

Poor knowledge and access to climate-smart agricultural practices, inadequate access to finance and the absence of safety nets present challenges for smallholder farmers adapting to increased vulnerability due to climate change. The rapid proliferation of smartphones in developing countries has made it possible to deliver agricultural advisory remotely to many farmers at a low cost. Through a randomized trial conducted in India, we test a novel method in which ground data and standardized pictures submitted by farmers through a smartphone application are used to provide highly customized real-time advisories. In randomly selected villages, farmers were also offered an insurance product in which they were compensated for damage visible in pictures. We find that the "picture-based advisories" improved farmers' knowledge of productivity-enhancing and risk-reducing practices, and helped farmers reduce risk more than generic advisories, potentially reducing expected insurance payouts and premiums. Moreover, bundling with insurance increased farmer engagement and satisfaction. As a result, we find that agricultural insurance bundled with personalized advisory can act as a complement rather than a substitute in promoting climate-smart resilience technologies. We conclude that these services, when combined, can improve farmers' adaptive capacity more than when offered in isolation.

Downscaled Agro-Weather Advisories and Hybrid Crop Insurance for Sorghum Farmers in Kenya

Author (s):

Stella Ndirangu - ACRE Africa; *Joab Osumba* - CCAFS; *John Recha* - CCAFS; *Dominick Arodi* - Kenya Met

Description:

Digital climate models for Climate-Smart Agriculture (CSA) are piloted in many parts of the world but with mixed results. In Kenya, CSA initiatives are innovating a Climate Information Services (CIS) model with smallholder farmers, which in one case has downscaled seasonal weather forecasts to community levels in the Lake Region, projecting agro-weather risks of local planting windows to trigger farmer-decisions. Farm-specific GPS locations were digitized for sorghum crop insurance monitoring. Partners held seasonal participatory community agro-weather scenario planning sessions to discuss downscaled forecasts and role of automated weather stations. Alerts and notifications were communicated to farmers via an ICT platform or local channels, reaching over 4,000 farmers in 3 years.

A blend of CIS, finance and market linkages is stimulating interest, both among lenders and borrowers. Financiers see potential in the model to capture climate risks in their risk matrices while also broadening financial inclusion. Exit survey indicated 85% of the farmers made climate-information plans and decisions. This model will increase adaptive capacity and resilience for crop farmers, and to some extent for livestock/dairy production and responsive livestock/dairy healthcare. However, data capture still needs to be more robust, to create opportunities for a mix of innovative climate risk management products.

Social networks to practical use: Can strong social network actors help improve digital-delivery of climate-risk reducing services in Bangladesh?

Author (s):

Wolfram J. Simon, MSc student in Organic Agriculture at Wageningen University and Research (WUR), Wageningen, the Netherlands; *Sumona Shahrin,* International Maize and Wheat Improvement Center (CIMMYT), Dhaka, Bangladesh; *Saleh Mohammad Shahriar,* International Maize and Wheat Improvement Center (CIMMYT), Dhaka, Bangladesh *Dr Jeroen C.J.* Groot, Associate Professor at Farming Systems Ecology Group (FSE) at Wageiningen University and Research (WUR), Wageningen, the Netherlands *Dr Norman Aguilar-Gallegos,* Postdoctoral Researcher at Knowledge, Technology and Innovation Group (KTI), Wageningen University and Research (WUR), Wageningen, the Netherlands; *Dr Timothy J. Krupnik,* Senior Scientist and Systems Agronomist, International Maize and Wheat Improvement Center (CIMMYT), Dhaka, Bangladesh

Description:

Farmers in Southern Bangladesh are strongly affected by climate risks. Heavy precipitation prior to harvesting can cause significant damage to profitable but weather-risk prone mungbean crops. We describe possible relations between farmers' access to weather alerts and market price information to Mungbean productivity and profitability. To overcome last-mile constraints to information delivery, ICT-based extreme weather and market information alerts are being merged with farmer-to-farmer information dissemination efforts. These target strong social network actors who, after receiving an interactive voice response (IVR) climate risk alert, can rapidly spread awareness to mungbean farmers and verbally encourage mitigating actions such as rapid harvesting. 300 mungbean farmers were surveyed from three regions in coastal Bangladesh. Using social network analysis (SNA), centrality and cohesion were analysed to describe farmers' capacity for receiving weather and market information and to assess face-to-face information exchange capacity by analysing friendship networks. We describe results from these analyses and their complementarity for improving IVR climate alerts for mungbean. Our work shows how SNA can be used to identify strong information agents who can contribute to information dissemination where ICT access is low or where additional technical support is needed to encourage management actions to reduce risks to mungbeans.

Speed talks

Disruptive technologies to end hunger under progressive climate change

Author (s):

Läderach, P. (CIAT); *Pacillo, G.* (CIAT); *Nguyen, N.V.B.* (CIAT); *Rivoal, M.* (CIAT); Burra, D. *Imbach, P.* (CIAT); *Firmian, I.* (IFAD); *Laganda, G.* (WFP)

Description:

The commitment of the international community to end hunger, achieve food security and improved nutrition by 2030 under progressive climate change, can only be achieved by transitioning vulnerable communities out of the continuous food-aid trap, into resilient livelihoods, enabling rural development programs to support equitable, sustainable and resilient food systems. Seamless support for communities to transition from food insecurity to self-reliance is where WFP, IFAD and CCAFS expertise and contribution is essential and unique. We conduct a comprehensive portfolio review of IFAD, WFP and CCAFS ongoing programs, approaches and tools employing a food security resilience measurement framework specifically developed to encompass heterogeneities in beneficiaries and mandates of these different institutions and with the aim of bridging, often, disconnected interventions to increase climate change resilience. Using a selection of case studies, we demonstrate how the continuum from humanitarian interventions to long-term food security resilience building can be documented and planned upon, using novel disruptive technologies building on big data analysis. With this approach, we aim to inform a more evidence-based, contextualised and effective future programming and decision making on solutions to end hunger.

Hot topic posters

Are they ready? Village-level capacity to use phone-based extension services in Rwanda

Author (s):

Mariette McCampbell, PhD researcher Knowledge, Technology and Innovation group, Wageningen University and Research; *dr. Julius Adewopo,* Geospatial data scientist and projectleader ICT4BXW project, IITA Rwanda; *dr. Marc Schut,* Innovation and scaling scientist and country representative, IITA Rwanda.

Description:

Digital technologies are increasingly accessible in Africa and the agricultural development

sector embraces their potential. Projects adopting digital tools in their interventions often promise unprecedented outcomes and impact. Yet, understanding about field-level readiness to adopt digital innovations is limited and national statistics of access to and use of phones, sim-cards, radios etc. often tell a skewed story. This study aimed to reduce this knowledge gap, assessing the status of ICT in Rwandan banana farming communities and the flow of information and knowledge. We conducted a baseline-survey on 692 banana farmers and 138 village extension agents, across 138 Rwandan villages, and analysed data from surveys and semi-structured interviews on extension delivery. Results show gender- and age-differentiated ICT access and near-zero uptake of web and smartphone technologies. 79% of the male farmers own phones, against 62% female farmer ownership. Radio is still a preferred medium for agricultural information, and phone-based services are only accessed by 20% of the respondents, mostly younger males. Agents use voice-calls and SMS but no other phone-functions for their work. Our findings suggest that deployment of digital innovations for extension requires awareness of the use context and function, and enhancement of user skills to improve adoption readiness.

Posters

Colombian Cilmate Service for Rice

Author (s):

Alexander Rojas Ruíz, Patricia Guzmán, Francisco Javier Hernández (Federación Nacional de Arroceros)

Description:

The national rice growers federation FEDEARROZ mission is promote the social, economic and technological development of rice producers to achieve the competitiveness and efficiency therefore in order to face the current challenges imposed by the globalized economy and climate change, it looked to incorporate the meteorological information into the farmers services. This objective has been developed since 2013, through different projects acompannied by the International Center for Tropical Agriculture. First, we worked on finding alternatives to strengthen the capacity of the sector to adapt to the variability and climate change, from which a methodology was obtained to generate agroclimatic simulations based on seasonal climate predictions, trying to answer specific needs such as when to plant and what variety plant. Later a platform was developed to automate the processes and improve the visualization of the results https://pronosticos.aclimatecolombia.org).

Finally, in a participatory manner, we identify the activities of the producers in which the meteorological information can help them make better decisions and we create the platform of the climate service for rice cultivation (www.climafedearroz.com) which suggests in a guided way specific tools and its possible uses, depending on the geographical location and the stage crop.

Real-time monitoring of invasive pests like fall armyworm (Spodoptera frugiperda J.E.Smith) using Artificial Intelligence

Author (s):

Sai Rekha Kadirimangalam (Scientific Officer); *Srikanth Rupavatharam* (Scientist), and *Ram Kiran Dhulipala* (Head) Digital Agriculture & Youth, International Crops Research Institute for Semi-Arid Tropics

Description:

Climate and agriculture are connected directly putting the food security at risk. The raise in CO_2 level, high temperature coupled with drought scenarios are leading to changes in plant ecosystem dynamics with change in adaptation of pest and diseases. With the advent of internet revolution and smart phones, digital tools in agriculture paved way to address challenges in plant health monitoring and advisory through apps. Recently, an invasive pest fall armyworm, Spodoptera frugiperda (J.E.Smith) was reported for the first time in Indian state of Karnataka in Maize crop during July, 2018. This polyphagus insect started damaging other crops like sorghum, pearl millet, ragi and sugar cane in a short span of one cropping season. Plantix, an android application is developed by Progressive Environmental and Agricultural Technologies (PEAT), a German startup company that uses artificial intelligence to detect pests, diseases and nutrient deficiencies using a smart phone image in real time. Images are geo-time tagged leading to live tracking of the spread of a pest. An online heat map showing spatial spread of the pest in the Indian sub-continent has been made possible using Plantix (https://plantix.net/en/live/fall-armyworm). More than 5000 data points validated on the identity of fall armyworm. There is potential to use Plantix app for real-time monitoring of pest and diseases which is critical for crop protection and management.

Understanding information needs and constraints in support of a mobile geospatial platform promoting climate-smart landscapes in Fiji and Tonga

Author (s):

Bryan J Boruff, Senior Lecturer, University of Western Australi

Description:

Agricultural interventions should be assessed in terms of livelihoods impacts, landscape sustainability, and capacity to respond to climate stressors. Within landscapes, accurate and timely monitoring of human-climate-environment interactions is important to inform management, policy, and climate-smart sustainable development. Contemporary data collection and monitoring approaches for capturing landscape information are challenged by management burdens, aligning system requirements with local needs, and socio-technical issues. Based on community consultations, stakeholder engagement, and ICT4D user requirements analysis, we mapped government data flows and information

needs of small holder farmers in Fiji and Tonga. We then identified barriers to data access and understanding to develop an open-source mobile geospatial platform to facilitate knowledge sharing between different stakeholders in multi-use landscapes. The prototype was collaboratively developed with the Ministries of Agriculture in Fiji and Tonga, addressing shortcomings in information delivery, environmental monitoring, and data sharing. We present lessons from our ICT4D analysis alongside tool functionality, and the results of field-testing with communities in the Ba Catchment, Fiji and Tongatapu, Tonga. Our results highlight importance in understanding specific needs and capacities of all stakeholders when developing digital climate information services.

Designing innovative digital tools at different scales to estimate yields of perennial crops in the tropics

Author (s):

Emile FAYE CIRAD, UPR HortSys, Dakar, Senegal. HortSys, Univ Montpellier, CIRAD, Montpellier, France.ISRA, Dakar, Senegal.; *Julien SARRON* CIRAD, UPR HortSys, 00100 Nairobi, Kenya.HortSys, Univ Montpellier, CIRAD, Montpellier, France.ISRA, Dakar, Senegal.; *Eric MALEZIEUX* CIRAD, UPR HortSys, F-34398 Montpellier, France. HortSys, Univ Montpellier, CIRAD, Montpellier, France.

Description:

For most crops, estimation of yield is a strategic and key information for both growers and stakeholders of the value chains involved in market supply and exports. Climate has already a strong effect on yields and yield variability but climate change may dramatically decrease yields and increase yield variability in some areas. For fruit tree production in the tropics such as litchee or mango, information on yields and production is barely available nor existing, making it difficult to improve the efficiency and resilience of the production process especially for smallholders.

An integrative toolbox was designed for different tree crop species, value chains and local conditions. This innovative toolbox brings together i) fruit load estimation at the tree scale, based on image processing using deep neural networks, ii) orchard production estimation, using UAV photogrammetry and geographic object-based image analysis, iii) regional production estimation using remote sensing technology and expert knowledge for orchard cropping systems classification. The global methodology was set up, adapted and performed at a regional scale for mango production in Senegal, providing new perspectives for finer forecasting of crop yields for perennials in the tropical value chains that include numerous smallholders.

In the Frame: Photovoice for Improving Understanding of Gender in Small-scale Fisheries and Aquaculture and the Impacts of Climate Change

Author (s):

Fiona Simmance (WorldFish); *Alison Simmance* (University of Southampton)

Description:

Understanding the role and value of fisheries and aquaculture to livelihood and food security is a key challenge in conserving fisheries resources and livelihoods. This is particularly true for inland small-scale fisheries and aquaculture, which are the most under-reported fisheries sectors, which increasingly face environmental change. Understanding the impacts of climate change on the sector and the livelihoods of men and women along the value chain is critical. One participatory method; Photovoice, has emerged as an innovative approach to understand this complexity in a culturally appropriate and empowering manner that can be applied amongst vulnerable, marginalised and illiterate communities. This paper presents the results of a Photovoice assessment applied for the first time within fisheries and aquaculture sites in southern Malawi experiencing climate variability. A comprehensive picture of the role, value and challenges of the sectors are outlined through the lens of men and women fisherfolk across the value chain. The paper argues that the use of Photovoice in the context of small-scale inland fisheries and aquaculture research is a timely endeavour given heightened interest to obtain rich insights into the overlooked role of women in the sectors, the social and economic value, and local impacts of climate change.

Picture-Based Insurance (PBI): Using Picture Streams from Farmers' Plots to Assess Crop Damage

Author (s):

Francisco Ceballos (IFPRI); *Berber Kramer* (IFPRI); *Miguel Robles* (World Bank)

Description:

Smallholder farmers are increasingly exposed to weather extremes but lack access to affordable insurance products for their crops. This paper introduces Picture-Based Insurance (PBI), an innovative concept for affordable, easy-to-understand agricultural insurance. Under PBI, farmers use their own cellphones to regularly take pictures of their plots throughout the season. An Android app ensures that each picture captures the same section of the field by using geotags and visual aids, collects additional information such as growth stage, agricultural practices, and damage, and uploads pictures to the cloud. Insurers can then inexpensively assess damage based on the pictures and disburse payments. PBI aims at boosting uptake by reducing basis risk relative to index insurance products and relying on direct farmer participation and increased trust arising from using their own pictures. Results from two initial seasons speak to the feasibility of this approach,

with farmers taking pictures regularly, experts being able to identify crop damage from the stream of pictures, and no evidence of moral hazard, tampering, or adverse selection. Future plans include further automation by relying on machine learning algorithms to identify losses, and bundling with value-added services such as personalized advisories, pest detection, and awareness and monitoring of climate-smart practices.

Climate services for agriculture: forecast skill no guarantee of success?

Author (s):

Julian Ramirez-Villegas[1, 2], *Steven D. Prager*[1], *Diego Obando*[1], *Diana Giraldo*[1, 3], *Lizeth Llanos*[1], *Diego Agudelo*[1], *Alejandra Esquivel*[1], *Steven Sotelo*[1], *Edward Guevara*[1], *Fanny Howland*[1], *Armando Muñoz*[1], *Jeferson Rodriguez*[1], *Leonardo Ordoñez*[1], *Jeison Mesa*[1]

1 International Center for Tropical Agriculture (CIAT), Cali, Colombia
2 CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), c/o CIAT, Cali, Colombia
3 University of Reading, Reading, UK

Description:

Climate variability affects agriculture across the globe. In Latin America, year-to-year climatic variations and in particular those associated with El Nino can substantially affect farmers' harvests. Here, we show that better on-the-ground data and skillful climate and crop models alone are not sufficient to fully realize the potential of climate services for agriculture through case studies in Colombia and Honduras. Diagnosing and strengthening the capacities of farmers organizations and farmers to produce, translate, transfer and use climate information, as well as understanding local information needs in farming communities are essential elements for climate services to be successful. Using these principles, for Colombia, we combined skillful seasonal climate forecast and crop models, to develop an adaptable and scalable web-based forecasting platform tailored to users' needs. We highlight that from a population of ca. 200 farmers and professionals, roughly two thirds correctly interpreted information and felt both confident and encouraged to use the platform. Challenges, however, remain for widespread use of the platform, as farmers identified training on agro-climatology as a crucial need. We conclude that for a climate service to be truly sustainable, well-calibrated and skillful models are as critical as the co-creation of the service itself with the community that will use it.

ICCO Cooperation and partners are utilizing geodata for the benefits of thousands of smallholder farmers in South East Asia

Author (s):

Marleen Brouwer, Business Developer South East Asia, ICCO Cooperation

Description:

Indonesian smallholders' productivity and income is affected by crop failures due to (unexpected) droughts, floods, extreme rainfall, pests and diseases. Farmers lack information on how to proactively adapt to climate change.

ICCO Cooperation, collaborating with private and public organizations (including Netherlands Space Office), initiated the SMARTseeds and SpiceUp projects. The purpose is to support 100,000 vegetable farmers and 100,000 spice farmers in Indonesia to increase production, income and food security, and to reduce water, fertilizers and pesticides inputs.

Farmers get better access to information about the weather, soil nutrients, water availability and GAP by utilizing satellite data. This helps to adopt more accurate crop calendars, apply fertilizers more efficiently, and mitigate pests and diseases better. Information is distributed via interactive SMS and a smartphone application platform.

SMARTseeds technology was launched in 2017, and distributed via the SIPINDO app and SMS services. Our pilot showed that, with the technology, vegetable farmers could increase cost efficiency and yield by 35% and 13% respectively.

With SMARTseeds and SpiceUp in Indonesia, as well as similar geodata-for-agriculture projects in Cambodia (vegetables) and Vietnam (coffee), ICCO has shown how agro-meteorology can be translated into actionable farm advice, leading to improved farmers' livelihoods.

TargetICT: A Spatial Framework for Targeting ICT based Weather and Agro-advisory Services for Climate Risk Management

Author (s):

Prasun K Gangopadhyay (BISA, CIMMYT); *Arun Khatri-Chhetri* (CCAFS, BISA, CIMMYT); *Paresh B Shirsath* (CCAFS, BISA, CIMMYT), *Pramod K Aggarwal* (CCAFS, BISA, CIMMYT)

Description:

Location and context specific appropriate information is one of the primary requisite to enhance resilience and build a climate smart farming community. Current agro-ICT services, however, are too generalized and also have spatial discrepancy between information desired and information provided. Thus, there is need for a spatially recognized framework to understand the accessibility of knowledge in conjugation with climatic vulnerabilities at lowest possible administrative units for informed decision making. To bridge this gap the present study discusses a spatially-explicit, multi-dimensional and data driven approach "TargetICT" for climatic risk management using weather information and relevant agro-advisories. The presented framework analyzes the climatic vulnerabilities and access to information thorough ICT services. An example to identify the hotspots at district level in India is also presented. Further, by considering poverty head ratio it prioritize the districts and also estimate the approximate cost. The framework reveals that out of 622 rural districts of India, 9 and 56 districts fall in very high and high vulnerable categories, respectively with high poverty rate. Moreover, to provide basic agro-ICT services to all the farmers in these districts a total of US$ 37 million is required.

Reaching the Unreached: School-on-the-Air on Climate-Smart Agriculture (SOA-CSA) in Cagayan Valley, Philippines

Author (s):

Rex L. Navarro (Philippine Agricultural Journalists); *Rogelio P. Matalang* (Philippine Federation of Rural Broadcasters); *Hector U. Tabbun* (Department of Agriculture); *Leocadio S. Sebastian* (CCAFS Southeast Asia)

Description:

In 2018, CCAFS SEA Southeast Asia catalyzed a collaborative radio based distance learning project with the Philippine Department of Agriculture Regional Office 2, Philippine Federation of Rural Broadcasters, Philippine Agriculture Journalists, Inc. Cagayan Valley Chapter, Philippine Rice Research Institute Isabela, Cagayan Valley Agriculture and Resources Research and Development Consortium, and other regional agencies. Conducted from February to August 2018 and dubbed as "Kaalamang Pagsasaka sa Himpapawid: A School-on-the-Air Project on Climate Smart Agriculture (SOA-CSA) in Cagayan Valley," this project showcased the power of radio in sharing improved agriculture technologies and support services to a critical mass of farmers under a climate change regime.

At the core of this project were schools-on-the-air on climate smart agriculture focused on rice production, post-production and marketing which were conducted in the region's major food producing provinces through live radio broadcast by a DA owned and controlled radio station, Philippine Broadcasting Service, other government stations in Cagayan Valley and members of PFRB. On 24 August 2018, more than 5,000 of the 10,078 farmers who enrolled in SOA-CSA project graduated en masse at the Isabela State University in Echague, Isabela. The graduates went through 68 modules aired over five months by participating radio stations.

CCAFS Regional Agricultural Forecasting Toolbox (CRAFT) for Agricultural Monitoring

Author (s):

Saurav Suman (Data Analyst, UN World Food Programme, Nepal, M.Tech. (IIT Bombay); *Dhiraj Gyawali* (Ph. D. Scholar, University of Stuttgart); *Moctar Aboubacar* (Head, Evidence Policy and Innovation Unit, WFP); *Dr. Paresh Shirsath* (Scientist, CIMMYT India) *Dr. Arun K.C.* (Scientist, CIMMYT India); *Dr. Pramod Aggrawal* (Project Leader, CIMMYT India)

Description:

The unpredictability of crop yields in climate vulnerable regions is damaging in many ways, negatively impacting food security as well as imports, exports, food prices, and people's livelihoods. The CCAFS Regional Agricultural Forecasting Toolbox (CRAFT) is an open source, flexible crop-forecasting platform that includes a crop-simulation module, a weather and seasonal forecast module, and a geographic information system module.

The tool uses historical databases of weather and crop yields as well as the current weather to estimate the yield of various crops. The outputs of the tool can be used to provide information to ensure better management of agricultural risks associated with increased climate variability and extreme events. This could enable the stakeholders as policy makers, line agencies, cooperatives, extension workers and farmers to better prepare the mitigation strategies to cope with the risks. CRAFT has been in use in Nepal since November 2014 through present to forecast yields of wheat and paddy; forecast levels aligned closely with Ministry estimates. Currently, CRAFT is being tested for yield forecasting at the sub-national level in Nepal. The main objective of this study is to highlight the application of CRAFT and its performance in monitoring food security in Nepal.

Towards a unifying theory for digital CSA: Lessons learned from climate services in LAC

Author (s):

Steven D. Prager, Julian Ramirez-Villegas, Diego Obando, Diana Giraldo, Lizeth Llanos, Diego Agudelo, Alejandra Esquivel, Steven Sotelo, Edward Guevara, Fanny Howland, Armando Muñoz, Jeferson Rodriguez, Leonardo Ordoñez, Jeimar Tapasco, Andy Jarvis (all affiliations CIAT)

Description:

Throughout the economy, "digital" has become the new enabler. Agriculture in the developing world is no exception. Climate services often build on this, with the assumption that digitally enabled climate information is inherently valuable to a wide range of next users for CSA related decisions. Is this the case?

This research unpacks a series of agro-climatic seasonal-forecast services developed in Colombia and later diffused to a number of other countries. Our approach uses structured stakeholder engagements, a climate service generation and delivery platform, and institutional capacity building across the information chain. This integrates across the meteorological services, agro-climatologists, last mile next users, and regional climate forums. We find that, in spite of digitization, every step in creating a climate service is fundamentally human-mediated. Information is thus not inherently valuable; context drives value and must be considered.

Maximizing impact of climate services thus requires a unifying approach, jointly optimizing the human and technical aspects. We call on the development community to consider sociotechnical systems (STS) theory as the basis for digital climate services and other digital agriculture activities. Initiatives in climate services should benefit from and contribute to the STS framework, resulting in coherent theory supporting future digital agriculture interventions.

Theme 3:
Climate-resilient and low-emission
practices and technologies

Oral presentations

The Suitability of CSA Practices in Africa under Current and Future Climate Conditions

Author (s):

Christine Lamanna (World Agroforestry Centre); *Peter Steward* (University of Leeds and World Agroforestry Centre); *Evan Girvetz* (International Center for Tropical Agriculture), *Todd S Rosenstock* (World Agroforestry Centre and CCAFS)

Description:

The multiple benefits of climate-smart agriculture can only be realized when appropriate practices and technologies are chosen for the local climate, soil, agricultural, and social conditions. Given the large diversity of CSA technologies available, it can be difficult to know a priori which options will be most suitable for a given context, let alone how those technologies might perform under future climate and population scenarios. Here we combined data from the CSA Compendium, a meta-analysis of over 1500 peer-reviewed studies of 100 CSA practices and technologies in Africa, with spatial data on climate, soils, farming systems, and social geography to look at suitability of CSA technologies (1) under current climatic conditions, (2) under future climate and social scenarios, and (3) under stress or shock conditions. We found that while some CSA practices, such as manure addition to crops, has near universal suitability across contexts, others such as agroforestry have narrower niches. This approach can be used to improve climate change adaptation and CSA planning by providing rapid information on the potential suitability of practices under current as well as novel conditions, such as in former conflict zones, or under future climate scenarios.

Solarising Irrigation in Indian Agriculture

Author (s):

Neha Durga, Shilp Verma

Description:

The way, India irrigates will evolve rapidly as the energy systems around it changes. Solar Irrigation Pumps (SIP) in Indian agriculture have grown by 64 percent CAGR in the last 5 years, owing to the government efforts and also because of the demand pull from farmers deprived of reliable and affordable electricity for agriculture. As the prices of solar PV

technology will fall further, the rate of adoption solar pumps is expected to increase in Indian agriculture. The farmers currently using electric pumps want to own a solar pump as a back-up or secondary pump as the electricity is supplied in nightly hours and is usually of poor quality. Farmers having diesel pumps want to replace the same with solar pump as diesel irrigation is prohibitively expensive given the increasing rate of fuel and considerable maintenance cost.

The mushrooming of solar pumps may happen in future and the policy for its promotion will determine its impacts not only on groundwater and energy sectors, given that their fates are intertwined, but also on farmers' income from agriculture. This paper presents the evolution of solar irrigation policies in India and synthesizes the current policy discourse around the same by reviewing literature on state solar irrigation policies and their early results. The paper also discusses different models employed to promote solarisation and their early results and potential impacts on agriculture and groundwater.

Wild futures: food-systems innovation for accelerating progress towards the SDGs

Author (s):

Mario Herrero, Chief Research Scientist of Agriculture and Food, The Commonwealth Scientific and Industrial Research Organization (CSIRO)*; Philip Thornton,* Flagship Leader, Climate Change, Agriculture, and Food Security (CCAFS)

Description:

We present a synthesis of technological alternatives, both developing and existing, that could directly influence future food systems. We articulate their potential impacts in relation to the SDGs and provide a framework for understanding the conditions that could facilitate more rapid implementation and adoption. This information is crucial for guiding investment and for planning actions to ensure human well-being while achieving key goals for safeguarding the planet. The application of new technology may open up new pathways for helping to attaining these goals in a concerted way. Most of the technologies considered have largely positive impacts on the SDGs most closely associated with the food system. Innovation has always produced winners and losers, and we need to ensure that there are safety nets for the losers of technological change so that they are not left behind. Innovation depends on enablers of change. Addressing issues associated with social licence to operate, with intellectual property to enable massification, and carbon pricing, for example, could help provide appropriate conditions for innovation at all levels. Success in these actions will create room across the SDGs for better health, wealth and environmental outcomes; failure will result in much more than a lack of food.

Data science to support climate smart agriculture in South Asia: How can crucial data gaps be filled with big data stacks?

Author (s):

Timothy J. Krupnik (International Maize and Wheat Improvement Center – CIMMYT); *Gokul P.Paudel* (CIMMYT); *Ashok Rai* (CIMMYT), *Lone Badstue* (CIMMYT); *Carlo Montes* (CIMMYT); *Murshedul Alam* (International Rice Research Institute – IRRI); *Sharif Ahmed* (IRRI), *Gideon Kruseman* (CIMMYT); *Jordan Chamberlin* (CIMMYT); *ML Jat* (CIMMYT); and *Tek Sapkota* (CIMMYT).

Description:

Heterogeneity in soils, climate, and rapid changes in rural economies complicate the expansion of climate-smart agriculture (CSA) in South Asia's cereal-based farming systems. Considerable previous research on CSA has relied on deductive observations from manipulative experiments analyzing limited agronomic variables, or survey data from project-driven initiatives. This can obscure the identification of relevant factors limiting CSA, leading to inappropriate extension and policies misaligned with the reality of farmers' circumstances. Alternative 'big data' approaches utilizing novel partnerships, digital surveys, crowd sourcing, and environmental datasets could conversely represent a powerful alternative source of agronomic practice performance information. We describe digital data collection approaches to collect primary agronomic management and socioeconomic data from >5,000 farmers in India, Nepal and Bangladesh. Combined with spatially-explicit secondary soils and gridded climate products, we applied machine learning to examine age- and gender-specific factors contributing to or limiting indicators of productivity and resilience. The CCAFS Mitigation-Options tool was also used to estimate yield-scaled greenhouse gas emissions. Our results provide insight into the ways that data science can be applied identify and devise strategies to overcome constraints to CSA in South Asia.

ITC's Climate Smart Agriculture: Livelihood Improvement through Low Emission Technologies

Author (s):

Vijay Vardhan Vasireddy, Operations Manager-Social Investments Programme, ITC Limited

Description:

ITC limited is a diversified Indian conglomerate with significant stakes in large agri-value chains. Its comprehensive Climate Smart Agriculture (CSA) programme strengthens and nurtures sustainable raw material base through knowledge management (KM), natural resources management (NRM) and fostering of farmer institutions to address various challenges faced by farmers including climate change. NRM replenishes and promotes efficient use of water, soil and biodiversity. KM promotes CSA through farmer capability building. An assessment of ITC's five major activities; catchment treatment, water

harvesting, micro irrigation and broad-bed furrow and zero-tillage methods of sowing disclosed that 3 hundred thousand farmer households and 4 hundred thousand ha area was covered with 10-20% yield increases and 34,203 tCO2e savings compared to conventional practices (calculated as per IPCC Guidelines). Results demonstrate that CSA contributes significantly to GHG reduction and climate change mitigation without compromising on food security, in line with FAO's emphasis on achieving the triple objectives of food security through increased productivity, adapting to climate change and contributing to climate change mitigation. It also validates IPCC's estimate that mitigation potential of agriculture can save up to three-quarters of the sector's global emissions by 2030

Speed talks

Uptake and Impact of Climate-Smart Agriculture on Food Security, Incomes and Assets in East Africa

Author (s):

Maren Radeny, CCAFS-ILRI; *Maurice J. Ogada,* Taita Taveta University; *John Recha,* CCAFS-ILRI; *Philip Kimeli,* CCAFS-ILRI; *Elizaphan J.O. Rao,* ILRI; *Dawit Solomon,* CCAFS-ILRI

Description:

Increasing agricultural productivity and meeting food security needs in the face of climate change requires technological, institutional and policy interventions. Since 2011, the CGIAR Research Program on Climate Change and Food Security (CCAFS) has been evaluating and promoting a portfolio of climate-smart agriculture (CSA) technologies and innovations in East Africa. Using quasi-experimental approaches, this paper analysed uptake and impact of improved multiple stress-tolerant crop varieties, improved and better adapted livestock breeds, and integrated soil and water conservation measures on livelihood outcomes—food and nutrition security, incomes and asset accumulation, all of which are indicators of resilience. In addition, the paper examines drivers of CSA adoption. Uptake of CSA technologies has increased across East Africa, coupled with improved agronomic and livestock management practices. Multiple stress-tolerant crop varieties and improved small ruminant livestock breeds had positive and significant impacts on food and nutrition security, and asset accumulation. Although positive, income effects of improved small ruminants were not significant. Impact of soil and water conservation practices is marginal. We conclude that adoption of crop and livestock-related CSA technologies and practices have positive impacts on food security, asset accumulation and incomes, underscoring the need to promote wider uptake of CSA.

The CSA Compendium: What is the evidence for climate-smart agriculture in Africa?

Author (s):

Todd Rosenstock, World Agroforestry (ICRAF), c/o INERA, Ave de cliniques, Kinshasa, DRC; *Christine Lamanna* (ICRAF), *Nictor Namoi* (ICRAF), *Hannah Kamau* (ICRAF), *Julia Shuck* (ICRAF), *Peter Steward* (ICRAF & University of Leeds)

Description:

Billions of dollars are being invested to catalyze a transition to climate-smart agriculture (CSA). These investments assume that changing farming practices can simultaneously improve food security, resilience and reduce emissions. However, there has been a lack of comprehensive information to evaluate this. Here we report results from an appraisal of the evidence base. We conducted a meta-analysis of the effects of 100 farm management practices on more than 50 indicators consistent with CSA goals. Our search of peer-reviewed articles produced nearly 50,000 candidate papers. Nearly 1,500 studies met our inclusion criteria. Mapping the location of the studies shows geographic and topical clustering in relatively few locations and around relatively few measures of CSA, indicating potential for bias. Furthermore, outcomes vary widely among studies and locations and are far from clearly positive or negative, suggesting the 'climate-smartness' of practices needs to be considered for local conditions and objectives to be meaningful. Co-located, cross-outcome research tends to be sparse except for a few practices. Thus, grand conclusions about synergies and trade-offs among CSA components may be unsupported. This meta-analysis provides the benchmark of CSA's scientific basis and can support the transition from hype to meaningful impact on the ground.

Flood-based rangeland restoration for improving productivity and resilience in drought-prone regions, Ethiopia

Author (s) :

Dr Tilahun Amede, Principal Scientist at ICRISAT; *Dr. Elisabeth Van den Akker*, Program manager, GIZ-Ethiopia; *Dr Asmare Dejen*, Vice President, Wollo University, Ethiopia

Abstract Description

Recurrent floods and drought in Eastern and Southern Africa have been profoundly affecting humans and livestock. An innovation approach, use using Water Spreading Weirs (WSW) as entry point to capture and spread the torrential flood emerging from neighboring highlands into rangelands of pastoral systems in Afar, Ethiopia. The landscape feature has changed from a barren field to a productive oasis within three years of intervention. The flood patterns and sediment loads created at least four different crop management zones, with various levels of management requirements. We developed farm maps showing differential fertility status of rehabilitated landscapes and identified best-bet technologies fitting to specific niches. The major 'agents' were community leaders, 'Kedoh Abbobati', who keenly debated and suggested changes in approaches and choices of interventions

considering local socio-cultural settings. Any violation of rules was reported to traditional judges/arbitrators to impose punishment on perpetrators. The livelihood change could be attributed to proper design of weirs, joint planning and execution, integration of best-fitting varieties for each management zone and developing simple GIS-based parcel level land to guide development partners. WLE CRP has been engaged in developing an innovation system approach to create local confidence, attract attention of government institutions and benefited pastoralists.

Uncovering the global potential of Climate-Smart Agriculture: insights from five years of CSA Country Profiles

Author (s) :

Andreea Nowak (ICRAF/formerly CIAT), *Caitlin Corner-Dolloff* (USDA/formerly CIAT), *Chase Sova* (Independent Consultant), *Godefroy Grosjean* (CIAT), *Miguel Lizarazo* (CIAT), *Evan Girvetz* (CIAT), Tam Ninh (CIAT), *Tobias Baedecker* (World Bank), *Svetlana Edmeades* (World Bank), *Ana Bucher* (World Bank), *Claudia Bouroncle* (formerly CATIE), *Sebastian Grey* (formerly CIAT), *Felicitas Roehrig* (formerly CIAT), *Andy Jarvis* (CIAT/CCAFS)

Description

When we look at CSA, what are the trends? Where, how, and what CSA technologies make the most difference? What are the biggest barriers to adoption? The CSA Country Profiles concept was developed five years ago to assess the state of climate challenges in agricultural sectors, CSA options, and enabling environments for CSA scaling. After completing 33 profiles across Africa, Asia, and Latin America, spanning nearly 300 production systems, we present a new dataset aggregating individual expert assessments of CSA technologies. Out of the diverse 1,700 combinations of production systems, regions, and technologies included, five technology clusters stand out, covering more than 50% of assessed practices. Context accounted for variation in practice smartness scores, yet at the regional level, clusters of practices considered 'smart' emerged. 'Smart' practices scored highest in productivity and adaptation, and roughly 90% of technology clusters also had perceived positive mitigation outcomes. Practices that were widely prioritized did not always have the highest 'smartness' scores, often due to adoption constraints, with training and information sharing as the biggest barriers. Further assessments of non-cropping systems and inclusion of integrated packages of technologies and enabling services (e.g. credit, information) will strengthen development of CSA transformation pathways.

Hot topic posters

Monitoring outcomes of climate-smart agriculture at multiple levels: understanding adoption synergies and tradeoffs

Author (s):

Osana Bonilla-Findji, International Center for Tropical Agriculture (CIAT) / CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS); *Anton Eitzinger,* International Center for Tropical Agriculture (CIAT); *Nadine Andrieu,* French Agricultural Research Centre for International Development (CIRAD) UMR Innovation / International Center for Tropical Agriculture (CIAT); *Gustavo Bejarano,* International Center for Tropical Agriculture (CIAT); *Mathieu Ouedraogo*, The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) / CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS); *Saaka Buah*, Savanna Agricultural Research Institute (SARI); *Robert Zougmoré,* The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) / CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS); *Andy Jarvis,* International Center for Tropical Agriculture (CIAT) / CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Description:

Despite major investment in CSA, efforts that perform detailed monitoring and evaluation of the most promising, locally and socially relevant climate-smart practices and technologies remain scarce. This work shows an integrated framework for monitoring climate smart agriculture in the field, with an associated set of standard indicators and a rapid and reliable ICT-based data collection instrument. The approach i) systematically assesses and monitors adoption trends, motivations and constraining factors at community level and ii) generates new evidence-based knowledge on location-specific perceived effects of CSA options at farm and household levels. To illustrate its use, we present the results obtained from its implementation in the Lawra-Jirapa Climate-smart village (Ghana) structured around three research questions: Who adopts what (typology of adoption)?; Which are the gender-disaggregated perceived effects of CSA options (assessed through 5 livelihood related indicators -agricultural production, income, food security, food diversity and adaptive capacity- and 5 gender indicators -participation in CSA related decision making, participation in CSA implementation and dis-adoption, control and access over resources and labour)? and Which are the CSA performance, synergies and trade-offs found at farm level (whole farm model analysis)?

Synergy or Antagonism: Interactions among CSA practices in Africa

Author (s):

Peter R Steward (World Agroforestry Centre, Nairobi, Kenya & School of Earth & Environment, University of Leeds, UK); *Todd S Rosenstock* (World Agroforestry Centre, Kinshasa, DR Congo); *Christine A Lammana* (World Agroforestry Centre, Nairobi, Kenya)

Description:

Many climate-smart agriculture policies and programs recommend integrating CSA practices to create portfolios that address multiple outcome needs, or to create practice synergies which substantially improve an outcome effect. However, very little is known about changes to productivity, resilience, and mitigation outcomes when CSA practices are combined. Here we review the evidence provided by the CSA Compendium, a large meta-dataset of African agricultural studies, to provide evidence for which practices work together and to highlight those lacking data. Mapping the evidence for practice interactions across multiple outcome indicators showed substantial data gaps across all the indicators analyzed with bias towards the reporting of yield productivity indicators compared to economic, soil quality or resilience indicators. Interaction data were also biased towards interactions containing fertilizer or tillage practices. A typology of antagonistic, averaging, sub-additive and super-additive (synergy) was used to classify practice interaction outcomes and effect-sizes were meta-analyzed. Many practice interactions outcomes showed a significant effect for their interaction type, whilst other interaction outcomes were variable in their classification suggesting context specificity. This provides useful quantitative evidence for decision making when considering CSA strategies that bundle different practices together.

Poster

More rice, less water and less greenhouse gas emissions in Colombia, Chile and Peru

Author (s):

Abubakar Halilu Girei (Main Author), *Myriam Guzmán*1; *Iván Avila*1; *Nelson Amezquita*1; *Gabriel Garces*1; *Viviana Becerra*2; *Gabriel Donoso*2; *Marta Alfaro*3; *Sara Hube*3; *Elizabeth Consuelo Heros*4; *Luz Gómez Pando*4; *Waldemar Mercado*4;*Alfredo Beyer*4; *Marta Ibañez*4; *Lia Ramos*4; *Sandra Loaiza*5; *Eduardo Graterol*7; *Álvaro Roel*8; *Hayden Montgomery*9, *Ngonidzashe Chirinda*5.
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Description:

Irrigated rice production systems are important sources of livelihoods and greenhouse gas emissions. Yet, the high water demands associated with irrigated rice production makes it vulnerable to conditions of limited or sporadic water supply and high air temperatures. A new collaborative multidisciplinary research project funded through

FONTAGRO is currently being implemented in Colombia (FEDERROZ), Chile (INIA) and Perú (UNALM). This project aims to compare socio-economic and environmental impacts of continuously flooded rice production systems to those of two water saving practices: safe alternate wetting and drying (AWD1) – for which water is allowed to dry to 5 cm depths and intense AWD2 for which water is allowed to dry to 10 cm depths. During two rice growing cycles, evaluations in each country are being conducted on-station. During the third cycle, to increase visibility of the water-saving practice among rice farmers, on-farm evaluations of the promising practice will be conducted. First cycle data on how the two water-saving practices increase resource use efficiencies and reduce greenhouse gas emissions, increase the competitiveness and sustainability of rice production will be presented. In addition, opportunities to increase uptake and, consequently, improve the climate resilience of Latin American's irrigated rice production systems will be discussed.

Climate-smart forages, a true and feasible triple win intervention

Author (s):

An Notenbaert, Tropical Forages Program, International Center for Tropical Agriculture (CIAT), P.O. Box 823-00621, Nairobi, Kenya ; *Michael Peters*, CIAT; *Jacobo Arango,* CIAT; *Stefan Burkart,* CIAT; *Juan Andres Cardoso*, CIAT; *Birthe Paul,* CIAT; *Valheria Castiblanco*, CIAT; *Rein Van der Hoek*, CIAT; *Sabine Douxchamps*, CIAT; *Solomon Mwendia,* CIAT; *Uwe Ohmsted,* CIAT

Description:

The livestock sector is important for people and planet alike and plays a crucial role in achieving the SDGs. Due to its high GHG emissions, the livestock sector is a main target for mitigation action. At the same time, climate change causes major impacts on livestock. Adaptation will be needed if millions of livestock dependent farming households are to cope. Forages with high productivity and nutritional quality adapted to specific edapho-climatic conditions can provide animal feed throughout the year while reducing GHGe. They are amongst the most promising climate-smart options in the livestock sector. This paper summarizes on-going and future plans of CIAT's Tropical Forages Program and its partners to contribute to the wide-scale implementation of this true triple-win intervention. Through its targeted breeding program and regional teams integrating improved forages into local livestock production systems, the program aims at simultaneously enhancing:

(i)   Livestock production: Improved feeding strategies can increase production of safe and nutritious livestock products and the income of livestock keepers.

(ii) Climate change resilience: Improved and well-adapted feed crops and can contribute to the resilience of livestock production systems.

(iii) GHG emission intensity: The provision of feeds and forages of higher digestibility is a well-documented mitigation option.

Towards resilient rice-wheat systems: Social-ecological dynamics of rice planting activities in the Indo-Gangetic Plains

Author (s):

Anton Urfels (CIMMYT), *Andrew McDonald* (Cornell), *Gerardo van Halsema* (WUR), *Paul Struik* (WUR), *Timothy Krupnik* (CIMMYT)

Description:

Wise timing of crop planting activities is crucial for climate smart agriculture. The impact of climate extremes on crop growth depends on the growth stage of the crop, which depends on planting date, cultivar choice and temperature. Terminal heat stress in wheat crops of the Indo-Gangetic Plains has become a major concern and basis for advocating early planting of the preceding crop – rice – in the region. But the factors influencing rice planting dates remain widely unknown. We address this knowledge gap and investigate the social-ecological dynamics around rice planting in the Indo-Gangetic Plains. We apply advanced statistical methods like random forests and clustering to a dataset of 10 000 farmers, and conducted focus group discussions, quantified participatory methods, and graph theory to a subset of the sample. Our findings indicate that heterogeneity in planting activities is best explained by socio-hydrological units: an irrigation focused framework accounting for the local configurations of social-ecological factors. In addition, we suggest that research is required on (i) climate dynamics before planting (ii) landscape level pest and disease dynamics and (iii) collective action issues. Combining these factors with insights from socio-hydraulic units will support the scaling-up of improved planting activities.

Development of Agricultural Irrigation Priority Area Scheme Based On Rainfall And Soil Moisture Content In Indonesia

Author (s):

Armi Susandi, Mamad Tamamadin, Aristyo R. Wijaya, Angga F. Fauzan, Alvin Pratama, Irvan Faisal (Institut Teknologi Bandung)

Description:

One alternative in dealing with uncertainty in the amount of water for planting activities is through the application of agricultural irrigation systems. However, in its implementation, the distribution of irrigation systems in Indonesia is not evenly distributed according to the priority based on the condition of soil water content availability. To overcome this problem, this study uses rainfall and groundwater content parameters and implements a network-optimization-algorithm method that is resolved iteratively to calculate the water discharge that enters the paddy field (atau rice emang istilahnya?) cluster. Simulation is made based on 3 climate scenarios, namely normal, wet and dry climate and tested in the Cimanuk River Basin. The scheme is able to provide information on the availability of water every month and can anticipate water deficits conditions in irrigated land in agricultural areas.

Landsharing for climat smart lanscapes in dry and humid tropical livestock areas

Author (s):

Blanfort V. 1,2, *Vayssières J.* 2,4, *Assouma M.H.*2,4, *Plassin S.*2,3 , *Poccard-Chapuis. R.* 2,3

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Description:

Livestock activities present large GHS emissions, especially in the Southern countries, but in the same time high potentialities for mitigation and adaptation. Promoting a transition to explore theses potentialities is a key challenge for CSA. The communication propose a strategy based on landscape structure designing in Amazon and Sahel, we discuss the contributions of landscape sharing or sparing debate.

In the Amazon, research references about the mitigation capacities of managed pasture and forest can improve practices. New landscapes are appearing, with land use matrixes highly efficient to produce ecosystemic services, for production and conservation objectives. Forage diversification and forest connectivity are key to increase the adaptability to CC. In West Africa, research conducted at landscape level underlined the capacity of extensive pastoral systems to mitigate the GHG emissions with carbon sequestration in soil and vegetation. Village terroirs were traditionally built around a complementary between rangelands and cultivated areas. The challenge is to keep this equilibrium to ensure nutrient spatial transfers, C soil sequestration, and food productivity.
An adapted governance to promote these landscape structure appears therefore as a key factor determining the land sharing level and the performances of these livestock agro-ecosystems face to CC (mitigation, resilience and productivity).

Acting locally and contributing globally: Tharu local knowledge and practices for climate-resilient agriculture in Nepal

Author (s):

Buddhi Chaudhary, Gregory Acciaioli, and *William Erskine*, The University of Western Australia

Description:

Local knowledge can function as a basis of innovation in agriculture because it is not only culturally accepted, but also environmentally adaptive. The debate and misunderstanding

between local and scientific knowledge is reducing and there is a trend to integrate all available knowledge to deal with complex issues such as climate change. Therefore, in this study we explore traditional understandings of Tharu farmers concerning weather and their farming system in the nexus of climate change for adaptation and mitigation, presenting an ethnographic analysis of the specific agriculture practices based on participant observation and a survey of 229 households in the western tarai of Nepal. We found that conservation-oriented agricultural practices, such as relay cropping and zero-tillage, are still important for the farming system in the study area. River-bed farming is practiced in flood-prone areas as an alternate livelihood option, mostly by landless and small farmers. Additionally, we also describe the continuing usage of traditional earthen grain storage ware called dehari. We conclude that local knowledge regarding weather and agriculture practices assists in making informed decisions for climate resilient and low emission agriculture. However, further research on the sustainable productivity of such practices is required before their widespread dissemination.

Data-Driven Approaches for Selecting and Assessing Climate-Smart Agriculture Technologies in Tanzania

Author (s):

Christine Lamanna (World Agroforestry Centre), *Barnabas Kurgat* (Laikipia University), *Anthony Kimaro* (World Agroforestry Centre), *Caitlin Corner-Dolloff* (USDA), *Sabrina Chesterman* (World Agroforestry Centre), *James Hammond* (ILRI), *Mark van Wijk* (ILRI), *Todd S Rosenstock* (World Agroforestry Centre)

Description:

Two of the biggest challenges for climate-smart agriculture projects are selecting CSA practices and technologies that are the most suitable for the given local context and assessing whether trialed options are performing well. Numerous methodologies exist for both practice selection and field-assessment, but they are often costly and time-consuming to implement, and not necessarily transferable across sites, contexts, or projects. Here we piloted the use of a single customizable survey tool, the Rural Household Multi-Indicator Survey or RHoMIS, for use in both selecting and assessing CSA technologies in a USDA-funded CSA project in Tanzania. We conducted more than 800 RHoMIS interviews with smallholder farmers in four regions of Tanzania: Zanzibar, Dodoma, Iringa, and Tabora. Data from the short one-hour survey was used to select practices by matching activities that directly contribute to farmers' livelihoods to CSA options, for example by focusing on climate-smart poultry in Zanzibar. We also assessed the drivers of adoption for CSA and found that land ownership and food insecurity were significant predictors. Data-driven approaches such as this can improve the likelihood of success of CSA projects while also lowering the barriers for data collection, and contributing standardized data for a global understanding of CSA.

Climate change and the strength of organic farming in adaptation and mitigation – a debate in Germany

Author (s):

Claudia Heidecke, Bernhard Osterburg, Hans Marten Paulsen, Jürn Sanders (all Thünen-Institute, Germany)

Description:

Organic farming can contribute to climate adaptation and climate mitigation in agriculture in various ways. Adapting to climate change should generally be enhanced by its diverse farm production patterns, crop rotations as well as soil conserving management. This preserves soil moisture and combats erosion. In mitigation of greenhouse gases organic farming can help to reduce emissions by the ban of mineral fertilizer application and enhanced soil carbon sequestration. In Germany's sustainability agenda, an expansion of organic farming to 20 percent of utilized agricultural area by 2030 has been set as a target, and also climate mitigation programs refer to this goal. However, the effect of organic farming on a reduction of greenhouse gas emissions is highly dependent on management and site conditions. Locally area related emissions are low and adaptation force can be high. But its lower yields compared to high input farming systems, possible leakage effects and consequences for food consumption must be evaluated on a national and global level. With the analysis of land use statistics and the evaluation of data on productivity in organic farming, we show the potential of regional and farm type specific expansion of organic farming in an ambitious climate mitigation policy in Germany.

The value of soil carbon sequestration to mitigate greenhouse gas emissions from grazing livestock

Author (s):

Corina E. van Middelaar, Raimon Ripoll-Bosch, Imke J.M. de Boer. Animal Production Systems group, Wageningen University & Research

Description:

This study assesses the value of soil carbon sequestration (C-seq) in grasslands to mitigate greenhouse gas (GHG) emissions of livestock systems, taking into consideration time-effects and intrinsic differences between long- and short-lived GHGs. Emissions of methane (CH_4, short-lived) and nitrous oxide (N_2O, long-lived) of grazing cattle, and uptake of carbon dioxide (CO_2, long-lived) in grassland soils were modelled for different grazing systems over 200 years. The climate impacts of emissions and uptake were simulated by using assumptions about radiative efficiency and atmospheric lifetimes in accordance with IPCC AR5. Due to a different lifetime, permanent soil C-seq could counteract emission of CH_4, but to do so for an annual emission of 80 kg CH_4 cow-1, 1000 ha of grassland permanently storing 300 tons CO_2 ha-1 is required. In case of N_2O from manure deposited during grazing of one cow with an annual excretion of 100 kg N, the benefit of C-seq

will be offset within decades. We concluded that when accounting for time-effects and intrinsic differences between GHGs, soil C-seq cannot be considered an effective strategy to mitigate GHGs from livestock.

Climate Resilient Rainfed Agriculture: Coping mechanisms in real-time

Author (s):

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Description:

Climate risks are best addressed through incorporation of adaptation and resilient practices in agriculture to increase the capacity of the system to respond to various risks like drought by resisting damage and ensure quick recovery. Real-time contingency planning implementation with two pronged approach i.e. preparedness and real-time response supported with village level institutions and convergences the immediate adaptation strategy to manage weather aberrations in rainfed agroecologies. The experiences under National Innovations in Climate Resilient Agriculture (NICRA) indicated that real-time contingency plan (RTCP) measures under delayed onset of monsoon conditions like suitable crops and varieties gave about 15-35% higher yields; crop, soil and in-situ moisture management measures during early season drought gave 16-31% higher yields while foliar sprays and protective irrigation from the harvested rainwater during mid-season and terminal drought resulted in yield increase up to 55%. In order to realize the potential economic and societal benefits, mainstreaming and of climate resilient practices on real-time basis in to developmental programs for scaling up will be a win-win adaptation strategy for achieving climate resilient rained agriculture, further to enhance the adaptive capacity of rainfed farmers.

Climate change and demand led plant breeding: hitting a moving target

Author (s):

Graham Thiele, Hugo Campos, Michael Friedmann, Bettina Heider, Thiago Mendes, David Ramirez, Bert de Boeck, and Maria Andrade - International Potato Center

Description:

Varietal development has been one of the great successes of the CGIAR. Currently there is a shift to demand-led breeding structured around well described product profiles to inform breeding approaches and accelerate genetic progress. However, the new paradigm

has not fully grasped complex challenges from climate change which could markedly increase food insecurity. Varieties will need to respond to hotter and drier conditions, more extreme and unpredictable climate events, higher salinity with rising sea levels, and more attacks from pest and diseases. The presentation describes and illustrates with examples from potato and sweetpotato a six-step framework for climate-smart breeding which entails: (1) foresight with downscaling climate change models and crop modeling to anticipate the types of varieties and traits smallholders would require in 20 and 50 years; (2) identifying and understanding key climate change responsive traits; (3) transforming breeding and varietal selection by drawing on our increased knowledge of the genome with next generation tools such as gene editing and applying high through-put phenotyping; (4) using big data and advanced statistics to understand how varieties respond in target environments impacted by climate change (5) developing management options for climate-smart varieties; and (6) climate proofing seed systems.

Fostering agricultural and non-agricultural livelihood transformation in rice-based landscapes in the Philippines

Author (s):

Jon Hellin (IRRI), *Sudhir Yadav* (IRRI), *Eleanor Fisher* (University of Reading), *Mary Ann Batas* (IRRI), *Jean Balie* (IRRI), *Ajay Kohli* (IRRI), *Mel Connor* (IRRI), *Ole Sander* (IRRI), *Nafees Meah* (IRRI) and *Reiner Wassman* (IRRI)

Description:

The tendency to homogenize farmers leads to ineffective targeting of climate smart agriculture (CSA). This undermines farmers' differential capacity for livelihood transformation, and stymies achieving Sustainable Development Goal (SDG) # 13 Climate Action and # 1 No Poverty (by excluding the poor and/or including those for whom agriculture is not a pathway out of poverty). "Climate smartness" requires an agenda that supports farm households to build non-farm and non-agriculture-based livelihoods. This requires a deep understanding of farmers' social, cultural, political, and economic relations and interventions to foster changes in attitudes and behaviors. Transforming food systems requires cross- and inter-disciplinary research-for-development. The climate change discourse (that has tended to focus on adaptation and/or mitigation) needs to accommodate "political" issues such as uneven power relations. Failure to do so undermines CSA being a mechanism for agricultural transformation. Initiatives in rice-based systems in the Philippines, reported here, illustrate an approach to build the knowledge base for agricultural transformation. This approach recognizes extant stakeholder heterogeneity, builds genuine partnerships, highlights trade-offs, and negotiates the emergence of a mosaic of agricultural and non-agricultural climate-smart transformation at the landscape level.

Enabling the breeding of climate-smart crops

Author (s):

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Description:

Climate change is projected to reduce agricultural productivity during the 21st century. Concomitantly, crop production will have to increase significantly to meet ever-increasing food demands. One such way of increasing yields is to develop climate-adapted cultivars through crop improvement; that is, breeding climate-smart crops. The breeding of climate-smart crops is contingent on having a clear set of target stresses and geographic areas on which the breeding program focuses. However, is this the case? This presentation addresses this question by drawing from various experiences across crops and regions, including rice (Colombia, Brazil), beans (Colombia, Brazil), and forages (Africa). In all these, climate-smart breeding is being effectively enabled through a combination of crop-climate modeling and data analysis in an approach known as Target Population of Environments (TPE). The TPE approach has allowed, for instance, the Brazilian upland rice and bean breeding programs to justify a significant focus on drought during early stages in the selection process. Similarly, it is allowing the identification of heat-stress environments for bean breeding, as well as the establishment of a forages breeding program for East Africa, focusing in three environments and for which the first stages of selection are conducted in representative sites in Colombia.

Assessing the Potential of Climate-Smart Crop Insurance in Ghana: The Case of Cocoa.

Author (s):

Lawton Nalley, Professor University of Arkansas, Department of Agricultural Economics, llnalley@uark.edu; *Justin McKinley,* Monash University; *Rebecca Asare,* Nature Conservation Research Centre; *Bruce Dixo*n, University of Arkansas, *Jennie Popp,* University of Arkansas and *Marijke D'haese,* Ghent University

Description:

Cocoa production in Ghana increases deforestation as poor landholders encroach into forests to expand production. The management practices proposed in Climate-Smart

Cocoa (CSC) can increase livelihoods while concurrently abating deforestation. This study investigates how yield and yield variation are affected by the adoption of CSC practices in order to determine the feasibility of a CSC crop insurance program in Ghana. To answer this question, we use a data set of twelve hundred cocoa farms representing five regions, 19 districts, and 109 villages in Ghana. These producers are then divided into two groups: those following CSC practices and those not following; then we used a multiple regression model to estimate yield and used the parameters of the model to simulate yields for CSC and non-CSC producers in each of the 19 districts. Our results show that producers who followed the CSC recommended practices had higher estimated yields by 19–25% (P<0.05), were 5–25% (P<0.05) less likely to have a yield loss large enough to receive an insurance payment, and the total expenses associated with indemnity payments in an insurance program were 20% less for CSC producers.

Food Forests – A key contributor in the transition of future urban food production

Author (s):

Luke J. Schafer, Lisa Lehmann, Stine S Holst, Josefine Nytofte, Marin Lysák , Christian B. Henriksen

Description:

Food forests as a multifunctional agroforestry system offer an emerging opportunity to aid the transition of urban areas into local food production hubs that are low cost, low maintenance, low emission and highly resilient. Food forests are consciously designed polycultures primarily based on perennials modelled to mimic natural woodlands with minimal management interference to create a diverse, self-replicating and mutually beneficial system to directly or indirectly benefit humans. Our research on temperate food forests show that 1 ha of food forest could potentially supply a balanced diet for 3-4 people and a mature food forest storing 39.53 ± 4.05 Mg C ha-1 in above ground biomass, highlighting its potential as a carbon sink under reforestation initiatives. Furthermore, we found that working in a food forest positively influence a community's connectedness to nature, health and wellbeing and individual awareness of environmental issues including climate change. One of the challenges that we have identified is the establishment of food forests that could potentially be improved by innovative solutions such as a combined seed and weed mat based on recycled plant material. Future food production needs to integrate with our cities and food forests could contribute to the transition of urban food systems.

Next-generation modelling approaches for real time pest predictions and sustainable crop protection

Author (s):

*Mamta Sharma*1*, *Ramanagouda G*1, *Amrender Jha*2, *Jaba Jagdish*1, *Raju Ghosh*1, *AG Sreenivas*3, *Sharath Chandran US*1
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2. ICAR-IARI, New Delhi-110012, India
3. UAS, Raichur-584104, Karnataka, India

Description:

The combined pre and post-harvest insect-pest and disease infestation causes an annual estimated 40-50% of total produce loss. Overall loss of attainable yield is more severe in the Asian and African continents because of transboundary insect pests, inconsistent access to crop protection products and lack of preparedness. Solicit innovative, digitally enabled low-cost climate smart pest management technologies for real-time pest forecasting and decision support systems (DSSs) are of great significance and inevitable. Considering this, efforts have been made to develop weather based forewarning models for pests in Chickpea and Pigeonpea (Helicoverpa, Phytophthora blight) and Cotton (Aphid, Leaf hopper, thrips, whitefly) for forewarning time of first appearance of pest, maximum severity/pest population vis-à-vis' crop age. Using weather indices, models were obtained through step wise regression technique and machine learning (artificial neural network and Bayesian network) techniques. In general, the models fitted well for all the available data and have good agreement between forecasts and observed status. Predictive ability and accuracy of models will be validated through cross-location and cross-year models. Further, development of Hybrid Mobile App with Microsoft Azure and promoting e/m-participation will help in dissemination of information to end users for real-time pest monitoring, prediction and crop protection advisory.

Effect of introducing balanced rations on greenhouse gas emissions from Indonesian small-scale dairy farms

Author (s):

Marion de Vries (Wageningen University and Research), *Edi Sadana* (Wageningen University and Research), *Deni Suharyono* (KPSBU Jabar, Indonesia), and *Bram Wouters* (Wageningen University and Research)
Description:

Small-scale dairy farmers often do not adjust the feed ration of individual cows to their milk yield and lactation stage. This can increase greenhouse gas (GHG) emissions from dairy farms due to sub-optimal milk production, health and fertility of cows, and inefficient use of feed resources. The aim of this study was to evaluate effects of feeding dairy cows according to their individual requirements on GHG emissions in 15 small-scale dairy farms in Lembang, West-Java, Indonesia. A dry-season balanced ration was formulated for each

individual dairy cow considering farm-available feed resources. For each farm, a life cycle assessment was conducted to calculate potential changes in total cradle-to-farm gate CO_2, N_2O and CH_4 emissions per farm due to the introduction of balanced rations. Results showed GHG emissions per farm decreased by 0.3 to 15.0% on 6 farms, and increased by 0.2 to 13.2% on 9 farms. Reduced GHG emissions were mainly due to reducing the amount of compound feed per cow, whereas increased GHG emissions were mainly due to increasing the amount of roughage per cow. As a next step, effects of balanced rations on GHG emissions per kg of milk will be evaluated by including estimated changes in milk yield.

Analysis of potential value chains for scaling up Climate-Smart Agriculture in West Africa

Author (s):

Mathieu Ouedraogo, Samuel T. Partey, Prosper Houessionon, Robert Zougmore
The CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS), West Africa, ICRISAT-Mali

Description:

Numerous success stories from West Africa (WA) prove that climate-smart agriculture (CSA) is the way forward to address food insecurity in the context of climate change. Despite the development of several CSA options and their positive gains, their wide scale adoption remains low in WA. The value chain (VC) approach sounds positioning as one effective upscaling approach of CSA. The EU-funded project "Developing climate-smart VC and landscapes for increased resilience in WA" will identify technological/institutional CSA options to benefit VC actors through enhancing VC's contribution to income and food security. This paper aims to identify and characterize promising VCs that can support the uptake of CSA in four WA countries. From a review of development projects in Ghana, Mali, Niger and Senegal, 2 to 3 VC projects were selected based on their viability under climate change and variability. The selected VC were analyzed to identify their strengths and weaknesses. A climate risk analysis was done to prioritize specific climate-smart interventions that address the most critical climatic risk. Through this study, a list of promising climate-smart VCs as well as CSA options with good potentials for business case in the four countries were defined for further mainstreaming into selected Value chains.

Enhancing nutrient-rich fisheries in seasonally flooded rice fields in southern coastal areas of Bangladesh

Author (s):

Md. Emdad Hossain, Harun Or Rashid, A.T.M. Eunus, Sarmin Siddiki • Benoy Kumar Barman, Martin Louis van Brakel (WorldFish-Bangladesh and South Asia Office)

Description:

In many different ecosystems fish production is declining due to environment change, overfishing and human impact. Fishers, communities and scientist have been challenged to find ways to improve fish production, maintain biodiversity and increase food security potential. Natural fish production in rice fields is enabled by the migration of fish when they become inundated. Conversely, fish production decreases during dry periods as because the rice fields are become shallow gradually by siltation, high temperature as well as high catch pressure. The present study developed microhabitats to enhance the abundance & production of small indigenous species in the rice fields. Three intervention and two control rice fields were selected for this study. A total of 290 sets of rings (microhabitat) were installed in the research sites. Water quality data showed that microhabitats were a more favorable environmental for fish than rice fields during the dry season. Fish availability in intervention areas increased 49% compared with that of control rice fields. Finding showed that 90% of fish captured from rings were consumed by farmers. Our evidence suggests that by increasing survival of fish during dry periods the installation of microhabitats ensured fisheries potential of rice fields leading to increased availability for household consumption.

Conservation Agriculture and Sustainable Development Goals: A meta-analysis from South Asia

Author (s):

ML Jat, International Maize and Wheat Improvement Center (CIMMYT), New Delhi India, *Debashish Chakraborty,* ICAR-IARI, New Delhi, India, *DS Rana,* IRRI, New Delhi, India, *Mahesh K Gathala*, CIMMYT Bangladesh, Dhaka*, JK Ladha*, *US Davis*, California, USA and *Bruno Gerard*, CIMMYT Mexico

Description:

Agriculture in South Asia is highly vulnerable to climate change and the region has emerged as Global Hotspots. It is a paradox that though the region enjoys high economic growth, at the same time suffers from extreme poverty, undernourishment, and the deterioration of its natural resources. The natural resources of the region are severely constrained due to mounting pressure to produce more for more population. Conservation agriculture (CA) adopted over 180 million hectare globally have paid dividends for making agriculture more efficient and sustainable, arrest land degradation, protect natural resources and produce more without negative environmental externalities. In South Asia, CA based sustainable intensification practices have been researched and deployed to address many of these challenges. During past 5 years, evidence on performance of CA have been generated through participatory research in CCAFS Climate Smart Villages and elsewhere. We undertook a meta-analysis of 8359 paired data points across South Asia and generated evidence on performance of CA on key parameters (yield, protein, water, profits, GHGs, soil health, adaptive capacity to climatic risks etc). CA has potential to contribute to the UN Sustainable Development Goals through alleviating the multiple stresses including emerging social issues currently faced by agriculture in South Asia.

Ex-ante mapping of favorable zones for disseminating CSA technologies: a case study in West Africa

Author (s):

Andrieu Nadine, UMR Innovation CIRAD, DAPA CIAT; *Dumas Patrice,* UMR CIRED CIRAD *Hemmerle Emma*, UMR CIRED CIRAD; *Caforio Francesca,* UMR Innovation, CIRAD; *Blanchard Mélanie,* UMR Selmet, CIRAD, NIAS; *Falconnier Gatien,* UPR AIDA, CIRAD; *Vayssières Jonathan,* UMR Selmet, CIRAD

Description:

This communication presents a pilot exercise aiming to map areas in West Africa suitable for the adoption of four potentially climate-smart technologies: intercropping cereals and cowpea, agroforestry, mulching, and fodder crops (Mucuna). This mapping considers biophysical (eg. soil, rainfall, temperature), socio-technical (eg. animal and human densities) and institutional variables (policy documents) to define "unfavorable", "more or less favorable" or "very favorable" zones for the adoption of these technologies. It shows that few zones are considered "very favorable" for the four practices considered. Mulching could be feasible in the largest area while cultivating Mucuna had the most limited area of feasibility. While the area in which the agroforestry technology could be feasible is extensive, no "very favorable" zone was identified. This illustrates the complexity of technology adoption processes. Nonetheless, by delineating areas where synergies exist or not between these different biophysical, socio-technical and institutional dimensions, it is possible to define differentiated strategies for the transition towards climate-smart agriculture (CSA). The limitations of the method are presented along with its possible uses, particularly to guide decision-making by development actors seeking to expand CSA in sub-Saharan Africa.

Assessing Climate Smartness of Solar Powered Irrigation Systems

Author (s):

Paresh B Shirsath (Associate Scientist, CCAFS-BISA-CIMMYT); *Sakshi Saini; Nilanjan Ghose; Diego Senoner,* and *Pramod K Aggarwal*

Description:

Agriculture though being one of the most vulnerable sector to climate change, has significant potential to curtail greenhouse gas emissions. This dual role has also been recognized by the Paris Agreement. Agriculture is one of the major contributors of GHG emissions and significant portion of these emissions coming from electricity used for groundwater pumping. Recently, with steep decline in prices of photovoltaic modules the solar powered irrigation systems (SPIS) are increasingly being used in many parts of the world.

This paper presents an assessment of SPIS as a technology to adapt and mitigate

climate change in India. This was done using a primary survey across seven Indian states representing regions with diverse agro-ecologies and ground water availability. The evaluation was done under three indicators of climate smart agriculture viz., adaptation, resilience and mitigation using indicator based framework. Results exhibit significant potential of SPIS in increasing adaptability and resilience of community, with increase in food production and income (75% respondents). Simultaneously it is substituting existing electric and diesel pumps (70%) leading to reduction in GHGs.

Turning to rice cultivars for solving the methane puzzle in irrigated rice systems

Author (s):

*Paul Soremi*1,2, *Eduardo Graterol*1, *Maria Fernanda Alvarez*1, *Ngonidzashe Chirinda*1
1. Latin American Fund for Rice for Irrigation (FLAR), International Center for Tropical Agriculture (CIAT), Cali, Colombia
2. Department of Plant Physiology and Crop Production, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria

Description:

Previous studies have reported that varietal differences in the amount of emitted methane (CH_4) are associated to some phenotypic traits, as tiller numbers; leaf area and quantity; grain starch content; duration in the field and the aerenchyma structure. We conducted a field study to explore the potential of different commercial rice cultivars to contribute towards the mitigation of CH_4 emissions from irrigated rice systems in Latin America and the Caribbean (LAC). Data were collected on those phenotypic traits and others like grain yield. Results show varietal difference in key parameters regulating CH_4 emissions from rice fields. These findings suggest that by exploiting differences in key factors regulating CH_4 emissions, we can accelerate the transition towards low emission rice production systems in LAC.

Carbon footprint in bovine dual-purpose systems in Colombia and identification of low emission practices
Author (s):

Ricardo González-Quintero (1;2); *Rolando Barahona-Rosales* (3); *Ngonidzashe, Chirinda* (1) *Jacobo Arango* (1), H; *Heiber Pantevez* (4); *Diana María Bolívar-Vergara* (3); *María Solange Sánchez-Pinzón* (5)
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5. Compañía Nacional de Chocolates, Rionegro, Antioquia.

Description:

In Colombia, cattle production generates the largest amount (31%) of greenhouse gas (GHG) emissions from the agricultural sector. Dual-purpose systems account for 39% of the cattle population, and 58% of the milk production. Yet, as studies on GHG emissions from dual-purpose cattle are limited, there are challenges in identifying appropriate GHG mitigation actions. We quantified the carbon footprint (CF) per kg of fat and protein corrected milk (FPCM) and per kg of live weight gain (LWG) for these systems. A total of 1313 farms were surveyed, and a Factorial Analysis of Mixed Data and a cluster analysis were conducted. Three clusters were identified and the farms closest to their centroids were selected. A "cradle to farm gate" system boundary and an economic allocation approach were used. The CFs for cluster 1 (2.0 kgCO2-eq/kgFPCM and 8.5 kgCO2/kgLWG) were the lowest among clusters. Cluster 1 farms were characterized by placing greatest emphasis on milk production and by implementing better agricultural practices and had better productive and reproductive parameters. Our results suggest that it is possible to improve the economic and environmental performance of farms with modest investments, by adopting good agricultural practices such as planting grass, fertilization, weed control, and rotational grazing.

Creating Climate-Resilient Farmers through Smarter Agricultural Technologies and Systems

Author (s):

Rosemarie Laila D. Areglado, Decibel V. Faustino-Eslava, Maria Victoria O. Espaldon, Loucel E. Cui, Moises A. Dorado, Maria Regina V. Regalado (all from the University of the Philippines Los Baños)

Description:

Agriculture's vital role in the Philippine economy and food security is constantly being threatened by climate change. As a developing country, the Philippines is among the hardest hit by climate change. In this line, advancement in science and technology have paved way to address the gaps for further refinement of crop forecasting methodologies to generate more accurate and timely crop estimates. With the government-funded project entitled "Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines" also known as Project SARAI, the Philippines is now in a position to incorporate Crop Forecasting System methodologies in order to provide stakeholders in the agricultural system much needed crop-climate information. Project SARAI is an integrated crop monitoring and forecasting system that provides near real-time crop advisories to our agricultural sector, particularly on weather, major crop production status, crop assessments and early warnings using Crop Simulation Model, Geographic Information System, Remote Sensing, and Vegetation Indices. With technology barriers slowly dissipating and data gaps being gradually filled in, the Philippines with the help of Project SARAI will be able to provide stakeholders critical information in formulating management strategies to address issues regarding food security and sustainable crop production.

Analyzing Synergies and Trade-offs to Identify Low Emissions Development Pathways in Semiarid Agriculture in India

Author (s):

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1. International Crops Research Institute for the Semi-Arid Tropics, Hyderabad, TS, 502324, India
2.   CSIRO Agriculture & Food, 306 St Lucia QLD 4067, Australia

Description:

Low-Emissions Development is the emerging paradigm to achieve triple win solutions in agriculture: productivity, adaptation and mitigation. This case-study examines opportunities for synergies between agricultural productivity, whole-farm profitability and GHG mitigation and explores how smallholder systems can be designed and managed to balance synergies and trade-offs. We used data from 100 farm-households of Telangana state, India. Quantifying synergies and trade-offs we employed crop, livestock and whole-farm simulation models, and Cool Farm Tool to estimate net GHG-emissions. Analysis revealed, plot-level crop-management and farm-level enterprise interventions have the potential to achieve synergies between profitability and mitigation outcomes. Combinations of reduced tillage, retaining crop-residue, improved nitrogen management, utilizing organic manure, improved livestock feeding practices, introducing agro-forestry could contribute to GHG abatement and improved profitability at our study-site. Such multi-model systems analysis using participatory design and tools could help practitioners and policymakers to identify and promote practices that achieve multiple objectives and guide investments towards synergistic climate-smart agriculture strategies. Our study contributes empirical evidence on integrated approaches to SDGs and adaptation and mitigation objectives.

Efficiently mitigating climate change through climate smart agriculture practices for smallholder farmers of Bangladesh

Author (s):

Sheetal Sharma, DS Rana, (International Rice Research Institute, New Delhi, India) *M Akter, M M Haque,* and *M R Islam* (Bangladesh Rice Research Institute, Gazipur, Bangladesh)

Description:

The economy of Bangladesh is heavily dependent on the agricultural sector, which is dominated by marginal farmers; linking farmers to practices that mitigate greenhouse gas (GHG) emissions and improve production efficiency could have significant economic and environmental benefits. The climate smart village (CSV) model, a community-based approach to sustainable agriculture provides common platform to various stakeholders to collaborate and identify the most appropriate climate smart agricultural practices (CSAP) to tackle local challenges related to climate change. While various agriculture

technical solutions provide potentials to deliver CSV benefits, assessing which option is most efficient and synergetic in any particular context is a critical necessity for effective scaling-up. Therefore, activities on CSAPs were instigated at different villages of Gazipur and Kishoreganj districts of Bangladesh since 2015.. Cool Farm Tool (CFT) Beta-3 and Mitigation option tools (MOT) were used to assess mitigation potential of various practices. Based on the information, the study finds that the crop production strategies are inadequate to deal with seasonal weather shocks and emerging threats of mitigation and adoption. In order to enhance the potential roles of the CSAPs, adaptation with improved crop varieties and capacity building of farmers in relation to climatic shocks is must.

Climate Smart Irrigation through Solar Irrigation Entrepreneurs

Author (s):

Shilp Verma (Consulting Researcher, IWMI); *Tushaar Shah* (Senior Fellow, IWMI); *Neha Durga* (Pre-Doctoral Fellow, IWMI-Tata Program); *Gyan P. Rai* (Pre-Doctoral Fellow, IWMI-Tata Program); *Dhiraj Kumar* (Field Manager, AKRSP-I)

Description:

Falling unit costs and ambitious government schemes are ensuring that solar irrigation pumps are growing at a compound annual growth rate of 64% in India. Despite abundant groundwater endowment, smallholder agriculture in the Gangetic floodplains of eastern India remains unrewarding. While many factors contribute to low agricultural productivity, lack of farm power supply and the high cost of diesel-powered irrigation are significant contributors. Here, solar-powered irrigation pumps can significantly improve agrarian incomes and improve climate resilience while lowering the carbon footprint of the region's groundwater irrigation economy.

This paper discusses a novel experiment of promoting solar irrigation entrepreneurs in Chakhaji village in north Bihar. The field pilot promoted seven 'Solar Irrigation Service Providers' (S-ISPs) and helped them acquire solar irrigation pumps and buried pipelines. Now in its third year of implementation, our data shows that the experiment has reduced cost of irrigation by more than 60%; increased value of agricultural output by 50%; and avoided more than 50,000 kilograms of CO_2 emissions. Compared to government-promoted individual solar pumps, solar entrepreneurs require much less capital subsidy and ensure affordable irrigation access for scores of poor farmers. The approach can be replicated across Gangetic plains in eastern India, Nepal Terai and Bangladesh.

Evaluating land suitability and potential climate change impacts on feedstock production for resilient livestock in Ethiopia

Author (s):

Sintayehu Alemayehu (CIAT-CCAFS); *Essayas Ayana* (TAMU); *Yihun Dile* (TAMU); *Yohannes Yimam* (TAMU); *Evan Girvetz* (CIAT); *Dawit Solomon* (CCAFS-EA); *Ermias Betemariam* (ICRAF); *Lulseged Desta* (CIAT); *Wuletaw Abera* (CIAT)

Description:

Ethiopia has the largest livestock population in Africa with an estimated 35 million tropical livestock units. The production system relies on natural open grazing, which is often affected by frequent droughts. This study evaluated land suitability, supplemental irrigation needs and potential climate change impacts on feedstock production for resilient livestock systems. It also provides evidence to livestock producers and policy makers current and future scenarios and feedstock production in Ethiopia including EC/IFAD project sites to improve livestock system in the country. The land suitability analyses were conducted based on biophysical and climatic factors using a Multi-Criteria Evaluation & GIS approach. A suitability level was assigned for each parameter based on the FAO land suitability classification. Results show that projected changes in climate alters temperature and rainfall regimes across Ethiopia. Highly suitable area under current climate scenarios ~472,000 km2 (43%), moderately suitable ~397,000km2 (36%) and marginally suitable covered ~16,200km2. Expansion of suitable land occurred in the highlands where climate scenarios predict an increase in temperature and precipitation. Areas that show a rainfall deficit under all climates scenario were, mostly in the lowland or dryland regions. This research provides guidelines for what to grow in certain geographic areas considering ecological and climate variability.

Combating Conflict and Displacement by Reducing Climate Vulnerability and Supporting Resilient Rural Livelihoods in Afghanistan

Author (s):

Sultan Nasari, Program Coordinator (EW), International Rescue Committee (IRC)

Description:

Climate change is seriously impacting Afghanistan's people and ecosystems, leading to increasingly severe weather patterns, economic despair, displacement and conflict in rural areas. As a result of a severe drought in 2018, nearly three million people are facing severe food shortages due to a staple food deficit of ~80% in 14 of 34 provinces where precipitation was 70% lower than the yearly average. This extreme loss of livelihoods has led to massive displacement in rural areas with an estimated 150,000 people at informal displacement sites and urban areas where the operational capacity and existing food supplies are insufficient to meet the life-saving needs of newly arrived families. Since 2016, the IRC has worked to build the capacity of rural communities in climate smart agricultural production and natural resource management. Using the Field Farmers School (FFS) approach farmers in 5 climate vulnerable provinces, rural communities are gaining access to knowledge and capital to use of climate adapted crop varieties, improved planting methods, green compost production and GHG reduction, adapted irrigation, and integrated pest and disease management aimed at minimizing the environmental impact of agricultural and livestock systems and building resilient agricultural livelihoods.

Resilient Soils, Healthy Climate - Farmer-Led Microbial Sequestration Research

Author (s):

Tegan Nock, Head of Research Partnerships, SoilCQuest 2031

Description:

Melanised endophytic fungi strains have demonstrated capacity to rapidly convert plant carbon into significant quantities of recalcitrant soil carbon. SoilCQuest 2031 is an Australian farmer-led not-for-profit research institute working to develop practical endophyte packages responsible for this newly discovered fungi-mediated soil carbon sequestration to increase soil organic carbon levels in agricultural soils in a reliable, predictable, easily-adoptable and economical manner.

The organisation is working to empower the world's farmers to take action, leading the charge in drawing down excess atmospheric carbon that threatens global food security, while improving the climate resilience of agricultural soils, increasing fertility parameters, and reducing input requirements.

Conservative estimates indicate annual CO2 drawdown potential sits at 6 billion tonnes of CO2 equivalent per year. Agricultural benefits, particularly in subsistence and low-carbon systems, include: healthier soils, higher crop yields, less dependence on synthetic fertilisers and increased resilience to drought and erosion. The substantial carbon sequestration potential offers opportunities for financial benefits for farmers through accredited carbon offset programs.

Characteristics of the technology make for easy adoption at scale, across a wide range of crop types over a range of agroecological zones, enabling large scale sequestration outcomes.

Climate smart nutrient management in rice-wheat systems: Meta-analysis of on-farm assessment of Nutrient Expert across IGP

Author (s):

Tek Bahadur Sapkota (CIMMYT), Mangi L Jat (CIMMYT), *Dharambir S Rana* (IRRI), *Hanuman S Jat* (ICAR), *Deepak Bijarniya* (CIMMYT), *Jhabar M Sutaliya* (Haryana Ag University) *Manish Kumar* (BISA), *Love K Singh* (BISA) *Raj K Jat* (BISA), *Kailash Kalvaniya* (CIMMYT), *Arun Khatri-Chhetri* (CCAFS-BISA), *Gokul Prasad* (CIMMYT), *Harminder S Sidhu* (BISA), *Munmun Rai* (CIMMYT), *T Satyanarayana* (IPNI), *Kaushik Majumdar* (IPNI)

Description:

Indian food production system, which consumes about one-fifth of global fertilizer, is important for both global food security and minimizing GHG emissions. Fertilizer-use-efficiency in India is very low but there exist tremendous opportunities to improve it thereby reducing environmental footprint. Here, we present the result of meta-analysis comparing Nutrient Expert (NE)- based fertilizer management against farmers' fertilizer practice (FFP) in rice and wheat across Indo-Gangetic Plans (IGP) over last six years. Overall, NE-based fertilizer management reduced N application in rice and wheat by 5-25% but increased potash and phosphorus input. NE also increased rice and wheat yield by 9-25% in Eastern IGP and by 2-2.5%, in Western IGP as compared to FFP. Return over the cost of fertilizer due to NE was much higher in Eastern IGP than in Western IGP in both the crops. Besides, NE lowered global warming potential (GWP) by about 2.5% in rice and between 12-20% in wheat. Adoption of NE-based fertilizer management practices in all rice and wheat area in India would translate into 13.92 million tonne (Mt) more grain production with 1.44 Mt less fertilizer N use and 5.34 Mt CO_2e GHG reduction per year over current farmers' practice proving NE truly a climate smart technology.

Deriving country-level greenhouse gas emission and mitigation opportunities using big data from small crop and livestock farms in Bangladesh

Author (s):

Fahmida Khanam (International Maize and Wheat Improvement Center -CIMMYT), *Tek B. Sapkota* (CIMMYT), *Md. Khaled Hossain* (CIMMYT), *Gokul Prasad* (CIMMYT), *Sk. Ghulam Hussain* (CIMMYT), *Timothy J. Krupnik* (CIMMYT)

Description:

While agriculture is crucial to Bangladesh's economy, it can also contribute to greenhouse gas (GHG) emissions and climate change. Numerous climate smart agricultural (CSA) practices can potentially mitigate GHG emissions, although most remain studied only at the field-plot level. To estimate national-level emissions from major crops and livestock, we used a bottom-up approach analyzing data from expert interviews and surveys of more than 17,700 farmer observations to identify emission hotspots. We also employed a scenario modeling approach to assess if and how commonly proposed crop and livestock CSA options can effectively mitigate agriculture's environmental footprint. These data were combined with secondary soils datasets and information on climate. Resulting life-cycle model estimates of GHG emissions were combined with official production statistics to estimate district-level net and yield-scaled emissions. Mitigation options for both the crop and livestock sectors were examined following expert consultation workshops and literature review to derive estimates of national summed mitigation. The abatement potential and associated cost of major mitigation options are presented in the form of Marginal Abatement Cost Curves (MACC). The practical implication of this method and our findings for policies and incentive mechanisms to promote large-scale adoption of CSA in Bangladesh are discussed.

Oral presentations

Designing Prize Competitions to Spur Private Sector Action in Climate-Smart Agriculture: The Case from Vietnam

Author (s):

Tran Thu Ha, Team Leader SNV Vietnam; *Tristan Armstrong,* DFAT Australia

Description:

The AgResults Initiative is a $147 million multi-donor fund that uses results-based prizes to incentivize private actors to address agricultural market failures. The Vietnam Greenhouse Gas Emissions Reductions Project is one AgResults contest that rewards Vietnamese companies based on their ability to work with smallholder rice farmers to reduce GHG emissions and increase yields.

The contest, launched in 2017 in northern Vietnam, is currently working with four companies. The project began with a testing phase to verify the suitability of rice farming technologies including improved seed and fertilizer and better water management. 2019 saw the start of the expansion phase, and in the first of four seasons the companies have engaged 5,000 farmers to implement the technology packages, which if used correctly could reduce CO2e emissions by over 10 tons per hectare annually.

At CSA2019, AgResults proposes an interactive "prize competition design" session to provide participants with the basics behind Pay-for-Results prize funding and oversee a prize design workshop. Given the initial success and response to the Vietnam project by the government and private sector, this innovative financing model can and should be used more regularly by donors to advance climate-smart initiatives that engage the private sector.

Scalable interventions for climate smart cocoa and coffee sectors

Author (s):

Tiffany Talsma, International Center for Tropical Agriculture; *Christian Bunn,* International Center for Tropical Agriculture; *Peter Laderach,* International Center for Tropical Agriculture *Martin Noponen,* Rainforest Alliance; *Mark Lundy,* International Center for Tropical Agriculture

Description:

Purpose: Agri-food companies and the producers who supply them increasingly cope with the uncertainties and losses brought on by progressive climate change. Investments into supply chain resilience are made by corporates, donors and banks who are therefore responsible for understanding the nature of the risks. However, they often lack a sufficiently simple yet robust methodology for assessing site-specific climate risks and responses.

Methods/approach: We have applied our framework for Climate Smart Value Chains (CSVC) over the last five years to assess and guide climate change response strategies in cocoa and coffee supply chains dominated by smallholder producers.
Results: The resulting CSVC framework consists of three steps including mapping of changes in crop suitability under future climates, prioritization of climate smart agriculture (CSA) responses for different producer typologies and identification of business models and actors to incentivize CSA adoption. The final step involves diverse value chain actors including banks, certifiers and policy makers to design CSA scaling pathways. We present results from applying the framework in Africa, Asia and Latin America as well as the lessons learned and proposed improvements.

Conclusion: A standardized framework is presented to guide commodity value chain leaders towards securing smallholder climate resilience via improved CSA adoption.

Speed talks

Climate-Smart Investment Planning: Making the Investment Case for Large-Scale CSA Investments in Mali and Côte d'Ivoire

Author (s):

Evan Girvetz (CIAT), *Todd Rosenstock* (World Agroforestry Centre), *Steve Prager* (CIAT), *Katrina Brandon, Carlos Gonzalez* (CIAT), *Christine Lamanna* (World Agroforestry Centre), *Megan Mayzelle, Andreea Nowak, Jamleck* Osiemo (CIAT), *Ben Schiek* (CIAT), *Tobias Baedeker* (World Bank), *Riad Balaghi* (Adaptation of African Agriculture), *David Treguer* (World Bank)

Description:

While CSA has gained traction globally, there is a lack of clear "bankable" projects for potential investors. Working directly with the Adaptation of African Agriculture Initiative, World Bank, governments of Mali, Morocco and Côte d'Ivoire, and many partners, we developed and implemented a novel approach for CSA investment planning. Our approach uses a combination of strong stakeholder engagement in-country, policy/program review, climate change analysis, macroeconomic modelling, CSA assessments, and cost-benefit analysis. The resulting evidence-based CSA Investment Plans for Mali and Côte d'Ivoire identify specific projects consistent with the countries' NDCs, National Agricultural Investment Plans, and other key targets. Each plan includes 12 key CSA investment concepts suitable for public- and private-sector investment to increase agricultural

productivity, build resilience, and where appropriate, reduce greenhouse gas emissions. A general monitoring and evaluation (M&E) framework for the CSA investment plan is incorporated, linking CSA outcomes from the investment plan to other monitoring activities for national-level development priorities. Ultimately, these CSA investment plans provide specific bankable actions in these countries and, at the same time, provide a more general approach can be scaled out for investment planning in other countries globally.

Satellite Technologies, Innovative and Smart Financing for Food Security (SATISFy)

Author (s):

Liangzhi You (IFPRI), *Apurba Shee* (University of Greenwich), *Calum Turvey* (Cornell University), *Esther Muiruri* (Equity Bank), *Erastus Ndege* (APA Insurance), *Sylvain Coutu* (SwissRe)

Description:

Weather related shocks are one of the major barriers to productive and sustainable agricultural production. Uninsured risks are a major cause of low agricultural productivity in Africa. Such severe shocks cannot be compensated for by the government and donor community alone. At the same time, the lack of capital and perceived risks limit farmers' ability to purchase agricultural inputs and access credit, contributing to low agricultural productivity. Banks remain resistant to providing loans to the agricultural sector. IFPRI, with private sectors partners, developed a market-based innovative risk management solution in the form of Risk-Contingent Credit (RCC), a social safety net that mitigates drought risks for the rural poor and improves farm productivity and livelihoods. RCC is a linked financial product that embeds within its structure insurance protection which, when triggered, offsets loan payments due to the lender. We are currently piloting RCC in Machakos County in Kenya, funded by Global Resilience Partnership (http://www.globalresiliencepartnership.org/teams/1ifpri-harnessing-power-tech/).

Hot topic posters

KANCHI – marginal farmer cashless Innovative digital platform for public private investments in climate smart agriculture in India

Author (s):

Ramasubramaniyan, M R, S V Murugan and *R S Hopper,* National Agro Foundation

Description:

Uthiramerur Farmers Producer Organization - UFPO, Tamil Nadu, India is a federation of 1000shareholder marginal farmers. Dairy enterprise was initiated as a mechanism of

mitigating climate change and mitigation due to consecutive droughts and crop failures. National Agro Foundation (NAF), Tamil Nadu India came forward to support the dairy farmers,when the banks refused to provide credit for marginal farmers to buy cows. NAF motived the banks, developed and introduced KANCHI, an innovative digital platform for paperless financial inclusion for dairy farmers.

- 1383 farmers enrolled in KANCHI and database digitized
- Annually 6.82 lakh litres of milk produced
- INR 129 lakhstransacted digitally
- 93 new loans (INR 83 lakhs)for purchase of dairy animalswith 95% loan recovery
- Three Government and Two- private financial institutions have committed funding
- The centralized service center (CSS)and the fodder banks support the enterprise
- Value chain study initiated

The transactions are purely cashless reducing manual currency, accounting books and thereby carbon footprint. Economical usage of vehicles reduced emissions. Banks and financial institutions and corporate agencies continue invest in climate smart dairy business to enable marginal farmers cope with climate change to bring about a transformational development of subsistence to resilient communities.

Posters

"Dana Pandan" – A new way of smallholder farmer resilience

Author (s):

Andra Daniswara, Actuary, Syngenta Foundation for Sustainable Agriculture

Description:

Agricultural sector in Indonesia is characterized with labor intensive pre-commercial smallholder farmer with low asset that are especially prone to risks related to agronomic activity and climatic condition, which then leads to negative coping mechanism due to their asset shortage and little to no access to formal and financial risk mitigation tools. Since 2016, Syngenta Foundation for Sustainable Agriculture (SFSA) has begun work on introducing affordable and scalable agriculture insurance solution for smallholder farmer in Indonesia, in order to increase farmer resilience to climate related shock and helping the transition from pre-commercial farmer to fully professional farmer. Exploring bundled insurance solution combining Financing, Agronomic Technical Advisory Service, and Weather Index Insurance Solution, SFSA has launched its first pilot in Indramayu Regency, West Java in 2017-2018, resulting in an average of 23.4% increase in farmer crop productivity in the face of severe weather anomaly in the growing season. The pilot also concludes that bundled insurance solution lead to increased farmer demand toward insurance due to increased value proposition of the bundled solution. Further scaling up effort is undergoing active development by SFSA focusing on enhancing business and operational capacity and targeting implementation in 10 Regencies in Java by 2019.

Climate Investment Model Under Multi-Objective Agriculture Growth Model

Author (s):

Arun Khatri-Chhetri (CCAFS-CIMMYT); *Pramod Aggarwal* (CCAFS-CIMMYT)

Description:

This paper presents a quantitative model/tool for developing a climate investment plan for agriculture sector. This model considers multi-objective agricultural growth model: improve food security, increase agricultural income, improve technical efficiency of input use, climate change adaptation, and low environmental footprint. The modeling process begins with assessment of climate change impacts (current and future) on agriculture and need for CSA interventions. Agriculture supply model predicts food production under different scenarios: current technology and different levels of CSA interventions under climate change and without climate change scenarios. A supply function was developed based on output supply elasticity, output price growth, elasticities of input demands, input price growth, total factor productivity growth, crop area growth and climate change impact on the crops in India. Results provide seed, labor, water, nutrients and energy requirements for a particular crop under different CSA intervention. These information are directly linked to CSA technology demand and investment requirement based on location, crop and cropping systems. This model can be used to develop short-term, medium-term and long-term investment plans for adaptation and mitigation in agriculture.

Investment planning to minimize climate risk in agricultural production – an optimization model for Semi-Arid region in India

Author (s):

Barun Deb Pal (IFPRI); *Shalander Kumar* (ICRISAT); and *Elias Khan Patan* (ICRISAT)

Description:

This paper aims to develop an economic modelling framework that provides evidence based planning for climate smart investment in the semi-arid region. Using five years district-level data from 2010-11 to 2014-15 on technology wise cost of cultivation for Telangana state, India, we have developed an optimization model that allows to evaluate trade-offs between minimization of climate induced production risk and maximization of income from crop production with and without climate smart technology (CST). The deviations in crop production across years have been modelled as risk and solved for minimizing risk and maximizing income given the land, capital and CST's potential area as constraint. Our model shows that adoption of CSTs can reduce 16% production risk as compared to farmers' practice (FPs) while achieving optimum level of income. If the probability of drought increases from the base of 0.4 to 0.6 the production risk likely to increase by 12% under FPs, however adoption of CSTs likely to reduce the risk by 25%. Under such greater drought frequency scenario, the adoption of farm pond and un-puddled machine transplanting in rice is likely to increase significantly and less likely adoption of ridge and furrow, residue incorporation and drip irrigation technologies.

Enhancing adaptive capacity through climate-smart insurance: Theory and evidence from India

Author (s):

Berber Kramer and *Francisco Ceballos* (IFPRI)

Description:

This paper analyzes how bundling agricultural insurance with climate-smart technologies and practices (CSA) affects demand for insurance and CSA. We show that in theory, calibrating index insurance parameters to CSA payoff profiles increases the demand for insurance, but only when basis risk is low, and the increase in demand is negligible compared to the impacts of reducing basis risk itself. We also show that new technologies can discourage the adoption of CSA by reducing basis risk of subsidized insurance products. A field experiment in India tests this prediction and studies the effects of conditioning insurance on CSA adoption to mitigate this effect. Specifically, we compare climate-smart residue management (i.e., not burning residues in our case) between farmers randomly assigned to receive a regular weather index-based product versus a product that adds picture-based insurance coverage to reduce basis risk. Insurance is provided either unconditional or conditional on not burning residues. The no-burning condition reduces burning rates significantly, suggesting improved risk management among some farmers, but other farmers keep burning residues, thereby forgoing their free insurance coverage. We conclude that there is potential in bundling agricultural insurance with CSA but more work is needed to understand how to optimally combine agricultural insurance and CSA technologies into an effective risk management bundle.

Looking Beyond Loss and Damage: Reframing Insurance as a Risk-Transfer Mechanism to Promote Adaptation and Resilience Building

Author (s):

Berber Kramer, IFPRI and *Melody Braun*, International Research Institute for Climate and Society, Columbia University

Description:

As insurance is increasingly discussed in the international negotiations on climate change as a tool to address loss and damage, a growing push-back is emerging from civil society, led by the perception that insurance is presented as a silver bullet. We argue that limiting the framing of the debate to the question of insurance for loss and damage, and the capacity, willingness and fairness of farmers to pay, is occulting an important part of the discussion and losing key nuances. We call for more focus on the potential of insurance as a risk-transfer mechanism to promote adaptation and resilience building by unlocking opportunities in 'good years', and more research, collaboration, learning and sharing on the critical conditions for success of insurance. We emphasize the need to discuss

constraints and challenges limiting existing projects, on technicalities of products and capacity to reduce basis risk, but also on the readiness of the institutional framework and the existence of a strong and viable business model. We will present several examples of CGIAR research testing the value of insurance as a mechanism to unlock investments in adaptation and resilience building.

How does reorganization within Development Finance Institutions impact on access to climate finance?

Author (s):

Andiswa Nyongwana(1), *David Styles*(1), *Muhammed Sayed*(2), *Olympus Manthata*(2), *Peter C. McKeown*(1), and *Charles Spillane*(1)
1. MScCCAFS Program, Plant & AgriBiosciences Research Centre (PABC), Ryan Institute, National University of Ireland Galway, Ireland
2. Climate Finance Unit, Development Bank of Southern Africa (DBSA), Pretoria, South Africa

Description:

The impacts of climate change are felt mostly by developing countries, due to their lack of resources to respond to climate change. The UNFCCC financial mechanism, which is based on "common but differentiated responsibilities", aims to address this. The mechanism consists of three global funds, namely the GCF, GEF and AF. Collectively, the UNFCCC financial mechanism mobilizes financial resources and channels the resources to developing countries, through direct access modalities or international modalities. Entities accredited to receiving funding from the GCF/GEF/AF are continuously looking for ways to improve their access to climate finance in order to achieve its adaptation and mitigation goals. One of the strategies the entities are taking is restructuring and building of capacity to (a) improve access to climate financing, and (b) use the levered funds more effectively. However, it is still not clear which types of reorganization or capacity building are most appropriate for these needs. This study aimed to determine how reorganization and capacity building, whether creation of a unit dedicated to climate change issues, hiring additional staff, up-skilling existing workers, receiving trainings from the funders or other reorganization or capacity building methods helps to improve access to climate finance.

Resource mobilization for climate change, agriculture and food security research through collaborative partnerships

Author (s):

Christine Costelloe(1), *David Styles*(1), *Peter C. McKeown*(1), *Anette Engelund Friis*(2), *Bruce Campbell*(2), and *Charles Spillane*(1)
1. MScCCAFS Program, Plant & AgriBiosciences Research Centre (PABC), Ryan Institute, National University of Ireland Galway, Ireland
2. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Description:

The need for financial support, or climate finance, to implement climate change mitigation and adaptation actions is well recognized internationally. Agricultural investment needs are estimated at between US$80-209 billion per year to meet the estimated 70% increase in demand for food by 2050. Investments in agricultural research and development are necessary to enable farmers to increase production and resilience while reducing emissions. The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) works with their partners, including CCAFS Strategic Research Partners, to address the climate-related challenges facing agriculture in developing countries. This research study investigated the potential for collaboration among CCAFS Strategic Research Partners to mobilize funding for CCAFS 2017-2022 research priorities and also investigated prospective sources of funding for CCAFS. Research was conducted with CCAFS Strategic Research Partners and results indicated the potential to form an effective Community of Practice (CoP) for collaborative resource mobilization on targeted funding opportunities. Desk research was conducted to identify prospective sources of European Union (EU), development finance institution (DFI) and foundation funding and results contributed to the generation of a EU funding roadmap and top DFI and foundation donor/funder lists as research outputs.

Investing in Disaster Resilience: Risk Transfer through Flood Insurance in South Asia

Author (s):

Giriraj Amarnath, International Water Management Institute (IWMI), Sri Lanka; *Niranga Alahacoon*, International Water Management Institute (IWMI), Sri Lanka; *Alok Sikka*, International Water Management Institute (IWMI), India, *P.S. Brahmanand*, Indian Institute of Water Management (IIWM), India; *Pramod Aggarwal*, Climate Change, Agriculture and Food Security (CCAFS), India

Description:

Protecting against floods and providing risk cover against losses due to floods has been a major area of concern for the governments around the world. Insurance is an important component in managing agricultural risks from these disaster events. In India, nearly 30 million smallholder farmers are affected by floods every year. For example, Bihar with a population of 100 million, 80% of whom living below the poverty line and mostly depended on agricultural sector lost between 0.5 to 120 million USD to floods every year. IWMI launched its Index-Based Flood Insurance (IBFI) in India covering 1000 households in 11 villages for the year 2017 and 2018, which is designed to safeguard farmers in locations at high risk of flooding. IBFI combines hydrological modelling and high-resolution satellite images to determine flood depth and duration, which is used to design index product. We are testing a subsidized public-private partnership business model for scaling up in flood prone regions. IBFI initiative promotes a closer linkage between risk transfer, risk reduction could make this a more sustainable, and robust tool for flood affected communities and reducing the burden of post-disaster relief funds for government.

Lessons learned from IFAD's Adaptation for Smallholder Agriculture Programme (ASAP) for CSA finance strategies

Author (s):

Leslie Lipper and *Romina Cavatassi*

Description:

IFAD has been an early innovator in the field of financing for climate adaptation in smallholder agriculture, with the establishment of the ASAP program in 2012. ASAP funds a variety of activities from policy engagement to climate risk assessment, women's empowerment in adaptation, climate services, natural resource and knowledge management as well as private sector engagement. ASAP intends to drive a major scaling up of approaches that can improve productivity of smallholders while reducing their vulnerability to climate-related risks. The program has completed a first phase of implementation, with grants linked to smallholder agricultural development projects. In the second phase, currently under implementation, the orientation is towards provision of technical support. In both phases, the program has sought to keep transactions costs low and leverage multiple sources of finance to support adaptation actions in smallholder agriculture.   The experience gained in the 6 years of ASAP implementation is quite relevant for informing global efforts to improve and expand finance for climate smart agriculture. The presentation will give a brief overview of the IFAD ASAP program and experience and provide an analysis of implications for effectively financing CSA efforts in smallholder agriculture.

Community-based finance and Climate-Smart Agriculture

Author (s):

Marcel van Asseldonk, Wageningen Economic Research, Wageningen University and Research; *Marcien Ndagijimana,* Soil Physics and Land Management group, Wageningen University and Research; *Aad Kessler,* Soil Physics and Land Management group, Wageningen University and Research; *Karl Deering,* CARE International; *Evan Girvetz,* International Center for Tropical Agriculture; *Joseph Hella,* Department of Food and Natural Resources, Sokoine University; *Stanley Karanja,* International Center for Tropical Agriculture; *Thabit Masoud,* CARE International; *Jamleck Osiemo,* International Center for Tropical Agriculture; *Lia van Wesenbeeck,* Amsterdam Centre for World Food Studies *Remco Oostendorp*, Amsterdam Centre for World Food Studies; *John Recha,* CCAFS East Africa; *Maren Radeny,* CCAFS East Africa; *John Gathiaka,* School of Economics, University of Nairobi; *Richard Mulwa,* School of Economics, University of Nairobi; *Cor Wattel,* Wageningen Economic Research, Wageningen University and Research; *Haki Pamuk,* Wageningen Economic Research, Wageningen University and Research; *Ruerd Ruben,* Wageningen Economic Research, Wageningen University and Research

Description:

It is well known that constraints in credit access and availability limit additional investment

in CSA practices, and therefore hamper the adoption and subsequent upscaling amongst wider segments of farmers' population. The objective of our field work in several pilot areas is to determine the effect of community-based finance on CSA adoption and impact.

Within on-going projects alternative forms of community-based finance are established, being either Village Savings and Loan Associations (VSLAs) in Burundi and Tanzania or merry-go-rounds in the form of table banking in Kenya. In all of these pilot areas extension services are included and linked with finance, to simultaneously address constraints in access to agricultural knowledge and access to finance.

Segments of farmers that are outside the current reach of main financial institutions, specifically subsistence farmers, can be stimulated to adopt CSA practices by means of community-based finance. Under certain contextual conditions, these community-based finance platforms may develop into an investable business proposition, and crowd in financiers (blending finance) as well as agribusinesses (bundling services).

Testing uptake pathways for CSA with impact investors, voluntary certifiers and lead firms

Author (s):

Mark Lundy (CIAT); *Christian Bunn* (CIAT); *Elizabeth Teague* (Root Capital); *Martin Noponen* (Rainforest Alliance); *Stephanie Daniels* (Sustainable Food Lab)

Description:

One of the major challenges for achieving the uptake of climate smart agricultural practices lies in translating climate science into actionable information. CIAT and IITA jointly managed a series of project to identify and test methods for scaling Climate Smart Agricultural (CSA) practices through (a) voluntary certification schemes; (b) impact investments in producer organizations; and, (c) lead firm business practices. We focused on smallholder coffee and cocoa systems in Latin America and Africa. Project partners included preeminent actors in voluntary certification (Rainforest Alliance) and impact investing (Root Capital). We assessed the climate exposure of coffee and cocoa systems at a sub-national scale, developed appropriate CSA practices to increase the resilience of these systems and codified these practices in adaptation guidelines. We mainstreamed these guidelines through certification training curricula and improved impact investor decision-making. The project achieved important results at a global scale for certification and impact investing as well as specific outcomes in cocoa for Ghana, coffee in Uganda and cocoa in Central America. The paper will discuss these results and reflect on the potential to use existing value chain structures to influence government, private sector and civil society actors towards a common adaptation agenda for smallholder agriculture.

Central Catastrophic Reinsurance for agricultural growth in India

Author (s):

Shalika Vyas, Project Scientist, CCAFS and BISA; *Mansi Nagpal,* CCAFS-BISA; *Pramod Aggarwal,* CCAFS-BISA

Description:

The positive correlation of farm yield losses defies the law of large number, thus prohibiting the ideal functioning of crop insurance in any given region. This paper presents feasibility of catastrophic risk pooling at national level for India and proposes a new model through reinsurance principles. Spatial regression is used to analyze possibility of actuarial cross-subsidization of indemnity payments for 20 major crops across 19 states, using government reported crop yield statistics. Results show economic feasibility with high profits (Benefit Cost Ratio 1.3) and low spatial dependence (P value 0.234 for Moran's I coefficient of spatial auto-correlation) for a national reinsurance agency. The results have important implications for the design and management of crop insurance and reinsurance programs of the country. Risk coverage through such a policy design can then be channeled to promote technologies for agricultural growth.

De-risking climate-smart agriculture for African smallholder farmers

Author (s):

Todd Rosenstock, World Agroforestry (ICRAF), c/o INERA, Ave des cliniques, Kinshasa, DRC; *Aslihan Arslan* (IFAD), *Meryl Richards* (CCAFS & U of Vermont), *Nick Magnan* (U of Georgia, Athens), *Christine Lamanna* (ICRAF), *Nictor Namoi* (ICRAF), *Andreea Nowak* (ICRAF), *Peter Steward* (ICRAF & U of Leeds)

Description:

Development partners aim to scale up climate-smart agriculture (CSA) to millions of African smallholder farmers. Initial and sustained use of CSA often hinges on the economic costs, benefits and risks of the new management practice, as well as farmer's socio-economic endowments. However, data showing the economic performance of CSA—though habitually discussed—is rarely presented. Here, we mine The CSA Compendium to ask the fundamental questions about economic performance when changing field practices from conventional to CSA. The Compendium is a systematic review of the effects of 100 farm management practices (e.g., leguminous intercropped agroforestry, increased protein content of livestock diets, etc.) on 50 indicators consistent with CSA goals including economic performance (e.g. costs, returns, benefit-cost ratio, rate of return, etc.). More than 1,500 papers met criteria for inclusion in Africa; of which, 218 contain farm enterprise budgets of economic performance. This paper will summarize, through meta-analysis and case studies, lessons on the economic costs, benefits and risks of CSA for African

smallholder farmers. This study sets the baseline to de-risk investment in CSA in Africa and sheds light into the constraints on and opportunities for scaling-up efforts across the continent.

Developing investment proposals for scaling CSA innovations in Southern Africa

Author (s):

Wiebke Foerch (GIZ), *Nathaniel Mtunji* (GIZ), *Baitsi Podisi* (CCARDESA), *Hanna Sabass* (GIZ)

Description:

The Southern African Development Community (SADC) is already affected by climate change impacts – especially the agriculture sector. Improving agricultural productivity while also increasing smallholder farmers' resilience are at the core of CSA. While regional and national agricultural policies are taking CSA into account, existing approaches have not been translated effectively into concrete investments. Empowering extension practitioners to support smallholders in selecting and adopting CSA requires enhanced national policy conditions, improved financing, and strengthened extension capacities that support their application. The availability of climate investment mechanisms for scaling CSA in the region remains low. The aim of this paper is to discuss practical experiences of the SADC Programme on Adaptation to Climate Change in Rural Areas in Southern Africa in building capacity and mobilizing investment for the upscaling of CSA. The objectives are to describe the processes with which this is done – from climate risk analyses, to prioritization of best-bet climate-smart practices and technologies, formulation of feasibility studies, and development of investment proposals – and discuss lessons learnt and ways to package and share such working technologies and how to move forward. It concludes with implications for the SADC region in terms of mobilizing climate finance for agricultural adaptation.

Reshaping supply chains, food retail, marketing and procurement

Oral presentations

One choice at a time: How supply chain decisions can transform the food system

Author (s):

Angela R. Hansen, Strategic Advisor, PhD Candidate, University of Cape Town Graduate School of Business

Description:

Our global food system is a rudderless entanglement of environment, society, governance and supply chains, all pushing up against planetary and human health boundaries. Transforming this system under a changing climate will require inspired science, technology, and most of all humans; humans with the vision and power to make hard choices. While many of these humans with be scientists, politicians and engineers, a great many more will be executives, setting the agenda from seed seller to supermarket, at the front line of the fight to feed the world.

Food executives make choices with far reaching consequence, yet proximal performance often outweighs system-wide ramification in their calculations. This reductionist focus is the central tragedy of our time.

In this paper I investigate how executives across food supply chains make decisions. Through an in-time update on on-going grounded theory research, I illustrate how executives use decision-making tools and aids to choose their next steps. I propose that attributes of those aids can educate food executives and exhort system-smart and climate-smart decisions.

In practical use, this research will generate system and climate smart decision aids, shaping future decision-making. In more academic settings, the research will inform new food system analysis and decision-making theory.

Reducing food emissions with an AI-powered recipe generator app for plant-based cooking

Author (s):

Rebecca Jean Elizabeth Marshall, Julia Kozakiewicz, Anne Hølmkjær Jacobsen, Timothy Vincent Waring, Jordan Kirby, Christian Bugge Henriksen (corresponding author) - Climate and Food Security Group, Department of Plant and Environmental Sciences, University of Copenhagen, Denmark.

Description:

Plant Jammer is an AI-powered app that combines a neural network trained on 3 million recipes with expert knowledge from professional chefs to create customized plant-based recipes from a list of 376 different food ingredients while balancing the five basic tastes (salt, sweet, sour, bitter, and Umami) and contrasting palate-pleasing textures (al dente, soft, crunchy and mouthfeel). In order to estimate the GHG emission reduction potential associated with the use of Plant Jammer a database of global warming potential (GWP) for the food ingredients was constructed and the climate footprint of meals produced from Plant Jammer recipes over a three month period was determined. The results show that the 22.415 plant-based recipes generated would result in GHG emissions corresponding to 16 t CO_2-eq (0.72 kg CO_2-eq per meal). This is a 82% reduction compared with a standardized meat-based recipe that would result in GHG emissions corresponding to 91 t CO_2-eq (4.05 kg kg CO_2-eq per meal). Future perspectives for developing the Plant Jammer app include visualizing the GHG emissions savings for the users and collaborating with other food chain actors by integrating options for marketing and distribution of plant-based food via local farmer's markets, pop-up stores, supermarkets and home deliveries.

Food Techs reshaping supply chains and consumer´s choice to reduce food waste

Author (s):

Daniele Eckert Matzembacher - Universidade Federal do Rio Grande do Sul (UFRGS); *Marcia Dutra de Barcellos* - Universidade Federal do Rio Grande do Sul (UFRGS)

Description:

Purpose: This paper aims to analyze the mechanisms used by food companies that use technology-based solutions to reshape supply chains and consumer´s choice to reduce food waste.

Background: Reducing food waste could address some of the major global negative externalities in economic, environmental, and social terms related to food production and consumption. Some emerging business proposes commercial solutions to this problem. A better understanding of how they address globally relevant questions can contribute to systemic change.

Methodology/approach: A multiple case study was carried out through observations visits, interviews and secondary data collection with eight different food companies in four countries (Brazil, Canada, Denmark, Finland). This is an ongoing study. Content analysis is going to be performed, with the help of NVivo 12 Software.

Expected results: It is expected to identify and describe the operation of business addressing food waste solutions and to provide a better understanding of the mechanisms used by them to reshape supply chain and consumer´s choice.

Originality/value: By identifying these mechanisms it is expected to provide the knowledge needed for food systems transformation. It is also expected to identify what lessons can be reached from such cases to achieve UN Sustainable Development Goals Target 12.3.

Climate Change Mitigation and Food Loss and Waste Reduction: Exploring the Business Case

Author (s):

Duncan Gromko - UNIQUE forestry and land use; *Gulbahar Abdurasulova* - UNIQUE forestry and land use

Description:

The carbon footprint of food loss and waste (FLW) is estimated to be up to 3.49 gigatons of carbon dioxide equivalent (gtCO2e), representing up to 6-10% of total anthropogenic greenhouse gas emissions. Reducing FLW is therefore an important strategy to mitigation global climate change. Moreover, many FLW reduction measures are profitable thanks to increased revenues, which suggests that they could be financed from private sources. This study examines the business case for reducing FLW by examining three supply chains in detail: tomatoes in Nigeria, dairy in Kenya, and cereals in Tanzania. The cases reveal key strategies involving enabling environment, credit, business promotion that should inform other efforts to reduce FLW at scale. Additional research is needed to assess social justice and equity and to focus on cases that may directly benefit women.

The importance of the aceptance of entomophagy in Western countries for a sustainable change in western and global diets

Author (s):

Gianmarco Jamal Amato, Master student, Humboldt University of Berlin

Description:

Many experts agree that changes in diet could address major global problems such as the imminent food and meat crisis, the rapidly changing climate, the intensification of agriculture and its rising greenhouse gas emissions. Public interest in insects as a sustainable alternative protein source seems to have grown rapidly in recent years due to their positive environmental and health benefits and to be increasingly seen as a potential solution. However, strong aversion and low acceptance in western societies results in low inclusion of insect food consumption in the sustainability and food security agendas of international organisations.

Since the acceptance of Western countries plays an important role in the recognition of insects as an alternative source of protein, a survey was conducted in Germany and Italy to analyze differences in the acceptance levels of both countries. Furthermore, the most willing respondents were profiled and potential product forms identified.

The following study enabled the identification of the group of people with the highest willingness to consume, as well as the most commonly accepted product forms of edible insects, in order to best integrate insects as food into the western markets and to achieve a sustainable change in western and global diets.

Climate services for improved nutrition

Author (s):

Hannah Nissan (Columbia University; London School of Economics & Political Science); *Jillian Waid* (Helen Keller International); *Madeleine Thomson* (Columbia University)

Description:

Both directly and indirectly, climate shocks and stressors affect nutritional security. This influence is exerted on multiple timescales, via seasonality, year-to-year variability, longer term trends and extreme weather events. Despite these connections, the pathways between climate shocks and stressors and nutrition are poorly understood, and there are few examples that provide empirical evidence of the impact of climate on nutrition outcomes. Effective humanitarian interventions and policy programs to improve nutrition cannot be designed without an understanding of the pathways via which nutritional outcomes are determined.

Working across the six countries of the project 'Adapting Agriculture to Climate Today, for Tomorrow', we aim to tackle this evidence gap by exploring the importance of different factors to nutrition outcomes while negotiating challenges associated with data coverage and homogeneity. Our goal is to identify entry points within food security and nutrition programs where climate information (forecasts and/or observations) could be harnessed to improve upon the nutritional outcomes of humanitarian and development interventions. Hypothesized pathways between climate stressors and food security are tested quantitatively using a variety of methods, with an emphasis on explaining seasonal and interannual variability in outcomes.

Analysing trade-offs between food loss and waste reduction and GHG emissions

Author (s):

Jan Broeze, Scientist, Wageningen Food & Biobased Research
Co-authors: *Bert Dijkink, Martijntje Vollebregt* and *Toine Timmermans*

Description:

Reducing food loss and waste (FLW) is broadly considered an effective measure for reducing both food demand and the associated environmental impacts. However, most FLW reducing interventions will not only reduce cumulative emissions per unit product available for consumption, but also induce extra emissions (energy, fuels, packaging materials, etc.).

We have developed a calculator that estimates net effects of post-harvest FLW reducing interventions on emissions; this tool will be made available online.

At the conference we will exemplify the approach and some results on the basis of case studies outcomes. Cases in developed and developing countries, with refrigeration, logistics and processing interventions will be presented.

In some cases, additional emissions due to the intervention exceed avoided emissions through FLW reduction. In others the FLW reducing interventions also induce significant GHG extra emissions, but the net emissions per unit product ending at the consumer is reduced.

Presented approach forms a basis for identifying priority FLW reducing interventions and for better estimating global GHG emission reduction potentials.
This work supported by CCAFS/CGIAR, EU Horizon2020 projects NoAW and REFRESH, the Dutch Top institute Food & Nutrition and Ministry of Agriculture, Nature and Food Quality.

What is the future of diets?

Author (s):

Keith Wiebe (IFPRI), *Nicola Cenacchi* (IFPRI), Shahnila Islam (IFPRI), *Adam Komarek* (IFPRI), *Daniel Mason-D'Croz* (CSIRO), and *Tim Sulser* (IFPRI)

Description:

Much research has been devoted to the links between climate change and agricultural production. There is also increasing interest in the role of food consumption patterns, and the transformation that is needed to keep food systems within environmental limits. Part of the resonance (and controversy) the consumption issue has achieved is due to the fact that although agriculture accounts for just a quarter of global employment and less than a twentieth of global income, all 7.7 billion of us are daily consumers, so messages about diets affect us directly and immediately. Diets have changed rapidly in recent years, but future changes in diet – and particularly demand for animal-source foods, with their important implications for greenhouse gas emissions – remain poorly understood, because they depend on interactions between population, income, technology and climate in addition to policy measures to transform food systems. This presentation will share the latest results from foresight modeling using different scenarios to explore the impact of those drivers on global and regional diets over the next generation, and their implications

for food systems of the future. Particular attention will be paid to the critical role that will be played by changes in South Asia and Sub-Saharan Africa.

Integrating Climate-Smart Rice Agriculture in Supply Networks

Author (s):

Olivia Vent, SRI-Liaison, Lotus Foods; *Caryl Levine,* co-founder and co-CEO, Lotus Foods.

Description:

Lotus Foods, the leading U.S. heirloom and organic rice company focusing on sustainable rice production, marks 10 years of committing to changing how the world grows rice to be more water- women- and climate-friendly. Ten years ago the company imported its first three containers of rice (54 metric tons) grown by some of the most marginalized farmers in Cambodia, Indonesia and Madagascar, who were producing surpluses of traditional rice using novel System of Rice Intensification (SRI) methods. These methods enable farmers to increase their yields dramatically with less water and seed inputs, no agrochemicals, less work for women, and less greenhouse gas emissions. Today, the company imports about 800 metric tons of organic, Fair Trade SRI-grown rice from about 1700 farmers that is sold nationwide. The presentation will speak to the social and environmental benefits and lessons learned in scaling this initiative, including capacity building of supply partners and outreach to consumers and the natural products industry. Lotus Foods is unique in its collaborative partnerships with a host of non-conventional academic, NGO and small-business partners. It is participating in the Regenerative Organic Certification pilot and is exploring carbon credits, blockchain technology and W+ certification to transfer more benefits to farmers.

Speed talks

Delivering the circular bio-economy for low-emissions development

Author (s):

Christopher Martius, Team Leader Climate Change, Bioenergy, and Low-Carbon Development (CCE), Center for International Forestry Research (CIFOR); *Vincent Gitz, Director* CGIAR Research Program on Forests, Trees and Agroforestry (FTA)

Description:

Moving towards a circular, bio-based economy is central to achieving climate goals. Innovative bio-economy products are increasingly substituting products based on fossil fuels. New wood-scrapers can be up to 70 stories high and replace energy-intensive cement. Fast-growing bamboo varieties provide many products from furniture to

charcoal. New approaches use insects to develop new forms of protein and reduce waste. Aquaponic systems produce animal and plant-based food together with bio-fertilizers. This also requires enlarging the concept of value chains to one of value webs, strengthening conceptual and operational linkages between on-farm and off-farm parts of the economy, and optimising the cycling of materials and byproducts between them. By using innovative products, closing resource gaps, and reducing waste, pollution and emissions, bio-economy approaches and products can support responsible consumption and production. It offers farmers and rural areas opportunities for growing and diversifying their income and developing new industries. But futuristic optimism must be underpinned with solid research and pragmatic know-how. Research on these new products, applications and industrial value chains will support circular bio-economies in developing countries. This speed talks intends to spark a debate.

A Truce in the War Between Market Systems Development and Climate Resilience – An Indonesian case-study

Author (s):

Suandi Darmawan Tanuwijanto; Teddy Kristedi - PRISMA

Description:

Market systems development (MSD) is a value-chain approach to rural poverty alleviation. It does not deliver solutions directly but rather introduces pro-poor innovations through market players with the expectation that if the innovation is relevant, market forces will sustain the change. When done right, MSD programs have been successful in improving the incomes of the rural poor. But at what cost environmentally?

The MSD approach relies on testing commercial concepts with the private sector that will attract further commercial investment and improve agricultural productivity. However, the business concepts, with their reliance on high chemical inputs and technology to increase productivity are often inherently at odds with climate resilience, but they don't need to be. PRISMA, an Australian government funded MSD program, is looking at an innovative and integrated approach to MSD that marries the MSD approach with climate resilience. Using a case study in maize in the Indonesian province of NTT, we show how supporting local seed producers to promote drought and heat resistant seeds coupled with modern soil treatment and environmentally friendly irrigation practices has led to 25,300 farmers increasing their income by 30% while effectively addressing climate change issues being faced by El Nino and other climate shocks.

Posters

Assessing environmental impacts of coffee post-harvest processing, waste & effluent management to improve the Cool Farm Tool

Author (s):

Mashula Nthivhiseni(1), *David Styles*(1), Peter C. McKeown(1), *Laurence Jassogne*(2), *Stephanie Daniels*(3), *Piet Van Asten*(4); *Richard Heathcote*(5), *Daniella Malin*(5) and *Charles Spillane*(1)

1. MScCCAFS Program, Plant & AgriBiosciences Research Centre (PABC), Ryan Institute, National University of Ireland Galway, Ireland;
2. International Insititute of Tropical Agriculture (IITA-Uganda), Kampala, Uganda;
3. Sustainable Food Lab, Vermont, USA;
4. Coffee Plantations Team, Olam;
5. Cool Farm Alliance, UK.

Description:

Coffee is one of the most valuable commodities worldwide. There is a considerable amount of agricultural waste arising coffee processing. Close to 50 % weight of the total coffee produced is waste, depending on the processing method used of course. There are three types of wastes arising from coffee post-harvest processing, which are wet residues, dry residues and effluent (waste water). The Ugandan coffee processors current approaches for managing the waste pose a great threat to the environment, with high risk of unecessary greenhouse gas emissions (GHG). There are large amounts of coffee wet waste and waste water poorly managed in Uganda. The study aimed to map out the Ugandan coffee post-harvest pathways and waste management to improve Cool Farm Tool. The next step will be calculating the Ugandan GHGs emitted from coffee post-harvest processors. There is gap that needs to be filled on the environmental impact of the poor management of coffee waste from coffee processors. The Cool Farm Tool will be developed to calculate all the emissions and environmental impacts arising from coffee processing.

Carbon creditor or debtor? Assessing the carbon impact of cocoa production in Sulawesi and Lampung provinces in Indonesia

Author (s):

Jan Rafter(1), *Louis Reymondin*(2), *Pablo Imbach*(2), *David Styles*(1), *Peter C. McKeown*(1), *Tiffany Talsma*(2), and *Charles Spillane*(1)

1. MScCCAFS Program, Plant & AgriBiosciences Research Centre (PABC), Ryan Institute, National University of Ireland Galway, Ireland;
2. CCAFS & International Center for Tropical Agriculture (CIAT) Asia Regional Office, Hanoi, Vietnam

Description:

Globally, Indonesia is the third largest producer of cocoa beans. Recent years have seen a decline in Indonesia's cocoa yields and an increase in full-sun cocoa plantations, particularly in Sulawesi. Cocoa-related deforestation, and cocoa carbon stocks and losses were examined for thirty-four districts across Lampung, and West, South, Southeast and Central Sulawesi. Multi-source dense remote sensing time-series were used to automatically classify cocoa. Forest loss was calculated using Terra-i data for 2000-2016 and AVHRR data for 1990-2000. Carbon stocks were estimated using previous regional studies. Estimated cocoa-related deforestation from 1990-2016 is approximately 42% of the total 2016 cocoa areas. A reduced rate of cocoa-related deforestation was observed after 2000 compared with 1990 to 2000. Estimates suggest total carbon lost from cocoa-related deforestation is approximately five time greater than the total cocoa carbon stock. Avoiding further expansion of cocoa into forested areas will have the biggest carbon impact. Another mitigation option to contribute to Indonesia's NDCs is to increase the level of shade across Sulawesi cocoa farms, which could increase carbon stock by up to 35%. With improved quality and quantity of input data, the methods used in this research have potential for use in national carbon assessments.

Transforming the city-region food system - the case of Greater Copenhagen, Denmark

Author (s):

Christian Bugge Henriksen(1), *Luke Schafe*r(1), *Marin Lysák*(1)
1.   Climate and Food Security Group, Department of Plant and Environmental Sciences, University of Copenhagen, Denmark.

Description:

A successful transformation of the global food system requires extensive collaboration between food chain actors from all relevant sectors. City-regions have the potential to play a key role in facilitating such collaboration. In the case of Greater Copenhagen different food chain actors have been able to drive significant change by establishing public-private, voluntary-private and private-private partnerships, e.g. a municipality and a non-commercial foundation succeeding in achieving 90% organic food procurement in public kitchens, a food co-op distributing 5 tonnes of vegetables and fruit from 27 food producers to 2.400 members every week, and a private company establishing a digital marketplace for direct transactions between 50 food producers and local restaurants. However, in order to foster the system wide transition towards healthier and more plant-based diets, that is needed for addressing the triple burden of malnutrition and meeting the Paris Agreement goals, an efficient mechanism for maturing, combining and upscaling successful food system innovations across all stages of the food value chain must be developed. The most promising approach is the establishment of open innovation living labs based on the quadruple helix model featuring multidisciplinary collaboration between key stakeholders from private companies, local governments, research institutions and the civil society.

Greenhouse gas emissions hotspots along vegetable value chains in Thailand

Author (s):

Daniel Ortiz Gonzalo (Department of Geosciences and Natural Resource Management, University of Copenhagen); *Thilde Bech Bruun* (Department of Geosciences and Natural Resource Management, University of Copenhagen)

Description:

Traditional-to-modern food value chain transformations are widely occurring in the Global South. The transition to food retailing often involves higher use of resources to comply with quantity and quality requirements, which might modify the environmental profile of products. This study aims to quantify carbon footprints and food losses along different trajectories of vegetable value chains in Thailand. We used a methodological framework based on Life Cycle Analysis of two horticultural products, onion (Allium cepa L.) and Chinese cabbage (Brassica rapa, subsp. Chinensis). Following a systemic approach, we gathered primary data using resource flow diagrams, mass balances and surveys at each node of traditional and modern value chains, from the farm, to traders-distributors and finally wholesale markets and retailers. Cradle-to-farm gate stage remained as the main greenhouse gas hotspot along the value chain –primarily due to fertilizer production and application– and no differences were encountered between production for modern and traditional markets. Although the largest share of the product carbon footprint was found at the farm gate, food losses at later stages on the value chain were generally larger in volume. Among the food waste management options, the disposal in agricultural fields and the use as animal feed had the highest potential to reduce carbon footprints.

Transforming coffee and cocoa landscapes through Multi-Stakeholder Collaborations. Focus on the SAFE Platform in Latin America

Author (s):

Juan Pablo Solís, M.Sc., SAFE Platform Manager, Hivos

Description:

The Coffee Barometer 2018 emphasizes that true transformation requires individual companies to disregard competitive differences and genuinely engage and invest in collaborative investments at grassroots levels. The SAFE Platform, managed by Hivos and powered by the IDB Lab of the Inter-American Development Bank, is a multi-stakeholder initiative that has been working since 2015 to transform coffee and cocoa landscapes in Latin America. Members and other leading industry actors have highlighted the Platform's efforts in piloting innovative projects and shifting dialogue within the sector towards collaborative change.

Motivated by a need to collaboratively invest in the transformation of the livelihoods of smallholder farmers, the SAFE Platform has managed to impact over 143,000 people in nine countries in Latin America. With an investment of over $20 million to date, and through the participation of the Platform partners in key industry events, the SAFE Platform has positioned itself as one of the leading multi-stakeholder initiatives in the coffee and cocoa sectors in terms of innovation, composition, and approach.

The use of technology has enabled the capture of insights regarding the adoption of climate-smart agriculture practices by producers, the challenges they face, and the need for further investments to reshape these supply chains.

How climate change interacts with inequity and risk to affect nutrition: a systematic mapping

Author (s):

Leah Salm (IFPRI), *Laura Cramer* (CCAFS), *Nick Nisbett* (IDS), *Philip Thornton* (CCAFS), *Stuart Gillespie* (IFPRI)

Description:

Climate change poses a growing threat to the achievement of optimal nutrition both directly through affecting food production and indirectly through altering the social, economic and policy influences on people's lives. These adverse nutrition outcomes span from deficiency (e.g. micronutrient deficiency, stunting, wasting) to excess (e.g. obesity and diet-related non-communicable disease). These outcomes are not evenly distributed; poor and vulnerable populations are generally the most impacted. Understanding how different forms of inequity interact with climate change and adverse nutritional outcomes is a novel area of research in today's challenging environment of increased climate change pressures and associated vulnerability.

We use a systematic mapping exercise to identify and categorise peer-reviewed and grey literature. This provides a foundation of knowledge regarding the connections, trends and pathways between climate change, inequity and nutrition outcomes, which in turn helps inform the research agenda in terms of gaps and trends on this topic. We consider whether the predominant conceptual frameworks used by the existing research require updating in relation to the climate-equity-nutrition pathways identified. Understanding these dynamics is essential for targeting research-for-development and policy to better protect the nutritional status of populations vulnerable to the impacts of climate change.

Implications of soybean transitions on nutrition wellbeing and rural livelihoods: Insights from a household survey in Zambia

Author (s):

Ndashe Kapulu (School of Food Science and Nutrition, University of Leeds, Leeds, LS2 9JT, UK); *Harriet Elizabeth Smith* (School of Earth and Environment, University of Leeds, Leeds, LS2 9JT, UK); *Simon Manda* (School of Humanities and Social Sciences, University of Zambia, Lusaka, Zambia); *Christian Chomba* (Agricultural Consultative Forum, Lusaka, Zambia); *Jennie I Macdiarmid* (Rowett Institute of Nutrition and Health, University of Aberdeen, Aberdeen, Scotland); *Caroline Orfila* (School of Food Science and Nutrition, University of Leeds, Leeds, LS2 9JT, UK)

Description:

Rising populations in sub-Saharan Africa (SSA) are associated with shifting food choices to increasingly meat-based diets, which might exacerbate human health issues such as obesity and diabetes, and environmental problems including land degradation and greenhouse gas emissions. There has been a rising demand for soybean towards livestock and human food value chains. In Zambia, annual soybean production increased from 56,000 MT in 2008 to 302,000 MT in 2017 due to improved government support and market demand. However, the implications of soybean expansion on the nutrition wellbeing and livelihood outcomes of rural African communities remain unclear. Using Zambia as a case-study, we draw on household survey data (n=400) from two major soy-producing areas: Mkushi and Chibombo Districts, to examine nutrition and livelihood outcomes from soybean expansion. Bringing empirical evidence from an African perspective, this study adds to current and future discourses regarding impacts of shifting diets on rural communities along with benefits and costs of transitions in grain commodities influenced by rising global demand. Through better understanding of these impacts, we can start to develop appropriate strategies for safeguarding vulnerable communities affected by consumer choices. This project is part of the GCRF-AFRICAP programme on climate smart agricultural development in sub-Saharan Africa.

Land Battery

Author (s):

Seth Wiley, Owner, Pretty Things, LLC

Description:

Food and energy are critical to our survival. They need to be available globally and managed locally in an equitable, distributed, resilient network; and, they need to be extensively re-envisioned to meet climate challenges and population growth. Land Battery visualize these two critical systems – food and energy production – as co-located operations in shared physical spaces. Further, co-locating these production systems should produce unforeseen, beneficial synergies in community-building and operations-maintenance. In

the most discrete view, Land Battery can be understood simply as a local food producing site including self-sufficient on-site sustainable electricity-producing sources feeding on-site processes. In an expanded view, Land Battery can be understood as a regional food producing site including self-contained sustainable electricity-producing sources feeding both on-site processes as well as regional legacy and/or new regulated electrical grids. This expanded sense of Land Battery can further be envisioned as an overlay network on existing built conditions such an in-fill development, or as deployed in undeveloped areas. Various public-private funding scenarios should be available to achieve a proposal such as this – a proposal which sees two basic human activities of food production and energy production as carried out in an integrated, mutually-reinforcing manner.

Do business models drive a transition toward climate-smart agriculture?

Author (s):

Todd Rosenstock, World Agroforestry (ICRAF), c/o INERA, Avenue des cliniques, Kinshasa, DRC; *Rob Lubberink* (WUR); *Sera Gondwe* (LUANAR); *Timothy Manyise* (WUR); *Golden Mahove* (Vuna); *Domenico Dentoni* (WUR)

Description:

'Climate-smart agriculture' (CSA) initiatives promote inclusive business models to achieve goals of productive, resilient and low emission agriculture at scale. It is unclear how business models can support these multiple goals, and the literature lacks consensus on mechanisms to design such models. Here, we will first discuss the evidence that business models are a vehicle for building productive and resilient value chains and create a typology of the factors influencing success. We then apply this typology to 13 business models for CSA in East and Southern Africa that we have been working with, and look for leverage points to improve outcomes for both enterprise and farmers based on two specific cases. We will conclude by proposing that the mechanisms of inclusive business models could be best investigated through the lens of complex adaptive systems to tease out more general findings applicable across enterprises and social contexts.

Mitigating agricultural nitrogen pollution through the reduction of food loss and waste

Author (s):

Xia Liang (The University of Melbourne); *Shu Kee Lam* (The University of Melbourne); *Deli Chen* (The University of Melbourne)

Description:

To feed the global population, the safe planetary boundary for nitrogen (N) has exceeded by over two-fold, resulting in severe air and water pollutions that adversely impact human and ecosystem health. Agriculture is the dominant source of N pollution, and overall N

use efficiency in agriculture is only about 50%. To meet the challenge of feeding a growing population without compromising environmental quality, many studies have explored options for improving N use efficiency of the food production. However, there have been few studies into the potential of the improvement of food supply and mitigation of N pollution from reduced food loss and waste

(FLW). The avoidance of FLW may yield substantial reductions in agricultural N pollution directly and indirectly. To fill this void, this study integrated data from meta-analysis, life cycle assessment (LCA) and process-based modelling to expand the evidence base for the mitigation of agricultural N pollution through the reduction of FLW. Cumulatively, our findings provide an approach to highlight the priority with a high potential for reducing FLW and N pollution, which can serve as effective tools to communicate to consumers, producers and policymakers.

Theme 6:
Fostering enablingpolicies and institutions

Oral presentations

Designing climate knowledge networks to link research with agricultural professionals and producers for timely action

Author (s):

Caitlin Corner-Dolloff (USDA FAS), *Kelly Witkowski* (IICA), Andrea Gardeazabal (CIMMYT)

Description:

The research community has progressed in identifying climate-smart approaches for different contexts, yet significant gaps remain in making this information accessible, understanding, and actionable for producers and decision-makers. USDA targeted science-action gaps by developing Climate Hubs where existing technical agencies partner to create regionally-specific content and dissemination methods. We present two innovative models for agricultural climate networks in Mexico and Central America that integrated lessons from the USDA hubs to clarify opportunities to leverage existing regional climate services and develop new capacity. In Mexico, the government, research institutions, and broader stakeholders from agriculture and linked sectors prioritized pathways to complement the established MasAgro Hubs, including a climate change community of practice to inform public policy, enhance technology co-design and adaptation, and support decision-making around agro-climatic challenges. In Central America, IICA convened key stakeholders to prioritize science-policy-action gaps and opportunities for multinational cooperation and capacity building that can be tailored and grounded at national and subnational levels. Lessons from these approaches related to institutional arrangements, divergent needs, and finance leveraging, among others, will be presented as input to institutions designing climate knowledge networks in other regions.

Mainstreaming Climate Smart Agriculture into a regional policy in a fast-track formulation process: lessons from the Centro American Region

Author (s):

Laura Meza (IICA); *Marieke Veeger* (UCI), *Deissy Martinez Baron* (CIAT/CCAFS), *Jean-Francois Le Coq* (CIAT/CIRAD), *A M Loboguerrero* (CIAT/CCAFS)

Description:

Mainstreaming climate solution in policy is key for transformation of agriculture in climate change context. Rapid policy changes are necessary to cope such urgent issue. While role of science in mainstreaming climate change process is widely recognized at international and national level, especially for raising awareness and agenda setting, the role science for policy construction has been further less analyzed. In this communication, we analyze the successful case of the rapid formulation and adoption of climate-smart agriculture approach by Central American governments, as a way to address both adaptation and mitigation issues while promoting agricultural development. By mobilizing analytical frameworks that combine policy process and policy-oriented research literature, we identify key factors that enabled this particular process. These factors encompass a combination of long and short terms characteristics of the regional policy arena, and science policy dialogue, as well as, engagement relationships and methodological features. Findings aim to provide lessons learned that feed the science-policy dialogue to jointly contribute to agricultural transformation in a climate change context.

Ease of doing adaptation and mitigation in agriculture: Can NDCs keep up to the promise?

Author (s):

Shalika Vyas, CCAFS-BISA; *Arun Khatri-Chhetri,* CCAFS-BISA; *Pramod Aggarwal,* CCAFS-BISA

Description:

Paris agreement resulting in Nationally Determined Contributions is often hailed as a major breakthrough in collective global climate action. Among other sectors, agriculture is recognized as a cardinal part of this agreement for most of the countries, focusing to preserve, enhance and strengthen farming systems to ensure future food security under changing climate. This paper evaluates, at a global level, critical role of existing constraints which can prevent nations from implementing adaptation and mitigation in agriculture, thus rendering NDCs unfeasible and difficult to implement. Different global indicators are synthesized, using Data Envelopment Analysis, into a composite probabilistic index, which determines globally enabling environment for adaptation and mitigation. Additionally, multi-dimensional quantitative approach is employed by analyzing the calculated ease of technology adoption index with nexus of current NDC commitments, scope for adaptation/mitigation and country needs; to identify potential hotspots of urgent policy action. We also profile country specific policy priority areas for co-creating enabling environment for adaptation and mitigation. As countries learn to adjust to new realities of changing climate, planned adaptation and mitigation measures in agriculture can help, if enabling conditions are improved and policy gaps are addressed, as identified in this paper.

The missing middle-a key institutional challenge for CSA policy implementation/upscaling:Evidence and ways forward in Africa

Author (s):

Susannah M. Sallu (University of Leeds), *Dhanush Dinesh* (CGIAR Research Program CCAFS, Colombia), *Kareen Urrutia* Estevez (Univerisity of Leeds), *Stephen Whitfield* (University of Leeds), *Andy Dougill* (University of Leeds), *Marta Gaworek-Michalczenia* (University of Leeds), *Robert B. Zougmore* (CGIAR Research Program CCAFS, Mali), *Ana María Loboguerrero Rodríguez* (CGIAR Research Program CCAFS, Colombia), *Maren Radeny* (CGIAR Research Program CCAFS, Kenya), *Dawit Solomon* (CGIAR Research Program CCAFS, Kenya), *Harriet Smith* (University of Leeds), *Marcelin Tonye Mahop* (University of Leeds) and *Claire Quinn* (University of Leeds)

Description:

The majority of efforts to scale up CSA in Africa have focused on: 1) national-level policy development, and 2) the design and funding of programmes and projects that promote and pilot climate-smart activities at the local level. In contexts with largely centralised governance structures for climate change and development policy creation and implementation, and where donors preferentially direct resources to NGOs for implementation, there is a potential risk of creating an institutional 'missing middle' between the central state and the local community, at Region/County and District levels. This 'missing middle' has been documented as an institutional barrier to sustainable operationalisation of many climate change adaptation and mitigation programmes in Africa. The extent to which this is an issue in CSA policy implementation and programming, therefore, requires investigation. In this study we collate and analyse experiential narratives of policy and programme implementation cases from across 6 African countries. We explore narratives to characterise the 'missing middle' and where efforts exist to overcome, we analyse the approach taken and identify best practices to support CSA scaling in the continent. In doing so, we contribute new insight into key institutional challenges to achieve food systems transformation under climate change.

TANDEM framework for innovative climate policy: new Climate Field School integrating traditional and scientific knowledge

Author (s):

Takeshi Takama, su-re.co (Sustainability & Resilience); *Albert Salamanca,* Stockholm Environment Institute (SEI); *Natalia Biskupska*, SEI; *Dodo Gunawan,* Indonesian Meteorological Agency (BMKG);

Description:

30% of Indonesians are farmers and are impacted by climate change due to rising temperatures and decreasing rainfall. Farmers are increasingly struggling to adjust their traditional agricultural practices, based on historical observations of their local

environment, to fit with the changing climate, leading to elevated risks of crop failure. Integration of traditional and scientific knowledge is therefore needed to support the adaptive capacities of farmers. This paper assesses the use of 'Climate in Tandem', a framework for the co-design of climate services, as a model for locally-responsive, demand-driven, and participatory delivery of climate information. 'Tandem' has been used to design a Climate Field School (CFS) programme to provide integrated traditional and scientific climate services for Indonesian coffee and cacao farmers. The CFSs, conducted together with the Indonesian Meteorological Agency (BMKG), consider not only current climate scenarios but also future climate projections, which was not regarded in previous CFSs in Indonesia. The first round of CFSs have shown positive results, with 22% of farmers demonstrating an increase in climate information knowledge. BMKG is now planning to expand the CFSs into a national programme and 'Tandem' will play a role in supporting the expansion through facilitating an innovative and participatory design process.

Speed talks

Sustaining sustainable development: Leveraging human rights structures to implement land-related SDGs

Author (s):

Beth Roberts, Program Manager Center for Women's Land Rights, Landesa

Description:

The combination of recent developments in human rights on women's rights to land and the inclusion of sex-disaggregated indicators in the Sustainable Development Goals (SDGs) creates unprecedented opportunities to end poverty and food insecurity, achieve gender equality, and address climate change. Significant links and overlaps between the SDGs and human rights realms provide a catalytic space for land rights advocacy. Human rights standards and the SDGs share common goals: human dignity and well-being, achieved through substantive, inclusive empowerment and poverty alleviation. In both realms, bridging the gap between international and national frameworks and policies and ground-level realities presents challenges with overlapping solutions and urgent needs for cross-sector coordination.

This paper will explore the potential of National Human Rights Institutions (NHRIs) to serve as bridging mechanisms between the human rights realm and land-related SDGs implementation and institutionalization. It explores the following questions, featuring a case study of Myanmar's NHRI:
- What role do NHRIs already have in SDG implementation, especially with regards to gender equality and social inclusion?
- What specific actions could NHRIs take to facilitate needed coordination for SDG implementation that takes a human rights based approach?
- What capacity building is needed for NHRIs to play a robust role in SDG institutionalization?

Hot topic posters

Transforming food systems under a changing climate in Latin America: A climate policy review

Author (s):

Deissy Martínez Barón CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), International Center for Tropical Agriculture (CIAT); *Andrea Castellanos* CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), International Center for Tropical Agriculture (CIAT); *Carlos Gonzalez* CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), International Center for Tropical Agriculture (CIAT); *Jean-Francois Le Coq* International Center for Tropical Agriculture (CIAT), French Agricultural Research Centre for International Development (CIRAD)

Description:

Enabling policy and institutions are key factors to generate transformation of food system under climate change. While governments have developed climate policy for agriculture, there is still scarce evidence of their effective implementation and their capacity to generate structural the changes needed to achieve sustainable transformation pathways. Based on an extensive grey literature and policy documents reviews in Latin American countries and a simplified framework for policy analysis, this communication aimed at identifying the current bottlenecks of policy implementation, and their potential to modify national trajectories. We identified three types of bottlenecks: policy process related (actors' coordination, power and interests balance, values), content related (lack of comprehensiveness), and financial related (access to international fund, low integration of climate change related criteria in existing economic instruments). The resolution of these bottlenecks require further context-based policy implementation analysis, fostering science-policy dialogue and cross-countries learning process in the region. In addition, a closer look to cases that successfully address such challenges will provide insights on how Latin American countries might develop solutions that increase effectiveness in climate policy implementation.

Posters

Climate Smart Land Reform – a framework to stimulate CSA in land reform contexts

Author (s):

Alexis Rampa, School of Agriculture, Policy and Development, University of Reading, U.K.

Description:

Enhancing food security in the context of climate change effects requires innovative ways and approaches to be implemented across food systems and thus also in the agriculture sector.

The present study introduces the development of a conceptual framework linking land reform to Climate Smart Agriculture (CSA). The framework is used to disentangle relevant channels through which the two macro objectives of land reform; increased income and reduced inequality, and the three CSA objectives; sustainable increases in agricultural productivity, climate change adaptation and climate change mitigation, can be attained. Amongst these channels, the design and provision of appropriate rural advisory services is highlighted as a key means to attain the five objectives of a Climate Smart Land Reform. A particularity of this framework is that it is sufficiently flexible and can be easily adapted to consider a number of external policy pressures, beyond that of land reform. For instance, the framework can be adapted to a context where a government wishes to support particularly vulnerable or marginalized population groups within a country (e.g. cultural/ethnic or religious minorities; refugees settled in rural areas of the country) in implementing agricultural practices that are deemed climate-smart and in attaining the five objectives listed above.

Strategy for developing a roadmap for scaling out CSA: Example of an Indian state

Author (s):

Alok Sikka, Mohammad Faiz Alam (IWMI), *Pramod Aggarwal* (CCAFS)

Description:

Indian agriculture is most vulnerable to climate change. Agriculture in Odisha with its reliance on monsoonal rainfall and low adaptive capacity due to small holdings and high poverty level, is extremely vulnerable to climate change and water related risks. Maintaining agricultural growth while minimizing climatic risks and shocks is therefore crucial to building a resilient food production and livelihood security system in meeting development goals in vulnerable areas of Odisha. A road map for scaling out climate smart villages (CSVs), an adaptive model built around promoting and implementing portfolio of best suited climate smart agriculture (CSA) practices in an integrated manner to build resilience, is presented in this paper.

We have followed a five step process for developing roadmap for scaling out CSA consisting: vulnerability analysis, CSA practices prioritization, financial outlay plan, convergence pathways and institutional arrangements for implementation. Following the process, roadmap for 1000 villages spread across most vulnerable 14 blocks in six districts has been prepared. Implementation plan with prioritized practices identified convergence of 27 government schemes and programs having scope for convergence with CSVs to maximize and optimize the benefits of such investments in building resilience. This provides a strategic example and framework for scaling out CSA.

A typology and assessment of policy instruments to promote agricultural adaptation to climate change

Author (s):

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Description:

By the end of the century, climate change will have a marked impact on agriculture. Agricultural adaptation to climate change has thus become a major issue in international climate negotiations and numerous instruments are to be implemented at different scales and in both developed and developing countries. However, little is known about existing policy instruments. Our aim was to begin to overcome this lack of knowledge by mapping instruments and designing a typology.

A baseline descriptive typology of policy instruments designed to facilitate agricultural adaptation to climate change was built, based on internal and external criteria. First, the typology was based on three types of policy instruments: incentive instruments (subsidies etc.), binding instruments (legal prohibitions etc.) and communicational instruments (certification etc.). Second, the typology is also based on the ex-ante potential impacts of the instruments. Specific sets of variables were defined for impacts that include political, economic, technical and environmental effects. Existing instruments are mapped for eight study sites in both developing (Senegal, South Africa, Colombia, Brazil) and developed countries (France, USA, Spain) for 3 sectors (viticulture, horticulture and market gardening). The typology will be used to bring new light on existing policy instruments and orient future policies.

Comparative dynamics of integration of climate change issue in policies for agricultural sector

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Description:

Integration of climate change issue within national agricultural agenda is a necessary step for transformation pathways of agriculture in climate change (CC) context. While international influence through international agreements is clearly established, national

process of integration of CC issue and national policy diversity is poorly explain yet. In this communication, we compare the dynamics of integration of CC issues in policy mix regarding CC adaptation for agriculture in three countries and territories (Brazil, Colombia, and Honduras) and a French tropical ultramarine territory (Guadeloupe). Focusing on the policy process dimension of policy mix concept, and relying on a hybrid conceptual framework including agenda setting and institutional change, we evidence four types of trajectories/pathways of integration: limited integration (invisibility), incremental integration, aggregation, multipolar integration. Those patterns of integration can be explain by pre-existing salient problems, institutional layouts and relative power of bureaucratic organizations and actors' interplays. While the level of innovation can be questionable, this research enables to better grasp the sites specific conditions of CC adaptation policy design and its limits

CS-MAP: Matching climate hazard with practical CSA options at scale

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Description:

The Department of Crop Production (DCP), Ministry of Agriculture and Rural Development (MARD) of Vietnam, and CGIAR Research Program on Climate Change, Agriculture and Food Security in Southeast Asia (CCAFS- SEA) collaborated to develop and test the climate risk-related mapping and adaptation planning (CS-MAP) process for developing regional and provincial adaptation plans for rice production in the Mekong River Delta (MRD), Vietnam. The CS-MAP participatory approach involves experts from various local and national offices working together to (1) identify climate-related risks; (2) delineate affected areas and risk levels; (3) propose corresponding adaptive plans; (4) fine-tune and verify proposed measures; and (5) develop integrated provincial and regional adaptation plans. Risk scaled adaptive interventions maps were developed for normal and ENSO years by using technical data (i.e. topography and hydrology), infrastructures (i.e. dikes, road, and canals), and local observations. CS-MAP is now is under various stages of development and implementation in 13 MRD provinces highlighting the organizational uptake and integration of the tool. More recently, the CS-MAP was recently used to guide the adjustment of planting calendar of rice seasons. MARD has issued a directive to disseminate the CS MAP for district level rice production planning and monitoring.

Effective incentives for CSA adoption

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Description:

There is a large and growing literature on the potential use of policy instruments for stimulating the adoption of CSA practices. The objective of this work was to review and understand how an array of potential policy instruments can serve as mechanisms for enhancing adoption and upscaling the array of potential CSA practices.

The effectiveness of certain policy instruments are ascertained by means of a matrix design, capturing CSA practices (rows) and policy instruments (columns). Six key CSA practices were identified, namely water management, crop tolerance to stress, agroforestry & intercropping, soil & nutrient management, crop rotation & mixed systems, and pest & disease management. Also six key policy instruments were identified, namely market prices, taxes & subsidies, land rights, rural finance, training & information, and certification & labelling.

Available studies have a narrow focus on the functional properties of policy instruments, disregarding indirect effects through income enhancement and food security. Also most studies look at an isolated combination of a specific policy instrument and CSA practice, thereby ignoring substitution, complementary or conditional effects between policy measures and CSA practices. We advocate for more integrated approaches that also consider the indirect effects of policy instruments on CSA adoption an upscaling.

Science-policy interactions for climate-smart agriculture uptake: lessons from national science-policy dialogue platforms

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Description:

Connecting science with policy for agricultural and environmental governance is always a challenge for both scientists and policymakers. Multi-stakeholder national science-policy dialogue platforms on climate-smart agriculture (NSPDP-CSA) were created in Ghana, Mali and Senegal to use scientific evidence to create awareness on climate change impacts on agriculture and advocate for the mainstreaming of climate-smart agriculture (CSA) into agricultural development plans. Through surveys and review of technical reports, this study used the evidence from the operations and achievements of the NSPDP-CSA to make recommendations for effective science-policy interaction on climate change and CSA. Results show that the NSPDP-CSA appear an innovative approach to engaging policymakers/decision-makers for climate change and CSA mainstreaming into countries' agricultural development policies and plans. The study recommends for effective science-policy interaction that: (a) NSPDP-CSA should be institutionalized by embedding within national institutions to improve their credibility, relevance and legitimacy among policymakers; (b) two-way communication may have a phenomenal advantage in the co-development of solutions that address climate change vulnerabilities and impacts; and (c) using relevant communication products and packaging CSA with evidence to align with country priorities will facilitate readily uptake in policy decision-makings.

Scaling up CSA and fostering investment through innovative engagement from local to global levels

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Description:

Climate change in agriculture are strongly felt in the Southern African Development Community (SADC). Strengthening regional resilience will require transformation of food systems. Mobilizing investment for scaling CSA is central to supporting transformation. Investment decisions require evidence of successful scaling approaches. This paper aims to summarize regional evidence of these drawing from investment proposals for scaling CSA embedded in national priorities, enabling policies and institutional environments and evidence-based policy advocacy, research into use and knowledge sharing, community-based adaptation, and private sector adaptation efforts. It describes an innovative approach to developing an investment pitch for global climate financiers through use of local to global dialogues and creative theatre play as means of communication. Multi-stakeholder dialogues are conducted at local, national and regional levels and utilized to develop climate-resilient development pathways for SADC and gather evidence of successful CSA scaling. Dialogues will be driven by a theatre for policy advocacy process that fosters creativeness, combines practical and technical knowledge, and brings local voices to a global audience. Evidence and ideas revealed through theatre will be packaged and communicated to global decision makers – culminating in a regional pitch for CSA investment. The paper will share the approach and lessons.