Climate-Smart Agriculture Technologies in Asia

Regional Workshop Report

Workshop Organizers

United Nations Environment Programme (UNEP)
CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS)
International Rice Research Institute (IRRI)

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Abstract

A regional workshop on Climate-Smart Agriculture (CSA) technologies was organized by the International Rice Research Institute (IRRI) in collaboration with the Consultative Group for International Agricultural Research (CGIAR) research program for Climate Change, Agriculture, and Food Security (CCAFS), with financial support from the United Nations Environment Programme (UNEP). Participants from thirteen (13) Asian countries attended the workshop, which consisted of two days of presentations on technical, organizational, and financial aspects of CSA technologies in Metro Manila, Philippines and a field visit to the IRRI campus in Los Baños, Philippines to view the development and testing of CSA technologies. Resource persons from global, regional, and national institutions contributed to the regional workshop, including: CGIAR Research Centers (CIAT, CIMMYT, CIP, ICRAF, IFPRI, ILRI, IRRI, and WorldFish); the CGIAR research program on Climate Change, Agriculture, and Food Security (CCAFS); the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES); the Asian Development Bank (ADB), the Asia Low Emission Development Strategies (ASIA LEDS), the Asia-Pacific Adaptation Network (APAN), and Deutsche Gesellschaft für Internationale Zusammena (GIZ).

Workshop sessions included: (1) Technical assistance, tools, and policy support, (2) Climate-Smart Agriculture technologies, (3) Climate-Smart Agriculture technologies in rice production, (4) Climate finance opportunities, and (5) Policies and programs to maintain an enabling environment for CSA. Participants visited the IRRI campus in Los, Baños to observe ongoing CSA field experiments relating to rice production. Presentations by CGIAR centers and research programs, regional and national research institutions, and development partners, accomplished the following workshop objectives: (1) explained the concepts and components of CSA; (2) described specific CSA technologies, methodologies, and tools currently available for use in Asia; and (3) identified climate finance opportunities for the agriculture sector. Descriptions of specific Climate-Smart Agriculture technologies included: Weather Smart; Water Smart;Carbon Smart; Nitrogen Smart; Energy Smart; and Knowledge Smart. Discussion sessions identified challenges and uncertainties which constrain scaling-up these technologies.

Participants identified potential synergies between national needs and existing technologies. They drafted concept notes for proposals to be submitted to the Asia-Pacific Climate Technology Network and Finance Centre (AP-CTNFC) pilot project. The workshop concluded with a panel discussion involving both country participants and resource persons identifying common challenges and interests, priorities, potential synergies and mechanisms, and follow-up actions to move CSA forward in Asia.

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CONTENTS

Abbreviations

ADB	Asian Development Bank
AFOLU	Agriculture, forestry and other land use
APAN	Asia-Pacific Climate Change Adaptation Network
AP-CTNFC	Asia-Pacific Climate Technology Network and Finance Centre
ASEAN	Association of Southeast Asian Nations
ASEAN-CRN	ASEAN-Climate Resilience Network
ASIALEDS	Asia Low Emission Development Strategies
ATWGARD	ASEAN Technical Working Group on Agricultural Research and Development
AWD	Alternate Wetting and Drying
BIMSTEC	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
BISA	Borlaug Institute for South Asia
CA	Conservation Agriculture
CCAC	Climate and Clean Air Coalition
CCAFS	Climate Change, Agriculture, and Food Security
CCARA	Climate Change Adaptation in Rainfed Rice Areas
CCF	Climate Change Fund
CEFPF	Clean Energy Financing partnership facility
CGIAR	Consultative Group for International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
COP	Conference of the Parties, United Nations Framework Convention on Climate Change
CSA	Climate-Smart Agriculuture
CSV	Climate-Smart Village
CTCN	Climate Technology Centre and Network
CTC-N	Climate Technology Center and Network
CTFC	Climate Technology Finance Center
CTNFC	Climate Technology Network and Finance Center
ENSO	El Niño-Southern Oscillation
GACSA	Global Alliance for Climate-Smart Agriculture
GAP-CC	The ASEAN-German Programme on Response to Climate Change
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammena
ICRAF	International Center for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute

IRRI	International Rice Research Institute
IWMI	International Water Management Institute
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
LDC	Least Developed Countries
LDSF	Land Degradations Surveillance Framework
LEAD	Low Emissions Asian Development
MODIS	Moderate Resolution Imaging Spectroradiometer
NAFRI	National Agriculture and Forestry Research Institute
NAMA	Nationally Appropriate Mitigation Actions
NAP	National Adaptation Planning
NDE	National Designated Entities
NEDA	National Economic and Development Authority
PAGASA	Philippine Atmospheric and Geophysical and Astronomical Service Administration
PIRCCA	Policy Information and Response Platform on Climate Change and Rice in the ASEAN Member States
PRISM	Philippines Rice Information System
RCM	Rice Crop Manager
REAL	Remote Expert Assistance on LEDS
RIICE	Remote sensing-based Information and Insurance for Crops in emerging Economies
RIMES	Regional Integrated Multi-hazard Early-warning System
SAARC	South Asian Association for Regional Cooperation
SAR	Synthetic Aperture Radar
SEARCA	Southeast Asia Regional Centre for Graduate Study and Research in Agriculture
SIDA	Swedish International Cooperation Development Agency
SPCR	Strategic Program for Climate Resilience
SRI	System Of Rice Intensification
TNA	Technology Needs Assessments
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WeRise	Weather-rice-nutrient Integrated Decision Support System
WHS	Water harvesting systems

Introduction

The workshop was organized by the International Rice Research Institute (IRRI) in collaboration with the CGIAR research program for Climate Change, Agriculture, and Food Security (CCAFS) with financial support of the United Nations Environment Programme (UNEP). The three-day workshop, from 2-4 June, 2015, consisted of two days of presentations in Metro Manila, Philippines and a field visit to the IRRI campus in Los Baños, Philippines. The presentations and field visits related to different aspects of Climate-Smart Agriculture (CSA). The complete agenda is provided as Appendix 1.

Resource persons from global, regional, and national institutions contributed to the regional workshop, including: CGIAR Research Centers (CIAT, CIMMYT, CIP, ICRAF, IFPRI, ILRI, IRRI, and WorldFish); the CGIAR research program on Climate Change, Agriculture, and Food Security (CCAFS); the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES); the Asian Development Bank (ADB), the Asia Low Emission Development Strategies (ASIA LEDS), the Asia-Pacific Adaptation Network (APAN), and Deutsche Gesellschaft für Internationale Zusammena (GIZ). The complete list of resource persons is provided as Appendix 2. Participants from thirteen (13) Asian countries attended the workshop (Figure 1). Although participants from Myanmar were unable to attend, they did contribute to the Poster Session and submitted Concept Notes for consideration.

Figure 1 Map of countries with attending participants

Workshop Activities, Objectives, and Output

Workshop sessions included: (1) Technical assistance, tools, and policy support, (2) Climate-Smart Agriculture technologies, (3) Climate-Smart Agriculture technologies in rice production, (4) Climate finance opportunities, and (5) Policies and programs to maintain an enabling environment for CSA. Participants visited the IRRI campus in Los, Baños to observe ongoing CSA field experiments relating to rice production. Participants drafted concept notes for proposals to be submitted to the Asia-Pacific Climate Technology Network and Finance Centre (AP-CTNFC) pilot project. The workshop concluded with a panel discussion involving both country participants and resource persons identifying common challenges and interests, priorities, potential synergies and mechanisms, and follow-up actions to move CSA forward in Asia.

Presentations by CGIAR centers and research programs, regional and national research institutions, and development partners, accomplished the following workshop objectives: (1) explained the concepts and components of CSA; (2) described specific CSA technologies, methodologies, and tools currently available for use in Asia; and (3) identified climate finance opportunities for the agriculture sector. Descriptions of specific Climate-Smart Agriculture technologies included:

1. Weather Smart: seasonal climate and weather forecasts, agro-advisories, agricultural insurance based on weather indices or remote sensing, and climate analogues;
2. Water Smart: rainwater harvesting, aquifer recharge, Laser Land Leveling (LLL), community management of water resources, and on-farm water management;
3. Carbon Smart: conservation tillage, agroforestry, land use systems, and livestock management;
4. Nitrogen Smart: Site-Specific Nutrient Management (SSNM)), and precision fertilizer application;
5. Energy Smart: agricultural residue management, minimum tillage; and
6. Knowledge Smart: farmer-farmer learning, FARM schools, off-farm risk management.

Discussion sessions identified challenges and uncertainties which constrain scaling-up these technologies. They also identified potential synergies between national needs and existing technologies. Some specific challenges to the Asian region included: sea-level rise, increased frequency of extreme weather events such as drought and floods, and higher day and night time temperatures.

Climate-Smart Agriculture: Rising to the Challenge

Dr. Andy Jarvis briefed participants on the objectives of Climate-Smart Agriculture,[1] including: supporting efforts from the local to global levels for sustainably using agricultural systems to achieve food and nutrition security for all people at all times; integrating necessary adaptation and capturing potential mitigation. This is useful in a context in which yields gaps are large, significant climate risk impacts the global food system, and where agriculture contributes 19-31% of global GHG emissions.

The challenges ahead are immense, but not insurmountable. Dr. Jarvis identified two key factors for success: (1) building a business case for CSA technologies and (2) directly addressing the constraints and challenges. He identified three major challenges faced by the developers of CSA technologies: (1) urgency: climate change will endanger agriculture, food security, and rural livelihoods in the coming decades; (2) there are trade-offs as well as synergies between food security and adaptation; and (3) there are different breeding challenges for different crops in different countries – there is no single solution. Implementing CSA requires a comprehensive approach involving technical, financial, and policy interventions.

Dr. Jarvis briefed participants on a wide range of technologies that, through successful pilots, are demonstrating how agriculture can develop in a climate friendly manner. Examples of practices and technologies included: alternate wetting and drying for rice, agroforestry systems, climate-stress tolerant varieties, climate information services, big data applications for agricultural extension, and others. Significant opportunities exist to contextualize future agricultural development with a climate-smart lens, through initiatives such as the Global Alliance for Climate-Smart Agriculture (GACSA)[2] which has the aim of benefitting 500 million farmers.

Andrew Jarvis, CCAFS

Technical Assistance, Tools, and Policy Support

Climate Services: Tools and Data for Agriculture and Food Security

Forecasts for weather and climate are available at the different scales relevant for agricultural use. For climate predictions to be useful to the agricultural sector, they need to be anchored in a well-coordinated end-to-end institutional system that begins with monitoring of weather and climate events and ends with a community level response. The main challenge is customization of information to climate sensitive points of the local agricultural practices, developed through an interactive stakeholder engagement process.

The Regional Integrated Multi-hazard Early warning System for Africa and Asia (RIMES)[3] is an international and intergovernmental institution, owned and managed by its Member States, which builds capacity to generate and apply user-relevant early warning information. Since its establishment in April 2009, RIMES has been providing hydro-meteorological research and development support to the National Meteorological and Hydrological Services (NMHS), under the framework of the World Meteorological Organization (WMO); generation of localized and tailored severe weather, short-term weather and flood information for contingency planning; medium-term weather and flood information for logistics planning; and seasonal climate outlooks for longer-term resource planning and management; analysis of risks to climate variability and change, and identification of risk management and adaptation options; development of decision-support tools; and development of new generation risk information products.

Dr. Srinivasan briefed the participants on the development and deployment of the Agro advisory expert system, which is an online system built to support farm level decision making at two pilot sites in Myanmar (Viz. Monywa and Nueang-Oo). The system has been developed in close collaboration with Myanmar's Department of Meteorology and Hydrology (DMH) and Myanmar's Department of Agriculture.

During Question and Answer, participants asked whether or not the different tools presented were validated through comparison with the actual weather Dr. Srinivasan explained that comparing the forecasts with observed data is part of the standard verification systems. Another participant asked how these tools are disseminated to the farmers. He explained that RIMES hold workshops together with Myanmar's DMH to explain the tools and products using the local language. In addition, DMH and RIMES operate FARM schools where they get feedback from the farmers, agricultural extension workers, and the agriculture department.

G. Srinivasan, RIMES

Agriculture: Role of a Research Institute

The World Agroforestry Centre (ICRAF) has been collaborating with the Oscar M. Lopez (OML) Center on climate and disasters risk management in the Philippines since 2012. Dr. Lasco briefed participants how this partnership was forged, what research activities are being conducted, and what are the lessons learned so far. The main research activities include climate change projections, flood modeling in lowland rice production areas using light detection and ranging (LiDAR) technology, and assessment of the impacts of Haiyan to human and natural systems.

ICRAF's project with the Philippine Atmospheric and Geophysical and Astronomical Service Administration (PAGASA) analyzes past trends (e.g. temperature and tropical cyclones) and looks into possible future changes through downscaling of climate change projections using different models to help understand uncertainties and identify alternative options for increasing resilience. A Climate Knowledge Portal for the Philippines has been established which provides access to local practitioners, researchers, and decision-makers on observed climate and future projections.

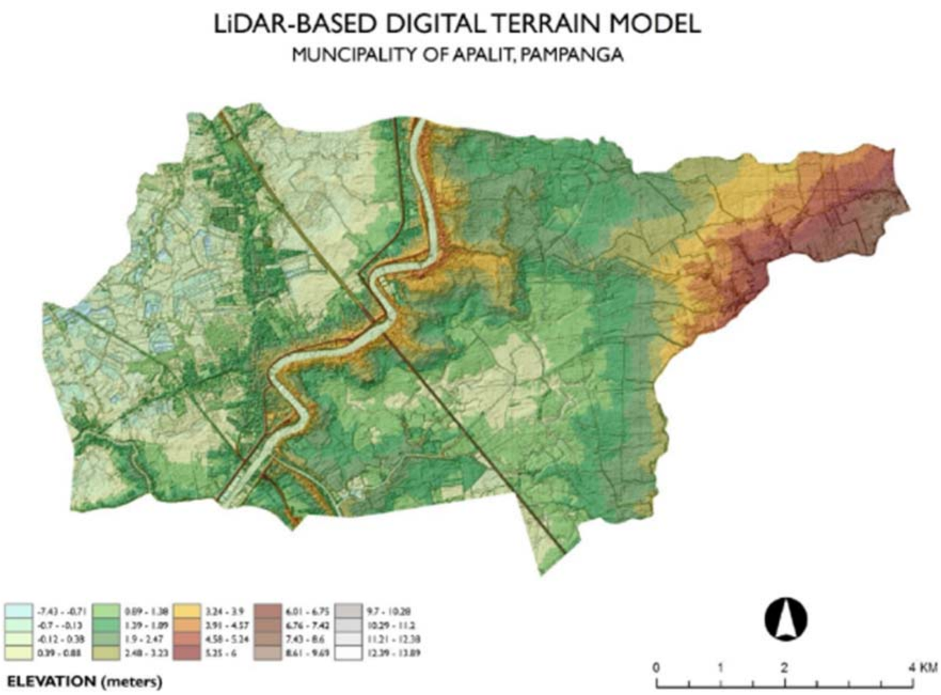

Figure 2 Digital terrain mapping in Pampanga, Philippines

One of the key benefits of this partnership is the ability to link with high-level policy makers and to tap private sector financing for research activities.

Rodel D. Lasco, ICRAF

Agriculture: Role of a Research Program

Climate change in Southeast Asia is projected to cause significant variations in rainfall patterns, increased incidence of severe weather events, higher temperatures, and sea-level rise affecting the main agriculture areas and the highly populated areas. ADB reports that these changes will adversely affect agricultural yields, biodiversity, forest harvests and availability of clean water. In this context, the CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS) primarily aims to catalyze positive changes towards climate-smart agriculture, food systems and landscapes. CCAFS generates equitable and gender-sensitive technologies, practices, and institutional and policy options with its four Flagship research for development (R4D) themes, namely: (1) Climate-smart agricultural practices, (2) Climate information services and climate-informed safety nets, (3) Low-emissions agricultural development, and (4) Policies and institutions for climate-resilient food systems. Along with these, the CCAFS-Southeast Asia (CCAFS-SEA) defined its strategic directions of agriculture and climate change R4D in the region, communicating them clearly and transforming them into action plans with national partners. Starting 2015, CCAFS-Southeast Asia is implementing 12 Flagship projects under the four Flagship themes. CCAFS provides regional program coordination, overseeing research from participating CGIAR Centers and coordinating actions that leads to coherent implementation. Moreover, CCAFS also implements a number of core activities with partners to contribute to research outputs critical to achieving goals and regional priorities. Among these is the establishment of ‘Climate-Smart Village’ (CSV) in selected countries in the region. Six Climate-Smart Villages have been established in Laos (2), Vietnam (3) and Cambodia (1) in areas representing different climate change challenges, agro-ecosystems and landscapes, and with existing CGIAR, government and other partner activities and programs. CCAFS is working with partners to increase the number of climate-smart villages.

In the discussion section, Dr. Sebastian described the CCAFS flagship project that focuses on understanding the behavior of farmers, women, and ethnic minorities in Vietnam with respect to climate change. ICRAF and CARE are collaborating to determine if the climate information received by these groups is useful, and how they benefit from it. The project is also investigating the relationship between the community and local government.

Leocadio Sebastian, CCAFS

Climate-Smart Agriculture Technologies

Water Smart: Water Harvesting and Water Saving Technologies

Water harvesting systems (WHS) for agricultural production have evolved over the millennia throughout water-scarce regions of the world. Compared to arid and semi-arid regions, Southeast Asia, cumulating more than 1,500 mm of average annual rainfall, is considered as a water-abundant region. However 80% of this rainfall amount is concentrated during the 6 months of the wet season (from May to October). With less than 300 mm of rain, the dry season (from November to April) exhibits the same rain water scarcity than that observed in semi-arid areas. Until recently, rainfed rice-based agriculture performed during the wet season was sufficient to sustain a moderate food demand for self-consumption. With the rapid population increase and the growing market demand, traditional rainfed agriculture is underperforming. The modernization of farming systems, from subsistence agriculture to more market-oriented cropping, requires a more secure water supply to cope with unpredictable droughts during the wet season and to allow irrigated crop production during the dry season.

For a broad and durable use by smallholder farmers, Water harvesting systems should be (1) affordable for implementation and long-term use, (2) manageable by farmers and easy to set-up with material available on local markets, and (3) adapted to the farmers' needs. In addition, WHS's foot-print should be as small as possible. IWMI has reviewed existing WHS in Southeast Asia through detailed case studies at various geographic scales. This review is not limited to traditional WHS that are typical of semi-arid areas but describes a range of interventions aiming to harvest, control, or save water from rainfall, overland runoff, river, aquifers and soils. Examples include dry season river flows sustained by hydropower dam cascades in Central Laos, managed aquifer recharge in Central Thailand, on-farm ponds for integrated farming in Northeast Thailand, roof-top rainwater harvesting in the Lower Mekong River Basin, and soil management for raising crop water productivity in Central Laos. This review reveals that each type of WHS is site specific. Its successful adoption by farmers depends on access to land and water, soil characteristics, climate patterns, crops, farmers' skills and habits, as well as non-structural factors like government supports and the efficiency of agriculture extension services.

Guillaume Lacombe, IWMI

Weather Risk Smart: Crop Diversity / Crop Suitability Analysis

Projected increases in temperatures and shifting precipitation patterns will pose challenges to agricultural production globally. Crop suitability modeling that highlights the challenges and opportunities for specific crops can support policy makers in evidence-based decision-making. Understanding how climate change may impact on agricultural systems is essential for the design and development of regionally specific, long-term adaptation and mitigation strategies to enhance farmers' resilience and to secure livelihoods.

An analysis of past climate trends, climate variability and calibration of the current and future climate was conducted for 28 crops in the Greater Mekong Sub-region. The future suitability for the selected crops was modeled using EcoCrop under different emission scenarios, showing higher suitability for cassava and groundnut, whereas maize and coffee are among crops that show reduced bioclimatic suitability by 2050.

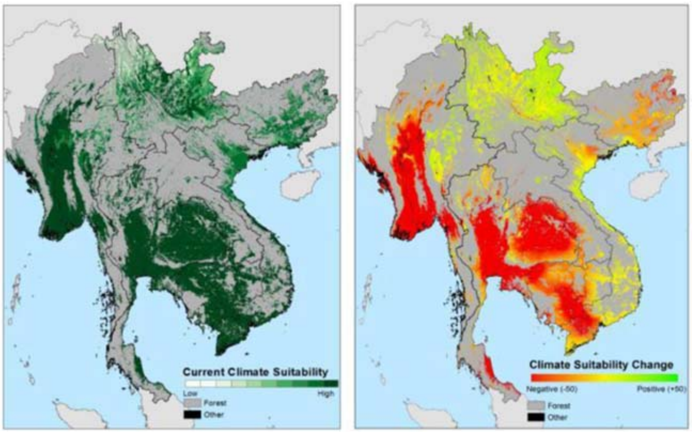

Figure 3 Maize suitability mapping, present and future outlooks

An assessment of climate change impacts on Arabica coffee production in Indonesia demonstrated that the projected climate impacts can lead to reduced yield and quality as well as increasing pressures from pests and diseases. Impacts are likely to result in a shift of Arabica production to higher altitudes, requiring adaptation strategies.

The Land Degradations Surveillance Framework (LDSF):[4] is designed to provide a biophysical baseline at landscape level and a monitoring and evaluation framework for assessing processes of land degradation and the effectiveness of rehabilitation measures over time.

CIAT assists governments to prioritize national adaptation and mitigation policies and actions (NAMA and NAP) based on scientific evidence. In Colombia, CIAT supports climate change adaptation of the agricultural sector.[5] In Costa Rica, CIAT supported development and implementation of a coffee, livestock and sugar cane NAMA.[6] In Nicaragua, CIAT helped shape the NAP and assisted the government to secure IFAD funding for adapting the coffee and cocoa sectors.[7] CIAT also supports governments to include gender in their climate policies.[8]

Nora Guerten, CIAT

Energy Smart: Zero-tillage Technologies

Ensuring food security while preserving natural resources and vital ecosystem services, requires a transition to agricultural production systems that use inputs more efficiently, are more resilient to climate variability, and which emit less GHG into the environment. Conservation Agriculture (CA) based management practices are a key strategy for addressing the labor, water, energy, soil health farm profitability and climate risk issues encountered under conventional tillage. The International Maize and Wheat Improvement Center (CIMMYT), in partnership with Borlaug Institute for South Asia (BISA) and other stakeholders, is evaluating, piloting and up-scaling various Conservation Agriculture-based practices.

Dr. Singh presented the preliminary results from an on-station and on-farm evaluation of CA-based technologies. Direct drilling (zero tillage) saves on labor, water, and energy, reducing the cost of production while improving and maintaining soil heath. Research on the energy dynamics of wheat production under different tillage techniques demonstrate that using zero-tillage technologies has the highest energy-use efficiency and the lowest consumption of water and fuel.[9] With zero-tillage practices, subsurface drip irrigation is possible, which saves water, increases productivity and makes the system sustainable and climate resilient. Sub-surface drip irrigation has been demonstrated to use less than half the irrigation water use with no yield penalty. There is also evidence of lower emission of greenhouse gases, showing that farm machinery need not be costly, especially for the environment.[10]

Laser Land Leveling reduces the use of water for irrigation and increases crop yields. Dr. Singh briefed participants on the use of a laser land leveler in India, including the results of a study indicating water savings of 15–30% and yield improvement for rice-wheat farmers.[11] Irrigation time in laser-leveled fields was reduced by 47–69 h/ha/season in rice and by 10–12 h/ha/season in wheat and yields of wheat and rice were 7–9 % and 7% higher, respectively, in laser leveled fields as compared to traditionally leveled ones. Shortening the duration of irrigation reduces energy use lowering GHG emissions associated with agricultural activities. Therefore, the practice of Laser Land Leveling contributes to climate change mitigation.[12]

Sustainable intensification in rice-wheat systems can be achieved by relay planting of green gram (“moong”) into standing wheat a using high clearance tractor and direct seeder. Participants viewed a video clip of the Turbo Happy Seeder, a planter capable of direct drilling in the fields with surface retention of residues and without any soil disturbance.[13]

Parvinder Singh, CIMMYT

Low-Emissions Livestock Management Technologies

Dr. Erickson briefed the participants on ILRI's research on CSA technologies in livestock systems. The livestock sector is of relevance to the Climate-Smart agenda because of its significant contribution to greenhouse gas emissions, the sensitivity of livestock to climate change, and the considerable increase in growth predicted for the sector. Reducing emissions intensities in the livestock sector represent opportunities for "triple" wins, given that emissions intensities can be reduced through technological interventions that improve productivity, thus also contributing to food and nutritional security. Much of ILRI's research on GHG emissions focuses on improving emissions factors to fill the data gap for developing countries. Currently IPCC emissions factors are all calculated using data from OECD countries, where production systems are vastly different from those found in the tropics. The promising technologies include improving feeding practices, integrated nutrient and manure management. On the climate change adaptation side, adapting livestock to heat stress, changes in feed and fodder availability, and changes in disease and pest distributions are issues that need to be addressed. Finally, there are many tradeoffs that must be assessed for the livestock sector, particularly between mitigation, adaptation, and food security goals.

Polly Erickson, ILRI

Climate-Smart Agriculture Technologies in Rice Cultivation

Stress Tolerant Varieties: Submergence (flooding) and Salinity

IRRI is developing rice varieties that can withstand conditions forecast to become more frequent and intense with climate change. This includes drought, flood, heat, cold, and soil problems like high salt and iron toxicity. In recent years, IRRI has developed rice with better tolerance to submergence and salinity.[14] IRRI's partners in the national research and agricultural extension services test these breeding lines in different locations and countries, including evaluating their performance on farmers' fields. Along with improved crop management, proper use of technology through extension work and the support of national institutions, these improved varieties or "climate change-ready rice" are showing substantial, positive impacts in the lives of poor farmers.

Abdelbagi Ismail, IRRI

Stress Tolerant Varieties: Drought

The Drought Physiology Group (DPG) works closely with the Drought Breeding Group (DBG) whose aim is to develop drought tolerant varieties[15] by crossing traditional drought tolerant varieties with modern high-yielding varieties that are mostly drought susceptible.

For the last decade, the focus has been reproductive drought stress screening. However with climate change, rain has been become less predictable in rainfed farms, thus, research agenda has broadened to various stages. Additionally, more work is devoted in examining different traits and selection for those traits to improve rice response to direct seeded condition. Their research works also cover the characterization of the severity and timing of drought stress. There are many types of drought that affect farmers. Using a tensiometer, soil moisture content, moisture potential and water tension are measured.

Amelia Henry and Rolly Torres, IRRI

Ecological Intensification

The ecological intensification platform[16] of IRRI provides a field laboratory for developing and researching probable futuristic rice production systems. It involves adaptation of mechanized agronomic activities to rice production, in conjunction with the implementation of efficient irrigation technologies, and the intensification and diversification of crop scheduling.

James Quilty, IRRI

Sustainability: Long Term Continuous Cropping Experiment

The Long-Term Continuous Cropping Experiment (LTCCE) has been continually cropped since 1962, barely two years after IRRI's establishment. To date, the standing crop is the 154th continuous rice crop cultivated in the same plot. The experimental field was established to look at the long-term sustainability of the rice cropping system to examine whether growing rice for more than one season per year will have detrimental effects on the soil and yield will collapse. Before, cropping was done only once a year using traditional varieties, which grow around 150 days, and with no irrigation facilities. This was the impetus in developing modern varieties that grow in shorter duration, thus, enabling a more intensified cropping system.

The LTCCE produces around 7-9 tons in the dry season, 5-7 tons in early wet season, and 4-5 tons in late wet season. The target is 15-17 tons per year. It was observed that in this system, yield tends to decline towards the end of the year due to the local climate. During December-May, the climate is ideal for rice growing with high solar radiation, almost no typhoons, and with low precipitation. Monsoon season usually occurs in the months of June-November, hence, productivity becomes low.

Sustainability is measured in terms of yield trends and soil fertility.[17] To get the yield trend, the measured yield is plotted against the potential yield (obtained through a crop simulation model called *Oryza 2000*). Potential yield assumes a perfect environment (i.e. no limitation to water, nutrients, pests, and disease; the varying factor is climate). Measured yield is a function of yield and management. The target measured yield is 80% of the yield potential or economic yield, which has been achieved for the past 20 years.

Jun Correa and Irish Lorraine Bicaldo, IRRI

Alternate Wetting and Drying in Irrigated Rice Production

The water-saving technology "alternate wetting and drying" (AWD)[18] for rice production has been developed by the International Rice Research Institute and its partners more than 10 years ago. Since then the practice that saves 15-30% of irrigation water has been implemented in various rice producing regions in Asia. In recent years, however, the greenhouse gas mitigation potential of AWD has become more and more relevant for policy makers as the main reason to encourage implementation of this technology.

AWD can reduce methane emissions from rice fields approximately by half without compromising yield. The Paddy Rice Component of the Climate and Clean Air Coalition (CCAC) aims to support large scale implementation of the technology in different regions by supporting policy makers with targeted information, assessments of suitability and implementation road maps.

In its current first phase, the CCAC Paddy Rice Component works in Vietnam, Bangladesh and Colombia with the clear goal of out-scaling activities to other countries of the three regions (Southeast Asia, South Asia and Latin America).

Bjoern Ole Sander, IRRI

Seasonal Weather Forecasts to Improve Rainfed Rice Production

The timing of sowing is a crucial determinant for rice growth and grain yield in rainfed rice production areas. It is usually decided by referring to past weather events; hence, it could be difficult to determine in the context of climate change. In Central Java, Indonesia, dry direct seeding is a common crop establishment method. Since crops tend to mature faster using this method, drought early in the season can result in substantial damages to the rice plant at their early growth stage. In Lao PDR, transplanting is the common practice. Drought in the early season delays the timing of transplanting which could result in problems while the seedlings are at the nursery. Seasonal weather forecasts provide information on characteristics of upcoming rainy season with lead time ranging from 1-24 months. Using this information to inform local farmers can help reduce risks during the early stages of rice cropping.

The Weather-Rice-Nutrient Integrated Decision Support System (WeRise)[19] has been developed through the IRRI-Japan collaborative research project on Climate Change Adaptation in Rainfed Rice Areas (CCARA). Grain yields are predicted using ORYZA, a crop growth simulation model for rice developed at IRRI, paired with a seasonal weather forecast, localized to target regions through bias reduction methods. The seasonal weather forecast is an output from the SINTEX-F model developed by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) that is designed to predict the El Niño-Southern Oscillation (ENSO) phenomenon. WeRise produces a weather advisory that shows the start and end of the upcoming rainy season and seasonal weather characteristics including rainfall distribution during the cropping season. A grain yield advisory predicts grain yields as a function of sowing dates and different varieties can be compared in this advisory, which helps users to choose the most appropriate variety for the upcoming season.

Predictions through WeRise advisories have been tested in farmers' fields in Central Java in 2012 and 2013. Popular varieties such as IR64 and Ciherang were planted on the recommended optimum sowing dates from the grain yield advisory. The observed grain yield was evaluated against the predicted one by computing for the root mean square error (RMSE). Normalized RMSEs for Ciherang and IR64 were 14% and 18%, respectively. These results indicate adequate model performance. Training participants found the WeRise tool to be easy to use, to understand, and to explain.

Keiichi Hayashi, IRRI

Rice Straw Management

Asia produces almost 600 million tons of rice straw[20] each year. In traditional rice growing systems rice straw is either incorporated in the soil, used as animal fodder, or used for other off-field purposes such as building materials, organic fertilizer, or mushroom production. The rapid introduction of combine harvesters in intensive rice growing systems has resulted in a change of practice because harvesters leave the straw spread on the field. Manual collection is unprofitable because of high labor cost. Incorporation in the soil is also not possible in systems with two to three crops per year because the time between harvesting and planting is too short for decomposition. As a result, the practice of field burning of rice straw has increased dramatically, leading to significant air pollution. It is estimated that 80% of the total straw is burned in the Philippines and around 60% is burned in the Mekong Delta. Field burning and straw incorporation, may increase methane emissions from rice production, although empirical data is insufficient, to date. Moreover, the energy balance of mechanized rice production is relatively poor when compared with that of traditional systems, further increasing the ecological footprint of rice production.

IRRI and its partners have therefore engaged in new research on sustainable rice straw management options. This includes trials for on-farm management such as: incorporation and mulching, the identification and verification of technologies for straw collection and processing, energy applications, other off field straw utilization applications, and business models for farmers to add value to their rice from collecting and selling straw or straw products. A new initiative establishes protocols and procedures to conduct life-cycle analysis under different straw management methods, combined with economic and social sustainability aspects with the aim to conduct sustainability assessments for the different straw management options.

Martin Gummert & Nguyen Van Hung, IRRI

GIS in Decision Support

Many Asian countries are highly dependent upon rice production for their food security. During the major rice growing season (June to October) rice fields are exposed to the risk of tropical storm related damage. Unbiased and transparent approaches to assess the risk of rice crop damage are essential to support mitigation and disaster response strategies in the region. IRRI plays a leading role in the Remote Sensing-based Information [21] and Insurance for Crops in emerging Economies (RIICE) project, which is a public-private partnership aiming to reduce vulnerability to climate shocks. The partnership uses remote sensing technologies to map and monitor rice production in selected countries in Asia. In the Philippines, RIICE technologies and methods have been incorporated into the Philippines Rice Information System (PRISM), a national decision support system.

RIICE and PRISM contributed to accurate assessments of the damages caused by Typhoon Haiyan (2013) and their impact on the rice crop in Leyte Province in the Philippines. A Synthetic Aperture Radar (SAR) derived rice area map delineated the area at risk. Rice transplanting and heading dates were identified within this area from a rice crop specific interpretation of Moderate Resolution Imaging Spectroradiometer (MODIS) time series data. The indicator of risk of standing crop loss was the time between estimated heading date and typhoon occurrence. Two critical periods were identified: from Typhoon (T) to T minus 30 days (T-30), where rice in the field was not yet mature, and from T minus 30 days to T minus 50 days (T-50), where harvesting activities were probably not yet completed according to common practice in the study area. Typhoon related flooding was assessed from SAR images acquired pre and post typhoon landfall.

Results show that Northeastern Leyte was the region most at risk to storm related crop damage due to late establishment of rice in the part of the province most affected by the typhoon. 700 ha of rice (71% in Northeastern Leyte) had not reached maturity at the time of the typhoon event and a further 8400 ha (84% in Northeastern Leyte) had not been harvested. Furthermore, analysis of pre- and post-event SAR images showed that 6,500 ha were flooded.

This approach has the potential to provide unbiased information on the status of the rice and other field crops and the risk of damage posed by tropical storms. The RIICE partners are utilizing data from the Sentinels satellite missions to further develop crop monitoring systems.

Andy Nelson, IRRI

ICT for Climate-Smart Agriculture

Climate-Smart Agriculture promotes a range of complex innovations to assist smallholders to improve yields, reduce production costs, and conserve natural resources in order to counter the impacts of climate change on crop productivity. Yet, the number of farmer reached by national agricultural knowledge systems remains dismally low. Information and Communication Technology (ICT) holds the promise of delivering low-cost solutions for reaching many more farmers with research-based innovations and increase uptake of knowledge intensive CSA practices. In spite of the recent proliferation of ICT solutions for CSA and climate-change information dissemination, the current status of the sector is fragmented, not always producing sufficient evidence to engage the National Agricultural Research and Extension Services (NARES).

Testing of the Rice Crop Manager (RCM)[22] in Vietnam provides an example of steps in the right direction. The RCM is a web-application available on smartphones, based on several IRRI research knowledge products. The RCM provides scalable, local–cost, decision support and site-specific crop management advisory to rice farmers, mediated by extension staff. A new climate-smart component is being developed for RCM, called Climate-Informed Rice Crop Low Emission (CIRCLE). RCM – CIRCLE can include information on climate-adjusted crop yields, climate and environmental risks and low-emission options for rice cultivation The RCM-CIRCLE versions developed for Vietnam's Mekong Delta and Red River Delta integrate CSA features, including climate-informed crop yields, reduced fertilizer inputs, AWD, and a GHG emissions calculator, based on rice field conditions and farmer straw management practices. NARES and other actors in the rice value chain are involved in the implementation of randomized control trials to build evidence of agronomic and economic impact of the RCM – CIRCLE.

Translation of CSA into knowledge products and ICT applications for dissemination at farmer level remain an on-going challenge at scale. The integration of ICT with climate forecasting, early warning and mitigation is equally important. IRRI is well positioned to offer integrated ICT platforms for CSA decision support to NARES in Asia.

Paolo Ficarelli, IRRI

Discussion Sessions – CSA Technologies

Participants asked how efforts to scale-up CSA technologies will consider the culture and the socioeconomic conditions of the farmers who are expected to adopt these technologies. Dr. Jarvis (CCAFS) responded that ultimately, all efforts have to be beneficial to the farmers. In able to achieve that, all the technologies must be aligned and put together with the policies, incentives, and financial mechanisms that enable adoption. The decision processes need to be participatory and understand the mindset and the behavior of the farmer who is making the choice. It requires a different way of thinking because not all CSA technologies increase productivity. Many of these technologies have multiple benefits and the farmers need to see them demonstrated and be given the opportunity to trial them. At this time, there are few, if any, financial incentives for mitigation technologies. No one is offering to pay farmers to adopt technologies which have mitigation benefits. In order to encourage farmers to adopt some of these technologies, we will need to provide incentives.

Dr. Srinivasan (RIMES) added that farmers are always interested to obtain information useful to them. However, information must be communicated in a context specific manner, which is best achieved through local systems. Leo Sebastian (CCAFS) added that the goal of scaling up CSA technologies to 500 million farmers is a huge challenge for everyone involved. Adopting climate-smart technologies is knowledge intensive and requires an integrated approach based upon an understanding of the needs of farmers. The ability to collaborate with stakeholders in different sectors is as important as the technologies themselves.

Dr. Sanders (IRRI) challenged the perception that smallholder farmers are not interested in reducing greenhouse gases. Since smallholder farmers have limited knowledge of greenhouse gases, global warming, and climate change they are not fully aware of the impact they will have on their lives and livelihoods. If farmers have an opportunity to understand climate change and its effects, they will definitely have a strong interest to mitigate it.

Participants asked how a regional workshop can have an impact on policymakers. Resource Persons responded that regional collaborations developed through workshops are important because food security does not depend solely on agricultural production but also on policies, regional integration, and collaboration. In her response, Dr. Erickson described ILRI efforts to develop stronger partnerships with government institutions involved in climate change policy making, which are traditionally located in the ministries of environment. In addition, ILRI is expanding their contacts in the ministries of livestock, to include staff interested in climate change mitigation and adaptation. ILRI's country offices are providing capacity building for government partners to enable them to understand how their data might be used in negotiations with private sector investments in the dairy sectors.

Participants asked how information about CSA technologies are disseminated, noting that the findings of these studies would be useful throughout the region, not only in those countries where they were conducted Although most of the CSA technology studies have published in journal articles available online, dissemination of the findings remains a major challenge.

Participants asked how experts in water, rice, farm management, and livestock, such as those contributing to the workshop, can increase awareness of the technology options that are available. CCAFS described how it supports and encourages CGIAR centers to engage with the media to disseminate good practices and lessons learned. Dr. Lacombe (IWMI) described plans for policy briefs that can be shared with national partners and decision makers. A good example of a policy brief is one that IRRI and CCAFS have developed to explain the potential benefits of Alternate Wetting and Drying practice in irrigated rice production. Demonstration sites and field schools were identified as other examples of effective mechanisms to share information about CSA technologies and practices. Dr. Singh (CIMMYT) cited the use of video to communicate the success of the Turbo Happy Seeder to stakeholders. As the seeder is manufactured locally in India, the machines and its spare parts are available for sale throughout Asia.

Climate Finance

The Climate Technology Centre & Network

The Climate Technology Centre & Network (CTCN) is the operational arm of the United Nations Framework Convention on Climate Change (UNFCCC) Technology Mechanism and is mandated to facilitate the transfer of climate technologies to developing countries at their request. It was created through a COP16 decision to promote accelerated, diversified, and scaled-up transfer of environmentally sound technologies in developing countries for climate change mitigation and adaptation, consistent with the national socio-economic and sustainable development priorities of the requesting countries. UNEP was selected to host the CTCN together with United Nations Industrial Development Organization (UNIDO) and 11 consortium partner (CP) institutions in developing and developed countries with expertise in climate technologies. The Centre, the coordinating entity, is located in Copenhagen, Denmark.

The CTCN provides technology solutions, capacity building and advice on policy, legal and regulatory frameworks tailored to the needs of individual countries. It facilitates the transfer of technologies through three core services:

1. Providing technical assistance in response to formal requests submitted by developing countries via their National Designated Entities (NDEs) to accelerate the transfer of climate technologies;
2. Creating access to information and knowledge on climate technologies;
3. Fostering collaboration among climate technology stakeholders via the Centre's Network of regional and sectoral experts from academia, the private sector, and public and research institutions. In addition, Network members participate in CTCN events, exchange information, and provide experts for webinars, e-learning courses, and other types of trainings offered by the CTCN.

The online technology portal serves as a gateway to the CTCN's technical assistance and capacity building services, with special hubs for NDEs and Network members. It is also designed to serve as a comprehensive library of climate-technology information and tools, organized by geographic region and technology sector, and made available through an open-source database.

Further, the CTCN launched the 'Request Incubator Programme' for Least Developed Countries (LDCs). The Request Incubator Programme aims at enhancing LDCs capacities to develop requests for technical assistance, to build on the assistance provided, to strengthen institutional capacities related to climate technologies, and to reinforce national efforts on technology transfer.

Parimita Mohanty, UNEP

Climate Technology Network and Finance Center

UNEP and the ADB are piloting a climate technology network and finance center with financial support from Global Environment Facility (GEF) that aims to accelerate the adoption and deployment of climate technologies and foster investments in environmentally sound technologies in Asia and the Pacific. It was established to generate experiences and lessons for the CTCN in Asia. The pilot project is of short duration (30-42 months), concludes December 2016, and its sustainability is the CTCN.

Designed in line with the functions of CTCN, the climate technology network secretariat managed by UNEP focuses on creating capacity readiness and enabling conditions for market transformation interventions in the region through fostering knowledge sharing, public-private partnerships, and the development of institutional capacity and climate technology policies. Activities focus on supporting countries with pilot technical assistance actions under Climate Technology Network and Finance Center (CTNFC)[23] and in developing requests to the CTCN, with a view to support implementation of priorities identified in their Technology Needs Assessments (TNAs). Regional networking is facilitated through meetings and training workshops for countries and relevant national and regional climate technology centers to exchange institutional and technological know-how. Studies have been commissioned to develop national and regional standards and regulations, highlight best practices/case studies, map regional climate change institutions, and develop operational toolkits in priority climate technologies in order to support the national capacity for policies and programs. Technical assistance activities are to be initiated in a few countries to support policies, programs, and projects that promote the transfer and dissemination of environmentally sound technologies.

The project works in 16 countries: Laos, Indonesia, Bangladesh, Bhutan, Thailand, Sri Lanka, Nepal, Philippines, Cambodia, Malaysia, Myanmar, Vietnam, Tajikistan, Kazakhstan, Uzbekistan, and Mongolia. Of the 16 country focal points for the CTNFC, 12 are CTCN National Designated Entities (NDEs).

Julia Stanfield, UNEP

Climate Technology Finance Center (CTFC)

The two-pronged role of the Asian Development Bank in climate financing consists of: (1) seeking climate finance for its development projects, which are best implemented using climate-change funds from bilateral donors or from ADB's own resources and (2) by serving as an implementing entity and currently, the only multilateral development bank accredited by the Green Climate Fund (GCF) for climate projects in countries in the Asia-Pacific region.

The GCF which was established in 2010 under the UNFCCC serves as the central global investment vehicle to channel climate finance. The GCF is set to be the most significant source of climate financing in the years to come. The GCF plays an instrumental role in fulfilling the promise of developed countries to channel an additional $100 billion of climate finance to developing countries from the year 2020 onwards. To date, initial pledges to the fund come close to $10.2 billion from 33 countries. The operations of the GCF are exclusively coursed through accredited implementing entities. The GCF is now moving forward to its operational stage and expected to endorse its first batch of projects in October 2015. Through accredited implementing entities, developing countries have access to money for programs, including those for climate-smart agriculture. Currently, ADB is one of seven entities accredited to access climate funds on behalf of the developing countries. This number is expected to grow in the coming years as other countries nominate entities to be granted access to financing for climate programs. The participants are encouraged to get in touch with the national designated authorities which can be found in the website of the GCF.

Aside from channeling resources from GCF, ADB deploys concessional resources for its developing member countries by establishing dedicated funds for financing climate change mitigation and adaptation actions in the region. These include internally-managed funds, such as: the Clean Energy Financing Partnership Facility (CEFPF) and the Climate Change Fund (CCF) as well as externally-managed funds, such as: the Climate Investment Funds (CIFs), the Global Environment Facility, and the GCF.

In the past years, ADB has worked with countries to mainstream technologies by integrating technology and financing issues into their national plans. Furthermore, ADB has helped them to understand that climate actions will have technological and financial implications and that certain financial mechanisms have to be mobilized in order to cover the costs of these implementing these technologies. To do this, ADB and the partner countries have developed framework plans that outline the relationship that ADB and the partner countries have in implementing programs. ADB will then mobilize experts in the countries to assess their climate technology needs and potential. The technology needs assessment usually serves as a starting point which is then further developed by looking at the needs that were identified in the assessments and identify where it is most probable for the country to mobilize some of its climate finance, thus reducing the cost of the technology. ADB also makes recommendations to the countries on how they can proceed with financing the identified gaps in their technology needs assessments. On the public sector side, ADB works at the strategic, country planning level as well as the individual project level. Concurrently, ADB also works together with private sector investors to gain investments into companies that produce climate technology, working with venture capital and private equity funds to encourage greater level of investments into climate technologies. ADB has also inaugurated a climate-technology marketplace which brings together buyers and sellers of climate technology.

Michael Rattinger, ADB

Mobilizing Private Investment for Green Growth and Low-Emission Development in Agricultural Sector (ASIA LEDS)

John Bruce Wells, Chief of Party of the US Agency for International Development (USAID) Low Emissions Asian Development (LEAD) program, briefed the participants on regional knowledge sharing products available through the Asia Low Emission Development Strategies Partnership (ALP), for which the LEAD program serves as Secretariat. The ALP website[24] together with the LEDS Global Partnership (LEDS GP) website[25] provides a key knowledge portal for Asian countries to share experiences on tools and approaches for designing and implementing green growth strategies across all sectors, including agriculture. A special ALP working group on agriculture, forestry and other land use (AFOLU)[26] provides specialized resources. A LEDS GP working group focused on financing green growth is also available online.[27] In addition, ALP offers a special Remote Expert Assistance on LEDS (REAL) service through which developing country participants can obtain free, specialized advice on green growth approaches. In addition, Mr. Wells noted that the work of ALP and LEDS GP has confirmed the importance of coordinated policy and regulatory environments that enable green growth and help mitigate risks; and that Asian countries need to consider both domestic and international sources of funding and financing from both the public and private sectors.

John Wells, ASIALEDS

Asia Pacific Network – Regional Network

Dr. Sawhney briefed participants on the history of the Asia Pacific Network (APAN).[28] Established in 2009 as a network under the UNEP – Global Adaptation Network, it is primarily supported by the Ministry of Environment Japan (MOEJ), ADB, the Swedish International Cooperation Development Agency (SIDA), USAID, and many other partners and institutions. The four core activities of APAN include: (1) knowledge management, (2) knowledge synthesis, (3) Asia-Pacific Climate Change Adaptation Forum, and (4) sub-regional and thematic conferences; targeted training workshops. Dr. Sawheny explained the structure of APAN and the modalities through which it carries out the core activities. APAN has, organized and co-organized more than 91 training workshops, conferences and forums since 2010, and training approximately 5,000 people, including government officials. It has participated in COP 19 and other international processes. APAN has organized 4 Adaptation Forums and the event is now considered a leading forum on adaptation in the region. The next Adaptation Forum will be held in Sri Lanka during 2016.

Dr. Sawhney described two databases hosted on the APAN website: one related to climate-change adaptation technologies and the other on good practices. The APAN webportal has 150 adaptation technologies covering multiple sectors, including: agriculture and fisheries (26), water resources management (46), coastal zone management (36), and disaster risk reduction and management (42). Both databases are open access and can be freely accessed online. Technologies can be added to the website using the APAN template.

Dr. Sawhney explained the collaboration with the Southeast Asia Regional Centre for Graduate Study and Research in Agriculture (SEARCA) which serves as the APAN thematic node for Agriculture, including: technical reports, papers, policy briefs, and capacity building through thematic conferences, training, and workshops. An online course on integrating climate change adaptation and disaster risk management in policies, plans, and investments is currently under development.

Puja Sawhney, APAN

Policies and Programs: Creating an enabling environment

The Role of National Organizations

In the Philippines, the agriculture sector plays an important role, involving over 30% of total labor and around 10% of the country's total GDP in 2014. As an archipelagic country, the Philippines is highly vulnerable to climate risks and extreme weather events, with losses in agriculture production from 14.7 billion PhP in 2008 to 35.7 billion PhP in 2014. Production losses in rice alone totaled more than 500,000 metric tons, from 2000 to 2014, approximately 3 percent of production.

Climate change threatens both the economic situation and the food security of the Philippines. The vision of agriculture systems that are resilient to climate change and to natural hazards will be pursued during the remaining years of the Aquino administration. The Philippine Development Plan 2011-2016 midterm update calls for the implementation of strategies and programs that generally subscribe to CSA as an integrative approach that promotes production systems and sustainably raise productivity, increase resilience, reduce greenhouse gas, and enhance achievement of national food security and development goals.

The National Economic and Development Authority (NEDA) and International Food Policy Research Institute (IFPRI) have recently collaborated on the study, "Addressing the Impacts of Climate Change in the Philippine Agriculture Sector." The study aims to develop a decision-support mechanism for agriculture, climate change, and food security policies using newly generated data, modeling output and scenario assessment. Initial findings of the study imply that there are already CSA technologies available. However, only a few technologies have been successfully implemented on a wide scale in the country. Farmers, primarily the poorer ones, are neither aware nor have the capacity to utilize these technologies. The study also noted the underinvestment or inadequate support provided to research and technology innovations, data generation and ex-ante analysis for evidence-based climate change and disaster risk reduction policy and investment options vis-à-vis public spending in post-disaster events such as relief, recovery and reconstruction. The study supports creation of an enabling environment for CSA technologies, and increased investments in: (1) development and promotion of climate-resilient crop varieties, particularly rice (e.g., Ma-ayon for drought-prone rainfed lowland, Hagonoy for saline-prone irrigated lowland, Submarino 1 for flood prone areas, and Gohang for elevated areas); (2) farm diversification, including inter-cropping in rainfed and upland areas to minimize the risks to farmers and increase their income; (3) climate-smart farmers field schools which build the capacities of farmers to use hazard assessments, typhoon tracking and evaluations of climate-resilient crop varieties; (4) alternate-wetting and drying (AWD) irrigation practices that can reduce methane emissions; and (5) climate-resilient rural infrastructures and agricultural facilities.

Gina Aljecera, NEDA

The Role of Regional Organizations

Climate change and agriculture in the ASEAN is addressed in the ASEAN Economic Community Blueprint through a number of sectoral and multi-sectoral ASEAN frameworks and by related ASEAN bodies. Existing ASEAN frameworks related to climate change, agriculture, and food security are: the ASEAN Integrated Food Security Framework (AIFS); the ASEAN Multi-Sectoral framework on Climate Change: Agriculture, Fisheries, and Forestry towards Food Security (AFCC); and the ASEAN Climate Change Initiative (ACCI). Within the ASEAN Secretariat (ASEC) the Agriculture, Industries and Natural Resources Division (AINRD) coordinates climate change related activities and processes in the agricultural sector. A new ASEAN strategic document for the Food, Agriculture and Forestry sectors is currently being developed and will address the challenges of climate change through 2025.

In 2013, the ASEAN-German Programme on Response to Climate Change (GAP-CC) commissioned a vulnerability assessment which highlighted rice, corn and cassava as the crops most vulnerable to climate change in ASEAN Member States. To address the challenge of climate change impacts on food security, an initiative on "Production System Approach for Sustainable Productivity and Enhanced Resilience to Climate Change" was proposed to the ASEAN Technical Working Group on Agricultural Research and Development (ATWGARD) by the Royal Thai Government. This led to the formation of the ASEAN-Climate Resilience Network (ASEAN-CRN) as a platform for knowledge exchange and coordination amongst ASEAN Member States on climate change and agriculture.

In 2014, the ASEAN-CRN coordinated national studies to assess the impacts of climate change on the value chains of rice and maize or cassava. The studies documented existing CSA practices that enhanced resilience to climate change and identified institutional barriers and challenges to scaling-up those practices. "Regional Guidelines for Scaling-up CSA Practices" were developed and approved by ATWGARD to facilitate knowledge sharing and promote the scaling-up and scaling-out of CSA practices throughout the ASEAN.

In 2015, the ASEAN-CRN was formally established to promote implementation of the regional guidelines, including: support for implementing CSA practices, identifying climate finance opportunities, promoting a CSA negotiation strategy for the ASEAN, and fostering regional exchange on CSA. One of the key lessons learned by GAP-CC was the importance of understanding how a regional organization such as the ASEAN functions and where the entry points to the organization are. Topics of interest can be advanced by identifying a member state whose interests align with the project goals and supporting them to place those topics on the agendas of the ASEAN technical forum and decision making bodies. References to existing ASEAN policies and frameworks help ensure that Member States have a mandate to address the issues and provide support.

Imelda Bacudo, GIZ

Discussion Sessions: Climate Finance, Policies, and Programs

Participants requested clarification about the level(s) of approval needed to submit a request for Technical Assistance under the CTNFC and CTC-N mechanisms. Ms. Stanfield (UNEP) stressed that requests for technical assistance under the CTNFC pilot need to be submitted by the project focal points and need not involve a lengthy process. Technical assistance requests submitted to CTCN need to be endorsed and submitted by the National Designated Entity of the country. Interested parties can access additional information about CTCN from the website.

Participants asked about the role of the CGIAR centers in the process of including climate-smart technologies and financial strategies in national policies. Mr. Rattinger reiterated that ADB works with countries to integrate both technology and financing issues into their national policies and plans. He added that ADB does not have expertise on climate-smart agriculture technologies and hires consultants when the need arises. In his opinion, collaboration with partners, such as the CGIAR centers, would be an effective way for ADB to access CSA expertise. CGIAR centers expressed interest in contributing to the process and indicated they would welcome an invitation to participate from ADB and/or the national governments involved.

Participants asked about the relationship between ADB's Strategic Program for Climate Resilience (SPCR) and the CTFC. Mr. Rattinger responded that there is not much linkage between SPCR and the CTFC, as the SPCR process began before the CTFC process. The SPCR is one of the climate investment funds that ADB helps to implement in the region, whereas the CTFC concentrates on countries that are not included in the climate investment funds.

Participants asked if climate finance institutions are committed to ensure sustainability of those technologies that are scaled up using their funds. The concern was that without commitment to sustainability, interest in the technologies declines when project financing was no longer available. Ms. Stanfield reiterated that the global CTCN funding represents a long-term commitment to the sustainability of the technologies supported by the CTNFC pilot in Asia.

Mr. Rattinger observed that the financial support from ADB, other multi-lateral development banks, and bilateral donors represent long-term commitments. The institutions making these commitments try to assist countries understand how to build an enabling environment. Ultimately, however, it is the responsibility of the country itself and its policymakers to provide consistent and clear policies that maintain investor confidence, especially those from the national private sector. Financial institutions plan for different scenarios, including failure to implement crucial steps. Avoiding dependence upon a sole source of finance support or upon a single government program or subsidy is crucial. Otherwise a change in government policy or program can negatively impact the adoption of a technology.

Participants asked how the private sector could best be engaged in the promotion and adoption of climate-smart agriculture technologies. The resource persons cautioned that appropriate government policies need to be in place prior to engagement with the private sector. They recommended a combination of government policies and market incentives to influence the private sector supply and distribution channels. It is critically important to use existing private sector distribution channels through which agricultural products are brought to market, rather than attempt to establish new channels. The challenge is to determine how to use existing channels to encourage a change in cultivation practice or production of a particular variety of rice or maize.

Resource Persons recommended that improving private sector awareness of CSA technologies, products, and practices would be a useful first step. Building capacity within the private sector to deliver CSA products and services to farmers should follow. Only then will private companies decide to produce and bring these technologies to market, using existing distribution channels.

Participants asked about mechanisms used to measure changes in knowledge and/or behavior of a regional or national organization, that result from increased awareness, knowledge management, and communication. Dr. Sawhney (APAN) responded that to measure the success of APAN initiatives, the topics chosen for various capacity building workshops are demand driven. APAN holds informal meetings, forums, and evaluation sessions where topics suggested by the countries are discussed and considered.

Participants asked how to engage with an ASEAN technical working group. Imelda Bacudo (GIZ) replied that the structure of an working group includes representatives from each ASEAN Member State. Each time they meet, the ASEAN working groups hold closed door meetings that are open to Member States only. At these closed door meetings, member states agree or disagree on the proposals for projects and project activities. Therefore, it is very important to identify member states that will act as champions for the project within the working group, with the role of proposing and defending activities that are aligned with project objectives.

Poster Session

Twenty-five (25) posters were displayed at a dedicated Poster Session on Day 1 which presented experiences implementing CSA technologies in Asia. The posters were displayed throughout the workshop facilitating communications between CSA technology providers and country representatives.

Five (5) CGIAR Centers presented posters documenting their current CSA technologies, including: International Potato Center (CIP) on farmer business schools in the Philippines; The International Center for Research in Agroforestry (ICRAF) on flood modeling using LIDAR data in the Philippines; International Water Management Institute (IWMI) presented CSA technologies in Lao PDR; and IRRI presented the progress made by the Policy Information and Response Platform on Climate Change and rice in the ASEAN (PIRCCA). The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) prepared four (4) posters documenting their CSA technology projects in Myanmar, including: potential areas for legume intensification in rice fallows; sorghum cultivars for forage production; improving systems productivity in legumes; and crop management options based upon seasonal rainfall forecasts.

The ASEAN – German Programme on Response to Climate Change (GAP-CC) contributed posters from the ASEAN Member States, which presented the findings of national studies on "Promoting Climate Resilience in Rice and other crops". These studies were conducted by national agricultural research institutions, including: Cambodian Agricultural Research and Development Institute (CARDI); Indonesian Agency for Agricultural Research and Development (IAARD); National Agriculture and Forestry Research Institute (NAFRI) in Lao PDR; Ministry of Agriculture and Irrigation in Myanmar; Department of Agriculture, Bureau of Agricultural Research (DA-BAR) in the Philippines; Department of Agriculture (DOA) in Thailand; and the Ministry of Agriculture and Rural Development (MARD) in Vietnam.

Country representatives were requested to prepare a poster documenting: (1) national circumstances, (2) adaptation efforts in the agricultural sector, (3) mitigation efforts in the agricultural sector, (4) policies that contribute to mainstreaming CSA, and (5) experiences and challenges. Ten (10) national teams contributed posters, including: two poster contributions from Indonesia and one poster each from Cambodia, Thailand, Bangladesh, Bhutan, Sri Lanka, Mongolia, Tajikistan, and Uzbekistan. Some posters described adaptation measures that were general, including the two Indonesian posters which documented crop insurance and the Indonesian Cropping Calendar Information System, which advises farmers when and how to modify the cropping calendar in response to variations in rainfall and temperature. Other posters showcased adaptation technologies or practices that address specific challenges, such as the use of raised plinth vegetable farming in Bangladesh to adapt to increased salinity. Several posters highlighted the need for readily available historical climate data, seasonal climate forecasts, short-term weather forecasts, and climate services which convey information to farmers through internet and mobile phone applications.

Posters highlighted the importance of community efforts to the dissemination of climate-smart technologies and practices, including: participatory varietal selection, farmer field schools, and provision of market information. In addition to incremental adaptation practices, some posters highlighted transformational adaptation practices, such as expanding agriculture into areas in Cambodia with low climate risk..

Posters documented a wide range of mitigation practices being undertaken in the Asia region, including: AWD in irrigated rice field, a key component of the System for Rice Intensification (SRI), agroforestry and reforestation, zero-tillage systems, livestock management, and nutrient management. One poster documented the innovative use of solar irrigation pumps in Bangladesh. Many national posters cited mitigation as an important national policy response.

Posters presented the experiences and identified challenges encountered in implementing and/or upscaling adaptation and mitigation practices in the agriculture sector. A major challenge identified was the difficulty of obtaining climate data and services including: historical climate data, forecasts of seasonal climate and short term weather data, and climate change projections downscaled to the local level. Another challenge was the farmers' limited understanding of and capability to effectively use historical climate data and climate/weather forecast products. Lack of financial resources is a major constraint to the adoption and up-scaling of CSA technologies. Another challenge was the inadequate awareness of climate change scenarios and/or the inability to link scenarios to disaster risk management. Incorporating CSA technologies and practices into policies occurs at national level throughout the region, including them at local level remains a challenge.

Climate-Smart Agriculture in Asia – The Way Forward

The workshop concluded with a panel discussion to characterize the current state of Climate-Smart Agriculture technologies in Asia; and identify a way forward. The panel members included: representatives from participating countries (Vietnam, Bhutan, and Tajikistan), resource persons from CGIAR centers (IRRI, IWMI, and IFPRI), and development partners (GIZ and UNEP). Dr. Andrew Jarvis (CCAFS) served as moderator.

Country representatives identified the following CSA technologies as high priority: climate information services and products, including historical data and forecasts of weather/seasonal climate; crop suitability mapping; varieties and practices that improve management of water stresses (drought and flooding); manure management for livestock operations, and postharvest technologies that address agricultural waste.

Common needs and challenges were identified by the panelists, including: the need for increased awareness and technology transfer, the challenges to upscale and out-scale these technologies, and the need for advice to ensure CSA technologies are included in the national policy framework. Panelists recommended collaboration with CGIAR centers and other international development partners at national and regional levels to address these challenges. Panelists discussed the potential benefits of developing a collaborative framework under regional organizations, such as ASEAN, SAARC, or the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC). The role of the ASEAN Climate Resilience Network in knowledge sharing and capacity building was cited as an example worth replicating in South Asia and Central Asia.

Workshop Outputs: Concept Notes for Technical Assistance

Southeast Asia: Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, Vietnam

<u>Cambodia Concept Note 1</u>

Technical Assistance (scope and nature): Conduct a Technical Needs Assessment for the agriculture sector.
Need (problem statement): Technical needs in the agriculture sector were not be included in the national Technical Needs Assessment (TNA) document due to lack of time and resources.
Benefits expected: access to technical support and financial resources
Catalyst: A TNA for the agriculture sector will inform donors of national priorities in the sector, facilitating access to technical support and financial resources necessary to implement adaptation and mitigation technologies..
Partner(s) - National: MAFF/RUA
Partner(s) - International: CCAFS
Geographical Focus: National

<u>Indonesia Concept Note 1</u>

Technical Assistance (Scope and nature): Agro-climate zone mapping. Identification of appropriate technologies for each zones. Improve/adapt technologies to local need
CSA Need (Problem Statement): Indonesia has many diverse climates. CSA technologies will vary across these areas. Different zones need to be identified and the appropriate CSA technologies should be identified in each zone.
Benefits expected: Adaptation technologies match local needs / conditions
Catalyst for Policy? Project? Scale up? : Financial support, Technical Support, Give authority to existing institutions to disseminate CSA technologies
Partner(s) – National: IAARD, Bogor Agricultural University BPPT
Partner(s) - International: ICRAF, CIAT, IRRI
Geographical Focus: National

<u>Indonesia Concept Note 2</u>

Technical Assistance (Scope and nature): Dissemination of information about CSA technologies. Technology sharing model
CSA Need (Problem Statement: There is a need for CSA and the technologies exist. However, outreach is a problem. There is a need to better inform farmers.
Benefits expected: (1)Accelerate technology adoption by farmers,
Catalyst: training of extension workers
Partner(s) – National: IAARD, Bogor Agricultural University
Partner(s) - International: ICRAF, CIAT, IRRI
Geographical Focus: Community

Lao PDR Concept Note 1

Technical Assistance: Technology transfer, manure management technologies
CSA Need: CSA livestock (pig) manure management to reduce GHG emissions
Benefits expected: (1) Reduce air and water pollution from pig production and (2) increased awareness of livestock manure management
Catalyst: for project(s)
Partner(s) – National: Livestock Research Center, NAFRI
Partner(s) – International: ILRI
Geographical Focus: National

Lao PDR Concept Note 2

Technical Assistance: (1) Research methodology, (2) Maize breeding, and (3) Experimental material (Seed of different varieties).
CSA Need: Adoption of drought stress tolerant maize varieties
Benefits expected:
Catalyst: for project(s)
Partner(s) – National: Maize and Cash Crop Research Center, NAFRI
Partner(s) – International: CIMMYT
Geographical Focus: National

Lao PDR Concept Note 3

Technical Assistance: Develop historical databases of rice production statistics and climate variables; analysis of statistical relationships between the two.
CSA Need: Analysis of historical impacts of climate variability on agr production
Benefits expected: (1) Agriculture planning and development and (2) enhance resilience of farmers
Catalyst: Scale-up
Partner(s) – National: NAFRI and MONRE, Department of Disaster Management and Climate Change
Partner(s) – International: RIMES and IRRI
Geographical Focus: National

Malaysia Concept Note 1

Technical Assistance: Updating agro ecological zones maps. Crop suitability analysis under current conditions and different climate change scenarios
CSA Need: Update agro-ecological zone maps for current conditions and various climate change scenarios
Benefits expected: Updated crop suitability maps, improved current agriculture planning, and policies for sustainable production
Catalyst: Policy and planning
Partner(s) – National: Dept of Meteorology, Dept of Agriculture and relevant. research institutes
Partner(s) – International: CIAT
Geographical Focus: National

Malaysia Project 2

Technical Assistance: Mechanisms to cope with conversion of rice straw to useful material. Development of a business model (paddy field to industry)
CSA Need: Reduced burning of rice straw: Logistic (Collection and transporting from rice field), use of straw (currently only used for compost and animal feed)
Benefits expected: Extra income for the farmer, reduction in GHG emission, enhancing other sectors such as livestock and energy
Catalyst: Agriculture policy and scaling-up
Partner(s) – National: authorities responsible for rice farming (MADA, KADA, IADA), research institutes,
Partner(s) – International: IRRI
Geographical Focus: National, Sub-National

Myanmar Concept Note 1:
Technical Assistance: Demonstrate RIICE technology to decision makers
CSA Need: mapping of irrigated rice cultivation for INDC and MRV
Benefits expected: increased awareness of CSA technologies
Catalyst: for project
Partner(s) – National: MOAI, Yezin Agricultural University
Partner(s) – International: IRRI
Geographical Focus: sub-national. one or more rice growing areas

Myanmar Concept Note 2:
Technical Assistance: Historical climate data cleaned, gridded and merged with satellite data.
CSA Need: Accurate historical climate data available for public dissemination and use in crop models
Benefits expected: increased accuracy of historical climate data. Increase use of data
Catalyst: for analysis and improved planning, response to climate variability
Partner(s) – National: Department of Hydrology and Meteorology
Partner(s) – International: RIMES, IRRI, CCAFS
Geographical Focus: national

Myanmar Concept Note 3:
Technical Assistance: Capacity Building in Agro-meteorology. Update national curriculum in Agro-Meteorology
CSA Need: Capacity building in agro-meteorology.
Benefits expected: MOAI capable of effectively utilizing World Bank project funds
Catalyst: for effective utilization of World Bank loan
Partner(s) – National: Yezin Agricultural University
Partner(s) – International: RIMES, IWMI, IRRI
Geographical Focus: National

Vietnam Concept Note 1
Technical Assistance: Restart Seasonal Forecast Forum process.
CSA Need: Public dissemination of seasonal forecast for Vietnam
Benefits expected: Improved resilience / adaptation to climate variability.
Catalyst: for policy and planning

Partner(s) – National: National Centre for Hydro-Meteorological Forecasting (NCHMF).
Partner(s) – International: RIMES, IRRI, CCAFS
Geographical Focus: National

Vietnam Concept Note 2
Technical Assistance: to create digital database of irrigation schemes.
CSA Need: identify areas suitable for implementing AWD
Benefits expected: upscaling CSA in rice production.
Catalyst: for planning and project implementation
Partner(s) – National: at Department of Water Resources, MARD.
Partner(s) – International: IRRI, IWMI, CCAFS
Geographical Focus: National,

Vietnam Concept Note 3
Technical Assistance: preparation of a Low Emissions Land Use Plan (LELUP) for province with substantial irrigated rice production,
CSA Need: upscaling of Alternate Wetting Drying included in provincial plans.
Benefits expected: Provincial commitment to up-scaling of AWD
Catalyst: for scaling-up
Partner(s) – National: MONRE, MARD, IAE, DWR, EDF
Partner(s) – International: IRRI, CCAFS
Geographical Focus: Province

Vietnam Concept Note 4
Technical Assistance: Insert CSA technologies into provincial planning process
CSA Need: Provincial Plans will guide actions for coming 5 years (2016-2020)
Benefits expected: Support for adoption of
Catalyst: for planning, for project(s)
Partner(s) – National: MONRE, MARD
Partner(s) – International: IRRI, CCAFS,
Geographical Focus: Province level

Thailand Concept Note 1
Technical Assistance: (1) Stocktaking and needs assessment of existing CSA technologies and practices (2) Identification of CSA interventions, partners, and stakeholders, (3) Building climate resilience capacity through adoption of CSA technologies, and (4) Scaling-up of Climate Smart Villages.
CSA Need: (1) Improving small-holder agricultural systems (2) enhance adaptive capacity of the food production system, as well as reduce emissions and increase carbon storage on agricultural soils and biomass (3) document empirical data on costs and barriers to adoption of adaptation and mitigation CSA technologies (4)
Benefits expected: identify best suited CSA technologies with synergies between food security, adaptation and mitigation opportunities. Differentiate by agro-ecological zones, climate regimes and land-use patterns. Climate Smart Villages piloted and scaled-up
Catalyst: for projects
Partner(s) – National: Department of Agriculture
Partner(s) – International: CCAFS, CIAT, CIMMYT
Geographical Focus: National, Community

South Asia: Bangladesh, Bhutan

Bangladesh Concept Note 1
Technical Assistance: watershed management, introduce water saving technology
CSA Need: Drought in North-West part of Bangladesh, reduce top soil erosion,
Benefits expected: strengthen food security, ground water holding capacity increase
Catalyst: Integrated action of concerned Departments may help improve situation . Our ministry of Environment and Forests has prepared national action plan on adaptation (NAPA)to serve as simplified and direct channels of communication for information relating to the urgent and immediate adaptation as a response to the decision of COP5 of the UNFCCC
Partner(s) – National: Ministry of Environment and Forests
Partner(s) – International: IWMI
Geographical Focus: National, Sub-national

Bangladesh Concept Note 2
Technical Assistance: Transfer of crop residue management technology
CSA Need: reduced burning of agricultural residues
Benefits expected: reduced GHG emission, strengthen food security
Catalyst: for project(s)
Partner(s) – National: Ministry of Environment and Forests, Ministry of Agriculture
Partner(s) – International: IRRI
Geographical Focus: National, Sub-national

Bhutan Concept Note 1
Technical Assistance: transfer of irrigation/sprinkler technologies
CSA Need: Water stress managed, sustainable land mgmt
Benefits expected: Water smart agriculture
Catalyst: for agriculture policy and planning
Partner(s) – National: Ministry of Agriculture and Forest (MAF)
Partner(s) – International: CGIAR centers
Geographical Focus: Sub-national Community

Bhutan Concept Note 2
Technical Assistance: establish a Monsoon Forum / Seasonal Climate Forum
CSA Need: Climate Services. Resilience to drought, flood
Benefits expected: Water smart agriculture
Catalyst: Agriculture policy and planning
Partner(s) – National: Ministry of Agriculture and Forest (MAF)
Partner(s) – International: RIMES
Geographical Focus: National

Bhutan Concept Note 3
Technical Assistance: establish model for rice production and test under different climate scenarios,
CSA Need: Agricultural Impact Assessment
Benefits expected: Weather smart agriculture
Catalyst: Agriculture policy and planning
Partner(s) – National: Ministry of Agriculture and Forest

Partner(s) – International: IRRI
Geographical Focus: National, Sub-national, Community

Bhutan Concept Note 4
Technical Assistance: livestock, Bio-gas, Fodder mgt
CSA Need: Improved Livestock Management
Benefits expected: Reduced emissions, energy smart agriculture
Catalyst: for Agriculture policy and planning
Partner(s) – National: Ministry of Agriculture and Forest
Partner(s) – International: ILRI
Geographical Focus: Community, Sub-national

Sri Lanka Concept Note 1
Technical Assistance: Map irrigated rice cultivation suitable for AWD
CSA Need: Identify rice growing areas suitable for Alternate Wetting and Drying
Benefits expected: reduced GHG emissions from irrigated rice cultivation
Catalyst:? For planning and up-scaling up of AWD
Partner(s) – National: Ministry of Environment & Mahaweli Development, Ministry Agriculture, Department of Agriculture (Natural Resource MC) Rice Research Development Institute , Mahaweli Authority of Sri Lanka
Partner(s) – International: IRRI
Geographical Focus: National

Sri Lanka Concept Note 2
Technical Assistance: Mapping of areas suitable for land consolidation
CSA Need: Assess areas suitable for land consolidation (facilitating CSA)
Benefits expected: accelerated adoption of CSA technologies
Catalyst for Policy? Project? Scale up?
Partner(s) – National: Ministry Agriculture , Ministry of Environment, Department of Agriculture (Natural Resource MC) Mahaweli Authority of Sri Lanka , Department of Irrigation Department of Agrarian Services
Partner(s) – International: IRRI & IWMI
Geographical Focus: National

Sri Lanka Concept Note 3
Technical Assistance: dissemination of rainwater harvesting technologies
CSA Need: Expansion of rain water harvesting (eye brows based Pitches)
Benefits expected: Transfer of proven technology
Catalyst for Policy? Project? Scale up?
Partner(s) – National: Ministry of Environment, Ministry Agriculture , Department of Agriculture (Natural Resource Management Centre), Mahaweli Authority of Sri Lanka, Department of Irrigation ,Department of Agrarian Services, Horticulture Crops Research Development Institute
Partner(s) – International: IWMI
Geographical Focus: Sub-national

Central Asia: Tajikistan, Uzbekistan, Mongolia

Tajikistan Concept Note 1
Technical Assistance: (1) Equipment for research and monitoring, (2) Access / acquisition of innovative technologies, and (3) Access / acquisition energy-efficient technologies and the use of renewable energy.
CSA Need: (1) Legislative base and regulation framework, (2) CSA technology transfer, and (3) Capacity building.
Benefits expected: (1) Diversification of crops; efficient use of irrigation water, (2) Reduced soil degradation, reduction of GHG emissions, (3) Increased productivity of agricultural crops, farmers' income, and (4) Improving social welfare, poverty reduction
Catalyst: Strengthening the legal and regulatory framework; Increase the capacity of trainers and sector specialists
Partner(s) – National: Committee Environmental Protection, Ministry Agriculture Tajikistan, Hydromet
Partner(s) – International: UNEP, UNDP, CIMMYT, ICARDA, IRRI
Geographical Focus: National, Multi-country

Uzbekistan Concept Note 1
Technical Assistance: (1) Development of regulatory and legal base, (2) Development of national programs and action plans, and (3) Capacity building: the coaches to introduce technologies, specialists from ministries and departments; farmers
CSA Need: Financial incentives for commercial banks and the conditions for reducing the risks of long-term loans. Regulatory mechanisms that promote the transfer of new CSA technologies. Incentives for the reduction of GHG emissions and increasing the use of low-emission technologies: (1) Create financial incentives for commercial banks and the environment to reduce the risks of long-term loan, (2) Development of Market ready CSA technologies, (3) Improvement of regulatory mechanisms to promote the inflow of new technologies, (4) Putting into operation of incentives for the reduction of GHG emissions and increasing the use of low-emission technologies, (5) Estimates of the costs of benefits by use technologies, (6) Regular training and exchange of experiences on new technologies and their implementation trainers, ministries and agencies, (7) The study of scientific, technical and socioeconomic aspects of climate change mitigation, (8) Development of monitoring and forecasting of extreme weather conditions. Development of the system of monitoring and forecasting of extreme weather conditions, and (9) Access and acquisition of technical means to use CST.
Benefits expected: (1) Saving water - reducing water scarcity, (2) Reducing greenhouse gases, (3) The reduction of land degradation and desertification, (4) Getting more energy, (5) Production of organic fertilizer, and (6) Welfare Improvement.
Catalyst: for projects and investment (public/private)
Partner(s) – National: Centre of Hydrometeorological Service (Uzhydromet), The Ministry of Agriculture and Water Resources, State joint stock company "Uzbekenergo", and State Committee for Nature Protection of Uzbekistan
Partner(s) – International: UNEP, UNDP, and ADB
Geographical Focus: National, Multi-country

<u>Mongolia Concept Note 1</u>

Technical Assistance: Support policy advice and assistance on CSA, and capacity building.

CSA Need: Mongolian agriculture sector (nomadic livestock and crop cultivation) is vulnerable to climate change. In order to mitigate GHG emissions in Mongolia we are facing following problems: (1) Lack of coordination between government organizations, research institutions and private sectors at different administrative level, (2) Inadequate process of dissemination of climate information to end users, (3) Lack of knowledge and practical use of climate information and CC adaptation, (4) Insufficient quality of agro meteorological data, (5) Lack of legal framework for early warning system in drought and dzud (harsh winter season), and (5) Lack of monitoring and evaluation.

Benefits expected: (1) A decision support mechanism on agriculture , climate change and food security polices, (2) strengthened a CSA national policy, (3) smart users, and (4) improved livelihood for herders and farmers.

Catalyst: for CSA projects and investment

(Scale-up): (1) Government agencies : Ministry of Nature, Green Development and Tourism (MNGDT), Ministry of Food and Agriculture (MFA), (2) Agencies: National Agency of Meteorology and Environment Monitoring (NAMEM), Agency of Land Administration, Geodesy and Cartography (ALAGaC), National Emergency Management Agency (NEMA), (3) Research institutions - Information and Research Institute of Meteorology, Hydrology and Environment (IRIMHE), Institute of Agriculture (IA), Research Institute of Animal Husbandry (RIAH), and (4) Private stakeholders.

Partner(s) – National: (1) Government agencies : Ministry of Nature, Green Development and Tourism (MNGDT), Ministry of Food and Agriculture (MFA), (2) Agencies: National Agency of Meteorology and Environment Monitoring (NAMEM), Agency of Land Administration, Geodesy and Cartography (ALAGaC), National Emergency Management Agency (NEMA), (3) Research institutions - Information and Research Institute of Meteorology, Hydrology and Environment (IRIMHE), Institute of Agriculture (IA), Research Institute of Animal Husbandry (RIAH), and (4) Private stakeholders.

Partner(s) – International: ILRI (livestock), CIMMYT or ICARDA or ICRISAT (crop), CCAFS (policy frameworks and monitoring and evaluation). ADB (Financial and investment guidance).

Geographical Focus: National

Appendix 1: Agenda

CLIMATE SMART AGRICULTURE TECHNOLOGIES IN ASIA
WORKSHOP AGENDA:

2 June, Tuesday: Setting the Stage, Tools, and Climate Smart Technologies

Venue: Acacia hotel, Alabang (http://acaciahotel-manila.com)

Time	Activity	Person in-charge
8.30 - 9.00	Registration	Gina Zarsadias (IRRI)
9.00 - 9.30	Welcome, workshop objectives, – UNEP Introduction of participants	Julia Stanfield (UNEP)
9.30 – 10.00	Introduction to Climate Smart Agriculture (CSA), global and regional initiatives	Andrew Jarvis (CCAFS)
10.00 – 10.30	Coffee Break / Group Photo	
	Session 1: Technical Assistance, Tools, and Policy Support	Michael Sheinkman (Moderator, IRRI)
10.30 – 11.00	Climate Services: Tools and Data for Agriculture and Food Security	G. Srinivasan (RIMES)
11.00 – 11.30	Agriculture: Role of a Research Institute	Rodel Lasco (ICRAF)
11.30-12.00	Agriculture: Role of a Research Program	Leo Sebastian (CCAFS)
12.00 -13.30	Lunch	
	Session 2: Climate Smart Agriculture Technologies	Valerien Pede (Moderator, IRRI)
13.30 – 13.50	**Water harvesting / water saving technologies**. [Water Smart]	Guillaume Lacombe
13.50-14.10	**Crop Diversity / Crop Suitability** [Weather Risk smart]	Nora Guerten (CIAT)
14.10-14.30	**Zero-Tillage Technologies** [Energy smart]	Parvinder Singh (CIMMYT)
14:30 – 14:50	**Low-Emissions Livestock Management Technologies**	Polly Erickson (ILRI)
14.50 – 15.20	Logistics Announcements/Coffee Break	
15.20 – 17.00	**Poster Session: CSA Case Studies from participating countries**	Ellanie Cabrera (Coordinator, IRRI)
17.00 – 18.00	Free Time	
18.00	Reception (hosted by UNEP) Venue: Alto Room, 16th Fl	

Climate Smart Agriculture (CSA) Technologies Workshop. 2–4 June 2015, Manila and Los Baños , Philippines

<u>3 June, Wednesday:</u> Climate Smart Agriculture Technologies in Rice Systems
Venue: IRRI, Los Baños, Laguna

7.00 – 8.45	Travel to IRRI Los Baños			
9.00 - 9.15	Welcome remarks by Bruce Tolentino, IRRI Deputy Director General for Communication and Partnerships (Harrar Hall)			
Session 3: IRRI Field Tour				Emma Quicho (Coordinator, IRRI)
9.15- 9.30	Orientation and walk to Station A (all participants); group photo			
9.30 – 10.00	Station A			<u>Station A:</u> Long-Term Continuous Cropping Experiment ***Jun Correa and Irish Lorraine Bicaldo (IRRI)***
	Bus 1:	**Bus 2:**	**Bus 3:**	<u>Station B:</u> Flood and Salt Tolerant Varieties ***Abdel Ismail*** <u>Station C:</u> Drought Stress Tolerant Varieties ***Amelia Henry*** <u>Station D:</u> Ecological Intensification ***James Quilty***
10.05-10.35	Station B	Station C	Station D	
10.40-11.10	Station C	Station D	Station B	
11.15-11.45	Station D	Station B	Station C	
12.00 -13.10	*Lunch at IRRI Guesthouse*			
Session 4: Climate Smart Agriculture Technologies and Tools (Venue: Harrar Hall)				Reiner Wassmann (Moderator, IRRI)
13.30 -14.00	Alternate Wetting and Drying (AWD)			Bjoern Ole Sander (IRRI)
14.00-14.30	ICT for climate-smart agriculture: An outlook and the example of the RCM-CIRCLE in Vietnam			Paolo Ficarelli (IRRI)
14.30- 15.00	Application of seasonal weather forecasts to improve rainfed rice production			Keiichi Hayashi (IRRI)
15.00-15.20	*Coffee break*			
15.20-15.50	Rice Straw Management			Martin Gummert (IRRI)
15.50-16.20	GIS in decision support: An example of rapid assessment of crop status in the Philippines			Andy Nelson (IRRI)
16.20	Closing Day 2, Travel to Manila			
18.00	Dinner at hotel (informal)			

<u>4 June, Thursday:</u> Scaling-up Climate Smart Agriculture Technologies

Venue: Acacia hotel, Alabang (http://acaciahotel-manila.com)

	Session 5: Climate Finance	Michael Sheinkman (moderator)
9.00 – 9.20	**Climate Technology Network and Finance Center (CTNFC) and the Climate Technology Center and Network (CTC-N)**	Julia Stanfield (UNEP)
9.20 – 9.40	**Climate Technology Finance Center (CTFC)**	Michael Rattinger (ADB)
9.40 - 10.00	**Mobilizing Private Investment for Green Growth and Low-Emission Development in the Agriculture Sector**	John Wells (ASIALEDS)
10.00 - 10.20	**APAN - Regional Network**	Puja Sawhney (APAN)
10:20 – 10:45	Coffee Break	
	Session 6: Policies and Programs: **How to create and maintain an enabling environment for CSA?**	Avinash Kishore (Moderator, IFPRI)
10.45 - 11.00	**The Role of a National Organization** NEDA, Philippines	Gina Aljecera (NEDA)
11.00 - 11.15	**The Role of a Regional Organization (ASEAN)** GIZ, German – ASEAN Program on Climate Change (GAP-CC)	Imelda Bacudo (GIZ)
11:15- 11:20	Travel / Logistics / Finance announcements	Gina Zarsadias (IRRI)
11.20 – 12.30	**Regional Discussions** Technical Assistance, Tools, Mechanisms, and Policies Challenges and Opportunities	Resource persons circulate to advise and assist participants
12.30 – 13.30	Lunch	
13.30 – 14.30	**Regional Discussions** Technical Assistance, Tools, Mechanisms, and Policies Challenges and Opportunities	Resource persons circulate to advise and assist participants
14.30 – 15.30	**Session 7: Report to Plenary,** **Outputs from Regional / National Discussions**	Polly Erickson (Moderator, ILRI)
	Participating Countries (all) • Needs: Technical Assistance, Tools, Mechanisms, Policies • Challenges and Opportunities	
15.30 – 16.00	Coffee Break	
16.00 – 17.00	**Session 8: Panel Discussion** **Climate Smart Agriculture in Asia – the way forward**	Andrew Jarvis (Moderator, CCAFS)
	Participating Countries (3) CGIAR Centers (3) Development Partners (2) (i) common challenges faced by countries; (ii) possible collaboration national or regional levels; and (iii) joint action within a CSA framework established by regional organizations (e.g. ASEAN and SAARC) and/or international agencies	
17.00	Closing Remarks	Julia Stanfield (UNEP)

Climate Smart Agriculture (CSA) Technologies Workshop. 2–4 June 2015, Manila and Los Baños , Philippines

Appendix 2: Participant List

Resource Persons	
Andrew Jarvis	Director, Decision and Policy Analysis Area, International Centre for Tropical Agriculture (CIAT) Flagship Leader, CGIAR Research Program for Climate Change, Agriculture and Food Security (CCAFS)
G.Srinivasan	Chief Scientist, Climate Applications, Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES)
Rodel Lasco	Senior Scientist, World Agroforestry Centre (ICRAF)
Leocadio S. Sebastian	Regional Program Leader for Southeast Asia, CCAFS
Avinash Kishore	Associate Research Fellow, IFPRI
Guillaume Lacombe	Senior Researcher, International Water Management Institute (IWMI)
Nora Guerten	Climate Risk Management Specialist, International Center for Tropical Agriculture (CIAT), based in Hanoi, Viet Nam.
Parvinder Singh	Research Scientist, Global Conservation Agriculture Program, CIMMYT
Polly Ericksen	Senior Scientist, International Livestock Research Institute (ILRI)
Steve Stahl	Regional Representative, East and Southeast Asia Livestock Systems and Environment
James Quilty	Head - Experiment Station (ES), IRRI
Amelia Henry	Scientist, Crop and Environmental Sciences Division, IRRI
Abdelbagi Ismail	Principal Scientist, Crop and Environmental Sciences Division (CESD), IRRI
Andy Nelson	Senior Scientist, Social Sciences Division- IRRI.
Reiner Wassmann	Coordinator, Climate Change Research Crop and Environmental Sciences Division (CESD), IRRI
Bjoern Ole Sander	Climate Change Specialist, Crop and Environmental Sciences Division (CESD), IRRI
Keiichi Hayashi	Project Coordinator, Climate Change Adaptation in Rainfed Rice Areas (CCARA) Project, IRRI
Martin Gummert	Senior Scientist, Post-Harvest, IRRI
Paolo Ficarelli	Exchange Senior Expert, Crop and Environmental Sciences Division (CESD), IRRI
Michael Rattinger	Climate Change Specialist - Asian Development Bank (ADB)
John Bruce Wells	International Finance Corporation International, Thailand
Puja Sawhney	Coordinator of the Regional Hub for Asia Pacific, Adaptation Network Institute for Global Environmental Strategies (IGES)
Gina Aljecera	Director III, Natural Resources and Environment, National Economic Development Authority (NEDA), Philippines
Imelda Bacudo	Senior Regional Advisor, ASEAN-German Programme on Response to Climate Change (GAP-CC)
Julia Stanfield	Consultant, Climate Change Unit - UNEP Regional Office for Asia and the Pacific (UNEP-ROAP)

Workshop Participants	
Nazim Hossain Sheikh	Assistant Director, Department of Environment Ministry of Environment and Forests, Bangladesh
Pema Thinley	Senior Planning Officer, Ministry of Agriculture and Forests, Bhutan
Karma Tshering	Senior Programme Officer, National Environment Commission, Bhutan
Heng Chanthoeun	Deputy Director, Climate Change Department, Ministry of Environment, Cambodia
Chhun Seiha	Acting Head, Adaptation and Vulnerability Assessment - Office Climate Change, Department Ministry of Environment, Cambodia
Abdul Basit	Director, Indonesian Center for Agricultural Technology Assessment and Development, Indonesia
Aris Pramudia	Researcher, Indonesian Agroclimate and Hydrology Research Institute (IAARD), Indonesia
Jonas Dallinger	Advisor, ASEAN-German Programme on Response to Climate Change (GAP-CC), Indonesia
Viengsavanh Phimphachanhvongsod	National Focal Point, ASEAN Technical Working Group on Agricultural Research and Development (ATWGARD), Lao PDR
Vanhthone Phonnasane	Department of Disaster Management and Climate Change Ministry of Natural Resources and Environment (MONRE), Lao PDR
Dato Mohamad Zabawi bin Abdul Ghani	Distinguished Researcher, Agro-Environment and Climate Change, Director General Office, Malaysia
Erdenetseseg Baasandai	Head, Agrometeorology Section Information and Research institute of Meteorology, Hydrology and Environment, Mongolia
Naranchimeg Bagdai	Officer, Land Resource Management Division Ministry of Environment, Green Development and Tourism, Mongolia
Angelica Barlis	Science Communication Specialist, Food Security Through Asian Roots and Tubers (FoodSTART) International Potato Center, CIP-Philippines Office
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Appendix3: Presenter Supplementary Materials

Climate-Smart Agriculture: Rising to the Challenge
[1] https://ccafs.cgiar.org/themes/climate-smart-agricultural-practices
[2] http://www.fao.org/gacsa/en/

Climate Services: Tools and Data for Agriculture and Food Security
[3] www.RIMES.int

Weather Risk Smart: Crop Diversity / Crop Suitability Analysis
[4] http://ciat.cgiar.org/featured_products/land-degradation-surveillance-framework-lsdf
[5] http://www.aclimatecolombia.org/
[6] http://www.nama-database.org/index.php/Costa_Rica
[7] http://ccafs.cgiar.org/research/annual-report/2013/building-climate-change-adaptation-strategy-nicaragua#.VH6WQFeUdig
[8] http://dapa.ciat.cgiar.org/negotiating-gender-in-climate-change-policies/

Energy Smart: Zero-tillage Technologies
[9] Kumar, V., Sharavat, YS., Gathala, MK., Jat, AS., Singh, SK., Chaudhary, N., Jat, ML. 2013. Effect of different tillage and seeding methods on energy use efficiency and productivity of wheat in the Indo-Gangetic Plains. F. Crop. Res. 142, 1-8.
[10] Sapkota, T.B., Majumdar, K., Jat, M.L., Kumar, A., Bishnoi, D.K., Mcdonald, A.J., Pampolino, M., 2014. Precision nutrient management in conservation agriculture based wheat production of Northwest India : Profitability , nutrient use efficiency and environmental footprint. F. Crop. Res. 155, 233–244.
[11] https://ccafs.cgiar.org/research-highlight/laser-land-levelling-how-it-strikes-all-right-climate-smart-cords#.VWbQV0aS8lT
See also: http://indiaclimatedialogue.net/2014/09/04/climate-smart-villages-show-adapt-make-money/
[12] Aryal, J.P., Sapkota, T.B., Jat, M.L., Bishnoi, D.K., 2015. on-Farm Economic and Environmental Impact of Zero-Tillage Wheat: a Case of North-West India. Exp. Agric. 91, 1–16.
[13] Sidhu, H.S., Manpreet-Singh, Humphreys, E., Yadvinder-Singh, Balwinder-Singh, Dhillon, S.S., Blackwell, J., Bector, V., Malkeet-Singh, Sarbjeet-Singh, 2007. The Happy Seeder enables direct drilling of wheat into rice stubble. Anim. Prod. Sci. 47, 844–854.

Stress Tolerant Varieties: Submergence (flooding) and Salinity
[14] http://irri.org/our-work/research/better-rice-varieties/climate-change-ready-rice

Stress Tolerant Varieties: Drought
[15] http://irri.org/our-work/research/rice-and-the-environment/drought-submergence-and-salinity-management

Ecological Intensification
[16] http://climatechange.irri.org/projects/mitigation-projects/eddy-covariance-flux-measurements-in-the-ecological-intensification-platform

Sustainability: Long Term Continuous Cropping Experiment
[17] http://irri.org/our-impact/protecting-the-environment/increasing-soil-health-and-productivity-of-rice-crops

Alternate Wetting and Drying in Irrigated Rice Production

[18] http://irri.org/our-impact/tackling-climate-change/addressing-water-scarcity-through-awd

Seasonal Weather Forecasts to Improve Rainfed Rice Production

[19] http://irri.org/tools-and-databases/werise

Rice Straw Management

[20] http://irri.org/our-work/research/value-added-rice/rice-straw-and-husks

GIS in Decision Support

[21] http://irri.org/our-work/research/policy-and-markets/mapping

ICT for Climate-Smart Agriculture

[22] http://cropmanager.irri.org/

Climate Technology Network and Finance Center

[23] http://www.unep.org/energy/Projects/Project/tabid/131381/language/en-US/Default.aspx?p=1204bc19-6f12-49b9-8985-0b158ff97138

See also: http://www.adb.org/publications/pilot-asia-pacific-climate-technology-network-and-finance-center

Mobilizing Private Investment for Green Growth and Low-Emission Development in Agricultural Sector (ASIA LEDS)

[24] www.asialeds.org
[25] http://ledsgp.org
[26] http://ledsgp.org/sector/AFOLU
[27] http://ledsgp.org/Finance/Work-Space

Asia Pacific Network – Regional Network

[28] http://www.asiapacificadapt.net/