Participatory and Institutional Approaches to Agricultural Climate Services:

A South and Southeast Asia Regional Technical and Learning Exchange

September 17-19, 2017 Dhaka, Bangladesh

Climate Services for Resilient Development

Strategic alignment

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Organized by the International Maize and Wheat Improvement Center (CIMMYT) in Bangladesh and the USAID SERVIR and Climate Services Support Activity

On behalf of the Climate Services and Resilient Development (CSRD) in
South Asia partnership

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Organization and Sponsorship

Both the International Maize and Wheat Improvement Center (CIMMYT) and the USAID SERVIR and Climate Services Support Activity jointly organized this technical exchange on behalf of CSRD. CSRD is a global partnership that connects climate science, data streams, decision support tools, and training to decision-makers in developing countries. Translating actionable climate information into easy-to-understand formats to spread awareness and use of climate services is core to CSRD's mission. CSRD works globally to create and provide timely and useful climate data, information, tools, and services. In South Asia, CSRD focuses the development, supply, and adaptation of agricultural climate services to reduce risk and increase resiliency in smallholder farming systems. The translation of actionable climate information into easy to understand formats to spread awareness and use of climate services is core to CSRD's mission, which is strategically aligned with the Global Framework for Climate Services. CSRD is also aligned with the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

The CSRD consortium in South Asia is led by the International Maize and Wheat Improvement Center (CIMMYT) in partnership with the Bangladesh Meteorological Department (BMD), Bangladesh Department of Agricultural Extension (DAE), Bangladesh Agricultural Research Council (BARC), Bangladesh Agricultural Research Institute (BARI), International Center for Integrated Mountain Development (ICIMOD), International Research Institute for Climate and Society (IRI), University de Passo Fundo (UPF), and the University of Rhode Island (URI). As a public-private partnership, CSRD is supported by the United States Agency for International Development (USAID), UK AID, the UK Met Office, the Asian Development Bank (ADB), the Inter-American Development Bank (IDB), Esri, Google, the American Red Cross, and the Skoll Global Threats Fund.

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Participating Countries and Organizations

Bangladesh:

- Bangladesh Centre for Advance Studies
- Bangladesh Rural Advancement Committee
- Bangladesh Meteorological Department
- Bangladesh Rice Research Institute
- Center for Geographic Information Services
- The Bangladesh Department of Agricultural Extension
- FAO/Bangladesh

- International Centre for Climate Change and Development
- Krishi Gobeshona Foundation
- Practical Action
- USAID/Bangladesh

India:

- Agricultural Meteorology Division and Agro Met Services (India Meteorological Department),
- Central Agricultural University (Pusa, Bihar)

Indonesia:

- BMKG - Center for Applied Climate Information Services (Indonesia Agency for Meteorology Climatology and Geophysics)

Myanmar:

- Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation

Nepal:

- I.C.T. For Agri Pvt. Ltd, Nepal and Nepal Agriculture Research Council (NARC), Nepal

Philippines:

- Rice Watch Action Network, Inc.
- Forest and Climate Change under ASEAN (Deutsche *Gesellschaft fuer Internationale Zusammenarbeit* (GIZ) GmbH)

Sri Lanka:

- The International Water Management Institute (representing Sri Lanka, and projects in India and Bangladesh)

Vietnam:

- The World Agroforestry Center (ICRAF) working across the globe
- The International Center for Tropical Agriculture (CIAT), working in more than 50 countries across the globe
- CARE International

***United Kingdom*:**

- The School of Agriculture, Policy, and Development (University of Reading)

***The Netherlands*:**

- Wageningen University
- Waterapps: Water Information Services for Peri-urban Agriculture

United States:

- International Research Institute for Climate and Society, Earth Institute, Columbia University
- Climate Information Services, Ltd.

Association of Southeast Asian Nations (ASEAN)

Bangladesh Agricultural Research Council (BARC)

Bangladesh Meteorological Department (BMD)

Bangladesh Rice Research Institute (BRRI)

Care International in Vietnam (CARE)

Chemonics International

Climate Information Services (CIS)

Department of Agricultural Extension (DAE)

Dhaka University (DU)

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

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Food and Agricultural Organization of the United Nations (FAO)/Bangladesh

I.C.T. For Agri Pvt. Ltd, Nepal

Indonesian Agency for Meteorological, Climatological and Geophysics (BMKG)

International Centre for Climate Change and Development (ICCCAD)

India Meteorological Department (IMD)

International Council for Research in Agroforestry (ICRAF)

International Maize and Wheat Improvement Center (CIMMYT)

International Research Institute for Climate and Society (IRI)

Independent University, Bangladesh (IUB)

International Water Management Institute (IWMI)

Krishi Gobeshona Foundation (KGF)

Nepal Agricultural Research Council (NARC)

Practical Action

Rice Watch And Action Network

University of Reading

Syngenta Foundation Bangladesh (SFB)

Wageningen University

Abbreviations

AFU	Agriculture & Forestry University (based in Nepal)
AMICAF	Analysis and Mapping of Impacts under Climate Change for Adaptation and Food Security
AMIS	Agriculture Management Information System
APIK	*Adaptasi Perubahan Iklim dan Ketangguhan* or Climate Change Adaption and Resilience-Indonesia
ASC	Agriculture Sub Centers
ASEAN	Association of Southeast Asian Nations
ATMA	Association of Technical Market Analysts
ATWGARD	ASEAN Technical Working Group on Agricultural Research & Development
BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agriculture Research Institute
BCAS	Bangladesh Centre for Advanced Studies
BDO	Block Development Officer
BMD	Bangladesh Meteorological Department
BMKG	*Badan Meteorologi, Klimatologi, dan Geofisika*
BRAC	Bangladesh Rural Advancement Committee
BRCH	Building Resilience to Climate-Related Hazards
BRRI	Bangladesh Rice Research Institute
BWDB	Bangladesh Water Development Board
CAMDT	Climate-Ag Modeling Decision Tools
CARE	Cooperative for Assistance and Relief Everywhere
CCAFS	Climate Change Agriculture and Food Security
CCC	Community Call Center
CCROM	Centre for Climate Risk and Opportunity Management in Southeast Asia Pacific
CDMS	Climate Data Management System
CEGIS	Center for Environmental and Geographic Information Services
CGIAR	Consultative Group for International Agricultural Research
CHIRPS	Climate Hazards Group Infrared Precipitation with Station data
CIMMYT	International Maize and Wheat Improvement Center
CIS	Climate Information Services
COF	Climate Outlook Forum
CPT	Climate Predictability Tool
CRAFT	CCAFS Regional Agricultural Yield Forecasting Toolkit
CRP	CGIAR Research Program
CS	Climate Service
CSD	CSD (Crops statistics Division)
CSISA	Cereal Systems Initiative for South Asia
CSRD	Climate Services for Resilient Development
DAC	Department of Agriculture and Cooperation
DADO	District Agriculture Development Office
DAE	Department of Agricultural Extension
DAO	District Agriculture Officer
DARD	Department of Agriculture and Rural Development
DDM	Department of Disaster Management
DeITY	Development of Electronics and Information Technology
DFID	Department of International Development
DG	Director General
DHM	Department of Hydrology and Meteorology
DLSO	District Livestock Service Office
DOA	Department of Agriculture
DOL	Department of Livestock
DST	Decision Support Tool
DU	Dhaka University

ENBAITA	Expanding Nepalese and Bhutanese Access to Indian Technologies for Agriculture (ENBAITA) Prgramme
FAO	Food and Agriculture Organization
GFCS	Global Framework for Climate Services
GIS	Geographic Information Systems
GIZ	Deutsche Gesellschaft for Internationale Zusammenarbeit (German Organization for International Cooperation)
GoB	Government of Bangladesh
HIMALICA	Support to Rural Livelihoods and Climate Change Adaptation in the Himalaya
ICAR	Indian Council for Agricultural Research
ICCCAD	International Centre for Climate Change and Development
ICIMOD	International Center for Integrated Mountain Development
ICM	Integrated Crop Management
ICPAC	IGAD Climate Prediction & Applications Centre
ICRAF	International Centre for Research in Agroforestry
ICT	Information and Communication Technology
IFA	ICT for Agriculture Private Limited
IFFCO	Indian Farmers Fertilizer Cooperative Limited
IFPRI	International Food Policy Research Institute
IIT	Indian Institute of Technology
IITM	Indian Institute of Tropical Meteorology
IMD	Indian Meteorological Department
IMHEN	Institute of Meteorology, Hydrology and Environment
IPM	Integrated Pest Management
IRI	International Research Institute for Climate and Society
ISRO	Indian Space Research Organization
ITCs	Information Communication Technologies
IUB	Independent University Bangladesh
IWM	Institute of Water Modelling
IWMI	International Water Management Institute
KGF	Krishi Gobeshona Foundation
KVK	Krishi Vigyan Kendra
LGU	Local Government Unit
MoA	Ministry of Agriculture
MoAD	Ministry of Agricultural Development
MoD	Ministry of Defense
MOES	Ministry of Earth Science
MONRE	Ministry of Natural Resources and Environment
NABARD	National Bank for Agriculture and Rural Development
NARC	Nepal Agricultural Research Center
NARES	National Agriculture Research and Extension System
NARS	National Agricultural Research Systems
NARSE	National Remote Sensing Center
NGO	Non-Government Organization
NHMS	National Hydrology and Meteorological Service
NMFD	Nepal Meteorological Forecasting Division
NMHS	National Meteorological and Hydrological Services
NWO	Netherlands Organisation for Scientific Research
PA	Practical Action
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PICSA	Participatory Integrated Climate Services for Agriculture
PPCR	Pilot Program for Climate Resilience
PSP	Participatory Scenario Planning
R1	Rice Watch Action Network Inc.
RCC	Regional Climate Center
SAAOs	Sub Assistant Agricultural Officers
SAC	Space Application Centre
SAU	South Asian University

SPARSO	Space Research & Remote Sensing Organization
TV	Television
UN	United Nations
UNDP	United Nations Development Programs
UPF	*Universidade de Passo Fundo*
UP-NOAH	University of the Philippines Nationwide Operational Assessment of Hazards
USAID	United States Agency for International Development
WF	Weather Forecast
WMO	World Meteorological Organization
WoGRAM	Working Group on Agricultural Meteorology
WUR	Wageningen University & Research

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Executive Summary

The World Meteorological Organization (WMO) and the Global Framework for Climate Services (GFCS) define climate services as providing "… *climate information in a way that assists decision making by individuals and organizations. Such services require appropriate engagement along with an effective access mechanism and must respond to user needs. Such services involve high-quality data from national and international databases on temperature, rainfall, wind, soil moisture and ocean conditions, as well as maps, risk and vulnerability analyses, assessments, and long-term projections and scenarios. Depending on the user's needs, these data and information products may be combined with non-meteorological data, such as agricultural production, health trends, population distributions in high-risk areas, road and infrastructure maps for the delivery of goods, and other socio-economic variables.*[1]"

Agricultural climate services collect, analyze and share climate information to ensure that farmers and other stakeholders have access to relevant information to make better-informed decisions. Some of these decisions might include how to manage livestock, and when and where to sow particular crops or varieties, as well as how to manage these crops (both in the field and after post-harvest) so that climate risks are mitigated. Weather-based crop insurance programs, and pest and disease early warning systems, in addition to seasonal yield predictions, are among the fastest growing agricultural climate services sectors. What, however is most important, is that climate information must be conveyed in ways that are decision-relevant.

This requires a radical re-thinking of how many agricultural extension and ag-meteorological bulletins and advisories are produced and conveyed, with emphasis on involving farmers themselves in the development of appropriate climate information and participatory extension messaging. The ultimate goal is to empower farmers, extension agents, agricultural development organizations, and policy makers with knowledge and new insights. This will give them the capability to innovate and make informed decisions, so they are better equipped to respond to climatic variability to overcome climate-related production and livelihood risks. Achieving this aim requires an ability to communicate across scientific disciplines, to establish the institutional arrangements to facilitate the exchange of climate information to and from farming communities.

In order to share experience and boost capacity in agricultural climate services, a three-day workshop titled 'Participatory and Institutional Approaches to Agricultural Climate Services Development: A South and South East Asia Regional Technical and Learning exchange" was held between September 17-19, 2017, in Dhaka, Bangladesh, with more than 50 leaders in agricultural climate services from 11 countries attending. The workshop was sponsored by the U.S. Agency for International Development (USAID) behalf of the Climate Services for Resilient Development (CSRD). The workshop was organized by the International Maize and Wheat Improvement Center (CIMMYT) alongside the SERVIR and Climate Services Support Activity and CSRD South Asian partners.

CSRD is an international public-private partnership dedicated to promoting and enabling climate services to improve resilience to the impacts of climate variability and climate change, and to positively change behavior and affect policy in developing countries. CSRD is committed to delivering climate services - including the production, translation, transfer, and use of climate information - purposefully designed to enable policymakers and decision-makers to address significant problems and create solutions. Toward this end, CSRD promotes services that are user-centric and collaborative and effectively harness the power of information, technology, and innovation from around the world. CSRD's founding partners are

[1] WMO. 2017 What are Weather/Climate Services? Global Framework for Climate Services. World Meteorological Organization (WMO). Available online: http://www.wmo.int/gfcs/what_are_climate_weather_services. Accessed 12 December 2017.

the government of the United States through USAID, the White House Office of Science and Technology Policy (OSTP), and the National Oceanic and Atmospheric Administration (NOAA), the government of the United Kingdom (through DFID and the UK Met Office), the American Red Cross, the Skoll Global Threats Fund, Esri, Google, the Inter-American Development Bank, and the Asian Development Bank. Focusing on South Asia, CSRD implementing partners include the Bangladesh Meteorological Department (BMD), the Bangladesh Department of Agricultural Extension (DAE), the Bangladesh Agricultural Research Council (BARC), CIMMYT, ICIMOD, the International Research Institute for Climate and Society (IRI), The University of Passo Fundo, and the University of Rhode Island. CSRD is also aligned with the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). CCAFS seeks to ensure a food-secure world in the face of a variable and changing climate, through a strategic research-for-development collaboration. It brings together agricultural, climate, environmental and social sciences to identify and address the most important interactions, synergies and trade-offs between climate change and agriculture.

The three-day workshop was interactive and offered new opportunities to bring leaders working on participatory approaches and instructional arrangements for the development of relevant agricultural climate services from across South and South East Asia together in one location. The workshop goals were to:

- Develop a broad overview of South and South East regional agricultural climate services programs;
- Assure that participants become familiar with participatory approaches and methods in agricultural climate services, and able to enact or improve them in their own country contexts;
- Develop an increased understanding among workshop participants of how to identify and leverage 'decision points' in the agricultural calendar during which climate information and advisories can most benefit farmers;
- Assure that participants are able to understand and verbalize the need for appropriate intuitional arrangements to facilitate the flow of relevant climate information and advisories to farmers, and to supply feedback to meteorological, extension, development, and policy oriented organizations;
- Improve participants sense of information communication and visualization skills required to develop relevant climate services.

The key outcomes and discussions held during the workshop are summarized in the pages of this report. Some of the key themes that surfaced that require further efforts to increase farmer participation and the effective delivery of climate services include the following:

- Each country that participated in the technical exchange is at a different stage in the use of climate services to advise and assist farmers. Some are highly advanced, while others are only just starting. Continued 'south-south' communication and further efforts to facilitate linkages among leaders in each country and region are needed. Exchange visits, visiting scientist sabbaticals, and professional internships for somewhat extended periods could benefit in rounding-out knowledge sharing among the region.

- Large data gaps – especially for historical information – are prevalent in several countries. Where data do exist, they are often available at scales that are too large to adequately assist farmers with climate information. Further efforts are therefore needed to increase both data access and data sharing – ideally on an open-access basis – and to boost technical skills for forecast downscaling.

- Programs focusing on participatory climate services may need to emphasize multi-meeting trainings and educational efforts with farmers. Farmers are often aware of the concept of climate change, but may not fully understand the mechanisms behind global-scale change processes, nor how they may affect them in the future.

- Considerable interest was raised among participants in the Participatory Integrated Climate Services for Agriculture (PICSA) approach to popularizing climate information and services. PICSA has been widely used Africa, and involves agricultural extension staff working with groups of farmers ahead of the season to analyze historical climate data and use participatory tools to develop and choose crop, livestock and livelihood options best suited to farmers' circumstances. Immediately prior to and during the season, extension staff and farmers consider the practical implications of seasonal and short-term forecasts on the plans farmers have made. PICSA is intended for National Meteorology Agencies, government extension agents and non-governmental organizations. Several participants expressed interest in making use in portions of the PICSA approach in South and Southeast Asia, although each participant noted that the approach would require significant adaptation to best fit their countries and farming systems.

- Season to season climate variability is also often more important than 'climate change' in terms of facilitating livelihood resilience options for farmers. Projects and programs that work to increase farmers' understanding of climate information, and involve communities in climate data collection and reflective analysis, tend to be well positioned for increasing climate adaptive capacities. This however often entails a trade-off in terms of project costs versus the degree of participatory interactions with farmers. These issues require further evaluation on a country-by-country basis, and are likely to differ in needs and outcomes depending on farming systems. Toolkits and approaches to assess how to address these issues and choose the most appropriate and cost-effective approach to participatory climate services development with farmers are lacking but are urgently needed.

- All countries and participants highlighted the need for skill-building in the 'translation' of climate information into simple to understand formats that are relevant to farmers. These skills however are rarely taught in meteorological or climate sciences training programs, nor are they common in agricultural sciences degree programs. As such, further educational efforts may be needed to boost scientists' communication skills and ability to package information in ways that are of use and benefit to farmers. Including farmers' feedback in programs disseminating climate information can be highly beneficial in meeting this goal.

- Information communication technologies (ICTs) are increasingly used for the *delivery* of climate information to farmers. Only a few programs however are using ICTs to *collect* information or *feedback* on the usefulness of such information or climate advisories. Fewer programs use ICTs to engage farmers in surveys or to collect ideas for the design of climate services programs. This represents a large area of opportunity to get large-scale feedback from farming communities, and to adapt climate and agronomic advisory messaging, for example through programs that request farmers to send back feedback via SMS or simple ICT based surveys.

- There is considerable interest among countries in developing weather-index and flood-index based crop insurance. Although there are several technical and social limitations on uptake of these options in different countries, participatory process can be used in the design of insurance programs. Experiences from several of the participating countries' representatives indicate that these approaches are more likely to have a strong rate of success and sustainability. Although index-insurance is widely studied in the academic literature, there remain large opportunities for participatory insurance development approaches in several countries in South and South East Asia. Many workshop participants stated their interest in in-depth training and technical assistance to establish index insurances in their home countries. This area in particular should be further explored, ideally with assistance from the International Research Institute on Climate and Society (IRI) that has developed a number of participatory tools and games to advance research and development in weather-indexed insurance programs in multiple countries.

- Cross-sector coordination between agriculture and meteorological departments are a large opportunity. There are many opportunities for co-operation between the agriculture and meteorological departments in Bangladesh, Philippines, India and Myanmar, but they remain inadequately exploited. This is a necessary area of coordination and collaboration to develop and deliver quality climate service products, and to share working expertise in participatory approaches that place farmers at the heart of the climate information service innovation process.

- Institutional relations are crucial for the development of viable climate services. Farmers should be placed in the center of programs aiming to develop, extend, and refine and adapt climate services. Strong multi-directional communication links between meteorological services, extension services, and farmers are required, but only a few participating countries appear to be deliberately designing their programs in this way. Differences may be due to the degree of funding available to implementing organizations, as well as cultural and institutional differences in each country. Nonetheless, all participants agreed that increased focus and effort to facilitate links and communication between these three core stakeholder groups, and to strategically link additional partners – especially those working with ICTs, participatory project design, and weather index insurance – in the future.

The above list is far from conclusive, and the following pages of this report provide much more detail and further insights from the 'Participatory and Institutional Approaches to Agricultural Climate Services Development: A South and South-East Asia Regional Technical and Learning Exchange'. It is hoped that this event will not be a single occurrence, as all participants recognized the value of the workshop and the need for continued cross-country and cross-regional communication, knowledge, and skill sharing. overall, however, the workshop can be considered a success in meeting the goals outlined above, with participants all benefiting from increased knowledge, ideas, inspiration, and professional links to others working in the growing and crucially important field of agricultural climate services.

I. Background

Agricultural climate services focus on producing relevant climate information and assuring that farmers and other stakeholders can access information. The ultimate goal is to provide this information in an actionable format so they can make better-informed decisions on how to manage livestock, when to sow crops, what crops to plant, and how to manage and harvest these crops so that climate related risks are reduced. Pest and disease forecasts, as well as weather-based crop insurance programs, are among the fastest growing agricultural climate service sectors to date. There is also growing interest in weather based crop index insurance, and use of climate information to model and project anticipated agricultural production in a given season, among other applications.

But regardless of these 'sectors', climate information must be conveyed in ways that are decision-relevant. This requires a rethinking of how both climate and agricultural extension advisories are produced and conveyed, ideally with emphasis on involving farming communities in the participatory development of appropriate climate information and extension messaging. Tools and media formats developed in collaboration with partners can assist in increasing use of climate information. Through these processes farmers, extension agents, agricultural development organizations, and policy makers are empowered so they are better equipped to respond to climatic variability to mitigate production risks. Effective agricultural climate services also require an ability to communicate across scientific disciplines, and establish the requisite instructional arrangements and technical capacities to facilitate the exchange of relevant climate data to and from farming communities.

To develop strategies to support the growth of farmer-focused climate services, agricultural and climate scientists from across South and Southeast Asia came together in Dhaka, Bangladesh for a three-day workshop from 17th to 19th September 2017. This report compiles the objectives, activities, discussions and outcomes of the workshop. The agenda of the workshop is given in Appendix A.

Participating organizations and countries:
Participants from ten countries took part in this technical exchange, with eight South and Southeast Asian countries (Bangladesh, India, Indonesia, Myanmar, Nepal, Philippines, Sri Lanka, and Vietnam). The other participants were from the United States, the Netherlands, and United Kingdom, who shared cross-regional experiences with participatory agricultural climate services projects in South Asia as well as sub-Saharan Africa. The list of participants and organizations are given in Appendix B.

Main Objectives of the Workshop

- The three-day workshop was highly interactive and offered the opportunity for leaders working on participatory approaches and institutional arrangements to discuss topics relevant to increasing agricultural climate services in South and Southeast Asia. The main workshop objectives were:
- To exchange ideas, stories, strategy, and to network to support the growth of farmer-focused and relevant agricultural climate services in the region.
- To review South and Southeast Asian regional agricultural climate services activities, with an emphasis on participatory development and institutional arrangements to facilitate the flow of relevant climate advisories to farmers with appropriate feedback to scientists, extension agencies, and policy makers.

Outcomes of the Workshop

Participants in the workshop left having achieved the following:

- Developed a broad overview and better understanding of South and Southeast regional agricultural climate services programs;
- Became familiar with participatory approaches and methods in agricultural climate services, and how to apply or improve them in their own country contexts;
- Gained an increased understanding of how to identify and leverage 'decision points' in the agricultural calendar during which climate information and advisories can most benefit farmers;
- Increased ability to understand and verbalize the need for appropriate intuitional arrangements to facilitate the flow of relevant climate information and advisories to farmers, and how to supply feedback to meteorological, extension, development, and policy oriented organizations;
- Gained an improved sense of information communication and visualization skills required to develop relevant climate information and advisories for smallholder farming communities in South and Southeast Asia.

II. Workshop Notes – Day 1

DAY 1: SUNDAY, SEPTEMBER 17, 2017

Inaugural Session of the Workshop

Timothy J. Krupnik, CIMMYT and the South Asia Project Leader for Climate Services for Resilient Development (CSRD) initiated the inaugural session of the workshop welcoming the participants, representing climate science and meteorology, forecasting, extension services, and national and international research in agriculture across government and non-government sectors.

Key representatives from among CSRD's partners and donors commended the technical exchange workshop whereby professionals from climate and agricultural research and extension services would come together and share experiences on how to translate climate information into understandable and actionable information for farmers. The key representatives at the Inaugural session included:

- Mr. Shamsuddin Ahmed, Director, Bangladesh Meteorological Department
- Dr. Stephen E. Zebiak, President, Climate Information Services and CSRD global coordinator
- Mr. Md. Abdul Hannan, Director, Bangladesh Department of Agricultural Extension
- Dr. James Hansen, Senior Research Scientist and CCAFS Flagship 4 Leader: Climate Services and Safety Nets, IRI, The Earth Institute, Columbia University
- Mr. David Westerling, the Acting Economic Growth Office Director and Feed the Future Team Leader, USAID.

Mr Shamsuddin Ahmed emphasized the need for specific climate services for the agriculture sector and highlighted how the Bangladesh Meteorological Department plays a key role in collecting and analysing data for climate advisories. The delivery of climate services depends on the quality of climate data collected and how it is analysed, which needs to be prioritised to ensure effective climate services. He pointed out that there are many models used to analyse and predict weather and climate, and that care should be taken in the selection of models to assure relevant and accurate results. Given the current state of global hunger and climate change (along with conflict and socio-economic slow-down), the need for climate services is crucial in order to plan for increased food production.

Dr. Stephen Zebiak described CSRD, a public-private partnership dedicated to providing climate services to enhance climate resilience and to enable decision making to address problems and create solutions in different sectors in developing countries. He emphasized that after two technical exchanges in Colombia and Tanzania where the focus was on information product and tools, this 3rd technical exchange in Dhaka emphasizes more the practice dimension of climate services. He commented that with the diverse range of experts from different sectors and countries, this technical exchange should provide an opportunity for knowledge sharing, dialogue and collaboration among the professional community which will inform and design and development of climate services in the Asian region.

Director of the Bangladesh Meteorological Department Mr. Shamsuddin Ahmed emphasized the need for specific climate services for the agricultural sector.

Mr. Md. Abdul Hannan appreciated CSRD's objectives to improve the delivery of climate services for farmers. These goals are in tune with other DAE activities, including the World Bank funded Agro-Meteorological Information project. Since DAE works at the administrative levels at the grass roots village level, it is in the position to inform and educate farmers on how to use the climate services. Weather information is needed at all stages of crop production from sowing to harvesting. Meteorological data, however, has to be translated into farmers' languages and terms to be understandable and useful.

Dr. James Hansen highlighted that the development community around the globe increasingly uses the language of resilience, recognizing the need for climate change adaptation for communities that must deal with climate variability. The need for climate services is growing, and particularly important for government planning in agricultural marketing and extension services to benefit farmers. Climate data and services are necessary to forecast climate related risk and early warning, and thus to design innovations whereby the lead time of a climate event turning into climatic disaster is reduced. As the supply side of climate science is continuously developing, the demand side of climate science is an area requiring more research and innovation. He finished his speech with expectations that this technical exchange workshop will beneficial and hold great benefit for South and Southeast Asia.

Mr. David Westerling pointed out the relevance of CSRD's activities to the US government's commitment to support smallholder farmers to build their resilience and ensure increased production, and to bolster country climate resilience and adaptation capacity. It is important that climate be translated into user-friendly information for farmers and the government. This workshop is a good platform on how to develop participatory climate services and institutional relationships to ensure that climate data is effectively translated into useful climate services.

Dr. James Hansen highlighted that this exchange could hold great benefit for South and Southeast Asia.

"CSRD's activities are relevant to the U.S. government's commitment to building resilience of smallholder farmers and to ensure increased production, as well bolster country resilience. That is why we are behind this effort."
- Mr. David Westerling, the Acting Economic Growth Office Director and Feed the Future Team Leader, USAID in Bangladesh

Keynote presentations: Sharing of Stories and Ideas on Participatory Agricultural Climate Services from across the Regions

The first session of the workshop started with different countries and organizations sharing their experiences and ideas on participatory climate services. The presentations included the following:

Developing climate services and approaches to support farmer decision making: Insights from Africa with relevance for South and Southeast Asia.

Peter Dorward, The School of Agriculture, Policy, and Development (University of Reading). (Presentation given in appendix C1)

Dr. Peter Doward gave an overview of what the current state of participatory efforts in climate services are.

Dr. Peter Doward gave an overview of what the current state of climate services are and commented that with mushrooming of innovations and initiatives, it is time to take stock as to how research and practices around climate services should be developed in the future. He introduced the concept of Participatory Integrated Climate Services for Agriculture (PICSA) – which has been found to be successful in being an integrated systems approach, being wholly farmer focused and practical, utilizing partnerships among farmers, government and non-government agencies to encourage farmers to understand climate and effectively plan their livelihood activities. Lessons from PICSA application in Africa were presented and discussed in terms of their relevance to South and Southeast Asia.

Communicating weather and climate information with farmers: Lessons from CCAFS's global experiences.

James Hansen, Senior Research Scientist and CCAFS Flagship 4 Leader: Climate Services and Safety Nets, and Ms. Mélody Braun, Research Staff Associate, Financial Instruments Sector Team (IRI) (Presentation given in appendix C2)

Dr. James Hansen gave an overview of the work and objectives of Climate Change, Agriculture and Food Security (CCAFS) CGIAR Research Program (CRP). CCAFS is a research-for-development program involving all 15 centers of the CGIAR and works with an extensive partner network that aims to ensure a food secure future in the face of a changing climate. CCAFS works across the globe and a major vision of CCAFS is that 'Farmers across Asia Africa and Latin America are supported by effective climate services and are protected by well-targeted safety nets, enabling transition toward climate smart agricultural systems and resilient livelihoods'. Dr. Hansen then discussed the lessons in developing and implementing participatory and institutional approaches to agricultural climate services development in various CCAFS related initiatives.

The main challenges identified in translating weather information into climate services are: 1) Farmer's capacity to access, understand, understand and act on climate information, 2) National Meteorological and Hydrological Service (NMHS) capacity to routinely provide tailored local information, 3) Gaps in historic data, 4) Translating raw climate information into agriculturally relevant terms, and 5) Institutional and governance arrangement to sustain co-production.

In addressing the challenges, CCAFS has supported National Meteorological Services (NMS) organizations to provide actionable climate information through the Enhancing National Climate Services (ENACTS) initiative. In some cases this has been linked to the PICSA communication processes.

The four preliminary lessons of CCAFS with respect to climate services include:

1. Climate services that work for farmers, at scale and sustainably, often require substantial investment in capacity:

    - **Supply side**: NMS capacity to provide locally relevant information tailored to the needs of farmers, often addressing historic data gaps;
    - **Demand side**: NARES capacity to translate, communicate, and build farmers' capacity to understand and act on climate information;
    - **Institutional and governance** arrangements to sustain co-development of services beyond project lifespan.

2. Climate research is expanding options for filling data gaps, generating relevant information without overextending NMS human resources.
3. A mix of delivery processes including participatory communication facilitated by trained intermediaries is often needed.
4. Mainstreaming climate services in agriculture requires strong partnership between agricultural and meteorological agencies and their associated Ministries, and enabling governance.

Agricultural climate services and farmer participatory extension in India.

N. Chattopadhyay and KK Singh. Agricultural Meteorology Division and Agro Met Services (India Meteorological Department) (Presentation given in Appendix C3)

Dr. Chattopadhyay and Dr. KK Singh presented the institutional set up of India's Agro Met Advisory Services at the village level, locally known as the Gramin Krishi Mausam Seva which currently has 130 Agro-Met Field units and 640 district level bulletins across India, which are prepared twice a week. The service has reached 21.69 million farmers through SMS. 95% of the farmers surveyed have experienced improved reliability through this service and the incremental profit due to Agro-Met Advisory Services is assessed to be 25% of their net income. The Annual Economic Profit was assessed at to 65 million US dollars, according to Governmental monitoring and evaluation. If these services are fully utilized by the targeted 95.4 million agriculture-dependent households, it is expected a net economic benefit up to USD 51,562.5 million will be generated.

The Agro Met Advisory Services has been set up through a collaboration of multi-disciplinary and multi-institutional agencies from the national to the village level. The service has a Climate Service Toolkit (CST) which is a suite of guidance, data, software tools, training resources, and examples for enabling climate services at global, regional, and national levels. It is comprised of:

- a data portal in public domain for access to and analysis of observations
- a data management system for quality control and simple management of data
- climate monitoring tools for calculation of anomalies, percentiles, return periods
- software tools for conducting climate analyses, making predictions, and assessing projections.

A wide range of climate products are generated; e.g., reports on normal temperature (annual), trends in annual temperature, rainfall patterns and trends in districts, frequency of days with precipitation exceeding specific thresholds, consecutive dry days, consecutive wet days, etc.

The presenters then described how climate information has been useful in advising farmers on sowing and harvesting times to reduce the risk of reducing crop losses. There is a Farmer Awareness Program which aims to make farmers more capable in dealing with weather issues as well as increase the interaction between the local farming communities and the different meteorological centers. Feedback from farmers is collected though personal contact, internet, media agencies (questionnaires/surveys and farmer meetings).

Farmer climate field schools in Indonesia: Strengths and weaknesses.

Indra Gustari. Center for Applied Climate Information Services (Indonesia Agency for Meteorology Climatology and Geophysics). (Presentation given in Appendix C4)

Indra Gustari described Indonesia's geography and climate.

Mr. Indra Gustari described Indonesia's geography and climate followed by the functions of the Indonesian Agency for Meteorological, Climatological and Geophysics (Badan Meteorologi, Klimatologi, dan Geofisika i.e. BMKG). BMKG is a non-departmental government agency for meteorology, climatology, and geophysics. The functions of BMKG include monitoring of consecutive number of rain days, groundwater availability, dry/wet season onset prediction, monthly rainfall analysis, prediction and probability of rainfall.

BMKG also translates upstream information on weather and climate prediction into downstream information for end-users. The weather information from BMKG is disseminated to the farmers through Climate Field Schools (CFS) managed by extension workers under the Ministry of Agriculture. The CFS activities are carried out in several levels from training of trainers down to farmer meetings to increase climate literacy of local and small farmers.

The main challenges faced are in improving climate literacy and adaptation in the agriculture sector, increasing productivity, accuracy of the climate forecasts, and involving the local government and scaling up the activities of the Climate Field Schools. The Climate Field Schools have been found to be a successful adaptation technique in improving climate literacy of farmers and increasing harvest production by 30%, although BMKG would like to increase this figure substantially.

Climate services and farmer participatory extension in Nepal.

Deepak Bhandari, Agri-Environment Division, Nepal Agricultural Research Council. (presentation given in Appendix C5)

Dr. Deepak Bhandari outlined the institutional set-up of the Ministry of Agriculture Development (MOAD) from the central level to the district level and of the Nepal Agricultural Research Council. Establishment of agro-climate services is recent in Nepal. The service objectives are:

- Making available agro-climate/ weather information for farmers and other stakeholders on time
- Use of Early Warning Systems (EWSs) in agriculture to reduce production risks due to climate/weather change
- Easy assessment of adaptive measures against impacts of climate change and latest agricultural technology for extension workers and farmers
- Development of infrastructure, human resources, and awareness for durable agro-climate services

The components of the agro-climate services include: 1) infrastructure development, 2) development of information products, 3) dissemination of products (agricultural Information), 4) capacity building, and 5) weather index based crop insurance, although not all are currently being implemented through current programming.

A major product of the agro-climate services is the Agro-Advisory Bulletin (AAB) which is a technical bulletin prepared by a team of experts to support farmers in adoption of advanced agricultural technology and to cope with unfavorable weather and agricultural circumstances. The major stakeholders for AAB preparation are Nepal Agricultural Research Council (NARC), Ministry of Agriculture Development (MOAD), Nepal and the Department of Hydrology and Meteorology (DHM). The AAB is dispatched through SMS to 25,000 farmers in 25 districts and other stakeholders on a weekly basis. AAB information is also relayed via radio in the local languages twice every day.

Another key intervention is the Kisan Call Center (KCC), which is a call center for farmers. The KCCs have been established in 25 districts and provide a two-way communication between farmers and experts at district and NARC levels. A cell phone application known as *Hamro Krishi* has also been introduced for smart phone users. The app is updated regularly and is available in both Google play store and at www.namis.gov.np. Weather index-based crop insurance is being introduced and currently research is being conducted on the development of financial risk transfer instruments for the agriculture sector.

Farmers have expressed a strong preference for information on:

- Rainfall, hailstorms and flooding
    - Harvesting, Planting, irrigation
    - Disease problems in livestock
- Pest problems in crops
    - Insects, Diseases
    - Availability of seed, fertilizers, variety, technology and subsidies
- More frequent SMS services
- Increased programming through radio FM in local languages

Dr. Bhandari however commented that the current farmer feedback mechanism is not very effective – information is mainly being collected through the KCC, field visits and some surveys. The challenges in developing and delivering improved agro-climate services and to harness farmer participation in Nepal are:

- Small land holdings, low commercial agriculture, diverse crops
- Diverse agro-ecological conditions
- Lack of sophisticated equipment to confirm weather forecasts
- Weather forecast (3days and 7 days) are short term, whereas extended range is needed for improved agricultural planning
- Quality of technical inputs: few trained focal person/farmers
- Communication with farmers/group to get proper feed back
- Federal structures not conducive to long term planning of agro-climate services
- Establishing sustainable linkage between DHM, Research and Extension services with local level bodies
- Need for better networking of extension services with sufficient manpower at local level

Talking toolkits, PSP, and methods for communicating agricultural climate services and adaptation in Vietnam.

Dr. Simelton provided a step by step description how farmers are involved in designing and producing climate service products.

Elisabeth Simelton and Mrs. Tam Thi Le (World Agroforestry Center) and Mr. Le Xuan Hieu (CARE)(Presentation given in Appendix C6)

This presentation introduced methods and toolkits used in communicating agricultural climate services in Vietnam and Cambodia. First the institutional set-up for Agriculture Climate Information Services (ACIS) was described where institutions from central level to farmers and farmer networks are involved.

Dr. Simelton provided a step-by-step description of the how farmers are involved in designing and producing climate service products. These included a baseline to understand the current situation, needs and scope of impact implemented through talking toolkits and stakeholder meetings and these are then followed with the Participatory Scenario Planning Process (PSP). The PSP is an interactive and iterative learning process where steps include 1) designing the process, 2) preparing the workshop, 3) facilitating a PSP workshop, 4) communicating the advisories and finally 5) carrying out feedback, monitoring and evaluation.

Testing was carried out to find out what kind of agro-advisory design women and men farmers preferred based on whether advisories are understandable, useful, appropriate and whether they take the time to read it.

The identified areas where farmers needed information for decision-making included:

- Seasonal forecast for planning the planting, variety selection, harvesting time
- Updated forecasts for day to day management

The main challenges involving farmers' participation and how these were addressed was described as shown below:

Challenges	How they are being addressed in Vietnam and Cambodia
Getting the weather information that farmers need	• Facilitators are important • Let forecasters meet farmers • Understand and advocate farmers' needs to higher levels • Bring evidence of how information helps (resource use efficiency, losses availed)
Quality/access to downscaled national weather forecasts	• Compare forecast sources • Train Youth Union/extension/ Farmer Champions • Post on Facebook
Literacy: icons versus words	• Let women and men farmers use their words/sounds to illustrate a weather situation; test on others
Keeping the momentum	• Do something quickly with a clear result while other things take more time, e.g. meteorological station/rain gauges, events, etc.

PANEL DISCUSSION, Day 1, Morning Session
After the presentations, a panel discussion was held which was facilitated by Stephen Zebiak. The issues raised and associated discussions are given below.

Issue: Lessons Learned - How negative experiences have changed programs or need to be addressed

General discussion

- *Emphasis on team building and knowledge sharing:* Since CCAFS is a network of organizations across the globe, the focus should have been first on team-building as there are many experiences that can be shared and replicated from other organizations and countries. After this has been clarified, then projects can be better developed without having to 'reinvent the wheel'. CCAFS may have also underestimated what programs other countries might already have. The pace of innovation is staggering, and also encouraging, and it is essential to stay informed of solutions to problems that have already been solved. Intensive knowledge sharing and community building should be a priority before CCAFS implements any more projects.

Panel discussants on the first day of the technical exchange.

- *Scaling-up to cover wider areas*: High quality forecast and advisories based on demand of the end-user, which in this case is the farmer, is critical. Demand might vary from short-term (within a few days) to longer term (e.g. a month's time). The Indian experience is that they are still struggling on how to expedite the process and reduce the time from receiving weather data to preparing advisories. India is currently producing 640 bulletins, but the challenge is how to scale this up to 6,500 in the span of two hours while ensuring the weather information is being correctly analyzed.
- *Resolving differences between different forecasting models*: Different models for long-term and medium-term weather forecast are used, giving various kinds of information and creating confusion which should be resolved to improve consistent forecasting. This should be resolved or at least clarified at the country level.
- *Capacity building and motivation of public institutions*: Funding was cut for the climate services programs in Vietnam and at the same time the government was also not interested in this area of research and development. The lesson was therefore to focus on the institutional capacity building so that even with reduced funds, the climate services sector remains in place to serve farmers.
- *Keeping up with the times*: New technologies are being developed everyday which farmers are picking up quite quickly from the internet. A key area of intervention is educating farmers to understand weather information to apply technologies appropriately.

Specific Issue- Technical expertise of persons responsible for preparing advisory and bulletins

- In India, the process is as follows: First the forecast is prepared by India Meteorological Department which is then sent to agricultural experts. The agricultural experts from different sectors e.g. plant pathologists, entomologists, soil scientists etc. who understand the sensitivity of the forecast who jointly prepare the advisory. These specialists are from Indian universities and agricultural research institutions.

Specific question topic - Reliability of forecasts:

- Feedback from farmers in southern Andhra Pradesh, India who receive weather forecast data from the crop advisory services is that they find the forecast is reliable about 50% of the time. However, farmers usually go ahead with their decisions irrespective of forecast. Farmers are at a quandary regarding whether to use the traditional crop practices or rely on the forecast and advisories. How do we address this confusion among farmers? how do we make weather forecasts more reliable and what are the three most important actions to address this in next 3-4 years?
- Forecasting is challenging and with climate change, even more so. To address this issue, India has contingency planning in all states where the progress of the monsoon season is tracked and farmers can be advised what crops to plant accordingly. Advice is given on whether the area is drought-prone or not, as well as on mid-season corrections/adjustment to assure no moisture deficits. Once the crop has been planted, corrections are made. It is obvious that not everything is 100% is correct and it is a continuous learning process where attempts to develop solutions through multi-stakeholder consultations are on-going.
- Forecasting should be reported with a degree of uncertainty or probability, which gives better transparency. Since farmers work with uncertainty, weather forecasts which incorporate uncertainty gives farmers better information to help their decision-making. Giving weather forecasts with the degree of accuracy and uncertainty is a step towards providing and empowering farmers with more reliable information.

Specific Issue – Assessments on climate service projects indicating measures for increased agricultural productivity

- Even though Indonesia reports a 30% increase in agricultural productivity from climate services as shown in the presentation in this workshop, it is not uniform in all areas. To attribute what contributes to production, and to increase accuracy of weather data and other information further research is required.
- Climate services only started about two years ago in Nepal and therefore no systematic surveys have been conducted. There have been only simple surveys with farmers receiving SMS who report the information sent via SMS to delay harvest until after storms that could have hampered post-harvest drying and processing.
- Production and productivity are the main concerns for farmers, and the first requirement is seasonal forecasts which will identify the crop stages that might be subject to stress conditions, such as floods, and droughts.

Specific question topic – Information for contingency planning: Lead time for weather (e.g monsoon onset) for contingency planning

- Normally onset of monsoon is 1st June and so around 15-20 May the forecast for monsoon progression is made in India. This year the monsoon started on 30 June, and so there was at least 15 -20 days lead time.
- There is increasing uncertainty as to when the monsoon will commence which has large implications for field crop production in South Asia. Research is needed in this area.
- A critical consideration is the lead time for the monsoon onset. Based state level estimates for 2015, it was predicted that production would be 215 million tons of cereals and pulses in India. This actually turned out to be 256 million tons and the Indian government attributed this to the increased availability of forecast information that was disseminated in advance of monsoon onset, so farmers could react accordingly.

The second session of Day 1 continued the thematic presentation from the morning and included the following:

Effective Climate Information Services for Agriculture in ASEAN.

Imelda Bacudo. Senior Advisor and Deputy Head of Project Forest and Climate Change under ASEAN (GIZ)(Presentation given in Appendix C7)

Ms. Imelda Bacudo introduced the ASEAN Climate Resilience Network (ASEAN-CRN) as a platform for regional exchange, particularly for sharing information, experiences, and expertise on climate smart agriculture (CSA) promoting resilience in the ASEAN countries.

Ms. Imelda Bacudo introduced the ASEAN Climate Resilience Network (ASEAN-CRN) as a platform for regional exchange.

The ASEAN CRN platform works like a match-making service, bringing together policy makers, scientists, practitioners, and private companies engaged in the development and delivery of Climate Information Services (CIS) for agriculture in ASEAN and where an exchange of experiences and knowledge on effective CIS in ASEAN Member States (AMS) is enabled. The network also identifies policy interventions and institutional framework whereby investment in technologies and management of CIS in agriculture can be increased as well as activities for regional collaboration and so is not only for ASEAN members.

Examples of ASEAN CRN cross-learning include:

- Cambodia intends to learn more about agro-climate information for agricultural water management from Thailand, as they are a leader in water management for rice production.
- Indonesia for example wants to learn more about crop insurance from the Philippines where there are emerging best practices and good case studies.
- Indonesia also wants to learn from Thailand about crop modeling, training and application.
- Laos want to learn from Indonesia about the utilization of android mobile applications for agriculture and capacity building activities in hydro-meteorology.
- Laos also intends to learn from the Philippines Atmospheric Geo-Physical Astronomical Services Association (PAGASA) training and capacity building in terms of services on climate information. PAGASA has a lot of best case practices that may be of interest to those working on climate services generally.
- Laos wants to learn from Thailand about the experiences of working with multiple agencies under a single command system. Thailand has a good example of a single command system, which is crucial in terms of governance to assure more reliable climate information is uniformly disseminated.
- Myanmar and Laos are interested in learning from Indonesia on how to strengthen capacity in hydro-meteorology. Other areas of interest for Myanmar include learning about improving technical assistance from PAGASA, and from Vietnam about the use of mobile services for agriculture.

- The Philippines wants to engage with the WMO Climate Monitoring Section on the standardization of the language of disaster.
- Thailand wants to establish ASEAN-level climate information service knowledge exchange and an expert advisory hub. Thailand also wants to learn from Indonesia on crop-pest forecasts, and from the Philippines on agro-meteorology. These are examples of pooling experiences and cross-learning among different countries.

Key challenges faced by ASEAN-CRN include:

- Difficulties in providing actionable information (often only climate information is provided but it is not linked directly to decisions farmers need to make)
- Challenges in the institutional arrangements - the meteorological and agriculture departments are separate
- Advisories are often not crop specific and are difficult to use
- There is a general lack of capacities in delivering seasonal forecasts, and in downscaling the climate data into information etc.
- Sometimes data are not good enough to produce quality climate information and services products
- Good pilots, e.g. field schools are implemented but the challenge is in scaling-up in a cost-effective manner
- Communication formats are not always appropriate, diverse media channels are required to relay a single message.

ICT solutions are becoming increasingly important and promising tools for dissemination. Also, there is considerable potential for crowd sourcing and big data approaches, and public-private partnership approaches, in development of CIS.

Farmer participation and communication in climate services and Index-based flood insurance initiatives in India, Bangladesh, and Sri Lanka.

Giriraj Amarnath (IWMI) (Presentation given in Appendix C8)

Dr. Giriraj Amarnath of IWMI provided clarity on his focus on monitoring and risk mitigating services with examples form Africa and Asia.

Dr. Giriraj Amarnath outlined his presentation and provided clarity on his focus on monitoring and risk mitigating services with examples form Africa and Asia, using public and private initiatives on weather index insurance and flood insurance, and challenges and lessons learned in scaling up interventions in Sri Lanka and other flood-prone countries.

There is need to educate the farmers on climate sciences and climate change before they can understand what information they are likely to require. IWMI conducted a number of consultation workshops with farmers, government agencies and international experts where case studies on climate change – particularly in Sri Lanka – were discussed. The climate change vulnerability map for Sri Lanka is based on data from 1961to 2000. This showed trends in warming, and a shift in the north-east monsoon and south-west monsoon. In the last five years of the period, the severity of floods is on the rise in the western parts of Sri Lanka, while there is water shortage in the north-east area. Sri Lanka is famous for the ancient irrigation tank system, unfortunately these tanks or reservoirs currently do not have sufficient water in drought years.

There have been many studies and publications using different parameters such as rainfall, sea level rise and temperature changes. Based on 32 parameters, the vulnerability to climate change has been mapped at district, country and global level, and has recently been published by IWMI (See slide on Mapping Vulnerability to Climate Change). Based on this information, adaptation measures are designed taking into account crops, climate tools, water resources and sea level rise. The data are usually more relevant for policymakers to use since they make decisions on where investment should be made.

The broad response to climate change has been around three key areas:

- Resilient markets
    - Reduction of food price volatility
    - Facilitation of private investments
    - Building better enabling markets
- Resilient Agriculture
    - Enabling resilient and sustainable intensification
    - Combating land and water degradation
    - Building climate smart agriculture
- Resilient people
    - Scaling up nutrition
    - Focusing on rural women and youth
    - Building diverse livelihoods

An example intervention of a climate service was described on 'Smart ICT for weather and water information and advice for smallholders in Africa' where the concept included a step-by-step process of developing the online database of farm fields, use of high-resolution remote sensing data to monitor the condition of crops, and converting this information into simple agro-advisory messages delivered via SMS.

Under this intervention the main outputs were:

- Crop Biomass Monitoring
    - Evapotranspiration, biomass Production and related parameters are *regularly* calculated for project areas in 3 countries, based on high-resolution 20m RS images

- Web Portal and SMS service
    - FieldLook portal www.fieldlook.com - in English, Arabic and Oromiffaa
    - Fieldlook spatial data are "translated" into simple SMSs - both qualitative and quantitative, and both on-demand and weekly "push"
    - SMS services match desired information, farmer skills, and language, and consistently revised according to user feedback

Other IWMI projects include flood risk mapping, multiple climate risk assessment, index-based flood insurance in India, drought monitoring system and early warning system in South Asia, drought index developed based on soil moisture; drought management and contingency plans. Another important remote sensing based crop insurance program in India – Agricultural RS insurance for security and equity (AgRISE) – is a crop data service with an insurance solution covering critical events in agriculture: sowing failure, mid-season calamity, localized calamity, yield index and post-harvest loss.

Experiences with ICT to communicate climate information to Farmers in Nepal.

Ishwor Malla. Deputy Head, ICT for Agriculture. SMILES – Nepal (Presentation given in Appendix C9)

Mr. Ishwor Malla, the co-founder and service director of SMILES-Nepal presented the use of ICT tools to extend information for small and marginal farmers in Nepal. The presentation focused on the use of mobile phone apps, the kind of information relayed, the use of SMS, and the effectiveness of the apps.

Agriculture is the main source of income for 66 percent of the Nepalese people, however about 60 percent cannot produce enough crops to feed themselves throughout the year. A main problem is that these farmers lack access to information which will help them take decisions to produce more and sell profitably. Opportunities in utilizing ICT include the prevalence of a range of agribusiness companies (seed, feed, fertilizer and machinery) who can promote their products in sync with weather. Extension staff in government and non-government agencies can effectively reach farmers and traders if equipped with climate smart information.

Challenges in delivering climate information appropriately include lack of classified farmer profiles, and the lack of a common platform. Another problem is the farmers understanding of how to get better yield of crops; many do not consider climate information, or associate this with being a yield-related factor. For the decision-maker, the usefulness of ICT apps is whether the information is accurate and what impact it can have on agricultural productivity or risk reduction. When developing agro-advisories, the primary concerns are the quality of data and how uncertainties are related to climate reported; how these are packaged in the local language; and the consistency and reliability of the information.

Products of SMILES include

- SMS based products
- Web based products
    - www.ict4agri.com
    - www.kinmel.ict4agri.com
- Android based products
    - *Krishi Guru*

SMILES has collaboratively worked with the following in the past:

- ICIMOD: *Kavre*
- LiBIRD: *Lamjung, Kaski, Nawalparasi and Dang*

And currently SMILES works with:

- iDE Nepal: *Rolpa, Surkhet, Banke, Kailali, Dadeldhura*
- ADRA Nepal: *Bara, Parsa, Rautahat and Mahottari*
- CARE: *Banepa, Sindhuli*
- ICIMOD: *Taplejung*

The SMS based advisories are in the Nepali language and are of three types

- Current market price of produce in the nearby market
- Three-day localized weather forecast info
- Advisories related to good farming practices

For users having smart phone and access to internet, the main features of the '*Krishi Guru*' app are:

- Weather information
- Market price information
- Commercial production technologies
- On demand queries

- Access to input supply and traders

Farmers' needs for information are mainly for the following:

- Time management: Sow time/pre-harvest and post-harvest management.
- How to adapt climate change and minimize the risk of loss induced by them.
- How to make an integrated farming plan for the year.
- Quick and easy access to desired information when and where they are needed.

Citing an example of use of ICT app in India: In Maharashtra, farmers do not need to go to the big towns/cities to buy seeds and fertilizers, instead these companies reach the farmers through Amazon. These farmers are registered and have accounts with the agro-service provider. They get advice and information related to their crops as and when required. ICT is an important way of helping farmers, saving time in obtaining advice and procurement of input.

Care however should be taken that when the advice is given on climate information to farmers, it should include not only climate information, but all elements of relevant information for better crop yield e.g. fertilizer, seed varieties etc. in order for the farmer to understand the value addition of using ICT-based agro-advisories. There is also a lot of information and research available widely on the internet and disseminated through different media. SMILES collects the information from various sources, checks the information for reliability, and then packages the relevant information in the local language for the farmers.

The *Krishi Guru* app developed by SMILES not only gives agro-advisories but has also increased interaction among the different stakeholders e.g. farmers, traders, extension agencies, who can communicate and interact with each other one-on-one or in group calls. Farmers under the SMILES initiatives have been supported to get quick solutions to their problems.

Approaches to developing better agricultural climate services in the Philippines.

Hazel Tanchuling, Executive Director (Rice Watch Action Network Inc.)(Presentation given in Appendix C10)

Ms. Hazel Tanchuling presented the benefits and experiences of setting up localized climate services for farmers in the Philippines. Because of the limited capacity and budget of the meteorological agency, localizing climate services for farmers at the community level would be an effective way to reach information to them. PAGASA has three regional offices, however products are developed and delivered at local level by the Local Government Unit (LGU) which is the frontline service provider in agriculture and disaster management and response. Furthermore, the local government is mandated to mainstream climate information in the local government's plans and services under the Climate Change Act of the country.

The intervention is based on a Community Resilience Framework where at the center is the organized community at the grass roots who are supported by enabling better access to climate info/warnings and livelihoods risk management advice; diversified income sources; Insurance and access to emergency support services and support to utilize sustainable, ecological and affordable farm and livelihood technologies.

Strategies employed include:

- Localized climate information services
- Season-long learning through a climate-resiliency/capacity building program
- Community resiliency planning and community organizing
- Linking Communities to market
- Livelihood set-up and business planning/incubation support
- Insurance promotion or actual coverage

Of these the climate information services are extended through a climate-resiliency field school, the program objectives of which include:

- Provide early warning services to help farmers manage climate/weather-related risks
- Enhance farmers and fishers' knowledge of climate variability and anticipatory abilities to inform livelihood decisions
- Teach, assist and link vulnerable rural groups to practice sustainable methods of farming/livelihood/ resiliency actions as individual and collectively as a community
- Generate climate information needed to inform local government units (LGUs) on climate change action planning
- Monitor climate change as it happens
- Help LGU's establish their disaster thresholds and response capacities

Ms. Hazel Tanchuling presented the benefits and experiences of setting up localized climate services for farmers in the Philippines.

To achieve the program objectives, activities have entailed capacity building of the LGU staff on localized climate services and climate-resiliency field schools (CRFSs). This was carried out in two parts, each part being a one-week training on various topics (see slides 8 and 9 of the presentation). The climate services that are conducted by the LGUs are local weather observation, climate risks and impact monitoring, farm-weather advisory creation and community dissemination of weather/climate risks and suggested management.

The process of generating farm-weather/livelihoods and general risk management advice starts with PAGASA generating forecasts and warnings which are sent to the LGUs which analyze the forecast and warning information and then determine kind of impact it might have before translating it into relevant information for farming and fishing communities. The communities then utilize the information they receive and make decisions, carry out collective planning, disseminate the information to the wider population of farmers and report back to the LGUs on community impact and accuracy of the information received. The LGUs take the farmer's feedback and report back to PAGASA to utilize in their data analyses.

The key actors in this process are the LGUs, PAGASA and communities and to facilitate communication among these parties, the Rice Watch Action Network Inc. (R1) has played a catalytic and capacity building role and the Department of Agriculture and associated institutions provide a resource pool for the field schools. R1 also supports needs of communities and LGUs in the program, in addition to replication and scaling up.

The next step of the intervention is about assisting LGUs to integrate Climate Risk Management into Local Agriculture Planning. Exercises on climate-Livelihood Risks Analysis are undertaken and utilized for Risk Management in two areas:

1) Short to medium term weather forecasts leading to
    a. Short-term planning and
    b. Emergency preparedness
2) Short to medium term weather forecasts leading to
    a. Medium-term operational planning
    b. Seasonal Risk assessment and management

For example, using data and information from PAGASA's 10-day forecast and seasonal climate forecast for a specific province, PAGASA will issue a forecast product e.g. a gale warning which is made available at the Municipal Weather and Climate Information Center operated by a Municipal Weather Observer. This center is expected to become a part of the LGU. The gale warning or any other early warning is then communicated to the community through digital boards and weather boards. The local community then assess the possible risks to their crops and livelihoods, and undertakes collective discussion of risks management measures farmers through the weekly Agro-Ecological System Analysis (AESA). This level of information is then relayed to the wider community at the grassroots through the local radio stations, and SMS.

The program has been found useful because it employs a multiple pronged approach including:

- Coaching/mentoring of LGU partners
- Capacity building of communities and linking to different service providers
- Emphasis on local capacity (increasing potential for sustainability)
- Enabling up-scaling
- Focus on inequality and promoting community and environmental well-being, not just of growth
- Institutional strengthening of both the LGU and community institutions

Main lessons from this intervention, which aims to make climate information more accessible for the farmers, include the following:

- LGUs are in a better position to localize climate services because they are "on the ground" and can directly provide warning immediately
- The program is appealing to LGUs because of the project's potential not just for agriculture and fisheries but also to inform other services

- To understand climate change scenarios, communities/LGUs need to understand their past and current climate and its local impacts
- The presence of PAGASA—the Philippine's national meteorological agency---in the project is critical (i.e. PAGASA's willingness and openness to continuously develop new products to better cater to local government partners for climate information provisioning for agriculture)
- Localized climate services are being introduced as a new function to LGUs and a new direct clientele of PAGASA—thus, it will require regular budget allocation and staff support from the LGU
- LGUs are very willing to provide counterpart support for the implementation of the project
- What is most essential to farmers are the possible impacts of forecasted weather and risk management options
- Based on experience, farmers/communities getting used to receiving regular climate information are already the ones demanding service most regularly
- We have seen farmers avoid potential losses because of the provision of weather information / seasonal climate information and advice during extreme events
- With manuals of operation already produced by R1, installation in other sites have become faster
- Immediate needs for the program is to consolidate the loss and damage records of municipalities in a database and process the data as input to a simple damage prediction and valuation tool.

Farmer decision making structures in Bangladesh: Preliminary and planned work in the CSRD South Asia and the Agro-Meteorological Information Systems Development Project.

Timothy J. Krupnik (CIMMYT) and Aziz Mazharul (Dept of Ag Extension, Bangladesh).)(Presentation given in Appendix C11)

Dr. Timothy Krupnik, CIMMYT, discussed the Climate Services for Resilient Development (CSRD) partnership in South Asia. The concept of agricultural climate services is still quite new in many ways. As research and design of applications ongoing in this area, and much work has been done in climate change adaptation and climate change impacts of on crop productivity and preparation, mitigation etc. The key issue is to render this research information directly useful by farmers. The spread of work that is being done under CSRD in climate services starts with monitoring, use of automatic weather stations, data processing, dissemination of information using traditional methods, potential use of ICTs etc. CSRD in South Asia has three objectives. The three objectives and key activities are:

- **Objective 1:** Impact-based national-scale decision tool platforms in Bangladesh
    - Updating agro-meteorological information using farmer decision making frameworks
    - Climate services capacity development
    - Development & refinement of decision support platforms
    - Irrigation scheduling tools
    - Wheat blast forecasting model
    - Improved ag. met forecast format and communication
    - Decision support tool assessment
- **Objective 2:** Collaborative development and refinement of South Asian regional-scale agro-climate decision support tools and systems
    - RS based drought forecasting
    - Regional wheat blast risk assessments using climatology data
    - Lentil disease forecasting model validation + early warning systems
    - Regional lentil disease modeling + forecasts
- **Objective: 3:** Coordination of CSRD partners
    - Supporting climate services awareness raising and capacity development in South Asia

In addition, the project is also engaged in doing basic research and training to help inform adaptation more broadly, e.g. using historical climatic data in Bangladesh to understand what the probability of exceeding a particular temperature stress thresholds for different crops which could result in yield losses. CSRD will also be looking at when and how farmers make decisions regarding use of climate and weather information in agricultural crop and management planning, to fine-tune advisories when and where they are relevant. CSRD will also strengthen linkages between BMD and DAE to develop advisories on crop management resulting from short- and medium-range forecasts.

Dr. Timothy J. Krupnik and D.r Mazharul Aziz collaborations between the CSRD South Asia and the Agro-Meteorological Information Systems Development Projects.

CSRD is also engaging NGOs working in climate service delivery to promote non-traditional communication and extension messaging. In Bangladesh mosques/temples/churches are a popular place to disseminate information, and the project is exploring use of these institutions to widely spread climate advisories. Increasing the capacity of extension to deliver appropriate climate information through Farmer Field Schools and Farmer Clubs is another area.

CSRD is also actively advising and working collaboratively with the World Bank funded Ag. Met Information Systems Project which is presented below.

Dr Mazharul Aziz (Project Director, Component C: Bangladesh Weather Climate and Services Regional Project, DAE)

Within the World Bank-funded Agro-Meteorological Information Systems Development Project (2016-2021), there are three agencies: the Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), and the Department of Agriculture Extension (DAE). Component C: Bangladesh Weather Climate and Services Regional Project is managed by DAE. There are 3 sub-components of the project that will take place until 2021:

Sub-Component C.1: Establishment of the Bangladesh Agro-Meteorological Information System (BAMIS)

A. Setting up a Comprehensive web-portal for BAMIS at DAE (Opportunity for CSRD decision support systems)
B. BAMIS infrastructure
C. Development of upazila level Agromet databases (CSRD assistance +technical advice)
D. Data analysis and future scenario development (CSRD assistance +technical advice)
E. Development of advisories (CSRD assistance +technical advice)
F. Risk mapping of climate vulnerable areas (CSRD assistance +technical advice)

Sub-component C.2 Training, Capacity Building, Project Management and Monitoring and Evaluation

Sub-Component C2.1 Provision of technical training to staff

A. Training of DAE staff and Workshops *(CSRD integration + assistance)*
B. Study tours / Exposure visits
C. Technical studies *(CSRD integration + assistance)*
D. Data analysis and future scenario development (sowing, harvest times, irrigation pest management) *(CSRD integration + assistance)*
E. District and local level workshops for training farmers in portal tools
F. Joint Technical Working Group on Agro-Meteorology (JTWG) *(CSRD technical input)*

Sub-Component C2.2 Project management, Monitoring and Evaluation

A. Formation of PIU at DAE; Monitoring and Evaluation activities

Sub-Component C.3: Agricultural Disaster Risk Management through Agro-Meteorological information dissemination

A. Assessment of farmer's needs for weather and climate services (CSRD integration + assistance)
B. Installation of Analog Agro-Meteorological display boards
C. Procurement of internet enabled tablets for extension agents
D. Kiosks
E. Development of mobile apps (CSRD integration + assistance)
F. Organization of roving seminars (Decision making frameworks and communication strategy assisted by CSRD)
G. Feedback from farmers through 30,000 lead farmers (feedback frameworks informed by CSRD activities)

The main agro-met information will be provided by BMD, BWDB, DAE, BARI, BRRI, Bangladesh Jute Research, Bangladesh Sugarcane Research, BARC, Bangladesh Disaster Management Bureau who will be meeting on a monthly basis. This information will benefit greatly from the work that CSRD is already doing to improve forecast skill. These agencies will work together to compile data, get results and transfer this information to farmers.

There are 1,500 Integrated Pest Management (IPM) clubs and 30,000 lead farmers across Bangladesh. From among each of the 1,500 IPM clubs, two farmers have been selected to whom the relevant information will be relayed through portals or advisories. The route of relay of information starts with development of the advisory by the advisory group, which is then sent to the district level officer, then upazila (sub-district) level officers, next the union level SAAO, and then finally to the farmers' level, who will also receive information via mobile SMS. These information advisories will be updated using outputs from the CSRD project to assure that communication of information is clear and in a format that farmers are able to use for informed decision making.

Agricultural call centers and climate advisories in Myanmar.

Moe San. International Cooperation Division (ASEAN), Ministry of Agriculture, Livestock and Irrigation (Presentation given in Appendix C12)

Ms. Moe San gave a detailed presentation of Myanmar's geography, role of agriculture in the national GDP, and land utilization. The major crops cultivated in Myanmar are cereals, oilseeds, pulses, industrial crops, kitchen crops and fruits and vegetables. The institutional set up of the agriculture and irrigation sector includes the Departments of Planning, Agriculture, Irrigation and water Utilization Management, Agriculture Research, Agricultural Mechanization, the Myanmar Agricultural Development Bank and Yezin Agricultural University.

Policies relevant to the sector include:

- Land use and management policy
- Water use and management policy
- Agricultural financing policy
- Agricultural mechanization and input sector policy
- Cooperative enterprise and cooperative system development policy
- Rural infrastructure development policy
- Research, development and extension policy

- Marketing and value – added processing and export policy
- Governance, institutional and human resource development policy
- Environmental conservation and climate change resilience policy

To support the farmers, Myanmar has an Agricultural Call Center operated by the Department of Agriculture. The major weather/climate events that impact agriculture in Myanmar include unexpected rain leading to floods and landslides, storms and extreme temperatures. The negative impact is:

- Damage of crops, farmlands, farm animals and agricultural infrastructure
- Contamination in irrigation and drinking water
- Damage of human and animal life
- High cost for rebuilding/replanting and to tackle unexpected pests and diseases

The government has taken steps to address the negative impacts through key structural adjustments

- Strengthening of research and extension system
- Efficient and sustainable land utilization
- Reform in land and water taxation
- Strengthening agricultural financing
- Favorable policies for private investment

Climate change preparation in Myanmar is done through 1) environmental characterization; 2) optimizing crop management and 3) pest and disease management. (explained in detail in the presentation slides). Myanmar's Climate-Smart Agriculture Strategy" has been developed by Myanmar agricultural specialists coordinating with foreign experts. In line with this strategy, there are specific interventions for 1) the Ayeyarwady delta and coastal regions which are subject to crop loss due to floods, cyclones, and intrusion of saline water and 2) the Central Dry Zone which is subject to scarce rainfall, drought, soil erosion, and land degradation.

The agriculture extension service is considerable and includes intensive capacity building for the field staff. The extension services for farmer communities include:

- Training and education
- On-farm demonstration
- Mother-baby agronomic trials (having a large, centralized 'mother' trial for farmers to observe different agronomic treatments, and then 'baby' trials for farmers to try different treatments on their own farms).
- Research and development
- Distributing information through media, pamphlets, booklets, etc.
- Mobile teams for agriculture
- Call Center
- Technology Transfer

Agricultural advice is also disseminated to farmers through radio, television, newspaper, posters, pamphlets, agricultural shows.

The Department of Agriculture's main activities to address impact of climate change in Myanmar are:

- The Department of Agriculture (DOA) provides reserved/stored paddy seeds.
- DOA seeks to help farmers by developing suitable crop varieties with climate change.

- DOA explores suitable farming systems to adapt in respective regions.
- Integrated nutrient management and integrated pest management systems were improved to meet crop and food security assessment relating to climate change.
- Education and training is being done with farmers regarding relevant climate change adaptation technologies.
- Collaboration with Agricultural Mechanization Department in crop and food security assessment.
- Post-harvest technology to minimize crop production losses by developing warehouses, driers and cold storage.
- The DOA is interested in expanding work in climate services and is exploring options.

Panel discussants reflect on earlier presentations.

PANEL DISCUSSION – Day 1, Afternoon Session

The afternoon session was followed by a second panel discussion of the day facilitated by Peter Dorward, Timothy J. Krupnik, and Stephen E. Zebiak. Specific discussion topics are summarized below, with bullet points presented for key questions and themes that arose during the panel session.

Specific question topic – Farmers' acceptance of forecasts in terms of accuracy and reliability and integrating uncertainty in weather prediction

- There is need to emphasize that meteorology is not a 'perfect science', and that forecasts are probabilistic. A key issue is that many say that farmers require accuracy of 90 percent to be satisfied. Also, in the ASEAN countries, farmers are more interested in the accuracy of near-term emerging weather forecasts and not long-term forecast.
- This however is something that can be overcome by work to educate farmers so that they can make better use of probabilistic forecasts.
- Forecast materials for the farmers in Nepal is converted into the local language which include five-day informational forecasts and a 3-day forecast information for accuracy. This way 80 percent accuracy has been achieved.
- Farmers in Bangladesh want 70-80 percent accuracy, which Bangladesh Meteorological Department and other partners find challenging. Since forecasts can never be stated with absolute certainty, it should instead be reported as relatively certain when above a particular threshold and then leave it to the farmers to take the decision.

Specific question topic - Communicating accuracy and uncertainty of weather forecast

- The goal of weather forecasting is not to tell the farmers what to do but to give them information for better decision-making. This can be done by communicating the accuracy and uncertainty that comes with the forecast.
- In case of extreme weather events such as cyclones, floods etc. it is better to have an early warning than none, even if the accuracy might not be as desired, since recovery costs are far more than disaster preparedness cost. With forecast information, farmers can decide to take on management options such as crop insurance, emergency support services etc. or a more holistic approach.
- There is an inherent amount of uncertainty with seasonal forecasts. The most appropriate way to report seasonal forecast is in terms of probability. What the user of forecast information wants to know is 'should I believe the forecast'. And in case of a probabilistic forecast, the measure of believability of a seasonal forecast is its reliability; for example, if a probabilistic forecast reports that 60% of a specific type of weather will occur – this report would be reliable if there is a track record of history that says in 60% of occasions when this forecast is issued, the forecasted event actually occurred. Once a forecast has thus been shown to be reliable, the user

can then use it appropriately for decision making. It is problematic to use words like accuracy in seasonal forecasting because it is not the right measure and causes confusion.

Specific question topic - Technical concerns in forecasting

- There are basically three types of weather forecasts: short-range, medium-range and long-range forecasts. Mesoscale (very high resolution) models are useful for short range and medium range forecasts, but not for long range forecasts. The variability that arises in the use of different models for short, medium and long term forecasts need to be resolved so that so that information relayed to the farmers is consistent and useful.
- An example of uncertainty of weather forecast from Nepal: The seasonal forecast for the monsoon in 2017 was that there would be normal rain in the eastern part of Nepal and slightly lower rain in the western part of Nepal. However, what happened was the opposite. There was some rainfall in the western parts and no rain in eastern Nepal, leading to conditions of drought. The government had to instead find measures to address drought. Later after the forecasted period for normal rain in the east, there was suddenly about 80 days of rainfall which then led to the initially forecasted rainfall for the whole monsoon period. The question is how do we deal with this kind of uncertainty?
- There is need to understand how the forecasts are made and comprehend the details of a forecast. For example, in Bangladesh, the BMD reports normal rainfall for all of Bangladesh as well as the specific differences across the country for example, '*there will be normal rainfall all over Bangladesh, but specifically heavy rainfall in the northern regions and catchment areas in the first week*'. The details following the overall forecast of the country are frequently ignored. The detailed forecast needs to be thoroughly read by those working in the agricultural sector, which is why it is necessary for the meteorological department to work closely with the agriculture department.

Specific question topic - Manuals/guidelines for delivering climate service support

- Before setting up the Early Warning System in the Philippines, other countries were researched for best-bet examples, however finding none that is suitable, the one for the Philippines had to be set up from scratch. The current modules are second edition and are continuously evolving with lessons and experience. The learning and assessment processes are facilitated based on which products are developed for different stakeholders. Since the first time of engaging the local government, it has been observed that over time budget support has increased, having realized the benefit of the project and now all stakeholders are contributing.

Specific Issue: Major lessons learned in the Philippines for other countries

- The involvement of the national meteorological agency is crucial
- A lot of patience and time is required to pilot a program in climate services delivery where institutional partners such as the local government are engaged. The local government in the Philippines drives the program since they have the resources and are necessary to have on-board
- Need a strong facilitator to coordinate the program among multiple stakeholders and make it work – this is where the NGO plays a role which in the Philippines case is R1.
- Working at the local level with cultural values and economics is important when trying to understand the end-user's behavior regarding an information product. For example, farmers may continue to practice traditional cropping irrespective of drought reports. Understanding what is acceptable to the farmers is the first step to developing the information product to bring about a necessary change in the local practices and behavior.

Specific Issue- Tailoring Information products for farmers and reaching all farmers

- Forecasting is a type of science and the communication of this information i.e. the downstream side is as important, and can likened to an art. Relevant questions in the development of information products are: did you start from scratch, did you review other training materials, was there a spontaneous development of the learning curricula?
- Seasonal forecasts have no meaning for small and marginal farmers unless it is accompanied with strong logic e.g. when advising the farmer to sow soya bean instead rice, he or she will ask

why? Also, when there are diverse types of advice for the different parts of the country at the same time, we need careful consideration in developing the climate service tools per needs of the farmer.

- Government participation is primary where the government extension services reach remote areas and all farmers. Another way is to engage private sector e.g. such as *Tata Consultancy Services* in India, who can reach the farmers based on company structure and sales of company products. In project design of climate services, there should be a value chain of partners that can reach farmers.
- So far forecasting has been largely focused on temperature and rainfall parameters where it is presented in terms of current scenarios and the future. Little has been done in other thematic areas e.g. what are the implications of combined temperature-humidity conditions? This information also has value for farmers. As technology improves, forecasting and weather bulletins can be improved per needs of farmers.
- Frequency of rainfall extremes are variable, and overall increasing, and so specific weather information such as the distribution of rainfall in amount and frequency over different geographical ranges etc. is required to advise farmers correctly. This is generally the case across countries in this meeting.
- A successful example of an agriculture advisory based on weather forecast is for maize in India: Farmers in Bihar were advised on changing the time of sowing the winter crop of maize since it was found that maize planted in October would face frost in January, which could be avoided if delayed by a month. Successfully, planting date of maize was shifted from October to November to avoid frost during flowering – this ensured good production of maize.
- An important aspect of climate service development is defining impact in climate bench marking – for particular regions. The local governments in the Philippines are being sensitized to understand the implications of a particular amount of rainfall, so that when the forecast is given they can understand the impact based also on their previous experience for their own local conditions. On the technical side, since the environment changes, the thresholds need to be reviewed continuously so that the community and the local government is better prepared.
- The key is to know your audience (farmers, agriculture specialists etc.) and then adapt the information material and service accordingly.

Specific question topic - Sustainability of Farmer Field schools and their use for climate services

- Farmer Field schools in Bangladesh end when projects end. So the question is what do we need to do to keep the climate resilience field schools open and active throughout the year as has been done in the Philippines? What modes of financing can be used?
- The Philippines used to have the same problem where the field schools would close after the project ended. Local government has had to implement almost 10 different types' field schools which was cumbersome. In case of the climate resilient field schools which can be implemented in different geographical contexts and ecologies, the local government partners need then to implement only one field school through which all the other messages are relayed. The local government has allocated their budget to the climate resilience field schools and this makes it a sustainable intervention. Local resource persons have also been developed, e.g. one of the partners of the local government partners have allocated 10,500 pesos for the field school, thus indicating potential sustainability.

Specific Issue: Effectiveness of the climate information product

- Early Warning Systems (EWSs) are acknowledged as useful for informing when critical and immediate weather events present threats at the global level. But whether EWSs are of use to farmers depends on the lead time when announcing the advent of a critical weather event so that farmers can respond with changes in management. It would be good to identify what the minimum and optimum lead time for farmers are in different contexts (e.g., growing different crops), so better EWSs can be developed.
- To assess the effectiveness of a project we need to consider questions such as: By the end of the project, will the farmer buy my information service? Are they able to pay or not? How can we subsidize this product? How to package the product for the illiterate/low-literate recipients that make up a large proportion of our clients?

III. Workshop Notes - Day 2

DAY 2: MONDAY, SEPTEMBER 18, 2017

Presentation and discussion: Products and processes for making seasonal climate forecasts useful for farmer decision-making: experiences in Africa with relevance to South and Southeast Asia.

Presented by James Hansen, Senior Research Scientist and CCAFS Flagship 4 Leader: Climate Services and Safety Nets, IRI, The Earth Institute, Columbia University (Presentation given in Appendix 13)

James Hansen spoke about how to make seasonal forecasts more useful in decision making for farmers through demonstrating experiences in participatory approaches that have been applied in Africa, and which have relevance to Asia. Initially CCAFS looked globally at what is typically available and what is not in terms of processes and products around seasonal forecasts. Participatory processes around seasonal forecasts were considered. Some products were found inadequate in addressing farmer needs. The more useful products tended to be highly visual, and included graphs where probability of exceedance beyond a particular threshold of relevance is shown (Appendix C13). Experience has also shown that farmers' needs in their use of seasonal forecast information included:

- Farmers need to be able to interpret product information in the local context e.g. rainfall, beginning and end of rainy season, risk of dry spells water satisfaction/requirements, water balance, even model based variables e.g. expected reservoir levels, flood risks, expected crop production
- Farmers need to be able to understand and interpret variability in the forecast the same way they relate to their own experience with the climate
- Farmers would like to have perfect accuracy from their meteorologist but they recognize the uncertainty, so forecasts should be presented transparently by considering uncertainty and historical variability.

<u>Points used in the workshop process with farmers:</u>

- Probability explains uncertainty in numbers – two out of five times we expect to have rainfall. Farmers are able to understand such terminology with ease
- Probability graphs look back at historical data and at the same time present forecast information

Based on experience, CCAFS is now confident that farmers are comfortable in understanding well-articulated forecasts. However, achieving this takes a fair amount of dialogue and explanation of the concepts. The basic concepts to clarify with farmers are:

- Variability
- Frequency
- Uncertainty
- Probability
- Forecast (or Prediction)

Participants in the CSRD technical exchange learn how to interpret precipitation probability graphs.

This probability of exceedance graph, which depicts an inverse cumulative probability distribution, has been successfully used to explain weather information, tested in Kenya, Senegal, Tanzania, and Rwanda. This entailed starting with a two-day workshop explaining the concepts and forecast information in terms and concepts that can be understood by farmers. Active engagement of farmers is crucial. Farmers are taken through a step by step exercise of plotting weather data using their collective memory, e.g. dry and wet weather over a period of 5-6 years to understand the variability and show the amount of rainfall associated with the weather. This is followed by the development of time series bar graph with historical data. The time series is then sorted to produce a graph of frequency of rainfall against amount of rainfall in the rainy season, and this helps farmers to understand probability, in this case probability of rainfall.

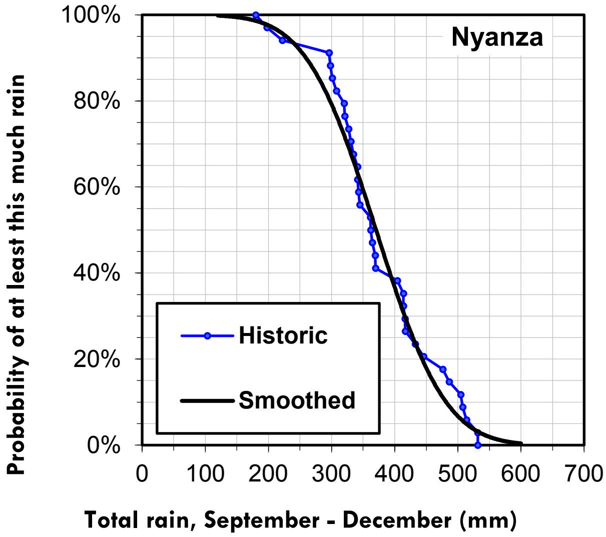
Following this presentation, an exercise on understanding a probability-of-exceedance graph was completed using data and example from the country of Rwanda, as shown below. The workshop participants were required read the graph and identify the median rainfall and solve questions on probability of a specific amount of rainfall occurring. The exercise can be used in focus group or farmer field school settings to get farmers or extension services to understand the probability of having sufficient rainfall for cropping applications. By working with these stakeholders, the objective is to better understand how to read and interpret climatic data, and to use it to discuss its relevance to agricultural planning. The exercise is detailed below:

Part 1: Historical rainfall distribution (left figure)

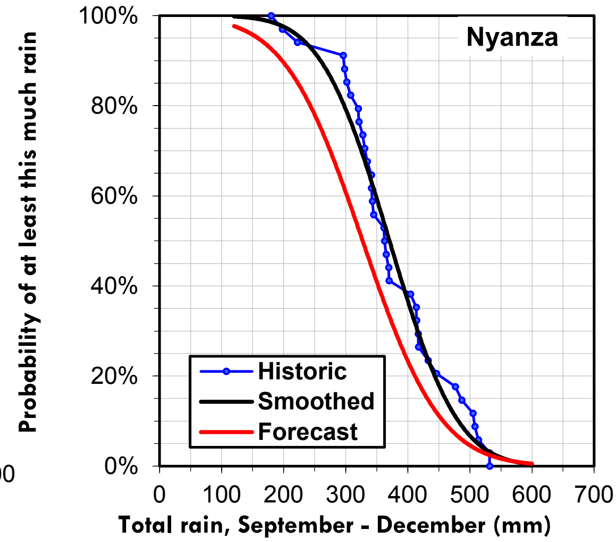
1. The median is the middle of the distribution, meaning that 50% of years are wetter and 50% of the years are drier (for the September-December season). Find the median rainfall.
2. Suppose that the risk of a particular crop disease greatly increases if seasonal rainfall is <u>more than</u> 450 mm. What is the probability that this will happen?
3. Suppose that yields of a high yielding bean variety are likely to fail if seasonal rainfall is <u>below</u> 250 mm. What is the probability that this will happen?
4. OPTIONAL: Seasonal forecasts are sometimes expressed as the probability of "below normal," "normal" and "above normal" rainfall. "Below normal" refers to the driest 1/3, "normal" is the middle 1/3, and "above normal" is the wettest 1/3 of years. What is the range of September-December rainfall that would fall in the "normal" category?

Part 2: 2016 Forecast distribution (right figure)

1. Referring to question 2, how does the forecast change the probability of getting enough rain (>450 mm) to cause risk of crop disease outbreak?
2. Referring to question 3, how does the forecast change the probability of getting too little rain (<250mm) to produce a successful crop of the high yielding bean variety?
3. **OPTIONAL**: Given this seasonal forecast, what is the probability of getting "below normal," "normal" and "above normal" rainfall?



Probability distribution of September-December rainfall, Nyanza, Rwanda



2016 forecast of September-December rainfall, Nyanza, Rwanda

> '*It has frequently been commented that even meteorologists initially find cumulative probability groups difficult, so how can farmers understand this? However, since farmers live a life of uncertainties and probabilities, with some work to clarify them, they should be able to grasp these graphs. This has actually been the case in many areas where we work*'. *James Hansen*

Presentation and discussion: Bringing participatory climate services to South and Southeast Asia: How could the Participatory Integrated Climate Services for Agriculture (PICSA) approach be applied?

Presented by Peter Dorward, The School of Agriculture, Policy, and Development (University of Reading) Presentation given in Appendices C14- C16)

Dr. Peter Doward presented Participatory Integrated Climate Services for Agriculture (PICSA) as an easy practical approach developed for farmers to assist them in their decision-making. It has been tested and implemented at different scales and contexts in 14 countries. Two parts of PICSA were explained and tried here – the first is looking at historical graphs and the second is looking at participatory budgeting.

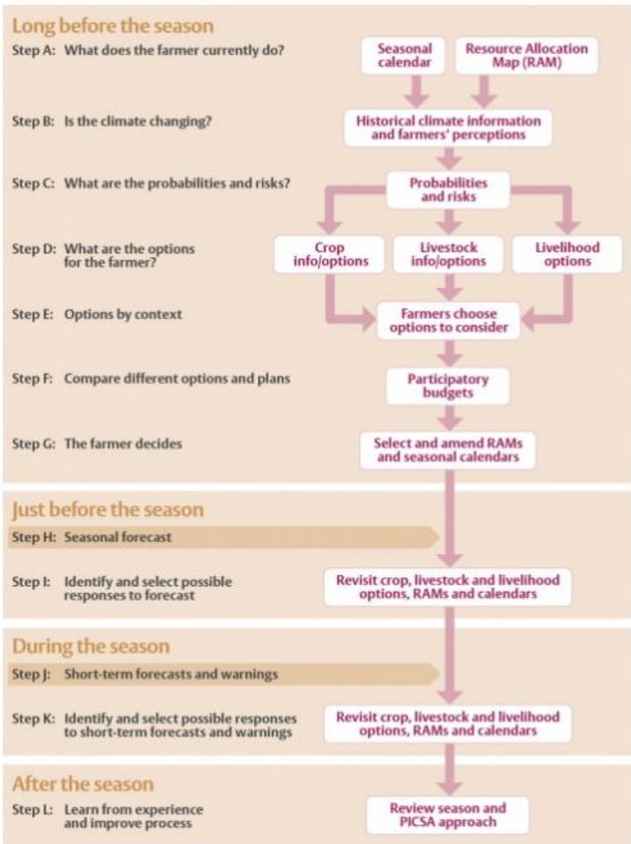
PICSA is centered around farmers. According to the PICSA field manual, 'The Participatory Integrated Climate Services for Agriculture (PICSA) approach aims to facilitate farmers to make informed decisions based on accurate, location specific, climate and weather information; locally relevant crop, livestock and livelihood options; and with the use of participatory tools to aid their decision making. PICSA is a step by step process to working though with farmer groups. It is primarily for the use of facilitators (e.g. NGO and extension field staff who have received training in the use of the PICSA approach). The PICSA approach is divided into twelve steps to be carried out with groups of farmers. Due to the location-specific nature of PICSA there are a number of preparatory activities that need to be completed before field staff are trained in the approach.

The two main concepts of PICSA are that 1) the farmer is empowered to decide what is best for them, and that 2) There are many different options for each context and situation that farmers face.

The main components of the PICSA approach[2]

So how does PICSA work? PICSA tends to be implemented in the field through extension workers/NGO field staff/farmer facilitator who are trained in PICSA. These field workers work with their regular farmer groups (e.g. in a fashion similar to Farmer Field Schools, but with most emphasis on pre-season meetings and planning).

The PICSA is implemented through a series of meetings with farmers. At each meeting 2-3 of the steps are discussed. The main steps are shown below:



Standard PICSA flow chart[3]

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[2] Figure from the following: Dorward P, Clarkson G and Stern R (2015). Participatory Integrated Climate Services for Agriculture (PICSA): Field Manual. Walker Institute, University of Reading. ISBN: 9780704915633 (https://cgspace.cgiar.org/rest/bitstreams/60947/retrieve)

[3] Figure from the following: Dorward P, Clarkson G and Stern R (2015). Participatory Integrated Climate Services for Agriculture (PICSA): Field Manual. Walker Institute, University of Reading. ISBN: 9780704915633 (https://cgspace.cgiar.org/rest/bitstreams/60947/retrieve)

Through these steps the farmers can develop a better understanding of their resources and context and what additional information they require. The ultimate goal is to take farmers through a series of structured discussions and interactions that involve the generation and analysis of climate, economic, agronomic, and livelihood data, and to empower farmers to identify and trial improved livelihood options using this information.

The 'basket' of options that emerges from the PICSA process enables the farmers to think constructively about their resources according to their capabilities. Farmers have been found to take on new ventures in choice of crops, livestock and livelihoods after the PICSA exercise. They choose options they feel would have less risk and good benefits. Although PICSA has tended to focus on precipitation and in sub-Saharan Africa, the approach can be easily adapted to different contexts and climates. Work is for example ongoing in South America, where excess water (flooding) and temperature are key constraints.

PICSA should be introduced **long** before the crop season facilitated by a well-trained extension worker. A complete PICSA exercise would take about 3-4 months. This way the farmers not only plan for the immediate coming season but also for the future years based on understanding and reliability of available forecasts. Farmers use the information and decide based on their context. PICSA helps farmers to have a plan ready before the season starts which they can adjust based on the short-term seasonal forecast when the season comes. Based on the strength of a forecast indicating unfavorable (or favorable) weather, farmers can change their plan. It also depends on the financial situation and other capabilities.

During the production season, farmers in some PICSA-enabled countries get SMSs of short-term forecasts. After the season is over, the farmers come back together to review what they have experienced and learned, including measurements of climatic variables they have collected themselves. Based on evaluations of the PICSA process across Ghana, Malawi, Tanzania and Rwanda, positive responses were obtained from farmers making changes to their livelihoods based on PICSA training. Trained farmers have shared tools and information with other farmers and conveyed their experiences in being better able to cope with bad seasons caused by the weather. Random case studies have also shown positive impact in the lives of the famers.

> *'PICSA is not a tool to convince the people to do something but an honest decision-making process to help people to plan'. Peter Doward*

a) *General Discussion: Q&A*

Question: Adapting African experiences to South Asia which has a higher population density and many more variables

- *Response:* PICSA has been implemented in Guyana, which has similar problems of floods and rains as in Bangladesh. Wherever it may be applied, PICSA considers all the variables. Farmers discuss their options based on how they are affected. Since PICSA integrates all the variables based on the context, and therefore will look at not only the extent of rainfall but how the flooding affects them. The approach is the same, the details vary from context to context.

Question: farmers take their own decision or are influenced to take the decision.

- *Response:* The whole idea of PICSA is that it is the farmer who makes the decision with the information and options available. In Malawi, PICSA intervention has been with WFP which is developing a range options for farmers. With a range of options available, PICSA was able to encourage farmers to learn and try new options.

Question: Any instance where the forecast has changed the decision, and farmers were actually adversely affected?

- *Response:* In Tanzania, the farmers suffered in the first year, and then in the second year these farmers moved to deciding their options based more on historical data and on practices related to documented variability, rather than relying heavily on the seasonal forecast.

Question: How can the government use PICSA to encourage farmers to adopt other crops

- *Response:* PICSA is fundamentally different in giving farmers the decision-making and therefore, for a government promoted crop, it would have to offered as an option.

Question: Does the PICSA consider the markets - how is this figured in?

- *Response:* PICSA does not provide directly market information, we are just working on a market app where the PICSA set of questions will be added. Farmers are however encouraged to make crop budgets and analyze their potential profit from livelihood activities, and how this is affected by the climate. We will practice this approach later today.

Question: In the Bangladesh context, a single extension officer has to work with up to 5,000 farmers. PICSA is a lengthy process, so is there any example of doing this in population dense contexts.

- *Response:* This can be still be done through traditional extension services e.g. Farmer Field Schools and farmer volunteers. In Ghana PICSA has trained NGOs who in turn trained farmer volunteers and who would then train farmer groups in manageable sizes. If this is first shared with literate farmers, this can then be shared with those who are semi-literate. There is no short-cut to implement PICSA and it will require time.

b) Exercise on interpreting climate and weather data

An exercise was conducted to show workshop participants the complexities and difficulties in interpreting climate and weather data. Exercises similar to that described below are also used with farmers as part of the PICSA process.

Participants were first grouped according to three districts - Dinajpur from the north of Bangladesh, Rajshahi from the North West and Barisal from South central. Each location has different climatic and cropping patterns, and are quite different from each other. Each group first wrote down what their perception of the climate in each region was. Secondly, based on historical rainfall graphs of the specific district they were working (e.g., graphs of historical annual rainfall totals, annual number of rain days, temperatures, etc.), the groups were asked to discuss and find indication of climate change and climate variability?[4]

Dr. Carlo Montes, CIMMYT Agricultural Climatologist, discusses the interpretation of historical climate data with the group focused on Rajshahi.

Discussion on Exercise:

Dr. Peter Dorward started the discussion of the first exercise with the observation that the group discussion on the graphs were mixed. Some said that climate change was shown, others indicated that variability was more evident. Overall, the main comments on the group-based discussions included the following:

'When looking at the graph that shows the start of monsoon season, the season starts earlier or later or is variable based on the period of time from when you are reading the data, recently, or in the year 2000 or earlier. While some of the graphs show change, many show variability more than change and we need statistical tests to understand whether there have been significant changes. For most of the graphs the trend is not clear when a farmer wants to predict what will happen in the future based on the past data. While it has been mentioned there is no right or wrong, these graphs are starting points of discussions with farmers. In some cases, perceptions come out stronger, in other not so much based on the data.'

[4]Change is long term trend; variability is year to year /season to season change

Question from the audience: Why are there differences between what farmers report versus the graphs of observed historical data?

- Sometimes farmers cannot agree which one was a bad year or a good year. This might depend on the crop and technology/adaptation they have applied which also has an enormous impact. Farmers might first question as to when it was a bad year or a good year. They may then ask why this was the case. Was it because of earlier rains or later rains or whatever the factors considered when starting a crop season. It would be simpler to ask farmers what they consider good or bad years.
- Perceptions vary according to the economic condition of farmers when they have to adapt to varying temp and rainfall and it has financial implications. Poor farmers are more vulnerable as their ability to adapt is also poor and so they perceive the effect of the weather differently and report a good or bad crop year as such.
- Farmers tend to talk about the impact of climate change instead of the variability. When talking about rainfall, they say it is more or less, but not in terms of frequency or intensity.

Response: For people running PICSA processes, one has therefore the need to clarify that we and the farmers are talking about the same thing. For example, while we might be clear in our minds that change means change over a long period, farmers might be talking about variability in shorter periods. Variability and change are often confused and need to be defined properly before discussion. Also, weather data might be presented in totals and we might need to go into details to understand the underlying factors. We look for the evidence of what farmers are saying which is good but we also need to understand why farmers have certain perceptions even when data does not support it. These perceptions should be treated with importance, as they influence why farmers make different choices.

For example, from the group work on Dinajpur, farmers have reported that the groundwater has fallen, and shallow tube-wells do not work in the dry season. This decrease in ground water level might not be dependent on rainfall and might just be because of more extensive irrigation. Another example in the case of flooding is that even with same amount of rainfall more flooding can occur because of changes in land management.

Looking at food shortages in Africa, there have been other factors that have been identified that influence a good or bad year. For example, even with adequate rainfall, there could be conflict or lack of subsidies on fertilizers that influences what is a good or bad year. So, farmers' perceptions need to be delved into deeply. Not everything is attributable to climate change and these other causes need to be considered.

In PICSA, this is how we start talking about farmers understanding and calculating probability and then bring in the other variables when deciding and thinking out options. This is demonstrated in the next exercise of Participatory Budgeting.

c) *Exercise on Participatory Budgeting*

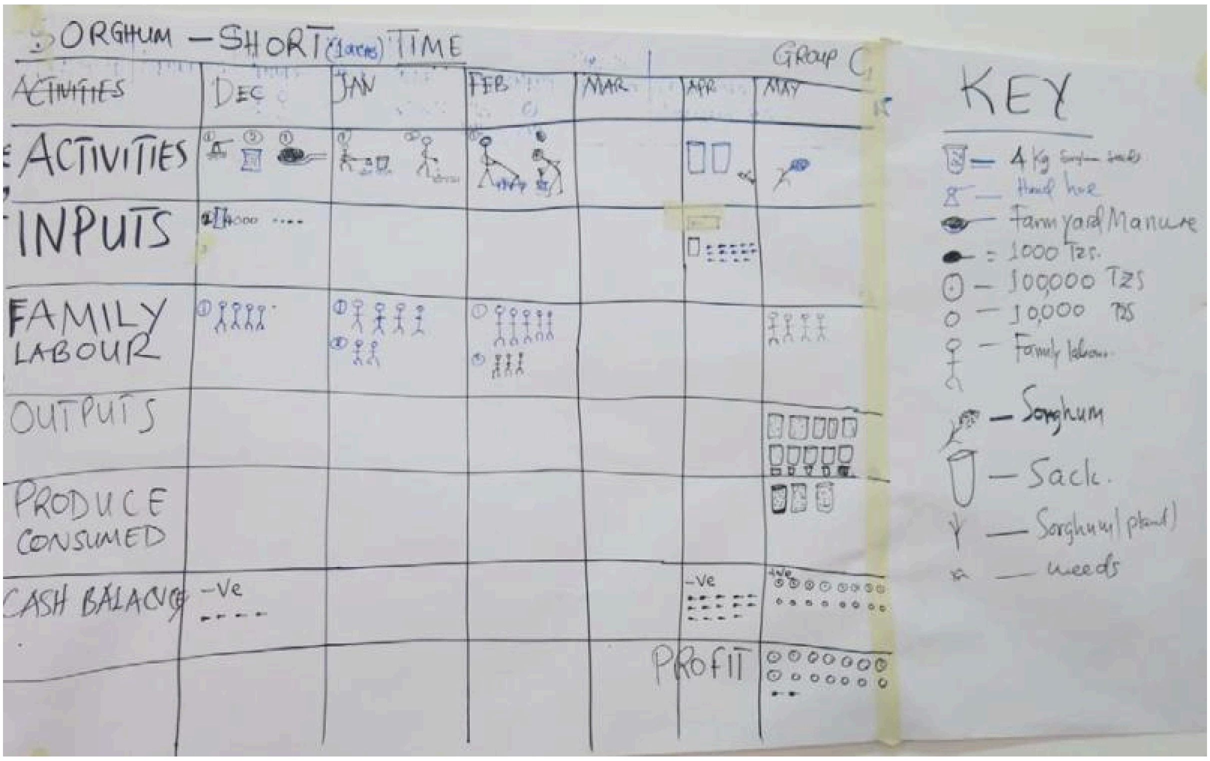
Participatory budgeting is carried out after a series of preliminary steps in PICSA on understanding what farmers do, climate risks, and then what options are available for their particular contexts. In this step, the farmer compares the different options and plans.

To illustrate this concept, each group was asked to practice a budget based on the table as given below, using only symbols and markers to count-out costs. After doing this, participants were asked to discuss how the climate might affect each variable listed in rows, for each month of a hypothetical cropping season.

	Month					
Time →	1	2	3	4	5	6
Activity (e.g., crop or livelihood option)						
Inputs						
Family labor						

Outputs						
Produce consumed						
Cash balance /profits						
Cash balance						

Note: This is at farmer level and the scale of the enterprise should be given e.g., size of land plot (acre/ha) or of number of cattle in a herd.



An example of a participatory budget from Africa[5]

Questions regarding the exercise:

- How can this be scaled up to national level?
- How does this work with rain-fed and irrigation and how is this linked to livestock?

Responses from Peter Dorward: Participatory farm budgets are calculated one enterprise at a time from the farmer's perspective since this is a decision-making tool for the farmer. It is not for us, or policy or government. This is to help the farmer to see what works for him or her, and to assess if he or she will be able to make a profit or not when considering their climate and other concerns. If a group of farmers are working together then it would be a group enterprise and all the variables including irrigation, etc. will also be considered.

Question About the exercise process: Should decisions affected by climate be highlighted?
Response: Decisions affected by climate do not need to be initially highlighted, it can be superimposed later based on a weather forecast. This is what helps farmers understand the implications of the climate on farm profitability.

[5] Figure from the following: Dorward P, Clarkson G and Stern R (2015). Participatory Integrated Climate Services for Agriculture (PICSA): Field Manual. Walker Institute, University of Reading. ISBN: 9780704915633 (https://cgspace.cgiar.org/rest/bitstreams/60947/retrieve)

Presentation by Barisal group for Aman Rice

An example of a participatory budget drawn by workshop participants for monsoon aman season rice production in Barisal, Bangladesh (left); Workshop participants building another budget for Rajshahi, Bangladesh (Right)

The group working on a hypothetical participatory crop budget commented on their experience with this method:

- There is no writing and no numbers and this is good – fully pictorial and symbolic and this is important because if someone wanted to make changes, it is just a matter of changing the symbols. By using symbols this spreadsheet is transparent, showing how the various aspects were calculated. It is also easier to spot any mistakes. For example, if the figures are calculated using a calculator and then jotted down, there is the risk of making a mistake in writing or calculating and would not be spotted.

Discussion on the participatory farm budgeting exercise (Q&A)
Questions:

- *This table is a crop calendar and so where do you think climate or meteorological information might be useful?*
- *This crop budget does not reflect risk periods for example flood or drought at time of flowering.*
- *There needs to be more sophistication included such as risk and how it should be addressed.*

  Response: One way to incorporate risks is to discuss the budget in terms of applying 'what if' scenarios considering if something happens i.e. what if a disaster happens and then figure in the adjustments required in the budget. So, after doing the budget the next step would be to discuss the possible risks and then strategize to address these. This again is how PICSA helps farmers to make informed decisions regarding climate variability.

Question: Other details that need to be considered involve input details - use of technology such disease prevention, whether to spray during the day and not at night, since these have different effects and affect crop productivity. How are these included in participatory farm budgets?

- *Response*: The purpose of this is for the farmer to decide what to do – option A or B and then after the decision is made, discuss the different scenarios in terms of '*what ifs*', such as the impact of a disease or disease control, and then redesign the budget including these and other alternative scenarios. Keep the table simple and look at the variation between the baseline and iterations. There is the risk of this tool becoming complicated when too many variables are considered and for this to be a useful decision-making tool for the farmers, it has to be easy to use.

Comment: The participatory farm budgets should be updated periodically/monthly based on changing conditions in climate, market etc. It should also be looked back at the at the end of the season.

In conclusion: PICSA looks at historical data as to what has happened and is happening, the challenges, how climate influences crop production, and the crops/enterprises options. The approach uses a series of structured interactions with farmers to walk them through a learning process to ultimately make more informed and climate-aware livelihood decisions. These tools can be applied in any context.

Day 2 Afternoon Session

Discussion: Potentials and Pitfalls for ICTs for 'last mile' agricultural climate services extension (Facilitated by KK Singh, India)

The session was a discussion of the opportunities and pitfalls of using ICTs as climate service tools to communicate information to farmers at the grassroots level.

Observations from general discussion: ICTs can be used in innovative ways to communicate information to farmers rapidly and with relatively little cost. The focus should be on small and marginal farmers who are low-literate or illiterate. Examples include sending text messages, voice messages, or using call-in centers, among others. Since farmers group in South and South East Asia region are often of medium literacy, using media and digital applications can be an effective way to reach this group. The messaging through ICT tools should be simple, relevant and credible and as swift as possible. ICTs can help in not only building the capacity of farmers but also bridging the gap between experts and farmers. The information flow should be two-way. Are farmers giving feedback, is this being communicated to the experts, so that effective products can be further developed? The product should also be useful for the extension worker who can then use it to advise farmers better.

Comments by Dr Giriraj Amarnath, IWMI

Based on IWMI's work with farmers, it has been observed that the kind of information that farmers first look for is that which will help them get highest yield, so the ICT services or products are only relevant if they package additional input products with ICT based information. Before climate information reaches the farmer, it should also be scrutinized and validated at various levels. The farmers using ICT based information should be linked with an extension officer or a resource person who can give continuous advice and support in understanding and applying the information.

In Maharastra, India, farmers can be reached at the grassroots by fertilizer companies which have call centers. Farmers send a photograph to the call center, which is checked. The farmer then gets advised by an agro-specialist through one-to-one call advising how to overcome nutrient deficiencies. Through this system, farmers are also able to order their required fertilizer and seed inputs which is delivered to the doorstep in a matter of a few hours. ICT here plays a considerable role by saving the farmers' time in travelling to towns for advice to procure inputs. At the same the ICT platform should be used carefully, so that farmers are not harmed with incorrect information. The information should be streamlined and user-relevant.

Comments by Ishwar Malla, ICT for Agriculture, SMILES Nepal:

A lot of resources are utilized in the packaging of information for agri-business advice. There is already a variety of information available for farmers from TV programs, extension materials, etc. in Nepal. Information is collected from various sources, which is checked and compiled by experts for accuracy and relevance. This is translated into local languages for farmers. SMILES has developed a mobile application which gives both information and enables interaction among farmers, traders and extension agencies. Farmers can post photos of their crops and get quick advice for solutions from the platform of which they are a member.

Comments by Dr. Md. Nadiruzzaman, Independent University, Bangladesh

Based on policy level experiences: Bangladesh and other countries have large platforms for cellphone operators and it is now possible to record data every time a user uses his phone to make a call or sends an SMS. These data can be utilized in many ways. Examples of utilization of these data include:

- Migration after the Haiti Earthquake. When the user changed location, this was also recorded through the towers that pinpoint the location of the user. This gave an indication of people's networks and mobility.
- In October 2010, there was a cholera outbreak, and the next cholera outbreak was predicted based on the movement and communication of the cellphone users. UNOCHA was able to respond very quickly to address the cholera outbreak in Haiti.
- Robi sent EWS messages from a corporate SIM to all its users in Sarankhola upazila during Cyclone Mahasen in May 2013 in Bangladesh
- Together with the University of Cologne, Germany, weather apps were developed in which farmers and fishermen from villages in Vietnam would enter changes in temperature or other environmental conditions they observed. This data was linked to a central system where it was analyzed.
- Under the Nobo Jatra project in Bangladesh, the use of cellphones and ICTs by farmers and also lactating and pregnant mothers was mapped. Farmers would get information relevant for their villages while the mothers would receive information about child health and nutrition for a 15-month period.

Discussion on ICTs

- ICTs have more scope to be used for delivery of climate and weather information. Other options of delivering information to use the radio, television and community radio. The phone is only one way to get some information to farmers. This has to complemented with other channels of information and advice.
- A lot of information relayed by the farmers over the phone is not relayed correctly or adequately since they may not understand what specific information is required to get appropriate advice. A German private sector company introduced an app similar to Facebook in Nepal where the farmers could upload an image of their field, based on which disease, pest or nutrient deficiency could be identified and correct advice given. This might be included in the government web portal.

Issue: Who your audience is and how they are involved is crucial in the design of the apps.

- Through a WhatsApp platform insurance policy users, climate specialists, agriculture experts, insurance agencies were brought together where two-way data could be uploaded. This was a platform where all stakeholders could participate and was acceptable since it built confidence among the users (IWMI experience).
- Prototypes were introduced by developers and then tested by farmers through the extension agency. The feedback was used to simplify and re-structure the prototype to make it more user-friendly.
- According to BBC Bangladesh report from Climate Asia, over 96 percent of the people in Bangladesh own a cellphone, and another 2 percent can access a cellphone. However, the use of the cellphone in rural Bangladesh is limited to making calls and checking funds transfer – e.g. Bikash. Smartphone use is rising, but still a small proportion.
- The Bangladesh Meteorological Department has developed a mobile weather app which regularly reports weather. It was used by BMD to report and monitor Cyclone Roano last year. 400,000 people accessed and used this mobile app overnight.

- Based on experience from Haryana and Maharastra States in India, social media has been successful in reaching significant number of farmers.

In all the countries in this region, it is necessary for government to provide infrastructure to expand the ICT services.

Activity and discussion: Scoping climate services in South and Southeast Asia: A participatory approach to cataloguing agricultural climate advisor services in the region.

Facilitated by Timothy J. Krupnik

A general scoping of climate services in South and Southeast Asia was carried out through three exercises. The goal was to get a sense of the general landscape of organizations and activities in some of the countries from which the technical exchange participants came from.

The first exercise was to catalogue climate services in the different countries represented at the workshop. These were listed in a table representing the key types of users of climate and meteorological information in each country; kinds of decisions users make requiring met or climate information; specific methods or systems to assess user needs /demand for climate and meteorological information; the effectiveness of these methods and whether the uncertainty of forecasts is communicated to each group, if yes, how.

The presentation of the group work is given below by country:

Country: INDIA

Users	Decisions made by farmer users	Methods to assess user needs and demand	Is uncertainty in forecast communicated & how?
Farmers	Land preparation, Crop selection, Sowing, Irrigation, Fertilizer application, Pest & disease management & Intercultural operations	Survey Meeting	Need based Stakeholder meeting
Livestock	Worm and disease management and stress management	Awareness programming	Review meetings
Fisheries	Breeding, Temperature and flooding	Field visit	Awareness meetings
Crop awareness associations	Irrigation, Pest & disease management	Expert interview	Meetings
Extension officer	Information communication of advisory	Krishan Mela	Not answered
Irrigation/DAM/ Water shed engineers	Water releases for agricultural operations	Krishan call center	Not answered
Seed/ Fertilizer company	Distribution and availability	Not answered	Not answered
Private sectors	Communication and feedback	Stakeholder workshop	
Insurance company & Bank	Premium and other insurance policies, credit loans		

Country: Nepal, (Deepak Bhandari- Agricultural Scientist & Ishwor Malla-Engineer & ICT Expert)

User	Decisions made by farmer users	Methods to assess users' needs and demand	Is uncertainty in forecast communicated & how?
Farmers	Crop Planting Crop variety Pest management Harvesting	KISAN Call center SMS M-Apps Extension Worker & Focal persons	No
Extension officers	Crop/variety Pest management	WOGRAM – Working Group On Ag Meteorology	Not answered

Country: Vietnam

User	Decisions made by farmer users	Methods to assess users' needs and demand	Is uncertainty in forecast communicated & how?
Farmers	Planting Crop varieties	Baseline Key Informant Interviews	No
	Agri. Inputs Pest management, irrigation	Pre-season planning workshop	
Agri. Dept.	Planting Crop varieties Agri. Inputs Pest management, irrigation	Sampling through questionnaire from central to local levels	Yes
Peoples committee	Annual land & development planners	Not answered	Not answered
	Early warning evaluation	Not answered	Yes, through evaluation

Country: Philippines

Users	Decisions made by farmer users	Methods to assess users' needs and demand	Is uncertainty in forecast communicated & how?
Farmers	Crop Pest Water Fertilizer Post-harvest management	Consultations by Extension workers Climate outlook forum SMS feedback from farmers Weekly field school sessions Weather boards (Community based)	Yes, Consultation/Orientation with farmers via trainings
Irrigation agencies/ Organization	Water use allocation Dam monitoring Irrigation design	Technical working group Stakeholder consultation Local weather information for infrastructure design	Yes, Using Scenarios for farmers
Local Government units, Extension & planners	Contract validations Delivery of support Policies of local climate actions Design management Quality of Infrastructure	Community risk assessment Sectorial risk assessment	Yes, Scenarios Past profiles Probabilities
Female & single headed HHs	Household management issues Diversification of income activities	Weather boards Media	No
NGOs	Assist farmers in resources managements Capacity building support Planning scheduling	Through community interactions	Not answered
Traders	Pricing Supply management	No process Media (feedback given) Private sources/contract Political actions	Yes
Agri. Insurance companies	Program scheme formulation	Climate information Met agency Private information providers	Yes

Country: Indonesia

Users	Decisions made by users	Methods to assess users' needs and demand	Is uncertainty in forecast communicated & how?
Farmers/ Extension	Crop Choice Irrigation Pest Management	National Centre for Organic Farming (6months) Focus group Discussion (1-2 Years)	Yes, rainfall forecasts are probabilistic

		Climate Forecasts Service (CFS) (10 days)	
Salt miner	Planning/ preparation	CFS Salt miner (10 days)	Yes, rainfall forecasts are probabilistic

Country: Myanmar

Users	Decisions made by users	Methods to assess users' needs and demand	Is uncertainty in forecast communicated & how?
Farmers	Crop Technology	Consultations by Extension workers via field visits (6 times)	Yes, through field visits

Country: Bangladesh:

Users	Decisions made by users	Methods to assess users' needs and demand	Is uncertainty in forecast communicated & how?
Farmers	Land preparation Crop selection & planning Irrigation Disease/pest Fertilizer Harvesting Storing	Consulting with DAE personnel Farmers meeting Training Mobile apps Survey Field visit	No
SAAOs/Extension workers	Crop management Crop varieties selection Pest management Fertilizer application	Training Mobile apps Agricultural information Service Internet /Website	Yes, by probability forecasting
Fisheries	Bleeding Disease Dissolved oxygen flooding Precaution measure	Focus discussion Survey Media Mobile apps Field visit	No
Livestock	Bleeding Disease Precaution measure	Focus discussion Survey	No
Poultry	Bleeding Disease Precaution measure	Focus discussion Field visit	No
Input dealers	Fertilizer Pesticide and fungicide	Field visit Discussion with focal people	No

Note: Bangladesh participants were unable to find time to complete more of this exercise – there are more activities ongoing in Bangladesh, so this should not be treated as fully complete.

Workshop participants completing their scoping study.

Some general Observations: Across the countries, the types of users are similar along with the kinds of decisions they make. The Philippines seems to have a richer repertoire of assessment methods to evaluate the needs and demands of the users. Likewise, communicating uncertainty in weather forecasts is done more systematically in the Philippines while it is either non-existent or just emerging in the other countries. All countries however need to do more work in communicating probabilistic forecasts and linking them to specific decisions farmers need to make.

The **second exercise** tabulated the kinds of climate and meteorological information that are available to the public in several of the participant's countries, the format(s) for this information, the audience(s), how this information is generated, and how this information has been refined / adapted to better respond to user needs. These are summarized in the tables below

Country: INDIA

Ag climate service project& Agency implementing the project	Describe the type climate service delivered	When did the service begin and end?	Rate how active the project is on a scale of 1-10 where 10 is most active
Agro-met Advisory services			
IMD/MOES	Medium Range Forecast station based Crop/Livestock/Fisheries/Poultry Extended range WF for contingent planning LRF for planners	1991 2014 1988	9 6 5
All India Coordinated Research Project on Agro meteorology			
ICAR	R & D on operational Agro meteorology information Pest & diseases Agro climatic characterization	1983	7
NICRA (ICAR)	Climate Resilient Services for Rural Community	2010	8
FASAL/IMD/MOES/MOAg	Operation in season Crop yield forecasting	2006	9
Outreach at Village level			
MSSRF	Agriculture/Veterinary/Fisheries	2000	8

Country: Nepal

Agri. Climate services	Agency leading the service	Type of Ag. Climate service	When did the service begin and end?	Rate how active the project is on a scale of 1-10 where 10 is most active
PPCR, BRCH	Dept. of Hydrology and Meteorology	Weather forecast	2015	4
AMIS	NARC, MOAD, DOA	AAB SMS Based advisory	2015	7
HIMALICA	ICLMOD	SMS Based advisory	2016	9
ENBAITA	IDE	SMS Based advisory	2017	8
Far Districts	FAO	AAB & SMS	Going to Start	Not answered
N & KSAP	CCAFS	Yield estimation module	2014-15	Not answered

Country: Vietnam

Agri. climate Service	**Agency/Organization**	**Type of Service**	**When did the service begin and end?**	**Rate how active the project is on a scale of 1-10 where 10 is most active**
Climate/Weather forecast	IMHEN provincial met station	Seasonal forecast 10 day weather forecast (WF)	Not answered	7 6 8

		Daily WF		
Weather Apps	Mobile operator Agri. media	Daily WF Daily WF	Not answered	5
Agro advisory	Department of Agri. & Rural Development	Seasonal agro advisory as needed	Not answered	5
Summary of weather forecast	• Local authority • Provincial met	Every 10 days WF Every day WF Seasonal forecast	Not answered	5
	NGOs (CARE & ICRAF)	Seasonal forecast 10 day WF Monthly WF	Not answered	Not answered

Country: Philippines

Agencies	Type of Service	When did the service begin and end?	Rate how active the project is on a scale of 1-10 where 10 is most active
PAGASA (FWS)	Farm weather advisories		Not all over appropriate
PAGASA1, R1 & LGU	Seasonal forecast 10 day forecast Historical climate profiles Localized formulators advisories Extreme users workers	2011	Not answered
Department of Agriculture	Instructed rain gauges automatic weather stations in selected areas	Not answered	• Project completed • Many rain gauges not recording
Project NOAH (UP)	Flood warning	Project ended but some information are being transformed to PASAGA	Many instruments not working
University of the Philippines with IRRI	CAMDT Tool	Not answered	Not answered
FAO-DA	AMICAF	Completed	
WFP	Forecast based financing in the Philippines: Innovative sources to extreme shocks	Not answered	Not answered
GIZ/CCC	CIS	Soon	
UN/SDR/WB	Community assessment reports improvements	2012	Report not fully followed up

Country: Bangladesh

Agri. climate Service	Agency/Organization	Type of Service	When did the service begin and end?	Rate how active the project is on a scale of 1-10 where 10 is most active
Modelling Climate Change Impact on Agriculture	Krishi Gobeshona Foundation - KGF	Historical Data Modelling research (Crops: Rice, Wheat, Maize, Mustard and Potato)	2013 - On going	9.5
Drought Monitoring System	BARC with ICIMOD	Agricultural Drought	2017 - On going	Initial Stage
Vulnerability to resilience	Practical Action	• Early warning of flood • Agro-met Services	2017 - On going	Initial Stage
Integrated Climate Smart Agriculture	FAO	Agro-climatic Intervention	Starts from Dec 2017	Not answered
Water Apps	Wageningen University	Water & Climate information	2016- 2021	Not answered

Agro-meteorological Information system development	DAE	Meteorological information for farmers	2017-2021	Initial Stage
Fisheries related climate change Scenario	KGF	Fisheries	2015-2018	Not answered
BMD-Weather App Climate Services for Resilient Development	BMD, CIMMYT, DAE, and others	Climate Forecasts, disease modeling, general ag. met advisories, capacity building	2017-2021 2017-2019	Initial Stage Initial Stage
Win Miaki activities	Various partners	General weather forecasts linked to call center advisories	Last few years	Initial Stage

Country: Indonesia

Agri. climate Service	Agency/Organization	Type of Service	When did the service begin and end?	Rate how active the project is on a scale of 1-10 where 10 is most active
APIK (Climate Change Adaption and Resilience Project)	BMKG, MoA & NGO	Infrastructure, Institutional Support , Capabilities	2015 - 2020	Not answered
Study to strengthen Hydro-met services in Southeast Asia	WB, UNDRR,WMO,NHMS, Global Facility for DRR	Country Assessment reports to improve NHMS to avoid losses	2013	Not answered

Remarks: Based on the presentations, the Philippines and India have a wider range of climate services projects than other countries in the technical exchange. The activeness of the on-going projects are reportedly high. In case of the Philippines, the country participants chose not to assess the activity status of the projects since they did not feel they had enough information to be sufficiently representative.

In Vietnam, the CSD projects were mainly around weather forecasting on daily and 10-day basis rated as fairly active (6-7). The agro-advisory service, led by government, was rated 5 indicating need for capacity building. CSD in Bangladesh, Indonesia and Nepal are mostly recent and still being established and therefore not rated for extent of activity, although activities are expanding rapidly, with both public and private sector organizations are becoming involved. Myanmar (not presented) have no major project activities related to agriculture that technical exchange participants were able to identify.

Dr. Timothy Krupnik facilitating the SWOT exercise.

Overall, despite the changing weather in South and Southeast Asian countries which is impacting agricultural productivity, CSD projects are relatively few in government, non-government and research institutions. This is an area of concern and should be addressed in an integrated manner through collaborative engagement of stakeholders within each country and internationally.

The **third exercise** was a SWOT analysis done in two steps – country wise and regional. The country wise SWOTs are given below.

Presentations of Country-wise SWOT

Bangladesh

STRENGTHS	WEAKNESS
• Extension network	• Lack of coordination

• CBOs • Govt. policy • ICT infrastructure • Institutions	• Communication and information gap • Gender inequality • No proper fund • Trained person power • Lack of data access availability • Data collection facility
OPPORTUNITIES • Inter-governmental or regional with the region. • Social / electronic media. • Use of ICT	**THREATS** • Climate Change • Over population • Trans-boundary issues

Nepal

STRENGTHS • Well established agricultural research and extension system	**WEAKNESS** • Basic weather services cannot address agriculture needs or spatial variability
OPPORTUNITIES • World Bank project building capacity of meteorology department	**THREATS** • Restructuring of government disrupts agriculture research and extension system

India

STRENGTHS • Women participation • Farmers' capacity building • Farm level input management • Forecast accuracy & reliability • Domain expert • Information delivery • Use of information products • Institutional infrastructure • Economic impact assessment	**WEAKNESS** • Feedback mechanism • Women participation • Farmers capacity building
OPPORTUNITIES • Farmers' capacity building • Economic impact assessment • Forecast accuracy and reliability • Feedback mechanism • Institutions infrastructure • Women participation • Information delivery • Use of information products	**THREATS :** • There are no threats

Vietnam

STRENGTHS • Farmers and extension are interested in Climate Service. • Some policies build on National plan/Program on climate change adaptation & mitigation.	**WEAKNESS** • Not strong link between **Ministry of Agriculture and Rural development** MARD and met **Ministry of Natural Resource and Environment**(MONRE) • Climate services are not mainstreamed into Gov't budget and institutionalized • Climate information channels & formats to reach farmers one-way are unclear and vague (not institutionalized) • Too low SPATIAL resolution of weather forecast information • Costly buy data, produce and communicate
OPPORTUNITY • ICT to reach more farmers and get their feedback on climate services.	**THREATS** • New policy (decision) on forecasting provides more costly to buy met data • Publish wrong forecasts could undermine innovation • Sustainable

Philippines

STRENGTHS	WEAKNESS
• Was able to get global cooperation for a given time. • Willingness of national met agencies to expand/ develop products. • High level of farmers participation in R1/*PAGASA/LGN programs • High level of interest from LGNS wanting CIS for agriculture / Fisheries. • Highly skilled meteorologists	• Lack of Coordination of different agencies with climate services into needs • *PAGASA lacking budget and staff to participate in local climatic forum • Many weather instruments are not working • Country assessment reports: recommendation not followed up • PAGASA does not have enough instruments and does not have enough people to maintain installed automatic weather stations
OPPORTUNITY	**THREATS**
• PAGASA modernization program. • Increase interest for forecast based decision mechanism. • Opportunity to expand climate based health warning. • Increasing funding interests • Opportunity for weather index based insurance. • Department of Agriculture (DA) mainstreaming climate information services for agri. & supporting replication. • Many opportunities for cooperation with different sectors.	• Competing actors/stakeholders • PAGASA modernization budget will not happen • Migration of skilled meteorologists to abroad

*PAGASA (Philippines Atmospheric Geophysical and Astronomical Services Administration)

Myanmar

STRENGTHS	WEAKNESS
• Farmer's strong participation • Regional cooperation very attractive to share farmers ASEAN participation • Climate information availability	• Lack of trust due to past experience • Department of agriculture and met don't often work together
OPPORTUNITY	**THREATS**
• Cross-sectional coordination (agril. + Met.)	

Indonesia

STRENGTHS	WEAKNESS
• Farmer's strong participation • Regional cooperation very attractive to share farmers ASEAN participation • Climate information availability	• Lack of trust due to past experience • Lack of farmers' knowledge • Varying levels of farmer population distribution makes difficult to implement
OPPORTUNITY	**THREATS**
• Cross-sectional coordination (agril. + Met.) • Immense experiences for exchanges within ASEAN. • ASEAN-CRN as a learning platform.	• National level interests first before regional cooperation

After completing flipcharts for the country wise SWOT, the groups took forward the discussion from the country SWOT exercise to step 2. This included the construction of a the Regional SWOT: the key 'themes' emerging from the country SWOTs were written on multi-colored card paper, with the following colors chosen to represent specific bins within the SWOT analysis: **Yellow –** Strengths; **Blue**– Weaknesses; **Red**– Threats; **Bluish/green**– Opportunities. Country names were included at the bottom of each card. After putting all the country SWOT issues onto one common South and South East Asian regional SWOT, participants were asked to discuss their observations of the results. The presentation of the regional SWOT is given below.

Regional with country specific issues SWOT for South Asia and Southeast Asian countries

Discussion on the regional SWOT

After going through country-specific SWOTs, the next step was to look at the common areas of strength, weaknesses, opportunities and threats across these countries in the supply of participatory climate services to farmers. This indicates where cross-learning from other countries can be pursued, and where problems and threats can be tackled through collaborative research and interventions. A brief summary of the regional SWOT analysis discussion that ensued is as follows:

Strengths:

1. Agricultural extension systems: India, Bangladesh and Nepal report the agriculture extension network is well established
2. Farmers' participation in community based organizations: In Bangladesh, India, Myanmar, Philippines and Indonesia, farmer participation is high. Participation is further supported through community based organizations or farmers' groups. Through the activities of the government extension services, government and non-government projects, farmers have been collectively grouped to enable transfer of skills and technology.
3. ICT Infrastructure: In India, Nepal and Bangladesh, the use of diverse ICT is present and growing in both countries.
4. Institutional infrastructure: Bangladesh and India have well established institutions set up in the research, policy and administration of projects and services to support agricultural initiatives
5. Trained and skilled human resources for weather forecasts information: Compared to other countries, India and Philippines have highly trained and skilled scientists in weather forecasting

Weaknesses:

1. Lack of inter-agency coordination: Bangladesh, India, Myanmar, Vietnam and Philippines experience that there are limitations in coordination and communication of information between the Agriculture and Meteorology departments.
2. Farmers' feedback mechanisms: The farmers' feedback mechanism in Bangladesh, India, and Myanmar are not as strong as they could be.
3. Funds/budgets: There is inadequate budget for climate information services in Philippines, Vietnam and Bangladesh
4. Gender inequality: Although India has strong women's participation in agriculture, it needs to be improved. Bangladesh is lagging in women participation considerably, a result of the generally more conservative culture.
5. Lack of data accessibility and collection facilities: Both Bangladesh and Philippines have data related to climate services, but there is lack of facilities for data access and dissemination. Myanmar has no data collection facility on climate information
6. Spatial Variability of weather forecast information: The spatial resolution of weather forecast information given by Nepal and Vietnam's Meteorological departments is not adequate.
7. Lack of farmers' knowledge and trust: Based on the experience of inconsistent weather forecast, farmers in Bangladesh, India, Vietnam and Myanmar do not trust weather forecasts as much as is desirable for their optimal use.

Opportunities:

1. Use of ICT: The use and application of ICT tools and services is growing and can be used for disseminating CIS towards farmers and extension workers in Bangladesh, Nepal and Vietnam.
2. Capacity building: There is scope of building capacity of farmers on climate services in India, Philippines, Bangladesh and Vietnam, through farmers' schools. There is also scope for building the capacity of the meteorology department through training and research in weather forecasting.
3. Cross-sector coordination between agriculture and meteorological departments: There are many opportunities for co-operation between the agriculture and meteorological departments in Bangladesh, Philippines, India and Myanmar, but they remain inadequately exploited. This is a necessary area of coordination and collaboration to develop and deliver quality climate service products.
4. Accuracy & reliability of weather: There is scope for improving the accuracy and reliability of weather forecasts for climate service products in Bangladesh, India and Philippines.
5. Building farmers' trust: The farmer field schools and extension network relationship offers face-to-face interaction which is an effective way to build trust between farmers and extension workers. Based on the Philippines experience - ICT services will only be effective when they trusted, and farmers trust needs to be first built through face-to-face interactions. This also has implications for work in PICSA.
6. Knowledge-sharing platforms: Like the AESAN-CRN platform, SASCOF (South Asian Climate Outlook forum) and SAAC Agriculture center can be a good platform for learning and sharing for South Asian countries and also sharing with and within the ASEAN platform
7. Women's Participation: Vietnam reports that there is room to increase women farmer's participation in farmer field schools and field-based training.
8. Funding: There is scope to increase funding in the Philippines for CS interventions now that the benefits and necessity has been demonstrated
9. Climate Based financing: Climate based financing is an innovation using weather forecasts to trigger funding for poverty reduction and pre-emptive risk mitigation. Thresholds are set for particular events such as floods or cyclones, and once the thresholds are reached, funds are released to enable farmers to be prepared for the adverse impact. In Philippines, they have both climate based financing and health warning. In Bangladesh, the German Red Cross has implemented the first phase of the climate based financing project for cyclone (Southern part of Bangladesh – Noakhali district) and for floods (Northern part of the country – Bogra district). There is opportunity to expand climate based financing in these two countries.

Threats:

Positively, not many threats were reported, the few reported varies by country:

1. In Bangladesh the main issues are trans-boundary effects of weather and water, e.g. floods because of rainfall in India, as well as the dense population challenges to extension
2. ASEAN: National level interest first before regional cooperation: For ASEAN, national level interests might be a threat, however this might be mitigated through exchanging experience and learning among ASEAN countries. ASEAN Climate Resilient Network is the learning platform for sharing knowledge
3. New policy or restructuring of government: In Nepal and Vietnam, new policies and elections and therefore new decisions, and the restructuring of government will disrupt agriculture research and extension system and make it costlier to buy meteorological data
4. Migration of skilled meteorologists abroad: Philippines finds that migration of skilled and training meteorologists is a threat to its national meteorological services
5. In the Philippines, the modernization budget for PAGASA (Philippines Atmospheric Geophysical and Astronomical Services Administration) might not be realized and that will affect PAGASA's upgrading and improvement
6. The sustainability of climate service interventions is a major concern across countries

IV. Workshop Notes - Day 3

DAY 3: TUESDAY, SEPTEMBER 19, 2017
Morning Session:

Special session on financial instruments for agricultural climate services

Bridging the 'space' between remote sensing science and local communities for better design of flood index insurance.
Giriraj Amarnath (IWMI)(Presentation given in Appendix C.17)

Dr. Giriraj introduced his project on Index based flood insurance financing (IBFI) which looks at how to reduce the gap between remote sensing science in weather forecasting and local communities. More on this project can be found at this link, which explains that 'Index-based flood insurance (IBFI) is an innovative approach to developing effective payout schemes for low-income, flood-prone communities. This project aims to integrate hi-tech modelling and satellite imagery with other data to predetermine flood thresholds, which could trigger speedy compensation payouts. Effective end-to-end solutions will be developed in collaboration with a range of organizations and experts from central and state government bodies, private insurance firms, community-based organizations (CBOs) and nongovernmental organizations.' Through this intervention, remote sensing products are being developed to accurately depict yield loss in smallholder farming due to weather and/or other risks as well as be scalable in insurance schemes delivered at micro and meso-levels.

The IBFI intervention is approached through a multi-disciplinary lens and links activities to improve the understanding of the complex issue of flood and disaster recovery. Index insurance is important because it has lower administrative costs than conventional indemnity insurance because the payout is made when an index — such as flood duration and depth over a specified time period — falls within a predetermined threshold, and then insurers do not have to travel to the field to verify losses.

The challenge is that validating agricultural damages and loss estimates from flood events, the conventional system requires verification through on-the-ground inspection. This is expensive, and time consuming for the government and the insurance firm. This problem can be solved with innovative flood risk management solution through flood index insurance that uses inundation model and remote sensing data to determine payouts, and help farmers to invest in measures that might increase their productivity and improve their economic situation. With a description of how the protection gap in India is higher than other countries, the insurance options for closing the protection gap was shown for different target groups.

The IBFI objective and approach includes:

- Developing IBFI and demonstrating positive impact in terms of agriculture resilience and policy which complements flood risk mitigation strategies.
- Developing tools and strategies including business models that support IBFI upscaling, integrated with existing disaster management plans in India and Bangladesh.

The progress of the IBFI project includes the following:

- Combining hydrological and hydraulic modelling and newly available 10 m resolution satellite images from the European Space Agency.
- Development of new flood index insurance that uses data from the past 35 years of floods in target districts. This enabled us to accurately estimate flood parameters, including inundation extent, depth and duration
- Implementation of first pilot in 2017 in over 200 households covering 9 villages implemented in India
- A review of index insurance business models and IBFI BM developed
- Publications in IBFI concepts, including gender and social equity in IBFIs (link here)

IBFI will also be piloted in Bangladesh. Farmers have been engaged in a participatory manner to understand and accept index based insurance. The farmers are involved in the process of what the insurance price and premiums should be to make it affordable and acceptable for them. Based on the duration of the floods, the farmers will be paid in proportion to anticipated losses.

Presentation and discussion: Financial instruments to mitigate climate risks: Global examples of how appropriateness and farmer participation be increased.

Mélody Braun, Research Staff Associate, Financial Instruments Sector Team (IRI))(Presentation given in Appendix C.18)

Ms. Melody Braun described how financial instruments such as index based insurance can be developed appropriately and in a participatory manner where farmers are involved. Index insurance relates weather events to losses. The advantage of index insurance is that it is cheaper, validated with farmer, simple and transparent. Importantly, it is an incentive for farmers to use best strategy for their production. Problems with traditional indemnity insurance have made it difficult to implement and for farmers to trust and adopt. So IRI tried to address this by instead of insuring losses directly, to insure some objective index.

Traditional insurance requires loss assessment while Index insurance is based on measurement of a weather variable that can be directly correlated with the loss (ex: rainfall deficits in rainfed agricultural or grazing systems).

Ms. Melody Braun reviewed why should index insurance be adopted

- Less administrative costs
- Product developed and validated in the field
- Product simple and transparent
    - Farmers can be made to understand and trust the product
    - Payout not linked to crop survival/failure
- Incentive to make the best decisions for crop survival
- Good potential to go to scale
    - Possibility to scale up to other regions, other crops, other risks

However, weather index insurance can be perceived incorrectly by farmers and care should be taken to identify where it is not appropriate. To establish the index, the first requirements are good spatial distribution of data, a longitudinal dataset (20+ years), and to have access to availability of data in real time. Transparency and accessibility are also crucial. All this data must be validated with farmers. This is done through participatory exercises at the village level.

The first part of the participatory validation exercise described by Ms. Melody Braun for weather index insurance included an interactive exercise around agricultural calendar, agricultural practices, types of crops, vulnerability of different crops/practices to different risks. This is followed by a discussion on climatology, worst years, risk characterization (late start, early end, pauses, global lack of rainfall, irregularity, etc.), which in turn leads to identification of a few window options based on farmers' agricultural calendar and vulnerability to risks.

The index design is therefore an integrated process with feedback loops requiring farmers' strong participation:

- Feasibility study (dry run)
- Participatory processes: data collection for index design
- Dataset selection for index design
- Prototype development, Validation with communities and stakeholders, commercialization
- Season Monitoring
- Index performance evaluation, index refinement

Insurance plans can then be adapted to increase productivity and resilience in normal years to cover bad year losses. To motivate farmers to adopt insurance, they can also be educated using a game process (which is widely implemented by IRI) with positive and negative scenarios to understand the implications of not adopting index insurance. Educating farmers through games on the various options improves understanding of farmers' coping capacities, enabling improved product design.

Presentation and discussion: Mind the gender gap in crop insurance! Farmers' gendered preferences and climate change skepticism in coastal Bangladesh.

Timothy J. Krupnik and Fahmida Khanam (CIMMYT) Presentation given in Appendix C19)

Dr. Timothy Krupnik started his presentation by emphasizing that insurance can help poverty alleviation. It however takes time to design a model acceptable to farmers. This presentation was about two studies[6] carried out with maize farmers in Bhola, which is a highly climate vulnerable coastal island in Bangladesh. The studies fussed on farmers' preferences for insurance and climate change skepticism. The maize crop was chosen since it is a high investment and high return crop. Both of these studies have been published as open source resources, with abstracts detailed below.

Akter, S., Krupnik, T.J., Khanam, F., Rossi, F.J. 2016. The influence of gender and product design on farmers' preferences for weather-indexed crop insurance. Global Environmental Change. 38: 217–229. Available online: Click here.

Theoretically, weather-index insurance is an effective risk reduction option for small-scale farmers in low income countries. Renewed policy and donor emphasis on bridging gender gaps in development also emphasizes the potential social safety net benefits that weather-index insurance could bring to women farmers who are disproportionately vulnerable to climate change risk and have low adaptive capacity. To date, no quantitative studies have experimentally explored weather-index insurance preferences through a gender lens, and little information exists regarding gender-specific preferences for (and constraints to) smallholder investment in agricultural weather-index insurance. This study responds to this gap, and advances the understanding of preference heterogeneity for weather-index insurance by analysing data collected from 433 male and female farmers living on a climate change vulnerable coastal island in Bangladesh, where an increasing number of farmers are adopting maize as a potentially remunerative, but high-risk cash crop. We implemented a choice experiment designed to investigate farmers' valuations for, and trade-offs among, the key attributes of a hypothetical maize crop weather-index insurance program that offered different options for bundling insurance with financial saving mechanisms. Our results reveal significant insurance aversion among female farmers, irrespective of the attributes of the insurance scheme. Heterogeneity in insurance choices could however not be explained by differences in men's and women's risk and time preferences, or agency in making agriculturally related decisions. Rather, gendered differences in farmers' level of trust in insurance institutions and financial literacy were the key factors driving the heterogeneous preferences observed between men and women. Efforts to fulfill gender equity mandates in climate-smart agricultural development programs that rely on weather-index insurance as a risk-abatement tool are therefore likely to require a strengthening of institutional credibility, while coupling such interventions with financial literacy programs for female farmers.

Akter, S., Krupnik, T.J., Khanam, F. 2017. Climate change scepticism and crop insurance demand in a low income coastal community. Regional Environmental Change. DOI 10.1007/s10113-017-1174-9. Available online: Click here.

This paper investigates if climate change skepticism, farmers' fatalistic beliefs, and insurance plan design influence interest in crop weather insurance. While studies of the influence of fatalism on disaster preparedness are common, the ways in which fatalism influences climate change skepticism, and in turn affects farmers' interest in crop insurance, have not been previously investigated.

[6]

An additional objective was to understand farmers' preferences for index versus standard insurance options, the former entailing damage compensation based on post-hazard assessment, the latter tying damage compensation to a set of weather parameter thresholds. A discrete choice experiment was conducted with maize farmers on a climate-risk prone island in coastal Bangladesh. Most farmers were insurance averse. Those who chose insurance were however significantly more likely to select standard as opposed to index-based insurance. Insurance demand was significantly and positively correlated with farmers' concern about the adverse livelihood impacts of climate change. Farmers who exhibited fatalistic views regarding the consequences of climate change were significantly less likely to opt for insurance of either kind. These findings imply that the prospect for farmers' investment in insurance is conditioned by their understanding of climate change risks and the utility of adaptation, in addition to insurance scheme design.

PANEL DISCUSSION – Day 3, Morning Session

After the presentations, a panel discussion was held with all workshop participants. Issues raised and associated discussions are given below:

Specific question topic – Method of damage estimation of the trigger points in IBFI

- In Bangladesh, simulation of 30 years of historical data was used and also data from additional stations set up at community level. Core data on water levels (crop damage specific water levels) was also taken
- Depth and duration was considered, taken from a hydraulic model. An evaluation was then done and all the information was backed up with farmers' reports of flood events. Then analyses were done to estimate time and amount/portfolio pay-out. This analysis takes into consideration social analysis and household surveys.

Specific question topic – Improving farmers understanding and trust of IBFI

- Need to work with local partners who work with farmers very closely to introduce topics like insurance in a positive light
- Farmers need to be walked through the concept using participatory approaches/processes. Time is required and we need good participatory processes in engaging farmers.
- Simple product is developed through a lot of analysis. To have a sustainable product, satellite data is required and not fully reliable, in some areas the correlation is difficult to reliably establish.

Specific question topic – Sustainability and scale-up of Index based insurance

- Some projects might fail if trying to implement the concept too quickly before farmers fully understand what the index based insurance means.
- Questions asked on IBFI commonly include: Should farmers pay the premium and how much should they pay, but the question should be what is the value of the product and within what context. Insurance should not be a stand-alone product and should be an option in portfolio of options.

Specific Issue: Southern Bangladesh is a very unique environment with a variety of problems– how are all these numerous factors considered in crop production and insurance in the Bhola study?

- We focused on three weather related risks to maize production. One needs to look at the study results very carefully – the area is relatively risk prone, coastal communities with very conservative culture and also happens to be an area where farmers are investing in high value crops. Since our work looked at maize as a high-value crop in a very unique kind of environment, the results may not be fully applicable to other areas such as Dinajpur. Like all studies, one must use care when extrapolating results.
- The principles that came out of the study were that (1) the right kind of engagement with the famers is needed (2) the Insurance market will be segmented (3) men and women will respond differently. These all should be considered in design of index insurance programs. Finally, (4) also that financial literacy needs to be improved, particularly for women farmers to engage in insurance options.
- The many challenges do not mean that index insurance will not work, but that caution should be taken in certain aspects when designing index insurance and especially when we considerable equitable development and gender equity in particular.

Specific question topic – How to design the trigger in instances of flooding as a result of rainfall happening elsewhere such as in Philippines?

- Where you have floods as a result of rains is where remote sensing is useful. Data sharing from river gauge information across countries/regions is also of use, especially in South Asia where predicting and understanding flood risk and impact is critical.

Specific question topic – Use of historical data from local weather stations appropriate to design products

- It is possible to design good index insurance products based on rain gauge or local data and historical data. IRI prefers satellite data because it is cheaper and easier to access. When it comes to trust, farmers would tend to trust rain gauge or ground data more because they can see it and measure it themselves compared to satellite data, but this is a trade-off that needs to be actively managed.

Specific question topic – Index insurance looks at of principle of baseline risk, with climate variability, the risk changes from year to year. How would the dynamic of changing risk be integrated into index insurance or is this too complicated?

- This is an area that we need to start thinking about. Index insurance is based on the frequency of an event. More frequency means more premiums. When you have more and more payouts for increasing bad weather impacts, it gets too expensive for the insurance provider. Instead of looking at index insurance as a single product, we might link it to forecast based financing. Index insurance should not be the only product but a part of a comprehensive set of products to offer. Products for countries would of course differ according to their context.
- A study with Indonesian farmers has shown that farmers would prefer to buy insurance earlier before the El Nino forecast is made. In other words, farmers want to be insured before a bad year is actually forecast.

Specific question topic – Strategies employed by insurance companies to make profit and cover losses with agricultural insurance

- When there are more good years than bad years – then insurance companies collect premiums during the good years which are used to cover the bad years. The money collected in the good years is how the insurance companies make money and clients are covered. Insurance companies cover different regions with different types of risks so that they do not have to pay at the same time. Also insurance companies tend to use reinsurance companies – another strategy to cover losses. The studies in Bangladesh addressed farmers' interest in linking savings with insurance, although this approach was not overly popular with the farmers surveyed.

Specific question topic – What are the different levels of insurance products?

- Insurance can be done at different levels: 1) Micro – farmer buys his own insurance products; 2) Meso – MFI/input provider/cooperative and 3) Macro – when government gets an insurance policy which is used to tackle post-disaster hazards.
- Insurance in South Asia is mixed i.e. government and private insurance. Not many independent insurance companies in Bangladesh are interested in working with risk-averse farmers. In India, there has been a lot of cooperation between the government and insurance companies because government realizes its limitations in serving farmers and insurance companies are good intermediaries to reach the farmers. Government's intervention is to reduce the premium that farmers have had to pay, and this has been successful. In Bangladesh, the field is still emerging. There are still bureaucratic hurdles in paying up. Insurance companies here will struggle to make money on their own since farmers are unwilling to pay for insurance products. There may be thus a need to mix and match government and private company services which will hedge the risk; also, diversification of the products is required.

Specific question topic – How to give information on crop damage in a village in a matter of hours based on high resolution data – interpolation? Validate satellite images? What is reliable in the current state of technology?

- There is not much data where crop productivity can be related to damage or ways to say that these data points demonstrated lower yield specific to weather-based influence and damage. Such data, however, would be helpful in designing schemes.
- There are challenges in correlating crop damage data to weather variables. We might take new approaches to data – weather, farmer's perception to damage and biophysical variables, then multivariate techniques which are emerging may throw light on where the relative influence of weather is compared to other factors.

- There are no magic tools for tomorrow; it's more about using multiple sources of information for calibration and validation.
- Index insurance is still new in Bangladesh and many partners are interested and hopeful that more will happen. There however has been relatively little coordination and this is a problem

Activity and discussion: Round table sharing of climate communication and visitation tools and methods: What works and what needs to be improved?
Elisabeth Simelton, World Agroforestry Center (Presentation given in Appendix C.20)

Dr. Simelton facilitated discussion on visual tools used to communicate climate information to farmers in climate services projects. Based on the previous discussions throughout the workshop where various climate services tools and ICT methods were described, Dr. Simelton summarized what she felt this community is already good at and what can be done better.

What we are good at?	What can we do better?
1. Agriculture Extension 2. Radio, Community Radio 3. TV 4. Cell Phone Communication 5. Field School 6. Weather Bulletin (Location Specific) 7. Community Display Board 8. Public Address System 9. Social Media (Facebook) 10. Web portals 11. IVR Based Service 12. Cable Network 13. Newspapers + Booklets/Leaflets 14. Community Call Center (Service center) 15. Union Digital Center 16. Agricultural Information Service Center	1. Users need assessment 2. Putting information considering specific impact 3. Coordination and sharing climate services who work with the farmers 4. Capacity development of agro-mate facilities/translation 5. Location / accountable information 6. Demonstration, transformation should be multi-trial 7. Addressing how to communicate uncertainty 8. Institutional arrangement

This was followed by an active discussion by participants who detailed what types of visual tools they felt to be most useful to reach farmers with climate information. More detail can be found in Dr. Simelton's presentation.

Activity and discussion: Institutional arrangements to improve the flow of agriculturally relevant climate information to farmers in South and Southeast Asia: A participatory mapping exercise.
Facilitated by Timothy J. Krupnik (CIMMYT)

Dr. Krupnik initiated this session by discussing the need for optimal collaborations between institutions involved in the production, dissemination, use, evaluation, and advancement of climate services. Examples include meteorological and extension departments, ministries of agriculture and commerce, farmers' organizations, banks or companies to provide insurance or inputs, among others. During many of the discussions that took place over the last two days, themes related to the need to align intuitional goals, roles, and aspirations emerged frequently. For this reason, workshop participants were asked to map how intuitions working in climate services interact in their countries, and then to envision how these relationships can be improved.

The exercise was completed in two parts where representatives from each of the countries were asked to map (using box and arrow diagrams, boxes for institutions, arrows for relationships and flows of information) the existing (baseline) institutional set-up around agricultural and meteorological services for farmers was drawn. The strength of these relationships was shown where positive by adding 1-3 plus

(+) symbols. Where negative relationships were perceived, participants added between 1-3 negative (-) symbols. In the next part of the exercise, areas of improvement were identified and discussed for each country. Due to the level of detail and complexity of relationships in each of the workshop participant's countries, it is not possible to show all the maps. For this reason, a select few are shown below (maps have been re-rendered based on drawings made on flipcharts).

The first map depicts the institutional set-up for Nepal, with baseline information and opportunities for improvement as identified by Nepali workshop participants. The major areas of improvement are around inclusion of the agriculture and forestry university (AFU) to improve the collaboration between NARC and MoAD. The other areas of improvement involve inclusion of more technical and R&D partners such as FAO and the Helvetas. Introducing an insurance company to implement insurance-based financing would offer potential for farmers, and as such these aspects were included in the 'improved' map drawn by participants.

Figure 1: Institutional Framework for Climate Services in Nepal

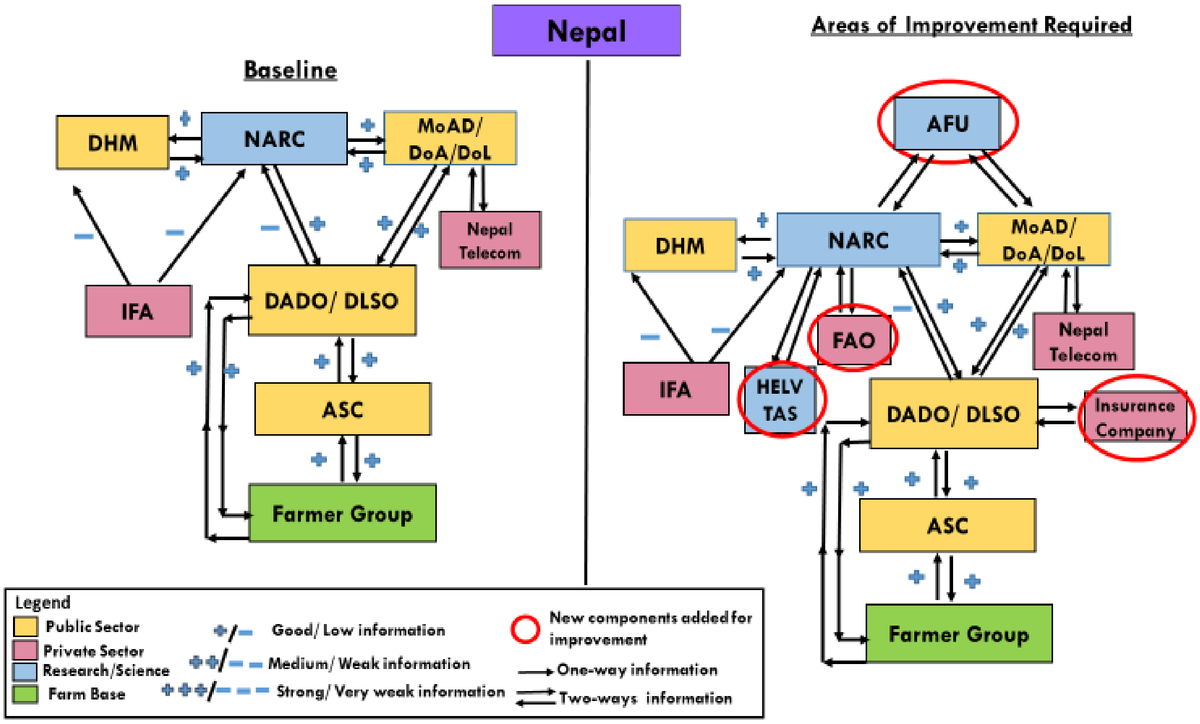
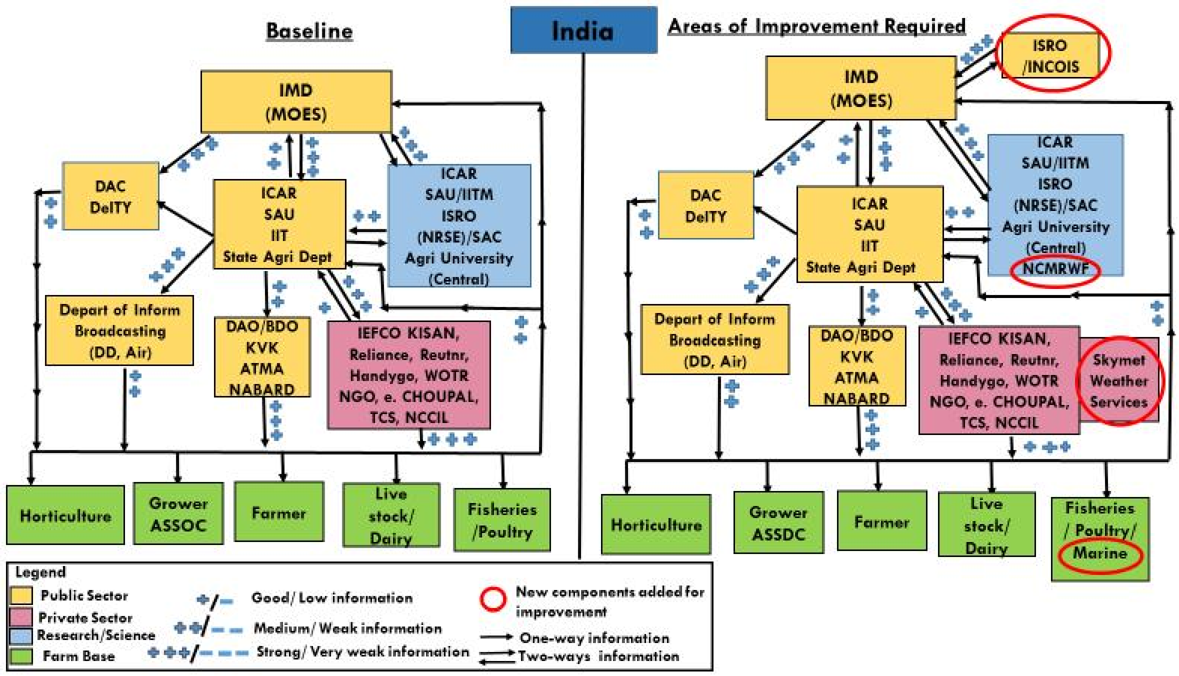


Figure 2: Institutional Framework for Climate Services in India



In comparison to Nepal, the perceptions of Indian workshop participants was that their institutional framework is already very strong. Most workshop participants however commented that the depiction of information flow was somewhat top-down in nature, with farmers and other producers receiving but not responding to or evaluating climate service information quality. These points were however not added to the map example from India. Rather, the areas of improvement are inclusion of research and analytics organization such as ISRO (Indian Space Research Organization) and private sector weather services such as [Skymet](). At the end-user level, consideration for inclusion of marine fishermen has been highlighted as a new opportunity for climate services in India.

The Vietnam institutional framework given below shows that like India, they have strong linkages. The relationships are complex but considers farmers at the center of their services. The major areas of improvement involve knowledge management and sharing through WMO, RIMES and ASEAN-CRN and in the introduction of index based insurance through insurance companies and banks. One key point that was widely discussed when participants looked at Vietnam's maps was that they appreciated how the maps placed farmers at the center of all information flows, and that two-way information flow and communication was included in the maps. This served as an example for other participants, who commented that this style depicted less of a top-down, and more inclusive and participatory approach.

Figure 3: Institutional Framework for Climate Services in Vietnam

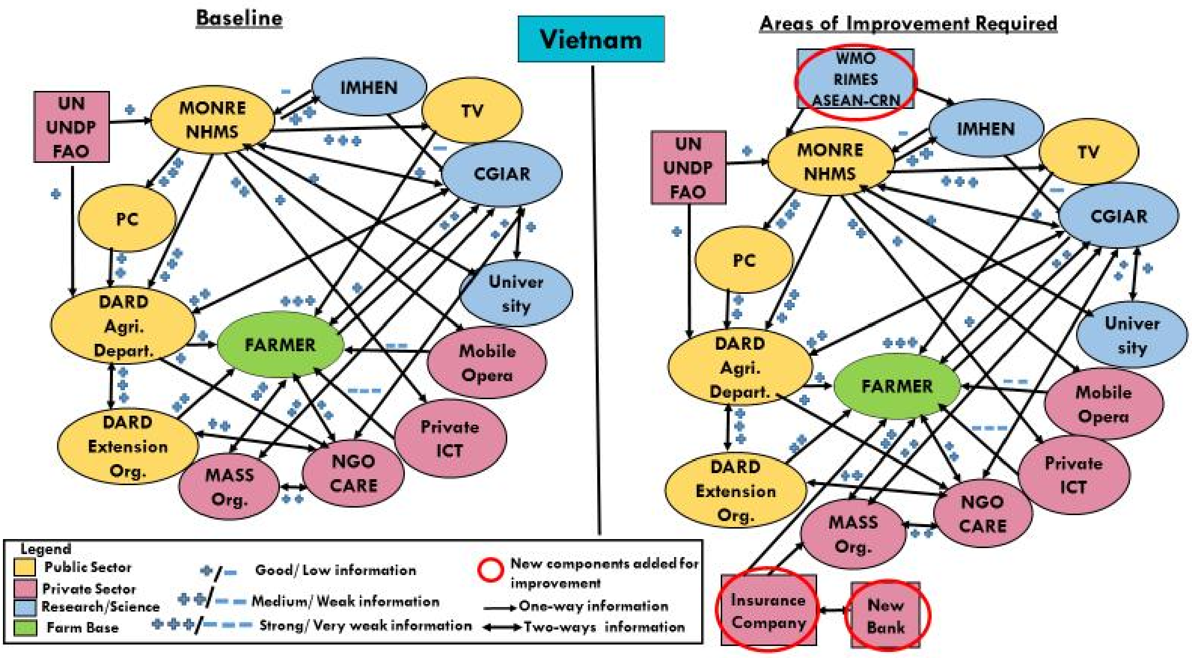
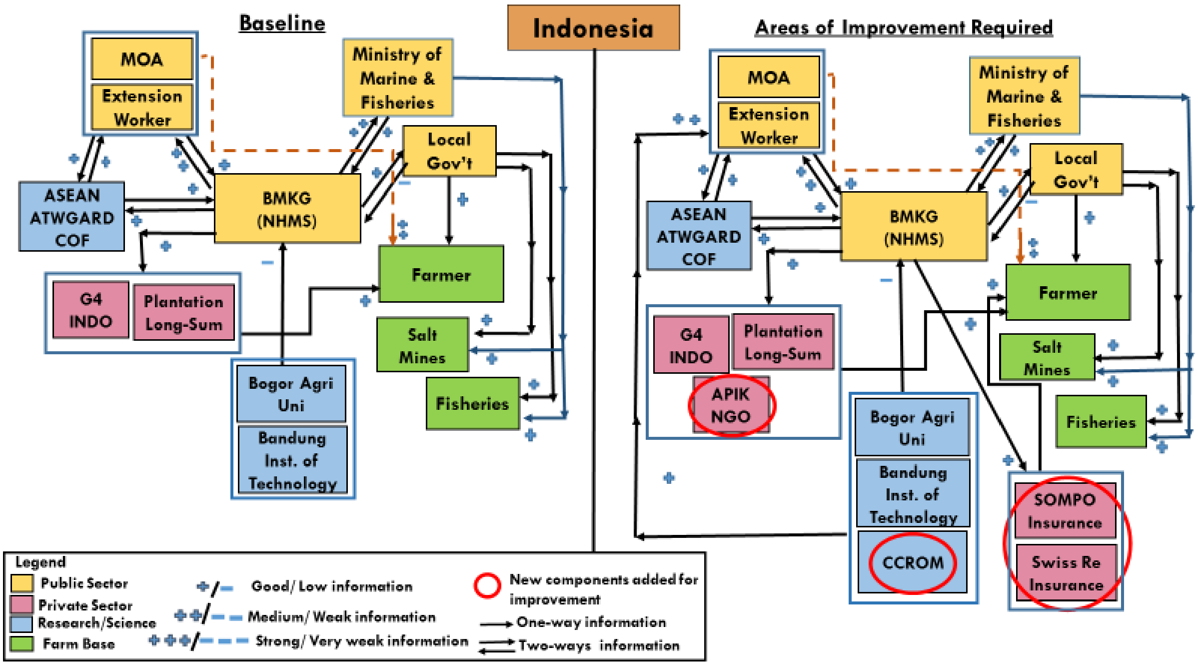


Figure 4: Institutional Framework for Climate Services in Indonesia



The institutional landscape in Indonesia includes numerous agencies related to climate services, although the interagency linkages are not as strong as they could be. Here too like Vietnam and Nepal, one area of potential improvement is in the introduction of insurance through different insurance companies. The other area of improvement is including a technical partner such as CCROM - Center for Climate Risk and Opportunity Management in Southeast Asia and Pacific.

Concluding reflection on lessons learned and next steps forward

Participants feedback: What have you learned and what will you take home to put into practice?
Facilitated by Timothy Krupnik

Representatives from each country were asked to give concluding thoughts on the workshop. These responses from included:

India:

- Practical exercises on participatory tools and exposure to new tools was highly appreciated
- A better understanding of the flood based insurance was also greatly appreciated, and there will be follow up opportunities in this area
- The connections made at this workshop were excellent, but the workshop was too short. It would be good to extend to a full week to permit more lateral learning

Bangladesh:

- Participants gained a much better appreciation of the usefulness of meteorological data
- Important connections were made with Reading University, IRI, and ASEAN, several of which are already materializing into longer-term collaboration and support opportunities
- Providing climate information as simple and appealing visual information (graphs, bulletins, etc.) is crucial for extending climate information to farmers

Nepal:

- There is a rich body of research on agricultural meteorology and data across the countries. That said, there is a great need for methods and careful attention to be paid to processing information into easy to understand information by farmers. This is best achieved by actively consulting farmers themselves
- Index based insurance is an exciting option that will be explored more fully in the future in Nepal
- Excellent connections were made with other country representatives that will hopefully result in increased collaborations in future

Indonesia:

- The workshop was a very good opportunity to learn from other countries e.g. India and Vietnam.
- Framing the supply of climate information in terms of the times of the crop calendar when farmers need to take decisions for management is a useful way to prioritize how and what climate information should be shared with farmers' groups
- There is a general need to improve farmers' feedback systems, intensive communication and coordination, to assure that advisories are improved for farmers in the long run
- Good connections were made with other agencies which needs to be maintained for collaboration and cross-learning, as well as advice
- Participants learned much about agricultural-meteorological data, and the way in which it needs to be very specific, and clearly communicated. More discussion and training in these areas is an important need

Vietnam

- Participants learned more about PICSA and index based insurance
- New ideas in the use of ICTs to inform climate services were presented, many of which are useful and will be considered in ongoing programming
- It was very good to meet other people working in agricultural climate services, especially in South Asia.
- We might include insurance and how to report uncertainty and we will advocate more for farmers' feedback

Myanmar:

- Have learned a lot of new things and made new connections with experts from other countries
- These ideas and the presentations from the workshop will be presented to government colleagues in Myanmar

Philippines

- There is a clear need to strategically strengthen institutions to be responsive to farmers
- The practical exercises on participatory tools to develop climate services messages were good and can be integrated in our work – this includes both visualization tools and approaches like PICSA
- It was useful to see experiences other than that of Southeast Asia, and to learn from colleagues in other countries

Overall participants found the practical exercises on participatory tools most useful, and informative for their work in the future. There was also a general sentiment that the workshop helped create a network which they feel will be useful for future collaboration and sharing of experiences. In summary, the main objectives of the workshop included the provision of a space and platform where participants could:

- Exchange ideas, stories, strategy, and to network to support the growth of farmer-focused and relevant agricultural climate services in the region
- To review South and Southeast Asian regional agricultural climate services activities, with an emphasis on participatory development and institutional arrangements to facilitate the flow of relevant climate advisories to farmers with appropriate feedback to scientists, extension agencies, and policy makers.

In general, there was a clear sentiment that these objectives had been achieved. In terms of outcomes, the workshop set out to assure that participants could:

- Have a broad overview and better understanding of South and Southeast regional agricultural climate services programs – this was accomplished by country and regional scoping exercises, including SWOT analyses
- Become familiar with participatory approaches and methods in agricultural climate services, and how to apply or improve them in their own country contexts – this was accomplished through exercises in PICSA and similar approaches and discussions on how to apply these in each country-specific context
- Develop an increased understanding of how to identify and leverage 'decision points' in the agricultural calendar during which climate information and advisories can most benefit farmers – this goal was accomplished through exercises to learn how to use participatory farm budgeting and the application of 'what if' scenarios in discussions with farmers.
- Understand and verbalize the need for appropriate intuitional arrangements to facilitate the flow of relevant climate information and advisories to farmers, and how to supply feedback to meteorological, extension, development, and policy oriented organizations – this goal was addressed through the exercise on institutional mapping and scenarios where participants imagined ways to improve intuitional arrangements to have more effective climate services
- Have an improved sense of information communication and visualization skills required to develop relevant climate information and advisories for smallholder farming communities in South and Southeast Asia – this objective was addressed through graphing exercises and presentations and sharing of useful climate services extension materials

Appendices

I. Appendix A: Agenda

DAY 1: SUNDAY, SEPTEMBER 17, 2017

TIME	ACTIVITY
8:45-9:00	Arrival and registration
Inaugural ceremony	
9:00 – 10.15	Welcome and introductions, facilitated by Timothy J. Krupnik, CIMMYT and CSRD in South Asia Project Leader
	Inaugural speech by Mr. Shamsuddin Ahmed, Director, Bangladesh Meteorological Department
	Inaugural speech by Stephen E. Zebiak, President, Climate Information Services and CSRD global coordinator
	Inaugural speech by Md. Golam Maruf, Director, Bangladesh Department of Agricultural Extension
	Inaugural speech by James Hansen, Senior Research Scientist and CCAFS Flagship 4 Leader: Climate Services and Safety Nets, IRI, The Earth Institute, Columbia University
	Inaugural speech by David Westerling, the Acting Economic Growth Office Director and Feed the Future Team Leader, USAID
Tea break	
10:15-10:30	Tea and refreshments served
Detailed welcome and introductions	
10:30-11:00	Ice breaking exercises for core participants, Timothy J. Krupnik (CIMMYT)
Keynote presentations: sharing of stories and ideas on participatory agricultural climate services from across the regions (15 minute presentations for each keynote speaker(s)	
11:00 -1:30	Developing climate services and approaches to support farmer decision making: Insights from Africa with relevance for South and South East Asia. Peter Dorward, The School of Agriculture, Policy, and Development (University of Reading).
	Communicating weather and climate information with farmers: Lessons from CCAFS's global experiences. James Hansen, Senior Research Scientist and CCAFS Flagship 4 Leader: Climate Services and Safety Nets, and Ms. Mélody Braun, Research Staff Associate, Financial Instruments Sector Team (IRI)
	Agricultural climate services and farmer participatory extension in India. N. Chattopadhyay and KK Singh. Agricultural Meteorology Division and AgroMet Services (India Meteorological Department)
	Farmer climate field schools in Indonesia: Strengths and weaknesses. Indra Gustari. Center for Applied Climate Information Services (Indonesia Agency for Meteorology Climatology and Geophysics).
	Climate services and farmer participatory extension in Nepal.

	Deepak Bhandari, Agri-Environment Division, Nepal Agricultural Research Council.
	Talking toolkits, PSP, and methods for communicating agricultural climate services and adaptation in Vietnam. Elisabeth Simelton and Mrs. Tam Thi Le (World Agroforestry Center) and Mr. Le Xuan Hieu (CARE)
	Speaker question and answers (talk show style Q&A, Facilitated by Stephen E. Zebiak)
Lunch	
1:30-2:15	Buffet lunch served
Keynote presentations continued*(Tea to be served on buffet basis)*	
2:15 - 5:15	Overview of agricultural climate services in the ASEAN Climate Resilience Network. Imelda Bacudo. Senior Advisor and Deputy Head of Project Forest and Climate Change under ASEAN (GIZ)
	Farmer participation and communication in climate services and Index-based flood insurance initiatives in India, Bangladesh, and Sri Lanka. Giriraj Amarnath (IWMI)
	Agricultural call centers and climate advisories in Myanmar. Moe San. International Cooperation Division (ASEAN), Ministry of Agriculture, Livestock and Irrigation
	Experiences with ICT to communicate climate information to Farmers in Nepal. Ishwor Malla. Deputy Head, ICT for Agriculture. SMILES - Nepal
	Approaches to developing better agricultural climate services in the Philippines. Hazel Tanchuling, Executive Director (Rice Watch Action Network Inc.)
	Farmer decision making structures in Bangladesh: Preliminary and planned work in the CSRD South Asia and the Agro-Meteorological Information Systems Development Project. Timothy J. Krupnik (CIMMYT) and Aziz Mazharul (DAE).
	Panel discussion on all presentations so far: What methods in participatory climate services implementation have we learned about across these programs (Panel Q&A, facilitated by Peter Dorward, Timothy J. Krupnik, and Stephen E. Zebiak)
	Further discussion and review of Day 1, plans and expectations for Day 2. Discussion on producing a scoping paper on participatory agricultural climate services in South and South East Asia (Timothy J. Krupnik)

DAY 2: MONDAY, SEPTEMBER 18, 2017

TIME	ACTIVITY
9:00-11:00	*Presentation and discussion*: Products and processes for making seasonal climate forecasts useful for farmer decision-making: experiences in Africa with relevance to South and South East Asia. James Hansen, Senior Research Scientist and CCAFS Flagship 4 Leader: Climate Services and Safety Nets, IRI, The Earth Institute, Columbia University

	Presentation and discussion: Bringing participatory climate services to South and South East Asia: How could the Participatory Integrated Climate Services for Agriculture (PICSA) approach be applied? Presented by Peter Dorward
	Activity and discussion: What do metrological and extension services have to offer farmers, and what do farmers need and want? A cross-country activity study. Facilitated by Timothy J. Krupnik
Tea break	
11:00 – 11.15	Tea and refreshments served
11: 15-1:00	*Practical activity with real data and discussion*: Climate perceptions vs. realities in contrasting locations in South and/or South East Asia: What are the implications for effective agricultural climate services and communications? Data visitation, interpretation, and fishbowl exercise led by Peter Dorward
	Activity and discussion: Identifying and planning for change: how can participatory tools support farmer decision making? Participatory exercises including enterprise budgeting led by Peter Dorward
Lunch	
1:00-2:00	Buffet lunch served
2:00-3:45	*Presentation and discussion*: Potentials and Pitfalls for ICTs for 'last mile' agricultural climate services extension facilitated by Dr. Kamalesh Kumar Singh, IMD, India
	Activity and discussion: Scoping climate services in South and South East Asia: A participatory approach to cataloguing agricultural climate advisor services in the region Facilitated by Timothy J. Krupnik
Working Tea	
3:45 - 6:00	*Participant presentations*: Scoping climate services in South and South East Asia continued Facilitated by Timothy J. Krupnik
	Open discussion on producing a scoping paper on participatory agricultural climate services in South and South East Asia. Facilitated by the CSRD team
	Further discussion and expectations for Day 3.

DAY 3: TUESDAY, SEPTEMBER 19, 2017

TIME	ACTIVITY
Special session on financial instruments for agricultural climate services	
	Bridging the 'space' between remote sensing science and local communities for better design of flood index insurance. Giriraj Amarnath (IWMI)
	Presentation and discussion: Financial instruments to mitigate climate risks: Global examples of how appropriateness and farmer participation be increased. Mélody Braun, Research Staff Associate, Financial Instruments Sector Team (IRI)

9:00 - 1:00	*Presentation and discussion*: Mind the gender gap in crop insurance! Farmers' gendered preferences and climate change skepticism in coastal Bangladesh. Timothy J. Krupnik and Fahmida Khanam (CIMMYT)
	Discussions Q&A facilitated by Stephen Zebiak
	Activity and discussion: Round table sharing of climate communication and visitation tools and methods: What works and what needs to be improved? ICRAF, Elizabeth Simelton
Lunch	
1:00-2:00	Buffet lunch served
Reflection on lessons learned and next steps forward	
2:00 - 4:30	*Activity and discussion*: Institutional arrangements to improve the flow of agriculturally relevant climate information to farmers in South and South East Asia: A participatory mapping exercise. Facilitated by Timothy J. Krupnik (CIMMYT)
4:30-5:00	Participant presentations: What have you learned and what will you take home to put into practice? Facilitated by Timothy Krupnik
	Discussion on producing a scoping paper on participatory agricultural climate services in South and South East Asia. Facilitated by the CSRD team & Closing of Workshop

II. Appendix B: List of participants

Name of Participants	Organization	Contact No.	Email
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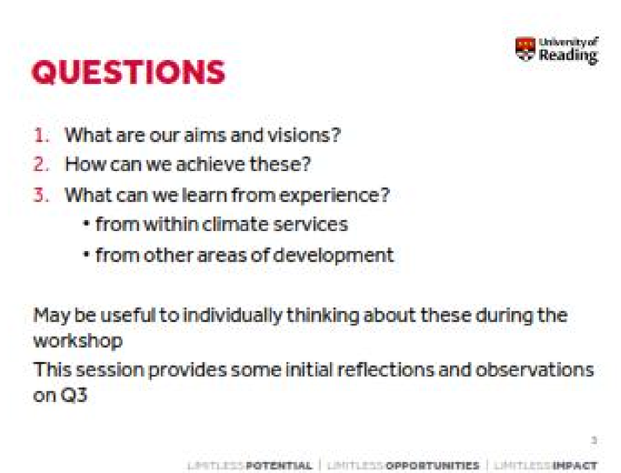
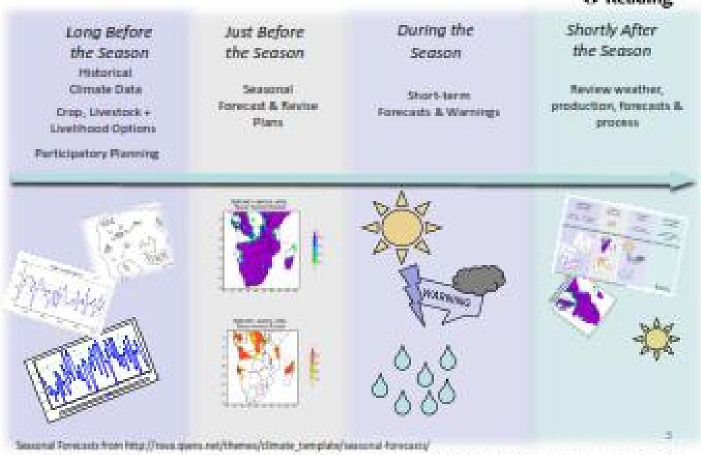
III. Appendix C: PowerPoint presentations

Appendix C1: Developing climate services and approaches to support farmer decision making: insights from Africa with relevance for South and South East Asia





LESSONS FROM THE DEVELOPMENT OF PICSA

Relatively successful

- 'Integrated ' or systems approach
- Farmer focused – supporting decision making
- Practically useful to farmers
- Partnerships –built around joint activities
- Helps institutions to do their activities better – useful for them

LESSONS FROM THE DEVELOPMENT OF PICSA

- Started small and piloted
- Iterative learning and feedback – always learning
- Always intended to i) be able to go to scale and ii) sustainable
- Adaptive – to different contexts, locations and environments
- New opportunities and challenges as go to scale

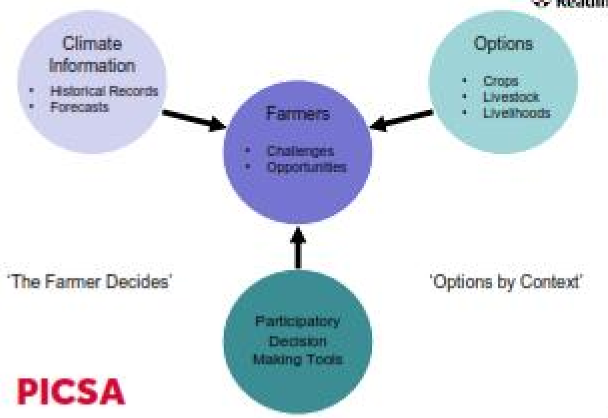
THE CHALLENGES – PARTICIPATORY & INSTITUTIONAL

- Focus on supporting **farmers** with **their** decision making
- **Institutions** playing effective roles – individually and collectively

There is no 'model' or 'blue print',

But are principles and ways of thinking that can help us

1. FOCUS ON SUPPORTING FARMERS WITH THEIR DECISION MAKING



PICSA

INSIGHTS FROM DEVELOPMENT THEORY AND EXPERIENCE

Shifts in Perspectives for Supporting Agricultural Research & Extension

Perspective	Adoption and Diffusion	Farming Systems Research	Agricultural Knowledge and Information Systems	Agricultural Innovation Systems
Time Period	Since 1960s	Started 1970s	From 1990s	2000s
Core Elements	Technology packages	Modified packages to overcome constraints	Joint production of knowledge and technologies	Shared learning and changes, politics of demand, social networks of innovators
Scope	Productivity increase	Efficiency gains (input-output relationships)	Farmer based livelihoods	Value chains, institutional change
Innovators	Scientists	Scientists and Extensionist	Farmers, scientists and Extensionist together	Multiple actors, innovation platforms
Role of Scientists	Innovators	Experts	Collaborators	Partners, one of many responding to demands
Key changes sought	Farmer's behaviour change	Removing farmer's constraints	Empowering farmers	Institutional change, innovation capacity
Role of Farmers	Adopters or laggards	Source of information	Experimenters	Partners, entrepreneurs, innovators exerting demand
Intended Outcomes	Technology adoption and uptake	Farming system fit	Co-evolved technologies better fit to livelihood systems	Capacities to innovate, learn and change

2. INSTITUTIONS PLAYING EFFECTIVE ROLES – INDIVIDUALLY AND COLLECTIVELY

Help from **Agricultural innovation systems** (AIS) thinking

- Overall aim is to support farmers to make changes that benefit them
- and to have institutions operating in effective systems that enable ongoing change and learning
- Institutions focusing on the overall aim (not their own / realigning their own)
- Institutions being flexible and ready adapt / change their activities and roles
- Institutions supporting each other (not just pursuing own 'agendas')

2. INSTITUTIONS PLAYING EFFECTIVE ROLES – INDIVIDUALLY AND COLLECTIVELY

Help from **Agricultural innovation systems** (AIS) thinking

- Institutions recognising their strengths (what they can offer) and their limitations (what they can't offer, support others to do)
- Requires confidence and security, attitudes, learning, willingness to change
- Success is when everyone is 'innovating' to support 'farmer innovation'
- Overall success - actually results in success for the institutions - win win

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LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

DOING DEVELOPMENT DIFFERENTLY

ODI & DFID initiative. Pushing back on the 'controlled results' agenda, and political push for the rigorous measurement of aid, but with view to increasing effectiveness and therefore results.

- **Form not function** (ie focus on the aims, rather than sticking to the plans / accepted ways of doing things)
- **Behaviours and attitudes** eg
  - Curiosity
  - Humility (embrace uncertainty and ambiguity, acknowledge your ignorance)
  - Reflexivity (be conscious of your own role, prejudices and power)
  - Include multiple perspectives, unusual suspects and be open to different ways of seeing the world.

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LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

- Hopefully some of the ideas shared from within and outside 'climate services' will be helpful as we consider

  Participatory and **institutional** approaches for success

- Together with the questions posed

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LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

QUESTIONS

1. What are our aims and visions?
2. How can we achieve these?
3. What can we learn from experience?
   - from within climate services
   - from other areas of development

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LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

THANK YOU

Contact: Professor Peter Dorward, School of Agriculture, Policy and Development, University of Reading, United Kingdom
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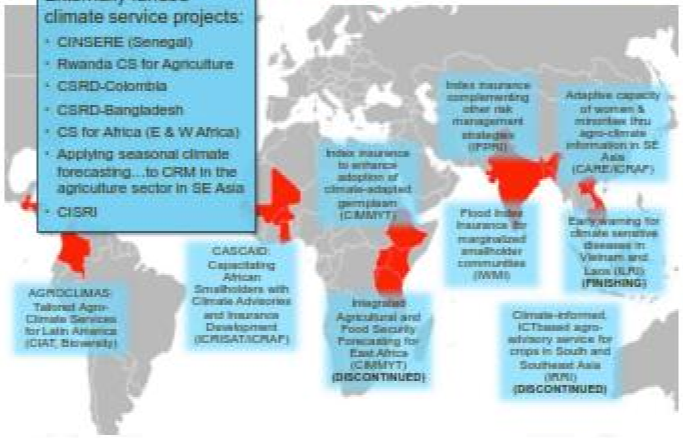
Acknowledgements: Graham Clarkson, Roger Stern and Mark Galpin for contributions of ideas and material

Appendix C2: Communicating weather and climate information with farmers: Lessons from CCAFS's global experiences

CCAFS Climate Risk Management Projects, 2015-2018



Climate services that work for farmers, at scale and sustainably, require more than just information

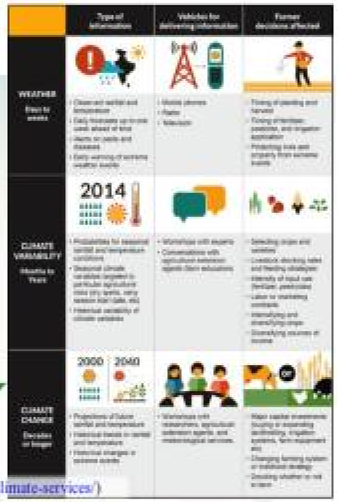
From weather to climate services

- All time scales are relevant to agriculture
- Information needed depend on decisions
- With increasing lead time:
  - Decisions more context- and farmer-specific
  - Information more uncertain, complex
  - Decision-makers need more help to understand and use the information

From weather to climate services

- Climate services more than adding climate products to weather services:
  - Generation
  - Translation
  - Communication
  - Application

…of climate knowledge and information for climate-informed decision making and climate-smart policy and planning



(http://www.climate-services.org/about-us/what-are-climate-services/)

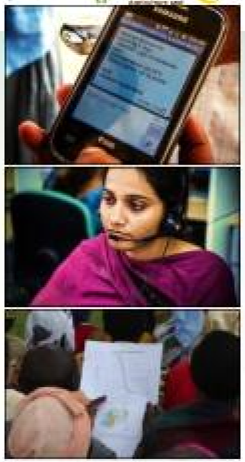
What will it take for climate services to benefit farmers – at scale? 5 challenges:

1. Gaps in capacity to access, understand, act on information
2. Gaps in capacity to provide actionable information
3. Gaps in historic observations
4. Gaps in information relevance
5. Institutional, governance arrangements to sustain co-development of services

Challenge #1: Farmers' capacity to access, understand and act on climate information

Building capacity to communicate, understand, act on information

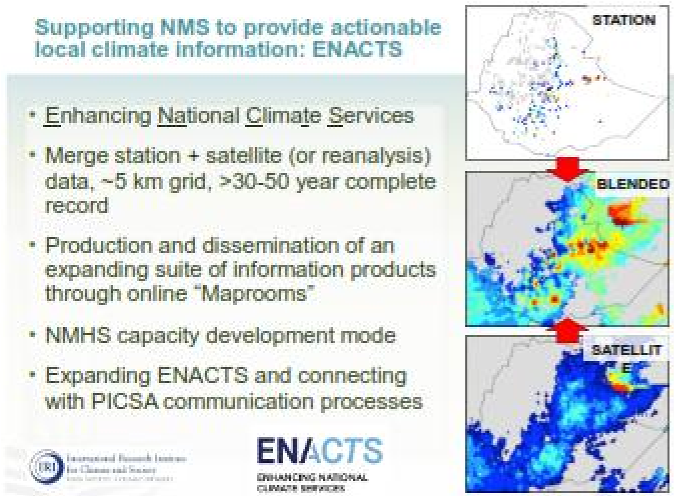
- Mix of communication and capacity-building processes
- ICT for short-lead weather forecasts and advisories
- Media for weather information and advisories, awareness
- ***Participatory processes for understanding climate variability and trends, pre-season planning***
- Women, other disadvantaged groups need special attention

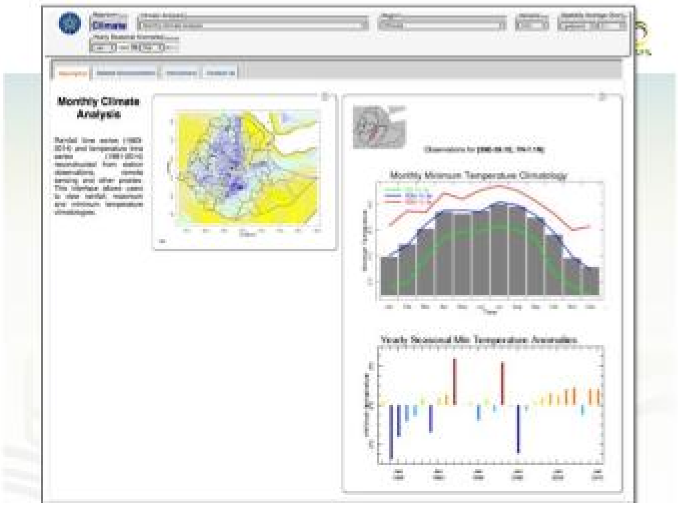


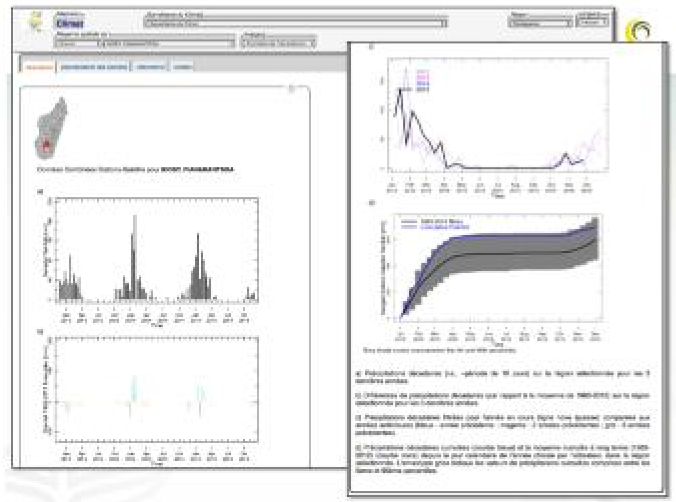
General comments about participatory communication processes

- Essential and effective for historical and forecast climate information, due to uncertainty
- Success factors:
  - Expert facilitation, with respect
  - Structured process bridge farmers' experience, quantitative information
  - Relevant local climate information in graphical formats -- ***products that many NMS don't provide routinely***
- The scaling challenge:
  - Embed in existing institutions, routines, mandates
  - Short-term training, ToT
  - Quality training materials

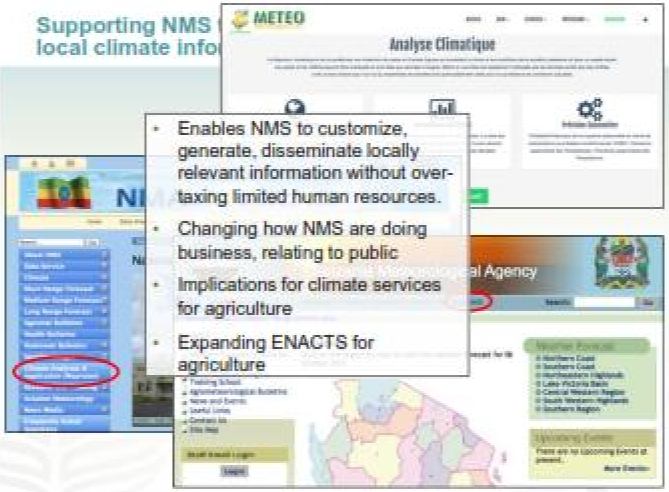

Challenge #2: NMHS capacity to routinely provide tailored local information
Challenge #3: Gaps in historic data
CGIAR
CCAFS


Supporting NMS to provide actionable local climate information: ENACTS
• Enhancing National Climate Services
• Merge station + satellite (or reanalysis) data, ~5 km grid, >30-50 year complete record
• Production and dissemination of an expanding suite of information products through online "Maprooms"
• NMHS capacity development mode
• Expanding ENACTS and connecting with PICSA communication processes
STATION
BLENDED
SATELLIT E
ENACTS
ENHANCING NATIONAL CLIMATE SERVICES


Monthly Climate Analysis
Monthly Minimum Temperature Climatology
Yearly Seasonal Min Temperature Anomalies



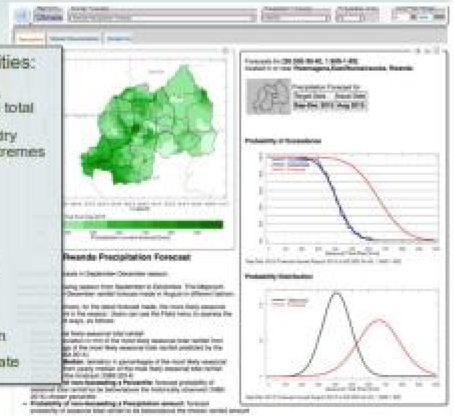
Supporting NMS t... local climate info...



- Enables NMS to customize, generate, disseminate locally relevant information without over-taxing limited human resources.
- Changing how NMS are doing business, relating to public
- Implications for climate services for agriculture
- Expanding ENACTS for agriculture

Supporting NMS to provide actionable local climate information

- Derived agromet quantities:
  - Season onset, cessation, duration, dynamic rainfall total
  - Frequency of damaging dry spells; wet, heat, cold extremes
  - Growing degree-days
  - Water balance, WRSI
- Seasonal forecasts:
  - Statistically downscaled
  - Same suite of agromet quantities
  - Full probability distribution
  - In context of historic climate



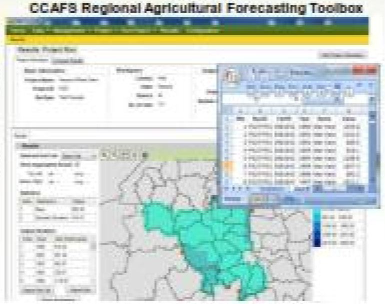
Challenge #4: Translating raw climate information into agriculturally relevant terms

From meteorological quantities to actionable agricultural information: Examples

- Weather-driven soil water balance modeling for agricultural drought, other applications
- Combine climate information with crop models to forecast production
- Combine with hydrological models, remote sensing for irrigation, flood, salinity analysis and management
- Weather-sensitive pest and disease risk advisories
- Management advisories

A word of caution…

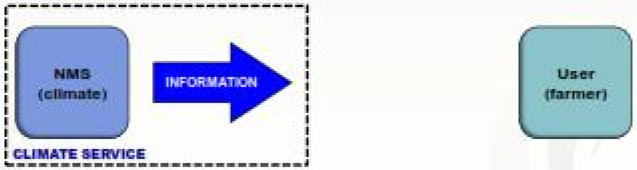
CRAFT:
CCAFS Regional Agricultural Forecasting Toolbox



Challenge #5: Institutional and governance arrangements to sustain co-production

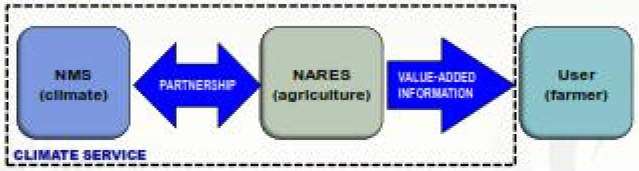
Preliminary thoughts about Climate Service Governance and Institutional Arrangements

- Limitations of supply-driven climate services



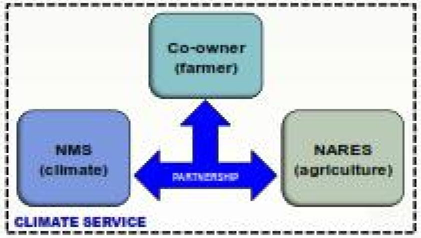
Preliminary thoughts about Climate Service Governance and Institutional Arrangements

- Limitations of supply-driven climate services
- Mainstream in agricultural strategy and programs



Preliminary thoughts about Climate Service Governance and Institutional Arrangements

- Limitations of supply-driven climate services
- Mainstream in agricultural strategy and programs
- Expand the boundaries to give farmers an effective voice



Preliminary thoughts about Climate Service Governance and Institutional Arrangements

- Limitations of supply-driven climate services
- Mainstream in agricultural strategy and programs
- Expand the boundaries to give farmers an effective voice
- Climate services effective partnerships span generation, translation, communication, application. National and local
- Regular communication, coordination and user feedback processes are needed to sustain co-production of services
- Rules formalize partner roles, processes, information flow, accountability to users
- GFCS "National Climate Services Framework" process
- An important topic for research

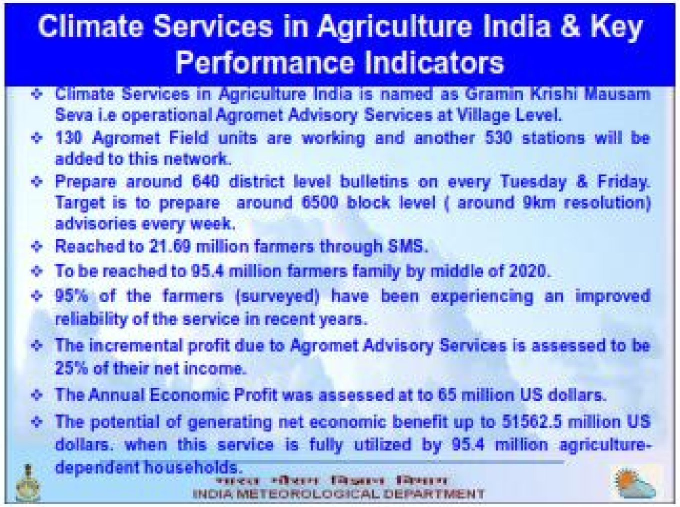
Four preliminary lessons

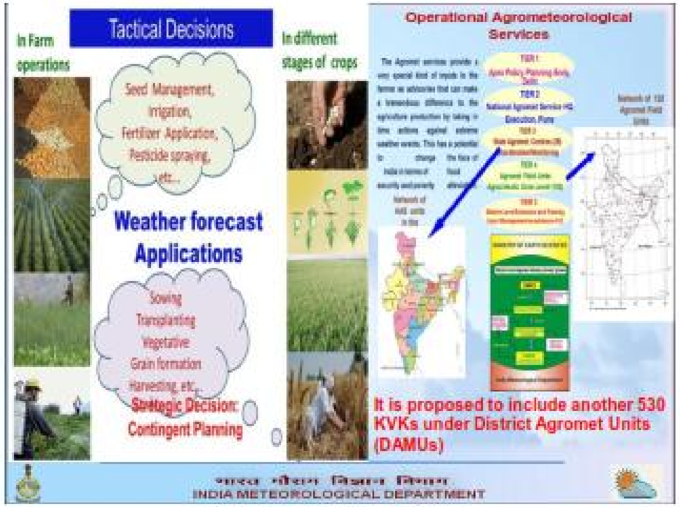
1. Climate services that work for farmers, at scale and sustainably, often requires substantial investment in capacity:
    - **Supply side**: NMS capacity to provide locally relevant information tailored to the needs of farmers, often addressing historic data gaps;
    - **Demand side**: NARES capacity to translate, communicate, and build farmers' capacity to understand and act on climate information;
    - **Institutional and governance** arrangements to sustain co-development of services beyond project lifespan.
2. Climate research is expanding options for filling data gaps, generating relevant information without overextending NMS human resources. Climate-agriculture research partnership.
3. Mix of delivery processes including participatory communication facilitated by trained intermediaries.
4. Mainstreaming climate services in agriculture requires strong partnership between agricultural and meteorological agencies and their associated Ministries, and enabling governance.

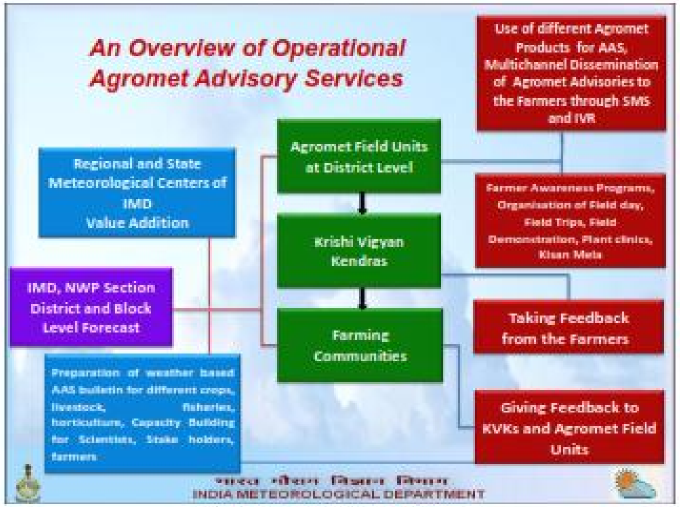
Thank you

Jim Hansen jhansen@iri.columbia.edu

Appendix C3: Agricultural climate services and farmer participatory extension in India.







Collaborating Agencies with National Organisations

Multi-Disciplinary & Multi-Institutional

- Indian Council For Agricultural Research
- Department Of Agriculture & Cooperation
- State Departments Of Agriculture
- State Agricultural Universities And Other Universities
- Department Of Space
- Ministry of Information Technology

Ministry Of Earth Sciences

- India Meteorological Department
- National Centre For Medium Range Weather Forecasting
- Indian Institute of Tropical Meteorology

Multi-Disciplinary & Multi-Institutional

- National Informatics Centre
- Ministry of Science & Technology
- Ministry of Information & Broadcasting (AIR & TV)
- Print Media
- Min. of Rural Development
- MSSR Foundation & Other NGOs & PP

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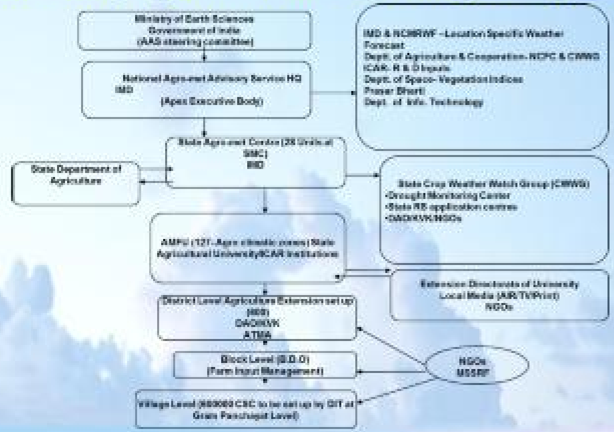
Collaborating organizations to reach even upto Village Level



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Use of Climate Services Information System & Climate Services Tools for agriculture in India

- Inventorying existing data libraries, products and analytical tools
- Making what is available accessible
- Making what is accessible useable
- Making systematic improvements (i.e. by enhancing access to developer's tools)
- Develop and support ongoing capacity and training (access, assessment/ applications, interpretation networks)
- Preparation of CST Toolkits
- Besides, for effectiveness of climate service including for creating climate products, for us is important and necessary access to:
  - Climate data
  - Guidance material
  - Methodology documentation
  - Software tools/packages
  - Training material

WMO's REGIONAL CLIMATE CENTRE (RA II REGION), Pune, India (Recognized in May 2017)

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Existing & Proposed deliverables

- Generation of climate data and inventory from the existing Observatories & access of these from the climate portal to be used in the different climate service programme. This also includes past, present and future – is routinely archived, analyzed, modelled, exchanged and processed.
- Climate analysis and monitoring, assessment and attribution and weather forecast (Short, medium, extended & seasonal scales)
- Diagnose weather related stresses (drought, pest & disease etc)
- Preparation of climate service products related to the agriculture (SPI, ESPI, Aridity Anomaly Index, realized and forecast for soil moisture, soil temperature NDVI etc.)
- Weather based farm management advisory including risk management
- User interface mechanisms. Here users would be the farmers
- Advisory bulletin dissemination (multi mode dissemination including short message services)
- Responding to specific queries
- Feed back
- Awareness at User level/ workshop and seminars
- Develop and support ongoing and proposed capacity and training (access, assessment/ applications, interpretation networks
- Monitoring mechanism.

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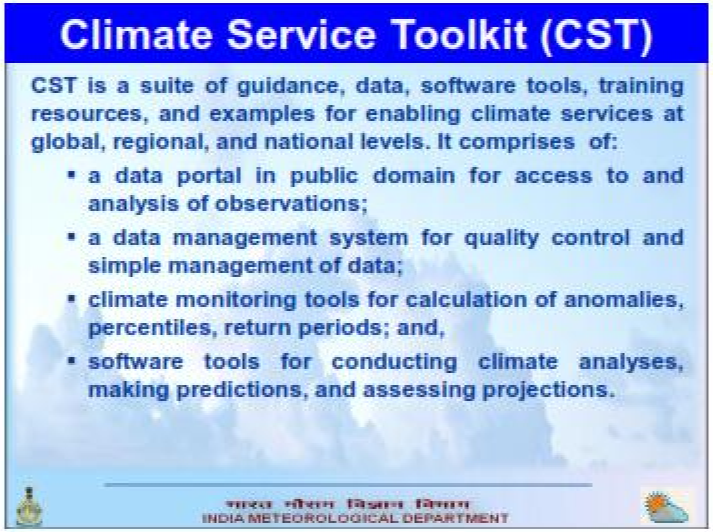
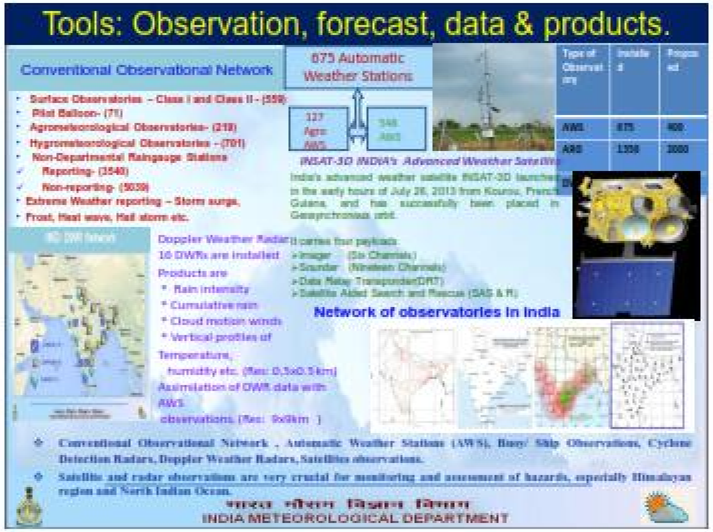
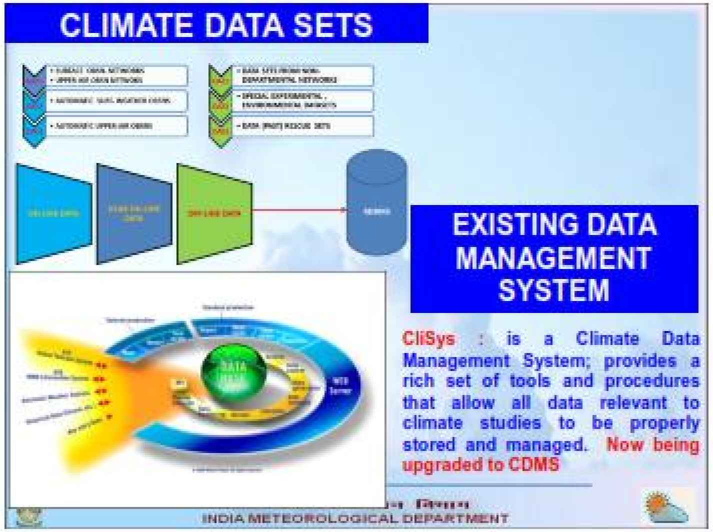
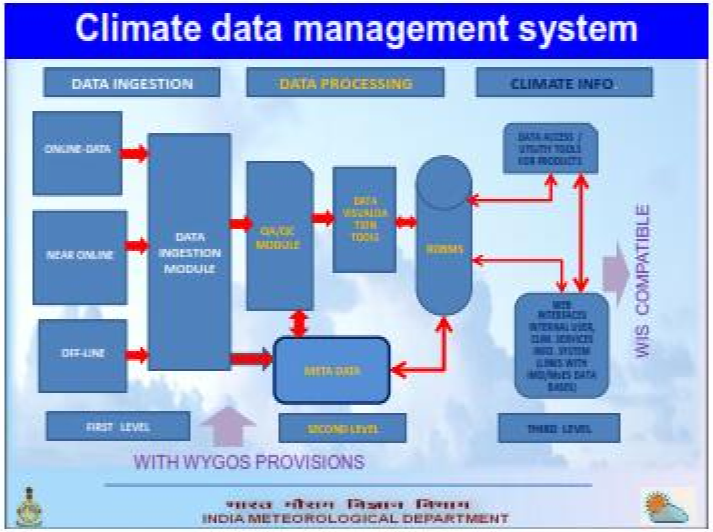
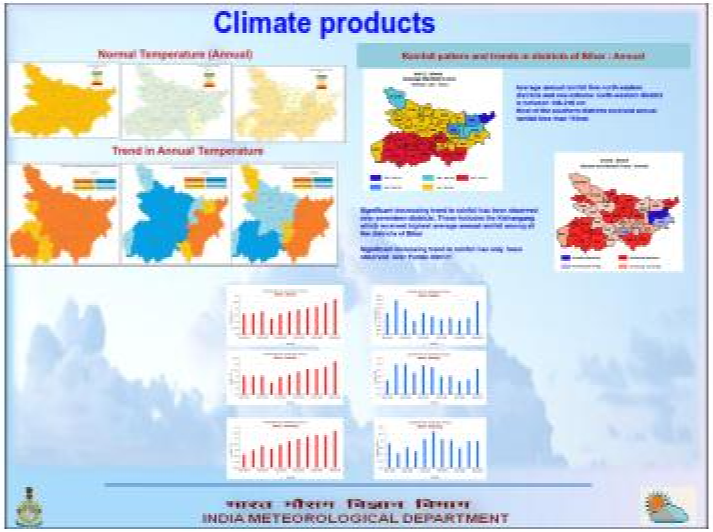
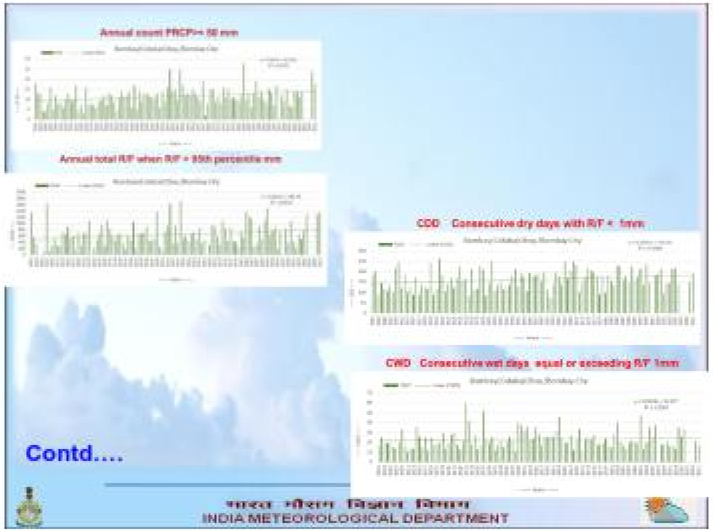

Climate Service Toolkit (CST)
CST is a suite of guidance, data, software tools, training resources, and examples for enabling climate services at global, regional, and national levels. It comprises of:
▪ a data portal in public domain for access to and analysis of observations;
▪ a data management system for quality control and simple management of data;
▪ climate monitoring tools for calculation of anomalies, percentiles, return periods; and,
▪ software tools for conducting climate analyses, making predictions, and assessing projections.
भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

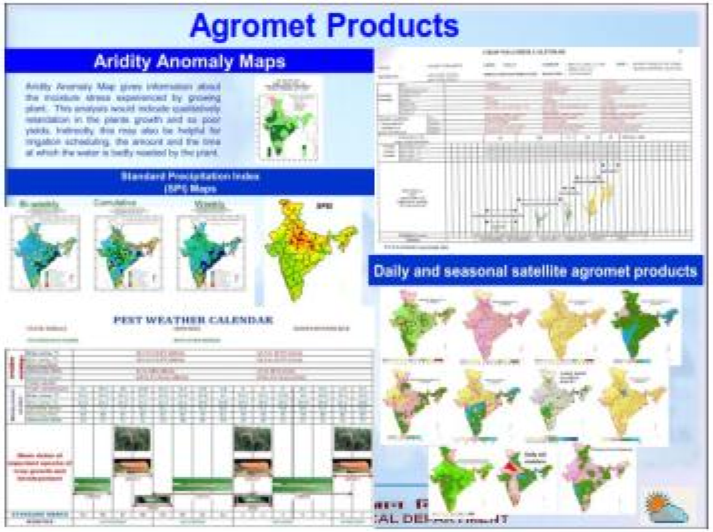

Tools: Observation, forecast, data & products.
Conventional Observational Network
675 Automatic Weather Stations
Surface Observatories – Class I and Class II - (559)
Pilot Balloon- (71)
Agrometeorological Observatories- (219)
Hygrometeorological Observatories – (701)
Non-Departmental Raingauge Stations
Reporting- (3540)
Non-reporting- (5039)
Extreme Weather reporting – Storm surge,
Frost, Heat wave, Hail storm etc.
127 Agro AWS
548 AWS
INSAT-3D INDIA's Advanced Weather Satellite
India's advanced weather satellite INSAT-3D launched in the early hours of July 26, 2013 from Kourou, French Guiana, and has successfully been placed in Geosynchronous orbit.
It carries four payloads
➢Imager (Six Channels)
➢Sounder (Nineteen Channels)
➢Data Relay Transponder(DRT)
➢Satellite Aided Search and Rescue (SAS & R)
Doppler Weather Radar
10 DWRs are installed
Products are
* Rain intensity
* Cumulative rain
* Cloud motion winds
* Vertical profiles of Temperature, humidity etc. (Res: 0.5x0.5 km)
Assimilation of DWR data with AWS observations (Res: 9x9km)
Network of observatories in India
AWS 675 400
ARG 1350 2000
❖ Conventional Observational Network , Automatic Weather Stations (AWS), Buoy/ Ship Observations, Cyclone Detection Radars, Doppler Weather Radars, Satellites observations.
❖ Satellite and radar observations are very crucial for monitoring and assessment of hazards, especially Himalayan region and North Indian Ocean.
भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

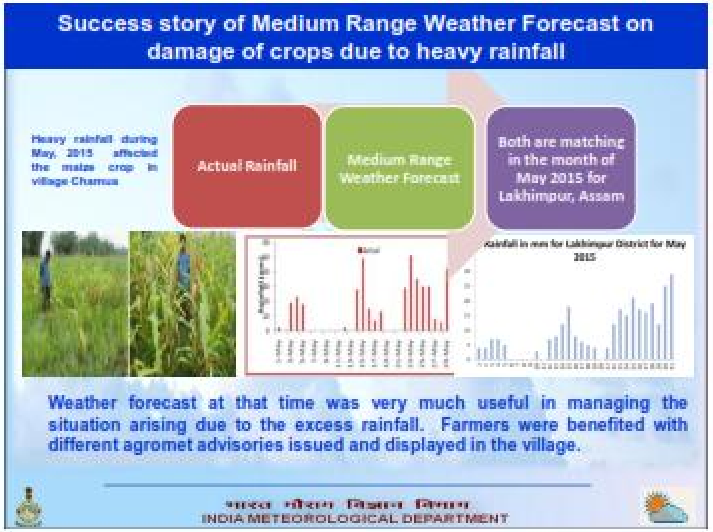

CLIMATE DATA SETS
ONLINE DATA
NEAR ON-LINE DATA
OFF-LINE DATA
RDBMS
EXISTING DATA MANAGEMENT SYSTEM
DATA
CliSys : is a Climate Data Management System; provides a rich set of tools and procedures that allow all data relevant to climate studies to be properly stored and managed. Now being upgraded to CDMS
INDIA METEOROLOGICAL DEPARTMENT

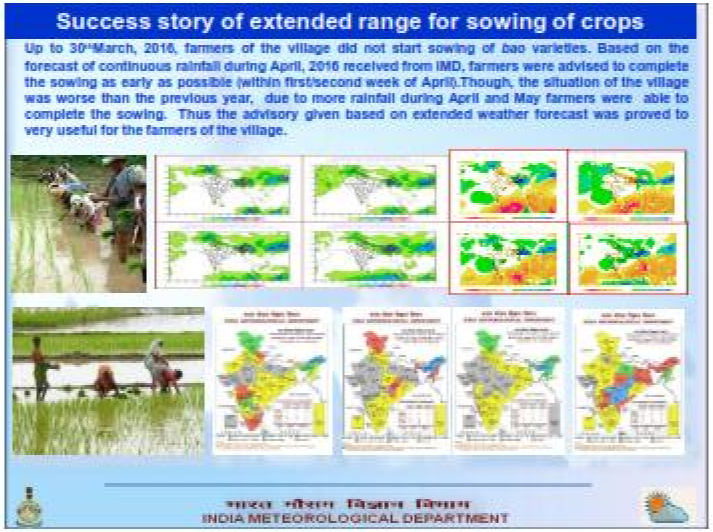

Climate data management system
DATA INGESTION
DATA PROCESSING
CLIMATE INFO
ONLINE-DATA
NEAR ONLINE
OFF-LINE
DATA INGESTION MODULE
QA/QC MODULE
DATA VISUALIZATION TOOLS
RDBMS
META DATA
DATA ACCESS / UTILITY TOOLS FOR PRODUCTS
WEB INTERFACES INTERNAL USER, CLIM. SERVICES INFO. SYSTEM (LINKS WITH IMD/RMCS DATA BASES)
WIS COMPATIBLE
FIRST LEVEL
SECOND LEVEL
THIRD LEVEL
WITH WYGOS PROVISIONS
भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT


Climate products
Normal Temperature (Annual)
Trend in Annual Temperature
Rainfall pattern and trends in districts of Bihar : Annual
INDIA METEOROLOGICAL DEPARTMENT

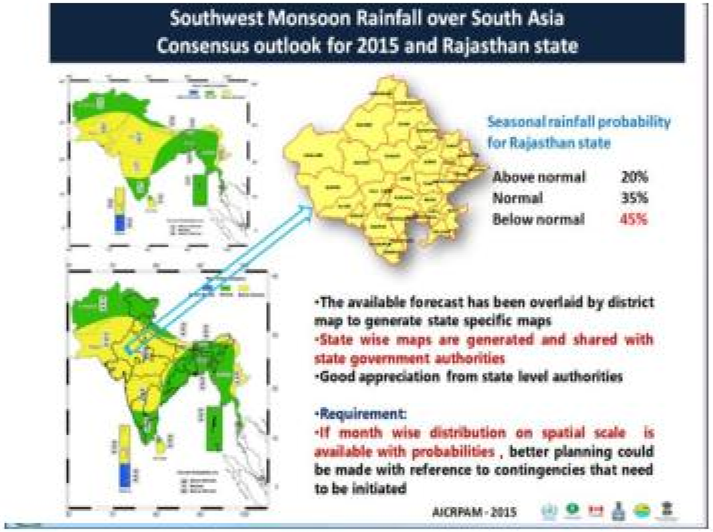

Annual count PRCP>= 50 mm
Annual total R/F when R/F > 95th percentile mm
CDD Consecutive dry days with R/F < 1mm
CWD Consecutive wet days equal or exceeding R/F 1mm
Contd....
INDIA METEOROLOGICAL DEPARTMENT


Agromet Products
Aridity Anomaly Maps
Standard Precipitation Index (SPI) Maps
Cumulative
SPI
PEST WEATHER CALENDAR
Daily and seasonal satellite agromet products

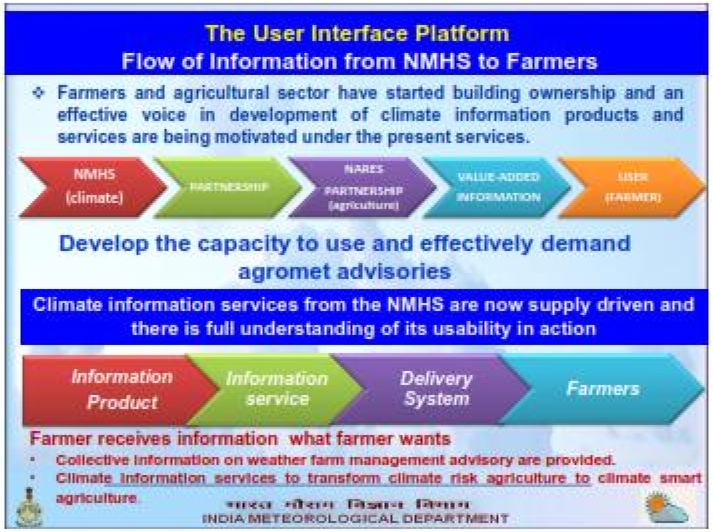

Success story of Medium Range Weather Forecast on damage of crops due to heavy rainfall
Heavy rainfall during May, 2015 affected the maize crop in village Chamua
Actual Rainfall
Medium Range Weather Forecast
Both are matching in the month of May 2015 for Lakhimpur, Assam
Rainfall in mm for Lakhimpur District for May 2015
Weather forecast at that time was very much useful in managing the situation arising due to the excess rainfall. Farmers were benefited with different agromet advisories issued and displayed in the village.
INDIA METEOROLOGICAL DEPARTMENT



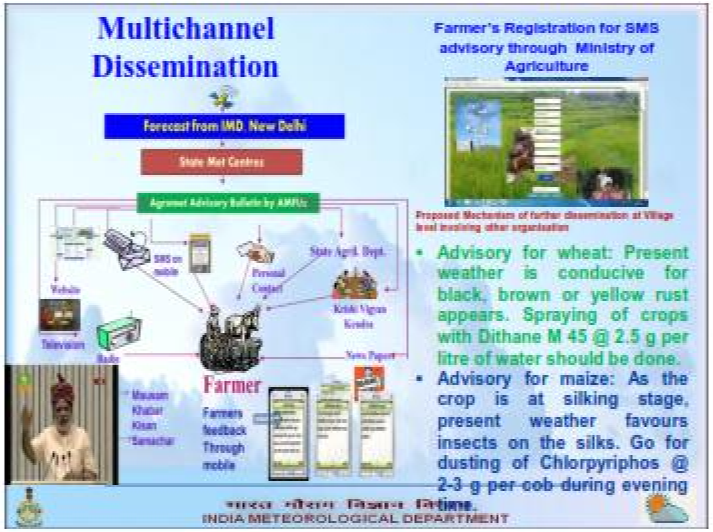
Success story of extended range for sowing of crops
Up to 30thMarch, 2016, farmers of the village did not start sowing of bao varieties. Based on the forecast of continuous rainfall during April, 2016 received from IMD, farmers were advised to complete the sowing as early as possible (within first/second week of April).Though, the situation of the village was worse than the previous year, due to more rainfall during April and May farmers were able to complete the sowing. Thus the advisory given based on extended weather forecast was proved to very useful for the farmers of the village.
INDIA METEOROLOGICAL DEPARTMENT



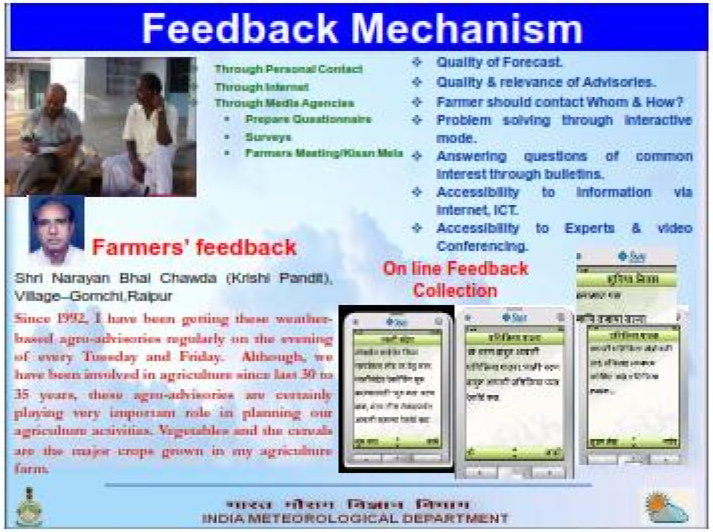
Southwest Monsoon Rainfall over South Asia
Consensus outlook for 2015 and Rajasthan state
Seasonal rainfall probability for Rajasthan state
Above normal 20%
Normal 35%
Below normal 45%
•The available forecast has been overlaid by district map to generate state specific maps
•State wise maps are generated and shared with state government authorities
•Good appreciation from state level authorities
•Requirement:
•If month wise distribution on spatial scale is available with probabilities , better planning could be made with reference to contingencies that need to be initiated
AICRPAM - 2015



The User Interface Platform
Flow of Information from NMHS to Farmers
Farmers and agricultural sector have started building ownership and an effective voice in development of climate information products and services are being motivated under the present services.
NMHS (climate)
PARTNERSHIP
NARES PARTNERSHIP (agriculture)
VALUE-ADDED INFORMATION
USER (FARMER)
Develop the capacity to use and effectively demand agromet advisories
Climate information services from the NMHS are now supply driven and there is full understanding of its usability in action
Information Product
Information service
Delivery System
Farmers
Farmer receives information what farmer wants
Collective information on weather farm management advisory are provided.
Climate information services to transform climate risk agriculture to climate smart agriculture.
INDIA METEOROLOGICAL DEPARTMENT



Multichannel Dissemination
Forecast from IMD, New Delhi
State Met Centres
Agromet Advisory Bulletin by AMFUs
SMS on mobile
Personal Contact
State Agril. Dept.
Website
Television
Radio
Krishi Vigyan Kendra
News Paper
Farmer
Mausam Khabar Kisan Samachar
Farmers feedback Through mobile
Farmer's Registration for SMS advisory through Ministry of Agriculture
Advisory for wheat: Present weather is conducive for black, brown or yellow rust appears. Spraying of crops with Dithane M 45 @ 2.5 g per litre of water should be done.
Advisory for maize: As the crop is at silking stage, present weather favours insects on the silks. Go for dusting of Chlorpyriphos @ 2-3 g per cob during evening time.
INDIA METEOROLOGICAL DEPARTMENT



Further improvement of Services based on the outcome of the meeting.

- ❖ We will be looking forward useful discussion on the following subjects and inclusion of the related information further to improve the climate services in India
- ❖ Existing/proposed Climate service Information system and Climate Service tools in South & South Asia along with cross-regional experiences with participatory agricultural climate services projects in sub-Saharan Africa.
- ❖ The success stories of Climate Services in both South & South Asia & sub-Saharan Africa
- ❖ Effective use of Sub-seasonal to seasonal (SOS) in climate services, SOS forecast information incl. model evaluation information, climate projections, climate variability analyses, capacity development plan, customised CST
- ❖ Mechanism for regional cooperation through collaboration in exchange and capacity building of climate service

INDIA METEOROLOGICAL DEPARTMENT


Thanks for the
attention.

Appendix C4: Farmer climate field schools in Indonesia: Strengths and weaknesses

BMKG

FARMER CLIMATE FIELD SCHOOLS IN INDONESIA
Strengths and Weakness

INDRA GUSTARI, & MARJUKI
Center for Applied Climate Information Services

Presented on **the CSRD Technical Exchange on Participatory Approaches to Agricultural Climate Services Development and Extension in South and South East Asia.**

Sep 17-19, 2017 in Dhaka, Bangladesh.

Agency for Meteorology Climatology and Geophysics (BMKG), Indonesia

INDONESIA

- Archipelagic country ~ 17,504 islands (10,000 small islands), right at the equatorial line;
- 4 M-km² width of ocean and 2 M-km² land, 6,000 km distance from east to west, and 80,000 km of coastal length;
- Flanked by 2 oceans (India and Pacific) and 2 continents (Australia and Asia);
- Exposed by 3 types of rain, 2 extreme weather on the east and west, more than 340 seasonal variation zone.

Natural Disasters

- Indonesia is one of the most vulnerable country for natural disasters.
- On average, 350 disasters occurred in each province during 2010-2017 period.
- More than 50 % of the disasters were hydro-meteorological disasters
- 31.6% Flood; 26.3% small scale tornado; 21% Landslide.

Accurate and multi- timescale forecast is needed for disaster mitigation plan

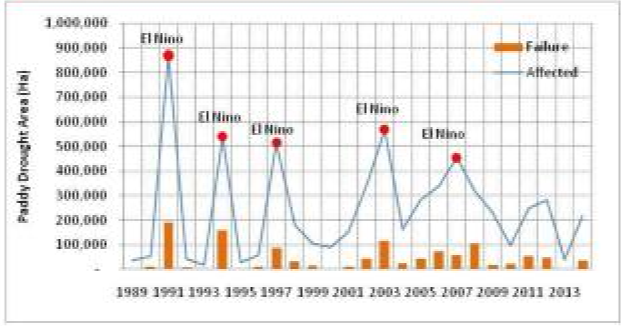
RICE FIELDS AREA

Irrigated Area (82.16%)
Non Irrigated Area (17.84%)

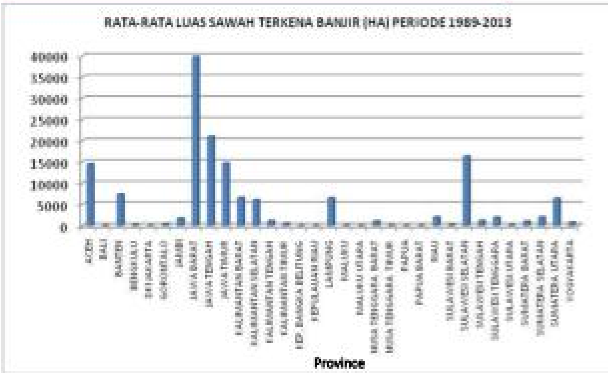
Rice fields in Indonesia are mostly located in Java Island (40%)

Source : IAARD, 2015

RICE AREA AFFECTED BY DROUGHT (1989-2014)

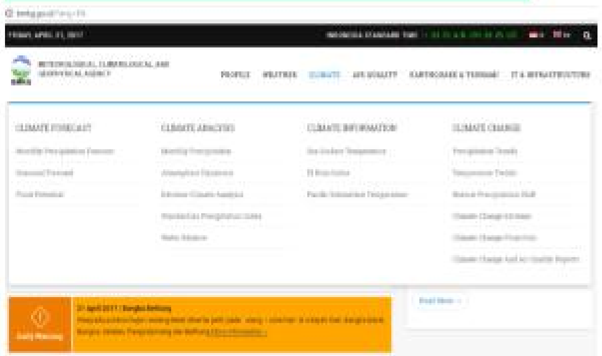


RICE FIELD AFFECTED BY INUNDATION (1989-2013)



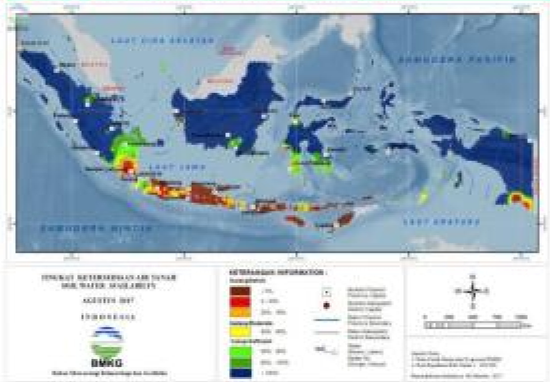
CLIMATE INFORMATION PRODUCTS

BMKG WEBSITE

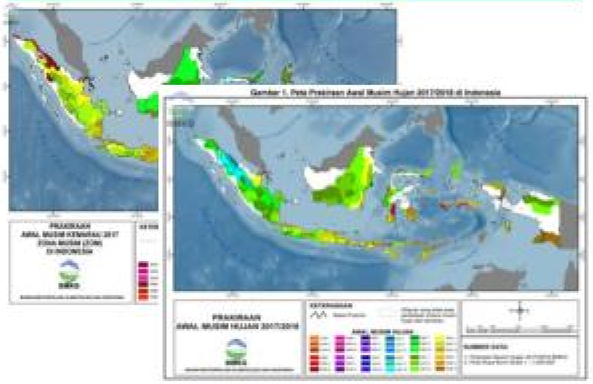


Monitoring of Consecutive No Raindays

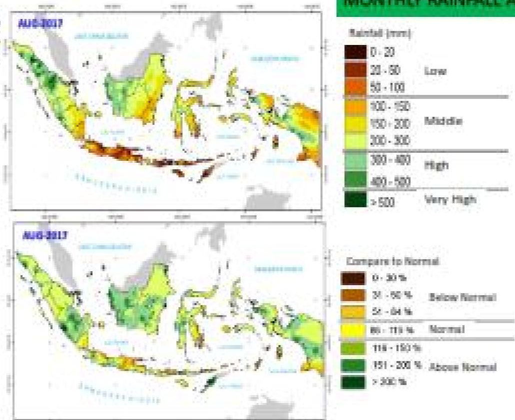
GROUND WATER AVAILABILITY

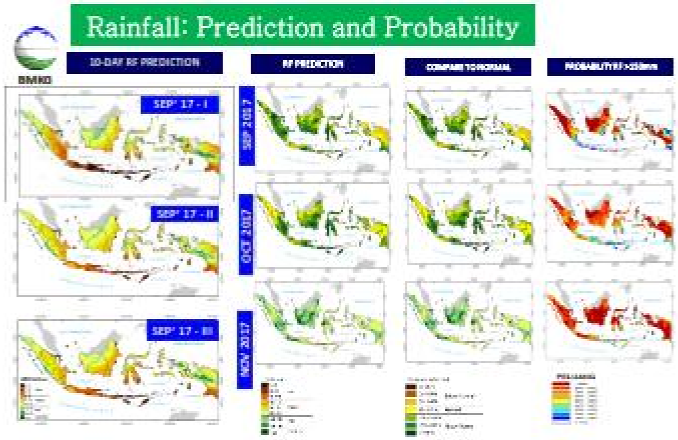


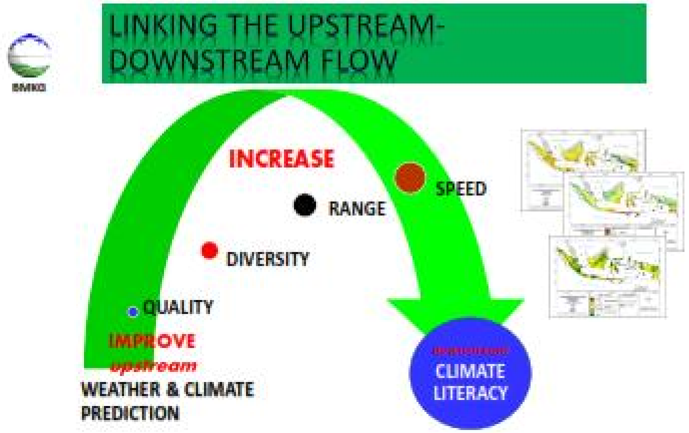
DRY/WET SEASON ONSET PREDICTION

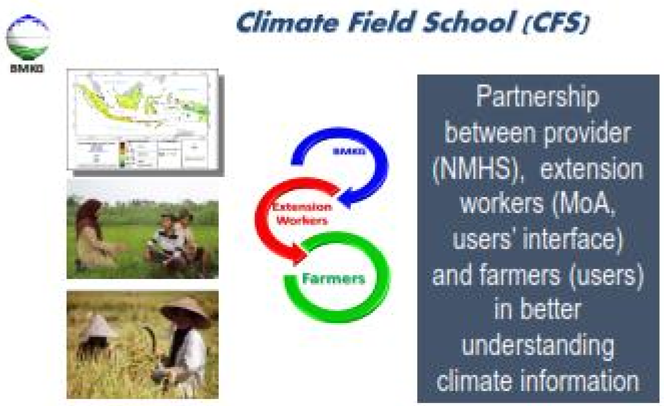


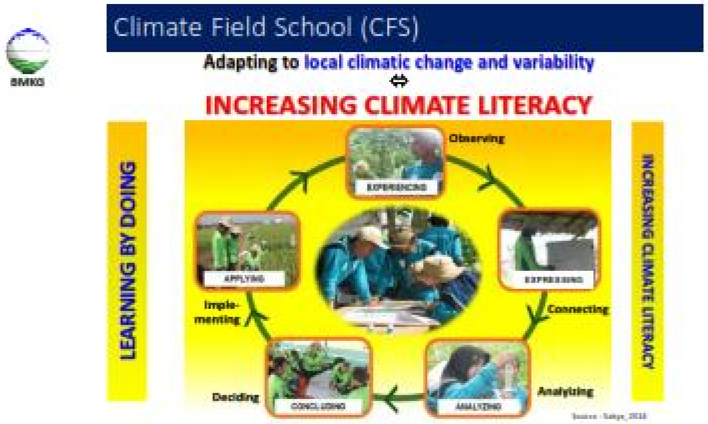
MONTHLY RAINFALL ANALYSIS




Rainfall: Prediction and Probability
BMKG
10-DAY RF PREDICTION
RF PREDICTION
SEP' 17 - I
SEP' 17 - II
SEP' 17 - III
SEP 2017
OCT 2017
NOV 2017

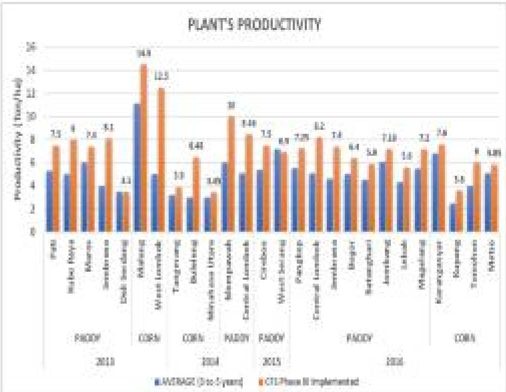

LINKING THE UPSTREAM-DOWNSTREAM FLOW
BMKG
INCREASE
SPEED
RANGE
DIVERSITY
QUALITY
IMPROVE
upstream
WEATHER & CLIMATE PREDICTION
CLIMATE LITERACY


Climate Field School (CFS)
BMKG
Extension Workers
Farmers
Partnership between provider (NMHS), extension workers (MoA, users' interface) and farmers (users) in better understanding climate information

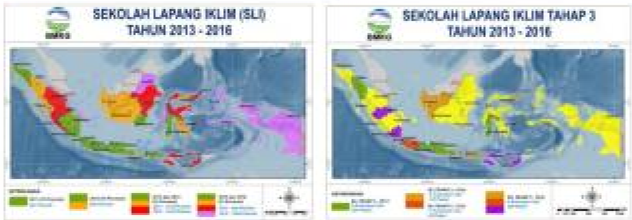

Climate Field School (CFS)
BMKG
Adapting to local climatic change and variability
⇔
INCREASING CLIMATE LITERACY
LEARNING BY DOING
INCREASING CLIMATE LITERACY
Observing
Connecting
Analyzing
Deciding
Imple-menting

3 Levels of CFS Activities

CFS LEVEL 3-LESSON LEARNT FROM PRACTICING IN THE FIELD



CFS Participants (2011 – 2016)



SLI	2011	2012	2013	2014	2015	2016
Extension workers	642	840	1076	1120	750	675
Farmers	-	-	200	125	50	325
Total	642	840	1276	1245	800	1000
Total (2011 – 2016)				5803		

TOT COURSE ON CFS FOR ASIA PACIFIC

"Training of Trainers of Climate Field School for Asia Pacific" August 26 – 29, 2014; 18 participants (8 countries).

"Training of Trainers Course on Climate Field School for Asia Pacific", August 25 – 28, 2015. 17 participants (7 countries).

Training of Trainers for Climate Field School Asia Pacific

Strengths and Weakness (Challenges)

- Climate literacy and adaptation in Agriculture Sector;
- Increase the production (increase harvesting up to 30 %);
- Climate Outlook Accuracy;
- Scaling up;
- Involve the local government.

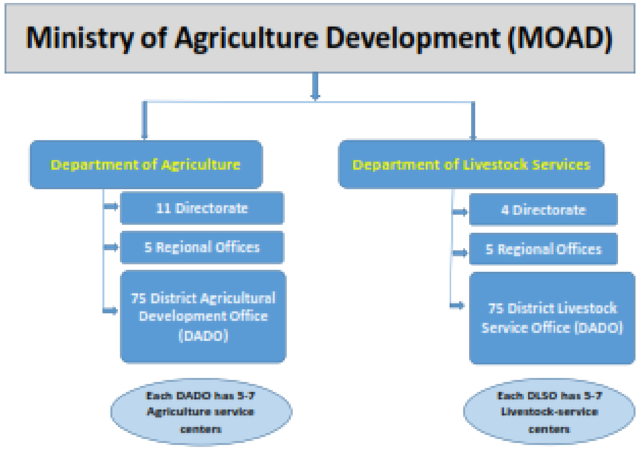
Concluding Remarks

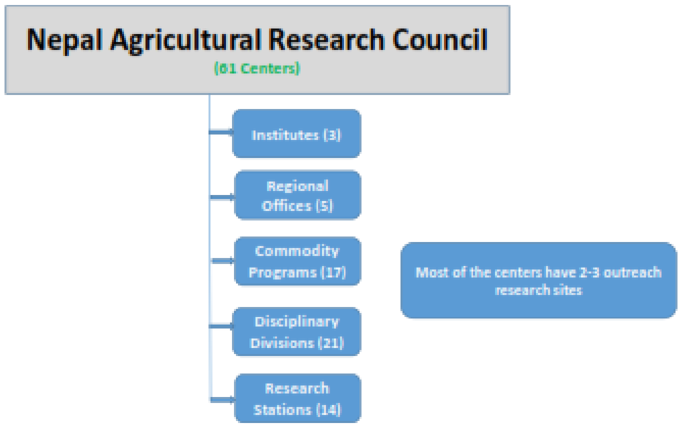
1. Provision of climate information comes with a good coordination with relevant agencies, improve the quality and equitable dissemination;
2. (Small) farmers are **vulnerable and directly impacted** by unavoidably **Climate Change** (and its Variability);
3. Increasing climate literacy is one of adaptation step to strengthen local farming that shift **traditional farming** into **observational (scientific) based farming**;
4. **Climate Fields School (CFS)** is one of successful CC adaptation techniques to facilitate the increase of **climate literacy** and **proven to increase harvesting up to 30 %**

Appendix C5. Climate services and farmer participatory extension in Nepal

Climate services and farmer participatory extension in Nepal

Deepak Bhandari, Ph.D.
Agricultural Environment Research Division
Nepal Agricultural Research Council
Kathmandu, Nepal





Objectives of the Recent Agro-climate Services

- Make timely available agro climate/ weather information in favor of farmers and other stakeholders
- Use of Early Warning System (EWS) in agricultural sectors to reduce production risks due to climate/weather change
- Easy assess of adaptive measures against impacts of climate change and latest agri. technology for extension workers and farmers
- Development of infrastructures, manpower and awareness for durable Agro-climate services

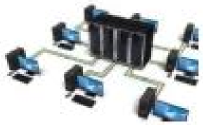
Districts covered by agro-climate services

Components of agro climate services

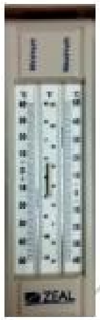
- Infra structure development
- Development of information products
- Dissemination of products (Agri. Information)
- Capacity building
- Weather index based crop insurance

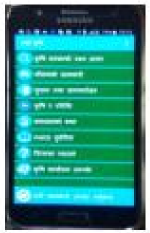
Infrastructure development

Development of web Portal and mobile application	• Mobile app is functioning and web portal is on the way
Acquisition/migration of data and installation on portal	• More than 3400 historical hard copy data of agriculture and livestock have been digitized



Infrastructure development Contd.





Android Mobile

1500 KISAN SIM Received in June 2016

Infrastructure Development Contd.

Farmers partnership

Distribution of Infrastructures (Mobile Phone, Rain gauge, Thermometer and Kisan SIM Card)

District	Region	DADO		DLSO		Total	
		Target	Distribution	Target	Distribution	Target	Distribution
Sankhuwasabha	Mountain	12	12	8	8	20	20
Mustang	Mountain	12	12	8	8	20	20
Jumla	Mountain	12	0	8	0	20	0
Darchula	Mountain	12	12	8	8	20	20
Dolakha	Mountain	12	0	8	0	20	0
Districts in Mountain Region		60	36	40	24	100	60
Dhading	Hill	26	26	17	17	43	43
Kavre	Hill	26	26	17	17	43	43
Ilam	Hill	26	0	17	0	43	0
Dhankuta	Hill	26	26	17	17	43	43
Kaski	Hill	26	26	17	17	43	43
Palpa	Hill	26	26	17	17	43	43
Surkhet	Hill	26	26	17	17	43	43
Rukum	Hill	26	0	17	0	43	0
Districts in Hill Region		208	156	136	102	344	258
Chitwan	Terai	38	38	25	25	63	63
Kailali	Terai	38	38	25	25	63	63
Rupandehi	Terai	38	38	25	25	63	63
Bara	Terai	38	38	25	25	63	63
Mahottari	Terai	38	0	25	0	63	0
Dang	Terai	38	38	25	25	63	63
Banke	Terai	38	38	25	25	63	63
Jhapa	Terai	38	38	25	25	63	63
Morang	Terai	38	38	25	25	63	63
Sunsari	Terai	38	38	25	25	63	63
Saptari	Terai	38	0	25	0	63	0
Siraha	Terai	38	0	25	0	63	0
Districts in Terai Region		456	342	300	225	756	567
Districts in All Region		724	534	476	351	1200	885

Knowledge enriched products development and distribution

Development of knowledge enriched products for decision support tools

- Development of Cultivation Practices and Crop Calendar of major Crops, Livestock and Fisheries
- Climate vulnerable area mapping of Pilot districts (18 districts)
- Frequently Asked Question and Answer (FAQs) on Cereal crops, Vegetables, Fruits, Fisheries, Livestock and Poultry
- The products uploaded/updated in Portal, Hamro Krishi mobile App and websites

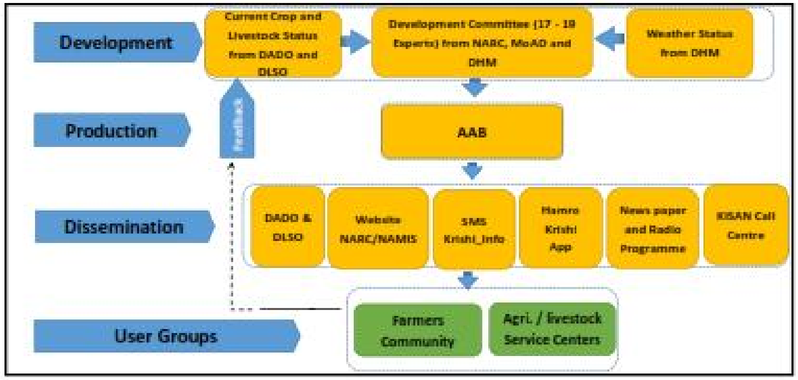
Agro Advisory Bulletin (AAB)

- An technical bulletin prepared by a team of experts to support farmers in adoption of advanced agricultural technology and to cope with unfavorable weather and agricultural circumstances
- Every Friday for 25 districts
- At Agriculture Environment Research Division, NARC
- Major stakeholders for AAB preparation:
  - Nepal Agricultural Research Council (NARC)
  - Ministry of Agriculture Development (MOAD), Nepal
  - Department of Hydrology and Meteorology (DHM)

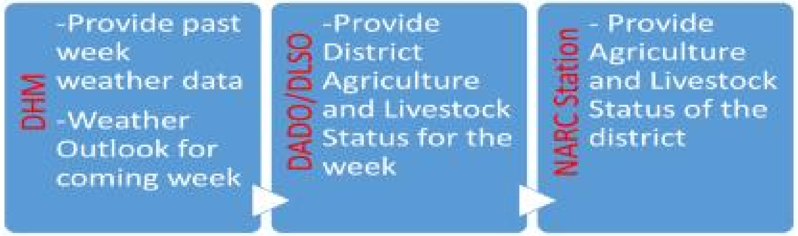
Areas of strong linkage between three major stakeholders

- Establishment of WOGRAM (Working Groups for Agricultural Meteorology)
  - NARC, MOAD, DHM
  - Meeting every month
- In AAB preparation
- In field visit
- SMS training etc

Process of developing AAB



Process of Information (inputs) collection



AAB Expert Team Meeting

Dissemination of AAB

AAB Preparation training to DADO/DLSO officers

AAB Expert Team, farmers and extension workers field visit

Dissemination of the products

Kisan Call center (KCC)

Established direct communication linkage with farmers at center, district (DADO/ DLSO) and at NARC center

- One Kisan Call Centre has been established at center
- Experts response the queries instantly three times a week
- The KCC has two-way communication between farmers and experts
- District level: KCC has been established at 25 districts (DADO/DLSO)

KISAN Call Centre Contd.

Expert responding to the farmers queries

Expert supports to the Kisan Call Centre

Mobile application: Hamro Krishi

Development of mobile applications

- A climate smart mobile application Hamro Krishi developed and regularly updated
- The app is available in both Google play store and www.namis.gov.np
- About 21,000 downloads or transformation via Bluetooth and USB cable

Status of download of 'Hamro Krishi' app

Source of download	Approximate Download (numbers)
www.namis.gov.np	12,315
Google Play store	5,000
Direct Transfer via Bluetooth	3,500
Total	20,815

SMS Services

- SMS based on AAB is regularly dispatched
- > 25000 farmers and stakeholders getting SMS regularly
- 5 SMSs every week having urgent and worthy information
- All the networked farmers are Nepal Telecom subscribers. Another SMS provider NCELL will also be included very soon

SMS services Contd.

Publications on agro-met services for farmers

Media Partnership Program

FM/Radio Program

- Radio program: 24 radios covering 18 districts
- Everyday morning/evening for 15-30 minutes
- Broadcast:
- Technical information of AAB
- Effects of climate change in agriculture and livestock
- Operation/production methods of Kisan call center and AAB
- AAB is in local language for Mid and Far Western Districts

Media Partnership Program Contd.

TV Program

- Regular TV program
- Activities, services and other programs are disseminated through NTV plus, Mountain TV and Krishi TV
- Video Jingle on Hamro Krishi app is being broadcasted

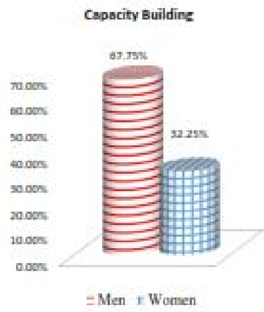
Capacity Building

Training for technical staff and farmers

- **Short-term Trainings**
  - Central level: Use of Agro-climate information, Crop modeling, Agro-weather data analysis, Agriculture disaster risk management etc
  - District level: Climate change adaptation training, Focal person and JT/JTA training etc
  - Farmers' Level: Roving seminars on use of climate service products/infrastructures use

Capacity building contd.

Training/Capacity Building	Total Participant		
	Man	Woman	Total
Workshop	1,023	252	1,275
Technical Training	326	81	407
Roving Seminar for farmers	4,714	2,590	7,304
Total	6,211	2,957	9,168



Capacity Building contd: District level focal person trainings

Capacity Building contd.: (Farmers Level)

Roving seminar at Farmers level- 15 Districts

Capacity Building Contd: Roving seminar at farmer's field

Insurance

Exploratory research to develop financial risk transfer instruments for the agriculture sector (agricultural insurance)

- Weather index based crop insurance

Brief description of tentative Beneficiaries

Beneficiaries Analysis (Direct) — Unit number of Population

Items	Unit	Direct Beneficiaries: Target	Achievement	Achievement %	
Roving Seminar (50x175)	Nos.	8750	6300	72%	50 participants in each RSx7RS in each district x for 25 districts
Agro-met advisory bulletin (AAB) (25x1250x25)	Nos.	781250	781250	100%	25 district x 1250 farmers group/cooperatives x 25 family members
Hamro_krishi app (25x1250)	Nos.	31250	18331	59%	25 district x 1250 farmers group/cooperatives
Krishi Info SMS service (100000)	Nos.	100000	25000	25%	Targeted
Kisan Call Centre (KCC) (1250x25)	Nos.	31250	22500	72%	25 district x 1250 farmers group/cooperatives
Mobile Phone, Raingauge & Thermometer Distribution (1250x25)	Nos.	31250	22125	71%	25 district x 1250 farmers group/cooperatives
SIM Card Distribution (5500)	Nos.	5500	1800	33%	Targeted
FM/Radio Program (25x1250x25)	Nos.	31250	18750	60%	25 district x 1250 farmers group/cooperatives x 25 family members

Farmers preferred information and needs

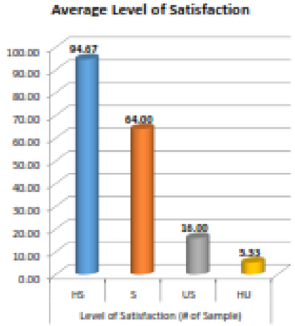
- Rainfall, Typhoon, Hailstorms and flood
  - Harvesting, Planting, irrigation
- Disease Problems in livestock
- Pests problems in crops
  - Insects, Diseases
- Availability of seed, fertilizers, variety, technology and subsidies
- More frequent SMS services
- Program through FM in local languages

Feedback mechanism in Nepal

- Not much effective
- Kisan call center
- Field visit and Roving seminar
- Survey
- Eager to know the feed back mechanisms of other countries

Feedback of agro-climate service through a survey

S. No	Tools	Level of Satisfaction (# Sample)				Total
		HS	S	US	HU	
1	Hamro Krishi App	68	86	18	8	180
2	AAB	86	68	18	8	180
3	Krishi_Info (SMS)	130	38	12	-	180
	Average	94.7	64.0	16.0	5.3	180
	%	52.6	35.6	8.9	3.0	100



For detail please click here

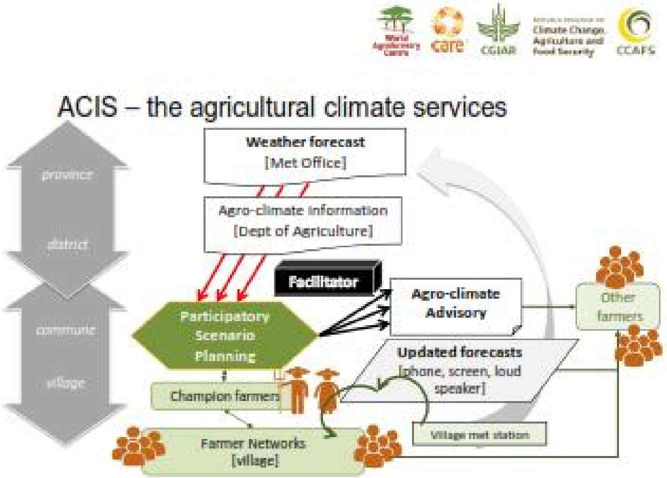
Challenges in successful agro-climate services in Nepal

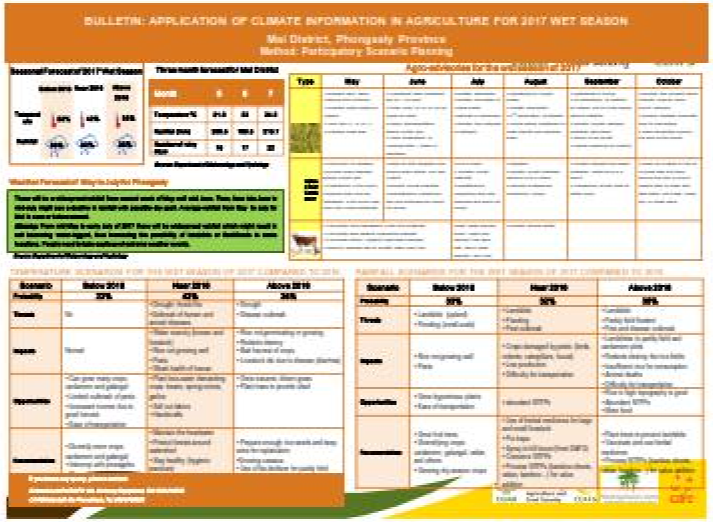
- Small land holding, low commercial agriculture, diverse crops
- Diverse agro-ecological condition (100 masl to 8888 masl)
- Enormous micro climate
- No sophisticated equipment for confirm weather forecast
- Short term weather forecast (3days and 7 days)
- Quality of technical inputs: less trained focal person/farmers
- Strong two way communication with farmers/group for worthy feed back

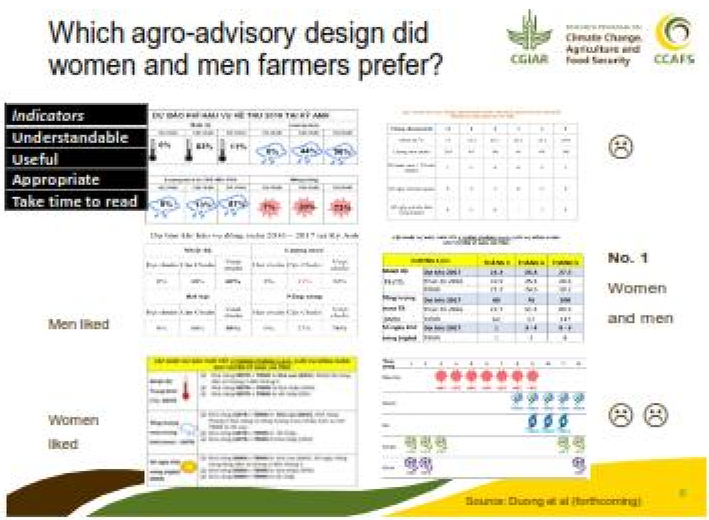
Challenges in successful agro-climate services in Nepal Contd.

- Federal structures: Long term plan of agro-climate services
- Durable structures/linkage between DHM, Research and Extension services along with local body
- Strong networking of extension services with sufficient manpower at local level

Appendix C6: Talking toolkits and Participatory Scenario Planning (PSP) - methods for communicating agricultural climate services in Vietnam + Lao PDR, Cambodia







How farmers get climate service information

CS information	Pros	Cons	Project comments
Forecasts (Gvmnt/online)	Farmers want (willing to pay for) them	Difficult to get hold of Quality Different sources	Requires facilitator: farmers, extension meteorologists meet
PSP-workshops	Social learning opportunities	Often same advice for different scenarios	Good to combine with other project (loan groups, CSA, rural dev)
Bulletin (board/ screen)	Opens up for discussion Screens can be updated faster	Difficult to 'please all' Takes time to read	Place in 'good spots', e.g. market, school
Bulletin (printed)	Can read/reread when have time Can be translated	Costly to update	Potential for website/phone message
Loudspeaker	Helpful for illiterate	Not all hear the message	Help prepare message
Podcast	Appreciated by extension Can watch many	Time-consuming to prepare Difficult to maintain	Potential for large areas with internet

Key institutional arrangements and cooperation (1/2)

- **Stakeholder engagements** with farmers/village leaders, local-provincial forecast providers and agriculture extension, mass organisations, farmer organisations
  - to understand farmers' needs; execute/participate in capacity building
  - to understand and gradually address capacity of government staff
  - Parallel meetings/policy dialogue at national level (if needed)

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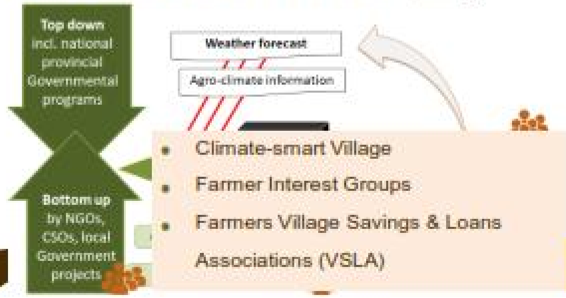
Key institutional arrangements and cooperation (2/2)

- **Complement ongoing rural development projects**
  - to ensure institutionalization of farmer networks, scaling



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Challenges involving farmers participation and some approaches to address them

Challenges	How we addressed them
Getting the weather information that farmers need	• Facilitators are important • Let forecasters meet farmers • Understand and advocate farmers' needs to higher levels • Bring evidence of how information helps (resource use efficiency, losses availed)
Quality/access to downscaled national weather forecasts	• Compare forecast sources (see InfoBrief) • Train Youth Union/extension/ Farmer Champions on using Windyty • Post on Facebook
Literacy : icons versus words	• Let women and men farmers use their words/sounds to illustrate a weather situation; test on others
Keeping the momentum	• Do something quickly with a clear result while other things take more time, e.g. met station/rain gauges, event,

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Reference material

- Video on Village Savings & Loans Associations (VSLA) : https://www.youtube.com/watch?v=qbUNixyAj_4&feature=youtu.be
- The Talking Toolkit : Simelton et al. 2013
- Comparing different forecasts Roy et al. 2017
- See CCAFS SEA for numerous material
- Sign up to My Loi CSV Newsletter ! Contact Tuan d.minhtuan@cgiar.org

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- **Contacts**

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Tam Thi Le L.Tam@cgiar.org

CARE Hieu Xuan Le LeXuan.Hieu@careint.org

Erik Madsen emadsen@care.dk

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SPARE SLIDES

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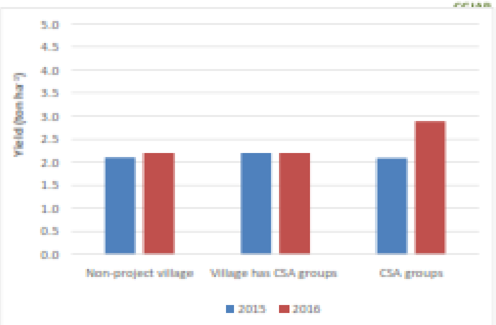
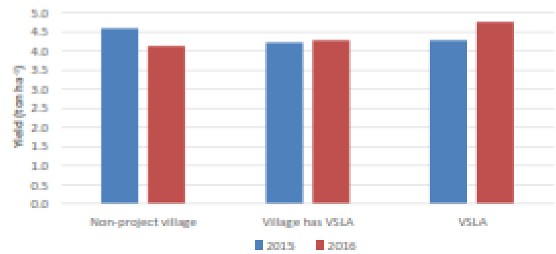


Rice yields for the summer-autumn seasons 2015 and 2016 in non-project (n=9) and project (n=1) villages, and average yield of 4 CSA groups in the project village, in Ky Son commune, Ha Tinh province

16



Rice yields for summer-autumn seasons 2015 and 2016 in non-project (n=13) and project (n= 23) villages with VSLA, and average yields for the 25 VSLA groups in the VSLA villages in Dien Bien district, Dien Bien province

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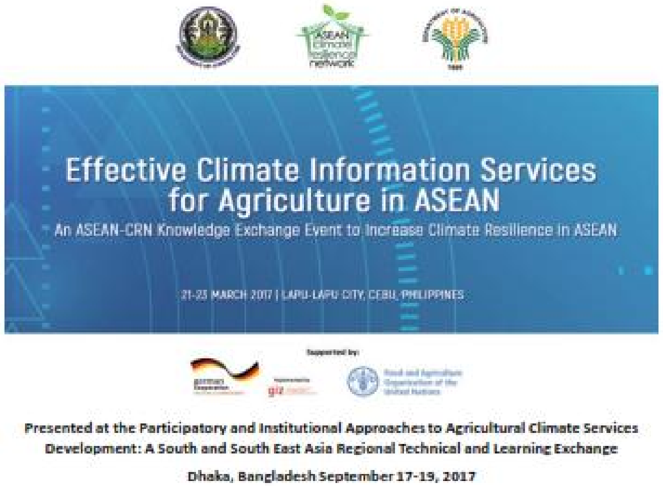
Appendix C7: Effective Climate information Services for Agriculture in ASEAN 7. Effective Climate information Services for Agriculture in ASEAN



Effective Climate Information Services for Agriculture in ASEAN

An ASEAN-CRN Knowledge Exchange Event to Increase Climate Resilience in ASEAN

Key results: areas for regional collaboration

	ASEAN/ Regional level	KH	ID	LA	MM	PH	TH	VN
KH			Seasonal development of cropping calendar				Agro-climate information for agricultural water management	
ID						Crop insurance	Crop modelling (training and application)	
LA			Utilization of Android mobile applications for agricultural use		Capacity building activities from experts on hydro-meteorology	Trainings and capacity building activities from PAGASA	Sharing of lessons and experiences on the linkages with agencies with a single command system	

Effective Climate Information Services for Agriculture in ASEAN

An ASEAN-CRN Knowledge Exchange Event to Increase Climate Resilience in ASEAN

Key results: areas for regional collaboration

	ASEAN/ Regional level	KH	ID	LA	MM	PH	TH	VN
MM				Strengthening capacity of hydro-meteorology staff through trainings		Technical assistance from PAGASA to strengthen capacities of hydro-meteorology staff through trainings		Upgrading of mobile services for agriculture use
PH	World Meteorological Organization Regional Climate Centers (WMO-RCCs) Climate Monitoring – ENSO, IOD, monsoon, etc. Standardization of the language of disaster (AHA Center) Data warehouse with ASMC ASEAN Regional Risk Insurance Facility (GCF proposal)		Crop pest fore-casting					

Effective Climate Information Services for Agriculture in ASEAN

An ASEAN-CRN Knowledge Exchange Event to Increase Climate Resilience in ASEAN

Key results: areas for regional collaboration

	ASEAN/ Regional level	KH	ID	LA	MM	PH	TH	VN
TH	ASEAN CIS Knowledge and Expert Advisory Hub Narrowing the gap between the CIS data rich and poor AMS		Crop pest forecasting			Training on agro-meteorology center		
VN						Training on agro-meteorology center Collaborate with PH and TH on a training program for agriculture extension workers on the provincial level to interpret CIS for agro-advisory development		

Effective Climate Information Services for Agriculture in ASEAN

An ASEAN-CRN Knowledge Exchange Event to Increase Climate Resilience in ASEAN

Key results: important opportunities & challenges

- Difficult to provide actionable information (often only climate info)
- Institutional arrangements challenging (Met and Ag separate)
- Advisory often not crop specific an difficult to use
- Lack of capacities (downscaling, seasonal forecast, etc.)
- Often scarce data for good quality CIS products

Effective Climate Information Services for Agriculture in ASEAN

An ASEAN-CRN Knowledge Exchange Event to Increase Climate Resilience in ASEAN

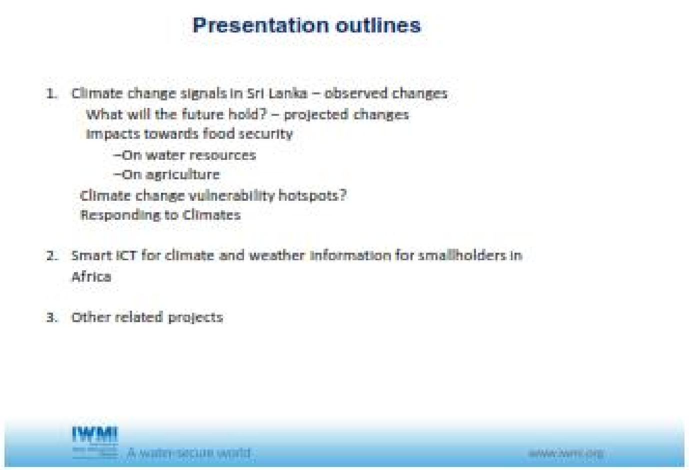
Key results: important opportunities & challenges

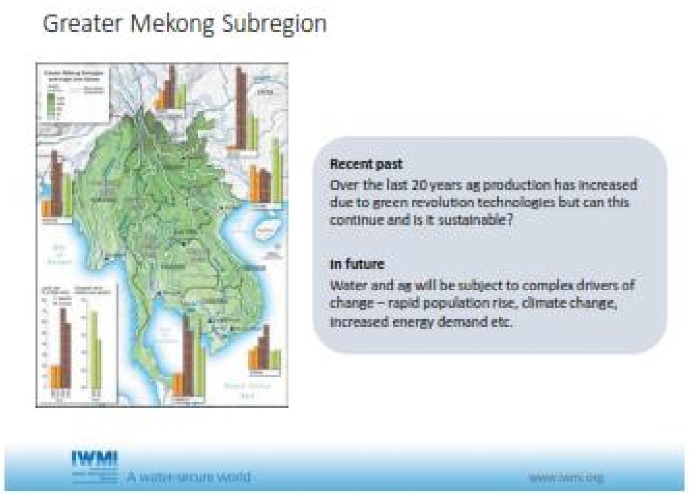
- Good pilots but challenges to get to scale (field schools, etc.)
- Communication formats not always appropriate, multiple channels needed
- ICT solutions are becoming increasingly important and promising
- Big potential for crowd sourcing and big data approaches
- PPP role? PPP pilots

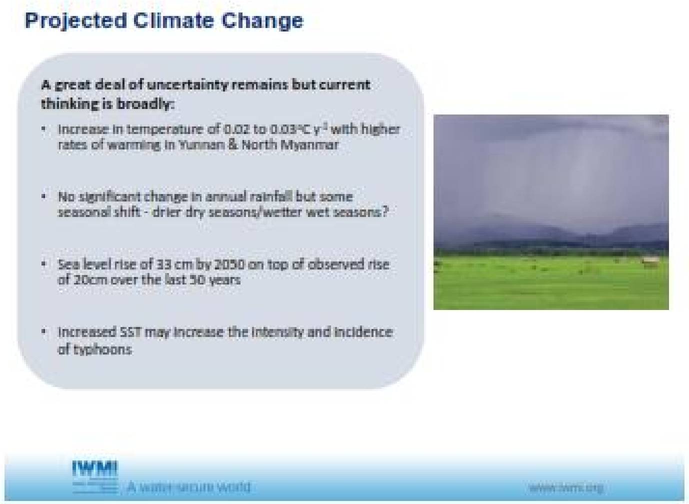
Maraming Salamat! Terimah Kasih!
Danke Schon!

Imelda.Bacudo@giz.de

Appendix C8: Farmer participation and communication in climate services and Index-based flood insurance initiatives in India, Bangladesh, and Sri Lanka







Sources

- Interviews and e-mail correspondence with
  - -Government officials
  - -International experts

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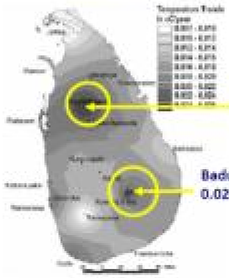
- Over 75 national and global climate change studies
- IWMI climate change vulnerability mapping
- Preliminary review of recent floods

Observed Changes

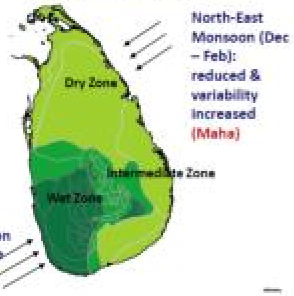
Temperature

Warming trends (°C/year)
1961-2000



Rainfall

No significant change in Mean Annual Rainfall Amount



Projected Changes (1)

Temperature

- General consensus: increasingly warmer in 21st century
- IPCC: stronger warming than the global mean in South Asia
- Projected magnitude of change: differs from study to study

Source	Model	Scenario	Base Year	Change at end 21st century
Cruz et al. 2007	AOGCM	A1F1, B1	1961-1990	+ 2.93-5.44 °C
Kumar et al. 2006; Islam and Rehman 2004	Regional Climate Model-RCM	A2, B2	1961-1990	+ 2-4 °C
Basnayake et al. 2004; De Silva 2006	Statistical Downscaling of GCMs	A1F1, B1, A2, B2	1961-1990	+ 0.9-3 °C

Projected Changes (2)

Rainfall - Projections for this century confusing and contradictory!

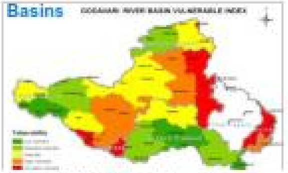
Mean Annual Rainfall

- Higher Mean Annual Rainfall
  - Higher South-West Monsoon R/F; Higher North-East Monsoon R/F — Kumar et al 2006; Islam and Rehman 2004; Basnayake et al. 2004; Basnayake and Vithanage 2004 a
  - Higher South-West Monson R/F; Lower North-East Monson R/F — Cruz et al. 2007; De Silva 2006; Basnayake and Vithanage 2004b
- Lower Mean Annual Rainfall
  - Lower South-West Monsoon R/F; Lower North-East Monsoon R/F — Ashfaq et al. 2009; Basnayake et al. 2004

Increased Variability → Increased Floods & Droughts

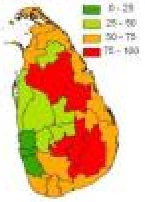
MAPPING VULNERABILITY TO CLIMATE CHANGE

Basins



Composite Vulnerability – in terms of exposure to CC, sensitivity and adaptive capacity

Countries



Globally

Socio-economic Vulnerability – in terms of diversity of employment, income and crops

Responding to Climate Changes

Adaptation

Crops

- Development of heat/salt/pest resistant short term crop varieties by 6 research institutes. eg. Rice Research and Development Institute (RRDI)
- Crop diversification, change of planting time and location

Climate Tools

- Predicting annual national coconut production
- Predicting seasonal water availability within the Mahaweli scheme

Water Resources

- Restoring existing tanks
- Developing sustainable groundwater
- Rainwater harvesting and storage
- Use of micro-irrigation
- Wastewater reuse
- Greater shift towards alternative energy from hydropower

Sea Level Rise

- Climate Change Adaptation Action Plan by Coast Conservation Department (CCD)

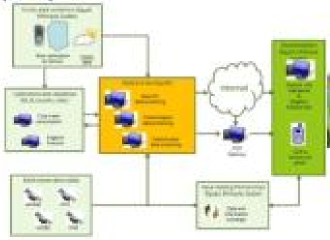
Responding to Climate Changes

Resilient Markets	Resilient Agriculture	Resilient People
✔ Reduction of food price volatility	✔ Enabling resilient and sustainable intensification	✔ Scaling up nutrition
✔ Facilitation of private investments	✔ Combating land and water degradation	✔ Focusing on rural women and youth
✔ Building better enabling environments	✔ Building climate smart agriculture	✔ Building diverse livelihoods

SMART ICT FOR WEATHER AND WATER INFORMATION AND ADVICE FOR SMALLHOLDERS IN AFRICA

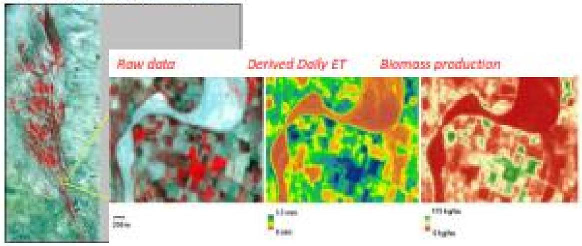
THE CONCEPT

- Develop online data base for all registered arm fields in Projects sites, around 60 fields in each site
- Use high-resolution RS data to monitor the condition of crops in a farmer's field
- Convert this info into simple regular agro-advisory delivered to farmers through SMS
- This should help optimise farm profits by providing water and other inputs at the right place, time and quantity



OUTPUTS –Crop Biomass Monitoring

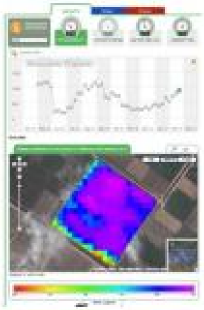
- ET, Biomass Production and related parameters are *regularly* calculated for project areas in 3 countries, based on high-resolution 20m RS images



OUTPUTS - Web Portal, and SMS Service

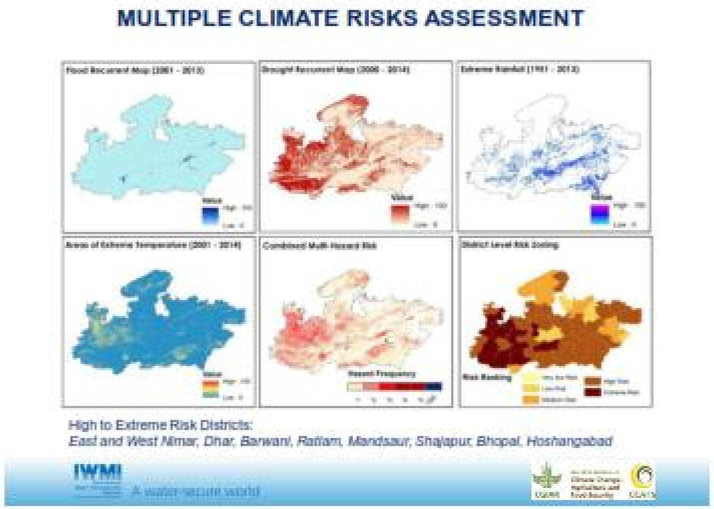
- FieldLook portal www.fieldlook.com - in English, Arabic and Oromiffaa
- Fieldlook spatial data are "translated" into simple SMSs - both qualitative and quantitative, and both on-demand and weekly "push"
- SMS services match desired information, farmer skills, and language, and consistently revised according to user feedback

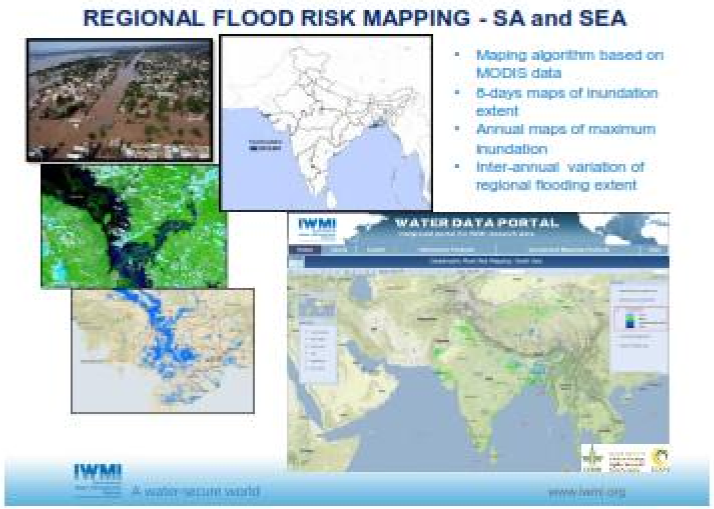
Biomass production for 21-27 March, 2013 at the field of the maize farmer Ibrahem Abdel-Halim Hassanen, Egypt

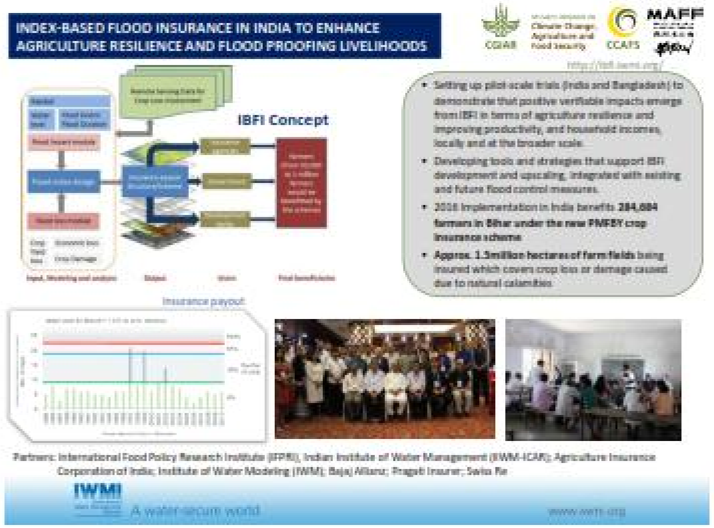


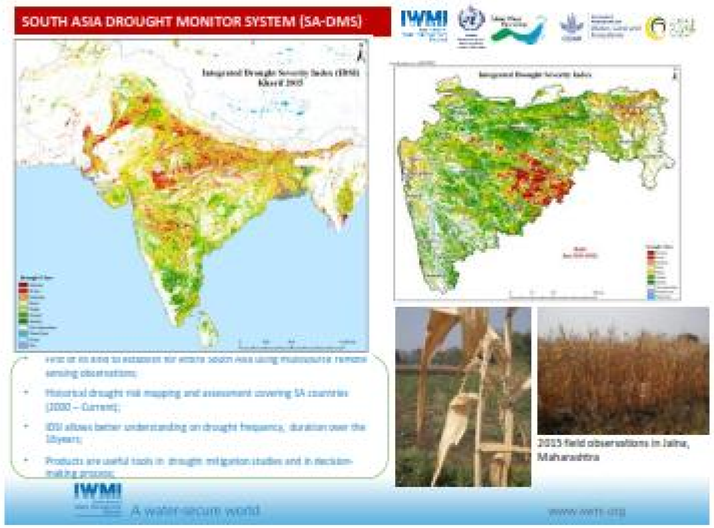
Other IWMI Projects

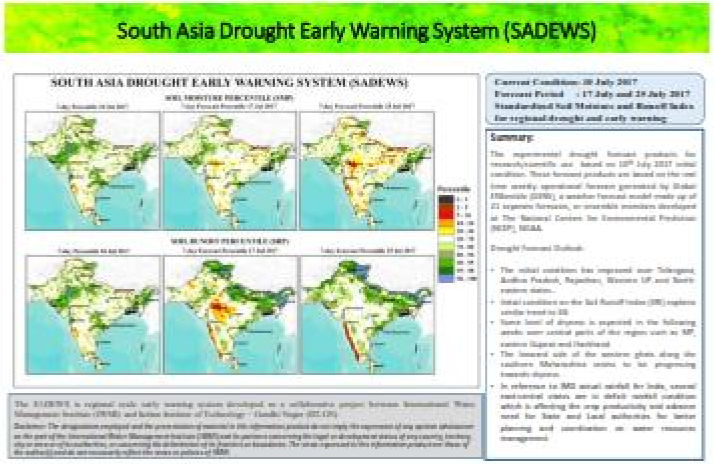
IWMI A water-secure world www.iwmi.org

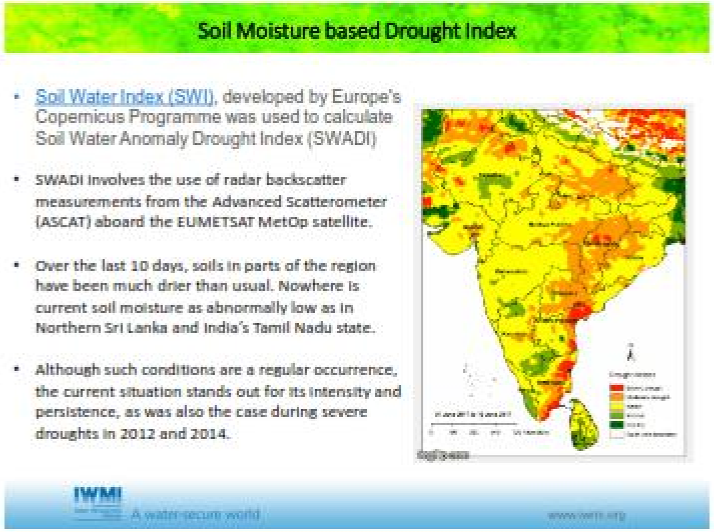

MULTIPLE CLIMATE RISKS ASSESSMENT
High to Extreme Risk Districts:
East and West Nimar, Dhar, Barwani, Ratlam, Mandsaur, Shajapur, Bhopal, Hoshangabad
IWMI
A water-secure world

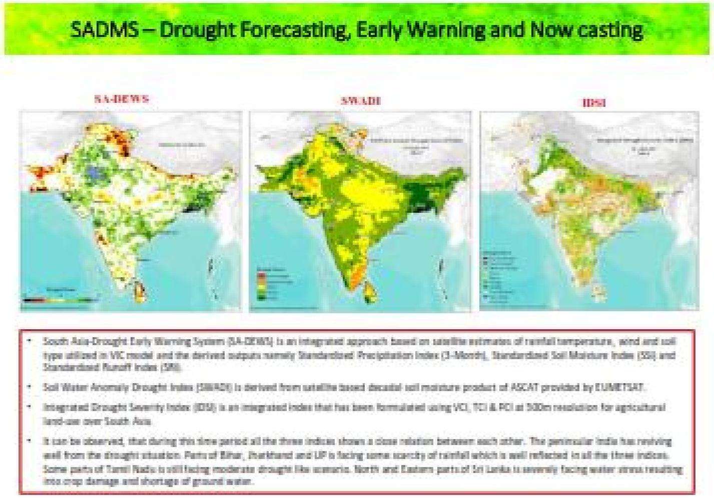

REGIONAL FLOOD RISK MAPPING - SA and SEA
Maping algorithm based on MODIS data
8-days maps of inundation extent
Annual maps of maximum inundation
Inter-annual variation of regional flooding extent
IWMI
WATER DATA PORTAL
A water-secure world
www.iwmi.org

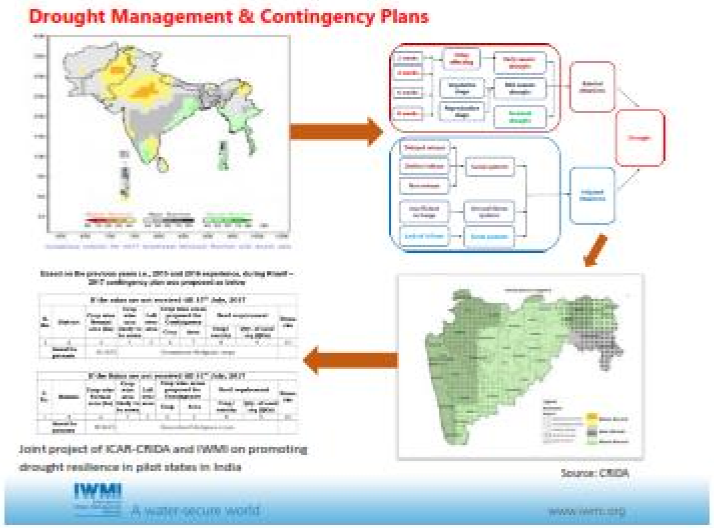

INDEX-BASED FLOOD INSURANCE IN INDIA TO ENHANCE AGRICULTURE RESILIENCE AND FLOOD PROOFING LIVELIHOODS
CGIAR
Climate Change, Agriculture and Food Security
CCAFS
MAFF
http://ibfi.iwmi.org/
IBFI Concept
Setting up pilot-scale trials (India and Bangladesh) to demonstrate that positive verifiable impacts emerge from IBFI in terms of agriculture resilience and improving productivity, and household incomes, locally and at the broader scale.
Developing tools and strategies that support IBFI development and upscaling, integrated with existing and future flood control measures.
2016 Implementation in India benefits 284,684 farmers in Bihar under the new PMFBY crop insurance scheme
Approx. 1.5million hectares of farm fields being insured which covers crop loss or damage caused due to natural calamities
Insurance payout
Partners: International Food Policy Research Institute (IFPRI); Indian Institute of Water Management (IIWM-ICAR); Agriculture Insurance Corporation of India; Institute of Water Modeling (IWM); Bajaj Allianz; Pragati Insurer; Swiss Re
IWMI
A water-secure world
www.iwmi.org

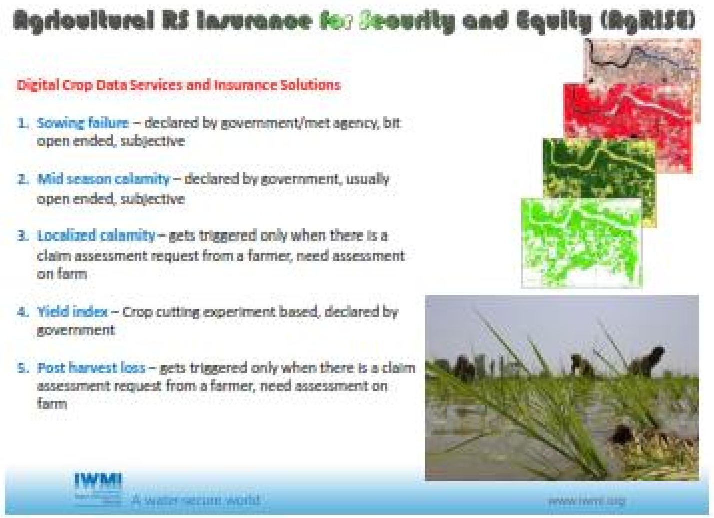

SOUTH ASIA DROUGHT MONITOR SYSTEM (SA-DMS)
IWMI
Integrated Drought Severity Index (IDSI)
First of its kind to establish for entire South Asia using multisource remote sensing observations;
Historical drought risk mapping and assessment covering SA countries (2000 – Current);
IDSI allows better understanding on drought frequency, duration over the 15years;
Products are useful tools in drought mitigation studies and in decision-making process
2015 field observations in Jalna, Maharashtra
IWMI
A water-secure world
www.iwmi.org


South Asia Drought Early Warning System (SADEWS)
SOUTH ASIA DROUGHT EARLY WARNING SYSTEM (SADEWS)
Summary:


Soil Moisture based Drought Index
• Soil Water Index (SWI), developed by Europe's Copernicus Programme was used to calculate Soil Water Anomaly Drought Index (SWADI)
• SWADI involves the use of radar backscatter measurements from the Advanced Scatterometer (ASCAT) aboard the EUMETSAT MetOp satellite.
• Over the last 10 days, soils in parts of the region have been much drier than usual. Nowhere is current soil moisture as abnormally low as in Northern Sri Lanka and India's Tamil Nadu state.
• Although such conditions are a regular occurrence, the current situation stands out for its intensity and persistence, as was also the case during severe droughts in 2012 and 2014.
IWMI
A water-secure world
www.iwmi.org

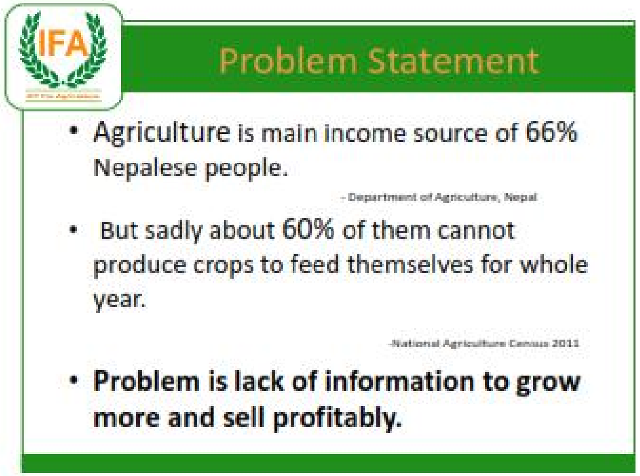

SADMS – Drought Forecasting, Early Warning and Now casting
SA-DEWS
SWADI
IDSI
• South Asia-Drought Early Warning System (SA-DEWS) is an integrated approach based on satellite estimates of rainfall temperature, wind and soil type utilized in VIC model and the derived outputs namely Standardized Precipitation Index (3-Month), Standardized Soil Moisture Index (SSI) and Standardized Runoff Index (SRI).
• Soil Water Anomaly Drought Index (SWADI) is derived from satellite based decadal soil moisture product of ASCAT provided by EUMETSAT.
• Integrated Drought Severity Index (IDSI) is an integrated index that has been formulated using VCI, TCI & PCI at 500m resolution for agricultural land-use over South Asia.
• It can be observed, that during this time period all the three indices shows a close relation between each other. The peninsular India has reviving well from the drought situation. Parts of Bihar, Jharkhand and UP is facing some scarcity of rainfall which is well reflected in all the three indices. Some parts of Tamil Nadu is still facing moderate drought like scenario. North and Eastern parts of Sri Lanka is severely facing water stress resulting into crop damage and shortage of ground water.

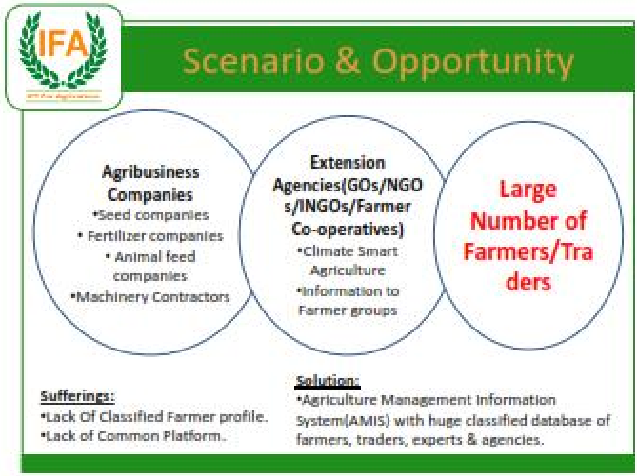

Drought Management & Contingency Plans
Joint project of ICAR-CRIDA and IWMI on promoting drought resilience in pilot states in India
Source: CRIDA
IWMI
A water-secure world
www.iwmi.org

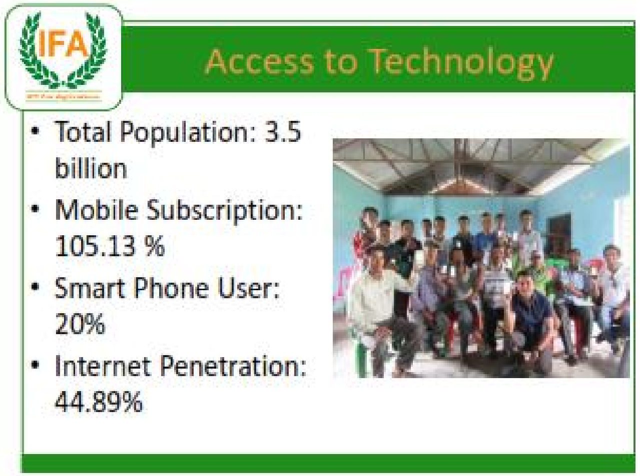

Agricultural RS Insurance for Security and Equity (AgRISE)
Digital Crop Data Services and Insurance Solutions
1. Sowing failure – declared by government/met agency, bit open ended, subjective
2. Mid season calamity – declared by government, usually open ended, subjective
3. Localized calamity – gets triggered only when there is a claim assessment request from a farmer, need assessment on farm
4. Yield index – Crop cutting experiment based, declared by government
5. Post harvest loss – gets triggered only when there is a claim assessment request from a farmer, need assessment on farm
IWMI
A water-secure world
www.iwmi.org


Thank You

Appendix C9: Experiences with ICT to communicate climate information to Farmers in Nepal.







Our Products

- **SMS Based**
- **Web Based:**
  - o www.ict4agri.com
  - o www.kinmel.ict4agri.com
- **Android Based:**
  - o *Krishi Guru*

Our Works & Services

Past Works:

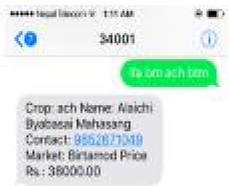
- ICIMOD: *Kavre*
- LiBIRD: *Lamjung, Kaski, Nawalparasi and Dang*

Current Works:

- iDE Nepal: *Rolpa, Surkhet, Banke, Kailali, Dadeldhura*
- ADRA Nepal: *Bara, Parsa, Rautahat and Mahottari*
- CARE: *Banepa, Sindhuli*
- ICIMOD: *Taplejung*

SMS Based Advisories

- Almost every day, subscribed farmers receive SMS advisories in Nepali language.
- Methods: **PUSH** and **PULL**
- Three types of advisories:
  - Current market price of produce in the nearby market.
  - Three day localized weather forecast info
  - Advisories related to good farming practices



AccuWeather

Krishi Guru

- For users having smart phone and access to internet.
- Main Features:
  - Weather information
  - Market price information
  - Commercial production technologies
  - On demand queries
  - Access to input supply and traders

Farmer's Use of Information

- Time management: Sow time/pre-harvest and post harvest management.
- Helps them to adapt climate change and minimize the risk of loss induced by them.
- Helps to make integrated farming plan round the year.
- Access to the desired information when and where they need.

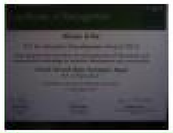
Farmers Feedback

"We female farmer group were growing vegetable seedlings. At this phase, weather forecast information was a big help. We covered the seedlings at heavy rain forecast, managed ponds to harvest water. When there was no rain in forecast, we carried water to irrigate because there is water problem at our village."
- *Jyoti Gurung, Majthana, Kaski*

Awards & Media Interest

•Most Promising Solution by USAID Nepal on Data driven farming prize, 2017

•Ncell App Camp: Agriculture Category Winner Grand Winner, 2014



•ICT for Mountain Development Award 2014

Thank You

Ishwor.stpl@gmail.com

Appendix C10: Approaches to developing better agricultural climate services in the Philippines

Presented by Hazel Arandez-Tanchuling
Rice Watch Action Network Inc

Why Localize Climate Services?

Limited Capacities and budget of our met agency

Although PAGASA has 3 regional offices (Luzon, Visayas and Mindanao), products are still done at the national level;

Local Governments are the frontline service providers in agriculture and in disaster management and response

Mandated to integrate/mainstream climate information in the local government's plans and services under the Climate Change Act

Community Resiliency Framework

Strategies

- Localized Climate Information Services
- Season-long Learning through the Climate-resiliency/Capacity Building Program
- Community Resiliency Planning and Community Organizing
- Linking Communities (to markets, LGUs, RFOs, etc)
- Livelihood Set-up and Business Planning/Incubation Support
- Insurance Promotion or Actual Coverage

Resilient Agriculture and Fishing Communities

- A **resilient agriculture** and **coastal community** is ***safe***, ***empowered***, ***productive***, ***well-informed***, ***food sufficient*** community that practices sustainable, ecological and climate-adapted farming and fishing systems, protects environment and promotes community health well-being and equipped to respond towards zero casualty, minimal damage on properties and livelihoods.

(CRFS Partners, 2015)

Climate Information Services/ Climate-resiliency Field School

Program Objectives

Provide early warning service to help farmers manage climate/weather-related risks;

Enhance farmers/fishers knowledge on climate variability and anticipatory abilities to inform livelihood decisions;

Teach, assist and link vulnerable rural groups to practice sustainable methods of farming/livelihood/ resiliency actions as individual and collectively as a community;

Generate climate information needed to inform LGU's CC action planning; Monitor climate change as it happens.

Help LGU's establish their disaster thresholds and response capacities

Training LGU staff on Localized Climate Services and the Climate-resiliency Field School (CrFS)

TOT Topics for LGUs

FIRST PART (1 week)

- Basic Meteorology (General wind circulation and Weather causing phenomena and Different Weather Systems)
- Weather Parameters and Weather Observation Instruments
- Introduction to Weather Forecasting and Weather Forecast Products
  - Typhoon Tracking
- Simple Statistics, Basic Climatology and ENSO
- Climate Prediction, CAD Products and Services
- Understanding Climate Change and Climate Projections
- Flood Forecasting and warning service
- Dam monitoring
- Introduction to Agrometeorology
- Introduction to Localization of Climate Services Thru the CRFS
- Introduction to the CrFS Module

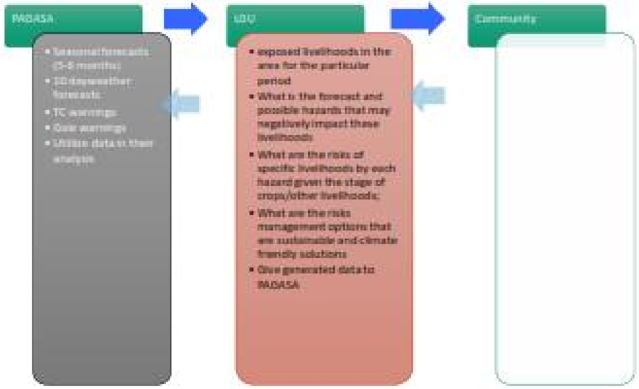
SECOND PART (1 week)

- Intro to the CRFS FRAMEWORK: Biodiversity Conservation, Sustainable Agriculture Principles Across Ecosystems
- CrFS Processes
- Site Selection
- Community Enrollment
- Calendar and Activities
- Community Baselining
- Learning Farm
  - FARM LAY-OUT for rice and corn, coconut
- Tools and Methodologies
  - Field Day
  - CRFS Evaluation
  - Community Resiliency Planning
- CrFS Reporting Requirements

CrFS Topics

Activities	Topics	Special Topics	Learning farm
Profiling of participants, Orientation	CrFS and Sustainable Agriculture as CCA		Learning Site Lay-outing
Climate-livelihoods risks analysis	Introduction to Philippine climatology and livelihoods risk management	Philippines weather/climate-based Warning Systems	Land preparation
		Study of Phenology/Morphology and livelihoods risk management tools	
	Biodiversity and Climate Change	Choose between biodiversity in the farm or coastal biodiversity (depending on the CrFS area)	Transplanting (farm)
Production of soil conditioners and botanicals	Soil Conservation and Management	Soil analysis ,KNF Different Methods of Composting,vermiculture,Crh/Bokashi, SALT (if area is upland)	AESA
	Water conservation and management	SRI (if rice), Rain Water Harvesting or Protective Measure	AESA
	Ecological pest management	EPM for focus crop or livelihood	AESA
	Hands-on training on specific livelihoods/production of specific products	Farm or Livelihood Diversification (Choose 5 livelihood options in the module/or identify additional topics not in the module) What is crop insurance and other insurance products for farmers	AESA
	Business Incubation Plan	Business Model, Financial Projections and Business Incubation Planning	
	Field Day Resiliency Planning		

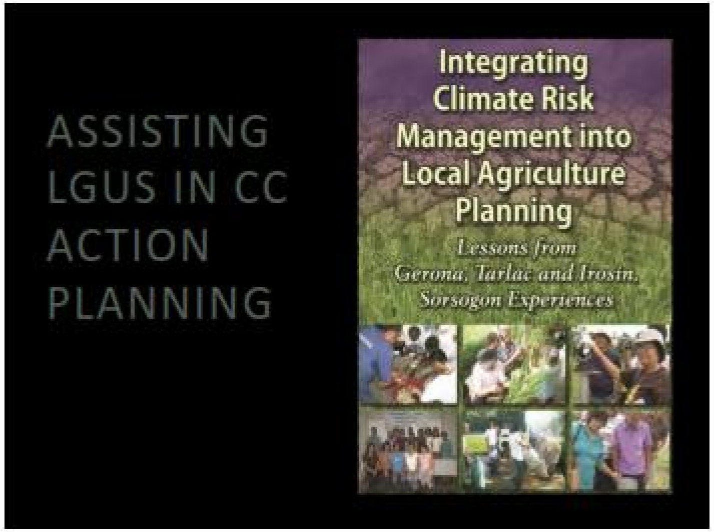
Process of Generating Farm-weather/Livelihoods and General Risk Management Advise



Actors	Roles
LGU	• Localizes Climate Services • Translates weather/climate forecasts into farm/livelihood and general related advise • Mainstreams the work in its work program and provides own budget for sustainability • Runs the learning program for its farmers/fishers • Provides the necessary support services • Organizes communities
PAGASA	• Trains the LGU • Provides forecast products • Calibrates instruments • Participates in climate outlook forum activities at the municipal level • Keeps local data for their own analysis and improvement of products
Communities	• Enrolls in the CrFS • Reports community impacts • Practices advisories and reports accuracy of PAGASA products
R1	• Facilitates and synthesizes learnings • Improves module and system • Capacitates LGUS • Showcases experiences and does Advocacy • Organizes communities
DA and other Insti	• Resource pool for the field school • Supports needs of communities and LGUs in the program • Supports replication and scaling up

Climate Information for Risk Assessment and Adaptation Planning

Climate Profiles of the Area	Climate Change Projections	Day to day recording
• Historical Annual Rainfall 10-20 years • TC records directly passing the area and within 50 kms • Normal rainfall per month • Average rainfall per month during EN • Average rainfall per month during LN • Historical community impacts	**2050 rainfall projections** **2050 temp projection** **Potential risks and impacts**	Weather recording and corresponding Community impacts



Utilization of Climate Information for Risk Management

Risk Management	
Short to medium term weather forecasts	Seasonal to inter-annual climate forecasts
Daily, 10 day weather forecast and farmweather, TC warnings Gale warning	**Seasonal outlook and possible hazards**
✓Short-term planning ✓ Emergency Preparedness	✓Medium-term operational planning ✓Seasonal Risk assessment and management

PAGASA's 10-day forecast

PAGASA's Seasonal Climate Forecast for a Province

	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Normal Rainfall (1980-2010)	89.5	83	129.9	151.7	277.1	323.9	322.6	243.7	262.1	281.4	220.7	132.8	2,518
Ave. EN Rainfall	75	51.9	87.2	86.1	228.1	341.8	425.6	257.3	328.6	232.6	152.1	88.2	2354.5
2014 actual		49.8	97.4	50.6	171.5	209.7	286.5	250.5	218.6	247.3	132.4	77.4	1,883.2
2015 actual	90.4	42.7	9.6	63.6	73.9	165.7	156.7	221.7	302.5	109.8	139	35.8	1,411.40
Forecast 2016	25	10	0	75	120	210							

PAGASA Forecast Product : Gale warning

Issued at: 05:00 AM TODAY , 03 February 2017

Fo strong to gale force winds associated with the surge of the northeast monsoon.

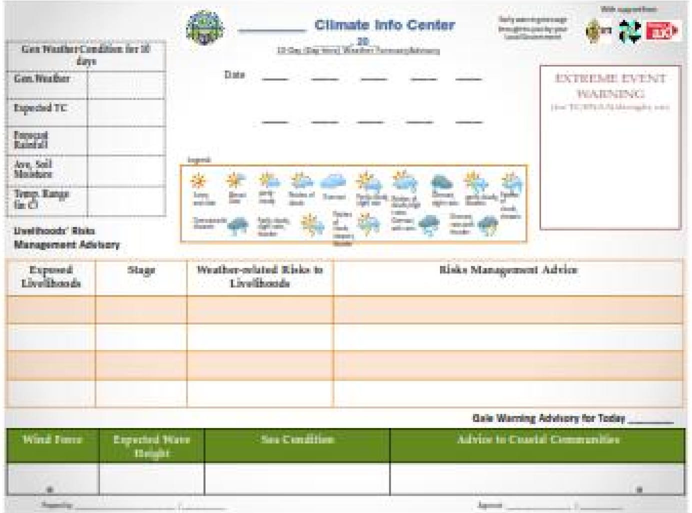
FISHING BOATS AND OTHER SMALL SEACRAFT ARE ADVISED NOT TO VENTURE OUT INTO THE SEA WHILE LARGER SEA VESSELS ARE ALERTED AGAINST BIG WAVES.

SEABOARD	WEATHER	WIND FORCE (KPH / KNOTS)	SEA CONDITION	WAVE HEIGHT (meters)
THE NORTHERN AND WESTERN SEABOARDS OF NORTHERN LUZON (Batanes, Calayan, Babuyan, Ilocos Norte, Ilocos Sur and Northern coast of Cagayan)	Cloudy skies with light rains	(52 - 63) / (28 - 34)	rough to very rough	3.4 TO 4.5

MUNICIPAL WEATHER AND
CLIMATE INFORMATION CENTER
operated by a Municipal Weather Observer

Communicating Warnings Digital Boards

Communicating warnings
Weather Boards



COMMUNICATING WARNINGS

Use in AESA during resiliency field school sessions /

1. Community analysis on possible risks of weather to their crops/livelihoods
2. Collective discussion of risks management measures farmers can take thru the weekly AESA

LOCAL RADIO STATIONS

COMMUNICATI NG WARNINGS

COMMUNICATING WARNINGS
SMS program

Sagip
BUHAY AT SAKA

Advantages of the Program

- Multi-approach
- Coaching/mentoring of LGU partners
- Capacity building of communities and Linking to different service providers
- Local and therefore more sustainable
- more communities have better chances of being included
- Addressing inequality and promoting community and environmental well-being, not just of growth
- Institutional strengthening both of the LGU and community institutions

Municipal Climate Outlook Forum

Making Climate Information More Accessible: Some Lessons and Conclusions

- LGUs are in a better position to localize because they are there on the ground and can directly provide warning immediately;
- The program is appealing to LGUs because of the project's potentials not just for agriculture and fisheries but also to further climate-inform other programs and services;
- To understand climate change scenarios, communities/LGUs need to understand their past and current climate and its local impacts.

Making Climate Information More Accessible: Some Lessons and Conclusions

- The presence of PAGASA—the Philippine's national meteorological agency---in the project is critical (i.e. PAGASA's willingness and openness to continuously develop new products to better cater to local government partners for climate information provisioning for agriculture;
- Localized climate services is being introduced as a new function to LGUs and a new direct clientele of PAGASA—thus, it will require regular budget allocation and staff support from the LGU;
- LGUs are very much willing to provide counterpart support for the implementation of the project;

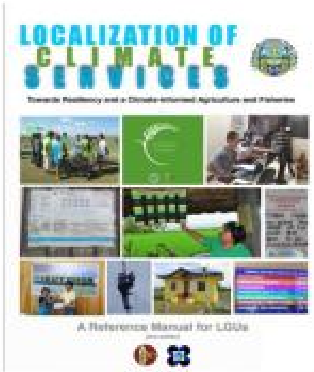
Making Climate Information More Accessible: Some Lessons and Conclusions

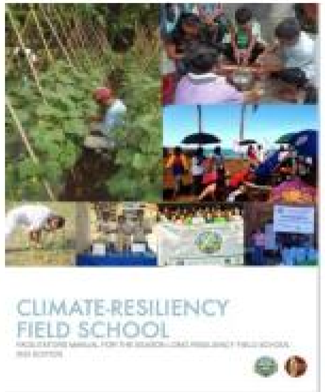
- What is most essential to farmers are the possible impacts of forecasted weather and the risks management options;
- Based on experience, farmers/communities getting used to receiving regular climate information are already the ones demanding demand the regularity of service;
- We have seen farmers avoid potential losses because of the provision of weather information/ seasonal climate information and advise during extreme events
- With manuals of operation already produced by R1, installation in other sites have become faster;

Some Immediate Needs

- Consolidate the loss and damage records of municipalities in a database and process as input to a---
- Simple damage prediction and valuation tool

Manuals for Replication





METRICS FOR COMMUNITY RESILIENCE

OUTCOME: Reduction/If not TOTAL avoidance of CLIMATE-RELATED damages and losses in life, livelihoods and assets

Output Indicators

- Availability of Daily forecast and localized farmweather advise (especially for tropical cyclones)
- Availability of 10 day forecast and localized farm weather
- Monitoring of slow-onset disasters (i.e. EN,sea level rise, etc)
- Number of individuals reached by advise (number of walk in requests, number of registered farmers in the sms service,
- Increased Community response capacities

METRICS OF COMMUNITY RESILIENCE

OUTCOME: INCREASED Biodiversity COUNT

Indicators

- Improved soil condition (i.e.water holding capacity, nutrient condition, etc)
- Improved water source
- Improved genetic pool
- Improved beneficial organisms in the farm
- Improved flora and fauna

OUTCOME: Increased Incomes

INDICATORS

- Cost reduction (i.e proper and timely use of inputs, use of organic, efficient use of labor, use of machines, use of less seeds, etc)
- Improved yield
- Better prices for farmers produced
- Increased market participation including negotiated procurement with LGU
- Value-adding
- Savings generation

OUTCOME:
Regularity of incomes/ seasonality of incomes addressed

INDICATORS

- Income source/s during lean months
- Value adding/processing thus ensuring availability of incomes through out the year
- IGP projects that bring incomes

OUTCOME:
Health Well-being of Farmers and Communities

INDICATORS

- Lessened exposure to harmful chemicals and pesticides both at the work area and in food intake
- Improved food sources
- Improved nutrition through food diversification
- Lessen exposure to climate-related illnesses through warnings

OUTCOME: Social Inclusion

INDICATORS

- Organized communities
- Vulnerable individuals Registered (in local and national registry systems—FishR, RSBSA, NMHS, SRFAO etc)
- Community Contingency plans (community action protocols especially for vulnerable groups)

Available Emergency/ QUICK RESPONSE support

INDICATORS

- Presence of mechanisms to respond/provide immediate assistance before, during and after a disaster (ie. Basic needs and production support)
    - local response capacities boosted (Examples are seed and food reserves)
    - Insurance cover
    - Network of communities with that pool resources to respond to (emerging) disasters in other nearby communities

Long term

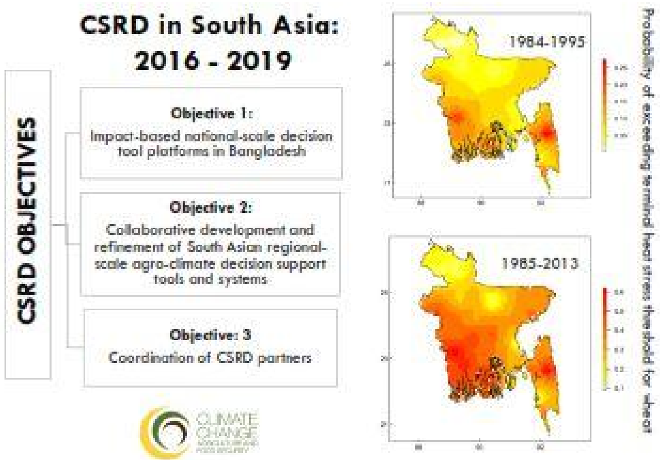
- Policies consistent with the outcomes mentioned
    - Reflected in the Budget
    - Procurement policies
    - Extension and Program support
    - Technology promotion

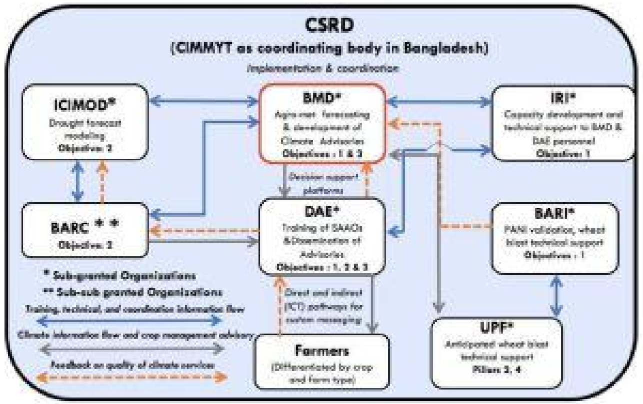
For more information:

Hazel Tanchuling
Executive Director
Rice Watch Action Network Inc.

Email: hazel_tanchuling@yahoo.com
Website: www.r1Phils.net

Appendix C11: Farmer decision making structures in Bangladesh: Preliminary and planned work in the CSRD South Asia and the Agro-Meteorological Information Systems Development Project





Objective 1: Bangladesh

- Updating agro-meteorological information using farmer decision making frameworks
- Climate services capacity development
- Development & refinement of decision support platforms
  - Irrigation scheduling tools
  - Wheat blast forecasting model
  - Lentil disease forecasting model validation + forecasting
  - Improved ag. met forecast format and communication
  - Decision support tool assessment

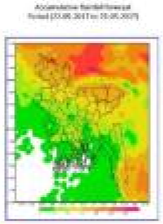
Objective 2: South Asia regional

  - RS based rought forecasting
  - Regional wheat blast risk assessment (historicals)
  - Regional lentil disease modeling + forecasts
  - Wheat blast regional climatology analysis model
  - Lentil leaf blight forecasting model validation + forecasting

Objective 3:

  - Supporting climate services awareness raising

Updating agro-meteorological information using farmer decision-making frameworks



Preliminary insights from field work

Study area	FGDs	Farmers	SAAOs
1. South Zone (Barguna, Bhola & Barisal) 2. Rajshahi Zone (Godagari & Tanore upzila) 3. Thakurgao & Dinajpur	Farmers' FGD =7 SAAOs' FGD= 7 Total FGDs = 14	Male Farmers= 69 Female Farmers= 1 Total Farmers= 70	Male SAAOs= 79 Female SAAOs= 9 Total SAAOs= 88

Climate related risks and influencing factors identified by farmers and extension agents

Area	Major weather risks on crop production
South Zone (Barguna, Bhola & Barisal)	1. Excessive rainfall 2. Cyclone 3. Heavy storm / Hailstorm
Rajshahi Zone (Godagari & Tanore)	1. Drought 2. Excessive cold weather 3. Storm
Thakurgao & Dinajpur	1. Drought 2. Excessive cold weather 3. Storm

Our ultimate goal is to reach farmers: 'End-user' extension of climate service information

- Communicate simple, actionable information
  - Life-saving and supplemental irrigation
  - Disease forecasts + crop protection
  - Sowing times
  - Managing boro seedbeds for cold stress
- Non-traditional communication and extension messaging
- Increased capacity of extension to deliver appropriate climate information (farmer clubs and FFs to include climate data collection, analysis, planning)
- **Insights, capacities, tools, and systems into the WB funded Ag. Met Information Systems Project**

Agro-Meteorological Information Systems Development Project

(Component C: Bangladesh Weather Climate and Services Regional Project, 2016-2021

Dr. Mazharul Aziz
Project Director
Department of Agricultural Extension (DAE)
Ministry of Agriculture
E-mail: azizdae@gmail.com

Sub-Component C.1: Establishment of the Bangladesh Agro-Meteorological Information System (BAMIS)

A. Setting up a Comprehensive web-portal for BAMIS at DAE
(Opportunity for CSRD decision support systems)

B. BAMIS infrastructure

C. Development of upazila level Agromet databases
(CSRD assistance +technical advice)

D. Data analysis and future scenario development
(CSRD assistance +technical advice)

E. Development of advisories
(CSRD assistance +technical advice)

F. Risk mapping of climate vulnerable areas
(CSRD assistance +technical advice)

Sub-component C.2 Training, Capacity Building, Project Management and Monitoring and Evaluation

Sub-Component C2.1 Provision of technical training to staff

A. Training of DAE staff and Workshops
(CSRD integration + assistance)

B. Study tours / Exposure visits

C. Technical studies
(CSRD integration + assistance)

D. Data analysis and future scenario development (sowing, harvest times, irrigation pest management)
(CSRD integration + assistance)

D. District and local level workshops for training farmers in portal tools

E. Joint Technical Working Group on Agro-Meteorology (JTWG)
(CSRD technical input)

Sub-Component C2.2 Project management, Monitoring and Evaluation

-Formation of PIU at DAE; Monitoring and Evaluation activities

Sub-Component C.3: Agricultural Disaster Risk Management through Agro-Meteorological information dissemination

A. Assessment of farmer's needs for weather and climate services
(CSRD integration + assistance)

B. Installation of Analog Agro-Meteorological display boards & Handheld ARGs

C. Kiosks

D. Development of mobile apps
(CSRD integration + assistance)

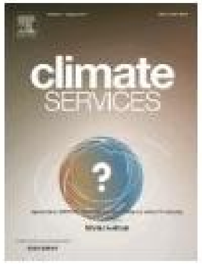
E. Organization of roving seminars *(Decision making frameworks and communication strategy assisted by CSRD)*

F. Feedback from farmers through 30,000 lead farmers *(feedback frameworks informed by CSRD activities)*

Scientific papers:
Sometimes useful, sometimes not so useful

We are working in an under-represented area of climate services – documentation and synthesis is likely to be of use

- The journal ***Climate Services*** brings science and practice together. It serves as a means of communication, dialogue and exchange forum between researchers and stakeholders…. The journal covers all topics related to climate services. **It directly refers to how climate information can be applied in methodologies and tools for adaptation to climate change.** It publishes best practice examples, case studies as well as theories, methods and data analysis with a link (or a potential link) to climate services.



Who wants to contribute?

- One of many options, but might be a good target
- Constructively critical review of our work
- Description of an emerging community of practice
- Potential focus:
  - (1) What is happening in each country,
  - (2) what is working and not working and why with respect to up- and down-stream linkages,
  - (3) review of how each country and project is engaging farmers mapped to constraints and opportunities,
  - (4) review issues related to communicating data, climatology, forecasts, and advisories,
  - (5) describing methods to evaluate forecast and advisory effectiveness with farming communities (?),
  - (6) mapping institutional arrangements in each county/project and identifying strong and weak links, and distilling lessons,
  - (7) others?

Appendix C12: Agriculture Call Center and Climate Change Advisors in Myanmar

Agriculture Call Center and Climate Change Advisors in Myanmar

Moe San
Stuff Officer
Department of Agriculture
Ministry of Agriculture ,Livestock and Irrigation

Geographic data in myanmar

Location:
Southeastern Asia, bordering the Andaman Sea and the Bay of Bengal, between Bangladesh and Thailand

Area:
total: 676,578 sq km
land: 653,508 sq km
water: 23,070 sq km

Land boundaries:
total: 5,876 km
border countries: Bangladesh 272 km, China 227km, India 1,453 km, Laos 235 km, Thailand 2099 km

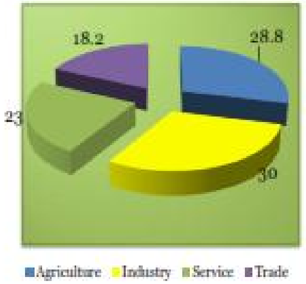
Coastline:
Rakhine 713 Km , Delta 438Km , Tainintharyi 1078 Km
Total 2229 Km

Climate
Summer Season (March to mid May),Rainy Season (Mid May to End of Oct),Cold Season (Nov to End of Feb)

Population:
52.22million (male 25.19/ female 27.03) 77/Sq kM

Per capital GDP
2015/16 1079262 Kyats (799.45USD)

National Gross Domestic product Ratio in Myanmar (2015-16)

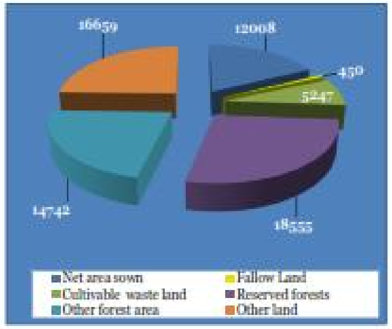


Reference: Myanmar Agriculture *in Brief* (2016)

- An Agricultural country 28.8% (2015-16) of GDP 25.5% of total export earning
  61.2% of the labour force.
- New Government laid down the 12 economic policies , of which 2 of them are related to Agriculture
- **"Establishing an economic model that balance agriculture, livestock and industry sector, so as to enable rounded development , food security and increased exports"**
- **" Achieving financial stability through a finance system that can support the sustainable long-term development of households, farmers and businesses"**

Land Utilization in Myanmar (000, ha)

particulars	2015-2016
Net area sown	12008
Fallow Land	450
Cultivable waste land	5247
Reserved forests	18555
Other forest area	14742
Other land	16659
Total	67659



Reference: Myanmar Agriculture *in Brief* (2016)

Major Crops cultivated in Myanmar

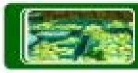
Cereals
paddy, wheat, maize, sorghum

Oilseeds
groundnut, sesame, sunflower, niger, mustar

Pulses
17 kinds of pulses including black gram, pigeon pea, green gram, pigeon pea soy bean, pelun, kidney bean, butter bean, chick pea, garden pea, sultapya

Industrial Crops
cotton, sugarcane, jute, rubber, coffee, mulberry, oil-palm

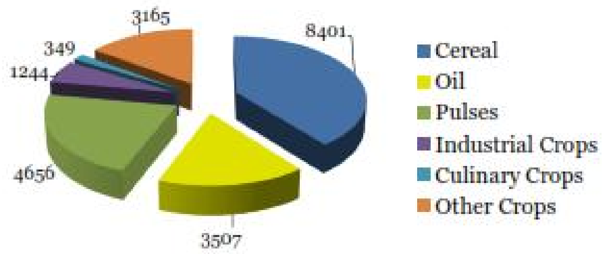
Kitchen Crops
Chilly, onion, garlic, ginger, turmeric, potato



Fruits & Vegetables
Mango, banana, citrus, pears, durian, mangosteen, pineapple, rambutan and others tropical and temperate vegetable

Crop Production in Myanmar (2015-2016)

Sown Area (000' Ha)



Reference: Myanmar Agriculture *in Brief* (2016)

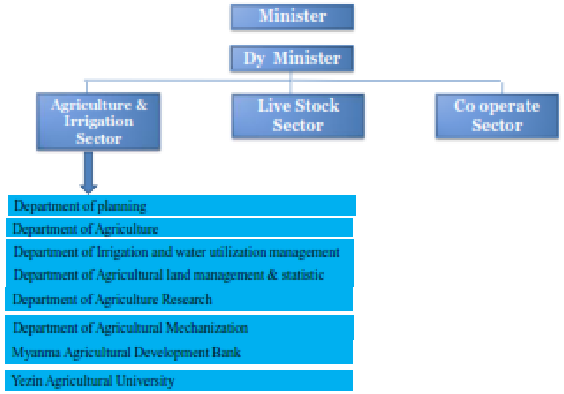
Major Crops production in Myanmar(2015-16)

Name of crop	Harvested/Sown Area (000' Ha)	Yield/ha (MT/ha)	Production (000' MT)
Paddy	7210	3.97	28210
Long staple cotton	291	1.79	521
Sugarcane	162	63.67	10305
Black gram	1133	1.47	1671
Green gram	1210	1.32	1595
Pigeon pea	648	1.36	881
Groundnut	955	1.63	1548
Sesame	1640	0.59	943
Sunflower	466	0.99	460
Maize	472	3.79	1779

Industrial Crops Production in Myanmar (2016-2017)

No	Name of Crops	Sown Acre	Harvested Acre	Yield per Ac	Total production
1	Sugarcane	405856	404697	25.80(ton)	10440176
2	Cotton	642680	642485	450.72(Viss)	289581944
3	Rubber	1616097	724018	685.81(lb)	496539117
4	Oil Palm	396749	139636	2.35(ton)	327479
5	Jute & Kenaf	3514	3113	160.5 Viss)	499627
6	Coffee	50598	33631	0.26(ton)	8840

Institution of Ministry of Agriculture , Livestock and Irrigation



POLICY

- Land Use and Management policy
- Water Use and Management policy
- Agricultural Financing policy
- Agricultural Mechanization and Input Sector policy
- Cooperative Enterprise and Cooperative System Development policy
- Rural Infrastructure Development policy

- Research, Development and Extension policy
- Marketing and Value – added Processing and Export policy
- Governance, Institutional and Human Resource Development policy
- Environmental Conservation and Climate Change Resilience policy

VISION

- An inclusive, competitive, food and nutrition secured and sustainable agricultural system contributing to the socio-economic well-being of farmers and rural people and further development of the national economy.

MISSION

- To enable rural population and agribusiness enterprises to get benefit from production and trade of diverse, safe and nutritious foods and agricultural products using innovative and sustainable production, processing, packaging, logistic and marketing technologies to meet the growing domestic and global demands.

Agricultural Call Center in Myanmar

Agricultural Call Center

- Objectives

- Establishing Agricultural CC

The Department of Agriculture opened a call centre aimed at quickly answering agricultural questions from farmers throughout Myanmar.

- How To Provide
- Duty of call centre employees
- Training for Call centre employees
- During the training
- Education of all the employees
- Going for word

Climate Change Impacts on Agriculture in Myanmar

Due to climate change as floods, landslides, unexpected rain, drought, storms, earthquakes, extreme temperatures (low & high),

Negative Impact

- Damages on constructive materials
- Damages on crops, farmlands, farm animals and other agricultural materials
- Contamination in irrigation and drinking water
- Damages on lives of human and animals
- More cost by rebuilding/replanting and by unexpected pests and diseases

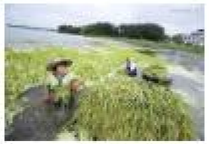
Positive Impact

- Some dams can store more irrigation water for some crops due to unexpected rain
- Some upland crops can produce higher yield according to unexpected occasional rain.
- Sentinatation effects on soil fertility for higher production

Flood Hazard

River-in Flood

Flash Flood

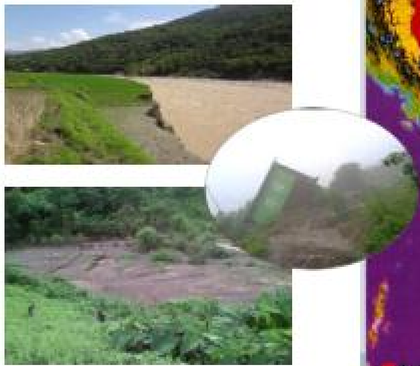


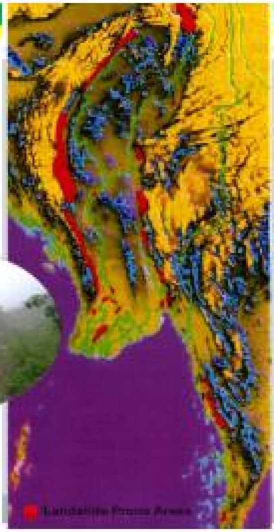
Drought hazard

Dry Zone Area

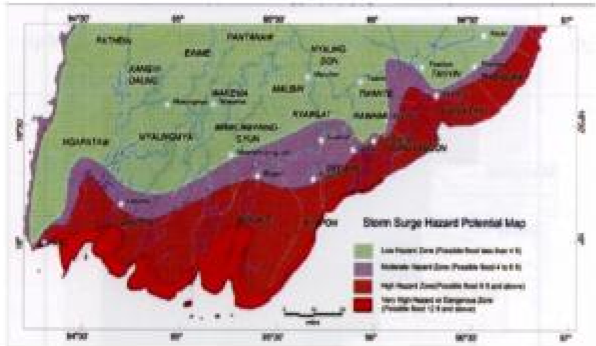
Landslide Hazard

Along rivers & mountains





Strom Surge Hazard



Unexpected Rain

Post-harvest losses in quantity and quality of crop produces

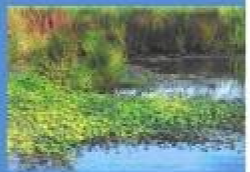
Food insecurity, malnutrition and poverty

Key Structural Adjustments

- Strengthening of research and extension system
- Efficient and sustainable land utilization
- Reform in land and water taxation
- Strengthening agricultural financing
- Favorable policies for private investment

Adaptation

- Delta and Coastal Region
  - To reserve wet land and mangrove forest
  - To restore the watershed
  - To introduce emergency spillway



- Dry Zone Region
  - To launch greening project (JICA, NGOs, helping)
  - Afforestation in watershed
  - Introducing modulating dams upstream
  - Natural disaster warning system
  - Worked out emergency preparedness plan

Application of Climate Change Modeling in Myanmar

- Environmental Characterization
- Optimizing Crop Management
- Pest and Disease Management

Environmental Characterization

- Crop model together with GIS can greatly facilitate demarcation of homologous zone at mega-, macro-, meso-, as well as micro level depending upon the availability of data and objectives.
- These tools have been used to determine the potential and attainable yields for a given level of inputs for various crops.
- Estimate of such yield of different varieties can establish a reference point for site quality and remove the confounding effects associated with large climate variation.

Optimizing Crop Management

- Once potential yields have been quantified, these can be converted to attainable yields to determine magnitudes of yield gap.
- Crop growth modeling can be used to in matching agro-technology with the farmers resources and analyzing the precise reason for yield gap.
- Simulation models can help fine tune of Nitrogen fertilizer application recommendation in irrigated rice.

Pest and Disease Management

- At a regional level, GIS, requisite environmental data coupled with epidemic simulation models further provide geographic delineation of disease and insect pest risk zone.
- Historical climate data from sites have been shown to be useful for characterizing the conduciveness of a site to specific diseases.
- Attempts are also being made to integrate disease predictive systems with online weather and weather – interpolation systems.
- Yield losses studies have been conventionally quantified the relation between nitrogen application rate, disease severity, season and grain yield.

Pest and Disease Management

- This has resulted in a qualitative understanding of the host-pathogen- environment interaction and in disease management recommendations. However, validity of such recommendations is limited, as they are strongly influenced by disease on set, disease spreading rate, farm management practices, environmental conditions and their interactions. Physiologically based simulation models can be applied to understand the damage mechanisms and analyze their effect on crop growth and yield of rice.

Shifting cultivation into permanent cultivation in hilly regions

Sloping Agriculture Land

Cropping Pattern Changes

- Variety changes
- Crop changes

Cropping patterns on irrigated lowland	Time of growing crops (Apr – Mar)
Rice – Pulses – Rice	Summer rice – Monsoon rice – Pulses
Rice – Groundnut – Sesame	Sesame – Monsoon rice – Winter groundnut
Rice – Rice	Monsoon rice – Summer rice
Sesame – Rice – Pulses	Monsoon sesame – Monsoon rice – Pulses
Pulses – Rice – Pulses	Pulses – Monsoon rice – Pulses

Cropping patterns on Rainfed lowland	Time of growing crops (Apr – Mar)
Rice – Pulses – Sesame	Monsoon rice – Pulses – Sesame
Rice – Pulses	Monsoon rice – Pulses
Rice – Sunflower	Monsoon rice – Sunflower
Sesame – Groundnut	Sesame – Groundnut
Pulses – Vegetables	Pulses – Vegetables

Agro-forest approach

Climate-smart agriculture

- **Definition (FAO)**
  - **Agriculture that sustainably increases productivity, resilience (adaptation), reduces/removes. GHGs (mitigation), and enhances achievement of national food security and development goals.**
- **The FAO identifies three pillars to the concept:**

- Sustainably increasing agricultural productivity and incomes
- Adapting and building resilience to climate change
- Reducing and/or removing greenhouse gases emissions

Climate Smart agriculture and Myanmar

- Global climate change also threatens Myanmar's economy which heavily relies on agriculture.
- The long-term effects of climatic change will have serious impacts on agriculture and food security, requiring substantive adaptation of agricultural systems over time.
- Myanmar has to develop a comprehensive strategy on climate change adaptation and mitigation for the agriculture sector focusing on rice-based systems."Myanmar Climate-Smart Agriculture Strategy" has been developed by Myanmar agricultural specialists coordinating with foreign experts.

Priority programs and target outcomes

- **Ayeyarwady Delta and Coastal Regions**
- (1) crop loss due to floods and cyclones and
- (2) intrusion of saline water due to sea-level rise.
- Action programs for biotic and abiotic tolerance of crop varieties and their introduction are urgently needed.
- The introduction of improved climate-ready rice germplasm from other countries or agencies and hybridization and selection of early maturing, salt- and submergence-tolerant rice varieties with high yield and quality need to be produced and distributed to farmers.
- Indigenous knowledge and practices should be recorded and integrated with climate-resilient technologies.

Central Dry Zone

(1) severe crop failures due to scarce rainfall and drought;
(2) soil erosion due to intense rains and storms; and
(3) land degradation due to high temperature and erratic rainfall.

- As a remedial action, programs on crop improvement and development of resilient farming practices (e.g., use of drought-resistant varieties, diversified and intensified cropping system, intercropping with climate-ready crops, crops-tree system, crop-livestock system, etc.) will be implemented intensively.
- Along with the foregoing, Myanmar will promptly promote the use of indigenous and locally-adapted plants and animals as well as the selection and multiplication of crop varieties adapted to adverse climatic conditions. The selection of crops and cultivars tolerant to abiotic and biotic stresses (e.g., high temperature, drought, flood, high salinity content in soil and water, pest and disease resistance)

Adaptation targets

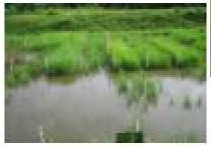
- New varieties and improved farming systems resilient to drought and water stress
- Diversified rural income and improved household economic resilience
- Increased prevention and protection against disasters

Adaptation programs

- Adapting crop varieties and corresponding farming practices
- Disaster risk management
- Crop and income loss risk management

Variety Selection

- Flood resistant varieties
- Drought resistant varieties
- Salinity tolerance varieties
- Short duration varieties
- Deep water preferred varieties
- Heat resistant varieties
- cold tolerant varieties
- So on



Environmental, Climate Change and Natural Disaster Resilience Policy

1. Ecological and environmental conservation are to be performed for the sustainability of the agriculture, livestock, and marine capture.
2. The conservation and the effective use of Genetic Resources are to be conducted in collaboration with technical committees, related ministries, experts.
3. The development of infrastructure for rural based agriculture sector is to be carried out in accord with Environmental and Social Management Framework.
4. In hilly and sloppy regions and water shed areas, soil conservation is to be performed in coordination with related ministries. In collaboration with experts, the conservation techniques for reduction of soil erosion by water and wind in dry zone and the dissemination of good practices and the effective harvest and use of rain water are to be performed.
5. Agriculture and livestock activities are to be supported by announcing and notifying weather forecasts regarding with agriculture, livestock and marine capture.
6. Agriculture and livestock systems that are adoptable with climate such as Conservation agriculture, Organic Agriculture, Good Agriculture Practices-GAP, Biotic Abiotic Stress tolerance varieties (heat tolerance, salt tolerance, drought tolerance, submergence tolerance), Good Animal Husbandry Practices – GAHP, Good Aquaculture Practices-GAqP are to be used for livestock and agricultural production. Land Use Management and Green Water Management are also to be practiced.

Motivation & Awareness

- Training and education
- On-farm demonstration
- Mother-baby trials
- Research and development
- Distributing information through media, pamphlets, booklets, etc.
- Mobile teams for agriculture Call Center
- Technology Transfer

Radio ,Television, Newspaper, Posters, Pamphlets, agricultural shows …..

Extension Teaching Methods (Mass M)

Meeting, Group Discussion, Method / result demonstrations, Field trip, Field day, Seminars, Workshops ………

Extension Teaching Methods (Group M)

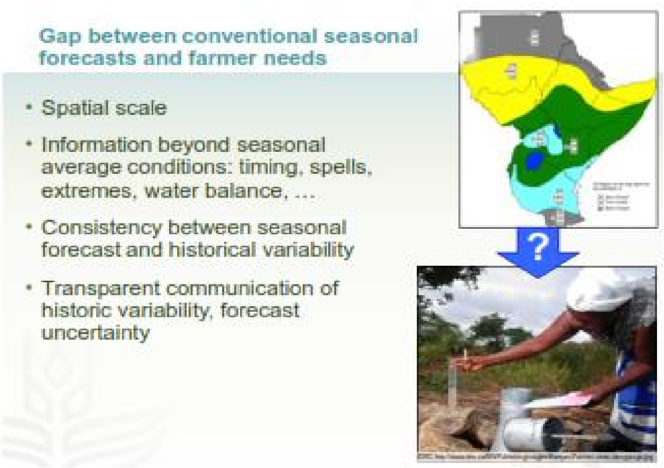
on going and Future Highlights

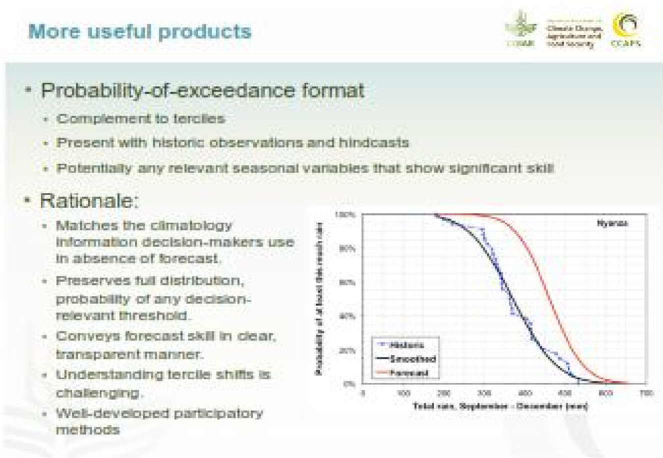
- Environmental sustainability –application of good agricultural practices (GAP) and food safety modules.
- Utilization of integrated pest management (IPM) not only in cereals but also in horticultural crop production.
- Capacity building activities- human resource development for key staff.
- Exchange vision among extension, research and farmers.
- Integration of activities and findings in one demo place.
- More information through multimedia (Call Centre , Farmer Channel , Agribusiness Journal and Website)
- Collaboration with NGO, INGO and other institutions.

Conclusion

- Climate change usually result in reduction of national crop yield, especially for paddy production. Thus, Department of Agriculture (DOA) provides reserved/stored paddy seeds.
- DOA seeks to help farmers by developing suitable crop varieties with climate change.
- DOA explores suitable farming systems to adapt in respective regions.
- Due to the climate change, integrated nutrient management and integrated pest management systems were improved to meet crop and food security assessment by agriculture.
- Education and training is being done for farmers on their farming system with relevant technologies as adaptation of climate change.
- Collaboration with AMD in crop and food security assessment is taken effectively after natural disaster by climate change.
- Post-harvest technology is very important to minimize crop production losses by developing warehouses, driers and cold storage.

Appendix C13: Making seasonal climate forecasts useful for farmer decision-making: Experiences in Africa with relevance to Asia Products and processes for making seasonal climate forecasts useful for farmer decision-making: experiences in Africa with relevance to South and Southeast Asia.





A structured workshop process

- Machakos & Makindu, Kenya, 2004
- Kaffrine, Senegal, 2011+
- Wote, Kenya, 2011+
- Same, Tanzania, 2013
- Kigali, Rwanda, 2016

Key concepts

- ***Variability*** - Deals with what happened in the past.
  - For example, rainfall in 2015 was different from rainfall in 2014, which was different from rainfall in 2013.
- ***Frequency*** - Expresses variability with numbers.
  - For example, in four out of the past ten years I was not able to produce enough maize to feed my family until the next harvest.
- ***Uncertainty*** - Deals with what will happen in the future.
  - Because the climate has been variable in the past, I am uncertain about what the weather will be like in next growing season.
- ***Probability*** - Expresses uncertainty with numbers.
  - For example, there are two chances in five that I will not produce enough maize to feed my family until the next harvest.
- ***Forecast*** (or ***Prediction***) - A forecast is new information that changes the probabilities about the future.

Key concepts

Does everyone agree on the best words in Kinyarwanda?

Would farmers have the same meaning?

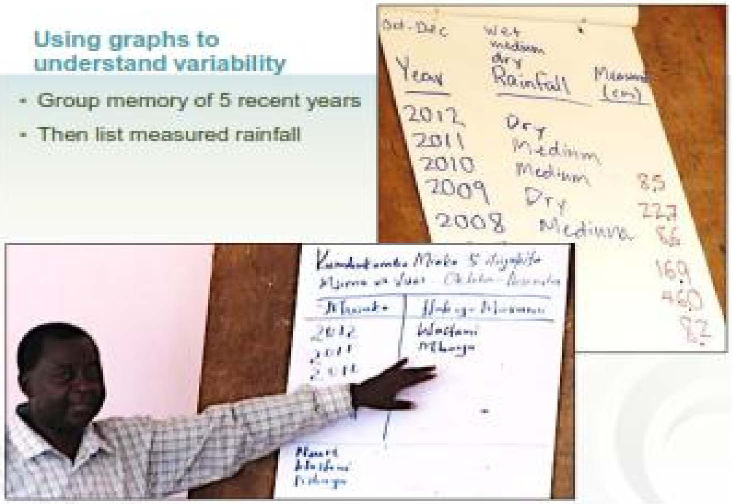
Key concepts

A forecast reduces uncertainty, but doesn't eliminate it completely.

We will show how to use probability graphs to describe past climate variability and express a seasonal climate forecast.

Using graphs to understand variability

- Group memory of 5 recent years
- Then list measured rainfall

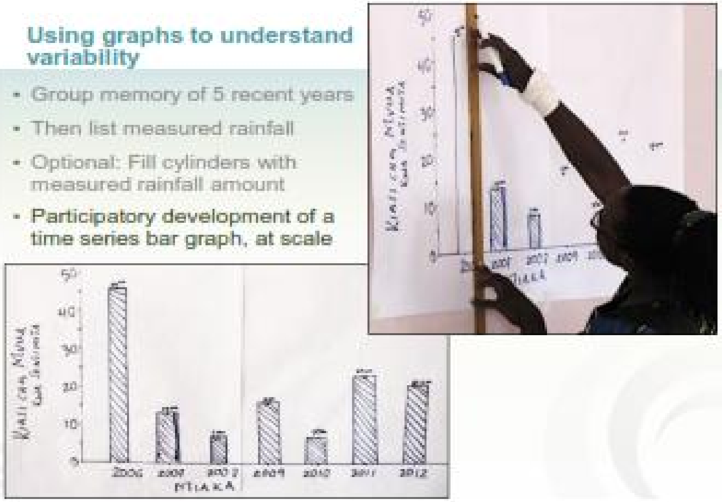


Using graphs to understand variability

- Group memory of 5 recent years
- Then list measured rainfall
- Optional: Fill cylinders with measured rainfall amount

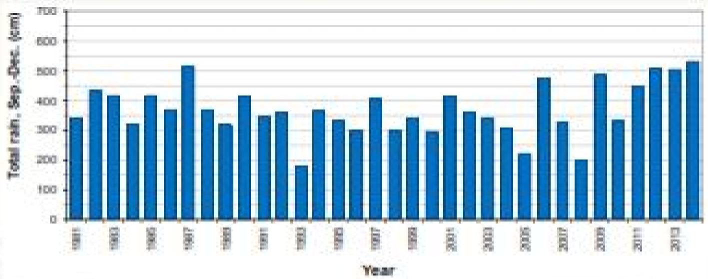
Using graphs to understand variability

- Group memory of 5 recent years
- Then list measured rainfall
- Optional: Fill cylinders with measured rainfall amount
- Participatory development of a time series bar graph, at scale



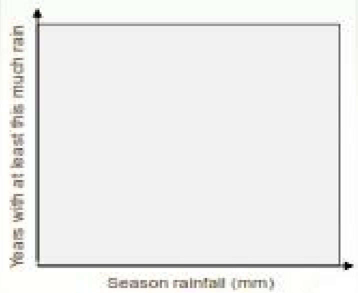
Using graphs to understand variability

- Participants should then be able to understand computer-generated graphs with more years.
- Consistent with what Peter will show you with PICSA.



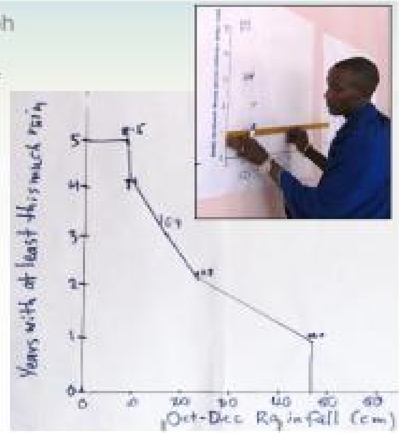
Using graphs to understand probability

- Produce a probability graph by sorting the time series
- Start with a blank graph of number of years, and rainfall



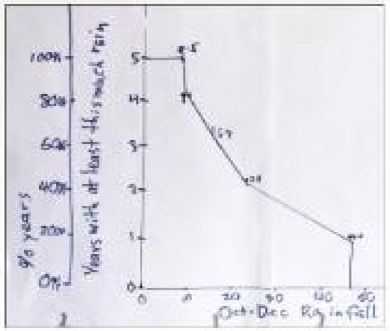
Using graphs to understand probability

- Produce a probability graph by sorting the time series
- Start with a blank graph of number of years, and rainfall
- Participants sort the last 5 (or 10) years, driest to wettest



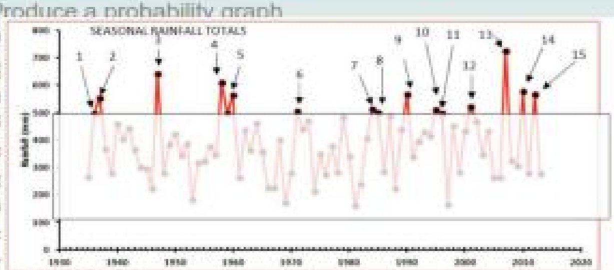
Using graphs to understand probability

- Produce a probability graph by sorting the time series
- Start with a blank graph of number of years, and rainfall
- Participants sort the last 5 (or 10) years, driest to wettest
- From number of years to frequency (4 out of 5 years = 80%)

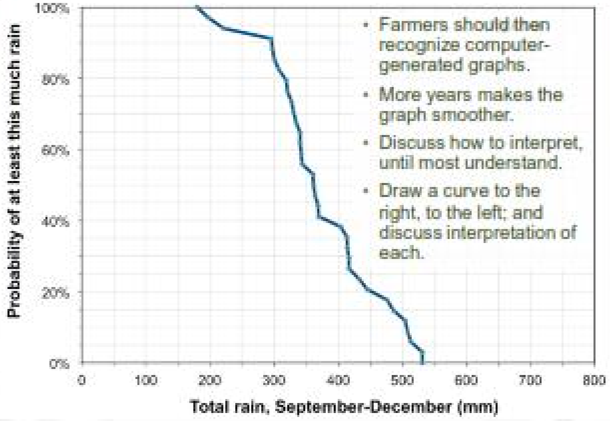


Using graphs to understand probability

- Produce a probability graph b
- S n ra
- P (c w
- F fr = 80%)
- **PICSA alternative**



Using graphs to understand probability



- Farmers should then recognize computer-generated graphs.
- More years makes the graph smoother.
- Discuss how to interpret, until most understand.
- Draw a curve to the right, to the left; and discuss interpretation of each.

Activity 1: Interpreting a probability-of-exceedance graph

- The median is the middle of the distribution, meaning that 50% of years are wetter and 50%f the years are drier (for the September-December season). **Find the median rainfall.**
- Suppose that the risk of a particular crop disease greatly increases if seasonal rainfall is more than 450 mm. **What is the probability that this will happen?**
- Suppose that yields of a high yielding bean variety are likely to fail if seasonal rainfall is below 250 mm. **What is the probability that this will happen?**
- **OPTIONAL:** Seasonal forecasts are sometimes expressed as the probability of "below normal," "normal" and "above normal" rainfall. "Below normal" refers to the driest 1/3, "normal" is the middle 1/3, and "above normal" is the wettest 1/3 of years. **What is the range of September-December rainfall that would fall in the "normal" category?**

Activity 1: Interpreting a probability-of-exceedance graph

1. The median is the middle of the distribution, meaning that 50% of years are wetter and 50%f the years are drier (for the September-December season). **Find the median rainfall.**
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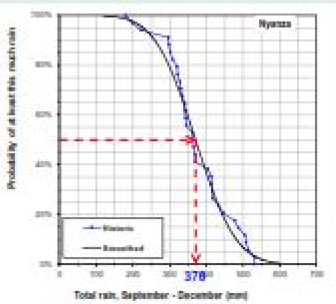

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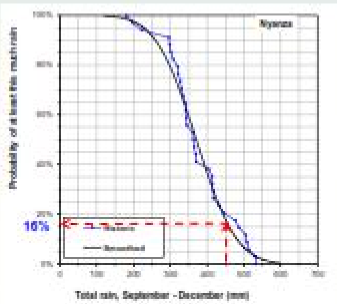
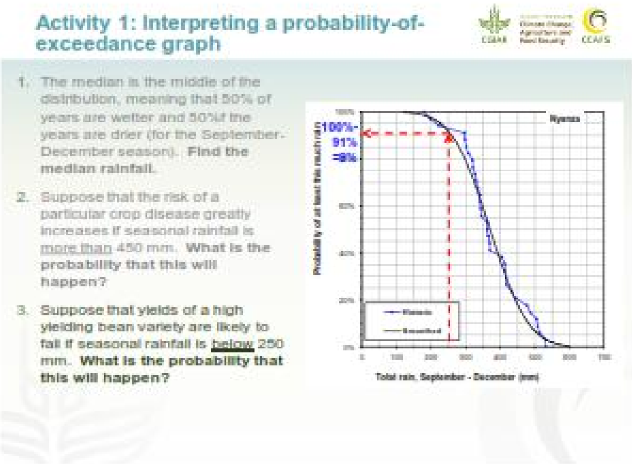
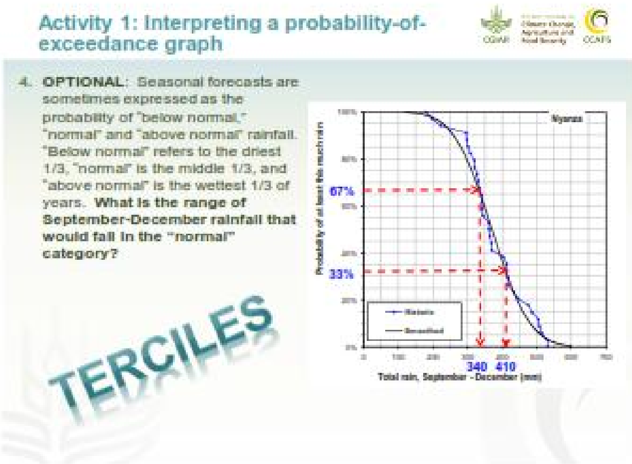
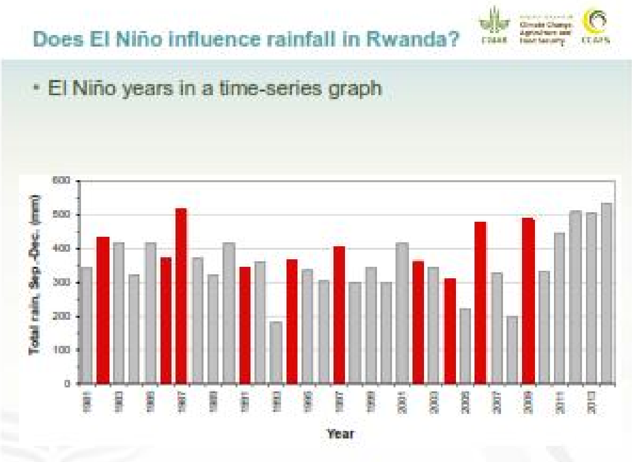
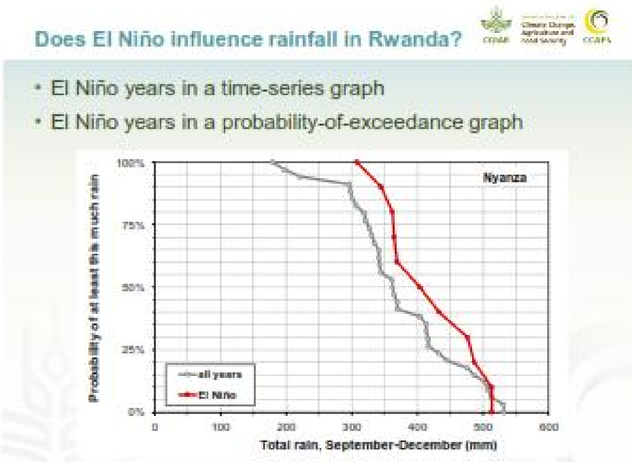
3. Suppose that yields of a high yielding bean variety are likely to fail if seasonal rainfall is <u>below</u> 250 mm. **What is the probability that this will happen?**




Activity 1: Interpreting a probability-of-exceedance graph
1. The median is the middle of the distribution, meaning that 50% of years are wetter and 50% if the years are drier (for the September-December season). Find the median rainfall.
2. Suppose that the risk of a particular crop disease greatly increases if seasonal rainfall is more than 450 mm. What is the probability that this will happen?
3. Suppose that yields of a high yielding bean variety are likely to fall if seasonal rainfall is below 250 mm. What is the probability that this will happen?
100%-
91%
Nyanza
Total rain, September - December (mm)


Activity 1: Interpreting a probability-of-exceedance graph
4. OPTIONAL: Seasonal forecasts are sometimes expressed as the probability of "below normal," "normal" and "above normal" rainfall. "Below normal" refers to the driest 1/3, "normal" is the middle 1/3, and "above normal" is the wettest 1/3 of years. What is the range of September-December rainfall that would fall in the "normal" category?
TERCILES
67%
33%
Nyanza
340 410
Total rain, September - December (mm)


Does El Niño influence rainfall in Rwanda?
• El Niño years in a time-series graph
Total rain, Sep.-Dec. (mm)
Year


Does El Niño influence rainfall in Rwanda?
• El Niño years in a time-series graph
• El Niño years in a probability-of-exceedance graph
Nyanza
Probability of at least this much rain
100%
75%
50%
25%
0%
all years
El Niño
0
100
200
300
400
500
600
Total rain, September-December (mm)

Does El Niño influence rainfall in Rwanda?

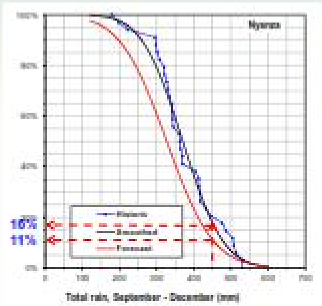
- El Niño years in a time-series graph
- El Niño years in a probability-of-exceedance graph
- Objectives of this activity:
  - Introduce the concept of a seasonal forecast
  - Build confidence that there is a physical basis for seasonal forecasting
  - Reinforce that a seasonal forecast is a shift of the historic probability distribution
  - Prepare farmers for the new seasonal forecast format

Activity 1: Interpreting a seasonal forecast in probability-of-exceedance format

5. Referring to question 2, how does the forecast change the probability of getting enough rain (>450 mm) to cause risk of crop disease outbreak?
6. Referring to question 3, how does the forecast change the probability of getting too little rain (<250mm) to produce a successful crop of the high yielding bean variety?
7. **OPTIONAL:** Given this seasonal forecast, what is the probability of getting "below normal," "normal" and "above normal" rainfall?

Part 2: 2016 Forecast distribution

5. Referring to question 2, how does the forecast change the probability of getting enough rain (>450 mm) to cause risk of crop disease outbreak?
6. Referring to question 3, how does the forecast change the probability of getting too little rain (<250mm) to produce a successful crop of the high yielding bean variety?
7. OPTIONAL: Given this seasonal forecast, what is the probability of getting "below normal," "normal" and "above normal" rainfall?



Part 2: 2016 Forecast distribution

5. Referring to question 2, how does the forecast change the probability of getting enough rain (>450 mm) to cause risk of crop disease outbreak?
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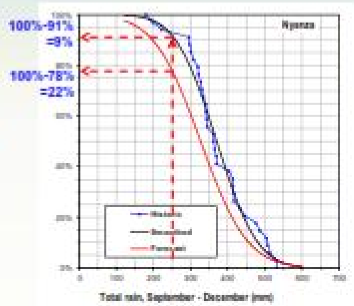
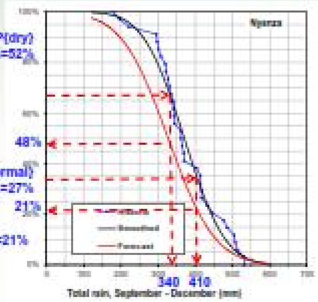
7. OPTIONAL: Given this seasonal forecast, what is the probability of getting "below normal," "normal" and "above normal" rainfall?



Part 2: 2016 Forecast distribution

5. Referring to question 2, how does the forecast change the probability of getting enough rain (>450 mm) to cause risk of crop disease outbreak?
6. Referring to question 3, how does the forecast change the probability of getting too little rain (<250mm) to produce a successful crop of the high yielding bean variety?
7. **OPTIONAL**: Given this seasonal forecast, what is the probability of getting "below normal," "normal" and "above normal" rainfall?

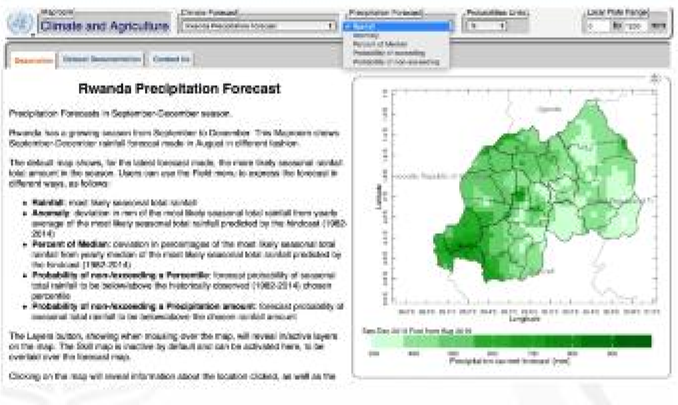


Making it work for a NMS: Rwanda

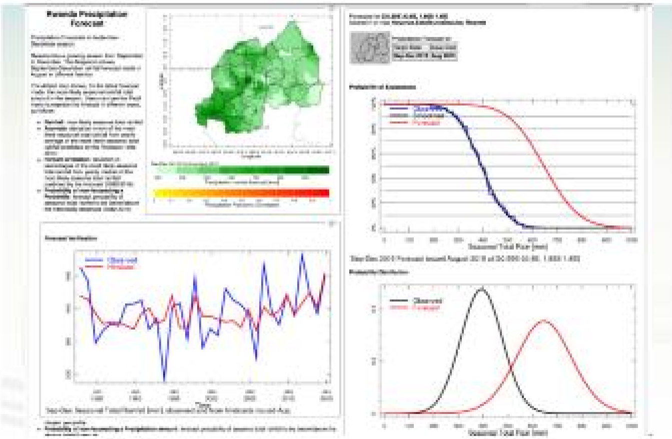
- 4 km gridded rainfall (34 years) and temperature (>50 years) daily time series
- Candidate seasonal forecast variables: seasonal total; number of rain days, dry spells, rainfall extremes; season onset, cessation, duration; water requirements satisfaction index, …
- Verify downscaled prediction skill
- Statistical downscaling with established predictors
- Online maproom interface allows users to generate historic and forecast graphs for any point
- Automation: historic seasonal variable analysis (done), seasonal forecast downscaling (incomplete)

Making it work for a NMS: Rwanda

Making it work for a NMS: Rwanda



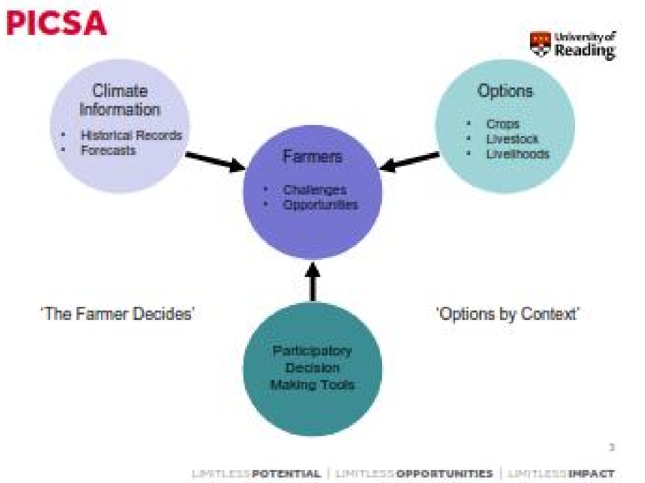
Making it work for a NMS: Rwanda



Thank you!

Jim Hansen: jhansen@iri.columbia.edu

Appendix C14: Bringing participatory climate services to South and Southeast Asia: How could the Participatory Integrated Climate Services for Agriculture (PICSA) approach be applied?



WHAT DOES THE FARMER CURRENTLY DO?

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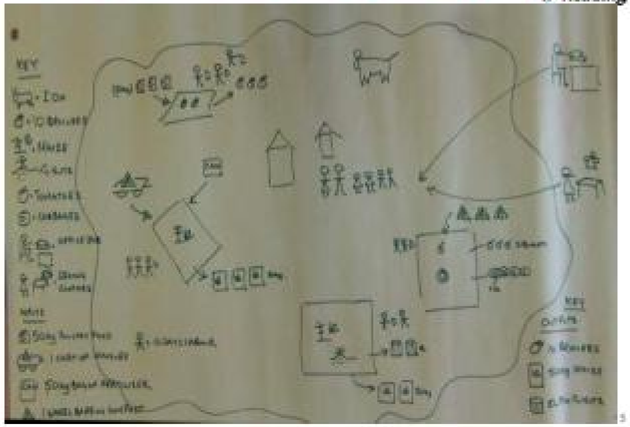
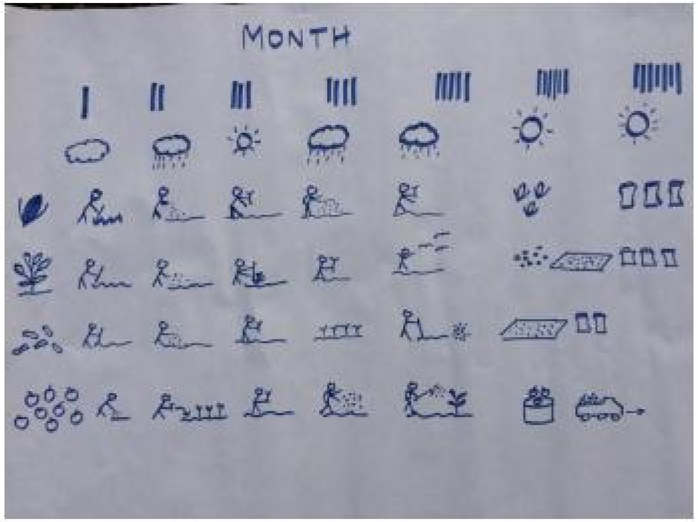


LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT



HISTORICAL CLIMATE INFORMATION

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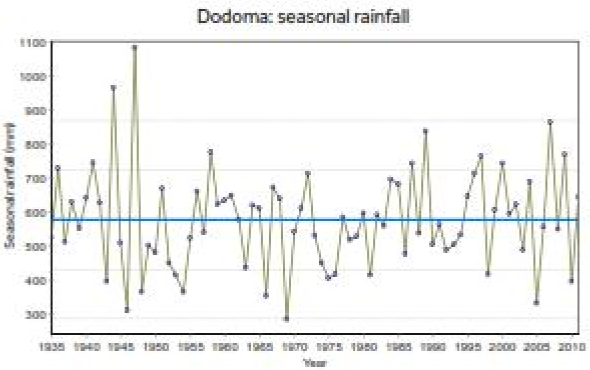

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LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

CALCULATING RISKS OF GROWING DIFFERENT CROPS

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8

LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

WHAT ARE THE FARMERS OPTIONS

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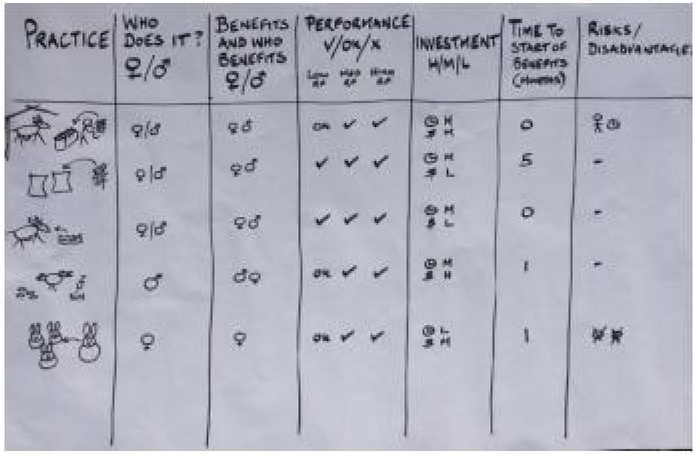

WHAT ARE THE FARMERS OPTIONS

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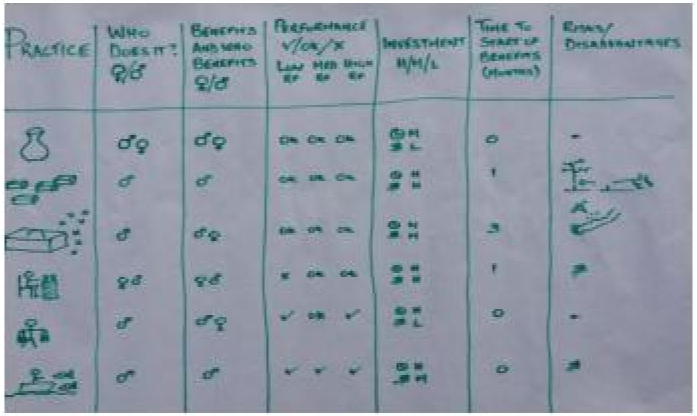

LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

FARMERS COMPARE AND DECIDE WHICH OPTIONS TO TRY ON THEIR FARM

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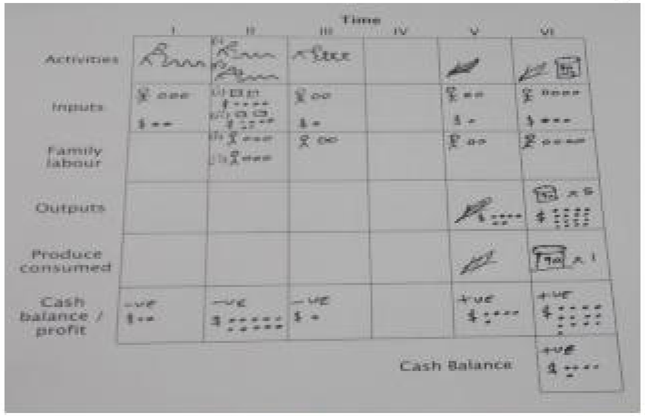
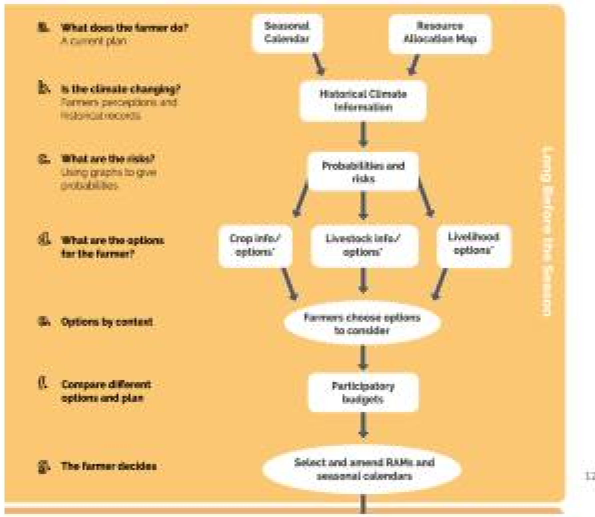
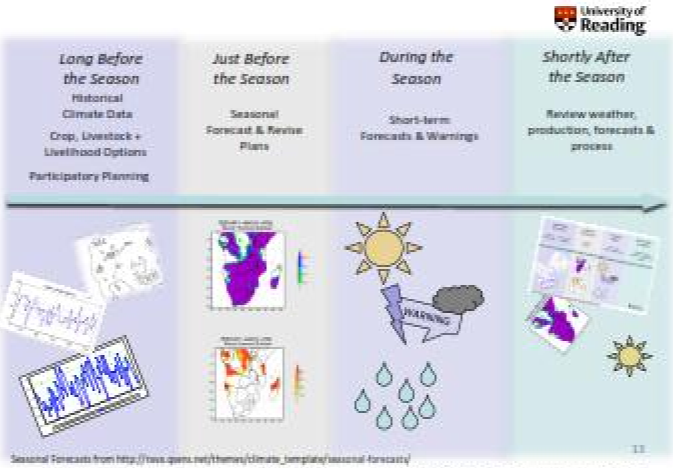


LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

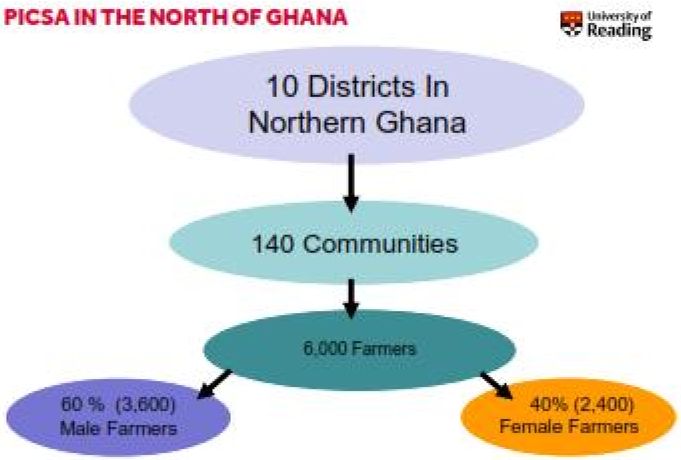




Seasonal Forecasts from http://iava.qpns.net/themes/climate_template/seasonal-forecasts/

LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

PICSA IN THE NORTH OF GHANA



LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

RESULTS FROM EVALUATION

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	Ghana (n=416)	Malawi (n=193)	Tanzania (n=611)	Rwanda (n=214)
% making changes in crops, livestock or livelihood enterprises as a result of PICSA training	97%	82%	52%	93%
% using participatory budgets in their planning and decision making	93%	80%	83%	97%
% of farmers using historical climate information in their planning and decision making	93%	86%	85%	98%
% of farmers 'better able to cope with bad seasons caused by the weather' following the training	88%	80%	88%	92%
% of PICSA trained farmers who had shared the information / tools with peers	84%	85%	88%	91%

LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

EXAMPLES OF CHANGES MADE

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Farmer starting a small business selling soya beans

Farmer engaging in a short-term (54 day) variety of cowpea

Farmer engaging in a new livelihood, making and selling shoes

16

LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

CASE STUDY HOUSEHOLDS

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Farmer	Changes	Impact
Male farmer, northern region, Ghana	Reduced the scale of maize farm and used early maturing variety	Increased maize yield by 3 bags and reduced cash losses. Extra bags helped feed his family for 4 months and money saved helped pay school fees and purchase a goat
Female farmer, northern region, Ghana	Started regularly feeding and vaccinating her livestock	Increased profit from selling her sheep which was used to pay her son's school fees; some was used to purchase food and some to purchase two sheep
Female farmer, Balaka, Malawi	Early maturing maize and conservation farming techniques	After a difficult season, she was able to harvest while others weren't. Paid daughter's school fees, fed extended family and bought seeds for the coming season (incl. trying new crops)
Male farmer, Longido, Tanzania	Introduced new cattle breed (more suited to dry environments), reduced the size of his herd and vaccinated	Some of the remaining money from sales of local breed were invested in building a house. He has also started to engage in agriculture, planting maize, some trees and vegetables which helps feed his family

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WORKING WITH PARTNERS IN NEW LOCATIONS

18

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20

THANK YOU

Peter Dorward, Graham Clarkson and Roger Stern

21

LIMITLESS **POTENTIAL** | LIMITLESS **OPPORTUNITIES** | LIMITLESS **IMPACT**

22

LIMITLESS **POTENTIAL** | LIMITLESS **OPPORTUNITIES** | LIMITLESS **IMPACT**

Appendix C15: Group exercise: Using historical information with farmers

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Group exercise 1

Using historical information with farmers

1

LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

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FORMING GROUPS

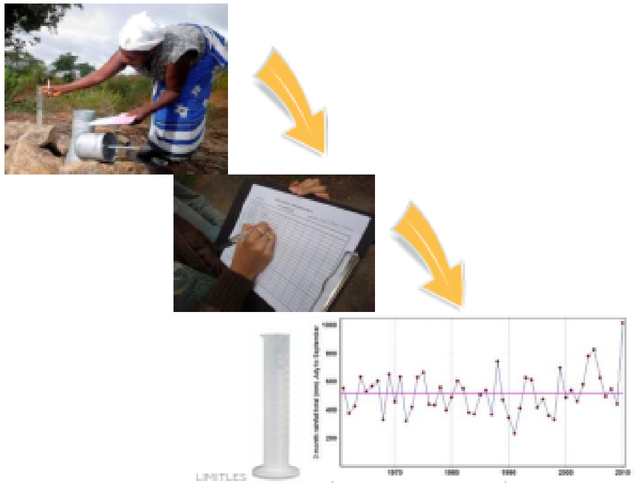
At least one group for each of a) Baisal b) Dinaipur c) Rajshahi locations

Please can you divide into groups with each group having

1. At least 1 person from Bangladesh who works with farmers
2. A mixture of people with experience of working a) in Meteorology b) with farmers

2

LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT



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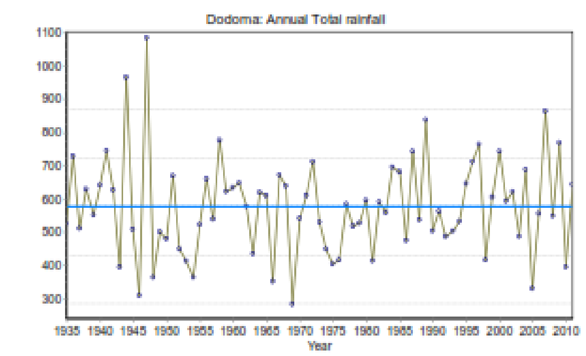

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QUESTIONS FOR EXERCISE

1. For non Met. Staff from Bangladesh only. Are farmers reporting changes in climate in Bangladesh? If so, what are the changes they are reporting (particularly in or near these areas)?
2. For everyone in each group. Are these graphs indicating climate change AND / OR climate variability? Please focus on one graph at a time.
3. For everyone in each group. Are there are differences between 1 and 2?
4. For everyone in each group. How could these (and similar) graphs be of practical use to farmers? What can they help with?

LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

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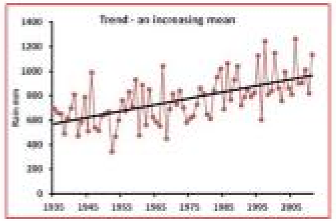
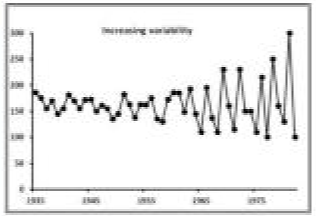
WHAT IS CLIMATE CHANGE?

Climate change: Refers to a *statistically significant variation* in either the mean state of the climate or in its variability, *persisting for an extended period, typically for several decades or longer.*





Caution: these are not real data!

LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

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USES OF GRAPHS WITH FARMERS

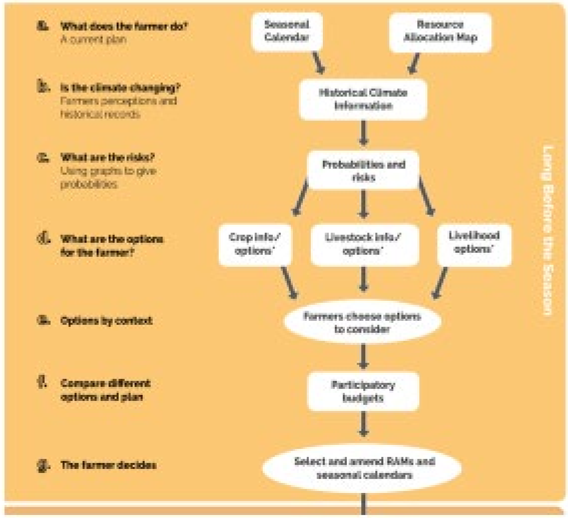
- Are we seeing changes – if so what changes and what does that mean for farming and other livelihoods?
- If perceptions do not agree with historical data – explore why this may be? Sometimes maybe associated with / made worse by other factors - that we and farmers can address
- Characteristics of the climate......... what is normal? VARIABILITY
- Simple estimates of risk (probabilities)
- Using probabilities to select crops, varieties and planting times

LIMITLESS POTENTIAL | LIMITLESS OPPORTUNITIES | LIMITLESS IMPACT

We should select crops that look like the climate

Farmer in Mtumba, Tanzania

Identifying possible crops and varieties using probability tables



- Identify which crops and varieties may do best in your area
  - Look at the crop details and requirements in the crops tables provided
  - Compare these to the probabilities (in the probability of exceedance tables)
  - Discuss and identify which crops and varieties may be good to grow here and why

  (Note: also use 'common sense'!)

NGABU
LENGTH OF THE SEASON - 60 DAYS

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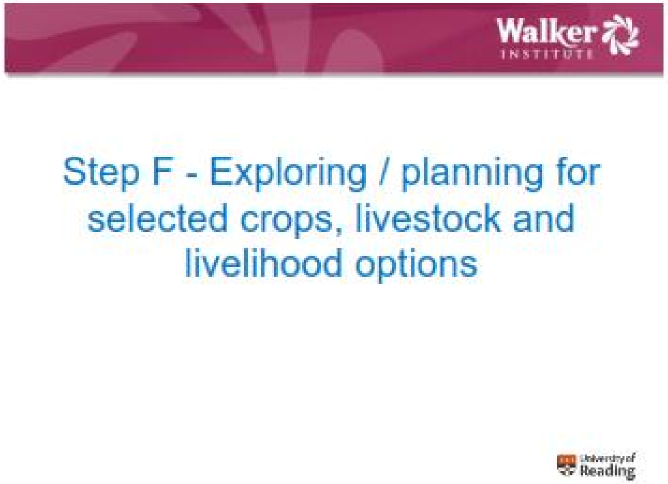
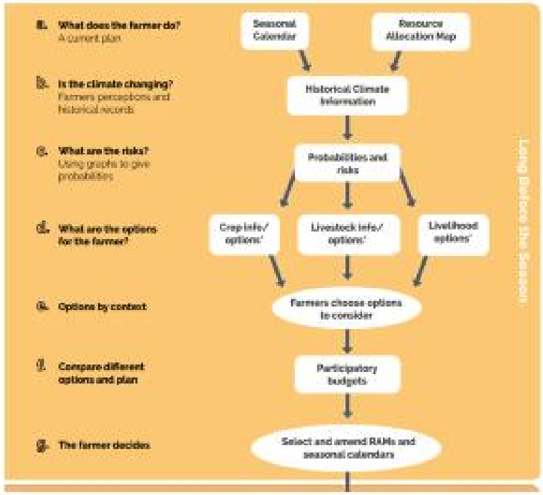
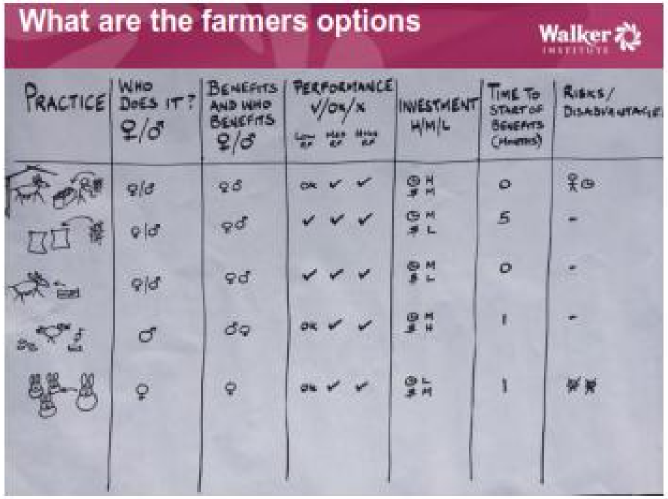
	15-Nov	25-Nov	5-Dec	15-Dec	25-Dec	5-Jan	15-Jan	25-Jan	5-Feb
300mm	1/10	1/10	3/10	5/10	5/10	4/10	3/10	3/10	3/10
350mm	0/10	1/10	3/10	4/10	4/10	3/10	2/10	2/10	1/10
400mm	0/10	1/10	2/10	3/10	3/10	2/10	2/10	2/10	1/10
450mm	0/10	0/10	1/10	2/10	2/10	2/10	1/10	1/10	0/10
500mm	0/10	0/10	0/10	1/10	1/10	1/10	1/10	1/10	0/10
550mm	0/10	0/10	0/10	1/10	1/10	1/10	1/10	1/10	0/10
600mm	0/10	0/10	0/10	1/10	1/10	1/10	0/10	0/10	0/10
650mm	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10
700mm	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10

Appendix C16: Step F - Exploring / planning for selected crops, livestock and livelihood options

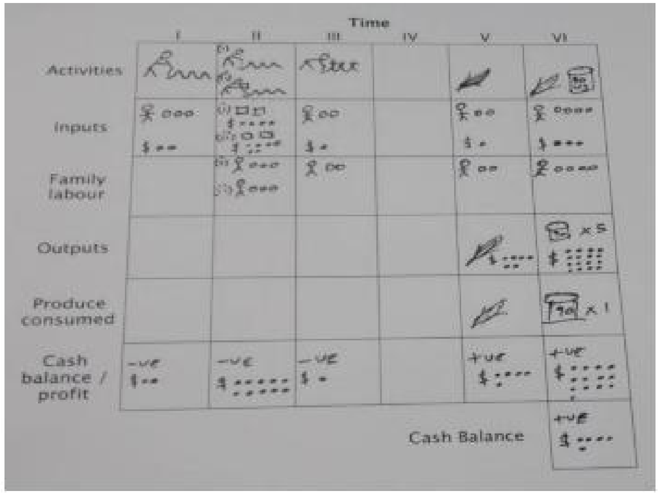






Participatory budgets

- What are they used for?
  - To evaluate the resource inputs and outputs of the different crop, livestock and livelihood options
  - To enable farmers to identify the options that are best suited to their household
  - Make informed choices about which options they may want to implement or try
  - To help plan ahead and prepare
    - Identifying what activities, money and resources are needed and when
    - Using 'what-if' scenarios

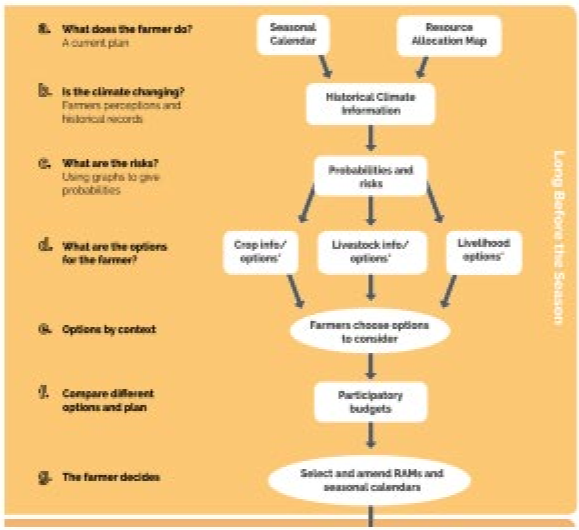


Helpful things to remember

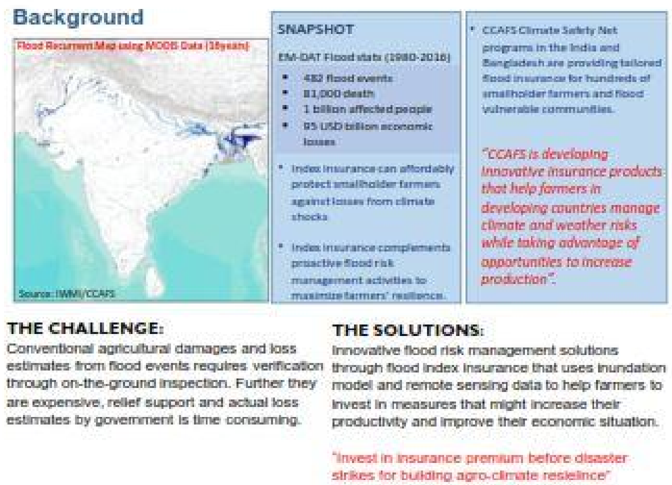
- Use symbols and counters that are easily remembered
- It should be the participants who are holding the pen
- Focus on what the farmers consider to be important
- Leave a copy with the farmers'

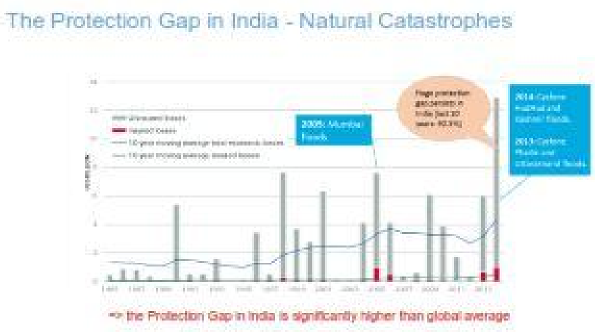
To conclude

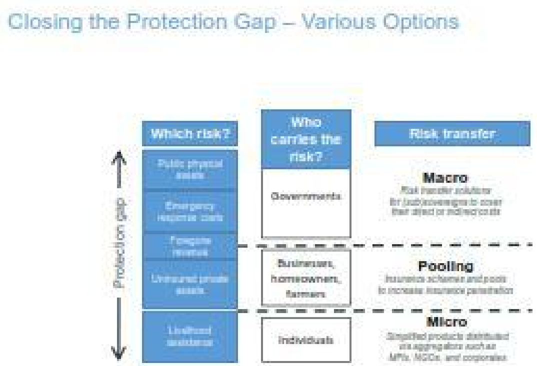
- What can participatory budgets be used for?
  - Plan new enterprises
  - Explore new options
  - Compare different options
  - Review: e.g. how did last season go?



Appendix C17: Promoting smallholder agro-climate resilience through index-based flood insurance (IBFI)

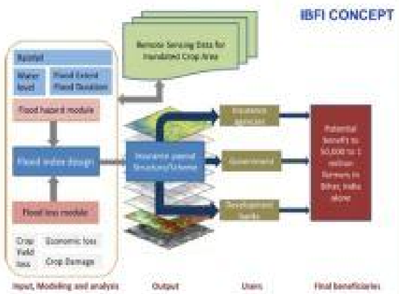






Specific objective and approach

- Develop IBFI and demonstrate positive impact in terms of agriculture resilience and DRM policy which complements flood risk mitigation strategies.
- Developing tools and strategies including business models that support IBFI upscaling, integrated with existing disaster management plan.

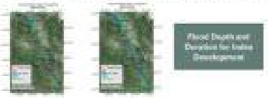


Project Components

- ✓ Flood Risk Mapping
- ✓ Flood Hazard Modeling
- ✓ Index Product Design
- ✓ Gender/Social
- ✓ Business models
- ✓ Institutional/Economic analysis
- ✓ Stakeholders engagement
- ✓ Workshop/Policy Dialogue
- ✓ Community awareness
- ✓ Pilot implementation

Scientific progress

- IBFI combines hydrological and hydraulic modelling and newly available 10m-resolution satellite images from the European Space Agency.
- To develop new flood index insurance that uses past 35 years of floods across floodplains in target districts. This enabled us to accurately estimate flood parameters, including inundation extent, depth and duration;
- 2017 year first pilot over 200 household covering 9 villages implemented;
- Review of index insurance business models and IBFI BM developed;
- 3 peer-reviewed journal; 5 conference proceedings; 1 book chapters; 2 magazine; 1 policy brief
  - IBFI Concept and Opportunities
  - IBFI scoping, Flood risk mapping and modelling for IBFI development
  - Business model and economic analysis
  - Gender and Social equity in IBFI



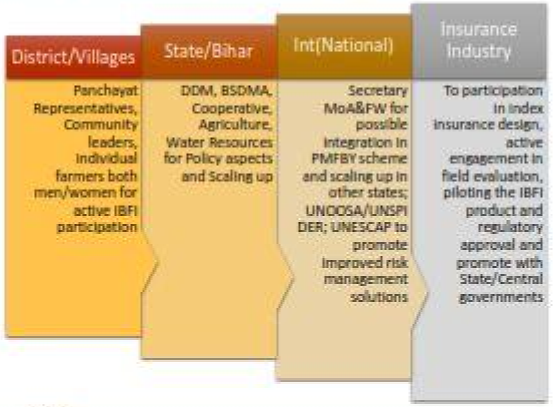
Term-Sheet

Name of Village	Water Level (w.r.t Elevation)	Name of Village	Water Level (w.r.t Elevation)
Ajitpur Bakuchi	1.950	Jamalpur Kodal	0.750
Akhtiarpur	2.050	Janta Tok	1.000
Andama	2.510	Kalyanpur urf Bishunpurkalyan	1.955
Balha	3.480	Katra	4.180
Barari Urf Brauddi Buzurg	2.020	Keotas urf Keotux	2.340
Belaur Nidhi urf Belaurthana	2.890	Ladaura	2.080
Bhagwatpur	4.450	Madhopur	1.180
Bihari Urf Bhatgawan	1.490	Madhura Patti Urf manorathpatti	2.880
Chandpura	1.030	Misrauli	2.960
Gangaura	3.630	Nawada Urf Khangura Khurd	3.000
Gangia Urf Parmanandpur	1.490	Paga	2.990
Harkhauli	2.860	Pahauri	1.270
Harpur Urf Kamalpurbhadaradih	2.830	Ram Patti	2.480
Hasanpur	1.230	Salaha	3.820
Hatha	4.810	Tharma	3.570

Pricing

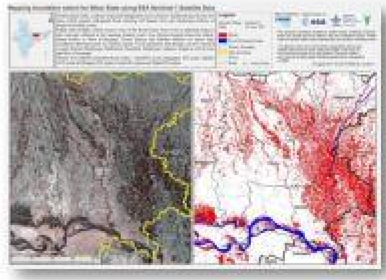
- Historical experience based approach
- About 25 years of data used for India
- Termsheet designed to 'simulate' major flood events in the past. Historical payouts indicate the 'possible payouts' if the same termsheet/product had been implemented in the earlier years

How next users/end users are engaged?



IBFI – The Bigger Picture

Maps That Matter…

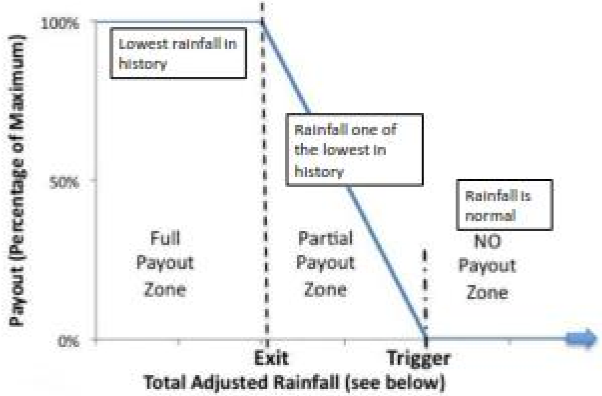



Managing Crisis Through Crowdsourcing, IoT
OPEN DATA KIT
Facebook
WhatsApp
Data Harvest
IWMI
A water-secure world
www.iwmi.org


Additional information
SATELLITE IMAGERY
+CROP INSURANCE
SMALLHOLDER
FARMERS' GAIN
indiatoday
IWMI to soon launch index-based flood insurance product
http://ibfi.iwmi.org

Appendix C18: Financial Instrument to mitigate Climate risk: Global examples of how appropriateness and farmer participation be increased

Measuring the risk



WHY *INDEX* INSURANCE?

Less administrative costs

Product developed and validated in the field

Product simple and transparent

- Farmers understand and trust the product
- Payout not linked to crop survival/failure → incentive to make the best decisions for crop survival.

Good potential to go to scale

- Possibility to scale up to other regions, other crops, other risks.

WHY *INDEX* INSURANCE?

Less administrative costs

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Product simple and transparent

- Farmers understand and trust the product
- Payout not linked to crop survival/failure → incentive to make the best decisions for crop survival.

Good potential to go to scale

- Possibility to scale up to other regions, other crops, other risks.

But...
Easy to get it wrong,
Important to get it right

→ An important part of our role is to identify where index insurance is not appropriate

DATA SOURCES

Satellites or ground data?

Needs for the index:

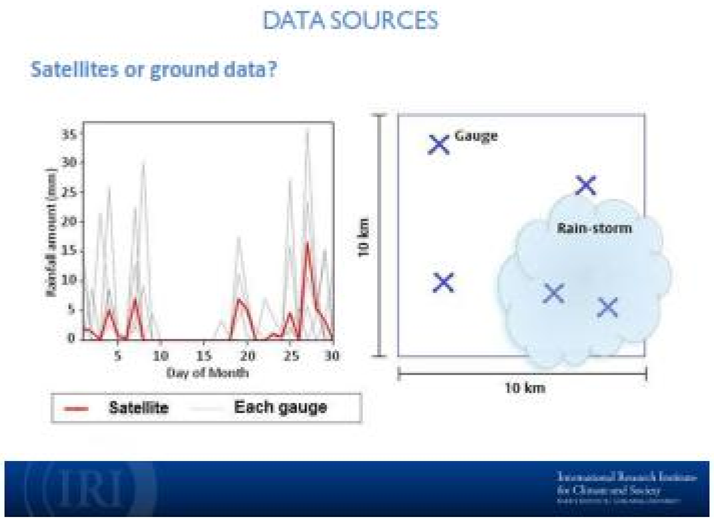
- Good spatial distribution of data;
- Length of dataset (20+ years)
- Availability of data in real time
- Transparency and accessibility

Limitations of raingauge data:

- Localized, not available everywhere, and oGen not many years back
- Cost, accessibility of data
- Possible technical problems

Satellites:

- OGen long time, free, available in near real time, covering all country
- But need to be validated to limit basis risk


DATA SOURCES
Satellites or ground data?
Rainfall amount (mm)
Day of Month
Satellite
Each gauge
Gauge
Rain-storm
10 km
10 km


Artificial Intelligence cannot distinguish between Poodles and Fried Chicken

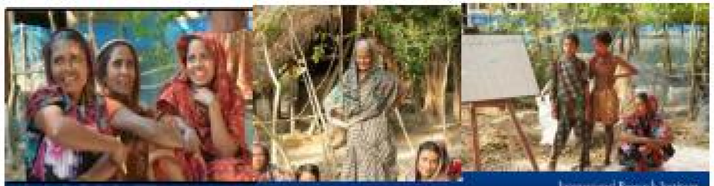

Artificial Intelligence cannot distinguish between Poodles and Fried Chicken
Modeling is wrong without sanity checks
Similar issues with all satellite products
Ground validation with farmers is crucial!


Participatory processes for index design

Interactive exercise – part 1

Agricultural calendar, agricultural practices, types of crops, vulnerability of different crops/ practices to different risks…

Crops	Apr/May Boishak	May/Jun Josto	Jun/Jul Asar	Jul/Aug Shrabon	Aug/Sep Bhaddro	Sep/Oct Asshin	Oct/Nov Kartik	Nov/Dec Agrahayan	Dec/Jan Poush	Jan/Feb Magh	Feb/Mar Falgun	Mar/Apr Chaitra
[illegible]		Seedling	Seedbed raising	Land preparation	Planting	Establish	Flowering	Harvesting				
Crops	Apr/May Boishak	May/Jun Josto	Jun/Jul Asar	Jul/Aug Shrabon	Aug/Sep Bhaddro	Sep/Oct Asshin	Oct/Nov Kartik	Nov/Dec Agrahayan	Dec/Jan Poush	Jan/Feb Magh	Feb/Mar Falgun	Mar/Apr Chaitra
Boro	Flowering	Harvesting						Seedling	Seedbed raising	Land Preparation	Plantation	Plant Establishment

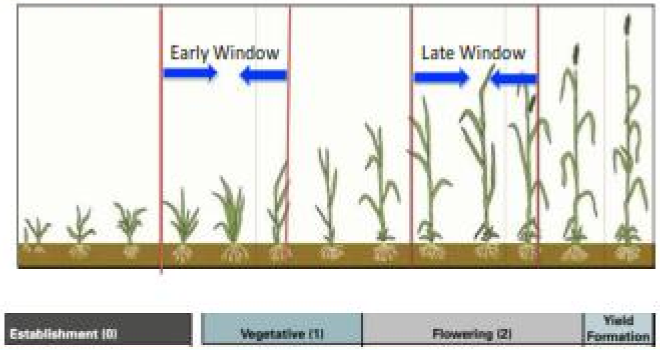


Interactive exercise – part 2

Climatology, worst years, risk characterization (late start, early end, pauses, global lack of rainfall, irregularity etc)

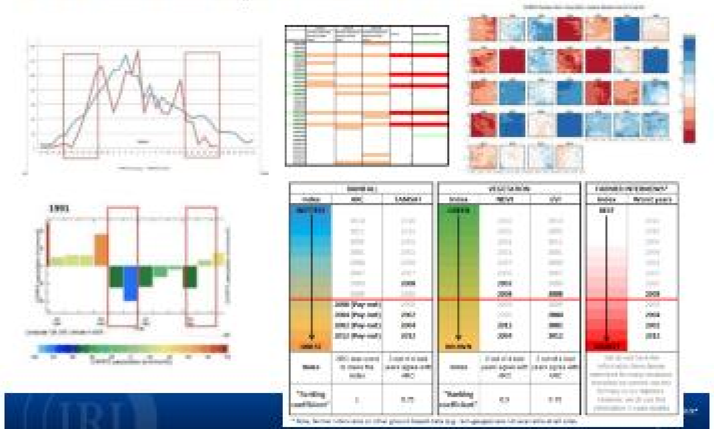
Participatory processes for index design

Identify a few window options, based on farmers agricultural calendar and highest vulnerability to risks



Participatory processes for index design

Validate windows and data using farmers recollection and other available information .



Participatory processes for index design

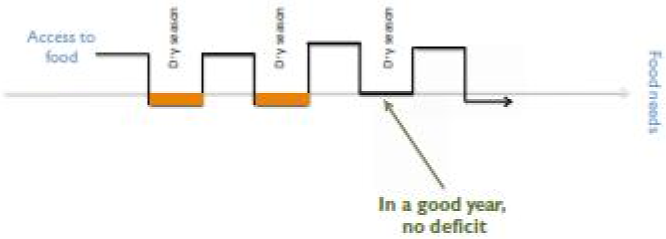
Integrated process and feedback loops

- Feasibility study (dry run)
- Participatory processes: data collection for index design
- Dataset selection for index design
- Prototype development, Validation with communities and stakeholders, commercialization
- Season Monitoring
- Index performance evaluation, index refinement

WHY INSURANCE?

PROTECTING AGAINST BAD YEARS

Cycle of livelihood decline

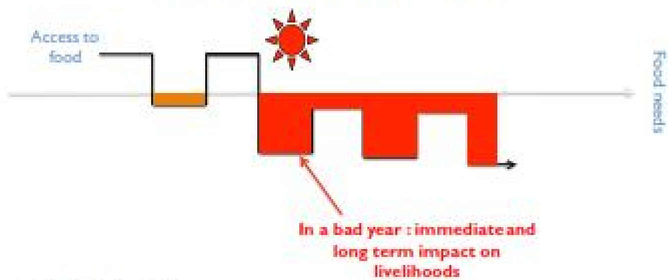


Slide idea courtesy of R4, Senegal

WHY INSURANCE?

PROTECTING AGAINST BAD YEARS

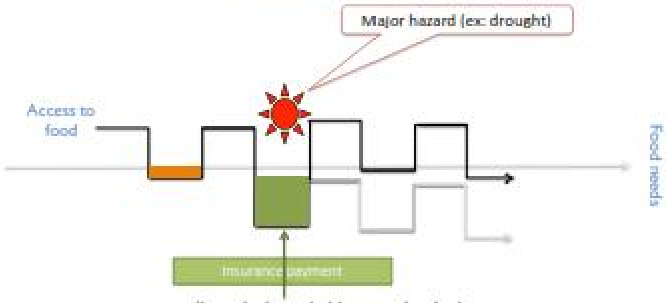
Cycle of livelihood decline



Slide idea courtesy of R4, Senegal

WHY INSURANCE?

PROTECTING AGAINST BAD YEARS



- Allows the household to cope in a bad year
- Prevents longer term impacts

Slide idea courtesy of R4, Senegal

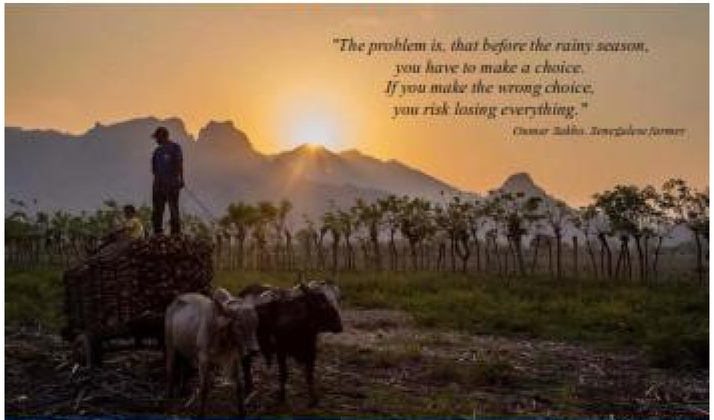
WHY INSURANCE?

- **But insurance is only covering major events!**
- **Climate change:** more bad years

- **Adaptation:** increase productivity and resilience in normal years to cover bad year loss
- Threat of 1 (drought) year out of 5 prevents other 4 from being much more productive

- **Role of insurance**: relax risk of bad year to unlock productivity options

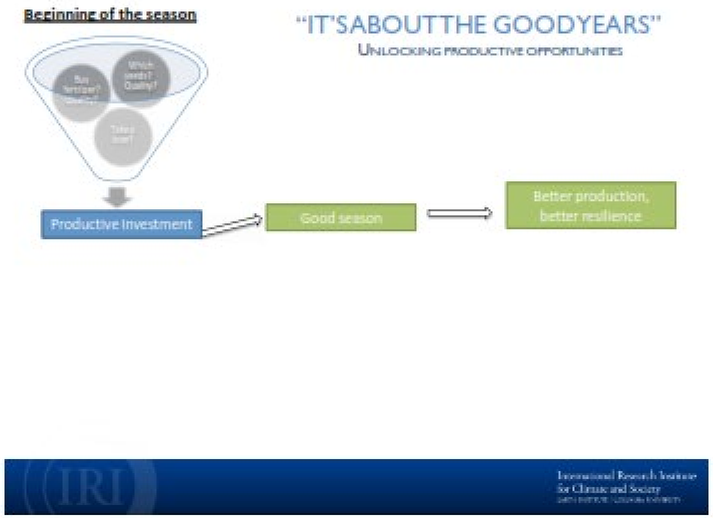
THE ISSUE

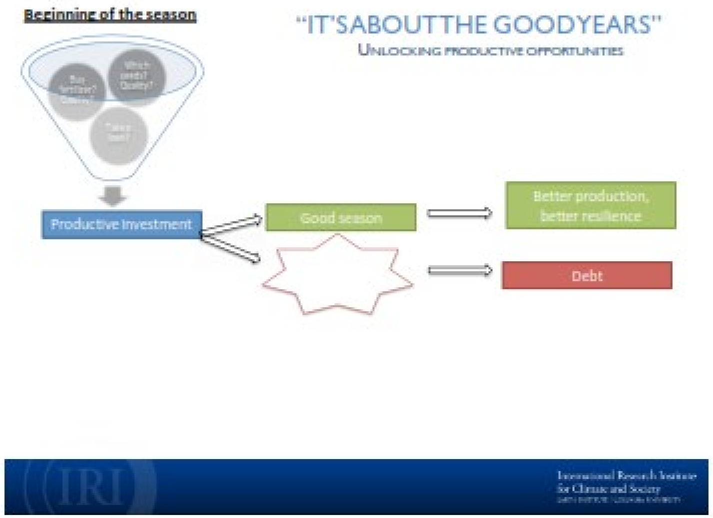


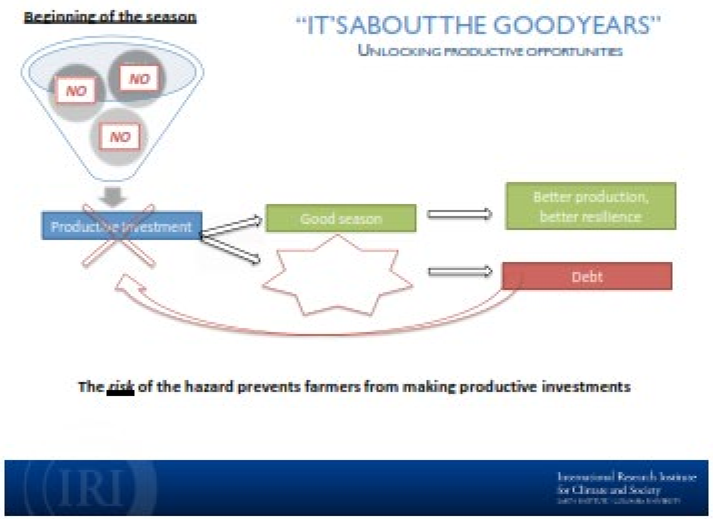
Beginning of the season

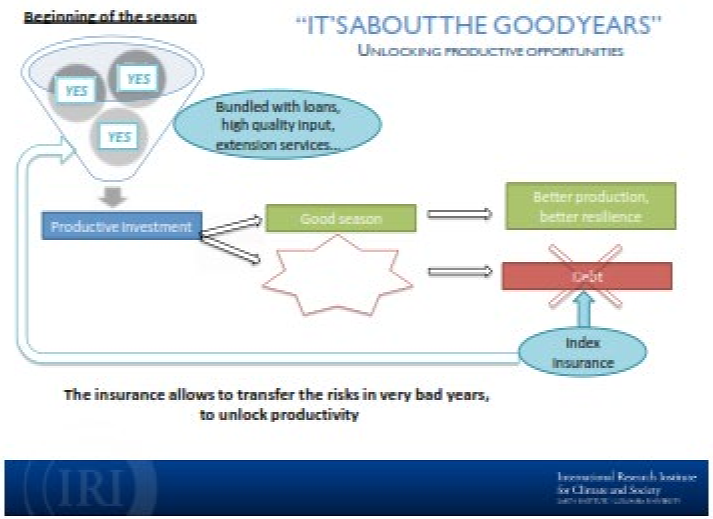
"IT'S ABOUT THE GOOD YEARS"

UNLOCKING PRODUCTIVE OPPORTUNITIES


Beginning of the season
"IT'S ABOUT THE GOOD YEARS"
UNLOCKING PRODUCTIVE OPPORTUNITIES
Productive investment
Good season
Better production, better resilience
IRI
International Research Institute for Climate and Society


Beginning of the season
"IT'S ABOUT THE GOOD YEARS"
UNLOCKING PRODUCTIVE OPPORTUNITIES
Productive investment
Good season
Better production, better resilience
Debt
IRI
International Research Institute for Climate and Society


Beginning of the season
"IT'S ABOUT THE GOOD YEARS"
UNLOCKING PRODUCTIVE OPPORTUNITIES
NO
NO
NO
Productive investment
Good season
Better production, better resilience
Debt
The risk of the hazard prevents farmers from making productive investments
IRI
International Research Institute for Climate and Society

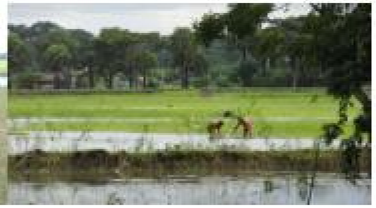

Beginning of the season
"IT'S ABOUT THE GOOD YEARS"
UNLOCKING PRODUCTIVE OPPORTUNITIES
YES
YES
YES
Bundled with loans, high quality input, extension services...
Productive investment
Good season
Better production, better resilience
Debt
Index insurance
The insurance allows to transfer the risks in very bad years, to unlock productivity
IRI
International Research Institute for Climate and Society

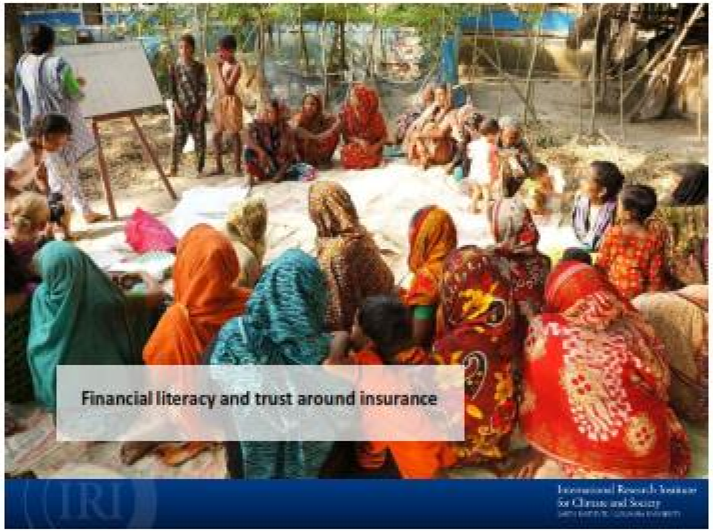
"IT'S ABOUT THE GOOD YEARS"

Unlocking productive opportunities

Need to understand farmers' 'business model'!

- How diverse are farmers practices within your group? Within the community?
- What are farmers' options to increase their productivity? What prevents them from doing so?
- What access do they have to extension services? Better inputs?
- How easily can farmers get an agricultural loan?
- What are some of the coping strategies in a very bad year?





Games to train, elicit risks and farmer opportunities

- Economic game
- Participatory exercise
- Educational game

Index Insurance Game: GAME SHEET 1

Stage 1. Make Decisions – Circle Your Choices

Decision A. Choose ONE Seed Type:

Traditional Seeds		High Quality Seeds
Normal Season: Make 10,000 BDT Bad Season: Make 0	OR	Normal Season: Make 30,000 BDT Bad Season: Make 0
No Cost Pay: 0		**Pay for Inputs** Pay: 4000 BDT at end of season

Stage 2: Season Type is Determined

Circle Outcome:

Normal Season   **Bad Season**

Index Insurance Game: GAME SHEET 2

Stage 1. Make Decisions – Circle Your Choices

Decision A. Choose ONE Seed Type

Traditional Seeds		High Quality Seeds
Normal Season: Make 15,000 BDT Bad Season: Make 0	OR	Normal Season: Make 30,000 BDT Bad Season: Make 0
No Cost Pay: 0		**Pay for Inputs** Pay: 4000 BDT at end of season

Decision B. Purchase Flood Index Insurance?

Purchase Insurance (YES)		Don't Purchase Insurance (NO)
Insurance Cost: Pay 4000 BDT If Normal Season: Payout 0 If Bad Season: Payout 12000 BDT	OR	Insurance Cost: Pay 0 If Normal Season: Payout 0 If Bad Season: Payout 0

Stage 2: Season Type is Determined

Circle Outcome:

Normal Season **Bad Season**

Index Insurance Game: GAME SHEET 3

Stage 1. Make Decisions – Circle Your Choices

Decision A. Choose ONE Seed Type

Traditional Seeds		High Quality Seeds
Normal Season: Make 10,000 BDT Bad Season: Make 0	OR	Normal Season: Make 30,000 BDT Bad Season: Make 0
No Cost Pay: 0		**Pay for Inputs** Pay: 4000 BDT at end of season

Decision B. Purchase Flood Index Insurance?

Purchase Insurance (YES)		Don't Purchase Insurance (NO)
Insurance Cost: Pay 4000 BDT If Normal Season: Payout 0 If Bad Season: Payout 12000 BDT If Bad Season because of pests: Payout 0	OR	Insurance Cost: Pay 0 If Normal Season: Payout 0 If Bad Season: Payout 0

Stage 2: Season Type is Determined

Circle Outcome:

Normal Season **Bad Season**

Index Insurance Game: GAME SHEET 4

Stage 1. Make Decisions – Circle Your Choices

Decision A. Choose ONE Seed Type

Traditional Seeds		High Quality Seeds
Normal Season: Make 10,000 BDT Bad Season: Make 0	OR	Normal Season: Make 30,000 BDT Bad Season: Make 0
No Cost Cost: 0		**Pay for Inputs** Pay: 4000 BDT at end of season

Decision B. Purchase Flood Index Insurance?

Purchase Insurance (YES)		Don't Purchase Insurance (NO)
Insurance Cost: Pay 4000 BDT If Normal Season: Payout 0 If Bad Season: Payout 12000 BDT If Bad Season because of pests: Payout 0	OR	Insurance Cost: Pay 0 If Normal Season: Payout 0 If Bad Season: Payout 0

Decision C. Purchased Insurance? If Yes, Participate in Community Cooperative?

YES Community Cooperative		No Community Cooperative
Cost: 800 BDT If Normal Season: Payout 0 Bad Season: **No Insurance Payout** – Coop Payout: 2,800 BDT; **Insurance Payout** – Coop Payout: 0	OR	Cost: 0 If Normal Season: Payout 0 If Bad Season: Payout 0

Stage 2: Season Type is Determined

Circle Outcome:

Normal Season **Bad Season**

TECHNOLOGIES COME INTO PLAY

If only the satellite info was available in farmer meetings….

- And the farmer meeting info available in the satellite analysis
- Being tested in the field

Terabytes of climate/weather big data in index insurance

- Many **FREE** sensors/products
  - Rainfall Estimates: CHIPRS, TAMSAT, ARC2, ENACTS…
  - Vegetation: EVI, NDVI, NDWI …
  - Soil Moisture (Passive Microwave, Active Microwave, Water Budget)
  - Evapotransporative Stress, Flood, High resolution imagery

1 Jun 2017

Global Merged Satellite Ground Rainfall CHIRPS

- IRI Data library-we hope to give you "convenient" access, even on phone
  - iridl.columbia.edu
  - bit.ly/IRIdataguide
  - fist.iri.columbia.edu/sathere
  - iri.columbia.edu/fi

1 Jun 2017

Global Satellite Soil Moisture VUT SWI

International Research Institute for Climate and Society

Dhonnobad !

Thank you !

International Research Institute for Climate and Society

Earth Institute | Columbia University

Mélody Braun
mbraun@iri.columbia.edu

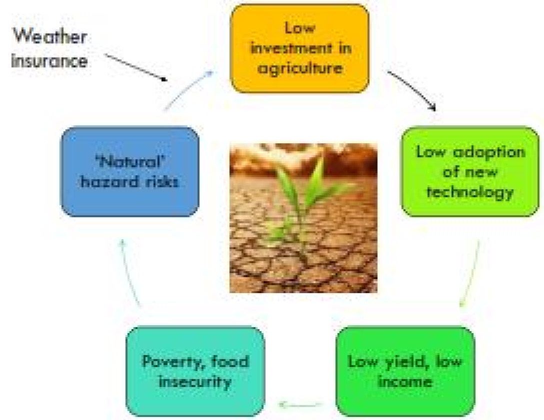
Appendix C19: Mind the gender gap in crop insurance! Farmers' gendered preferences and climate change skepticism in coastal

The influence of gender and product design on farmers' preferences for weather-indexed crop insurance

Sonia Akter (National U. Singapore), Tim Krupnik (CIMMYT),
Fahmida Khanam (IRRI/CIMMYT),
Frederick Rossi (CIMMYT)

ipa

Agricultural insurance and poverty alleviation

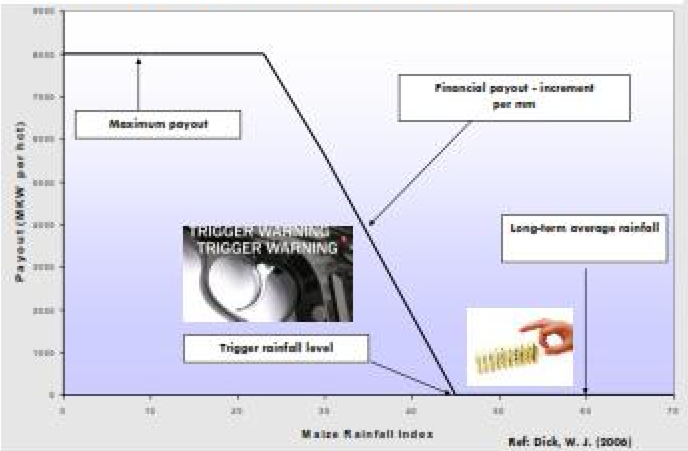


Traditional vs index insurance

- 'Traditional' insurance
  - Loss adjustment and farm level data
  - Moral hazard
  - Adverse selection due to asymmetric information
  - High monitoring and administrative costs
  - Operationally difficult for small farmer agriculture
- Weather index insurance (WII)
  - An index is a variable that is highly correlated with losses.
  - Example indices: rainfall, temperature, regional yield, river height levels, etc.
  - Payout is tied to the value of an "index"- not on actual losses.

Ref: Dick, W. J. (2006)

How does weather based index insurance work?



Ref: Dick, W. J. (2006)

Advantages and challenges

Advantages:

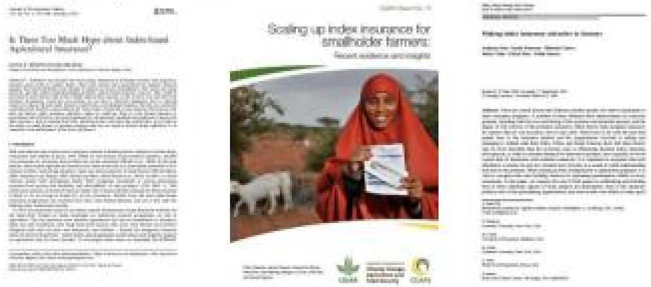
- Objective and transparent (at least to some)
- Provides timely payout where agencies are well functioning
- Reduces administrative costs for insurers
- Widely promoted as suitable for small-scale farmers

Challenges:

- **Basis risk** – the potential mismatch between losses and payouts
- May not be suitable for all hazard types
- Data to identify trigger levels may not be easily available
- Index measurement may entail high upfront costs
- Primarily focusses on single-risk hazard protection
- Requires local adaptation – slows the scaling up

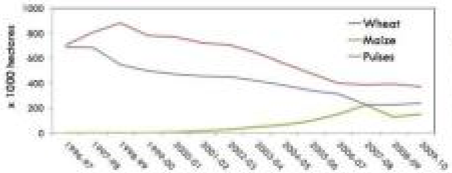
Low adoption rate and savings-linked insurance?

- Low demand for index insurance product (Cole et al., 2010; Giné et al., 2008; Cole et al., 2011)
- Potential clients' desire for 'good time payment' (Akter, 2012)
- Is the problem product "packaging" (Stein and Tobacman, 2011)?
- People view insurance as a form of investment, and people save primarily to protect against shocks.



Study background

- Agriculture: 40% of Bangladesh's GDP.
- High risk → low adoption of new technology.
- Maize is Bangladesh's most rapidly expanding cereal crop.
- Maize is a 'high-investment-high-return' cash crop.
- But extreme weather is a recurrent threat to maize production.
- Farmers should theoretically have an intrinsic interest in insuring their crops against large losses.



Maize: Highly remunerative, and also highly risky

Study objectives

- Understanding the gendered implications of new maize farmers' preferences for index-based, savings-linked weather insurance products.

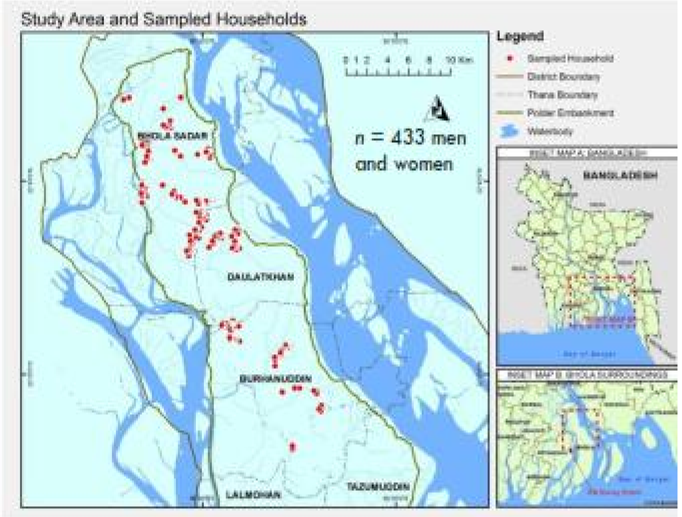
Hypotheses

1. Demand for savings-linked insurance product is higher than pure weather index insurance.
2. Demand for insurance varies across weather risks (i.e., flood, storm, hail).
3. Demand for insurance varies across: farmers' risk profiles and gender


Global Environmental Change

The influence of gender and product design on farmers' preferences for weather-indexed crop insurance

Sonia Akter, Timothy J. Krupnik, Frederick Rossi, Fahmida Khanam



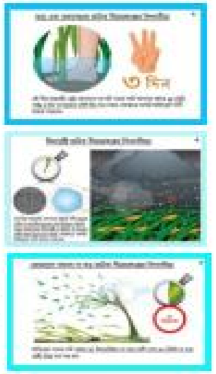
Methodology: Choice experiment

Attributes	Levels
Insurance type	(1) Pure insurance (i.e., good time payment=0) (2) Pure savings (i.e., good time payment=deposit) (3) Insurance-savings mix (i.e., good and bad time payment>0)
Premium	 US$ 1.2 to US$ 50
Bad time payment	 US$ 12.5 to US$ 62.5
Good time payment	 US$ 0 to US$ 50
Risk type *Note: US$ 1= Tk 77*	 Flood  Wind  Hail

Methodology: Choice experiment

Trigger levels = intensity (I) + duration (d)

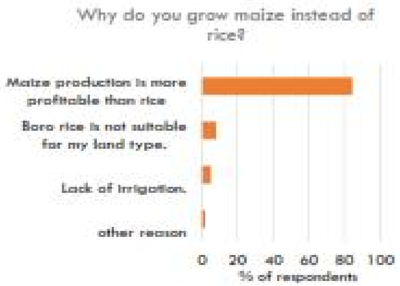
	Flood	Wind	Hail
Level 1	I=15 cm	I=75km/h	I=1 Tk coin
	D=3 days	D=30 min	D=5 min
Level 2	I=15 cm	I=75 km/h	I=1 Tk coin
	D=2 days	D=15 min	D=3 min
Level 3	I=10 cm	I=60 km/h	I=any size
	D=3 days	D=30 min	D=5 min

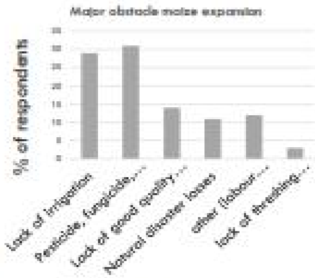


Sample description

	Male [299 (69%)]	Female [134 (31%)]
Average age (max-min)	45 (18-85)	35 (20-70)
Head of household	87%	23%
Household size	6.58	5.57
Illiterate	21%	18%
Electricity connection	22%	29%
Cultivable land (in decimal)	103	45
Non-land asset (in Taka (US$))	152,000 (US$ 1,948)	96,000 (US$ 1,230)
Agricultural decisions are made		
By the respondent alone	74%	10%
In consultation with the spouse	10%	86%
Household expenditure decisions are made		
By the respondents alone	65%	8%
In consultation with the spouse	17%	88%

Gendered implications of maize production





	mean
Difference in profit between maize and rice per decimal of land (US$, 1 decimal < 1% of 1 hectare)	3
Farm size (decimal, < 1% of 1 hectare)	30
Revenue (US$ per decimal) Note: US$ 1=Tk 77	139
Experience of maize production (in years)	3.28

Women and maize:
- Earn less ***
- Less educated**
- Less familiar with insurance*
- More risk averse**
- Lower discount rate***

Latent class logit model: main- and interactive effects

- Pseudo R^2, Bozdogan Akaike Information Criterion (AIC3) & Bayesian Information Criterion (BIC): 2-segment model optimum (Andrews and Currim, 2003).
- **Segment group 1:** Status-quo, "insurance averse" ($P<0.001$)
- **Segment group 2:** Opted for insurance, "insurance favored" ($P<0.001$)
- **Both segments:** Coefficients for *deposit*, *good time payment*, and *bad time payment* indicate lower demand for inundation based WII (as a baseline hazard)
- **Segment group 1:** Insurance averse farmers had significant ($P<0.001$) preference heterogeneity with respect to hazard type
- **Segment group 1:** *Hail* index insurance had significantly ($P<0.01$) lower demand than *inundation* insurance; *wind* insurance results inconclusive
- **Segment group 2:** Coefficients of interaction terms indicate equal willingness to pay for *hail*, *inundation* or *wind* insurance

Intra-group heterogeneity and gender gaps

Explanatory variables	Group 1	Group 2	Explanatory variables	Group 1	Group 2
Gender gap			*Farming characteristics and spatial variation*		
Female*Non-status quo	-1.40**	-2.60***	Revenue*Non-status quo	0.004	0.025*
Female*Time*Non-status quo	0.03*	0.06**	Land size (high)*Non-status quo	-0.0002	-0.002
Female*Spouse*Non-status quo	0.22	-0.84**	Land size (med*Non-status quo	0.0015**	0.007***
Risk aversion			Land size (low)*Non-status quo	-0.005	0.004
Risk averse*Pure insurance	0.10	-0.90***	Sub-district 2**Non-status quo	0.80***	0.80*
Risk averse*Pure savings	0.75***	-0.80***	Sub-district 3**Non-status quo	0.50**	-1.12***
Risk averse*Mix	-0.33	-0.41	***Model fit statistics***		
Time preference			McFadden Pseudo R^2		0.20
Time preference*Pure insurance	-0.53**	-0.22	Number of groups		433
Time preference*Pure savings	0.42	0.002	Number of observations per group		6
Time preference*Mix	0.05	0.17	Chi squared		1051.17 [p<0.0001; 61 d.f.]

Intra-group heterogeneity and gender gaps

- Wealthier households and HHs with savings account significantly more likely to favor insurance than poor HHs ($P<0.05$ and <0.01)
- Women significantly more insurance averse ($P<0.001$)
- *Things are more complex than what you see in a photograph!*

'Unbundling' insurance preferences

- **Segment group 1:** "insurance averse": Less likely to choose partial or no return over full return ($P<0.001$), equal between genders
- **Segment group 2:** "insurance favored": Full return preferred under all other options ($P<0.001$), women showed less preference for full and partial return ($P<0.001$); no return was equal across genders

Implicit prices (Willingness to pay premium)

1 USD – TK 77	'Insurance averse'	'Insurance favored'	Difference
Premium for US$13 bad time payment			
Pure insurance	$1.5***	$ 3.4***	$ 2.0***
Insurance-Savings Mix	$1.2	$ 4.0***	$ 3.0**
Premium for US$13 good time payment			
Insurance-Savings Mix	$12.0***	$ 7.2***	$ -5.0***
Premium for risk type			
Flood/Wind	$1.2***	$0.6	$ 0.6

Semi-quantitative follow-up study

- ***Hypothesis 1:*** Low insurance demand may be due to a lack of trust in insurance institutions.
  - 1/3 of respondents victims of previous financial fraud by NGOs.
  - No gender difference ($Chi^2 = 1.5$; $P=0.2$).
  - Strong preference for government or Islamic banks.
- ***Hypothesis 2:*** Low insurance demand may be linked to distrust in WII
  - Men in particular distrusted WII – did not like that compensation is not linked to direct damage assessment
  - Basis risk concerns
  - Low insurance demand linked to low financial literacy: 25 and 75% men and women found the WII concept complicated

Conclusions

- Maize insurance markets – if they develop – are likely to be segmented.

  What about our early hypotheses?

- ***H1***: Demand for savings-linked insurance product is higher than pure insurance (disproven)
- Pure insurance is preferred over pure-savings or insurance-savings mixed products.
- ***H2***: Demand for insurance varies across risks (i.e., flood, storm, hail). (Proven, and *ironically* depending on segment)
- ***H3***: Demand for insurance varies across risk preference, and gender (Proven)
  - Medium to large and wealthier farmers: likely WII clients
  - Women respondents were significantly more likely to prefer no insurance, with clear links to financial literacy levels.
- ***Surprises***: Lack of trust and confidence in insurance products a key consideration in insurance project design.

Implications

❖ Bundled savings-weather index insurance products may not be attractive.
  - Start with a focus on simpler products

❖ In similar risk-prone environments, and with farmers adopting new and risky technologies, emphasis should be placed on:
  - Developing knowledge of existing social safety nets
  - Understanding insurance market segmentation
  - Assuring and strengthening the creditability of insuring institutions
  - Consider that trust in financial institutions and insurance concepts may vary significantly between men and women
  - Efforts to boost women's financial literacy may be prerequisite for the equitable distribution of benefits from crop insurance, including weather index insurance

Thanks to IPA for funding this study!

More reading…

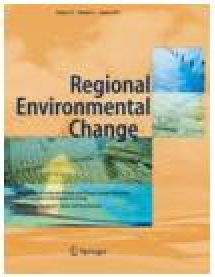
Reg Environ Change
DOI 10.1007/s10113-017-1174-9

CrossMark

ORIGINAL ARTICLE

Climate change skepticism and index versus standard crop insurance demand in coastal Bangladesh

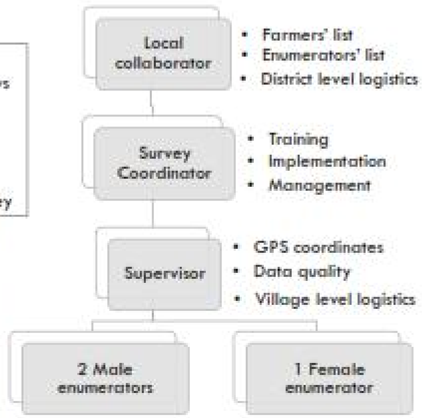
Sonia Akter [1,2] · Timothy J. Krupnik [3] · Fahmida Khanam [2,3]



Data collection

- Focus group discussions
- Key informant interviews
- Secondary data collection
- Experiment design
- Pretest
- Fully structured hh survey

Male farmer	299
Female farmer	134
Male enumerator	12
Female enumerator	6
Survey team	6
Supervisor	6

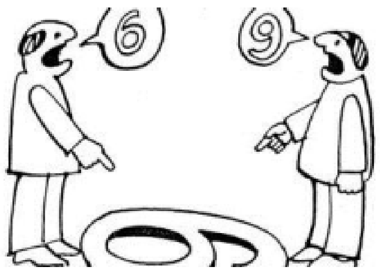


Appendix C: 20. Round table sharing of climate communication and visitation tools and methods: What works and what needs to be improved?

Visualisation and communication

what works where and when for whom

- What we we're good at?
- What we need to do better?



Visualising Climate Services

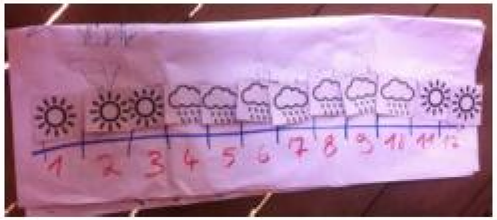
- Understanding farmers' perceptions of weather/climate
  - Talking Toolkit : http://www.worldagroforestry.org/output/talking-toolkit
  - PICSA http://www.walker.ac.uk/media/1114/picsa-field-manual-final-english-11-03-16.pdf
- Gender Toolkit
  - CARE http://gendertoolkit.care.org/default.aspx
  - ICRAF & CARE https://ccafs.cgiar.org/publications/gender-and-inclusion-toolbox-participatory-research-climate-change-and-agriculture#.WcCUosgJHDc
  - IWMI https://cgspace.cgiar.org/rest/bitstreams/84748/retrieve
- Crop Calendar
  - FAO http://www.fao.org/agriculture/seed/cropcalendar/searchbycrop.do
- How to adapt?
  - FAO Climate-smart Agriculture Sourcebook http://www.fao.org/docrep/018/i3325e/i3325e00.htm
- Index-based flood insurance
  - IWMI https://www.youtube.com/watch?v=k8WkWhnchmc

Visualisation

- Nabansu – Bulletins structure & flowchart of bulletins + video
- Tam & Hieu - Agroadvisory Vietnam
  - Village Loan and Savings Associations (video) CARE https://www.youtube.com/watch?v=qbUNixyAj_4&feature=youtu.be
- Hazel – weather information
- Imelda - ASEAN Guidelines
  - ASEAN Guidelines on the Promotion of CSA Practices Volume 1.pdf
  - 2407_CSA Guidelines Vol_2 DB1.pdf
- Imelda – 10 steps for crop insurance
  - Updated 10 Phases Guide (for SSOM_38 AMAF submission).pdf
- IWMI – Index-based Flood Insurance (Video)
  - https://www.youtube.com/watch?v=k8WkWhnchmc

Prototype before workshop

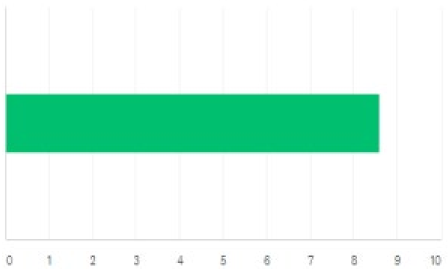
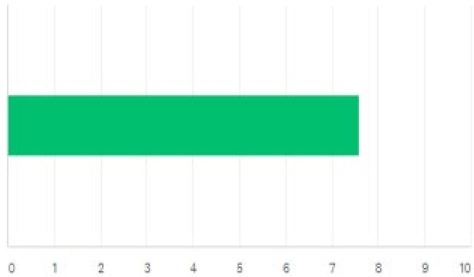
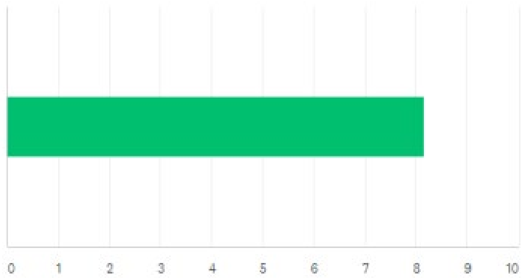
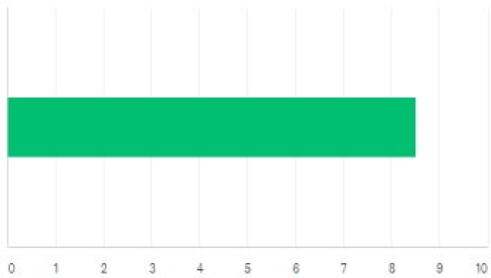
Using farmers' icons



After feedback from communities

- Local numbers
- Local symbols
- Reiterations
- Using pictures

IV. Appendix D: CSRD Technical Exchange Feedback Survey:

<table>
<tr>
<td>Was the content of the workshop relevant to your current (future) professional activities? (Rank 1-10)
</td>
<td>Please rate the presentations, panels and discussions throughout the three days?
</td>
</tr>
<tr>
<td>Please rate the interactive and participatory sessions on the second and third days? (Rank 1-10)
</td>
<td>Do you believe you have made connections at the workshop with new colleagues that will continue to be a resource for you once you leave this r
</td>
</tr>
</table>

What are the top two things you learned from the workshop that you expect to take back to your home countries or projects and make use of?

- We learned about 'PICSA' which is a new thing for us and a very useful sustainable approach to manage climate risks
- Tools of PISCA and other climate information services/CIS to support farmers in decision making
- Knowledge on ICT and participatory tools
- Different ways of climate forecast to farmer's decision making process
- Importance of weather and climate information in agriculture
- Different modules of agro-climate services possibly more appropriate after restructuring of the country
- Climate services are needed for Bangladesh
- Better understanding of similarities and differences between SA and SEA regions
- Flood Index Insurance/ Climate Insurance
- Crop planning - day 2 morning session
- India has greatly scaled up weather information and advisory dissemination through mobile phones
- Uses of graphs, probabilities to describe climate variabilities and to select crops/varieties and planting time
- How to deliver agro-met forecast and Agro-meteorological advisories to the farmers

- ICT based service to farmers in India
- Scope to develop Agricultural Climate Services in BD
- Application of sub-seasonal to seasonal forecast in agriculture
- Need and potential of agro metro logical interventions for efficient agricultural practices
- Design of Climate Information for Agricultural sector
- Relationship between Climate and Agriculture

Please list any specific methods or tools that you found to be particularly useful and describe why.

- PICSA tools and participatory learning will help for designing research tools and facilitation at field level
- PICSA' which is a new thing for us and a very useful sustainable approach to manage climate risks and would be very useful for our CSRD activities and farmer can easily understand this method.
- SWOT analysis. Easy to understand strengths, weaknesses, opportunities, and threats of all the stakeholders in the technical exchange
- Options by contexts are simple and easy to apply
- Participatory decision making process, which is very useful for correct and accurate decision making by farmers
- The agro-climate services used in India and other countries having federal system will be very useful for our future structure of the research and extension services. Farmers field school on agro-climate services will be also useful in Nepalese context
- Climate service project analysis and management
- PICSA, also interesting to see the app from the Nepal
- IRI game method for index insurance
- How to use probability tools and graphs for farmers benefits
- Support service to farmers in India is praise worthy
- Activity and discussion: Institutional arrangements to improve the flow of agriculturally relevant climate information to farmers in South and South East Asia: A participatory mapping exercise. Facilitated by Timothy J. Krupnik (CIMMYT)
- Examples showed how EL Nino is correlated with seasonal rainfall prediction and its application in agricultural planning in Africa
- Satellite based forecasting for fishing in sea implemented by India. It has got huge potentials under the present initiative of Blue growth Economic Development in Bangladesh.
- The method to identify the user/farmer need
- Climate Insurance Index

Can you describe any suggestions you might have to improve workshops like this in the future?

- More exercises can be added because they are more useful and easily understandable. A short field visit with a success story (Like Agriculture Insurance/field school etc.) can be organized.
- A short field trip will be more interesting in this regard.
- Some materials presentations and concept paper are needed to be distributed to the participants before the workshop
- All participants should be residential for 100% participation.
- The workshop was perfect, but had very hectic schedule. Some leisure time for foreigners for a glance of the new country may energize the participants
- Country specific presentation could be checked and verified earlier before presentation
- Some of the participatory exercises scratched the surface and didn't provide much new, e.g. the institutional system
- Perhaps keep a tighter focus on a main theme or objective. The workshop seemed to cover a broad and perhaps diffuse set of topics and objectives.

- Demonstration of case studies on Climate Service Information system and Climate service tools that are being used/to be used for making a comprehensive solution to the farmers under the climatic variability and climate change.
- Researchers are not the best choice to represent farmers. In future for the working group session it is better to invite farmers to our workshop or organize collective field visit to draw upon key recommendations. Overall workshop was useful and relevant to me.
- Field visit
- Reduce the duration. Too many speakers having no commendable items to discuss is meaningless.
- For such very interactive and participatory research workshop venue should be selected inside any university or research institute campus
- Minimum 5 days of Workshop
- More detail discussion, more practical session
- It is fantastic for participant to share experience and knowledge

Would you like to be regularly updated on CSRD South Asia activities and notified of future opportunities to participate in learning exchanges and workshops?

- 96% (24 out of 25 participants) agreed that they would like to be regularly updated on CSRD South Asia activities and notified of future opportunities to participate in learning exchanges and workshops.
- Among 25 participants, one explained that it would be very useful if a system could be developed where the participants of the workshop could interact each other on regular basis and some exchange programme among the participating countries could also be arranged

V. Appendix E: Additional organizations' flowcharts from Day 3 activity: Institutional arrangements to improve the flow of agriculturally relevant climate information to farmers in South and Southeast Asia: A participatory mapping exercise

Figure 1: Institutional Framework for Climate Services in Bangladesh

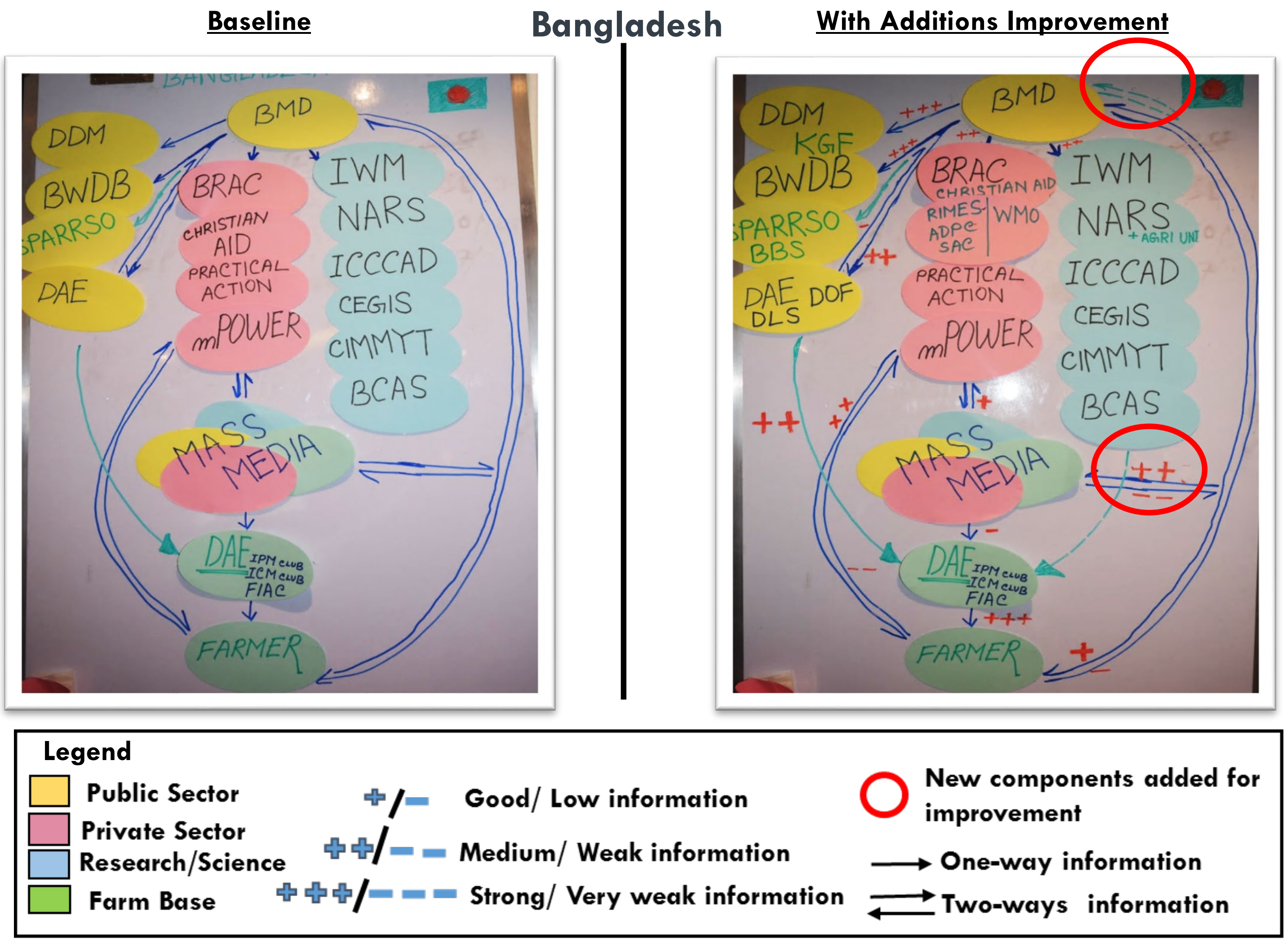
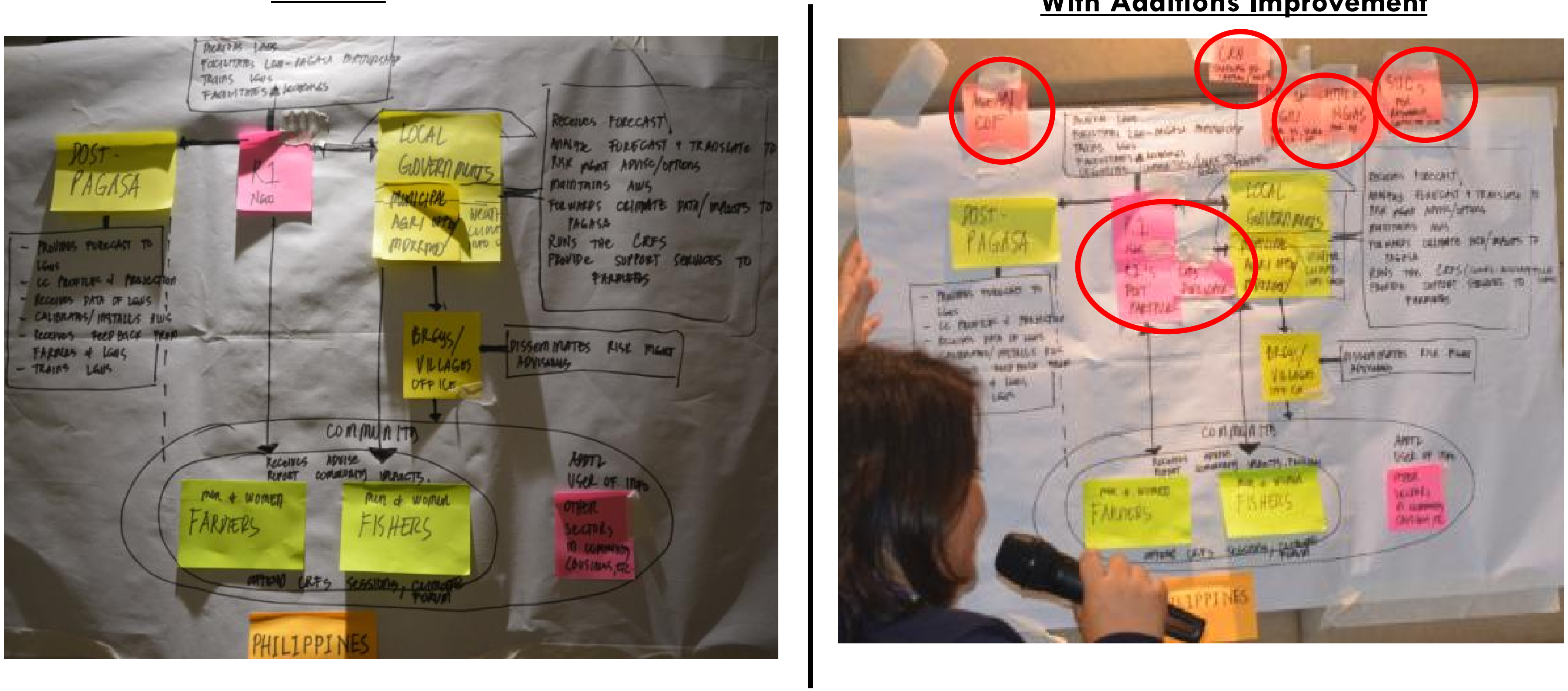


Figure 2: Institutional Framework for Climate Services in Philippines

Philippines

Baseline

With Additions Improvement



Legend

- Public Sector
- Private Sector
- Research/Science
- Farm Base

+/– Good/ Low information

++/– – Medium/ Weak information

+++/– – – Strong/ Very weak information

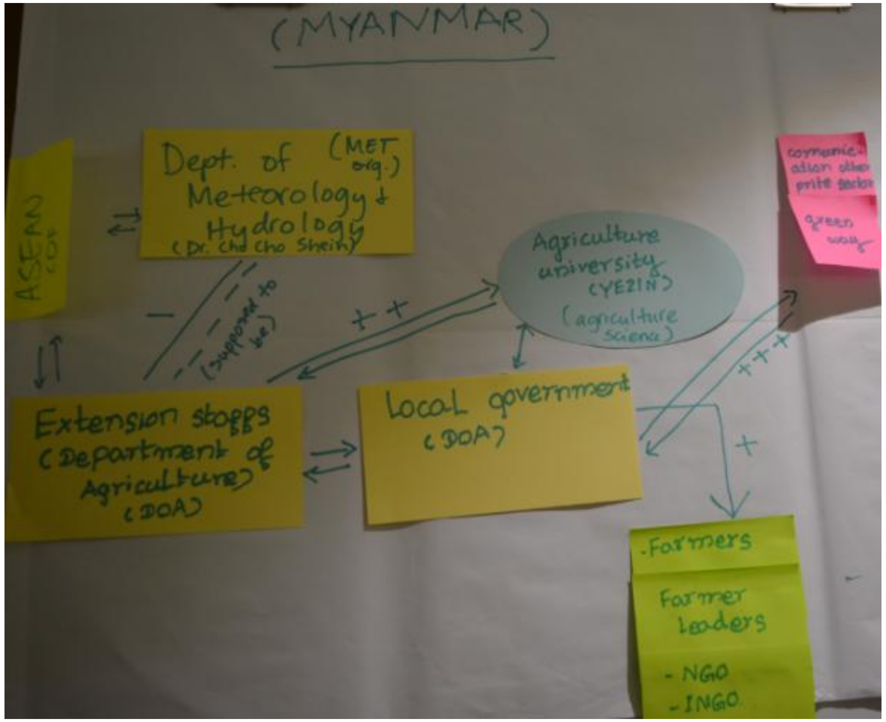
→ One-way information

↔ Two-ways information

Figure 3: Institutional Framework for Climate Services in Myanmar

Myanmar

Baseline



With Additions Improvement

Legend

- Public Sector
- Private Sector
- Research/Science
- Farm Base

+/− Good/ Low information

++/− − Medium/ Weak information

+++/− − − Strong/ Very weak information

New components added for improvement

→ One-way information

⇄ Two-ways information

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