Proceedings of the Regional Forum on Climate Action and Food Systems Transformation in South Asia

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Dhaka, Bangladesh

Organized by:

College of Agriculture and Natural Resources
Michigan State University
East Lansing, Michigan, USA
and
Farming Future Bangladesh
Dhaka, Bangladesh

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- North South University, Bangladesh
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- The Energy and Resources Institute, India
- University of Jaffna, Sri Lanka
- University of Liberal Arts, Bangladesh
- University of Peradeniya, Sri Lanka

Foreword

In the face of an accelerating climate crisis, over 2 billion people of the South Asia region find themselves at the crossroads of two critical challenges: ensuring food and nutritional security for one of the most populous regions of the world and adapting to climate changes that threaten agricultural productivity, food security and livelihoods. The impact of climate change on agriculture is not just a distant threat; it is a present reality for millions of farmers across the region. The South Asia Regional Forum on Climate Action and Food System Transformation, organized in Dhaka, Bangladesh in mid-April 2024, sought to address these challenges by bringing together experts from six countries in the region and the U.S., representing diverse organizations and stakeholders.

Numerous organizations, both public and private, are playing a pivotal role in fostering dialogues and collaborations to address the climate crises threatening food security and livelihoods in the South Asia region. Through this forum, a community of policymakers, researchers, scientists, and practitioners gathered with a shared purpose: to dialogue, collaborate and innovate. It is our collective hope that the conversations initiated during this event will lead to tangible outcomes that benefit the most vulnerable communities in South Asia to help adapt and mitigate climate change. Climate change does not respect national borders, and neither should our solutions. The urgency of addressing climate challenges calls for a unified, cooperative approach across the region in partnership with other programs globally.

These proceedings capture the critical insights, discussions, and recommendations made during the forum, and highlight the path forward for climate action in South Asian food systems. It is a call for action, not only for governments and organizations, but for every individual whose life depends on the sustainability of agriculture and food systems in this era of climate change.

We hope that the recommendations made by the forum participants will be useful to various stakeholders and organizations engaged in addressing climate change issues at local, regional and international levels.

With Best Wishes,

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We also extend our heartfelt thanks to the *Bangladesh Agricultural Research Institute (BARI)* and *Bangladesh Rice Research Institute (BRRI)* for opening their doors to the participants and showcasing the remarkable innovations happening within the country's agricultural research system. Their work exemplifies the types of advancements that can help South Asia adapt to the growing threats of climate change.

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A special thanks goes to the representatives from various countries in South Asia who shared their experiences, expertise, and visions for the future. The participation of experts from *Bangladesh*, *India*, *Nepal*, *Pakistan*, *Sri Lanka*, and *Myanmar*, and non-governmental organizations, CGIAR Centers, Alliance for Science, and various development agencies added immense value to the dialogue and interactive discussions.

Lastly, these proceedings would not be complete without acknowledging all the participants, panelists, and breakout session facilitators, whose contributions helped shape this critical dialogue. Their expertise, active engagement, and shared commitment to building a resilient food system have paved the way for future collaborations and action.

Acronyms

AI/ML	Artificial Intelligence / Machine Learning
BARI	Bangladesh Agricultural Research Institute
BRRI	Bangladesh Rice Research Institute
BSKKV	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth
CANR	College of Agriculture and Natural Resources
CGIAR	Consultative Group on International Agricultural Research
DoE	Department of Environment
FFB	Farming Future Bangladesh
FAO	Food and Agriculture Organization of the United Nations
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IWMI	International Water Management Institute
IoT	Internet of Things
MSU	Michigan State University
NARC	Nepal Agricultural Research Council
NGO	Non-Governmental Organization
SAARC	South Asian Association for Regional Cooperation
TERI	The Energy and Resources Institute
USA	United States of America

Executive Summary

The South Asia Regional Forum on Climate Action and Food System Transformation held in Dhaka, Bangladesh from April 16-18, 2024, brought together over 60 experts from six countries across the region and the U.S. to discuss and formulate recommendations to address the increasing threats of climate change on food systems, food security, and livelihoods. The impacts of climate change are multi-sectoral, affecting agriculture, health, education, transportation, and trade, among others. With a focus on actionable solutions, the forum facilitated interdisciplinary discussions on policy, research, innovation, outreach, and collaborations to build climate-resilient food systems across the South Asia region.

The forum's primary objectives were to explore strategies for climate adaptation and mitigation in the agricultural sector, promote knowledge sharing across borders, and inspire policy reforms and investments to address the challenges of climate change. With country representatives from *Bangladesh*, *India*, *Nepal*, *Pakistan*, *Sri Lanka*, and *Myanmar* and faculty members from Michigan State University, USA, this regional forum also provided an essential platform for regional collaboration and cooperation in a global context.

Key highlights of the forum included:

- *Summary Presentations* from country representatives on national climate challenges and food security measures.
- *Panel discussions* on early warning systems, research and outreach collaboration, policy pathways, socio-economic issues, and training and capacity building in climate action and food systems transformation.
- *Breakout group discussions* on the above-mentioned issues.
- *Site visits* to Bangladesh Agricultural Research Institute (BARI) and Bangladesh Rice Research Institute (BRRI), highlighting research and local innovations to help address climate change.

The participants of the forum recognized that climate change poses significant threats to food security and livelihoods in South Asia, affecting nearly 2 billion people. The participants recognized and emphasized continued awareness creation, education, training, and capacity strengthening to address climate change issues. The forum concluded with a series of key recommendations listed below to enhance climate resilience in South Asian agriculture and food systems, including expanding the use of climate-smart technologies, fostering regional partnerships for collaborative research and outreach, and integrating traditional knowledge with modern agricultural practices.

- **Foster multidisciplinary and multisectoral collaborations along value chains.**
- **Encourage policy alignment between national policies and regional strategies.**
- **Develop early warning systems for extreme weather events.**
- **Strengthen capacity and infrastructure for big data management, remote sensing, and modeling for climate-smart agriculture.**
- **Develop strategies that are specific to the diverse agroclimatic conditions, socio-cultural contexts, and identified hazards and risks in different regions.**
- **Tailor adaptation and mitigation strategies to smallholder farming and provide incentives for local farmers and communities to adopt these strategies.**
- **Strengthen knowledge sharing through blending of indigenous knowledge with modern approaches and learn from experiences of local communities.**

The forum strongly emphasized the need for all the stakeholders to work together to strengthen capacity for building climate resilient food systems and expanded regional and international collaboration for continued sharing of expertise, experiences, information, and technologies.

Background and Introduction

Climate change poses one of the most significant threats to agriculture in the South Asia region and globally. The South Asia region consists of eight countries of the South Asian Association for Regional Cooperation (SAARC), including Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. The region has a population of over 2 billion people (25% of the world's population), including some of the world's poorest and most vulnerable populations. Millions of these people are dependent on farming for their livelihoods, and the region is highly vulnerable to climatic shocks and extreme weather events. For the last few decades, this region has been experiencing intensifying heat waves, droughts, heavy rainfall, cyclones, floods, and excessive salinity.

South Asia is highly reliant on agriculture, which contributes significantly to the region's GDP and employs a large portion of the population. However, climate change has begun to impact every aspect of agriculture, from crop yields to the availability of arable land. These changes have disrupted agricultural practices, leading to reduced crop yields, increased food insecurity, and rising poverty levels. Climate change is not only affecting agricultural productivity but is also exacerbating food and nutrition insecurity in South Asia. Poor households in rural areas are particularly vulnerable, as they rely heavily on subsistence farming. The impacts of climate change are multi-sectoral, affecting not only agriculture, but also health, education, transportation, and trade, among others.

Agricultural innovations are essential for combatting the adverse effects of climate change. Advanced technologies are emerging as powerful tools to support sustainable agriculture and mitigate the impacts of climate change in South Asia. Accurate weather forecasting and sophisticated early warning systems enable farmers to anticipate and prepare for extreme weather events like heavy rains, floods, droughts, and heatwaves. Generative AI models can simulate the effects of climate change on crop yields, aiding in developing adaptive strategies. Data science, particularly big data analytics, empowers scientists and policy makers by providing actionable insights from complex climate and soil data. By optimizing crop management practices and water use, these technologies contribute to building resilient food systems that can withstand the increasing climate variability and extreme weather events prevalent in the region.

The South Asia Regional Forum on Climate Action and Food System Transformation sought to explore the multi-dimensional impacts of climate change on agriculture, food security, and livelihoods, while discussing strategies for resilience and adaptation. The forum was held in the InterContinental Hotel Dhaka, Bangladesh, from April 16 to April 18, 2024, and engaged over 60 diverse stakeholders from six South Asian countries, including Bangladesh, India, Pakistan, Sri Lanka, Nepal, and Myanmar, as well as representatives of CGIAR International Centers, non-governmental organizations, Farming Future Bangladesh, and Michigan State University. This forum provided an excellent platform for dialogue on climate change issues facing the region and to collectively formulate recommendations to address climate change issues in a regional context. Among the distinguished attendees were climatologists, agricultural scientists, policymakers, and development professionals who brought valuable insights into the impact of climate change on agriculture and food systems.

Scope and Format of the Forum

The program included summary presentations, six interactive panel discussions, four breakout groups, and a concluding session to discuss the recommendations for a way forward.
The scope of the event extended beyond academic and theoretical discussions. It aimed to create a tangible impact by encouraging the participants to develop collaborative research projects, partnerships, and actionable recommendations for both the local and regional levels. The diversity of participants ensured that a range of perspectives and experiences were shared, contributing to a more comprehensive

Objectives

The key objectives of the forum were to:

1. *Facilitate dialogue* among diverse stakeholders from various organizations, representing agriculture, climate science, policy, and development, to discuss solutions for building climate-resilient food systems.
2. *Encourage interdisciplinary research and partnerships* to address climate challenges in agriculture, promoting the exchange of ideas and technologies across borders.
3. *Inspire policy reforms* by engaging policymakers, advocating for climate-smart agricultural policies, and ensuring that governments prioritize food security and climate adaptation in their national agendas.
4. *Foster regional and international collaboration to mobilize expertise, experiences and resources* for the development and implementation of climate-resilient agricultural technologies and programs ensuring that smallholder farmers have access to these innovations and solutions.

understanding of the challenges and opportunities for building climate-resilient agriculture.

The forum followed a *multi-modal format* that allowed for maximum engagement, interactions and collaboration. Each day was structured around a combination of:

- *Summary Presentations*: These brief presentations, given by representatives from different countries, focused on the specific issues related to climate challenge and food security in their respective nations. Each talk highlighted key climate impacts, ongoing initiatives, and strategies to adapt and mitigate the risks posed by climate change.
- *Panel Discussions*: Panelists, drawn from a variety of disciplines, were engaged in six in-depth panel sessions focusing on topics such as early warning systems, policy advocacy, communication and awareness creation, technology integration, socio-economic dimensions, and the importance of education, training and capacity building.
- *Breakout Sessions*: Participants were divided into four smaller groups to dive deeper into specific themes. These sessions fostered collaboration on potential research projects, regional partnerships, and innovative solutions to address shared climate risks.
- *Site Visits*: Participants visited two agricultural research institutions, including Bangladesh Agricultural Research Institute (BARI) and Bangladesh Rice Research Institute (BRRI), where they met scientists working on cutting-edge innovations in agriculture, such as biotic and abiotic stress-tolerant crop varieties. These field visits allowed participants to witness firsthand how science and technology are being leveraged to combat climate change.
- *Way Forward Session*: The forum concluded with a series of key recommendations to enhance climate resilience in South Asian agriculture and food systems, including expanding the use of climate-smart technologies, fostering regional partnerships for collaborative research and outreach, and integrating traditional knowledge with modern agricultural practices.

Opening Remarks

Mr. Md Arif Hossain, Chief Executive Officer of Farming Future Bangladesh (FFB), welcomed all the participants to the regional forum. He emphasized the importance of collaboration in addressing climate change issues and food security challenges. He concluded by calling for collective action towards sustainable, resilient, and equitable food systems in South Asia.

Dr. George Smith, Director of AgBioResearch and Senior Associate Dean for Research in the College of Agriculture and Natural Resources (CANR) at Michigan State University (MSU), USA, focused on the global nature of climate change, emphasizing that agriculture contributes significantly to climate change emissions. He added that research should lead to benefits for

people, and limited farmland necessitates more efficiency with current resources.

Dr. Sheila Ochugboju, Executive Director of the Alliance for Science, shared her insights on the effects of climate change in sub-Saharan Africa, where drought and water crises have devastated local communities. She emphasized the need for global learning and collaboration, particularly looking to Asia-Africa collaborations for innovative solutions.

Dr. Karim Maredia, Assistant Dean and Director of CANR International Agriculture Programs at MSU, underscored the necessity of safeguarding food systems in South Asia and advocated for collaboration among governments, civil society, industry, academia, and development agencies to address climate change issues and enhance food security. He recognized the complex issues surrounding climate change and its impact in the South Asia region and advocated for developing indicators for monitoring and evaluation to assess impacts of adaptation and mitigation strategies to ensure effectiveness of efforts and inform future decisions.

Dr. Muhammad Abdus Shahid, the then-Honorable Minister of Agriculture for Bangladesh, emphasized the urgency of addressing the impacts of climate change on food security and biodiversity in Bangladesh.

Professor Emeritus Dr. Abdus Sattar Mandal of Bangladesh Agriculture University concluded the session, stressing the need for long-term regional and global collaboration to combat climate change, highlighting the effects of the changing climate on crop and food production in Bangladesh.

Summary Presentations

Nepal

Dr. Ram Krishna Shreshtha, Joint Secretary Ministry of Agriculture and Livestock Development, Government of Nepal, shared that Nepal has observed longer droughts, erratic

rainfall patterns, and a recurrent trend of late monsoon in recent years. These critical climate challenges have led to poor harvests and increased incidence of diseases, pests, and invasive species, and increased livestock and poultry diseases. Inadequate policy and funding support and lack of inter-ministerial and inter-agency coordination have made these issues difficult to address. However, some initiatives have been launched, such as developing stress-tolerant crop varieties, adaptation of technologies at the farm level, crop diversification, and agroforestry promotion to ensure food security.

India

Professor Atul Mohod from Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth (BSKKV) in Dapoli, India highlighted that India is a

geographically diverse country affected by a wide range of climate-related risks and is highly vulnerable to the impacts of climate change due to its vast population, extensive coastline, heavy reliance on agriculture, and significant poverty levels. Key issues include extreme heat waves, extreme rainfall, flooding, and landslides during the monsoon season, causing loss in infrastructure, agriculture, and food systems. These climatic conditions are creating salinity intrusion and coastal erosion, high soil erosivity and rising infiltration rates of soil strata. The Indian Government has started some initiatives to address climate change and food security. Priority areas include integrated coastal zone management, climate-resilient infrastructure and agriculture, and early warning systems and disaster preparedness.

Myanmar

Dr. Cho Cho San from Myanmar (currently a research and development specialist with MSU), discussed the major climate issues in Myanmar, their impacts on the country's food system, and Myanmar's priority sectors in addressing these challenges. Myanmar faces significant deforestation, along with rising temperatures, droughts, carbon emissions, and threats from El Niño and La Niña events, which occur every 3 - 4 years. In 2023, Cyclone Mocha caused an estimated $2.24 billion in direct damage. Policy- and farm-level bottlenecks hinder the implementation of corrective measures to reshape agriculture for the future. Myanmar's National Adaptation Programs of Action have outlined four key priority clusters for sustainable agriculture.

- *First Priority*: 1) Technology adaptation, 2) Early warning systems, 3) Seed conservation of genetic resources.
- *Second Priority*: 1) Legume diversification 2) Climate-resilient varieties.
- *Third Priority*: 1) Renewable energy 2) Solar power modification, 3) High-value crops.
- *Fourth Priority*: 1) Reducing the vulnerability of livelihoods in agro-ecological zones through high-yielding and climate-resilient varieties.

Pakistan

Dr. Fahad Sayeed, Climate Analytics South Asia Office, shared that extreme weather has impacted Pakistan in the last five years. In 2022, Pakistan experienced the worst monsoon floods in the history of the country and a record- breaking spring heatwave; in 2023, there was also an extreme heatwave; and in 2024, there was heavy and deadly rainfall in March. These events disrupted agricultural patterns and led to food insecurity due to reduced crop production and frequent crop failure. Pakistan lacks a framework for climate-smart agriculture, but the government is now prioritizing new farming technologies, better farm inputs, and programs focused on mitigating flood risk through ecosystems, restoring the ecological health of rivers, and afforestation to mitigate climate change impacts.

Sri Lanka

Professor G. Mikunthan, Senior Professor in Agricultural Biology at Jaffna University in Sri Lanka, discussed that in the last 3-5 years, high temperatures, flooding, drought, erratic rainfall, and accelerated land degradation have affected the health of the soil, causing farmers to use more chemical fertilizers. The most extreme climate event the Sri Lanka faces is flood; from 2017-2023, 202 people died and 600,000 were displaced. Floods and cyclones damage transport infrastructure and hinder the movement of food products, leading to price fluctuations and food shortages. Sri Lanka has limited adoption of modern agriculture and farmers have limited access to crop insurance schemes. The northern province of Sri Lanka is still recovering from the civil war and the people of Sri Lanka are still experiencing the post-war infrastructural challenges. Sri Lanka's national priorities are promoting climate-smart agriculture, strengthening water management, and deploying proper monitoring systems and enhanced food storage and distribution systems. Current programs focus on identifying the sectors most vulnerable to climate change and outlining strategies for adaptation, investing in renewable energy, and achieving 70% renewable energy in electricity generation by 2030.

Bangladesh

Dr. Md. Kamruzzaman, Sr. Scientific Officer, Bangladesh Rice Research Institute, shared the challenges Bangladesh faces, including a large population (170 million) on a small land area (148,460 square kilometers (57,320 sq mi)), with an even smaller amount of arable land (61%), which is decreasing due to migration and the establishment of unplanned shelter homes. Massive deforestation is leading to excessive heat. Bangladesh also experiences flash floods. Farmers are not aware of modern technologies, smart farming, and other innovations. Climate resilience technologies should focus on water resources management due to the country's extensive rice production. The National Adaptation Plan developed in 2023 outlines a long-term adaptation strategy, emphasizing resilience building and integrating climate considerations into national development plans. Programs focusing on crop diversification, developing stress resistant crop varieties, hydroponic farming, and alternate irrigation systems have been initiated. Dr. Kamruzzaman suggested mitigation strategies, including coastal green belt tidal river management, establishing early warning and weather forecasting systems, building cyclone shelters, and developing crop insurance programs.

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

Dr. Shalendar Kumar, Deputy Director of the Global Research Program on Enabling System Transformation at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), based in India, shared that droughts and floods repeatedly impact vulnerable regions of India. Climate change is increasing agricultural costs. Innovative technologies allow some to withstand the change, but many smallholder farmers cannot. A holistic approach is needed to balance both supply and demand – bundling recent innovations and next-generation climate information with market and technical information. ICRISAT's rural development programs have shown a 3-fold increase in farmers' income and an increase in cropping intensity from 110 to 180%. ICRISAT has embraced a unified approach for scaling up its Climate Smart Agriculture science-policy platform. One of ICRISAT's key programs, Virtually Integrated Systems to Access Agricultural Resources (VISTAAR), is an open public network dedicated to agricultural information and advisory services for addressing climate change and food security issues.

International Water Management Institute (IWMI)

Dr. Shreya Chakraborty, Lead of the Transforming Agri-food Systems in South Asia Initiative of International Water Management Institute (IWMI), highlighted that early retreat of winter affects the wheat crop in Bangladesh and India, leading to loss of income for farming households and decreased affordability of food for the households. Other key issues and impacts related to climate change and food security in IWMI's geographic focus areas in South Asia include 1) extension services that are highly focused on large and progressive farmers and prioritize mostly mechanization-related services; 2) lack of integration of climatic, resource use, and market-related services into extension; and 3) women are almost entirely missing in extension efforts. IWMI is developing social safety net policies for coping with climate change, subsidies for energy sources for irrigation, and extension for climate-resilient crop varieties.

USA

Dr. George Smith, Director of AgBioResearch and Senior Associate Dean for Research in CANR at MSU, highlighted that prolonged wet weather and rising temperatures have affected soil health, and changed pest and pathogen pressures over the last 3 - 5 years in the state of Michigan, USA. Increased salinity is affecting water quality. More funding is needed for research and extension. National priorities include soil health, efficient use of water, plant resilience, and local and regional food systems.

Michigan State University

Dr. Bruno Basso, John A Hannah Distinguished Professor at MSU, discussed how the integration of remote sensing, artificial intelligence, big data analytics, modeling, and an early warning system for agriculture can play a crucial role in mitigating the impacts of climate change on food security and livelihoods. These technologies create the bridge between the physical and digital world. Remote sensing and utilizing satellite imagery and remote sensing data to monitor land surface temperature, vegetation health, soil moisture levels, and other relevant parameters can provide insights into the current state of agricultural lands and help identify areas at risk for drought, excessive rainfall, or temperature extremes. Dr. Basso's team is working on developing different simulation models to apply machine learning algorithms and modeling techniques to predict how climate change may impact crop growth, pest infestations, and other agricultural variables. Making these technologies accessible to farmers and including them in national policies could increase the accuracy of forecasting and allow farmers to make informed decisions.

Panel Discussions

Six interactive panel discussions were held. The summary of the panel sessions, challenges, recommendation and key strategies are highlighted as follows:

Panel I. Early Warning and Forecasting Systems, Modeling, Remote Sensing, and Big Data

This panel focused on the challenges faced by South Asian countries in terms of agriculture, climate change, and technological interventions, and how early warning systems, big data, modeling, and remote sensing could play a crucial role in mitigating climate impacts on agriculture. The discussion opened with the observation that agriculture in the region is deeply affected by soil erosion, water shortages, forest reduction, and crop sensitivity, and there is a need to improve agricultural productivity through data collection and interpretation technology.

Panel I Moderator: Suruchi Bhadwal, Director, Earth Science and Climate Change, The Energy and Resources Institute (TERI), India

Panel I Members:

- Fahad Saeed, Climate Scientist / Regional Lead: South Asia and the Middle East Climate Analytics South Asia Office, Pakistan
- Younsuk Dong, Irrigation Specialist, MSU, USA
- G. Mikunthan, Senior Professor in Agricultural Biology, Jaffna University, Sri Lanka
- Atul G. Mood, Professor & Head, College of Agricultural Engineering and Technology, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, India
- Bruno Basso, Hannah Distinguished Professor, Department of Earth and Environmental Sciences, MSU, USA

Challenges

- **Inaccuracy in Forecasting**. In South Asia, weather forecasting systems are not precise, especially in dry zones where predictions are critical for agriculture. Forecasting accuracy, particularly for localized weather, is not accurate for timely agricultural decision-making.
- **Limited Infrastructure and Accessibility**. Internet connectivity and technology infrastructure, such as weather stations and Internet of Things (IoT) sensors, are often limited in rural areas. Farmers live far from weather stations and cannot access reliable data, which impedes their ability to make informed decisions.
- **Lack of Farmer-Centric Information**. Although various technologies like IoT sensors are available, the information reaching farmers is often not tailored to their specific needs. Overloading farmers with information without providing practical advisory services creates a gap between information use and action.
- **Climate Change Impact on Crops**. South Asian countries face direct impacts of climate change, such as increased temperatures, drought conditions, invasive pests, and diseases affecting crops. Rainfed cropping areas are especially vulnerable to these changes, yet precision agriculture tools and approaches to combat such issues are not widely available.
- **Maintenance and Reliability of Technology**. Even when advanced sensor technologies are developed and implemented, keeping them functional and maintained is a major challenge. Many technologies available are not operational due to inadequate support systems or poor infrastructure.

Recommendations and Strategies

- **Adopt Precision Agriculture with IoT and Crop Modeling**. Deploying IoT sensors and crop modeling systems can provide localized, real-time data and information to farmers, allowing them to predict weather conditions like heat or frost stress and take preventive actions, such as timely irrigation.
- **Form Public-Private Partnerships for Digitalization**. Governments alone cannot bring about digital transformation in agriculture. Public-private partnerships are essential to introduce digital tools and systems to farmers, making data accessible and actionable at a local level.
- **Embrace a Collaborative, Multidisciplinary Approach**. Multidisciplinary teams, including meteorologists, agronomists, and technologists, should work together to deliver tailored, farmer-specific information. This

collaboration can improve the reliability and relevance of data.

- **Strengthen Early Warning Systems and Advisory Services**. Advisory services should avoid providing an abundance of data and information to farmers, and instead provide data interpretation and practical solutions.
- **Improve Forecasting Models for Dry Zones**. Special focus should be placed on improving forecasting models for rain-dependent regions, such as dry zones in Sri Lanka and India. More precise forecasting, combined with better sensor technology, can help these vulnerable areas.
- **Strengthen Technology Collaboration for Remote Sensing and Forecasting**. Countries in South Asia could benefit from stronger collaboration with the USA and other advanced nations, particularly in areas like remote sensing, crop modeling, and forecasting systems, to enhance precision farming in the region.

The panel highlighted the urgent need to improve early warning systems, precision agriculture, and data interpretation. A combination of technology, public-private partnerships, and advisory services is crucial to help farmers adapt to the impacts of climate change and make informed decisions about their crops.

Panel II. Fostering Collaborative Research Programs for Adaptation and Mitigation (Part 1)

This panel focused on the importance of collaborative research programs aimed at addressing climate adaptation and mitigation. The discussion revolved around key areas such as reducing greenhouse gas emissions, developing advanced technologies, adapting to a changing environment, and fostering partnerships to address climate change. The panel explored regional vulnerabilities and the socio-economic impacts of climate change, particularly in the agricultural sector, and emphasized the need for interdisciplinary collaboration.

Panel II Moderator: Dr. Haseeb Md. Irfanullah, Visiting Research Fellow, Center for Sustainable Development (CSD), University of Liberal Arts, Bangladesh

Panel II Members:

- Atul G. Mood, Professor & Head, College of Agricultural Engineering and Technology, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth (BSKKV), India
- Buddhisrilal Marambe, Senior Professor, University of Peradeniya, Sri Lanka
- Shakeel Ahmad, Director, Institute of Agronomy, Faculty of Agricultural Sciences and Technology, Bahauddin Zakariya University, Multan, Pakistan
- Abigail Bennett, Assistant Professor, MSU, USA
- Harpalsinh Chudasama, Manager, Climate Change Research, Aga Khan Rural Support Programme (AKRSP-I), India

Challenges

- **Greenhouse Gas Emissions**. Agriculture is responsible for a significant portion of greenhouse gas emissions, and South Asian countries face challenges in minimizing these emissions, especially in sectors like fisheries, livestock, and transportation. Reducing these emissions requires innovative approaches and diversified cropping systems.
- **Data Reliability and Accessibility**. The reliability and accessibility of data is a major hurdle in climate research, particularly in South Asia. Accurate data is essential for understanding climate vulnerabilities and developing effective mitigation strategies. However, insufficient data often impedes progress.

- **Vulnerability of Livelihoods**. Farmers and coastal communities are highly vulnerable to the impacts of climate change. Factors such as crop loss, soil degradation, and invasive species exacerbate these vulnerabilities, affecting both food security and livelihood sustainability.
- **Sectoral Focus and Adaptation Gaps**. Most research efforts in South Asia focus heavily on the food system, while other critical sectors, such as transportation, which directly impact the food supply chain, are often neglected. Additionally, fewer mitigation strategies are implemented for sectors like poultry and fisheries.
- **Lack of Collaborative Efforts**. Collaborative research efforts are insufficient, both within regions and across sectors. The absence of multi-stakeholder partnerships and institutional cooperation hampers the ability to address climate change effectively.

Recommendations and Strategies

- **Provide Diversified Cropping Systems and Livelihoods Options**. Research should prioritize the diversification of cropping systems and livelihoods support options in vulnerable regions, such as coastal areas, and encourage community-based initiatives. Farmers should adopt diversified cropping systems, including legumes and maize, to improve soil health and reduce the risk of crop losses due to climate change.
- **Adopt Low-Carbon Agriculture**. Transitioning to low-carbon agriculture and livestock systems is essential to mitigate greenhouse gas emissions. Examples include adopting sustainable farming practices and encouraging the use of technologies and approaches that reduce carbon footprints.
- **Develop Collaborative Research and Partnerships**. Multi-stakeholder collaborations are crucial for addressing climate change effectively. Partnerships should be fostered across various sectors—public, private, academia, and producers. Collaborative efforts between organizations, farmers, researchers and extension services are needed to develop actionable solutions for climate adaptation.
- **Focus on Socio-Economic Impacts**. Research should prioritize understanding the socio-economic impacts of climate change, particularly on women farmers and marginalized communities. Vulnerability assessments should guide adaptation strategies that consider social equity alongside environmental sustainability.
- **Promote Interdisciplinary Research Priorities**. Interdisciplinary collaborations that address not only the food production system, but also post-harvest sectors, trade, and transportation are needed. Research programs should focus on adapting to climate change in these areas, while also facilitating the transformation from vulnerability to resilience.
- **Build Capacity and Share Knowledge**. Institutions should play a role in translating scientific research into practical applications for farmers and other stakeholders. Conferences and forums that bring together different actors should encourage partnerships and knowledge exchange, enabling collective action against climate challenges.

The panel highlighted the critical need for collaboration across sectors, regions, and disciplines to tackle the effects of climate change. By fostering partnerships, enhancing research focus, and adopting low-carbon, diversified systems, South Asian countries can strengthen their resilience and adapt to the rapidly changing climate in the South Asia region.

Panel III. Fostering Collaborative Research Programs for Adaptation and Mitigation (Part 2)

This panel discussion emphasized the importance of fostering collaborative research to address the multifaceted challenges posed by climate change in South Asia. The discussion focused on overcoming barriers to collaboration, tailoring solutions to specific regional issues, and exploring the root causes of climate change. It highlighted the role of innovation and knowledge exchange in

Panel III Moderator: George Smith, Director, AgBioResearch, Michigan State University, USA

Panel III Members:

- Shreya Chakraborty, Lead, Transforming Agrifood Systems in South Asia Initiative, International Water Management Institute (IWMI), India
- Kelekoralale Gedara Pathmasiri Bandara Karunarathne, Rice Breeder, Rice Research and Development Institute, Sri Lanka
- Neena Amatya Gorkhali, Chief and Senior Scientist, Animal Breeding Division, Nepal Agricultural Research Council (NARC), Khumaltar, Lalitpur, Nepal
- Younsuk Dong, Irrigation Specialist, Michigan State University, USA

promoting sustainable agricultural practices and improving farmer resilience.

Challenges

- **Barriers to Effective Collaboration**. Collaborative research efforts are hindered by differences between partners and a gap between knowledge and understanding. These barriers prevent effective knowledge exchange and cooperation among stakeholders, slowing progress in climate action efforts.
- **Abiotic Stress and Climate Complexity**. The interconnected nature of climate stresses, such as droughts, floods, and extreme temperatures, creates a complex challenge for South Asian agriculture. These weather events often occur in succession, complicating efforts to address them through single interventions. Solutions must therefore be multidisciplinary and region-specific.
- **Farmer Vulnerability to Climate Change**. Farmers are at the forefront of experiencing the tangible impacts of climate change, including shifts in animal behavior and disrupted farming practices. Their livelihoods are increasingly threatened by these changes, and they are actively seeking sustainable solutions to adapt.
- **Identifying the Root Causes of Climate Change**. There is a need for a comprehensive understanding of the various factors contributing to climate change, such as industrial emissions, deforestation, land-use patterns, and energy consumption. Without pinpointing these drivers, it becomes challenging to formulate effective strategies for both mitigation and adaptation.

Recommendations and Strategies

- **Break Down Barriers in Collaborative Research**. Efforts must focus on fostering deeper collaboration by bridging the gaps between stakeholders, including improving communication and understanding between partners, creating a comprehensive map of the research landscape, and addressing inefficiencies in current research efforts. Innovation in assistance systems can help facilitate more productive collaborations.
- **Develop Multidisciplinary Solutions for Abiotic Stress**. Addressing abiotic stress in agriculture requires multidisciplinary approaches tailored to specific regional needs. Solutions should focus on empowering researchers and practitioners through knowledge exchange, targeting specific agricultural pressures, and developing strategies that improve both sustainability and farmer incomes.
- **Develop Farmer-Centric Adaptation Strategies**. Researchers and policymakers must prioritize immediate action to support farmers in adapting to climate change, including identifying emerging challenges and developing innovative adaptation and mitigation strategies to safeguard food systems and livelihoods. Collaborative efforts should pool expertise and resources to enhance agricultural resilience in the region.
- **Conduct Targeted Research on the Root Causes of Climate Change**. To effectively

address climate change, researchers must identify and focus on its root causes, such as industrial emissions, deforestation, and unsustainable land-use patterns. A nuanced understanding of these drivers will allow for more precise interventions, fostering long-term sustainability and resilience.

- **Facilitate Low-Carbon Agriculture and Partnerships**. Collaborative research should aim to reduce the carbon footprint of agricultural systems. By integrating knowledge-sharing organizations, universities, and stakeholders from the public, private, and producer sectors, efforts to transition towards low-carbon agriculture can be accelerated. Partnerships must be strengthened to ensure practical and scalable solutions for reducing greenhouse gas emissions.

This panel reinforced the critical role of collaborative research in tackling climate change challenges in South Asia. By overcoming barriers to partnership, developing multidisciplinary solutions, and focusing on the root causes of climate variability, stakeholders can work together to build a more sustainable and resilient agricultural system.

Panel IV. Policy Pathways to a Climate-Resilient Future

This panel discussion focused on the integration of climate considerations into national policies, emphasizing the need for climate-friendly legislation, economic development balance, incentives for farmers and businesses, and both national and international support for climate resilience. The panel explored how South Asian countries can navigate these challenges while fostering regional collaboration and leveraging best practices to accelerate progress toward climate-resilient food systems.

Challenges

- **Balancing Economic Development with Climate Policies**. Implementing climate-friendly policies while maintaining economic growth is a key challenge for South Asian countries.
- **Policy Integration and National Roadblocks**. Difficulty integrating climate considerations into national policies due to conflicting priorities, resource limitations, and lack of infrastructure is a challenge in some areas.
- **Incentives for Climate-Smart Agriculture**. There is a lack of incentives to encourage farmers and businesses to adopt climate-smart agricultural practices.
- **Financial Constraints**. Limited resources and financial constraints make it difficult to implement climate-resilient policies and programs.
- **Regional Collaboration**. Coordination among South Asian countries to develop and implement effective regional policies to address climate change issues is limited.
- **Knowledge Gaps and Information Accessibility**. Access to reliable climate data and information is insufficient, which hinders

Panel IV Members: M Zakir Hossain Khan, Executive Director, Change Initiative, Bangladesh

Panel IV Members:

- Ram Krishna Shrestha, Joint Secretary, Government of Nepal, Ministry of Agriculture and Livestock Development, Nepal
- Buddhisrilal Marambe, Senior Professor, University of Peradeniya, Sri Lanka
- Shalander Kumar, Deputy Director, Global Research Program on Enabling System Transformation, ICRISAT, India
- Cho Cho San, Research and Development Specialist, MSU Myanmar
- Fahad Saeed, Climate Scientist / Regional Lead: South Asia and the Middle East, Climate Analytics South Asia Office, Pakistan

farmers' decision-making processes. Farmers in rural and remote areas are disconnected from modern communication systems, reducing the reach of climate data, forecast information, and advisory services.

- **Vulnerability to Natural Disasters and Changing Climate Patterns**. South Asian countries are highly vulnerable to natural disasters such as heatwaves, cold spells, glacial retreats, and cyclones, all of which are exacerbated by climate change.

Recommendations and Strategies

- **Integrate Climate into National Policies**. Countries must develop national policies that prioritize climate resilience, especially in agriculture and water management. These policies must be developed using climate data for agricultural decision-making and must be aligned to regional contexts.
- **Develop Tailored and Decentralized Approaches**. National climate policies should be decentralized, allowing flexibility to address regional and local climate challenges. Solutions must be tailored to the specific needs of various regions, with a focus on traditional knowledge.
- **Incentivize Climate-Smart Practices**. Governments should provide financial incentives such as subsidies or tax benefits for businesses and farmers adopting climate-smart technologies. These incentives can boost private sector involvement in implementing sustainable solutions.
- **Strengthen Capacity Building and Knowledge Sharing programs**. South Asian countries should prioritize capacity-building initiatives, including technology transfer and knowledge-sharing programs. These initiatives will enhance climate resilience by empowering farmers, local communities, and other stakeholders to adopt sustainable agriculture practices.
- **Enhance Forecasting and Early Warning Systems**. National policies must include improving forecasting and early warning systems for extreme weather events. Collaboration with mobile phone service providers and media outlets can ensure that critical climate information reaches even remote farmers. Communication should be in local languages and tailored to specific regions and crop needs.
- **Leverage International Support**. South Asian nations should explore international financial and technical support to strengthen their climate resilience. They should aim to attract investment for infrastructure projects, such as cyclone shelters and irrigation systems, and cutting value-added tax (VAT) on necessary climate adaptation tools.
- **Promote Regional Collaboration**. Regional cooperation is essential for sharing best practices, conducting joint research, and fostering partnerships that enhance climate adaptation across South Asia. Collaborative frameworks should be developed to facilitate knowledge exchange and collective policymaking.

This panel underscored the critical need for integrating climate considerations into national policies across South Asia, while fostering regional and international collaboration. Addressing challenges such as balancing economic growth with climate resilience, financial constraints, and knowledge gaps, the panel highlighted the importance of tailored, decentralized approaches to policy implementation. Key recommendations included incentivizing climate-smart agriculture practices, enhancing early warning systems, and strengthening capacity-building efforts. The discussion emphasized that South Asian countries must prioritize regional cooperation and leverage international support to build a climate-resilient future that effectively mitigates the impacts of natural disasters and changing climate patterns.

Panel V. Socio Economic Issues, Risk Management, and Assessing Impacts

This panel emphasized the interconnectedness of climate change and socio-economic issues. Climate change has adverse impacts on agriculture and food security, which, in turn, create significant socio-economic challenges. This panel also focused on risk management and the socio-

Panel V Moderator: Shalander Kumar, Deputy Director, Global Research, Program on Enabling System, Transformation, ICRISAT, India

Panel V Members:

- M Zakir Hossain Khan, Executive Director, Change Initiative, Bangladesh
- Harpalsinh Chudasama, Manager, Climate Change Research, Aga Khan Rural Support Programme (AKRSP-I), India
- Imtiaz Ahmad, Assistant Professor, Department of Economics, National University of Sciences and Technology, Pakistan
- Duncan Boughton, Professor, Michigan State University, USA

economic impacts of both climate change and adaptation and mitigation strategies.

Key Challenges and Deficiencies

- **Socio-Economic Consequences of Climate Change**. Climate change exacerbates poverty, inequality, and social instability, particularly affecting vulnerable groups such as the elderly, women, and children. Extreme weather events (erratic rainfall, floods, droughts, landslides) lead to food insecurity, malnutrition, waterborne diseases, social conflict, and displacement/migration both within and across borders. Short-term social protection schemes are insufficient to address the long-term socio-economic impacts of climate change.
- **Limited Access to Climate-Resilient Practices**. Smallholder farmers face challenges in adopting climate-resilient agricultural practices due to high upfront costs and market instability. The knowledge gap between scientific data and local traditional knowledge hinders effective climate adaptation and risk management at the community level.
- **Inadequate Support Mechanisms**. Governments struggle to create enabling environments for climate-smart agriculture due to insufficient policies and incentives provided for smallholder farmers. Limited infrastructure and lack of crop insurance programs make it difficult for farmers in regions such as Pakistan to recover from climate-related disasters.
- **Sectoral Policy Fragmentation**. In some countries, climate risk management and adaptation efforts are hampered by fragmented government policies across different sectors. Lack of collaboration and dialogue among government organizations prevents the development of comprehensive and integrated risk management strategies.

Recommendations and Strategies

- **Strengthen Social Safety Nets**. Expand social protection programs such as cash transfers, social insurance, and labor benefits to help vulnerable populations cope with the socio-economic impacts of climate change. Governments should implement climate risk insurance for marginalized farmers, ensuring that premiums remain affordable to prevent adding financial strain. Climate-Resilient Agriculture should be promoted by providing training and extension services on climate-smart agriculture techniques, including conservation agriculture, agroforestry, and efficient water management. Farmers should be encouraged to use weather-indexed insurance and other risk management tools to help mitigate the financial impacts of climate-related disasters. Governments should offer incentives such as subsidies, grants, or low-interest loans to farmers and private companies engaged in climate-resilient practices.

- **Enhance International Collaboration and Knowledge Transfer**. International organizations can support capacity building and knowledge transfer through funding for infrastructure development, research, technical support and training. Partnerships can be developed between local governments and international bodies to provide financial and technical assistance for smallholder farmers.
- **Bridge the Gap Between Science and Local Knowledge**. Collaboration should be promoted between scientists, policymakers, and local communities to develop risk management strategies that integrate both scientific data and traditional knowledge. Climate information and forecasting systems should be tailored to local needs, ensuring the information is accessible and actionable for smallholder farmers.
- **Improve Policy Coordination**. Government agencies should work together, streamlining climate adaptation and risk management policies across different sectors to avoid duplication and inefficiencies. Regional collaboration between South Asian nations should be fostered to address shared climate vulnerabilities and coordinate risk management strategies.

This panel concluded that addressing the socio-economic impacts of climate change requires a multi-faceted approach that includes strengthening social safety nets, promoting climate-resilient agricultural practices, and enhancing international collaboration. Bridging the gap between scientific data and local knowledge is crucial for developing effective risk management strategies, while governments must create more cohesive policies and incentives to support these efforts.

Panel VI. Awareness Creation, Education, Training, and Capacity Building

This panel focused on the critical role of education, awareness, training, and capacity building in empowering communities, particularly farmers, to tackle the challenges posed by climate change. The panelists discussed how education, knowledge sharing, and capacity building can help communities survive and thrive in the face of changing climate, ensuring food and nutritional security, health, and ecosystem preservation.

Challenges

- **Accessibility of Educational Programs**. Ensuring that educational programs for

Panel VI Moderator: Gunasingham Mikunthan, Senior Professor, Agricultural, Biology, University of Jaffna, Sri Lanka

Panel VI Members:

- Kelekoralale Gedara Pathmasiri Bandara Karunarathne, Rice Breeder, Rice Research and Development Institute, Sri Lanka
- Shakeel Ahmad, Director, Institute of Agronomy, Faculty of Agricultural Sciences and Technology, Bahauddin Zakariya University, Multan, Pakistan
- Karim Maredia, Director, CANR International Programs, Michigan State University, USA
- Sheila Kaka Ochugboju, Executive Director, Alliance for Science, Kenya
- Mizan R. Khan, Professor, Department of Environmental Science & Management, North South University, Bangladesh

farmers are culturally relevant and accessible in local languages is a major barrier.

- **Integrating Traditional Knowledge**. The difficulty in blending traditional and indigenous knowledge with modern agricultural practices remains a challenge.
- **Empowering Farmers for Decision Making**. Beyond raising awareness, there is a challenge in empowering farmers to make informed decisions about their livelihoods, including integrating them into climate change negotiations and decision-making processes.
- **Bridging the Science-Practice Gap**. There is a significant gap between scientific advancements and practical applications in farming, making it hard for farmers to benefit from modern technologies.
- **Gender-Specific Challenges**. Training programs often fail to address the specific needs of women farmers, who face unique challenges in the agricultural sector.
- **Lack of Resources for Women**. Beyond training, there is a lack of resources and support systems needed to empower women in agriculture and create alternative employment opportunities, particularly during the dry season.
- **Measuring Program Effectiveness**. Evaluating the effectiveness of agricultural education and training programs remains a challenge in many regions, hindering improvements in their design and implementation.

Recommendations and Strategies

- **Develop Culturally Relevant Education**. Develop educational programs in local languages and culturally relevant formats to ensure broader accessibility for farmers and rural communities.
- **Incorporate Indigenous Knowledge**. Integrate traditional and indigenous knowledge into modern agricultural education and training programs, recognizing its value in building resilient farming practices.
- **Empower Farmers through Education**. Strengthen educational and training programs that go beyond awareness to empower farmers with the knowledge and tools to make informed decisions about climate resilience, food choices, and environmental sustainability.
- **Bridge Scientific and Practical Knowledge**. Focus on bridging the gap between scientific innovations and on-the-ground applications through localized demonstration trials, multi-environment testing, and scaling up precision farming techniques.
- **Provide Gender-Specific Training**. Tailor training programs to address the specific needs and challenges of women farmers, ensuring that they receive the support necessary to thrive in agriculture.
- **Expand Resources for Women in Agriculture**. Provide additional resources and support systems for women farmers, including creating alternative employment opportunities and enhancing their access to sustainable agricultural practices.
- **Conduct Program Evaluation**. Implement systematic approaches to measure the effectiveness of agricultural education and training programs, ensuring continuous improvement and responsiveness to local needs.

This session emphasized the importance of education and capacity building as cornerstones for empowering communities to confront climate change. The panelists highlighted the need for culturally relevant educational programs, the inclusion of indigenous knowledge, gender-sensitive approaches, and bridging the gap between scientific advancements and practical applications. Collaborative efforts across academia, industry, non-governmental organizations, government organizations, and development agencies are crucial to making these strategies effective. Lastly, measuring the impact of these initiatives is essential for their continuous evolution and success in fostering sustainable agricultural practices.

Breakout Sessions

After the panel discussion, breakout sessions were conducted. The panelists and participants were divided into four breakout groups as follows:

Breakout Session	Participants
1. Early Warning and Forecasting Systems, Remote Sensing, Modeling, and Big Data	• George Smith, Director, AgBioResearch, MSU, USA • Harpalsinh Chudasama, Manager, Climate Change Research, Aga Khan Rural Support Programme (AKRSP-I), India • Neena Amatya Gorkhali, PhD, Chief & Senior Scientist, Animal Breeding Division, NARC, Khumaltar, Lalitpur, Nepal • Karim Maredia, Director, CANR International Programs, MSU, USA • Abu Noman Faruq Ahmmed, Professor, Department of Plant Pathology, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Bangladesh • Abigail Bennett, Assistant Professor, Department of Fisheries and Wildlife, Michigan State University, USA
2. Adaptation and Mitigation Strategies	• Shalander Kumar, Deputy Director, Global Research Program on Enabling System Transformation, ICRISAT, India • Buddhisrilal Marambe, Senior Professor, University of Peradeniya, Sri Lanka Mzan R. Khan, Professor, Dept of Environmental Science & Management, North South University, Bangladesh • Duncan Boughton, Professor, Department of Agricultural, Food, and Resource Economics, MSU, USA • Fahad Saeed, Climate Scientist / Regional Lead: South Asia and the Middle East, Climate Analytics South Asia Office, Pakistan • Kbd. Hamidur Rahman, Former Director General, Department of Agriculture Extension, Bangladesh
3. Policy Enhancement and Advocacy	• Suruchi Bhadwal, Director, Earth Science and Climate Change, The Energy and Resources Institute (TERI), India • Kelekoralale Gedara Pathmasiri Bandara Karunarathne, Rice Breeder, Rice Research and Development Institute, Sri Lanka • Ben Belton, Associate Professor, Department of Agricultural, Food, and Resource Economics, MSU, USA • Imtiaz Ahmad, Assistant Professor, Department of Economics, National University of Sciences and Technology, Pakistan • Atul G. Mohod, Professor & Head, College of Agricultural Engineering and Technology, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth (BSKKV), India
4. Awareness Building, Communication, Training, Education, and Capacity Building	• Gunasingham Mikunthan, Senior Professor in Agricultural Biology, University of Jaffna, Sri Lanka • Shreya Chakraborty, Lead, Transforming Agrifood Systems in South Asia Initiative, International Water Management Institute (IWMI), India • Sheila Ochugboju, Executive Director, Alliance for Science • Anwar Faruque, Advisor- Advocacy and Policy Affairs, Farming Future Bangladesh, Bangladesh • Cho Cho San, Research and Development Specialist, MSU, USA/Myanmar

- Inadequate regional data-sharing platforms for crop monitoring and forecasting.
- Lack of capacity development in numerical modeling and weather forecasting among local professionals.
- Inconsistent collaboration between public, private, and research sectors in ensuring system sustainability and resilience.
- Difficulty in managing crop-specific decisions such as irrigation, fertilizer application, pest control, and post-harvest management due to variability in weather conditions.

Breakout Group 1: Early Warning and Forecasting Systems, Remote Sensing, Modeling, and Big Data

Group Question

How can South Asian countries collaboratively develop an early warning, forecasting, and decision-support system leveraging remote sensing, modeling, big data, and AI/ML (Artificial Intelligence / Machine Learning) technologies to enhance risk resilience and improve smallholder farmers' agricultural productivity?

Introduction

The group focused on establishing a South Asian Regional Cloud for an Intelligent Decision Support System, designed to provide impact-based advisories centered on smallholder farmers. The initiative aims to integrate AI/ML-based systems with local knowledge, ensuring scalability, sustainability, and risk mitigation for crops such as rice, wheat, maize, and horticultural crops. Key management decisions, including irrigation, fertilizer application, pest control, and value chain improvements, will be informed by real-time data.

Key Issues:

- Lack of integration between local knowledge and advanced technologies (AI/ML, remote sensing) in agricultural decision-making.
- Limited availability of impact-based advisories tailored to smallholder farmers.
- Need for scalable technological solutions for weather and climate modeling, crop simulation, and agricultural risk management.

Recommendations:

- **Co-develop and integrate local knowledge**: Involve smallholder farmers and local stakeholders in the development of AI/ML-based decision support systems to ensure that technological solutions address on-ground realities and needs.
- **Design impact-based advisories**: Design farmer-centric advisories focused on mitigation actions and solutions tailored for major crops like rice, wheat, maize, and horticultural crops.
- **Establish a South Asia Regional Cloud Platform**: Establish a regional cloud platform to share remote sensing data and agricultural research and development data, ensuring data accessibility for crop monitoring and real-time decision-making.
- **Pilot and test technologies for scalability**: Pilot and test technologies on a regional scale, ensuring that they are adaptable for diverse geographical and agricultural contexts.
- **Foster public-private partnerships** to promote risk resilience and ensure long-term sustainability of decision support systems.
- **Strengthen capacity**: Invest in training programs for local professionals, focusing on numerical modeling, climate and weather forecasting, and crop simulation modeling to enhance regional technical expertise.

- **Coordinate as a region**: Encourage the SAARC Agriculture Center to act as a regional umbrella body, facilitating cross-country coordination, knowledge sharing, and policy alignment.

Breakout Group 2. Adaptation and Mitigation Strategies

Group Question

What effective adaptation and mitigation strategies can be developed and implemented to prepare communities and the agricultural sector for addressing the impacts of climate change?

Introduction

The group discussed the importance of both pre-adaptation and post-adaptation readiness activities to address the challenges posed by climate change. Emphasizing that proactive measures are crucial, they highlighted the need for individuals, communities, businesses, institutions, and governments to be prepared for the impacts of climate change. While mitigation efforts aim to reduce the severity of climate change, adaptation strategies are essential for minimizing unavoidable damages.

Key Issues:

- Insufficient capacity and infrastructure for accurate and timely weather forecasting leads to inadequate preparation for farmers.
- Limited access to agricultural extension services that integrate traditional knowledge with modern practices.
- Inadequate cold storage facilities for preserving cash crops, which can lead to losses from pests, heat, or flooding.
- Lack of drought-resistant crop varieties and efficient irrigation systems, increasing vulnerability to crop failures during droughts.
- Insufficient communication of climate change information to farmers and grassroots communities in local languages and dialects.
- Over-reliance on traditional staple crops (e.g., rice) in regions vulnerable to climate impacts, limiting food security options.
- Inadequate public awareness and outreach regarding climate change through effective media communication strategies.

Recommendations:

- **Enhance weather forecasting capabilities**: Invest in developing human resources, technical expertise and infrastructure for accurate weather forecasting and information dissemination to help farmers make informed planting and other decisions.
- **Strengthen agricultural extension services**: Provide farmers with weather information and integrate indigenous knowledge into crop management practices for improved outcomes.
- **Facilitate cold storage facilities**: Governments should establish cold storage infrastructure to help preserve cash crops longer and protect them from pests and extreme weather events.
- **Promote drought-resistant crops**: Encourage the adoption of drought-resistant crop varieties and implement efficient irrigation systems, particularly in drought-prone areas.
- **Utilize crop modeling technology**: Leverage crop modeling extension services to provide farmers with accurate forecasts of potential harvests, enabling better planning.
- **Diversify food systems**: Encourage the exploration of alternative staple foods, such as potatoes, in flood- and cyclone-prone areas to enhance food security.

- **Increase climate change communication**: Use various media, including advertisements and billboards, to disseminate information about climate change in local languages and dialects, ensuring that all communities are well informed and engaged.

Breakout Group 3: Policy Enhancement and Advocacy

Group Question

How can policy enhancement and advocacy improve climate resilience in agriculture through incentives and crop insurance programs in South Asia?

Introduction

The group discussed the critical role of policy perspectives in addressing climate change impacts on agriculture. Emphasizing the need for context-sensitive solutions, they highlighted the importance of aligning agricultural technologies, markets, and policies to ensure they meet the diverse needs of different regions and populations. The group focused on fostering evidence-based policymaking, strengthening partnerships across disciplines, and ensuring that policies are communicated effectively to end users.

Key Issues:

- Misalignment between agricultural technologies, markets, and policies, leading to ineffective solutions for farmers.
- Lack of respect for regional and country-specific contexts, including gender responsiveness and engagement of elderly farmers in policy formulation.
- Need for evidence-based policymaking to ensure informed decision-making in agricultural practices.
- Insufficient communication of climate policies in understandable language, leaving end users uninformed.
- Absence of an accessible platform for climate information and policies, hindering effective dissemination.
- High vulnerability of smallholder farmers, requiring targeted interventions like crop insurance and subsidies.
- Need to document disaster risks and their impacts across all agricultural sectors to inform policy decisions.
- Ineffective coordination mechanisms between national and local government institutions, impacting policy implementation.

Recommendations:

- **Create monitoring mechanisms**: Develop a system to generate and monitor the environmental footprint at critical points within the food system to inform policy decisions.
- **Adopt climate forecasting models**: Promote the development and adoption of high-precision climate forecasting models to support farmers in their planning and decision-making.
- **Assess climate-induced losses**: Implement quick and scientific assessments of climate-induced losses in agriculture (crops, livestock, fisheries) to facilitate access to loss and damage funds.
- **Incentivize coordination**: Establish a coordination mechanism that effectively connects national and local government institutions, gradually transitioning to private sector involvement with appropriate business models.
- **Implement weather-indexed crop insurance**: Introduce weather-index-based crop insurance programs with state-supported

premium payments for the most vulnerable farmers, linking it to adaptation efforts.

- **Explore carbon markets**: Consider developing carbon markets to target greenhouse gas emissions reductions in agriculture, enabling income generation through appropriate mechanisms.
- **Promote digital tools**: Invest in digital infrastructure and awareness campaigns to promote climate-smart agriculture and options that do not impose additional costs on farmers.
- **Mainstream climate information**: Ensure climate change impact data and information is integrated into national and local development agendas, involving stakeholders from all sectors in policy formulation and implementation.

Breakout Group 4: Awareness Creation, Communication, Training, Education, and Capacity Building

Group Question:

How can awareness creation, communication, training, education, and capacity building be enhanced to address climate resilience?

Introduction:

The group focused on creating a comprehensive plan to mitigate issues surrounding awareness building, communication, training, education, capacity building, and gender dimensions. The group emphasized the importance of recognizing gaps in literacy and awareness while connecting these challenges with effective policy solutions. They highlighted the need for inclusive approaches that involve various community stakeholders, including traditional leaders, media professionals, and farmers, to foster sustainable climate resilience practices.

Key Issues:

- Low literacy rates hinder effective communication and understanding of climate-related issues among communities.
- Politicians and policymakers lack awareness of climate change challenges and their connections to policy solutions.
- Farmers face barriers to accessing value chains, limiting their economic opportunities and resilience.
- There is a need for tailored awareness programs targeting various groups, including extension workers, university students, and farmers with due consideration to gender equity. These stakeholders play a crucial role in influencing community perceptions and behaviors and require targeted training.
- Professionals in relevant sectors need to be informed about climate issues to effectively communicate and support community resilience efforts.
- Training and capacity-building efforts must specifically address the unique challenges faced by women, youth, and marginalized groups.

Recommendations:

- **Organize dialogues and seminars for policymakers**: Engage members of parliaments (MPs) and local leaders in discussions to build their awareness and understanding of climate challenges and solutions.
- **Develop multidisciplinary training groups**: Collaborate with various stakeholders to train community representatives, ensuring a holistic approach to capacity building.
- **Implement exposure visits and demonstrations**: Allow community members to see successful practices

in action, facilitating knowledge sharing and inspiration.

- **Customize training content**: Tailor training materials and methods to suit the needs and cultural values of different community groups and local farmers.
- **Incorporate farmer trainers**: Empower local farmers to share their success stories and train their peers, fostering peer-to-peer learning.
- **Utilize multimedia communication**: Leverage local media, including radio, TV, smartphones, dramas, and wall paintings, to disseminate information in accessible formats.
- **Provide training in local languages**: Ensure that training resources are available in the languages understood by local community members and farmers.
- **Engage financial actors**: Develop business models that promote broader ownership and investment in climate resilience initiatives.
- **Facilitate community marketing training**: Equip communities with skills to market their products effectively.
- **Integrate indigenous knowledge systems**: Leverage existing local practices that are climate-friendly to enhance community resilience.
- **Identify community interaction spots**: Utilize local markets and gathering places to facilitate training and awareness activities.
- **Implement a 360° awareness program**: Adopt a holistic approach that includes listening to stakeholders, identifying target groups, contextualizing training, including marginalized voices, iterating on actions, and ensuring sustainability.

Forum Synthesis

The forum participants recognized that climate change poses significant threats to food security and the livelihoods of the nearly 2 billion people in South Asia, and that impacts of climate change are multi-sectoral, affecting agriculture, health, education, transportation, trade, etc. The synthesis of the forum consolidated the discussions and outcomes of the three-day event, reflecting a strong commitment from all stakeholders to work together in addressing the climate crisis. Key themes that emerged include:

- **Interdisciplinary and Multisectoral Collaboration**: A recurring theme was the need for collaborative approaches that involve multiple disciplines and multiple sectors—agriculture, environment, policy, infrastructure, trade, and economics. By fostering interdisciplinary collaborations, participants believed they could develop more holistic solutions to climate-induced challenges.
- **Capacity Building**: Capacity building at both institutional and community levels was seen as critical. Training programs for smallholder farmers on climate-smart agricultural practices, along with policy advocacy for government officials, were highlighted as crucial steps in building resilience.
- **Policy Alignment**: It was noted that many countries in South Asia have made progress in developing climate-resilient policies, but there is still a need for greater alignment between national policies and regional strategies. Governments must ensure that their national agricultural policies reflect the urgent need to address climate change and food security.

Through interactive discussions, the participants made the following recommendations:

1. **Foster Multi-Disciplinary and Multi-Sectoral Approaches**: Promote research and outreach programs across various disciplines and sectors to address climate change challenges.
2. **Strengthen Capacity for Early Warning and Forecasting Systems and Climate-Smart Innovations**: Build and enhance capabilities for developing and implementing early warning systems, climate-smart innovations, and information services.
3. **Tailor Adaptation and Mitigation Strategies**: Develop strategies that are specific to diverse agroclimatic conditions, socio-cultural contexts, and identified hazards and risks in different regions.
4. **Adopt a Landscape Ecological Approach**: Promote agricultural diversification for resilient, sustainable, and gender-responsive agri-food systems.
5. **Engage Marginalized Communities**: Include women, youth, and marginalized groups in climate change programs.
6. **Advocate for Evidence-Based Policies**: Promote coherent and people-friendly policies that integrate a climate lens.
7. **Strengthen Knowledge Sharing and Capacity Building**: Document and share best practices and success stories. Enhance knowledge exchange, education, and capacity building at various levels, incorporating indigenous knowledge and learning from local experiences.
8. **Foster Inter-Sectoral Collaboration:** Encourage collaboration and coordination among different sectors at local, national, and regional levels.
9. **Promote Regional and International Partnerships**: Strengthen partnerships and collaborations among government, industry, NGOs, academia, and international organizations in South Asia.
10. **Disseminate Findings**: Publish the forum proceedings and a policy brief to widely distribute recommendations to various stakeholders.
11. **Establish a Social Media/WhatsApp Group:** Form a WhatsApp group for continued networking and information sharing on climate change related issues, publications, training programs, and funding.

The forum participants strongly emphasized the need for all the stakeholders to work together to build climate-resilient food systems and expanded regional and international collaboration for continued sharing of expertise, experiences, information, and technologies.

Publications and Resources Related to Climate Change in South Asia

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