

# ACASA: Atlas of Climate Adaptation in South Asian Agriculture

## Inception Meeting Report

25<sup>th</sup> to 27<sup>th</sup> April 2023

ICAR Lecture Hall - 2<sup>nd</sup> floor, NASC Complex, New Delhi-110012



## About ACASA

To address the vulnerability of South Asian countries to climatic risks, the Borlaug Institute for South Asia (BISA), with the support of the Bill and Melinda Gates Foundation (BMGF) is collaborating with the NARS systems of the region to develop the Atlas of Climate Adaptation in South Asian Agriculture (ACASA). This comprehensive Atlas aims to provide granular-scale information for South Asian countries by integrating various spatially explicit data sets. It offers a unique set of tools that can facilitate improved investment targeting and priority setting, and support stakeholders' decision-making and investments in agricultural technologies, climate information services, and policies.

## Project management

**Scientific Advisory Committee:** Prof. Leigh Anderson, Evans School of Public Policy and Governance, University of Washington, Seattle, USA; Prof. Miranda Meuwissen, Professor of Risk Management and Resilience, Wageningen University, Netherlands; Prof. Geetha Lakshmi, Vice Chancellor, Tamil Nadu Agriculture University, India; Dr. Alex Ruane, Co-Director, Climate Impacts Group, NASA Goddard Institute for Space Studies, USA; Ms. Michiko Katagami, Principal Natural Resources and Agriculture Specialist, ADB, Manila, Philippines; Dr. Pramod Joshi, Former Director-International Food Policy Research Institute, India; Dr. Tess Russo, Senior Program Officer, BMGF, Seattle, USA; and Dr. Pramod Aggarwal, Regional Program leader, BISA-CIMMYT, Delhi, India

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## Funding

Bill & Melinda Gates Foundation (BMGF)

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## About BISA

Borlaug Institute of South Asia (BISA) is an international research institute established through a joint initiative between the International Maize and Wheat Improvement Centre (CIMMYT) and the Indian Council of Agricultural Research (ICAR), New Delhi, to implement the vision of Nobel laureate Norman E. Borlaug. It is a non-profit international research institute dedicated to food, nutrition, livelihood security, and environmental rehabilitation in South Asia, home to more than 300 million undernourished people. [Read more about BISA](#)

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## Key recommendations/highlights from the inception meeting

1. All South Asian countries endorsed the ACASA work plan, which encompasses four workstreams: risk characterization, adaptation options for risk management, UI/UX development, and use cases of the Atlas.
2. Senior management representatives from Bangladesh, India, Nepal, and Sri Lanka expressed keen interest in hosting a country-specific version of the Atlas on their respective national websites to facilitate its greater use by the stakeholders.
3. It was agreed that risk characterization at the district level will involve analysing the intensity and frequency of yield loss from measured historical crop yields. A similar exercise may also be done for the profitability of crop production depending upon the data availability. All countries will explore the use of satellite signatures for downscaling climatic risks, in addition to traditional methods of risk characterization following IPCC approach of hazards, exposure, and vulnerability assessment.
4. The initial method to be tested for adaptation is decision trees, based on literature review and Delphi approach, which will be linked to the characterized risks for different spatial and temporal units. Delegates were introduced to a simple spreadsheet-based analysis of risk and its connections with potential adaptation options. This method, although straightforward, requires further elaboration for its application within ACASA.
5. There was significant interest shown by participants in utilizing crop growth models and econometric techniques to enhance understanding of adaptation options and their targeted applications.
6. Emphasis was placed on assessing socio-economic viability of adaptation interventions to ensure the visualization of only those options that are practically implementable.
7. It was agreed that the ACASA team should initially explore the use of web GIS for rapid visualization of preliminary results. This could serve as a basis for engaging a software company to provide detailed analysis.
8. Various use cases of the Atlas were discussed, with a particular focus on its usefulness in informing policy and investment decisions related to climate change adaptation.
9. It was agreed that ACASA has the potential to serve as a valuable tool for risk insurance and supporting climate change management in the private sector supply chains. Communication efforts need to be strengthened to create awareness about ACASA in these sectors.
10. Participants acknowledged the importance of leveraging the knowledge and experience gained from the Sub-Saharan Africa Atlas, while exploring new knowledge and its data-driven application in South Asian context.
11. Participants expressed their interest in capacity building activities related to methods of econometric models such as the positive mathematical programming, crop growth modelling, and systematic literature review. BISA is expected to organize the first workshop or training program on these topics.
12. Ensuring effective project communication will be crucial, necessitating collective inputs from all project partners and stakeholders. ACASA aims to document its collective progress through various means, including annual reports, bi-annual newsletters, and regular blog updates featuring expert columns.

## Introduction

South Asia has diverse climatic zones given its vast physical landscape. However, the region constantly displays the impact of climate change, intensifying the stresses on the most marginalized communities living in South Asia, who are dependent on agriculture, forestry, and fishing for their everyday needs. Increasing climatic risks make it imperative to identify spatial and temporal risks, that are likely to impact agricultural commodities. Adaptation options are thus needed to mitigate the negative impacts.

Considering this, **the Borlaug Institute for South Asia (BISA)** organised an inception meeting to develop an **Atlas of Climate Adaptation in South Asian Agriculture (ACASA)** in collaboration with the **National Agricultural Research System (NARS) of the region, supported by the Bill and Melinda Gates Foundation (BMGF)**. It aims at improving access to climate risk and solution option analytics for South Asian countries.

The Atlas consolidates diverse South Asian data, presenting spatially explicit information on climate hazards, their evolving patterns, and their impact on smallholder populations, farms, and agricultural enterprises. Through the Atlas, an assessment will be conducted to evaluate the vulnerability and adaptive capacity of these populations, as well as the implications for critical commodities in the region. Furthermore, the Atlas will provide evidence of the effectiveness of gender-informed climate adaptation interventions.

This comprehensive toolset offered by the Atlas will empower stakeholders, including governments, insurance providers, agri-food industries, international and national donors, and adaptation-focused organizations, to make informed decisions regarding investments in agricultural technologies, climate information services, and policies. The project will also prioritize capacity building for all stakeholders, including researchers, policy planners, industry professionals, and non-governmental entities, ensuring their proficiency in utilizing the Atlas effectively.

By enhancing resource utilization, the project seeks to improve the efficiency and effectiveness of various institutions, ultimately strengthening the resilience of millions of vulnerable small-scale producers.

To discuss ACASA, **a 3-day inception meeting was held in Delhi from 25th to 27th April 2023, marked by 70 distinguished guests from Nepal, Sri Lanka, Bangladesh, and India** discussing the various aspects of Atlas.

The following report summarizes the key notes from each session of the inception meeting spanned across three days.

## Key Notes from the Inception Meeting

Day-1

25th April 2023

### Session 1

Day one of the inception meeting started with an inaugural session featuring welcome remarks from **Dr. Arun Joshi, Managing Director, BISA-CIMMYT**. He welcomed all the dignitaries present in the meeting and expressed gratitude to BMGF for the funding of the project. **Dr. Pramod Aggarwal, Project Leader, ACASA, BISA-CIMMYT**, then briefed about the project and introduced the partners of the project.



*Panel for the Keynote Address*

**Purvi Mehta, Deputy Director, Agriculture-Asia, BMGF**, congratulated the partners of the project. She spoke about BMGF's contribution in supporting the project. Her emphasis was on considering economic and ecological areas for the Atlas development. BMGF will act as a catalyst and looks forward to new opportunities during its association with the project.

Next, remarks from **Tess Russo, Senior Program Officer, BMGF**, spoke about how the use cases of the Atlas will be valuable and South Asian context will vary from the already existing Africa's Atlas. The usage of Atlas will require analysis and calculation at the back end, with each country having a better understanding of climate hazards and adaptation options, while compiling and validating the data.



*Purvi Mehta, Deputy Director, Agriculture-Asia, BMGF*



*P. Malathy, DG-Agriculture, Sri Lanka, delivering the keynote address*

From **Bangladesh Agricultural Research Council (BARC)**, **Hasan Md. Hamidur Rahman, Director, GIS Unit, BARC**, spoke about the impact of climate change in South Asia and his hopes on Atlas providing an overview, risk, adaptation options/ strategies, and capacity building of stakeholders (farmers/ local communities). Next, **Tika Ram Chapagain, Director, Nepal Agricultural Research Council (NARC)**, spoke about Nepal's demography, land use, and agricultural contribution to GDP and his hopes on actively collaborating and promoting an adaptive capacity building. Keynote by **P. Malathy, DG-Agriculture, Sri Lanka**, then spoke about how Atlas will support climate-smart activities with evidence-based solutions considering the wide spatial and temporal dimensions of South Asia.

Keynote by **Himanshu Pathak, Secretary-DARE and DG, The Indian Council of Agricultural Research (ICAR)**, discussed climate change scenarios and the current state of Indian agriculture with initiatives taken so far and challenges faced. He emphasized the approach of de-risking agriculture from the climatic risks. The ICAR is committed to Atlas development and will deploy a large team of young scientists to support and benefit from this work. ICAR will also host this Atlas on its website for larger use in the country.



**Himanshu Pathak, Secretary-DARE and DG,  
The Indian Council of Agricultural Research  
(ICAR)**

## Session 2

Chaired by **S K Chaudhari-DDG, ICAR, India**, this session discussed the work done earlier by various South Asian countries on climate adaptation/vulnerability atlases, including approaches for risk characterization, identifying and prioritizing adaptation options, scale, data used, and data available for use.

### Work done earlier in the country on climate adaptation/vulnerability atlases

#### 1. Bangladesh: Hasan Hamidur Rahman, BARC

Bangladesh previously has come up with 'Bangladesh climate and disaster risk atlas: Volume 1 & 2' and 'Climate Adaptation Services Bangladesh (Haor region)'. In the former Atlas, 228 maps were used, with the classification of 10 natural hazards, and data sets on water level, precipitation, wind speed, population, education, income, crop, forest, settlement, poverty, education, etc. The latter Atlas, on the other hand, had a total of 71 maps with spatial variation, exposure variables, socio-economic vulnerability, and adaptive capacity.

#### 2. Nepal: Tika Ram Chapagain, NARC

Nepal has made concerted adaptation efforts through National Adaptation Program of Action (NAPA, 2010), National Adaptation Plan (NAP 2021-2050), Agriculture Development Strategy (ADS-2015-2035), Agriculture Development Strategy (ADS-2015-2035), Green, Resilient, & Inclusive Development (GRID), 2021. The Himalayan Climate and Water Atlas used data from five main river basins from the Hindu Kush Himalayan region, historic climate data developed by APHRODITE's water resources were analyzed and the delta change approach adopted to downscale global climate models, temperature, precipitation, climate hazards, and extreme events projected.

#### 3. Sri Lanka: Harsha Kadupitiya, NMRC

Sri Lanka is exposed to the hazards like flood and drought in Southwest and western provinces, high-intensity rainfall in the northern region, the occurrence of heavy rainfall, landslides, and raise in sea level in the West, Southwest, and Southern Coastal Belt. To this end, climate-smart agriculture and interventions like stress tolerance varietal development, rainwater harvesting, solar-powered micro irrigation, soil conservation bunds, and crop diversification have been implemented.

#### 4. India: C A Rama Rao, CRIDA-ICAR

In Indian agriculture, economy, and climate change, more than 86% of farmers are small landholders with holding less than 2 ha. Mr. Rao explained the status of India and the Indian state in terms of vulnerability and resilience to climate change. Pertaining to the mapping of vulnerability to climate change in India considering the IPCC AR4 approach, India has taken a note of sensitivity indicators, exposure indicators, and adaptive capacity indicators. India has also mapped vulnerability of Agriculture using Geospatial Technologies considering AR4 Framework sensitivity indicators, along with the district level assessment and mapping the exposure, sensitivity, and adaptive capacity using spatiotemporal analysis and combined risk of hydro-met disasters and their compounded impacts on vulnerability.

The session was concluded with an emphasis on how different approaches taken by different countries will be instrumental in guiding the tool building under ACASA which will benefit the entire South Asia. Dr. Aggarwal then briefed the risk characterization session. He also introduced the next session's chair, Dr. V. Geethalakshmi, VC-TNAU, India.

## Session 3

Chaired by **V. Geethalakshmi, VC-TNAU, India**, discussed approaches for risk assessment, including the IPCC framework. For the IPCC Framework referred to for the risk analysis, **C A Rama Rao, CRIDA-ICAR, India**, explained how the IPCC has defined the risk and vulnerability. He explained the concept of risk

has evolved over a period. He also explained the definitions of vulnerability, exposure, hazards, and risk as per the IPCC AR5 and how the climate change risk index is already built at the district and at the country level. He suggested that commodity-specific assessments need more quantitative assessments. Moreover, a combination of different approaches and methods should be used for risk assessment.

Next, regarding the risk characterization, **Paresh Shirsath, Scientist-Climate Adaptation, BISA-CIMMYT**, explained how the focus on granularity can make the intensity and frequency analysis, risk characterization, and adaptation options more relevant. Risk characterization in agriculture is highly complex, often interlinked, and single consequences are difficult to disentangle. A reliable approach is thus required for managing risks using a risk impact matrix, which provides a solid framework. He explained the risk layering approach framework used by World Bank. The framework provides a strong basis for guiding adaptation solutions when the intensity and frequency of events occur. He showed the risk analysis based on crop statistics at the district scale, statistics, and satellite signatures at the district as well as village scale. We need to thus understand the connection among production risks with hazard, exposure, and vulnerability and find out the appropriate adaptation options at the granular scale.

This ended with Q&A round with Dr. Aggarwal providing comments and introducing a poll-based exercise for the participants on risk assessment.



***Poll-based exercise among the participants on risk assessment***

Next, there was a parallel session conducted by countries focusing on selecting the indicators for hazard, exposure and vulnerability for rice, wheat/maize, at least one more commodity of choice, and deliberating on its integrated assessment.

#### **Session 4**

Chaired by **P. Malathy, DG-Agriculture, Sri Lanka**, this session delved into the Atlas already existing for the Sub-Saharan Africa region. The session discussed its methodology to help South Asia understand the approach and databases used. It will also introduce multiple methods to identify and prioritize adaptation solutions.

The first speaker under this session, **Todd Rosenstock, ABC, Kenya**, explained the application of Africa's Atlas by giving the example of the maize crop, which is prone to stress by different hazards. He explained how to identify the areas under different risks and levels of hazards; and how different adaptation options will work through qualitative assessment. He also mentioned investment tools, metrics, and data tools for assessing the climatic risks. One of the newest things in the South African Atlas is to link the adaptation solution to the climatic risk which is - Atlas Solution Prioritization Algorithm. Considering the experiences from the Global gridded simulations (AgMIP) and Point-based simulations (GYGA), the African Atlas is working on the middle ground by using machine learning and crop simulation model. This will help to understand the changes in suitability, productivity, and profitability with and without adaptation solutions. Next, regarding the resilient agriculture database for Africa-ERA, **Peter Steward, ABC Kenya**, emphasized the potential for leveraging past research efforts and utilizing advanced data extraction techniques for

informed decision-making in climate change adaptation strategies for South Asia. These research efforts include meta-analysis which is a rigorous method to inform our understanding of climate change adaptation and develop outputs for the South Asia Adaptation Atlas. Meta-analysis and systematic review have had significant impacts on decision-making and policy in the past. Talking about systematic literature review, it holds the potential to revolutionize the way agricultural research data can be managed, by leveraging data science and reducing the difficulty, effort, and cost of evidence-generation.

Lastly, **Phil Thornton, UK**, discussed about identifying and prioritizing adaptation options using systematic literature review, meta-analysis, and heuristic models. He briefed the IPCC framework for climatic risk and the impacts of climate change on livestock systems. Livestock models are complicated and quite difficult to have a generic model which gives an actual estimation of losses. He also emphasized on the local-level innovation in the agri-food system for the adaptation options and possible accelerators for those options. He explained the adaptation curve and the context of the adaptation options based on the suitability, scalability, and the cost-benefits.

## Day-2 26th April 2023

### Session 5

**Chaired by Stanley Wood, Professor, Evans School of Public Policy, University of Washington**, this session introduced the use of econometric and crop growth simulation models to identify and prioritise adaptation options and their evaluation from a gender perspective.

**Pratap Birthal, Director, NIAP-ICAR, India**, discussed about identifying and prioritising adaptation options using econometric analysis. Dr. Birthal discussed different methods such as value at risk, fixed effects regression, and multinomial endogenous switching regression. While talking about identifying adaptation measures, information on several farm activities that provide a cushion against production and livelihood risks will be required. Further, there is a need to identify such activities and classify based on their risk functions. Household-level data that is integrated with climate data at district-level needs to be considered. Therefore, adaptation strategies would include risk mitigation, risk transfer, and risk coping. Moreover, there would be several layers in implementation. First, we need to prioritize adaptations from feedback from farmers based on their exposure to different risks and empower them in mitigation and adaptation. Second, at policy level, formulate risk management policies, programs, and their implementation strategies. Lastly, taking into spatial differences, the administrative structure should coordinate with village level institutions to implement adaptation strategies.



Next, **Maxwell Mkondiwa, CIMMYT, India**, also discussed about identifying and prioritizing adaptation options using econometric approaches. Certain unique points of discussion highlighted by Dr. Mkondiwa were the future of causal machine learning and AI which will allow “personalized adaptation solutions” just as it has done for “personalized medicine”. Options such as the spatial bayesian kriging can allow interpolating to new sites. Positive mathematical programming (PMP) will allow the testing of benefits of the ML+AI recommended “adaptation solutions” in a context with agency, feedback loops, and much more. All this while, fairness, ethical ML and replication/reproducibility should be the key criteria.



Regarding, identifying, and prioritizing adaptation options using crop models, **V Geethalakshmi, Tamil Nadu Agricultural University (TNAU), India**, emphasized on understanding and predicting the behavior of biological systems. This would involve increasing the efficiency of agricultural research and management. There is a need to improve agronomic efficiency and environmental quality through joint adaptation and mitigation modelling. A thorough evaluation of adaptation packages (new varieties, adjusting sowing window, sowing density, appropriate dose and time of fertilizer application, irrigation optimization) will be best suited as a way forward. Identifying the best crop rotation/system under varied climate can improve

the soil fertility and maximize crop productivity. Crop simulation models need broadening to account for technological development and to reflect the full range of options available. Lastly, coupling remote sensing information and crop modeling can improve spatial crop yield prediction and crop management.

Talking about the gender suitability analysis for adaptation options, **Hom Gartaula, IRRI, India**, highlighted the need of including gender sensitive climate adaptation measures by catalyzing actions that recognize and integrate the different vulnerabilities, knowledge and roles of men and women. This would require empowering women as agents of change and innovation, rather than passive victims. This will also ensure the acceptance of new adaptation technologies in communities and facilitate cost-saving opportunities for adaptation projects and programs. This will only make our efforts more resilient and effective and build efficient policies and practices.

### Session 6

Introduced by **Dr. Aggarwal**, this session conducted **parallel group discussions**. The delegates listed opportunities and constraints of using these models for climate adaptation atlas, data requirements, and availability by region and commodity.



**Parallel group discussions conducted to list opportunities and constraints of using different models for climate adaptation Atlas**

First group discussion was around the statistical and econometric modelling, chaired by **BMK Raju, India, and Shivendra Srivastava, India**. The discussion was anchored around the statistical and econometric methods, data requirement, availability, data sources, data quality, and capacity in the country team. Second group discussion was on crop growth modelling, chaired by Naresh Kumar, India, and Apurbo Chaki, Bangladesh. It discussed crop models for adaptation options, technologies, and practices, data requirement, availability, data sources, data quality, and capacity in the country team. Next discussion was on systematic literature review, meta-analysis, and heuristic models, chaired by Peter Steward, Kenya. The discussion was centred around the process of systematic literature review and meta-analysis, tools available, and capacity in the country team. The last group discussion was around the visualisation, chaired by Golam Mahboob, Bangladesh, and SS Senanayake, Sri Lanka, discussing Atlas visualisation through various options-scale, team skills/ outsourcing, and the country hosting arrangements.

### Session 7

Chaired by **Rajbir Singh, ADG-ICAR, India**, this session conducted the group work to list the possible adaptation solutions for major commodities and map their suitability, implementation feasibility, and gender intentionality of the listed solutions for current and future climate hazards for different agro-ecologies. The introduction to group work was provided by **Dr. Aggarwal** with demonstration given by **Anil Pimpale, and Kaushik Bora, BISA-CIMMYT, India**. List of adaptation options by commodity and country, their suitability scoring for the following for current and future hazards were discussed. This included agro-ecosystem (irrigated/rainfed/ plains/coastal/hills), Community supported agriculture

(yield promoting/risk reduction/risk transfer/mitigation), and the implementation feasibility (cost, credit, farm size, gender-friendly, and ease of implementation).

Next, brief presentations on systematic literature review and meta-analysis, statistical and econometric modelling, crop simulation models, Atlas visualization, risk characterization, and adaptation options were presented. For adaptation solutions, Bangladesh identified ICT as important adaptation option for rice and most options were identified as yield promoting and risk reducing. For India, 10 adaptation solutions were attempted. Maladaptation of some options was also identified. For Sri Lanka, adaptation solutions included agro-advisory, IPM/INM, and insurance. In case of Nepal, direct seeded rice (DSR) and system of rice intensification (SRI) were identified as important to handle multiple hazards.

Regarding the role of simulation models in adaptation to climate change, **Professor S. Naresh Kumar, CESCRA, IARI, India**, discussed about how hydrological model, coupled pest model, GIS, and economic models play an indispensable role in climate change research. Essentially, database creation, calibration, validation, and application consist of crucial steps in modelling.

The day two of the inception meeting ended with team field visit to ICAR's campus to look at the climate impact and adaptation facilities.



*Team at the ICAR campus for the field visit to explore climate impact and adaptation facilities*

### Day-3 27th April 2023

#### Session 8

Chaired by **Purvi Mehta, Director, BMGF**, this session discussed the use cases of Atlas.



Talking about the potential use cases of risk and adaptation of Atlas, **Stanley Wood, Professor, Evans School of Public Policy, University of Washington**, highlighted that the access to extensive data and multiple use cases requires a cautious and inclusive approach. Early involvement of users, including representatives from the insurance industry, is crucial for meaningful contributions and desired outcomes. Developing the infrastructure within the Atlas to address time and space is essential, particularly for use cases like the insurance industry. Moreover, the Atlas's architectural features enables flexibility for multiple countries and themes. It provides insights into the impact of threats on the agriculture sector and offers adaptation and mitigation options. Utilizing crop simulation models and econometrics approaches can expedite progress in impact estimation and decision-making within the Atlas.



Further, from the perspective of donor agencies, **Tess Russo, BMGF**, presented that the Atlas should target topics where other entities are not incentivized to work, focusing on areas of high need. The ACASA Atlas includes a risk section that considers producers' preparedness and their ability to benefit from solutions. Information from the Atlas can be quantitative or semi-quantitative, with relative importance ranking likely to be adopted. Vulnerability and adaptive capacity layers help prioritize adaptation strategies for small-scale producers. The Atlas should focus on sub-national levels for policy and adaptation program planning. The platform for the Atlas could be a website or downloadable program,

emphasizing quantitative output and easy-to-extract data tables and maps. The vision is to create a sustainable product that is regularly updated with new data sets and adaptive capacity survey layers. The product can be shared with donors, partners, and governments to advocate for specific actions in targeted areas.

From the perspective of multilateral agencies, **Hoe Yun Jeong, Asian Development Bank (ADB)**, discussed ADB has made significant commitments to climate initiatives and food security investments with a focus on climate adaptation and mitigation. The ACASA Atlas is expected to provide valuable insights for the planning and design of ADB's adaptation investment projects. Atlas can help integrate its recommendations into ADB's project planning process, aligning with the Paris Agreement goals. Upstream studies and knowledge generated by Atlas can identify investment opportunities for ADB across countries and sectors. ADB actively seeks partnerships and new sources of knowledge, including the Atlas, to support their sustainability and climate resilience goals.



On behalf of **United Nation's World Food Program (WFP)**, **Sudeshna Sen/Pradnya Paithankar**, highlighted the potential use of the Atlas for guiding WFP programs. The Atlas is expected to contribute to achieving nutrition, food security, and resilience outcomes for WFP. Social stratification factors like gender, income level, caste, and ethnicity should be included as a layer in adaptation options within the Atlas. WFP expects the Atlas to cover various food systems, including livestock, fishery, and horticulture crops. The inclusion of under-utilized crops and indigenous practices is also desired within the Atlas for a comprehensive understanding of food systems.

From the government perspective, **Aruna Sooriyaarachchi, Sri Lanka**, discussed the government's role in utilizing the policy guidance from ACASA. The government aims to address identified resource changes in a sustainable manner based on the guidance provided by ACASA. The focus is on implementing a sustainable development plan that ensures the needs of future generations are met. The government recognizes the importance of long-term planning and resource management to achieve sustainability goals.



Regarding the implications for **reinsurance and insurance Industry**, **Dr. K N Rao**, discussed the Atlas in the insurance industry. The Atlas is expected to identify and assess risks and propose suitable adaptation measures, including extreme options like discontinuing crop cultivation in unsuitable areas. The Atlas's granularity can facilitate the recommendation of more effective policies for the Indian government and potentially lead to increased insurance penetration rates. The insurance industry aims to leverage Atlas to enhance penetration by identifying, quantifying risks, and recommending adaptations. Collaboration between the

insurance industry and ACASA is desired to create an instance of the Atlas focused on crop insurance. The reinsurance industry could benefit from using crop growth simulation models that align with the Atlas, providing a more dynamic and useful approach. The insurance industry expresses its willingness to work with ACASA and collaborate on the implementation of these ideas to improve crop insurance practices.

As for the agri-food industry, **Mr. V Vijay Vardhan, ITC Limited**, emphasized the company's strong focus on agriculture and its efforts to promote sustainable and inclusive supply chains. The importance of considering the status of natural resources and implementing climate-resilient practices for major crops during Atlas development was emphasized. Also, decarbonization in agriculture through practices like solar, biogas, and biomass usage was identified as a priority.



**Remarks from the session chair, Dr. Mehta**, emphasized the importance of stakeholder perspectives and the need for a regional approach in developing the agro-climate-based Atlas. It was realized that diversities within the region, including climate variations, indicator requirements, national capacities, and private sector participation, should be recognized and addressed. Consideration should be given to landless farmers and gender disparities in land ownership in South Asia, despite potential data limitations. Integration of data layers and collaboration with external initiatives like ADB programs and existing dashboards can maximize the benefits of the Atlas. The steering committee should proactively focus on maximizing the use and long-term sustainability of the Atlas, including planning for handover and continuously improving the design based on country perspectives and needs.

Dr. Mehta expressed her gratitude to all the speakers and acknowledged the session's significance. Dr. Aggarwal expressed his appreciation for the session. The session was crucial to comprehend the viewpoint of the users for whom we are creating the Atlas. He emphasized that Atlas cannot fulfil every demand, so we need to prioritize certain things. Therefore, he asked to focus on tiers 1, 2, 3, and additional tiers through brainstorming and discussion in the team.

#### **Session 9**

Chaired by **Dr. Aggarwal**, this session focused on the proposed methodology for the South Asia's adaptation atlas. Approaches for risk characterisation, impact assessment, and identifying adaptation options were discussed. ACASA teams discussed country-specific work plans with detailed activities, timelines, deliverables, and agreed methodology.

**Paresh Shirsath, BISA-CIMMYT** then conducted an opinion poll about the methodologies and view of country representatives on the same. As next steps, each country presented the team plan refinement, methodology, data, use cases, partnerships, and Atlas hosting site.

Pertaining to India's plan for next six months, activities include the broad spectrum of impact and adaptation assessment with input data collection at grid level; methodology and time scales were discussed at the district level; sub-groups formation was seen as a necessity; conducting a systematic literature review; and district level yield data needs to be compiled for wheat, rice, and sorghum.

Proposed plan for Nepal includes the stakeholder identification, data availability, partnership development, systematic literature review, and development of program to conduct risk assessment. All timelines were discussed to achieve these activities. Regarding Sri Lanka, climate change vulnerability map for risk zoning, adaptation options for each crop and hazards, policy directions, and providing supportive information for agro-met advisory were discussed.

Lastly, for Bangladesh, National Data Centre (NDC) will be the hosting site for Atlas. Data and finance partnership and knowledge sharing was seen as a significant step. The team plan includes – systematic literature review, exploration of existing Atlas, data collection, crop modelling, econometric analysis, risk prioritization, solution prioritization, and fortnightly consultation meetings.

*As last steps to the inception meeting, a rounded country team leaders meeting was conducted. The three-day inception meeting thus strongly placed an emphasis on the spirit of South Asian countries to venture on a joint mission to mitigate the impact of climate change on South Asian Agriculture using Atlas.*



**Annexure II**  
**List of the participants**

<b>S.No.</b>	<b>Name</b>	<b>Position</b>	<b>Institution</b>	<b>Country</b>	<b>Email</b>
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# ACASA: Atlas of Climate Adaptation in South Asian Agriculture

**Inception Meeting (25 to 27 April 2023)**

 ICAR Lecture Hall - 2<sup>nd</sup> floor, NASC Complex, New Delhi-110012

**Day-1 [25 April 2023]**  
**Inaugural Session**

Time		
<b>0815 to 0845</b>	Registration	<b>BISA-CIMMYT</b>
<b>0845 to 0850</b>	Welcome	<b>Arun Joshi,</b> Managing Director, BISA-CIMMYT
<b>0850 to 0905</b>	About the Atlas and workshop	<b>Pramod Aggarwal,</b> Regional Program Leader, BISA
<b>0905 to 0915</b>	Remarks from BMGF	<b>Purvi Mehta,</b> Director, BMGF
<b>0915 to 0920</b>	Remarks from BMGF	<b>Tess Russo,</b> Senior Program Officer, BMGF
<b>0920 to 0925</b>	Remarks from Bangladesh	<b>Hasan Md. Hamidur Rahman,</b> Director, BARC
<b>0925 to 0930</b>	Remarks from Nepal	<b>Tika Ram Chapagain,</b> Director, NARC
<b>0930 to 0940</b>	Keynote by DG-Agriculture, Sri Lanka	<b>P Malathy,</b> DG-Agriculture, Sri Lanka
<b>0940 to 0955</b>	Keynote by Secretary-DARE and DG ICAR, India	<b>Himanshu Pathak,</b> Secretary-DARE and DG ICAR, India
<b>0955 to 1000</b>	Vote of thanks	<b>Richa Sharma Puri ,</b> Communication specialist, BISA
<b>1000 to 1030</b>	<b>Tea break and group photo</b>	



## Session 2 [Chair: S K Chaudhari, DDG- ICAR, India]

Time	This session will discuss the work done earlier in the country on climate adaptation/ vulnerability atlases, including approaches for risk characterisation, identifying and prioritising adaptation options, scale, data used, and data available for our use.	
1030 to 1140	1. Bangladesh 2. Nepal 3. Sri Lanka 4. India	Hasan Hamidur Rahman, BARC Tika Ram Chapagain, NARC Harsha Kadupitiya, NMRC C A Rama Rao, ICAR-CRIDA
1140 to 1145	Chair's remarks	

## Session 3 [Chair: V. Geethalakshmi, VC-TNAU, India]

Time	Approaches for risk assessment, including the IPCC framework, will be discussed.	
1145 to 1205	IPCC Framework for risk analysis	C A Rama Rao, CRIDA-ICAR
1205 to 1225	Bringing Granularity and Intensity-Frequency Analysis in Risk Characterization	Paresh Shirsath, BISA
1225 to 1245	Parallel session by country- The session will focus on selecting the indicators for hazard, exposure and vulnerability for rice, wheat/ maize, at least one more commodity of choice, and integrated assessment.	Introduction by Pramod Aggarwal, BISA Demo by Prasun Gangopadhyay
1245 to 1345	Lunch	
1345 to 1500	Parallel session by country- continued	Parallel sessions by country Bangladesh: Abdus Salam [Venue: Bioversity] India: CA Rama Rao [Venue: ICAR Lecture Hall- 2 <sup>nd</sup> floor] Nepal: Tika Ram Chapagain [Venue: ICRISAT] Sri Lanka: Kadupitiya Harsha [Venue: CIMMYT]
1500 - 1530	Tea break	

## Session 4 [Chair: P Malathy, DG-Agriculture, Sri Lanka]

Time	Sub Saharan Africa region has developed a similar atlas in the last few years. This session will introduce its methodology to help SA delegates understand the approach and databases used. It will also introduce multiple methods to identify and prioritise adaptation solutions.	
1530 to 1600	Overview of Sub Saharan Africa Atlas	Todd Rosenstock, ABC, Kenya
1600 to 1630	Resilient agriculture database for Africa-ERA	Peter Steward, ABC Kenya
1630 to 1700	Identifying and prioritising adaptation options -Using systematic literature review, meta-analysis, and heuristic models	Phil Thornton, ClimEat, UK
1700 to 1705	Chair's remarks	

Workshop Dinner 1900 onwards at Mandala Banquet Hall (First Floor), Jaypee Siddharth Hotel



# ACASA: Atlas of Climate Adaptation in South Asian Agriculture

## Inception Meeting (25 to 27 April 2023)

### Day-2 [26 April 2023]

#### Session 5 [Chair: Stanley Wood, Professor, Evans School of Public Policy, Univ. of Washington]

Time	This session will introduce the use of econometric and crop growth simulation models to identify and prioritise adaptation options and their evaluation from a gender perspective.	
0900 to 0920	Identifying and prioritising adaptation options using econometric analysis.	Pratap Birthal, NIAP-ICAR, India
0920 to 0940	Identifying and prioritizing climate adaptation solutions: Recent advances in econometric approaches	Maxwell Mkondiwa, CIMMYT, India
0940 to 1000	Identifying and prioritising adaptation options using crop models.	V Geethalakshmi, TNAU, India
1000 to 1025	Climate change adaptation: gender-sensitive approaches, tools, and practices	Hom Gartaula, IRRI, India
1025 to 1030	Chair's remarks	
1030 to 1100	Tea Break	

#### Session 6 Parallel group discussions: Session introduction by Pramod Aggarwal, BISA

1100 to 1230	Group discussions (in parallel). The delegates will list opportunities and constraints of using these models for climate adaptation atlas, data requirements and availability by region and commodity. (Initial remarks by Chairs- 20 minutes, general discussion 50, summary and conclusion- 20 minutes).			
	Statistical and Econometric modelling	Crop growth modelling	Systematic literature review, Meta-analysis, and heuristic models	Visualisation
	Chair: BMK Raju, India, and Shivendra Srivastava, India	Chair: Naresh Kumar, India, and Apurbo Chaki, Bangladesh	Chair: Peter Steward, Kenya	Chair: Golam Mahboob, Bangladesh, and SS Senanayake, Sri Lanka
	Statistical and econometric methods, data requirement, availability, data sources, data quality, capacity in the country team	Crop models for adaptation options- Technologies and practices? Data requirement, availability, data sources, data quality, capacity in the country team	Process of Systematic literature review and meta-analysis, tools available, capacity in the country team	Atlas visualisation: Various options-scale, team skills/ outsourcing, the country hosting arrangements
	[Venue: ICAR Lecture Hall- 2nd floor]	[Venue: Bioversity]	[Venue: CIMMYT]	[Venue: ICRISAT]
1230 -1330	Lunch			



## Session 7 [Chair: Rajbir Singh, ADG-ICAR, India]

Time	The group work in this session will list the possible adaptation solutions for major commodities and map their suitability, implementation feasibility and gender intentionality of the listed solutions for current and future climate hazards for different agro ecologies.	
<b>1330 to 1445</b>	<p>List of adaptation options by hazard, commodity and country, their suitability scoring for the following for current and future hazards-</p> <ol style="list-style-type: none"><li>1. Agro-ecosystem (irrigated/rainfed/ plains/coastal/hills),</li><li>2. CSA (Yield promoting/ risk reduction/ risk transfer/mitigation),</li><li>3. Implementation feasibility (cost, credit, farm size, gender-friendly, ease of implementation)</li></ol>	<p>Introduction by Pramod Aggarwal</p> <p>Demo by Anil Pimpale, Kaushik Bora and Aniket Deo</p> <p>Parallel sessions by country</p> <p>Bangladesh: Faruque Ahmed [Venue: Bioversity]</p> <p>India: VK Singh [Venue: ICAR Lecture Hall- 2<sup>nd</sup> floor]</p> <p>Nepal: Amar Bahadur Pun [Venue: ICRISAT]</p> <p>Sri Lanka: Harsha Kadupitiya [Venue: CIMMYT]</p>
<b>1445 to 1515</b>	<b>Tea break</b>	
<b>1515 to 1615</b>	<p>Reporting from the group work session by session chairs.</p> <p>(7 minutes presentation and 3 minutes discussion)</p> <ul style="list-style-type: none"><li>• Systematic literature review and Meta-analysis</li><li>• Statistical and econometric modelling</li><li>• Crop simulation models</li><li>• Atlas visualisation</li><li>• Risk characterisation</li><li>• Adaptation options</li></ul>	<p>Peter Steward</p> <p>BMK Raju/Shivendra Srivastava</p> <p>S Naresh Kumar/ Apurbo Chaki</p> <p>Golam Mahboob/SS Senanayake</p> <p>V Geetalakshmi/C A Rama Rao/Prasun Gangopadhyay</p> <p>Rajbir Singh/Kaushik Bora</p>
<b>1615 to 1730</b>	Field trip to IARI climate impact and adaptation facilities	



# ACASA: Atlas of Climate Adaptation in South Asian Agriculture

Inception Meeting (25 to 27 April 2023)

Day-3 [27 April 2023]

## Session 8. Use cases of the Atlas. [Chair: Purvi Mehta, Director, BMGF]

Time	Use cases of the Atlas is an important objective. In this session, representatives of multi-lateral agencies, governments, and the industrial sector will discuss the potential use cases of the SA Atlas, considering the work illustrated on days 1 and 2. This will guide the partners to prioritise and develop use cases by geography and thematic area.	
0900 to 0915	Potential use cases of risk and adaptation Atlas	Stanley Wood, BMGF
0915 to 0925	Donor agencies	Tess Russo, BMGF
0925 to 0935	Multi-lateral agencies	Hoe Yun Jeong, ADB
0935 to 0945	UN agencies	Pradnya Paithankar, UN-WFP
0945 to 0955	Governments	P Malathy, Sri Lanka
0955 to 1005	Crop insurance industry	K N Rao, International Reinsurance and Insurance Consultancy and Broking Services
1005 to 1015	Agrifood industry	V Vijay Vardhan, ITC Limited
1015 to 1030	General discussion on other potential use cases	
1030 to 1040	Rapid survey on potential use cases	Paresh Shirsath, BISA
1040 to 1045	Chair's remark	Poorvi Mehta, BMGF
1045 to 1100	Tea Break	

## Session 9. The team plans and closing. [Chair: Pramod Aggarwal and Tess Russo]

Time	The session will introduce the proposed methodology for the SA adaptation atlas. Approaches for risk characterisation, impact assessment and identifying adaptation options will be discussed. ACASA teams will prepare country-specific work plans with detailed activities, timelines, deliverables and agreed methodology.	
1100 to 1130	SA Atlas Methodology	Pramod Aggarwal, BISA
1130 to 1230	Rapid survey on methodologies of ACASA	Paresh Shirsath, BISA
1230 to 1330	Lunch	
1330 to 1430	Team plan refinement, methodology, data, use cases, partnerships, Atlas hosting	Country teams Bangladesh: [Venue: Bioversity] India: [Venue: ICAR Lecture Hall- 2 <sup>nd</sup> floor] Nepal: [Venue: ICRISAT] Sri Lanka: [Venue: CIMMYT]
1430 to 1515	Team plan presentation, feedback, and closing	Country Team leaders
1515 - 1545	Tea	

Country Team Leaders Meeting [1545 to 1630] Venue: CIMMYT