SESSION 3 ACHIEVING A PATHWAY TO CLIMATE RESILIENCE

Lessons from Asia and Africa

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Abstract

Agri-food systems across Asia and Africa, where over 2.5 billion people depend on agriculture for livelihoods and food security, are at risk due to current and projected climate change. For example, in Africa, maize and wheat yields have already declined by 5.8% and 2.3%, respectively, due to increased drought frequency and warming trends (IPCC, 2022a).

Across both continents and more so in Africa than Asia, rain-fed agriculture accounts for over 90% of staple crop production, making it acutely vulnerable to erratic rainfall and temperature extremes (IPCC, 2022a; IPCC, 2022b). In Asia, monsoon variability, glacier retreat affecting all perennial rivers, sea-level rise, and extreme heat threaten food production in densely populated river basins and deltas, such as the Ganges, Mekong, and Indus (IPCC, 2022b). Fisheries and aquaculture, which provide more than 20% of animal protein in many Asian countries, are also increasingly disrupted by warming and ocean acidification (IPCC, 2022c).

Without adequate adaptation, cereal yields could decline by 10–30% by 2050 across both regions, and suitable areas for rain-fed crops, such as maize, could shrink by up to 40% in parts of Sub-Saharan Africa under 1.5°C warming (IPCC, 2022a). While relatively under-researched, yields of non-cereal crops, as well as the nutritional content of all major food groups also decline at higher levels of global warming. These disruptions deepen food insecurity, affecting a disproportionate share of the 783 million people globally who are already undernourished, and exacerbating inequality for smallholders, women, and youth.

A range of solutions exists, encompassing adaptation and mitigation and their various co-benefits with nutrition and related SDGs and CGIAR and partners are working to scale these solutions. Climate-smart agriculture, including drought- and heat-tolerant crops, efficient irrigation, and agroecological practices, offers immediate adaptation benefits while leveraging digital tools such as AI-powered climate services, decision-support platforms, and mobile-based advisory systems, which helps small holder producers be better prepared for climate-induced hazards like floods and droughts.

Technological breakthroughs highlighted in recent CGIAR reports include methane inhibitors,

improved forages, green ammonia, and site-specific nutrient management are interventions that simultaneously boost productivity and reduce emissions. Scaling these solutions requires targeted adaptation finance, inclusive governance, and enabling policy frameworks and calls for a just transition in agri-food systems in Asia and Africa.

Introduction

Today I will share insights from the IPCC AR6, where I served as a Coordinating Lead Author, and from my work with CGIAR and the International Livestock Research Institute.

I want to begin with three key takeaways:

1. The intensity and severity of the climate crisis, particularly for agriculture, is still not fully appreciated. Incremental adjustments will not suffice.
2. Solutions exist, but chronic underinvestment in agricultural R&D has prevented low-emission technologies from maturing, leaving us unprepared.
3. Climate change is deeply entangled with global inequality — those least responsible are most affected. Tackling inequality is central to tackling climate change.

Climate Change and the Water–Food Nexus

Our findings from IPCC AR6 show that every component of the water cycle—precipitation, glaciers, groundwater, and soil moisture—has been altered by climate change. These shifts intensify extreme events, which cascade into risks for food and nutrition security. Impacts include reduced yields, increased pests and diseases, and declining nutritional content of crops. Governments worldwide endorsed these findings, lending them strong legitimacy. Heatwaves, heavy precipitation, and agricultural drought are already widespread, particularly in Africa and Asia. Attribution science confirms these trends are directly linked to greenhouse gas emissions, not natural variability.

Impacts on Agriculture and Food Systems

Climate change is already reducing yields of major crops across most regions. Projected warming will further diminish yields in a non-linear fashion: the higher the warming, the sharper the declines. Livestock systems are also highly vulnerable, with mid- to high-level warming scenarios projecting widespread heat stress and productivity losses.

Beyond crops and animals, human labour in agriculture is at risk. In South Asia, rising heat and humidity are already reducing farm labour capacity and, in some cases, causing mortality. These physical limits to adaptation underscore the urgency of mitigation.

Agriculture as a Driver of Climate Change

While agriculture is a victim of climate change, it is also a contributor. Food systems account for roughly one-third of global greenhouse gas emissions. However, fossil fuels remain the dominant driver, and the burden of mitigation cannot fall solely on agriculture.

Still, agriculture must transition to lower-emission pathways. This transition is constrained by a lack of cost-effective technologies, inadequate safety nets for farmers, and decades of underinvestment in R&D.

Adaptation and Mitigation Pathways

CGIAR and partners are working on a broad spectrum of adaptation strategies:

- Risk sharing and safety nets such as insurance.
- Climate services to deliver actionable weather and risk information.
- Disaster risk management and migration planning.
- Sustainable cropland and livestock management.

Promising technologies include:

- Low-methane forages to reduce enteric emissions in livestock.
- Site-specific fertilizer management to cut emissions while maintaining yields.

These are most likely to be adopted when they also provide adaptation co-benefits—such as resilience to drought or improved soil health.

Yet adaptation has limits. Once global warming crosses 1.5–2°C, many adaptation options (such as drought- or heat-tolerant crop varieties) will no longer be effective. This makes emission reduction urgent alongside adaptation.

Five Pathways Towards Resilience

From the Agricultural Breakthrough Report, five key pathways emerge:

1. Reduce unsustainable consumption (e.g., cutting food waste, reducing excess meat consumption, lowering fertiliser overuse).
2. Increase sustainable food production without expanding agricultural land.
3. Protect natural resources such as soil, water, and biodiversity.
4. Reduce emissions through cost-effective technologies.
5. Prioritise smallholder producers and food security, ensuring just transitions that protect the most vulnerable.

Beyond Incremental Change: Research and Justice

We must move beyond incremental adaptation to transformational change. Key emerging questions include:

- How do we account for losses and damages in agriculture, including through legal mechanisms such as the recent International Court of Justice advisory opinion?
- How do we prepare for overshoot scenarios, where global temperature temporarily exceeds 1.5°C?
- How do we ensure a just transition for food systems, comparable to the energy sector's debates, so that low-emission agriculture does not compromise food security?

Conclusion

The climate crisis is too severe for marginal adjustments. Without bold investment in research, equitable policy, and systemic transformation, adaptation options will diminish as warming intensifies. Agriculture must reduce emissions, but this transition must be just, farmer-centred, and globally supported.

References

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Dr Aditi Mukherji is Principal Scientist – Climate Action in the Livestock, Climate and Environment Program of the International Livestock Research Institute (ILRI) , effective 1 July 2025. Before joining ILRI, Aditi was the Director, Climate Change Adaptation and Mitigation Impact Action Platform of the CGIAR and was hosted by ILRI in Nairobi. She has also been a Principal Researcher at the International Water Management Institute based in India and Sri Lanka, and before that she led the Waterover and Air Theme at the International Centre for Integrated Mountain Development (ICIMOD) and was based in Nepal.

Aditi was a Coordinating Lead Author (CLA) of the Water Chapter in the Working Group II of the Intergovernmental Panel on Climate Change (IPCC) published in February 2022, and was a member, Core Writing Team of the IPCC's AR6 Synthesis Report which was published in March 2023. She is a currently a member of the Earth Commission where she is working with global experts on quantifying safe and just planetary boundaries. Her areas of specialization are climate change adaptation, agricultural resilience for small holder producers, climate governance, water-energy nexus and community governance of natural resources. She has worked in South Asia including the Hindu Kush Himalayan region, Nile basin and in Central Asia. She has published over 80 peer reviewed research papers, including four edited books. In 2012, she was awarded the Inaugural Norman Borlaug Field Award, endowed by the Rockefeller Foundation and given by the World Food Prize Foundation, USA.

Aditi is a human geographer by training and has a PhD from Cambridge University, United Kingdom where she was a Gates Cambridge Scholar. She has been widely quoted by the media, including New York Times, BBC, DW International, CNN, Al Jazeera and various news outlets in South Asia.