Foresight4Food
International Collaborative Initiative

Background Brief

Enhancing climate resilience of Bangladesh's food system: vulnerability, measures, and way forward

International Centre for Climate Change and Development (ICCCAD)

November 2024

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Acknowledgements

Foresight4Food would like to thank the wide range of food-system stakeholders consulted in Bangladesh. They are particularly grateful to The Government of Bangladesh and GAIN Bangladesh for hosting the Foresight for Food Systems Transformation Programme (FoSTr) in Bangladesh. Additionally, we would like to extend our thanks to the FoSTr research partner, ICCCAD, for their contribution to this report.

This report was produced in collaboration with partners in Bangladesh, as part of the Foresight4Food FoSTr Programme. This programme is funded by the Dutch Ministry of Foreign Affairs through the International Fund for Agricultural Development (IFAD) and implemented by Foresight4Food partners, led by the Environmental Change Institute at the University of Oxford, and by Wageningen University & Research.

Citation: Rozario, S.R., Mirza, A. B., & Khan, R.J. (2024). *Enhancing climate resilience of Bangladesh's food system: vulnerability, measures, and way forward*. Foresight4Food. Oxford.

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Key messages

01 Around 70% of Bangladesh's landmass is dedicated to agriculture and the intensified climate-induced disasters threaten the country's food safety and security.

02 Marginalized farmers face socio-economic and climatic challenges, exacerbating poverty and limiting their ability to adapt to adverse conditions. Therefore, A long-term multi-stakeholder approach is required to implement contextual and localized climate-smart agricultural (CSA) practices.

03 Strengthening early warning systems (EWS); establishing crop insurance; and supporting food system producers through training, financing, and climate-smart adaptation technology adoption would boost nutrient-dense crop development.

04 The government to establish market procedures and monitoring agencies at the local, divisional, and national levels to decrease pricing distortions, prevent food loss and improve transparency, thereby maintaining Bangladesh's food system resilience.

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1 Introduction

Bangladesh is highly vulnerable to climate change due to its location, fast-growing population, and frequent climatic shocks. Climate-induced disasters are becoming more frequent and severe – with intensifying heatwaves, floods, and cyclones, and slower-onset impacts such as sea level rise. All of these events harm livelihoods and ecosystems, especially food systems (IPCC, 2018, 2021, 2022).

Nearly 70% of the country's landmass is dedicated to agriculture, a critical sector for employment and food security (FAO, 2023). However, the industry faces serious threats, as climate change undermines productivity. The country's diverse food system, which includes horticulture, fisheries, livestock, and poultry, supports millions of livelihoods but is increasingly at risk from cyclones, floods, droughts, and slow-onset events like sea level rise and salinity intrusion. Socio-economic challenges, such as poverty, land fragmentation, and poor infrastructure, further limit the ability of farmers and communities to adapt.

To enhance food system resilience in Bangladesh, comprehensive, proactive actions are essential. Key strategies include investing in climate-smart agriculture (CSA) for small-scale farmers through long-term financial mechanisms and supporting local-level dissemination of CSA technologies. A collaborative, multi-stakeholder approach—engaging government, research bodies, NGOs, farmer groups, youth, and women—should prioritize "learning by doing." Additionally, strengthening food system resilience requires localized, multi-risk early warning systems and improved market linkages to protect the livelihoods of marginalized farmers.

2 Research objective, questions, and methodology

2.1 Objective

This study analyzed the impacts of climate change on Bangladesh's food system and evaluated national policies to improve its resilience. It also examined climate impacts (based on the IPCC scenarios), identified key vulnerable areas, and explored adaptation strategies. The final sections offered recommendations based on policy analysis.

2.2 Questions

Throughout the study process, we attempted to answer the following questions:

- What is Bangladesh's vulnerability to climate change?
- What are the impacts of climate change on the food system?
- What are the region-specific vulnerabilities to climate change, food production, and security?
- What are some examples of successful food system resilience interventions?
- What are some innovative adaptation strategies under different climatic stressors in Bangladesh?
- Why is a multi-stakeholder approach important to resolving food system challenges?
- What gaps and opportunities exist in policies that improve food system resilience?

2.3 Methodology

The research involved a systematic literature review (2000-2023), including journals, reports, and policies. Spatial analysis using QIGS (Quantum Geographic Information System) identified climate vulnerabilities, using data from the Bangladesh Meteorological Department (BMD) and Bangladesh Bureau of Statistics (BBS). Policies related to climate change, agriculture, and food safety and security (2005-2023) were also analyzed to develop recommendations.

3 Projected climate change scenarios for Bangladesh

Between 2000 and 2019, Bangladesh experienced 185 extreme weather events, making it the seventh most vulnerable country to climate change (Germanwatch, 2021). In terms of temperature rise and extensive heat waves, the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report outlines scenarios where, even with climate action under RCP2.6, the South Asian region may face up to 30 more days of hazardous heat per year (Ranasinghe & Vautard, 2021); and in June 2023, during a prolonged heatwave temperatures hit 40°C (Letsch, 2023). With no exceptions, under low-emission scenarios, Bangladesh could experience a 0.8°C temperature increase by 2100, rising to 2.2°C under high-emission scenarios (Huq et al., 2024; Rashid et al., 2021). Additionally, higher temperatures will intensify tropical storm formations, and influence the monsoons leading to catastrophic floods and flash floods. On the coast, a sea level rise could flood 18% of Bangladesh's coastal areas (MoEFCC, 2022), threatening food security by damaging crops and increasing salinity – which will hamper fisheries and particularly impact marginalized communities who rely on fish as a protein source (Oppenheimer et al., 2019). Despite current adaptation strategies, continued warming and extreme weather will likely surpass existing measures, making it harder to protect lives, livelihoods, and infrastructure, Annex I, figure A (Huq et al., 2024).

4 Varied impacts of IPCC scenarios on Bangladesh's food system

Climate impacts are a major factor in declining agricultural production and pose severe threats to Bangladesh's fragile food system. While extreme weather worsens food production and security, high population density, rapid urbanization, and land fragmentation further reduce cultivable land (Islam, 2014; Rai et al., 2017; Sikder & Xiaoying, 2014).

According to the IPCC Working Group II assessment, climate-induced disasters in Bangladesh have affected approximately 850,000 families and damaged 250,000 hectares of agricultural land, leading to a 30% rise in rice prices from 2014 to 2021 (Huq et al., 2022). Cyclones, floods, riverbank erosion, saline intrusion, and drought have caused crop failures, altered fish species, damaged homes, and reduced livelihood options, particularly in the southern region. Furthermore, climate scenarios (RCP2.6, RCP4.5, RCP6.0, and RCP8.5) predict rising temperatures by mid-century, worsening health issues and threatening water and food security (WB, 2024). Increased floods, droughts, and heat stress are expected to further diminish food availability, contributing to undernourishment and imposing higher costs on producers while limiting consumer choices and product quality (IPCC, 2022).

4.1 Impacts on food production

Between 2015 and 2020, natural disasters in Bangladesh caused crop damage worth BDT 517,961 million (BBS, 2022). Under a business-as-usual scenario, climate change could result in an annual agricultural loss of USD 7.7 billion, with rice production potentially decreasing by 33% in the next two decades (Chowdhury et al., 2022).

Extended periods of hot days, shorter winters, and rising temperatures are already reducing crop yields. For example, a 1-2°C temperature increase, combined with lower solar radiation, can cause rice sterility, decreasing yields for Aus, Aman, and Boro rice (Chowhan et al., 2016). With a 4°C temperature rise, rice and wheat production could drop by 28% and 68%, respectively (Rezvi, 2018). Additionally, rapid shifts in temperature, humidity, and radiation intensify pest infestations and diseases, increasing pesticide use and subsequently raising public health concerns (Doody, 2020; Khatun et al., 2023). Drought-like conditions are becoming more common in the arid and semi-arid northwestern regions, severely affecting agricultural productivity (Khan et al., 2019). In contrast, excessive rainfall in some areas leads to floods that damage crops. In 2020, floods submerged 159,000 hectares of agricultural land, causing BDT 13 billion in losses (Hossain, 2020).

Coastal regions face additional challenges from tropical cyclones and tidal surges. Cyclone Sidr in 2007 damaged 95% of crops in the coastal areas, while Cyclone Amphan in 2020 affected 176,007 hectares of cropland, resulting in a loss of USD 6.72 billion (Dhali, 2020; Wardad, 2020). Salinity intrusion is another issue, with salinity-affected land increasing from 83 million hectares to 102 million hectares between 1973 and 2000 (Haider, 2019). By 2030, salinity could advance eight kilometers further inland, reducing farmland availability and crop productivity. While saltwater shrimp farming has become profitable in these areas, there has been a 69% reduction in rice production in districts like Satkhira since 1985 (Ali, 2006); and concerns have been raised about sustainability and socio-economic disparities.

Livestock production, involving over 10 million people and contributing 1.6% to the gross domestic product (GDP), is also vulnerable (MoF, 2023). Climate change deteriorates feed quality, causes water scarcity, and spreads diseases, resulting in annual economic losses between USD 1-35 million in livestock and USD 1-11.8 million in poultry (Biswas et al., 2019).

4.2 Impacts on food processing and trade

Extreme weather events damage infrastructure and disrupt food processing and transportation (Gössling et al., 2023). In Bangladesh, natural disasters often lead to decaying raw materials, food shortages, and rising food prices, exacerbated by a lack of storage facilities (Moon, 2023; Neogi, 2022; Raihan, 2022). Extreme weather anomalies influence agricultural labor supply and decrease the number of outdoor laborers. As a result, their income, affordability, and access to sufficient nutritious food are impacted (O'Leary et al., 2024). Higher temperature and humidity increase the risk of pest and pathogen intensification affecting the quality of raw materials, and agricultural goods, and deteriorating food safety and security (Chowdhury et al., 2022).

4.3 Impacts on consumption

Income significantly affects consumers' access to nutritious food. In climate-vulnerable areas, extreme weather events reduce food intake, leading to food insecurity (Islam et al., 2022). IPCC scenarios (RCP2.6, RCP4.5, RCP6.0, RCP8.5) predict that climate change will significantly disrupt food consumption patterns in Bangladesh, increasing vulnerability among rural and urban communities.

Rising temperatures and irregular rainfall hinder market access, limiting farmers' ability to produce and purchase diverse foods, while flash floods and sea-level rise drive up transportation costs (Biswas et al., 2019). To promote healthier diets by 2050, Bangladesh should halve the consumption of unhealthy foods (e.g., red meat, sugar) and double the intake of healthy options (e.g., fruits, vegetables, legumes) (Hamm et al., 2021; Willett et al., 2019).

4.4 Impacts on marginalized farmers

Small-scale and marginalized farmers make up 76% of Bangladesh's farming community, yet individually own less than 1-1.5 hectares of land (Ahmad, 2017). This marginalized community faces both climate-related disasters and socio-economic challenges, including limited access to resources, tenure insecurity, and income disparity. Climate-related stressors further degrade their livelihoods, trapping them in a cycle of poverty and reducing their ability to adapt or improve their situation, Figure 1.

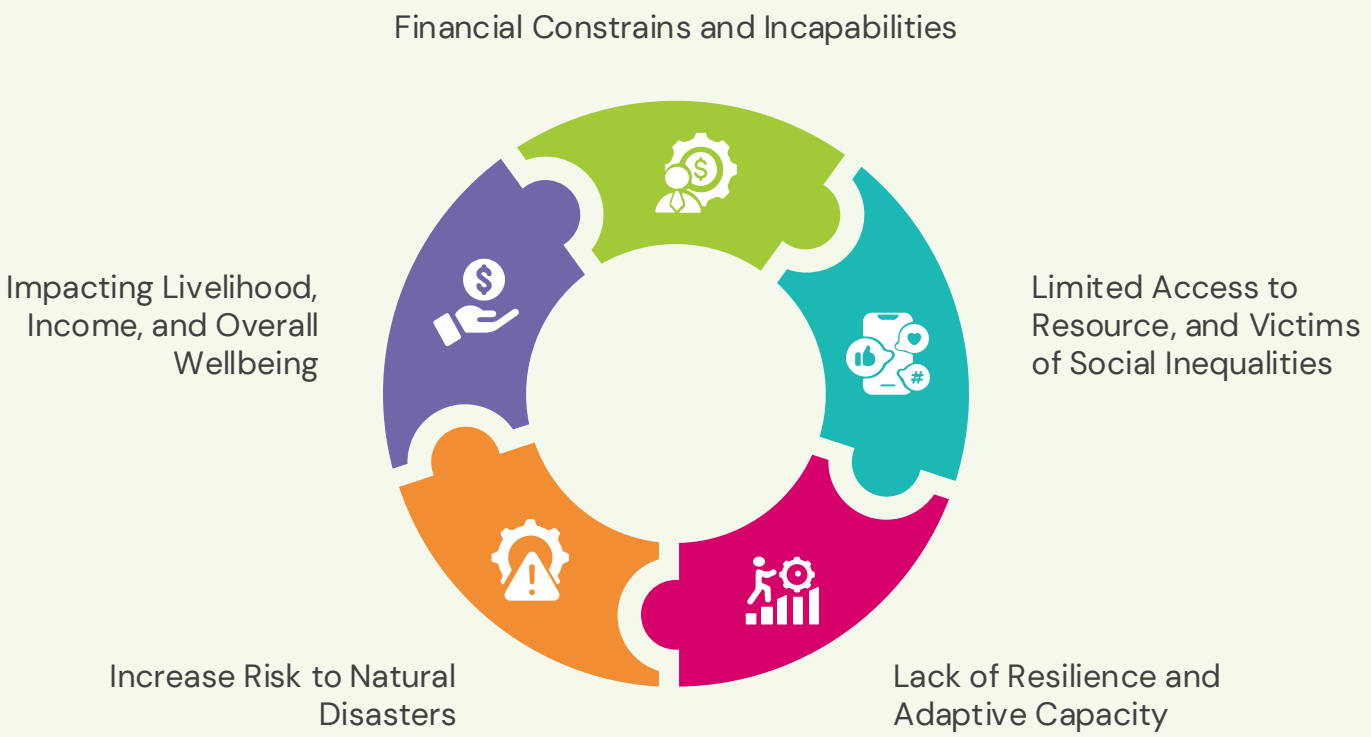

Figure 1: The interrelation between climatic and non-climatic factors enhancing the vulnerability of marginalized farmers in Bangladesh.

Source: Authors' own.

Image credit: IFAD/GMB Akash

5 Climate-vulnerable food-producing areas in Bangladesh

Bangladesh's climatic vulnerability stems largely from its geographical location and exposure to extreme weather events. The country's 64 districts are divided into six climate-vulnerable hotspots, based on their risk and exposure levels (GED, 2018; Goosen et al., 2018). Of this, only six districts, due to their proximity to the coast, floodplains, or higher elevation, are considered less vulnerable to natural hazards (GED, 2018). Annex II, Table A categorizes the vulnerable districts according to their risk profiles, geography, and socioeconomic status.

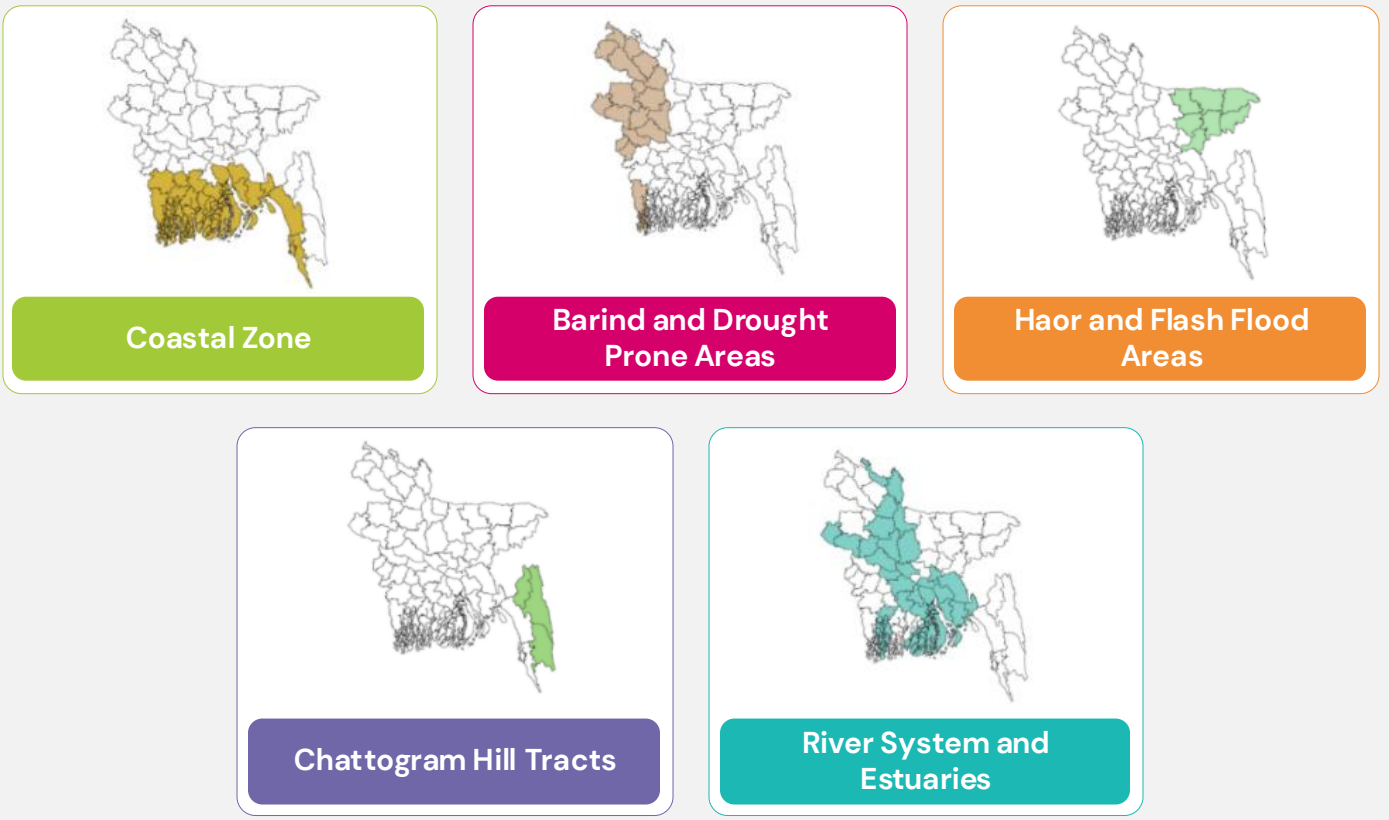

Figure 2: Climate-vulnerable hotspots of the country.

Source: Authors' own

The coastal zones of Bangladesh frequently face cyclones, storm surges, and salinity intrusion. Between 2015 and 2020, these events caused losses of BDT 153,921 million, BDT 2,731 million, and BDT 5,934 million, respectively (BBS, 2022).

The north-western Barind area, characterized by low moisture-holding soils, experiences higher temperatures and lower rainfall. Droughts in this region between 2015 and 2020 caused significant crop losses, amounting to BDT 12,311 million (BBS, 2022).

In the Hoar region, known for rice production, 80% of the population relies on Boro rice cropping and fishing. The area produces 18% of the country's rice and contributes 6% to GDP. However, frequent flash floods devastate cropland, with an estimated loss of 800,000 metric tons of Boro rice in 2017 due to flooding (Ali & Rahman, 2017).

The Chattogram Hill Tracts, home to more than 11 indigenous communities, face challenges such as landslides, droughts, water scarcity, and flash floods, which significantly impact livelihoods. Between 2015 and 2020, landslide-related crop losses in this region totaled BDT 381 million, with 99.74% of the damage concentrated in Chittagong (BBS, 2022).

Riverine, floodplains, and erosion-prone areas also suffer substantial crop losses. From 2015 to 2020, flooding caused a total loss of BDT 241,842 million, while river and coastal erosion added another BDT 26,765 million in damages (BBS, 2022).

6 Promising climate resilience measures

To mitigate the cascading effects of climate change on agriculture, Bangladesh has introduced various CSA practices to enhance resilience, productivity, and income. These practices reduce greenhouse gas emissions (GHGs), incorporate local knowledge and innovative techniques, create income opportunities for women and youth, and promote the use of local resources. Together, they bring transformative changes to the food system. Below are examples of key CSA practices:

Stress-tolerant crop varieties

Bangladesh has introduced various stress-tolerant, high-yielding crop varieties tailored to the specific climate challenges in each region. These varieties, developed by the Bangladesh Rice Research Institute (BRRI) and the Bangladesh Institute of Nuclear Agriculture (BINA), include drought-, saline-, flood-, and heat-resistant crops. These stress-tolerant varieties offer more reliable, sustainable, and profitable harvests, helping address food security challenges. A recent study in the northwest region revealed that farmers adopting the stress-tolerant variety 'Submerged-1' (Sub 1) achieved a 6% increase in yield, a 55% increase in profit, and a 15% improvement in household consumption. Non-adopters could benefit even more, with potential gains of 8% in yield, 48% in profit, and 15% in household consumption if they adopt this variety (Bairagi et al., 2021).

Floating agriculture

Floating agriculture, a centuries-old practice in Bangladesh, has gained popularity among farmers in flood-prone and coastal regions. The training involves growing crops on floating beds made from water hyacinth and other organic materials. These floating gardens adjust to rising and falling water levels, making them an effective solution in flood-prone areas. Floating agriculture has expanded arable land by 40% for cultivating crops such as spinach, okra, turmeric, potatoes, cucumbers, gourds, and amaranth. A case study from Gopalganj District showed that farmers using this method earned a net return of BDT 457,901 per hectare per year, with 65% of production costs attributed to labor (Bala et al., 2020). As this method is labor-intensive, it has expanded the involvement of small and marginalized farmers, resulting in a 1.80 times higher benefit-cost ratio (BCR) compared to the traditional land-based agricultural practice (Bala et al., 2020).

Cage culture

Cage culture – cultivating fish in confined enclosures made from bamboo, nets, and wooden structures – is another widely adopted CSA practice in flood-prone and coastal regions. Water flows freely through the enclosures, while fish movement is restricted, making this practice essential during floods. Although it dates back to the 1970s, cage culture wasn't scaled up until the late 1990s. Fish production from cage culture increased from 2,490 metric tons to 3,802 metric tons between 2016 and 2019 (Agarwal, 2021), providing an essential source of income and food security in vulnerable regions.

Alternative wet and dry (AWD) irrigation

Farmers in the northwest region have adopted AWD irrigation technology to address water scarcity. This method involves alternating between flooding and allowing the fields to dry out. By carefully managing the water level, farmers can increase crop yields while reducing water usage. Studies show that AWD requires 30% less water to grow Boro rice compared to conventional irrigation practices, reducing irrigation costs by 12-15%. Farmers using AWD also reported an additional profit of BDT 4,224 per hectare over conventional methods (Alam et al., 2009).

Rainwater harvesting system

In the coastal region, rainwater harvesting has become a key adaptation strategy to combat freshwater scarcity. Rainwater is collected from catchment areas and stored in reservoirs through pipelines, where it is later filtered and purified for drinking and irrigation. This cost-effective practice is especially useful in remote and hilly areas where traditional water reserves are difficult to excavate. For example, in the Chattogram Hill Tracts, managed rainwater harvesting reservoirs annually increased crop yields by 155-300% and lowered annual groundwater pumping costs (Islam et al., 2017).

Image credit: IFAD/GMB Akash

7 Climate adaptation strategies for different climatic scenarios

Various adaptation interventions are actively practiced and promoted across climate-vulnerable areas of Bangladesh (Table 2). The adaptation interventions outlined in Table 2 are implemented and promoted by the government, NGOs, INGOs, and local stakeholders to reduce the impact of climate change on agriculture and livelihoods.

However, these initiatives are often project-based, fragmented, and short-term. Without a long-term perspective, these solutions may fail to effectively reduce existing vulnerabilities (Berrang-Ford et al., 2021). For instance, in southwest Bangladesh, the shift from traditional agriculture to shrimp farming aimed to address salinity intrusion, but has since been identified as a maladaptation practice (Huq et al., 2022).

Table 2: Adaptation strategies and interventions under different climatic scenarios in Bangladesh

Measures	Drought-prone areas	Saline- and storm-prone areas	Flood-prone areas
Application of interventions	• Introduce drought-tolerant and short-duration crop varieties	• Introduce saline-tolerant and short-duration crop varieties • Planting deep-rooted fruits and crops	• Introduction of flood-resistant varieties • Change in cropping pattern • Short-duration *boro* rice cultivation for flash-flood regions
Structural measures	• Excavate mini ponds, ponds, ditches to harvest rainwater • AWD method	• Floating cultivation • Cage culture • Sarjan technology • Rainwater harvesting	• Floating cultivation • Cage culture
Non-structural measures	• Encourage farmers to follow traditional and innovative practices, such as zero-tillage, priming, mulching, relay cropping, dryland farming • Encourage farmers to adopt homestead gardening • Adjustments to planting time • Encourage farmers to cultivate less water-loving crops (maize, wheat, linseed, pulses, oil crops)	• Early warning and preparedness measures	• Encourage farmers to grow pulses (mung bean, lentil), vegetables, and oil seeds • Capacity building in homestead bag planting • Use of green manure
Research and innovation (Cultivars developed)	• Crop: BRRI dhan 33,42,43,56,57, BINA dhan 07, BARI gom-25,26, BARI sharisha 11,16, Oil Crop: BINA Til-1,2, BARI-1,2 • Sugar cane: Iswardi-20	• Crop: BRRI dhan 23,40,41,47,53,54,55 BINA dhan 08, BARI gom 25, BARI sharisha 10 • Sugar cane: Iswardi-38,39,40	• Crop: BRRI dhan 28,46,51,52 • Sugar cane: Iswardi-38,39,40

Source: Rozario et al., 2021

Despite the progress and success that has so far been achieved in disaster risk management, further improvements are needed to cope with the increasing intensity of climatic hazards. A coordinated, multi-stakeholder approach with long-term interventions is essential to tackle future climate challenges. The shift from a top-down approach to Locally-led Adaptation (LLA) is already acknowledged in Bangladesh's national policies. LLA is critical for addressing future uncertainties and ensuring predictable funding reaches grassroots and vulnerable communities. Key action areas for future adaptation include developing local leadership and resilience, enhancing local government capacity, and supporting monitoring, evaluation, and learning. These measures will help minimize losses and damages in various sectors, including agriculture.

8 A multi-stakeholder approach to a resilient food system

A multi-stakeholder approach is crucial to addressing the current and future challenges of climate impacts on Bangladesh's food system. Figure 3 illustrates how food chain actors will be affected by IPCC climate scenarios in the coming years, highlighting the urgent need for a whole-society approach.

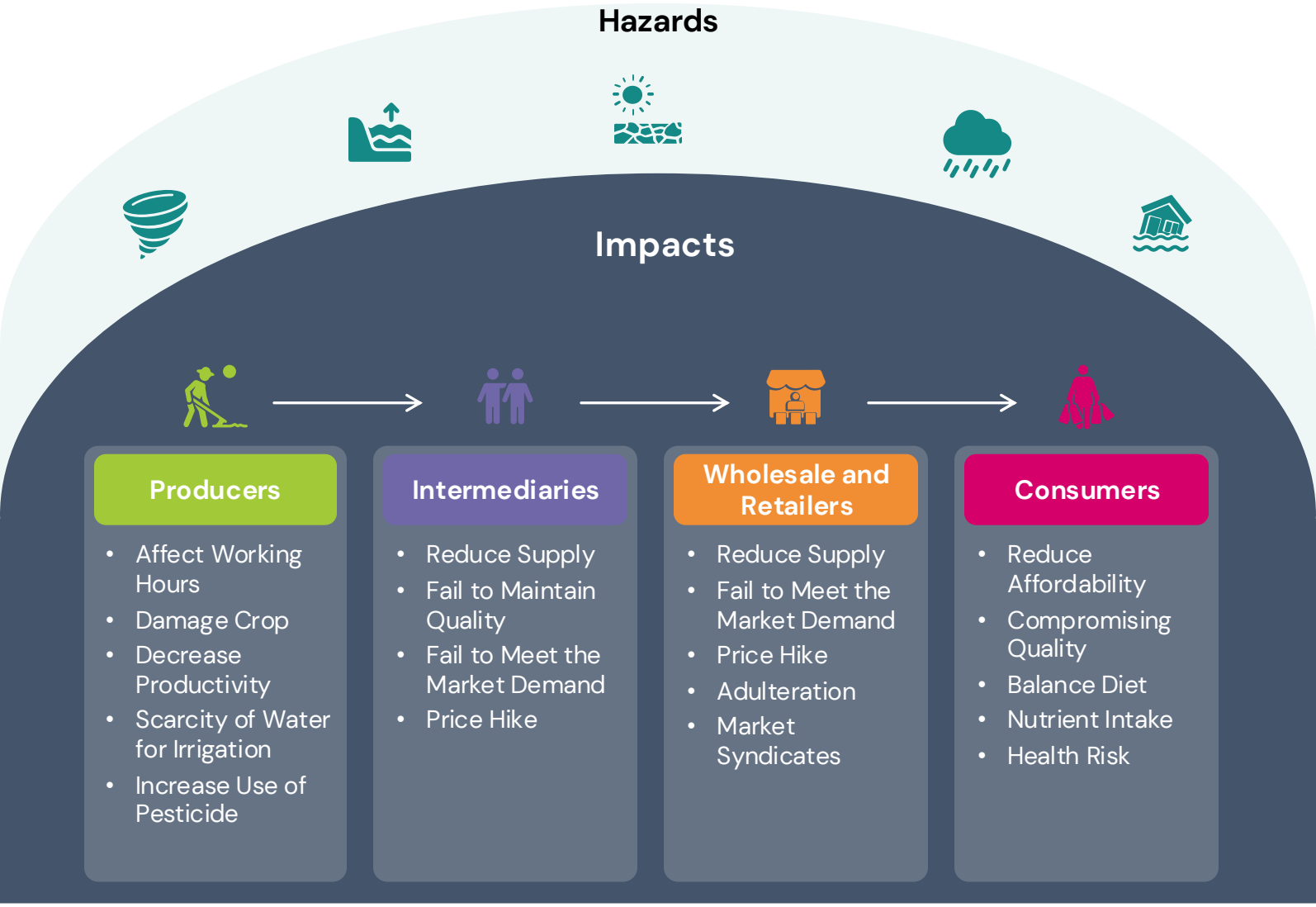

Figure 3: Potential impacts of climate hazards on key food system stakeholders

Source: Authors', own

8.1 Key stakeholders of the food system and their roles

Producers: Farmers (mainly smallholders) involved in livestock, rice, vegetable, and fruit production; fishermen; and food manufacturers.

Intermediaries: Small and large traders (Faria, Bepari, and Aratdar) who buy from producers and sell to local or regional markets (Hasan & Naim, 2018).

Wholesalers and retailers: Companies or individuals who purchase products from intermediaries or directly from producers to sell in bulk or retail quantities.

Consumers: Individuals who purchase and consume the goods and services.

8.2 Impacts of climatic hazards on key stakeholders

In this section, the impacts of climate change on each of the stakeholders within the food system are described for each IPCC scenario (RCP 2.6, 4.5, and 8.5), Table 3.

Table 3. Climate change impacts different stakeholders of the food system in Bangladesh under IPCC scenarios

Stakeholders	Impacts on the Stakeholders Based on IPCC Scenario		
	Drought prone areas	Saline- and storm-prone areas	Flood-prone areas
Producers **Intermediaries** **Wholesalers and retailers**	Temperature rise will reduce incomes restricting their time to work outdoors due to health issues, which reduces their chances to afford sufficient nutritious food (O'Leary et al., 2024). The temperature increase will lead to producers' dependence on groundwater and increase the usage of pesticides (Veer, 2024). Increase in health risks of malnutrition and climate-related morbidity	Rising heat will kill agricultural produce and livestock- causing producers to lose livelihoods and poverty to rise nationwide (Moon, 2023, Huq, et al., 2024); and reduce the supply of products to wholesalers and retailers. Frequent floods, tropical cyclones, and sea level rise will make hectares of land non-arable, destroy crops, and reduce the incomes of producers, intermediaries, wholesalers, and retailers (Saleh, 2024).	As global temperatures rise, negative effects on all food sectors will become more common, putting more strain on food availability, agricultural labor productivity, and food access. Rural farmers, pastoralists, and fishers' livelihoods will deteriorate as they rely on production (IPCC, 2022). Intensifying cyclones and floods will cause migration of producers (smallholder farmers) to already congested cities and towns and resettle in crowded slums/footpaths/bus stations that lack access to basic services (Chowdhury and Moore, 2017). The marginalized consumers will face more risks due to insufficient social safety nets, rising food prices, and unreliable supplies. The urban poor will have to pay more for food (IPCC, 2022).
Consumers	Reduce household income; increase food prices (Climate hazards cause multiple impacts, interacting to compound risks to food security, nutrition, and human health	Rise in the prices of food and reduce the purchasing power of consumers (IPCC, 2022).	The marginalized consumers will face more risks due to insufficient social safety nets, rising food prices, and unreliable supplies. The urban poor will have to pay more for food (IPCC, 2022).

In recent years, multi-stakeholder partnerships have become a key tool for promoting climate-resilient food systems (Brouwer et al., 2016). In Bangladesh, where agriculture provides every second livelihood, high-yield crops are particularly vulnerable to climate impacts (Saleh, 2024). Producers – mainly smallholder farmers and fishermen – play the most critical role in the food system. A holistic approach is essential to support them, and NGOs, governments, research organizations, and think tanks should collaborate closely with farmers. Such partnerships should encourage the cultivation of climate-resilient crop varieties tailored to local climate vulnerabilities and values.

9 Recommendations

Based on the IPCC scenario assessment, and review of the national policies [Annex III] the following recommendations can be considered in making the food system of Bangladesh more climate resilient.

9.1 Development of a comprehensive Early Warning System (EWS)

Implementing localized, effective early warning systems (EWS), disaster preparedness, and response measures is critical to protecting smallholder farmers and other producers. Key strategies include using radio and SMS alerts, enhancing community awareness, and forming disaster response teams. The National Adaptation Plan 2023–2050 endorses the Interactive Voice Response (IVR) early warning service, which has proven successful and can be scaled across Bangladesh's climate-vulnerable areas under IPCC scenarios RCP2.6 to RCP8.5. Establishing adaptation and health clinics at union and upazila levels is also essential for building resilience among producers and the broader community.

9.2 Further Integrate climate change adaptation into agricultural policies and monitoring

Since 2009, national policies (see Annex III) have incorporated climate change adaptation strategies to enhance food security, promote CSA practices, promote crop diversification, and support sustainable farming. The National Adaptation Plan 2023-2050 offers a roadmap for medium- and long-term adaptation strategies. Rising crop prices due to climate impacts make adopting these strategies essential for boosting domestic food production and reducing reliance on imports. Strengthening institutional capacity, encouraging knowledge exchange, and improving coordination between governments, farmers, businesses, NGOs, and academics are critical to monitoring policy success.

9.3 Improving support and capacity development for smallholder farmers

Supporting food system producers through training, financing, and climate-smart technology adoption will boost nutrient-dense crop development, create safety nets, and improve access to safe water for smallholder farmers across IPCC scenarios. Strengthening sustainable market connections for farmers also requires joint public-private investment in local infrastructure and business services.

Crop insurance mechanisms can protect against losses by offering subsidies, managing quality data, and launching public awareness campaigns, with the government acting as a reinsurer. Including insurance in safety net programs and investing in national savings and storage facilities will further enhance resilience in agri-food systems under RCP scenarios 2.6, 4.5, 6.0, and 8.5.

9.4 Promote CSA aligned with farmers' needs

Rigorous research on farmers' needs will support effective CSA practices at the union level through a multi-stakeholder approach. Government bodies, research institutions, NGOs, farmer groups, youth, and women should collaborate, leveraging local, traditional, and modern knowledge in a "learning by doing" model. Key CSA initiatives include promoting saline-tolerant crops, aquaculture, sustainable land management (such as agroforestry), and pest management. The government should also establish market mechanisms and monitoring bodies at local, divisional, and national levels to reduce price distortions, prevent food loss, and enhance transparency, ensuring a resilient food system for Bangladesh.

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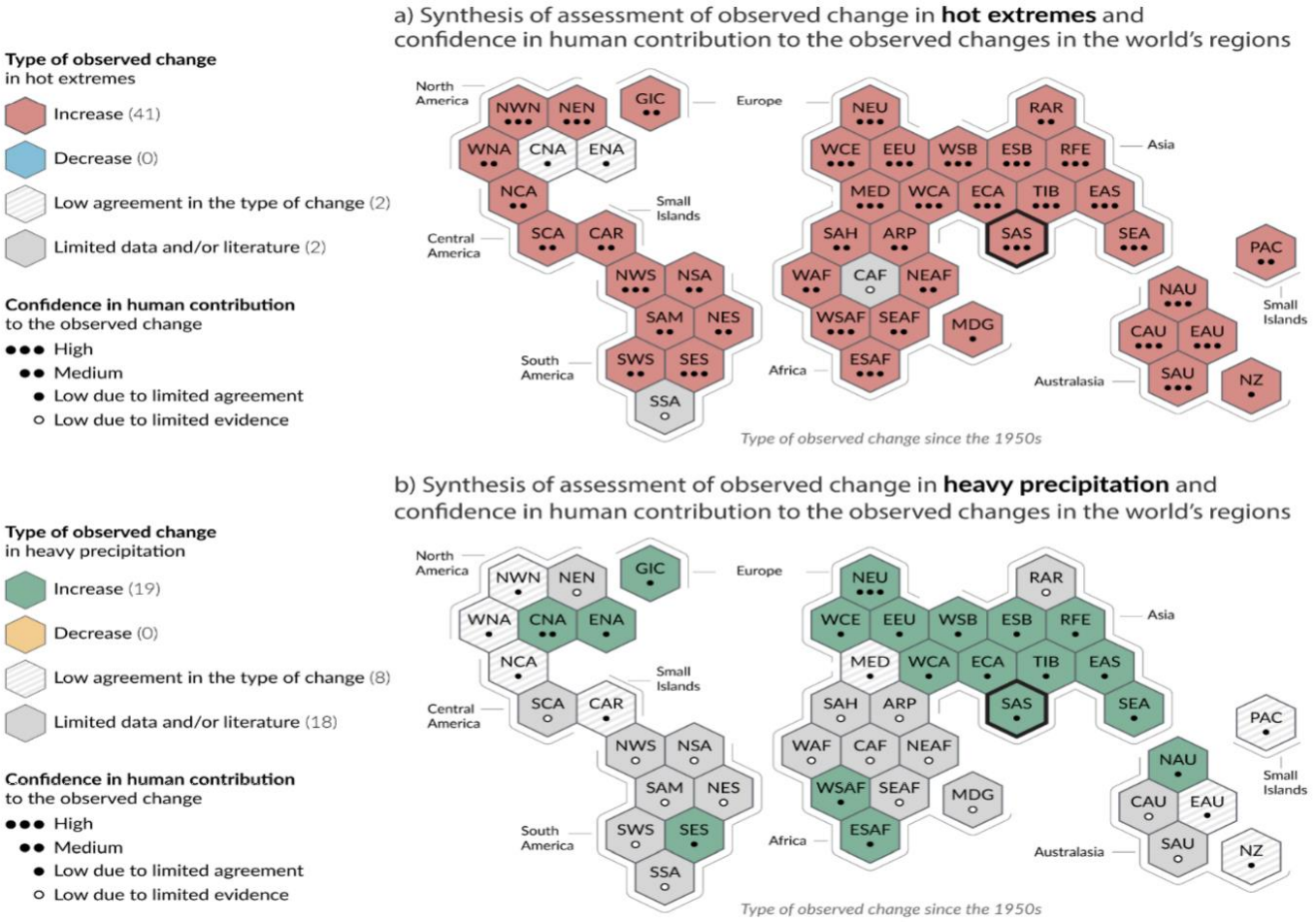
Annex I



Each hexagon corresponds to one of the IPCC AR6 WGI reference regions

NWN *North-Western North America*

IPCC AR6 WGI reference regions: **North America:** ***NWN*** *(North-Western North America),* ***NEN*** *(North-Eastern North America),* ***WNA*** *(Western North America),* ***CNA*** *(Central North America),* ***ENA*** *(Eastern North America),* **Central America:** ***NCA*** *(Northern Central America),* ***SCA*** *(Southern Central America),* ***CAR*** *(Caribbean),* **South America:** ***NWS*** *(North-Western South America),* ***NSA*** *(Northern South America),* ***NES*** *(North-Eastern South America),* ***SAM*** *(South American Monsoon),* ***SWS*** *(South-Western South America),* ***SES*** *(South-Eastern South America),* ***SSA*** *(Southern South America),* **Europe:** ***GIC*** *(Greenland/Iceland),* ***NEU*** *(Northern Europe),* ***WCE*** *(Western and Central Europe),* ***EEU*** *(Eastern Europe),* ***MED*** *(Mediterranean),* **Africa:** ***MED*** *(Mediterranean),* ***SAH*** *(Sahara),* ***WAF*** *(Western Africa),* ***CAF*** *(Central Africa),* ***NEAF*** *(North Eastern Africa),* ***SEAF*** *(South Eastern Africa),* ***WSAF*** *(West Southern Africa),* ***ESAF*** *(East Southern Africa),* ***MDG*** *(Madagascar),* **Asia:** ***RAR*** *(Russian Arctic),* ***WSB*** *(West Siberia),* ***ESB*** *(East Siberia),* ***RFE*** *(Russian Far East),* ***WCA*** *(West Central Asia),* ***ECA*** *(East Central Asia),* ***TIB*** *(Tibetan Plateau),* ***EAS*** *(East Asia),* ***ARP*** *(Arabian Peninsula),* ***SAS*** *(South Asia),* ***SEA*** *(South East Asia),* **Australasia:** ***NAU*** *(Northern Australia),* ***CAU*** *(Central Australia),* ***EAU*** *(Eastern Australia),* ***SAU*** *(Southern Australia),* ***NZ*** *(New Zealand),* **Small Islands:** ***CAR*** *(Caribbean),* ***PAC*** *(Pacific Small Islands)*

Figure A: Human influence has contributed to an increase in hot extremes (top), across South Asia (SAS). Heavy precipitation has also increased, since the 1950s. Source: Masson-Delmott, 2021, IPCC, adapted to emphasize Bangladesh.

Annex II

Table A: Climate-vulnerable hotspots of Bangladesh

Hotspots	Area (km^2)	Districts	Number of districts	Major crops (*)
Coastal zones	27,738	Bagerhat, Barguna, Barishal, Bhola, Chandpur, Chattogram, Cox's Bazar, Feni, Gopalganj, Jashore, Jhalkati, Khulna, Lakshmipur, Narail, Noakhali, Patuakhali, Pirojpur, Satkhira, Shariatpur	19	Rice (T.Aman, B.Aman, Boro), pulses
Barind and drought-prone area	22,848	Bogura, Chuadanga, Dinajpur, Gaibandha, Joypurhat, Kushtia, Meherpur, Naogaon, Natore, Nawabganj, Nilphamari, Pabna, Panchagarh, Rajshahi, Rangpur, Satkhira, Sirajganj, Thakurgaon	18	Rice (T.Aman, B. Aman, Boro), wheat (north-west), maize (north-west), pulses (north and north-west), potato (north-west)
Haor and flash flood area	16,574	Brahmanbaria, Habiganj, Kishoreganj, Moulvibazar, Netrokona, Sunamganj, Sylhet	7	Rice (Boro, Tea, T.Aman, B.Aman)
Chattogram Hill Tracts	13,295	Bandarban, Khagrachhari, Rangamati	3	Banana, turmeric, ginger, pineapple, papaya, sugarcane
River system and estuaries	35,204	Barguna, Barishal, Bhola, Bogura, Chandpur, Cumilla, Faridpur, Feni, Gaibandha, Gopalganj, Jamalpur, Kurigram, Lakshmipur, Lalmonirhat, Madaripur, Manikganj, Munshiganj, Narayanganj, Natore, Chapai Nawabganj, Noakhali, Pabna, Potuakhali, Rajshahi, Rajbari, Shariatpur, Sirajganj, Tangail, Khulna	29	Rice (T.Aman, B.Aman), wheat (north-west), maize (north-west), potato
Urban areas	19,823	Barishal, Chattogram, Dhaka, Khulna, Rajshahi, Rangpur, Sylhet	7	Non-significant

(*) List to be updated

Annex III

Table A list of relevant national policies of climate change to food system, agricultural production, and food security

Name of Policy	Year	Ministry	Focus and Relevancy	Remarks
Mujib Climate Prosperity Plan (MCPP)	2021	Ministry of Environment, Food, and Climate Change	MCPP includes an action plan to make food production sustainable by addressing all issues concerning producers, production process, supply chain, and adverse effects of climate change, fisheries, and supply chain.	The policy is well-aligned with the food system; however, it lacks an implementation and monitoring plan.
National Pathway Document for the UN Food Systems Summit	2021	Ministry of Food	The Pathway's Plan of Action (2021-2030) includes sustainable intensification, diversification, emissions reduction, and increasing resilience of production, through the adoption of agroecological practices and agri-food system. Modernization, including the use of nanotechnology, the development of the ocean, and the blue economy, will be prioritized, in line with targets under sustainable development goals (SDGs) 6, 13, 14, and 15 (clean water and sanitation, climate action, life below water, and life on land).	The policy is well-aligned with the SDGs embedded in the plan. The existing indicators of the SDGs mentioned in the document can be used to track the progress of the current food system scenario and find the gaps.
National Food and Nutrition Security Policy and Action Plan (2021-2030)	2021	Ministry of Food	The action plan includes an action agenda that relates to agricultural credit service, incentives for clean, efficient, and sustainable technologies, the promotion of the blue economy, the establishment of an agro-information market system, and other aspects of agro-food security. Climate-smart agricultural technologies, such as vertical farming, aquaponics, and hydroponics are mentioned here. Several action plans highlighted in the draft directly and indirectly support agro-food security and climate actions.	They are well-aligned. The action plan could be reviewed annually through strategic monitoring and reporting and updated with the lessons learned. There needs to be more rigorous capacity-building training conducted with relevant stakeholders to understand the feasibility of adopting climate-smart agricultural technology in urban and rural areas.

Annex III

Table A list of relevant national policies of climate change to food system, agricultural production, and food security

Name of Policy	Year	Ministry	Focus and Relevancy	Remarks
Bangladesh Delta Plan (BDP) 2100	2018	Ministry of Planning	BDP 2100 is a long-term integrated techno-economic mega plan integrating all delta-related sector plans and policies strategies that will make it possible to secure the future of water resources and mitigate the likely effects of climate change and natural disasters. Agriculture, food security, and livelihood are identified as cross-cutting issues. The plan proposes strategies for supporting agricultural activities and livelihoods based on the six climatic hotspots that the country's Delta has been divided into.	Well-aligned. If the plan is implemented with accountability and transparency, it will benefit the marginalized communities hit hardest by the impacts of climate change. Supporting agricultural activities and livelihoods based on the six climatic hotspots is a good initiative if it is helping the most vulnerable adapt to the impacts of climate change and operationalizing social protection.
National Agriculture Policy	2018	Ministry of Agriculture	Several sections and subsections of the policy address food security and climate change impacts, also including adaptation solutions. Strengthen research and initiatives to determine climate change impacts on different crops and natural resources and introduce low greenhouse gas emission crop technology.	Partially aligned. The plan mentions the increased need to research how climate change is impacting the production of diverse crops. The results of introducing low greenhouse gas emission crop technology are still a work in progress.
Bangladesh Country Investment Plan	2011	Ministry of Food	The policy has a direct connection with investment programs to improve food and nutrition security in an integrated way, enhance access, and improve nutrition and food security-related Government investments. One program of the plan includes integrated research and extension to develop and propagate sustainable responses to climate change to ensure food availability at all scales. Another area of investment is in the research and development of agricultural practices and farming systems aiming to adapt to and mitigate climate change.	Partially aligned, since investment is lacking for equitable access to protein and nutrients for low-income households (who are most prone to climatic impacts). Research should be scaled up in Haor regions.

Annex III

Table A list of relevant national policies of climate change to food system, agricultural production, and food security

Name of Policy	Year	Ministry	Focus and Relevancy	Remarks
National Adaptation Program of Action (NAPA)	2009	Ministry of Environment, Food, and Climate Change	The key goal is to establish coping mechanisms and adaptation measures to reduce adverse effects of climate change and promote sustainable development. The policy includes agriculture, fisheries, livestock, food security, land use, forestry, and climate change aspects.	Well, aligned. Should be a segue for the recently developed NAP in 2022.
Bangladesh Climate Change Strategy and Action Plan (BCCSAP)	2009	Ministry of Environment, Food, and Climate Change	Of the plan's six pillars, the first addresses food security, social protection, and health. The policy has a direct connection with food security, social protection and health, comprehensive disaster management, infrastructure, research and knowledge management, mitigation and low carbon development, and capacity building and institutionalization. Under the six pillars, there are 44 programs that directly or indirectly address climate change issues, of which 19 directly address food security and carbon mitigation issues.	Partially aligned. As food security is a key pillar of the plan, the 19 programs should be assessed to understand the impact of reducing food insecurity and greenhouse gas emissions.
National Food Policy	2006	Ministry of Food	The objectives of this policy are to: 1. Ensure adequate and stable supply of safe and nutritious food 2. Enhance the purchasing power of the people for increased food accessibility 3. Ensure adequate nutrition for all (especially women and children).	Partially aligned. Should be updated and implemented to reduce food insecurity amongst marginalized communities.