



# Policy brief

## Tackling the impacts of climate change on food security in Bangladesh

### Summary

- Bangladesh has a long history of addressing food insecurity through policies that focus on food availability and access.
- Early programmes to enhance access included a focus on safety nets such as 'Food for Work', and on vulnerable groups. Programmes to increase food availability have generally focused on food production, within the National Agricultural Policy.
- More recent policies have started to explicitly recognise the links between climate change and food security. These include the National Adaptation Programme of Action.
- There is evidence that climate change is already negatively affecting food security in Bangladesh, and this is projected to worsen substantially under high-warming scenarios. Therefore, it is increasingly important that policies targeting food security take explicit account of the implications of a warming world.
- Climate-smart agriculture approaches can play a vital role in building resilient food supplies and help tackle the issue of food availability. In Bangladesh, relevant approaches include increasing access to drought-resistant and flood-tolerant crop varieties, adopting agroforestry methods, and implementing sustainable land management techniques.
- In parallel, Bangladesh needs to focus on both food availability and access, particularly for the most vulnerable populations. Examples include building on existing early warning systems to provide advance notice of crop failures; and targeted safety nets to mitigate risks of food insecurity following extreme events.
- Though Bangladesh's greenhouse gas emissions are low by international standards, its agriculture sector can still play an important role in mitigation, focusing on reducing methane emissions from paddy fields, livestock, manure and fishponds; and reducing nitrous oxide emissions by addressing the sub-optimal application of fertilizer.

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**Policy briefs** provide analysis on topical issues, presenting specific recommendations to inform ongoing policy debates. Drawing on the Grantham Research Institute's expertise, they summarise our research findings or the state of knowledge about a particular issue.

This policy brief has been written by Lauren O'Leary, Shouro Dasgupta and Elizabeth JZ Robinson.

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## Introduction: food insecurity and climate change vulnerability in Bangladesh

Across the world climate change is threatening food security, and Bangladesh is no exception. Furthermore, factors affecting global markets, in particular the ongoing Russia–Ukraine conflict, are causing dramatic surges in the prices of staple foods, fuel and fertilizer, which poses a significant concern for poverty levels and food insecurity and exacerbates the problems caused by climate change. This policy brief examines the challenges Bangladesh faces and the trajectory of policy in this area, and briefly considers how the agriculture sector can contribute to climate change mitigation.

Bangladesh has a high level of vulnerability to climate change by international standards, which is already negatively affecting health and the labour force.<sup>1</sup> The country has long experienced cyclones, droughts and floods, but climate change is increasing the frequency and intensity of extreme weather events, which has a direct negative impact on crop production, reducing availability and pushing up prices. Changing precipitation patterns, irregular monsoons and extended dry spells also make it harder for farmers to plan when to plant (Barua and Rahman, 2020; Kabir et al., 2017; Kumar et al., 2020).

As well as increasing flooding, which is causing damage with an increasingly high financial and humanitarian cost (Letsch et al., 2023a), climate change is causing Bangladesh to suffer from a greater number of days when there is extreme heat. This reduces crop yields and harms livestock health, changes the distribution of pests and diseases, can make it harder to prepare food under hygienic conditions, and can reduce agricultural labour supply. An increase in extreme heat can also reduce incomes, for example by reducing the time available for outdoor labour, which restricts the ability of households to afford sufficient nutritious food (O’Leary et al., 2023).

## Current and projected food (in)security in Bangladesh

### Dimensions of food security

Food security is defined by the Food and Agriculture Organization (FAO) of the UN as existing when “all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2006). As such, it is a multifaceted concept, encompassing production and availability, access and utilisation:

- **Food availability** is the physical presence of food in a particular area, which is determined by domestic food production, food stocks and net imports.
- **Food access** depends on the ability of an individual or household to obtain food, and this in turn depends on factors such as food prices, market accessibility, income and employment.
- **Food utilisation** encompasses the ability of humans to derive full biological benefits from food based on nutritional value, socio-cultural value, and food safety.

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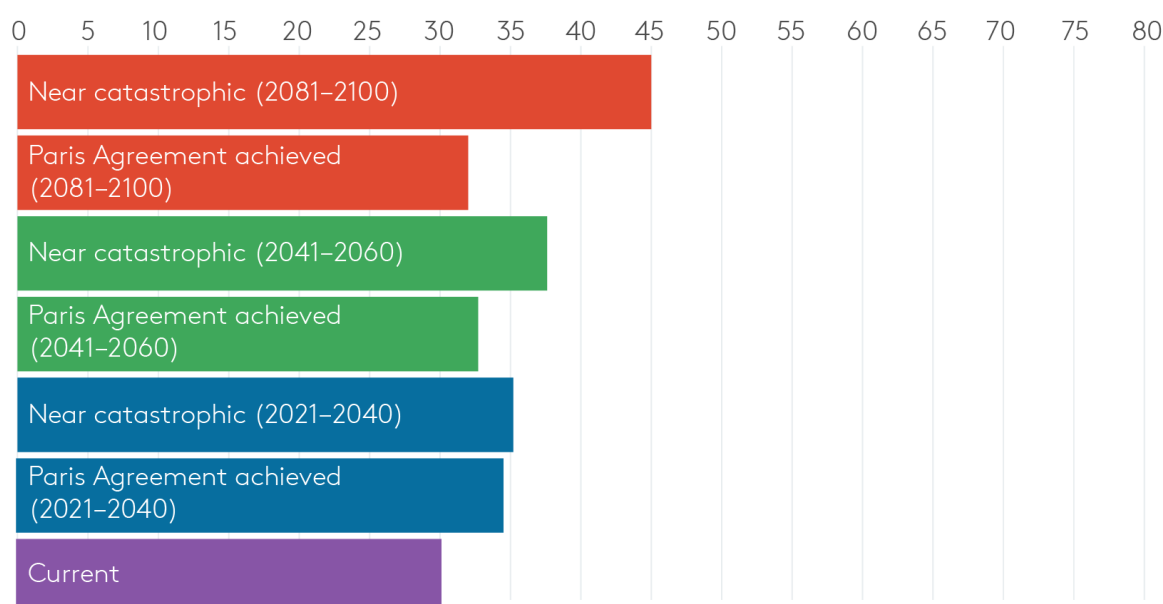
1. Three previous policy briefs in this series examine: the impacts of and responses to flooding; extreme heat and the labour force; and health implications of climate change in Bangladesh. See Letsch et al. (2023 a and b) and O’Leary et al. (2023).

## Prospects for food security

Despite its challenges, Bangladesh has, in the main, done well to improve food production and food security: crop production and yields have increased, and most measures of food security are moving in the right direction, helped by the policies described later in this brief. However, climate change is likely to make future improvements more challenging. Priorities for increasing food security further include the need to increase the diversity of diets (Szabo, 2014), and improve food distribution and access, particularly in rural areas.

Under a near catastrophic climate change scenario, which would see global average temperature increase by 3.6°C by 2100, without adaptation the proportion of the Bangladeshi population affected by moderate to severe food insecurity is projected to increase considerably: by nearly 5 percentage points between 2021 and 2040, and nearly 15 percentage points between 2081 and 2100, compared with the period 1995–2014. In contrast, if the Paris Agreement target of limiting temperature rise to well below 2°C is achieved, with global emissions cut to net zero around 2050, the proportion affected by food insecurity would increase by 4.4 percentage points between 2021 and 2040 but the increase between 2081 and 2100 would be just under 2 percentage points, due to net zero targets being achieved and emissions falling (CVF and V20, 2022). This suggests that strong action taken globally to mitigate climate change will have clear food security benefits in countries like Bangladesh.

**Figure 1. Projected absolute food insecurity (% of population affected) in Bangladesh under future climate change scenarios, 2021–2100**



Source: CVF and V20 (2022)

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## Evolution of food security and agri-food policies in Bangladesh

Historically, Bangladesh has faced numerous challenges in ensuring food security for its growing population. In the early years following independence in 1971, Bangladesh prioritised agricultural development to achieve food self-sufficiency, in part by introducing high-yielding rice and wheat varieties; this way, it was able to significantly increase food production (Hossain and Da Silva, 2013). However, a major famine in 1974 had devastating consequences for crop yields. This prompted the Government to consider a more comprehensive approach to food security that included improving irrigation facilities, providing agricultural inputs and extending credit to farmers (Roksana et al., 2014).

Where food is available but not accessible, especially to the poorest and most vulnerable, and especially when food prices increase, safety nets are particularly important. In the mid-70s the Government introduced two food-based relief programmes, Vulnerable Group Development (VGD) and Vulnerable Group Feeding (VGF), with the overall goal of ensuring access to food for vulnerable populations in the wake of natural disasters (see Annex 1 for a detailed discussion of these policies and more). These early measures laid the foundations for a more proactive approach to addressing food security.

Two additional safety net schemes, the Food for Work (FFW) and Test Relief (TR), were implemented to improve rural infrastructure development and address shortages in both food and work opportunities. The FFW programme was effective in meeting its primary objectives of generating seasonal employment for the rural poor during the lean season when food shortages are most significant and the rural labour force has fewer employment and income generating opportunities, contributing to the development of rural infrastructure to enhance agricultural productivity, and strengthening resilience against natural disasters to minimise physical damage and loss of life. Through these achievements, FFW has contributed to ensuring a more stable food supply for communities in need. The TR programme revolved around developing rural infrastructure and aimed to address disaster and climate change-related risks by combatting food insecurity among rural populations and alleviating poverty through the generation of seasonal employment. Simultaneously, it sought to enhance overall quality of life by improving access to electricity, promoting renewable energy, and reducing reliance on fossil fuels. These schemes have been adapted over the years, with an emphasis on targeting efficiency, increasing spending, and expanding coverage.

The National Agricultural Policy of 1999 played a pivotal role in the country's efforts to become self-sufficient in food production and to improve the nutritional status of the Bangladesh population. The policy prioritised sustainability, promoting practices such as crop diversification and Integrated Pest Management to reduce risks. In 2006 the National Food Policy reinforced the country's commitment to ensuring a dependable food system by guaranteeing adequate and safe food supplies, improving food accessibility, and enhancing nutrition for vulnerable groups, particularly women and children.

These policies reflect Bangladesh's progressive strides in addressing food security and nutrition challenges. However, hikes in global food

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prices during 2007–08 caused a sharp rise in the prices of staple foods in Bangladesh, which in turn led to a significant rise in the number of households falling below the poverty line. In response, the Government implemented the largest public workfare programme, the 100 Day Employment Generation Programme, which resulted in many participating households reporting increases in food consumption. There have been setbacks since, notably the Russia–Ukraine conflict and its impacts on food prices and availability, as well as the increasing impacts of climate change.

## Future policy implications for the Bangladeshi Government

### A greater focus on adaptation and resilience

As Bangladesh confronts the impacts of climate change, food security is increasingly interlinked with resilience to climate change impacts. Recognising this, the Government has started to integrate climate change adaptation strategies into agricultural policies, with an emphasis on promoting climate-smart agricultural practices, crop diversification and the use of sustainable farming methods.

Policies such as the 2008 Bangladesh Climate Change Strategy and Action Plan (BCCSAP) highlight the importance of adapting to climate change to achieve national food security and meet future demands of the nation. The more recent National Adaptation Plan (NAP) of 2023–2050 aims to create a climate-resilient food system for ensuring food and nutrition security. This policy demonstrates an understanding that effective medium- and long-term adaptation strategies are crucial for reducing the negative impacts of climate change and promoting sustainable planning for future development. Moreover, Bangladesh heavily depends on food imports, especially for rice and wheat, to fulfil increasing demand. The effects of climate change and more frequent extreme weather events across the world could increase the prices of these crops, significantly affecting Bangladesh's future food security. Therefore, integrating climate change adaptation strategies into agricultural policies to increase domestic food production becomes an important step towards fostering improved resilience.

### Increasing food availability through 'climate-smart' agriculture

In common with many countries, the adoption of so-called climate-smart agriculture will be essential to building resilient food supplies and increasing food availability, one of the pillars of food security. This term can encompass a package of actions, including increasing access to drought-resistant and flood-tolerant crop varieties, agroforestry, and sustainable land management techniques. The following points are of relevance to the Bangladeshi context:

- **Saline-tolerant crops and aquaculture.** Bangladesh's coastal regions are at increasing risk of saltwater intrusion, suggesting that saline-tolerant varieties will be increasingly needed. This can be supported through targeted research and development that understands the needs and preferences of farmers. Embankments and tidal gates could have a role to play, but Bangladesh's experiences to date with efforts to reduce flooding suggest that structural interventions could have unintended negative consequences. For example, the number of flash floods and the extent of flooded areas increased after the construction

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of coastal polders, because they caused silt accumulation (Choudhury et al., 2014). This interruption to normal sedimentation processes can increase the amount of runoff during extreme rainfall and monsoons, making areas in Bangladesh more vulnerable to tidal flooding. In the southern coastal region, often regarded as one of the world's most climate-vulnerable areas due to rising sea levels, the Government and donor community have identified a move to shrimp aquaculture as a primary adaptation strategy, as shrimp are better adapted to the escalating salinity levels in rivers caused by encroaching seawater (Paprocki, 2018).

- **Resilient varieties of crops including rice.** New ways of growing rice are likely to be needed. The 'System of Rice Intensification' (SRI), though initially developed to increase yields, may help farmers adapt to climate change and reduce methane emissions associated with paddy rice (Thakur and Uphoff, 2017). Though more research is needed, there is already evidence that SRI crops might be more resistant to pests and diseases, and better able to tolerate extremes of heat and drought (Uphoff, 2008). In the districts of Sylhet, Chapai Nawabganj and Panchagarh, studies have shown that the adoption of drought-tolerant rice varieties, such as BRRI dhan56 and BRRI dhan71, outperformed other varieties popular with farmers, even under stress conditions (Nayak et al., 2022). More broadly, the Government could invest further in research and development oriented towards drought-resilient, heat-resilient, and pest-resistant crops. In addition, sustainable land management practices such as crop rotation, inclusion of pulse and legume in cropping systems, and soil erosion monitoring are likely to be key to ensuring food security.
- **Agroforestry.** While trees sequester carbon, they can also provide shade and reduce soil erosion, support and enhance biodiversity, and protect crops from extreme weather. Agroforestry, another example of sustainable land management practice, where trees are planted around or among crops, therefore enables farmers to increase their resilience to climate change (Riyadh et al., 2021). In the flood-prone Chilmari upazila (district sub-unit), for example, agroforestry is already practised by almost 40% of surveyed farmers producing fuelwood, fruit and timber. However, there are barriers to adopting agroforestry, including farmers' age, family size, education level, and gender: young men who have completed primary education, acquiring knowledge of basic agricultural and agroforestry principles at a higher level, are more inclined to adopt agroforestry practices than others (Jahan et al., 2022). Policies need to address these barriers to ensure successful adoption.
- **Pest management.** Integrated Pest Management (IPM), which involves the growth of crops with the least possible disruption to agroecosystems and encourages natural pest control, can enable farmers to cope better with changing patterns of pest and disease outbreaks induced by climate change. IPM also reduces the use of pesticides and associated negative environmental impacts. An example of IPM in use is the Integrated Pest Management Activity project, implemented in Bangladesh in 2021 and funded by USAID, which aimed to strengthen the capacity of agricultural sector stakeholders to control and prevent

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the spread of current and emerging threats to crops. It focused training on identification, conducting field assessments, monitoring techniques and control management of Fall Armyworm. Participants gained practical knowledge through a combination of classroom lectures and hands-on field practice ([Feed the Future, 2021](#)).

### Improving nutrition and utilisation

To ensure a link from food security to nutritional security, individuals need to be able to prepare affordable, safe and nutritious food under sanitary conditions, and for their bodies to be able to absorb sufficient nutrients. This is emphasised in the Bangladesh National Food and Nutrition Security Policy (2023–2050). Ensuring a more diverse and nutritious diet is an important starting point, and is consistent with building a more climate-resilient diversified agricultural sector. Climate-smart technologies can be employed to help develop nutrient-dense crops, while safety nets can increase the likelihood that low-income households can afford such a more nutritious diet. To improve utilisation requires policies outside of the food and agriculture domain such as scaling up the provision of safe water, expanding immunization programmes, and controlling diseases such as cholera, acute respiratory infection (ARI) and iron deficiencies.

### Additional government support

The Government can support the agricultural sector to improve food security in several further ways:

- **Improve climate services**, to create better early warning systems (EWS), combined with disaster preparedness and response. This might combine better use of radio and SMS alerts, improved community awareness, and disaster response teams. The National Adaptation Plan 2023–2050 highlights the success of the Interactive Voice Response (IVR) early warning service. This multi-hazard EWS enables people to receive emergency alerts and early warning information related to weather, rainfall, cyclones, floods and landslides. The service is free of charge and is available over all existing mobile phone operators in Bangladesh. It has increased the flood forecast lead time from three days to nine days for people living in at-risk coastal areas.
- **Crop insurance** has a long history of poor adoption but arguably is needed more than ever, to provide a safety net during crop losses or livestock mortality. The Government can support crop insurance schemes by providing subsidies to reduce costs, acting as a reinsurer by providing a stop-loss fund, collecting and managing insurance-quality data, launching public awareness campaigns, and by including insurance as part of safety net programmes.
- **Savings and storage** are increasingly considered an important element of building resilience across agri-food chains. Alternative methods of crop storage such as plastic drums could be more widely adopted given their effectiveness for storing rice. Recent studies in Bangladesh have highlighted that plastic drums exhibit the least amount of insect infestation after five months of storage compared with conventional storage methods ([Hossain et al., 2019](#)).

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## The role of the agri-food sector in climate change mitigation

The agriculture sector in Bangladesh, as in all countries, is both a driver of climate change and key to mitigation efforts. Anaerobic conditions in flooded rice paddy fields result in the microbial breakdown of organic matter, releasing methane. The rice cultivation technique of alternate wetting and drying (AWD) has the potential to reduce paddy rice emissions in Bangladesh by half while helping farmers to manage their resources more efficiently. However, there are barriers to the successful use of AWD among farmers, including a lack of economic incentives to save water, as irrigation schemes in Bangladesh are based on a fixed charge per unit area, fragmented and scattered land holdings, and uncertain electricity supply (Pandey et al., 2020; Pearson et al., 2018).

Methane sources also include livestock, manure and fishponds. Selective breeding and feed additives can contribute to reducing methane emissions from ruminants, while emissions from manure can be reduced through aeration and composting. Reducing sediment accumulation has the potential to lower methane emissions from fishponds, but more research is needed. A good start would be to monitor fishpond emissions.

Synthetic nitrogen-based fertilizers can result in the release of nitrous oxide (N<sub>2</sub>O), another greenhouse gas. Bangladesh has committed to improving fertilizer management through increasing urea deep placement (UDP) in rice fields. UDP reduces unintended losses of nitrogen through volatilisation of ammonia, surface runoff and N<sub>2</sub>O emissions. The Government is also implementing improved soil management practices involving cropping, fertilizer and organic resources, which is essential for maintaining or increasing the efficiency of agricultural inputs.

Bangladeshi farmers often burn agricultural residues, which increases both atmospheric CO<sub>2</sub> and local air pollution, jeopardising food security by harming crops and soil quality, and compromising air quality. The impacts of poor air quality extend beyond immediate health concerns to the economy, via heightened healthcare expenses and diminished labour productivity. For farmers to change this practice requires government support and intervention, which might include increasing awareness and knowledge, supporting alternatives that may require new technologies or resources, or introducing new policies and regulations.

## Conclusion

Bangladeshi farmers often burn agricultural residues, harming crops and soil quality and thus jeopardising food security, and increasing both atmospheric CO<sub>2</sub> and local air pollution. Climate change is making this increasingly important but increasingly difficult. A two-pronged approach is needed that both targets food production and ensures that people can afford a sufficient and nutritious diet, particularly after climate and weather shocks that decrease food availability and increase prices.

Bangladesh is on the right track but with temperatures set to rise further greater efforts are needed, which will require extension and increased investment in research, more targeted consumer protection, and improvements to sanitary conditions in households and better access to health care facilities. Though these actions will be costly, the returns to such investments would include a healthier population that is more productive and more resilient to the changing climate.

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## References and annex

The in-text citations are hyperlinked. For a separate, downloadable list of the references cited in this brief and a three-page overview of existing food policies and plans in Bangladesh, please visit: <https://www.lse.ac.uk/granthaminstitute/publication/tackling-the-impacts-of-climate-change-on-food-security-in-bangladesh/>

## Authors and acknowledgements

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