

# “Women-Led Collective Advocacy for Climate Action” Project

## Climate Risk Memorandum: Bangladesh

**About this document:** This document is a climate risk report for Bangladesh and features gender-informed perspectives as well as an emphasis on understanding climate risks as they relate to land-based solutions to climate emergencies, preparedness and reduction of climate emergencies and disasters, and resilience. The summary, including Box 1: Key Takeaways, and Table 3 are likely to be of particular interest for readers with limited time. This memorandum is intended to be a point of departure for the country coalition (and civil society member organizations) to further conceptualize and respond to climate risks, gender and human security dimensions, as well as response opportunities associated with land-based solutions, adaptation, and resilience. The aim is that these memorandums be reviewed by the country coalition (and civil society member organizations), and that the content within (in addition to existing knowledge, expertise, lived experiences, and perspectives – as well as considerations such as organizational motivations, mandates, capacities, and strengths) be utilized to identify priority areas of focus. These memorandums and the eventual priorities identified will inform further coalition discussion at the upcoming national workshop convening. The convening will, in turn, ultimately foster the generation of national coalition strategies for climate action, including a) targeted areas for capacity building and b) advocacy priorities. The climate risks and items detailed in Table 3 of this document might also serve as a valuable resource to reference for inspiration on capacity building and advocacy once priorities are determined. Subsequent activities will then involve carrying out targeted capacity building and the pursuit and execution of local, national, and regional advocacy for creating or reforming policies and programs focused on climate resilience, sustainable land use planning, emergency preparedness and reduction, and sustainable livelihoods – all within the context of women-led collective advocacy for climate action (and an emphasis on women and gender considerations and women’s land rights). This memorandum, therefore, serves as a point of departure for discussion, reflection, and prioritization for the country coalition – and it is hoped that the document will help with the development of a national coalition strategy, the identification of capacity building opportunities of interest, and the selection of the focus for coalition advocacy efforts moving forward.

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## 1) Summary

This climate risk memorandum presents information on the climate change context in Bangladesh. Current context and historical trends of climate change in the country are discussed, flagging trends of warming which are projected to continue. Precipitation changes are expected to see an increase in intensity and occurrence of extreme events (including of tropical cyclone activity), and a slight increase in annual rainfall is expected in Bangladesh, though the specifics of precipitation changes have greater uncertainty. Climate context, risks, and response measures vary throughout the country and its various regions, populations, and local circumstances.

Bangladesh is one of the most vulnerable countries in the world to climate-related hazards, and there are several significant climate and disaster risks discussed for the country, perhaps most notably high exposure to floods and cyclones. Flash floods, riverine flooding, and coastal flooding are likely to be exacerbated by intensified extreme rainfall events, tropical cyclones, and associated storm surges. These compounding events place ecosystems and biodiversity, human lives and livelihoods, infrastructure, and the economy all at risk. Livelihoods in Bangladesh's coastal zone (which include many of the poorest communities) are relatedly at risk from sea level rise, saltwater intrusion, and degraded natural resources which are also linked to climate change. Additionally, increased frequency of periods of prolonged high heat are also a major threat to human health and living standards in Bangladesh (particularly in urban environments and for outdoor laborers).

Table 3 in the document (which draws from [Bangladesh's 2022 National Adaptation Plan](#), [Bangladesh's Third National Communication to the UNFCCC](#), and the [World Bank Climate Risk Country Profile for Bangladesh](#)) presents key climate risks and intersections with ecosystems and biodiversity, women's livelihoods and human security, and adaptation options & the role of land-based solutions in addressing climate risk (preparedness/disaster reduction/resilience). Ecosystems and biodiversity are expected to see losses and changes in range for many of the climate risks. Climate risks present challenges to human health, life, livelihoods, well-being, land, energy, water and natural resources, and infrastructure. Poor and marginalized groups, and women, as well as youth and those with disabilities are likely to suffer disproportionately in a changing climate – exacerbating existing inequalities. Adaptation and disaster risk reduction are urgent priorities in Bangladesh as the livelihoods and wellbeing of millions of people are threatened. Adaptation and methods for resilience feature planning and management of natural resources, land, and disaster preparedness and early warning systems with an emphasis on ecosystems, landscapes, and green infrastructure such as mangroves and wetlands. Specific options are context-dependent and adaptive livelihood options, leveraging traditional ecological knowledge, and natural resource management that is socially inclusive and locally driven can help further climate action. Supplemental to the table presented, the appendices of this document (Appendix A, B, and C) depict reproduced materials from the National Adaptation Plan of Bangladesh which illustrate climate stresses and the extent to which they impact various regions in the country.

This information and analysis presented in the table is complemented by a subsequent exploration of additional gender and social inclusion considerations. Factors contributing to women as well as children, youth, and the elderly being among the highest risk groups are discussed, and examples of specific measures of adaptation for women, elderly, persons with disabilities, and other disadvantaged groups are also presented (as noted in the National Adaptation Plan of Bangladesh). Additionally, this document reproduces a high-level summary of adaptation priorities and entry points by sector (similarly as noted in the National Adaptation Plan of Bangladesh), which could serve as further inspiration for women-led collective climate action.

This memorandum concludes by citing two tools for additional consideration: the US National Parks Service “Resist-Accept-Direct (RAD) Framework” (which provides a framework for natural resource managers to consider strategic actions in the face of ecological change) and the “UN FAO EX-Ante Carbon Balance Tool” (which can be used for estimating and tracking greenhouse gas emissions in the land use sector).

### Box 1: Key takeaways

- Bangladesh is one of the most vulnerable countries in the world to climate-related hazards
  - Warming trends are projected to continue 
  - Precipitation changes are expected to see an increase in intensity and occurrence of extreme events 
- Notable climate and disaster risks in Bangladesh include high exposure to:
  - Floods 
  - Cyclones  and storm surge 
- Further notable climate risks include:
  - Extreme heat 
  - Drought 
  - Sea level rise 
  - Changes in precipitation patterns 
  - Cold spells 
- Ecosystems and biodiversity are expected to see losses and changes in range with climate change 
- Climate risks present challenges to human health, life, livelihoods, well-being, land, energy, water and natural resources, and infrastructure.
- Poor and marginalized groups, women, youth, and those with disabilities are likely to suffer disproportionately in a changing climate – exacerbating existing inequalities
- Methods of adaptation and resilience could include:
  - planning and management of natural resources and land
  - disaster preparedness and early warning systems
  - an emphasis on ecosystems, landscapes, and green infrastructure (such as mangroves and wetlands)
- Specific responses are context-dependent
- Adaptive livelihood options, leveraging traditional ecological knowledge, and natural resource management that is socially inclusive and locally driven can help further climate action

## 2) Climate change: current context/historical trends and future projections

### 2.1) Current context/historical trends

Bangladesh's climate tends to be warm and wet, with some seasonal variation (particularly with respect to precipitation). Most of the country is a low-lying river delta. Formed by the sedimentary deposits of the Ganges, Brahmaputra, and Meghna Rivers – which flow from the Himalayas to the Bay of Bengal. Much of the land is flat and contains a network of over 230 major rivers and thousands of tributaries and canals. The country also has one of the highest population densities in the world and features coastal mangrove forests, including the Sundarbans in the southeast of the country.<sup>1</sup> Figure 1, below, reflects Bangladesh's 30 agro-ecological zones.

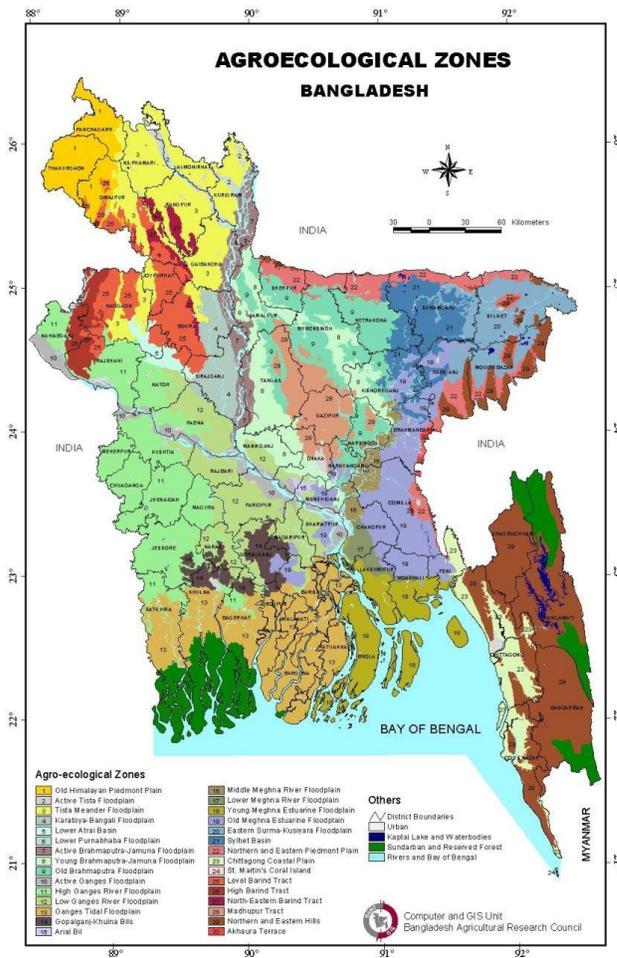
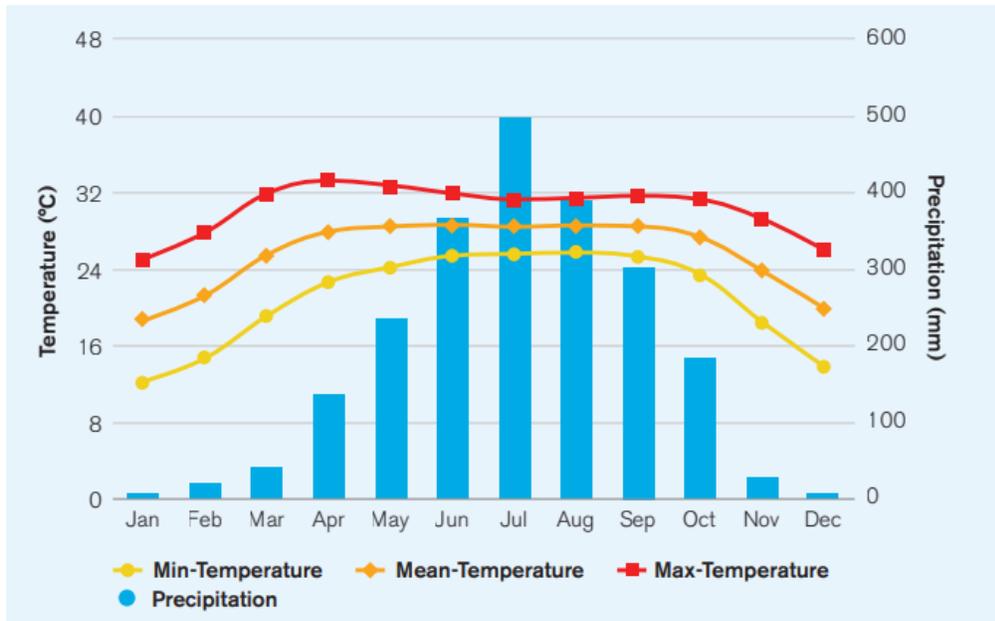


Figure 1: Agro-ecological zones of Bangladesh<sup>2</sup>

<sup>1</sup> World Bank Group and Asian Development Bank. 2021. "Climate Risk Country Profile: Bangladesh" Available at: [https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15502-WB\\_Bangladesh%20Country%20Profile-WEB.pdf](https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15502-WB_Bangladesh%20Country%20Profile-WEB.pdf)

<sup>2</sup> Bangladesh Agro-Meteorological Information Portal. 2023. "Agro-Ecological Zones - AEZS Maps." Available at: <https://www.bamis.gov.bd/en/page/aezs-maps/>

Figure 2, below, depicts the seasonal variation in temperature and rainfall in Bangladesh overall in terms of national averages, with warmer, wetter months occurring April-September and comparatively drier winter months (December-February) which are still warm yet slightly cooler on average.



**Figure 2: Average monthly temperatures and rainfall in Bangladesh (1991-2020)<sup>3</sup>**

Bangladesh is in general a warm and very wet country, receiving on average about 2,200 millimeters (mm) of rainfall per year. There is some spatial variability in the country in terms of precipitation, as most regions receive at least 1,500 mm while others, such as in the northeastern border regions of the country receive as much as 5,000 mm of rainfall per year. High humidity peaks during the monsoon season (June-October) yet remains high throughout the year. Rainfall patterns in the country are driven largely by the Southwest monsoon, which originates over the Indian Ocean and carries warm, moist, and unstable air. Tropical cyclones make landfall in Bangladesh once in every two to three years, bringing heavy rainfall, very high wind speeds, and storm surges.<sup>4</sup>

Historical trends for Bangladesh have observed an estimated 1.3 degrees Celsius of average temperature warming in the past century (1900-1917 to 2000-2017), with temperature rises being strongest in the monsoon season (June-August). Observations around precipitation are a bit less certain – Bangladesh’s Third National Communication to the UNFCCC reports no statistically significant historical changes in average annual precipitation. Changes in seasonality of precipitation were significant over the period of 1975-2003, however, as there have been observed increases in the post-monsoon season in the range of 5-15% (increase in precipitation), and some decreases in precipitation in the pre-monsoon season (less than 5%).<sup>5</sup>

<sup>3</sup> World Bank, 2021.

<sup>4</sup> World Bank, 2021.

<sup>5</sup> World Bank, 2021.

## 2.2) Future projections<sup>6</sup>

### **Temperature:**

Future modeling and projections for Bangladesh show a trend of consistent warming. The below tables (reproduced from the World Bank’s Climate Risk Country Profile on Bangladesh) depict information on temperature projections for four scenarios over two horizons of time compared to the reference period of 1986-2005.

**Table 1: Projected anomaly (changes in degrees Celsius) for maximum, minimum, and daily average temperatures for Bangladesh for 2040-2059 and 2080-2099.**

Scenario	Average Daily Maximum Temperature		Average Daily Temperature		Average Daily Minimum Temperature	
	2040–2059	2080–2099	2040–2059	2080–2099	2040–2059	2080–2099
<b>RCP2.6</b>	1.1 (-1.3, 3.7)	1.2 (-1.3, 3.8)	1.2 (-0.8, 2.9)	1.3 (-0.8, 3.0)	1.1 (-0.5, 2.7)	1.2 (-0.5, 2.8)
<b>RCP4.5</b>	1.5 (-0.9, 3.9)	2.2 (-0.3, 4.9)	1.6 (-0.5, 3.2)	2.1 (0.1, 4.1)	1.4 (-0.2, 3.2)	2.1 (0.3, 4.0)
<b>RCP6.0</b>	1.2 (-1.6, 3.7)	2.6 (-0.1, 5.6)	1.2 (-0.9, 3.1)	2.5 (0.4, 4.6)	1.2 (-0.3, 2.9)	2.6 (0.7, 4.4)
<b>RCP8.5</b>	1.9 (-0.5, 4.4)	3.9 (1.4, 6.7)	1.9 (0.0, 3.8)	3.9 (2.0, 6.2)	2.0 (0.4, 3.8)	4.2 (2.3, 6.3)

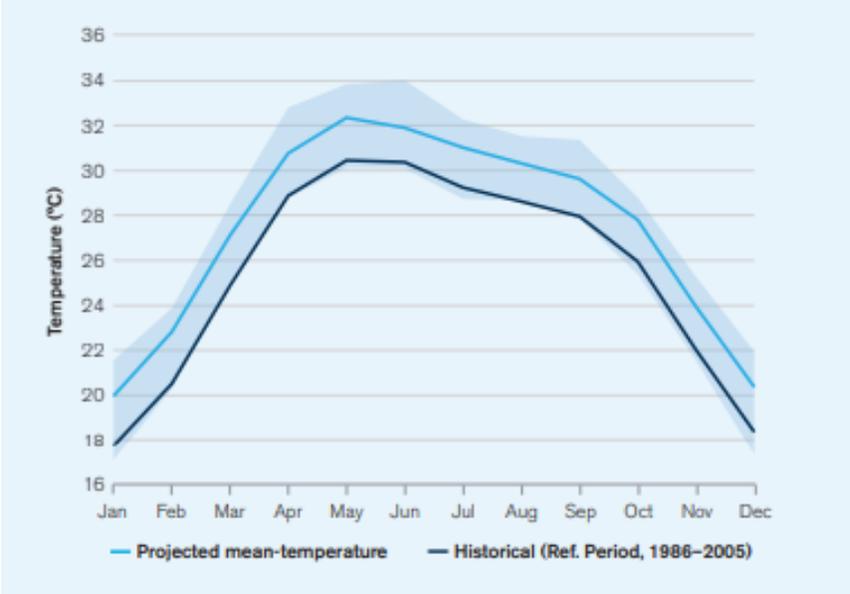
As depicted in the table above, average temperature projections (maximum, minimum, and average) are projected to increase, with higher increases anticipated under higher emissions scenarios. The daily maximum and minimum might also be interpreted to explain how daily life might change, affecting key variables such as the viability of ecosystems, health impacts, productivity of labor, and the yield of crops, which can be disproportionately influenced by temperature extremes. For both the table above and the table below, the median temperature change is presented for each category as well as the 10<sup>th</sup>-90<sup>th</sup> percentiles in parenthesis.

**Table 2: Projections of average temperature change (degrees Celsius) in Bangladesh for different seasons over different time horizons and emissions pathways.**

Scenario	2040–2059		2080–2099	
	Jun–Aug	Dec–Feb	Jun–Aug	Dec–Feb
<b>RCP2.6</b>	0.6 (-1.1, 2.9)	1.5 (-0.7, 2.8)	0.6 (-0.9, 3.2)	1.7 (0.7, 2.9)
<b>RCP4.5</b>	1.0 (-0.6, 3.3)	1.6 (-0.4, 2.9)	1.6 (-0.1, 4.2)	2.3 (0.3, 4.0)
<b>RCP6.0</b>	0.7 (1.1, 3.4)	1.5 (-0.7, 2.8)	1.8 (0.1, 4.8)	2.9 (0.8, 4.5)
<b>RCP8.5</b>	1.6 (0.0, 4.0)	2.2 (0.0, 3.8)	3.4 (1.7, 5.9)	4.5 (2.4, 6.2)

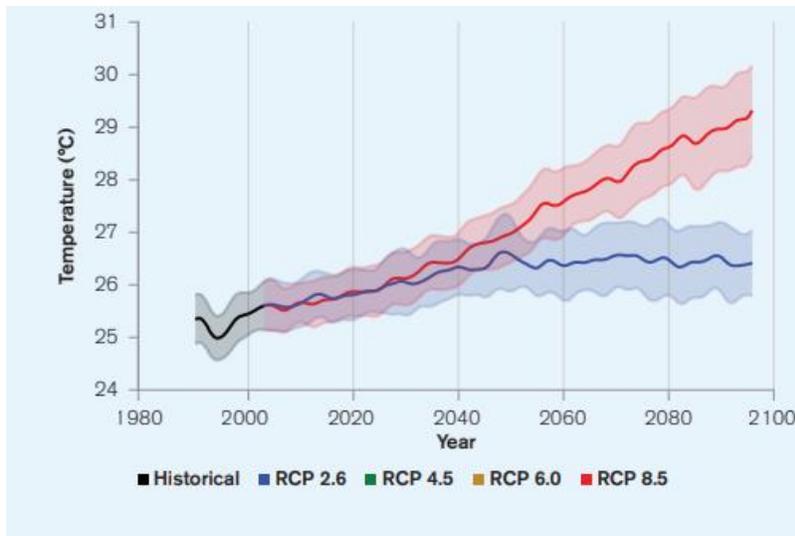
<sup>6</sup> Note: This section presents data on future projections and modeling sourced primarily from the World Bank Group’s Climate Change Knowledge Portal, using the Coupled Model Inter-comparison Project Phase 5 models, which are used within the Intergovernmental Panel on Climate Change’s Fifth Assessment Report. Four Representative Concentration Pathways (i.e., RCP2.6, RCP4.5, RCP6.0, and RCP8.5) are used and defined by their total radiative forcing, or the cumulative measure of greenhouse gas emissions from all sources, reflecting four different pathways and levels by 2100. RCP2.6 represents the low extreme which would be characterized by significant mitigation while RCP8.5 represents the high extreme characterized by business-as-usual in terms of emissions pathways.

The table above shows temperature increases are projected in all seasons under the different emissions scenarios, and there are slightly higher/more dramatic temperature increases that are expected in December-February relative to the already warmer months of June-August. The below figure (Figure 3) further represents projected changes in temperature by month.



**Figure 3: Projected change (degrees Celsius) in monthly temperature shown by month for Bangladesh for the period of 2040-2099 under RCP8.5.**

In the above figure, the light blue line represents the median future temperature projection, and the shaded regions show the 10<sup>th</sup>-90<sup>th</sup> percentiles (range), while the darker blue line represents the mean temperature for the historical reference period 1986-2005.



**Figure 4: Historic and projected average annual temperature in Bangladesh under RCP2.6 (blue) and RCP8.5(red)**

Figure 4, above, depicts the projected warming trends under a high-emissions (business-as-usual) model and a low-emissions (aggressive climate action and mitigation) model. The lines represent the average while the lighter shading of red, blue, and black represent the standard deviation of the model.

Projections for warming in Bangladesh suggest that the country will breach the 2°C (increase) threshold by the end of the century under all modeled scenarios except for pathway which features the most aggressive climate action (RCP2.6). Projected warming trends such as the increases in daily maximum and minimum, as well as the warmer winter season notably have the potential to amplify impacts of temperature rise on human health and livelihoods.

**Precipitation:**

Projections in rainfall provide a higher degree of uncertainty yet a slight increase in average annual rainfall is indicated, with a likelihood of an increase in intensity for extreme rainfall events. Climate change impacts on monsoon rainfall patterns and tropical cyclone activity is also likely to impact precipitation, and while exact implications are less certain, models suggest a decrease in lighter precipitation events and an increase in the frequency and intensity of high and extreme precipitation events.

### 3) Climate Risks, Impacts, Intersections with Women’s Livelihoods & Human Security, Adaptation Options & Role of Land-Based Solutions

Bangladesh faces some of the highest disaster and climate risk levels in the world. The country notably has an extremely high exposure to flooding (ranked first in the world), including riverine, flash, and coastal flooding. The country also faces a high exposure to tropical cyclones and their associated hazards as well as drought. High levels of socioeconomic deprivation and social vulnerabilities also intersect with these high risks.<sup>7</sup>

The below table depicts key climate risks in Bangladesh. For each climate risk, intersections are depicted in terms of impact on ecosystems and biodiversity, women’s livelihoods and human security, and adaptation options & the role of land-based solutions in addressing climate risk/preparedness/disaster reduction/resilience. Information in the table was pulled primarily from the World Bank Climate Risk Country Profile for Bangladesh, Bangladesh’s National Adaptation Plan, and the country’s Third National Communication to the UNFCCC (United Nations Framework Convention on Climate Change).

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<sup>7</sup> World Bank, 2021.

3.1) Table 3: Climate Risks, Impacts on Ecosystems and Biodiversity, Intersections with Women’s Livelihoods & Human Security, and Adaptation options & the Role of Land-Based Solutions <sup>8,9,10</sup>

Climate Risk	Impact on ecosystems and biodiversity	Intersection with women’s livelihoods & human security	Adaptation options & role of land-based solutions to addressing climate risk/preparedness/disaster reduction/resilience
Heat waves (increased frequency and severity) & warmer temperatures	<ul style="list-style-type: none"> <li>• Heat stress on plants and animals</li> <li>• Expansion of hot and humid summer seasons</li> <li>• Impacts on fish species development, maturity, and breeding</li> <li>• Decreased dissolved oxygen and poor habitats for aquatic species (including due to thermal shock)</li> <li>• Loss of native flora and fauna</li> <li>• Loss of biodiversity</li> <li>• Los of permanent wetlands and “beels” (smaller lakes/ponds)</li> <li>• Less favorable habitat conditions</li> <li>• Changes in growth, composition, and density of specific flora and fauna (such as mangrove species <i>sundari</i>, <i>gewa</i>, &amp; also <i>goran</i>)</li> <li>• Loss of water from canopy of trees/forests,</li> </ul>	<ul style="list-style-type: none"> <li>• loss of life and harm to human health including heatstroke (without adaptation, annual heat-related deaths in South Asia region could increase by 149% by 2030s and 276% by 2050s, with Dhaka facing some of highest heat-related health risks in the world)</li> <li>• heat stress by humans (&amp; plants/agriculture and livestock/wildlife that are depended upon for livelihoods)</li> <li>• under higher emissions scenario a near permanent state of heat waves</li> <li>• very significant increase in annual exposure to extreme heat</li> <li>• impacts on living standards</li> <li>• impacts especially strong in urban environments and for outdoor laborers</li> <li>• impacted crop growth (key staple crops in Bangladesh of Aman rice, Boro rice, and wheat have all been shown to suffer significantly under increases in maximum temperatures)</li> <li>• potential increase in pests and diseases on crops and livestock</li> <li>• shifts in optimal and viable spatial ranges for crops</li> <li>• Changes in crop timing/seasons for growth and productivity</li> <li>• Changes in timing of livestock breeding and rearing</li> <li>• impacts on fisheries/aquaculture (development/readiness/breeding)</li> <li>• potential increase in disease outbreak in aquaculture</li> <li>• heat resulting in a decline of labor productivity among those in the agriculture &amp; fisheries sectors especially</li> <li>• Reduction in standards of living</li> <li>• Urban Heat Island effect especially compounding/impacting impacts in urban areas</li> <li>• Increase in potential disease outbreaks</li> <li>• Increase in electricity demand</li> </ul>	<ul style="list-style-type: none"> <li>• Natural infrastructure (such as trees and vegetation) that facilitate cooler microclimates (in urban contexts, urban street trees and parks)</li> <li>• Early warning systems</li> <li>• Cooling shelters</li> <li>• Capacity-building &amp; education</li> <li>• Adaptation that pulls on traditional ecological knowledge for managing heat</li> <li>• Technology and species selection for crops that are heat resistant</li> <li>• Expanding access to markets for existing sustainable livelihoods to further build resilience amidst a changing climate (especially for women farmers)</li> <li>• Improved/expanding agricultural extension services that incorporate climate considerations</li> <li>• Incorporate energy efficiency measures into community infrastructure and activities</li> <li>• Participatory and coordinated land and water resources management</li> <li>• Awareness raising, capacity development, and behavior change</li> <li>• Gender, youth, and disability responsive diversified livelihood options</li> <li>• Climate-stress tolerant breeds and livestock systems</li> <li>• climate action and land use/natural resource planning</li> <li>• community-based forestry, community-conserved areas, and/or other effective areas based conservation</li> </ul>

<sup>8</sup> World Bank, 2021.

<sup>9</sup> Government of the People’s Republic of Bangladesh: Ministry of Environment, Forest, and Climate Change. 2022. "National Adaptation Plan of Bangladesh (2023-2050)." Available at: [https://www4.unfccc.int/sites/SubmissionsStaging/Documents/202211020942---National%20Adaptation%20Plan%20of%20Bangladesh%20\(2023-2050\).pdf](https://www4.unfccc.int/sites/SubmissionsStaging/Documents/202211020942---National%20Adaptation%20Plan%20of%20Bangladesh%20(2023-2050).pdf)

<sup>10</sup> Government of the People’s Republic of Bangladesh: Ministry of Environment, Forest, and Climate Change. 2018. "Third National Communication of Bangladesh to the United Nations Framework Convention on Climate Change." Available at: [https://unfccc.int/sites/default/files/resource/TNC%20Report%20%28Low%20Resolution%29%2003\\_01\\_2019.pdf](https://unfccc.int/sites/default/files/resource/TNC%20Report%20%28Low%20Resolution%29%2003_01_2019.pdf)

	<p>less moisture (especially in the “Chattogram Hill Tracts” region)</p>	<ul style="list-style-type: none"> <li>• Agricultural and manual laborers among most at risk of losses (economic, productivity) due to heat stress – exacerbating existing inequality among the lowest paid</li> <li>• Exacerbated economic disparity</li> <li>• Increase in vector- and water-borne diseases</li> <li>• Poorest and most vulnerable communities likely to be hit hardest with these groups least able to afford air conditioning (projected to have higher need for cooling days in context of extreme heat)</li> <li>• Gender and domestic violence (climate change impacts and associated conditions as risk/threat multiplier)</li> <li>• Exacerbated social inequality</li> <li>• Children, youth, and elderly especially at risk of heat</li> <li>• Drinking water crisis / water level and quality decrease</li> </ul>	<p>measures other effective areas based conservation measures (OECMs)</p> <ul style="list-style-type: none"> <li>• document &amp; identify good practices of community based measures proven effective to reduce biodiversity loss, and then use the documented good practices as advocacy tools. (consider links to the Biodiversity Action Plan and Article J8 of the Convention on Biological Diversity (CBD) (related to protection and conservation of traditional lifestyles for the conservation and sustainable use of biodiversity)</li> </ul>
<p>Drought (increased frequency and severity)</p>	<ul style="list-style-type: none"> <li>• Health of groundwater resources (many of which have already experienced salinization)</li> <li>• Precipitation and hydrological drought</li> <li>• Drought/precipitation has a complex relationship/connection to larger-scale climate phenomena such as El Niño Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD)</li> <li>• Minimum acceptable surface water levels in many streams and rivers likely to be compromised at times which threatens existing aquatic ecosystems and fisheries</li> <li>• Loss of aquatic ecosystems/habitats</li> </ul>	<ul style="list-style-type: none"> <li>• Agricultural drought</li> <li>• Impacts additionally due to and on water sharing agreements with India</li> <li>• Water scarcity (including drinking water crisis)</li> <li>• Potential for water conflict and competition</li> <li>• Impacts on crop growth</li> <li>• Increase in fish/aquaculture mortality (and loss of fish diversity and composition) &amp; decrease in fish production</li> <li>• Minimum acceptable surface water levels in many streams and rivers likely to be compromised at times which threatens existing aquatic ecosystems and fisheries</li> <li>• Exacerbated economic disparity</li> <li>• Poorer farmers and communities least able to afford water storage, irrigation infrastructure, and technologies for adaptation</li> <li>• Exacerbated water stress (depleting surface water quality and availability and increasing pressure on groundwater resources)</li> <li>• Arsenic exposure due to contaminated groundwater with arsenic with subsequent health impacts</li> <li>• Communities who depend on rain-fed croplands for livelihoods (among others) increase likelihood to migrate</li> <li>• Irrigation water crisis</li> <li>• Less crop yield</li> <li>• Food &amp; nutrition crisis</li> <li>• Increase in pests and diseases</li> <li>• Gender and domestic violence (climate change impacts and associated conditions as risk/threat multiplier)</li> </ul>	<ul style="list-style-type: none"> <li>• Green/natural infrastructure (forests, wetlands, vegetation) which help to replenish, store, and maintain water resources</li> <li>• Irrigation infrastructure (which is compatible with land/land use planning/water resources)</li> <li>• Adaptation that pulls on traditional ecological knowledge for managing drought</li> <li>• Technology and species selection for crops that are drought resistant</li> <li>• Climate-stress tolerant breeds and livestock systems</li> <li>• Early warning systems</li> <li>• Capacity-building &amp; education</li> <li>• Promotion of efficient use of existing water resources</li> <li>• Enhanced understanding of impacts of climate change and upstream activities on Bangladesh’s water resources</li> <li>• Land &amp; water planning in the delta</li> <li>• Improved groundwater management</li> <li>• Reducing (surface &amp; groundwater) pollution</li> <li>• Access to markets (especially for women farmers)</li> <li>• Improved/expanding agricultural extension services that incorporate climate considerations</li> <li>• Rainwater harvesting</li> </ul>

	<ul style="list-style-type: none"> <li>• Declining water area and connectivity of water bodies</li> <li>• Desertification of hills and forests due to less soil moisture</li> <li>• Less soil moisture and groundwater recharge</li> </ul>	<ul style="list-style-type: none"> <li>• Increased workload for women</li> <li>• Spend long hours to fetch pure/sweet drinking water from long distance.</li> <li>• Exacerbated social inequality</li> <li>• Less spring water available in hills</li> </ul>	<ul style="list-style-type: none"> <li>• Managed aquifer recharge (including benefit of natural/green infrastructure such as forests and wetlands in facilitating this)</li> <li>• Drought monitoring system</li> <li>• Participatory and coordinated land and water resources management</li> <li>• Awareness raising, capacity development, and behavior change</li> <li>• Gender, youth, and disability responsive diversified livelihood options</li> <li>• climate action and land use/natural resource planning</li> <li>• community-based forestry, community-conserved areas, and/or other effective areas based conservation measures (OECMs)</li> <li>• document &amp; identity good practices of community based measures proven effective to reduce biodiversity loss, and then use the documented good practices as advocacy tools. (consider links to the Biodiversity Action Plan and Article J8 of the Convention on Biological Diversity (CBD) (related to protection and conservation of traditional lifestyles for the conservation and sustainable use of biodiversity)</li> </ul>
<p>Floods (increased frequency and severity)</p>	<ul style="list-style-type: none"> <li>• Increase in extreme river flows</li> <li>• Previous 1 in 100-year flows could become 1 in 50-year or 1 in 25-year events in much of the region</li> <li>• In part, upstream melting of Himalayan glaciers &amp; increased precipitation intensities in upstream basins could link to these events</li> <li>• Species range shifts</li> </ul>	<ul style="list-style-type: none"> <li>• Currently, population annually affected by river flooding in Bangladesh estimated at 1.6 million people and expected annual impact on GDP is \$2.6 billion (USD)</li> <li>• Climate change is projected to increase affected population (by 2030s) by an additional 5.3 million people, and an increased impact on GDP by another \$24 billion under the high-emissions/business-as-usual scenario (RCP8.5)</li> <li>• Additional projections suggest increase in population affected by extreme floods in the region to be 6-12 million people by 2036-2044 while a separate World Bank study suggests an increase of 40% of population to be exposed to river flood risks by mid-century.</li> <li>• Pressures on Bangladesh's flood defense system</li> <li>• Increased risk of disaster-level flood events</li> <li>• Implications for intergovernmental water-sharing agreements with India</li> <li>• Water and sanitation problems</li> </ul>	<ul style="list-style-type: none"> <li>• Management of water resources (flood control, drainage, and irrigation) which factors in natural infrastructure (such as wetlands)</li> <li>• Infrastructure interventions to protect agricultural lands including through reinforcement and expansion of the polder network in the coastal zone</li> <li>• Early warning systems</li> <li>• Capacity-building &amp; education</li> <li>• Ecosystem-based adaptation (conservation, restoration, afforestation) of mangroves and other green infrastructure (wetlands, vegetation, etc.) to help with flood impacts</li> <li>• increase of flood protection barriers, levees, canals, dykes and improve soil and water conservation efforts</li> </ul>

<ul style="list-style-type: none"> <li>• Increase in vector- and water-borne diseases</li> <li>• Freshwater ecosystems could be disrupted</li> <li>• Riverbank erosion</li> <li>• Habitat disruption and habitat quality loss (impacting flora and fauna in both terrestrial &amp; aquatic systems)</li> <li>• Water quality deterioration (mixing with agro-chemicals and other runoff pollutants)</li> </ul>	<ul style="list-style-type: none"> <li>• Women walk long to collect drinking water</li> <li>• Damage/loss of infrastructure</li> <li>• Migration (permanent and/or seasonal)</li> <li>• Urban areas that are poorly planned are at risk of exposure to flood and informal developments are among poorest and most vulnerable groups</li> <li>• Waterlogging of agriculture fields</li> <li>• Heightened pressures on water resources</li> <li>• Likely need for widespread land use and livelihood changes due to crop range shifts, saline intrusion, floods</li> <li>• Potential for heightened water conflicts</li> <li>• Increase in vector- and water-borne diseases</li> <li>• Livelihoods at risk/loss of livelihoods (including inland aquaculture/fisheries such as those of carp, cichlids, and catfish as well as livestock)</li> <li>• Overtopping of ponds/shrimp/prawn/aquaculture farms with fish escaping</li> <li>• Impacts on crop growth (including rice “Boro”)</li> <li>• Stresses on capacity of urban sewerage systems to cope with extreme rainfall and flood events</li> <li>• Exacerbated economic disparity/increased poverty</li> <li>• Some of greatest vulnerability found in northeastern region where flash flooding and river flooding are frequent</li> <li>• Economically poorer residents and businesses located in most flood prone areas with lives, livelihoods, and infrastructure most at risk</li> <li>• Harvesting and storage challenges for crops</li> <li>• Changed cropping patterns</li> <li>• Shifting occupations</li> <li>• Gender and domestic violence (climate change impacts and associated conditions as risk/threat multiplier – including also at flood/disaster shelters)</li> <li>• Exacerbated social inequality</li> <li>• Health risks for persons with disabilities during extreme weather events</li> <li>• Disruption to education</li> <li>• Communications systems disrupted</li> <li>• Landslides in hilly regions</li> </ul>	<ul style="list-style-type: none"> <li>• facilitate drainage of heavy rainfall and stormwater</li> <li>• reservoirs and retention ponds</li> <li>• enhanced embankments / river bank stabilization</li> <li>• increased flood forecasting taking into account landscape, flood zones, and climate change – including early warning systems</li> <li>• monitoring systems in flood prone areas</li> <li>• irrigation and drainage systems</li> <li>• flood shelters (including gender and disability sensitive)</li> <li>• raised land for people and livestock</li> <li>• Climate refugee shelters/buildings (including gender- and disability-sensitive shelters)</li> <li>• Maintaining connectivity of waterbodies</li> <li>• Participatory and coordinated land and water resources management</li> <li>• Awareness raising, capacity development, and behavior change</li> <li>• Landslide management with eco-engineering measures (and planting in hilly areas to protect top soil erosion)</li> <li>• Gender, youth, and disability responsive disaster preparedness and emergency rescue and evacuation services</li> <li>• Gender, youth, and disability responsive diversified livelihood options</li> <li>• Planned relocation of settlements/managed retreat</li> <li>• Indigenous/integrated agriculture methods (e.g., floating, Sojan, sandber, sack)</li> <li>• fertilizer efficiency (including green fertilizers), minimizing runoff issues</li> <li>• construction of Killa (raised earthen platform to shelter livestock during floods/cyclones)</li> <li>• climate action and land use/natural resource planning</li> <li>• expansion of low impact developments that work with nature (permeable pavement, bio-swales, green parks, green buildings, etc.) in urban areas</li> </ul>
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Sea level rise and flooding in coastal zones	<ul style="list-style-type: none"> <li>• Relative sea-level rise in Ganges Delta likely to be 5-10mm per year</li> <li>• Increase in salinity in coastal zones</li> <li>• Changes in ecosystems &amp; species viability and range shifts</li> <li>• Loss of land masses (and habitats) in coastal zone</li> <li>• Changes in fish and other species distribution</li> <li>• Damage to mangrove ecosystems (including Sundarbans)</li> <li>• Threats to viable range of species including Bengal tigers (including increased risk of human/wildlife conflict as species habitat shifts toward fresh water localities which might also have human development)</li> <li>• Shifts in mangroves and flora species to more salt-tolerant varieties (changes in mangrove species diversity and composition)</li> <li>• Loss of biodiversity (flora and fauna)</li> <li>• Land degradation</li> <li>• Changes in biodiversity habitat</li> </ul>	<ul style="list-style-type: none"> <li>• Note that in addition to climate change, human development processes, such as groundwater extraction, sand mining, and aquaculture have contributed to accelerating the sinking of the land, and the blocking of sediment which would otherwise deposit on the floodplain with dykes and dams acts to accelerate the relative rate of sea-level rise.</li> <li>• Vulnerability is highest in areas outside of these polders (low-lying tracts of land that form an artificial hydrological entity, enclosed by embankments known as dikes). Those most vulnerable areas outside of where polders are present are often inhabited and farmed by the poorest groups.</li> <li>• Around 900,000 people could face migration out of coastal areas due to permanent inundation by mid-century under the highest-emissions (RCP8.5) scenario</li> <li>• Higher salinity levels and lower elevation = risks for livelihoods and poverty</li> <li>• Lower crop yields</li> <li>• Less suitable irrigation water</li> <li>• Crop pattern changes</li> <li>• Crop damages among traditional varieties</li> <li>• Crop pattern changes</li> <li>• Women work long hour in the saline water for catching shrimp and crab, affect their hygiene and reproductive health</li> <li>• Minimized opportunities for agricultural production</li> <li>• Livestock loss (lower drinking water quality and feed)</li> <li>• Salinity yielding potentially decreased milk production in livestock</li> <li>• Increased food insecurity</li> <li>• The population left behind in the exposed lands are often dominated by women, the elderly and disabled (representing some of the most impoverished communities with limited ability to cope &amp; have resilience with climate hazards)</li> <li>• Increase in coastal flood risk (2.5 million to 7.2 million people may be affected by coastal flooding in Bangladesh in 2070s-2100s)</li> <li>• Increase in storm surge heights (cascading impacts with tropical cyclones/storms, potential for dyke breaches and flooding)</li> <li>• Loss of habitable land in coastal zone</li> </ul>	<ul style="list-style-type: none"> <li>• Extensive networks of polders (low-lying tracts of land that form an artificial hydrological entity, enclosed by embankments known as dikes) mitigate some of the impacts of sea-level rise; vulnerability is highest in areas outside of these polders</li> <li>• Polders help to protect against monsoon and storm surge flooding</li> <li>• Infrastructure interventions to protect agricultural lands including through reinforcement and expansion of the polder network in the coastal zone</li> <li>• Habitat restoration initiatives</li> <li>• Coastal greenbelt construction/protections (ecosystem/nature-based adaptation) (e.g., strips of natural or artificially created coastal vegetation including mangroves, beach forest, phytoplankton, and seagrasses designed to prevent coastal erosion)</li> <li>• Coastal housing/shelters in critical locations</li> <li>• Embankment infrastructure to protect against flooding</li> <li>• Capacity-building &amp; education</li> <li>• Improved/expanding agricultural extension services that incorporate climate considerations (salt water intrusion)</li> <li>• Community patrol groups, awareness raising campaigns, safety, and education which seek to both protect tigers and people and adapt to potential species range shifts</li> <li>• Protection and management of vulnerable coastal areas</li> <li>• Shoreline erosion management with ecosystem/biological engineering</li> <li>• Participatory and coordinated land and water resources management</li> <li>• Awareness raising, capacity development, and behavior change</li> </ul>

	<ul style="list-style-type: none"> <li>• Degraded freshwater ecosystems and dependent biodiversity</li> <li>• Loss of habitable lands for species</li> </ul>	<ul style="list-style-type: none"> <li>• Increase soil salt concentrations and saline intrusion distances, which can negatively impact/damage crop yields and change fish species distributions and aquaculture viability/potential</li> <li>• Damage to fisheries (increasing salinity; threatening freshwater fish and fisheries)</li> <li>• Damage to mangroves (and livelihoods that depend on mangroves)</li> <li>• Loss of livelihoods and natural resources/ecosystem services upon which people depend (including in Sundarbans/mangroves/coastal areas)</li> <li>• Reduction in rice output due to salinity</li> <li>• Decline in arable/farmable lands</li> <li>• Permanent loss of land through permanent inundation</li> <li>• Poorer and marginalized groups face largest challenges to adaptation</li> <li>• Potential for rising land use conflicts</li> <li>• Exacerbated economic disparity</li> <li>• Migration and displacement</li> <li>• Gender and domestic violence (climate change impacts and associated conditions as risk/threat multiplier)</li> <li>• Salinity causing health issues with births and children with disabilities</li> <li>• Exacerbated social inequality</li> <li>• Drinking water crisis</li> <li>• Sanitation problems</li> <li>• Corrosion of roads, bridges, and other infrastructure due to salt</li> <li>• Need for reoccurring investment</li> <li>• Human health issues that could come with increases in salinity especially in water supply (impacts on women, births/premature childbirth or death, stroke, high blood pressure, etc.)</li> <li>• Tiger habitat shifting toward localities with human development for fresh water access, with increased risk of human/wildlife conflict or human health impacts/deaths</li> </ul>	<ul style="list-style-type: none"> <li>• Gender, youth, and disability responsive diversified livelihood options</li> <li>• Planned relocation of settlements/managed retreat</li> <li>• indigenous (floating, Sojan, sandber, sack) agriculture</li> <li>• facilitate mangrove ecosystem health and mangrove-friendly aquaculture (i.e., silvofisheries)</li> <li>• climate action and land use/natural resource planning</li> <li>• extension and expansion of mangroves and coastal greenbelt</li> <li>• vegetative barriers or ecosystem-based protection (such as oyster reef) structures</li> <li>• community-based forestry, community-conserved areas, and/or other effective areas based conservation measures (OECMs)</li> <li>• Strengthen capacity of Indigenous Peoples and Local Communities to manage and govern of their forest especially the role of women and youth, including on community participatory mapping, develop community conservation plan and monitoring</li> <li>• document &amp; identity good practices of community based measures proven effective to reduce biodiversity loss, and then use the documented good practices as advocacy tools. (consider links to the Biodiversity Action Plan and Article J8 of the Convention on Biological Diversity (CBD) (related to protection and conservation of traditional lifestyles for the conservation and sustainable use of biodiversity)</li> </ul>
<p>Cyclones and storm surge (increase intensity &amp; increased frequency of higher intensity storms)</p>	<ul style="list-style-type: none"> <li>• Ecosystem degradation</li> <li>• Biodiversity loss</li> <li>• Forest damages</li> <li>• Habitat damages</li> </ul>	<ul style="list-style-type: none"> <li>• Intersection of climate change, sea level rise, cyclones, storm surge (increase frequency/intensity), increased wind speeds, intense precipitation impacting people, land, and livelihoods.</li> <li>• Exposure to wind and associated damage</li> <li>• Need for disaster shelters and disaster risk reduction and management efforts</li> <li>• Unprotected lands (outside of polders) and when dikes fail suggests potential for especially strong storm damage</li> <li>• Crop damages</li> </ul>	<ul style="list-style-type: none"> <li>• Infrastructure interventions to protect agricultural lands including through reinforcement and expansion of the polder network in the coastal zone</li> <li>• Ecosystem-based adaptation (conservation, restoration, afforestation) of mangroves and other green infrastructure (wetlands, reefs, etc.) to help with storm surge impacts</li> <li>• Storm shelters (including gender- and disability-sensitive)</li> </ul>

	<ul style="list-style-type: none"> <li>• Livestock loss and disease</li> <li>• Overtopping of ponds/shrimp/prawn/aquaculture farms with fish escaping</li> <li>• Degradation of conditions of fish ponds and shrimp farms</li> <li>• Decline of fishing days and reduction of fish caught</li> <li>• Loss of livelihoods</li> <li>• Loss of human lives</li> <li>• Food, water, and medicine crisis</li> <li>• Gender and domestic violence (climate change impacts and associated conditions as risk/threat multiplier)</li> <li>• Maternal healthcare problems may increase in disaster</li> <li>• Salinity causing health issues with births and children with disabilities</li> <li>• Exacerbated social inequalities</li> <li>• Health risks for persons with disabilities during extreme weather events</li> <li>• Disruption to education</li> <li>• Communications systems disrupted</li> <li>• Loss of houses/infrastructure</li> <li>• Water, sanitation and hygiene health problems</li> <li>• Landslides in hilly regions</li> <li>• Women's aquaculture work (collecting shrimp fry/prawns) negatively impacted and</li> </ul>	<ul style="list-style-type: none"> <li>• Embankment infrastructure to protect against flooding &amp; monitoring systems to ensure sustainability of embankments</li> <li>• Early warning systems &amp; enhanced weather forecasting with attention to at-risk areas</li> <li>• Capacity-building &amp; education</li> <li>• Trainings for communities, volunteers, and coastal fishermen on cyclone preparedness (including women) (including engagement in Bangladesh's Cyclone Preparedness Programme)</li> <li>• Disaster relief centers and information centers</li> <li>• Rescue boats and teams in place</li> <li>• Climate refugee shelters/buildings (gender-and disability-sensitive shelters)</li> <li>• Protection and management of vulnerable coastal areas</li> <li>• Increased data and monitoring of local climate variables (sea level rise, land subsidence, salinity intrusion) and involvement of communities</li> <li>• Maintaining connectivity of waterbodies</li> <li>• Awareness raising, capacity development, and behavior change associated with cyclone/storm surge impacts, early warning, and responses</li> <li>• Gender, youth, and disability responsive disaster preparedness and emergency rescue and evacuation services</li> <li>• Gender, youth, and disability responsive diversified livelihood options</li> <li>• construction of Killa (raised earthen platform to shelter livestock during floods/cyclones)</li> <li>• facilitate mangrove ecosystem health and mangrove-friendly aquaculture (i.e., silvofisheries)</li> <li>• climate action and land use/natural resource planning</li> <li>• extension and expansion of mangroves and coastal greenbelt</li> <li>• vegetative barriers or ecosystem based protection (such as oyster reef) structures</li> </ul>
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Changes in precipitation pattern	<ul style="list-style-type: none"> <li>• loss of biodiversity</li> <li>• changes in ecosystems</li> <li>• shifts in in suitable geographic ranges of flora and fauna</li> <li>• changes in habitat and behavior of species</li> </ul>	<ul style="list-style-type: none"> <li>• crop damage</li> <li>• loss of cultivable lands</li> <li>• changed cropping patterns</li> <li>• Exacerbated social inequality</li> <li>• Chance of livestock disease increases</li> <li>• Increases in mortality of fisheries and aquaculture</li> <li>• Gender and domestic violence (climate change impacts and associated conditions as risk/threat multiplier)</li> <li>• damage to livelihoods and well-being (including nutrition)</li> <li>• availability of natural resources (including water resources)</li> <li>• increased burden on women as primary caretakers (including related water and forest/natural resource management)</li> </ul>	<ul style="list-style-type: none"> <li>• Participatory and coordinated land and water resources management</li> <li>• Awareness raising, capacity development, and behavior change</li> <li>• Gender, youth, and disability responsive diversified livelihood options</li> <li>• Climate action and land use/natural resource planning</li> <li>• Green infrastructure to help minimize surface runoff</li> <li>• Rainwater harvesting</li> <li>• Improved drainage systems</li> <li>• Retention ponds</li> <li>• Early warning systems and weather forecasting</li> </ul>
Cold spells	<ul style="list-style-type: none"> <li>• Phenological changes (timing of seasonal biological events such as migrations, egg laying, flowering, hibernation, mating)</li> <li>• Potential increases in drylands</li> <li>• Potential shifts in ranges or loss of biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Crop damages</li> <li>• Pests and diseases</li> <li>• Disease outbreaks in livestock</li> <li>• Exacerbated social inequality</li> <li>• Changes in crop timing/seasons for growth and productivity</li> <li>• Distress/negative health impacts for homeless and most marginalized</li> <li>• Gender and domestic violence (climate change impacts and associated conditions as risk/threat multiplier)</li> </ul>	<ul style="list-style-type: none"> <li>• Participatory and coordinated land and water resources management</li> <li>• Awareness raising, capacity development, and behavior change</li> <li>• climate action and land use/natural resource planning</li> </ul>

Supplemental to the above table, the appendices of this document (Appendix A, B, and C) depict reproduced materials from the National Adaptation Plan of Bangladesh which illustrate climate stresses and the extent to which they impact various geographic regions in the country.

Appendix A ("Climate stress area coverage and related hazards") presents a reproduced table of "climate stress areas" (that is, particular geographies/regions within the country) noting the prominent climate hazards impacting that particular area, depicting the various districts, land area, and population numbers that are vulnerable. Appendix B ("Map of Climate Stress Areas of Bangladesh") presents a reproduced map displaying the climate stress areas and risks throughout the country. Appendix C ("Table of climate stresses and climate stress impact levels relative to climate stress areas in Bangladesh") presents a display of various climate stresses and the relative impact for each in each of the "climate stress areas"/regions within the country as defined and reflected in Appendix A and B.

### 3.2) Additional gender and social inclusion considerations:

The level of impacts of climate-related disasters on people and livelihoods and coping strategies of populations depend strongly on socio-economic status, socio-cultural norms, resource access, and gender. Women and children are among the highest risk groups, with key factors accounting for differences in gender equality, vulnerability including gender-based differences in time use (of natural resources/exposure), reduced access to and control over natural resources, access to assets and credit, treatment by formal institutions which can constrain opportunities of women, limited access to policy discussions and decision making, limited opportunities for decent work, social status, dependency on men for information, and a lack of sex-disaggregated data for policy change.<sup>11,12</sup>

According to the Third National Communication of Bangladesh to the UNFCCC, an assessment of gender and climate suggests that 1) women are more likely to be employed in climate-sensitive sectors like agriculture, 2) women are mainly confined to rural areas where deprivations and insecurities are more prominent (such as in the face of storms and in their aftermath), and 3) women endure unfavorable conditions in terms of wages, availability of working hours and receiving basic service facilities.<sup>13</sup> Additionally, for women, climate effects can compound or exacerbate impacts such as: nutritional availability of foods during pregnancy or menstruation during floods, salinity impacting women's health (including pre-eclampsia, gestational hypertension, and reproductive health risks), exposure to water-borne diseases and maternal healthcare problems (including more births of children with disabilities).<sup>14</sup>

Climate change-induced extreme heat and heat stress can especially become a problem for pregnant women, children, youth, and the elderly. Climate-induced disasters and their effects can limit or disrupt education prospects for youth, and result in both physical and mental health impacts. People with disabilities can also face neglect, health, mobility, and other challenges in the context of climate change-related hazards. Lower participation rates of women (as well as youth and those with disabilities) in decision-making spaces also render them more vulnerable to climate risks, despite a strong ability to act on and adapt to climate stresses.<sup>15</sup>

Climate change action that ensures socially inclusive adaptation, including for women, youth and people with disabilities is essential. Specific measures of adaptation for women, the elderly, persons with disabilities and other disadvantaged people, as noted in the National Adaptation Plan of Bangladesh, might include some of the following:<sup>16</sup>

- Ensuring adequate space, facilities and equitable access to disaster preparedness such as through the establishment of multipurpose and climate-resilient cyclone and flood shelters with safe Water, Sanitation and Hygiene (WASH), lactation and maternities facilities, disability friendly entries and rooms, etc.
- Gender-, age- and disability-inclusive search and rescue programmes during disaster periods
- Ensuring better access to inclusive and responsive early warning systems in appropriate languages and modalities
- Building climate-resilient houses and health-care facilities with accessible communication facilities
- Monitoring and surveillance of mental and physical health due to climate-induced disasters

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<sup>11</sup> World Bank, 2021.

<sup>12</sup> National Adaptation Plan of Bangladesh, 2022.

<sup>13</sup> Third National Communication of Bangladesh to the UNFCCC, 2018.

<sup>14</sup> National Adaptation Plan of Bangladesh, 2022.

<sup>15</sup> National Adaptation Plan of Bangladesh, 2022.

<sup>16</sup> National Adaptation Plan of Bangladesh, 2022.

- Green infrastructure development and nature-based solutions for improved well-being
- Increase inclusive coverage of social security and social safety net programmes
- Design and implement specialized training, skills and awareness development programmes
- Design, plan and build capacities for climate-resilient alternative livelihoods
- Prioritize and ensure effective participation in decision-making for adaptation
- Collect and use data and indicators disaggregated by gender, age and disability for monitoring and evaluation
- Generate climate adaptation relevant materials and communicate them to reach people regardless of gender, age, ethnicity, language or disability
- Prepare local adaptation plans inclusive of the issues and perspectives of women, the elderly, persons with disabilities and other socially disadvantaged people

Major implementation challenges of such measures include participation and inclusion of stakeholders such as women, people with diverse gender identities, the elderly, youth, persons with disabilities and ethnic communities up to desired level. Thus, stakeholder engagement, consent, advocacy, action, decision-making, and leadership of these groups is crucial.

Note, an additional policy document that of particular relevance in the context of gender and climate in Bangladesh is the country's 2013 [Climate Change and Gender Action Plan](#) (ccGAP), which aims at mainstreaming gender concerns into climate change-related policies, strategies, and interventions – ensuring access to, participation in, contributions towards, and benefits for the diverse group of stakeholders for the sustainable and equitable development of Bangladesh.<sup>17</sup>

### 3.3) Adaptation priorities and entry points by sector:

Reducing the negative impacts of the climate risks/stresses reflected in the table are considered high-priority entry points for adaptation, according to the National Adaptation Plan of Bangladesh. As such, and as the far-right hand column of the table helps to point to, building the resilience of different natural resources through sustainable management is a high-priority for adaptation which can have positive consequences for addressing the various climate risks as well as for people, food systems, and livelihoods.<sup>18</sup>

The key entry points for the agriculture, fisheries, aquaculture and livestock sector are irrigation water availability during the dry season and under drought conditions, conservation of soil moisture, freshwater availability for salinity-prone regions, quality seeds and understanding of crop flowering patterns and phenology changes, and managing pest infestations. The NAP also refers to the livestock fodder crisis because of floods, salinity or droughts, and the drinking or bathing water crisis due to floods or salinity intrusion.<sup>19</sup>

Adaptation actions and priorities as listed in Bangladesh's National Adaptation Plan by sector (on page 56 & 57 of that document):<sup>20</sup>

- **Agriculture, fisheries, aquaculture, and livestock:** Key entry points for agriculture, fisheries, aquaculture, and livestock are identified to include irrigation water availability during the dry season and under drought conditions, conservation of soil moisture, freshwater availability for

<sup>17</sup> FAOLEX Database. 2022. "Bangladesh: Bangladesh Climate Change and Gender Action Plan." Available at: <https://www.fao.org/faolex/results/details/en/c/LEX-FAOC208348/>

<sup>18</sup> National Adaptation Plan of Bangladesh, 2022.

<sup>19</sup> National Adaptation Plan of Bangladesh, 2022.

<sup>20</sup> National Adaptation Plan of Bangladesh, 2022.

salinity-prone regions, quality seeds and understanding of crop flowering patterns and phenology changes, and managing pest infestations – as well as managing for livestock feed and water (during floods, drought, storm, and increases in salinity). For fisheries and aquaculture, managing habitat conditions (such as water temperature and pH dissolved oxygen, disease outbreaks, freshwater, marine and ocean ecosystems, deoxygenation, and ocean acidification) are priority entry points.

- **Water resources:** Critical entry points for the water resources sector are managing land, water and sediment; water related disaster management such as for floods and flash floods, erosion, droughts, salinity intrusion, storm surge inundation, etc.; freshwater flow availability and wetlands ecosystem conservation; desalinization for drinking water purposes; management and restoration; early warning and dissemination.
- **Urban areas:** For urban areas, priority entry points include solving urban drainage problems; the resilience of urban communities, especially the poor and slum dwellers; urban environmental conservation; youth-led urban wetlands management and improvement in human well-being; unplanned urbanization and deforestation; urban heat island effects; the sustainable management of stormwater; urban greens and blue infrastructures; boosting the urban economy; climate-resilient rural and urban infrastructures and communication facilities; climate-stress resistant construction materials; the adequate opening of cross drainage; innovative research on construction materials; setting adaptation standards for critical infrastructure and mainstreaming these into relevant guidelines or policies; stress-tolerant housing, eco-engineering or bioengineering interventions, etc..
- **Cross-cutting priorities:** As a cross-cutting priority sector, climate-resilient WASH technologies and health-care facilities for urban, slum and hard-to-reach areas, the Chattogram Hill Tracts, and coastal and drought prone areas are prioritized as key entry points. Alongside climate change-induced vector or waterborne diseases, research on climate sensitivity of diseases and boosting physical and mental health, well-being, etc., are adaptation entry points for the WASH and health sector.
- **Physical (land- and ecosystem-based) adaptation interventions:** Ecosystem conservation, restoration and biodiversity conservation, nature-based solutions or ecosystem-based adaptation, wetlands and ocean ecosystem conservation, and hill forest and soil conservation as priority physical adaptation interventions. It also focuses on understanding the sensitivity of flora and fauna to climate change and on the conservation of native species, coastal afforestation, deforestation, land degradation, agroecosystem development, and youth-led nature conservation as high-priority entry points for physical adaptation interventions under the ecosystem, wetlands and biodiversity sector.

The inclusion of gender dimensions, youth and the elderly, persons with disabilities, ethnic communities and socially disadvantaged communities in all possible aspects are also core adaptation needs across all sectors and interventions.<sup>21</sup>

Capacity development, research, and innovation are also encouraged across all sectors on matters such as: climate change adaptation, planning processes, adaptive capacities, diversified livelihoods, implementation of nature-based solutions and locally led adaptation, locally-based evidence on climate change risks and vulnerabilities, climate-smart agriculture and livestock livelihoods, climate-resilient fisheries and aquaculture, traditional ecological (& indigenous) knowledge on climate adaptation), nature-based solutions and ecosystem-based adaptation, climate change impacts on systems (land, water, coastal

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<sup>21</sup> National Adaptation Plan of Bangladesh, 2022.

ecosystems), climate and stress-tolerant species (of plants/trees/vegetation), climate-improved infrastructure and improved health measures and WASH technologies, green infrastructure and integrated drainage management.<sup>22</sup>

## 4) Additional Tools for Consideration

### 4.1) Resist-Accept-Direct (RAD) Framework<sup>23</sup>

The Resist-Accept-Direct (RAD) Framework stems from the US National Parks Service and it provides a framework that encourages natural resource managers to consider strategic, forward-looking actions, rather than structure management goals based on past condition.

The Resist-Accept-Direct (RAD) decision framework provides a simple tool that encompasses the entire decision space for responding to ecosystems facing the potential for rapid, irreversible ecological change. It assists managers in making informed, purposeful choices about how to respond to the trajectory of change, and moreover, provides a straightforward approach to support resource managers in collaborating at larger scales across jurisdictions.

### 4.2) UN FAO EX-Ante Carbon Balance Tool<sup>24</sup>

The UN FAO EX-Ante Carbon Balance Tool can be used at future stages of analysis/decision-making. The tool has utility in evaluating greenhouse gas emissions in the land use sector.

The EX-ACT provides a consistent way of estimating and tracking the outcomes of land use change interventions on GHG emissions. EX-ACT covers the entire agricultural sector including Agriculture, Forestry and Other Land Use (AFOLU,) inland and coastal wetlands, fisheries and aquaculture, agricultural inputs and infrastructure. The tool aims at:

- i) identifying the climate mitigation outcomes of land use change interventions (projects, policies and investments) at any stage of their implementation (ex ante, during and ex post) and at any level (local, regional and national);
- ii) supporting countries (public and private sectors) in accessing funds from international financial institutions;
- iii) strengthening the capacities of national and international stakeholders in estimating, monitoring and evaluating progress on emissions reduction goals; and
- iv) support policy makers in integrating climate change mitigation objectives into national strategies and international commitments, such as Nationally Determined Contributions or National Adaptation Plans.

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<sup>22</sup> National Adaptation Plan of Bangladesh, 2022.

<sup>23</sup> <https://www.nps.gov/subjects/climatechange/radframework.htm>

<sup>24</sup> Freely available for download at <https://www.fao.org/in-action/epic/ex-act-tool/suite-of-tools/ex-act/en/>

## Appendix A: Climate stress area coverage and related hazards\*

\*a reproduction of Table 2.1 as depicted in the National Adaptation Plan of Bangladesh.

Climate stress area	Districts	Area (sq. km)	Vulnerable population, 2020 (millions)	Prominence of climate hazards
South-western coastal area and Sundarbans (SWM)	Satkhira, Khulna, Bagherhat, Pirojpur, Barguna, Barisal, Patuakhali, Jhalokhathi, Bhola, Shariatpur, Gopalganj, Jashore, Sundarbans	30,646	13.57	Rainfall variability, river floods, sea-level rise, salinity, tropical cyclone, storm surges, drought, extreme heat waves, extreme cold, riverbank erosion and lightning
South-east and eastern coastal area (SEE)	Noakhali, Feni, Lakshmipur, Chattogram, Cox's Bazar, Chandpur	13,891	10.93	Rainfall variability, river floods, sea-level rise, salinity, tropical cyclone, storm surges, drought, extreme heat waves, extreme cold, riverbank erosion, lightning and landslides
Chattogram Hill Tracts (CHT)	Rangamati, Khagrachari, Bandarban	13,294	1.33	Rainfall variability, flash floods, tropical cyclone, storm surges, drought,

(Note, please proceed to next page for continuation of the reproduced table)

				extreme heat waves, extreme cold, lightning and landslides
Rivers, floodplains, and erosion-prone areas (FPE)	Nilphamari, Kurigram, Lalmonirhat, Gaibandha, Rangpur, Bogura, Sirajganj, Pabna, Rajshahi, Jamalpur, Tangail, Manikganj, Dhaka, Munshiganj, Mymensingh, Sunamganj, Netrokona, Habiganj, Kishorganj, Sylhet, Brahmanbaria, Narsingdi, Narayanganj, Rajbari, Faridpur, Madaripur, Gopalganj, Narail, Sariatpur, Barisal, Patuakhali, Bhola, Jhalokathi, Khulna, Chandpur, Cumilla, Noakhali, Lakshmipur, Cox's Bazar	58,010	12.72	Rainfall variability, river floods, tropical cyclones, tornado, extreme heat waves, extreme cold, riverbank erosion and lightning
Haor and flash floods areas (HFF)	Sunamganj, Netrokona, Habiganj, Kishorganj, Sylhet, Maulvibazar, Brahmanbaria	19,662	4.02	Rainfall variability, flash floods, tropical cyclone, tornado, extreme heat waves, intense cold, riverbank erosion, lightning and landslides
Drought-prone and <b>barind</b> areas (DBA)	Naogaon, Chapai Nawabganj, Rajshahi, Bogura, Joypurhat, Rangpur, Dinajpur, Meherpur, Chudanga, Kushtia, Jashore, Magura, Jhenaidah	21,512	3.85	Rainfall variability, tropical cyclone, tornado drought, extreme heat waves, extreme cold and lightning
Northern, north-western region (NNW)	Panchagarh, Thakurgaon, Nilphamari, Lalmonirhat, Rangpur, Kurigram, Dinajpur	9,917	6.32	Rainfall variability, river floods, flash floods, tropical cyclone, tornado, drought, extreme heat waves, extreme cold, riverbank erosion, lightning and landslides
Chalan beel and low-lying area of the north-western region (CBL)	Pabna, Natore, Sirajganj, Rajshahi, Naogaon	5,027	5.70	Rainfall variability, river floods, , tropical cyclone, tornado,, extreme heat waves, extreme cold, riverbank erosion and lightning
Char and islands (CHI)	Nilphamari, Lalmonirhat, Kurigram, Gaibandha, Sirajganj, Jamalpur, Mymensingh, Manikganj, Munshiganj, Shariatpur, Chandpur, Bhola, Patuakhali, Feni, Noakhali,	3,976	8.51	Rainfall variability, river floods, sea-level rise, salinity, , tropical cyclone, tornado, storm surges, extreme heat waves, extreme cold, river bank erosion, lightning, higher sea surface temperature and ocean acidification

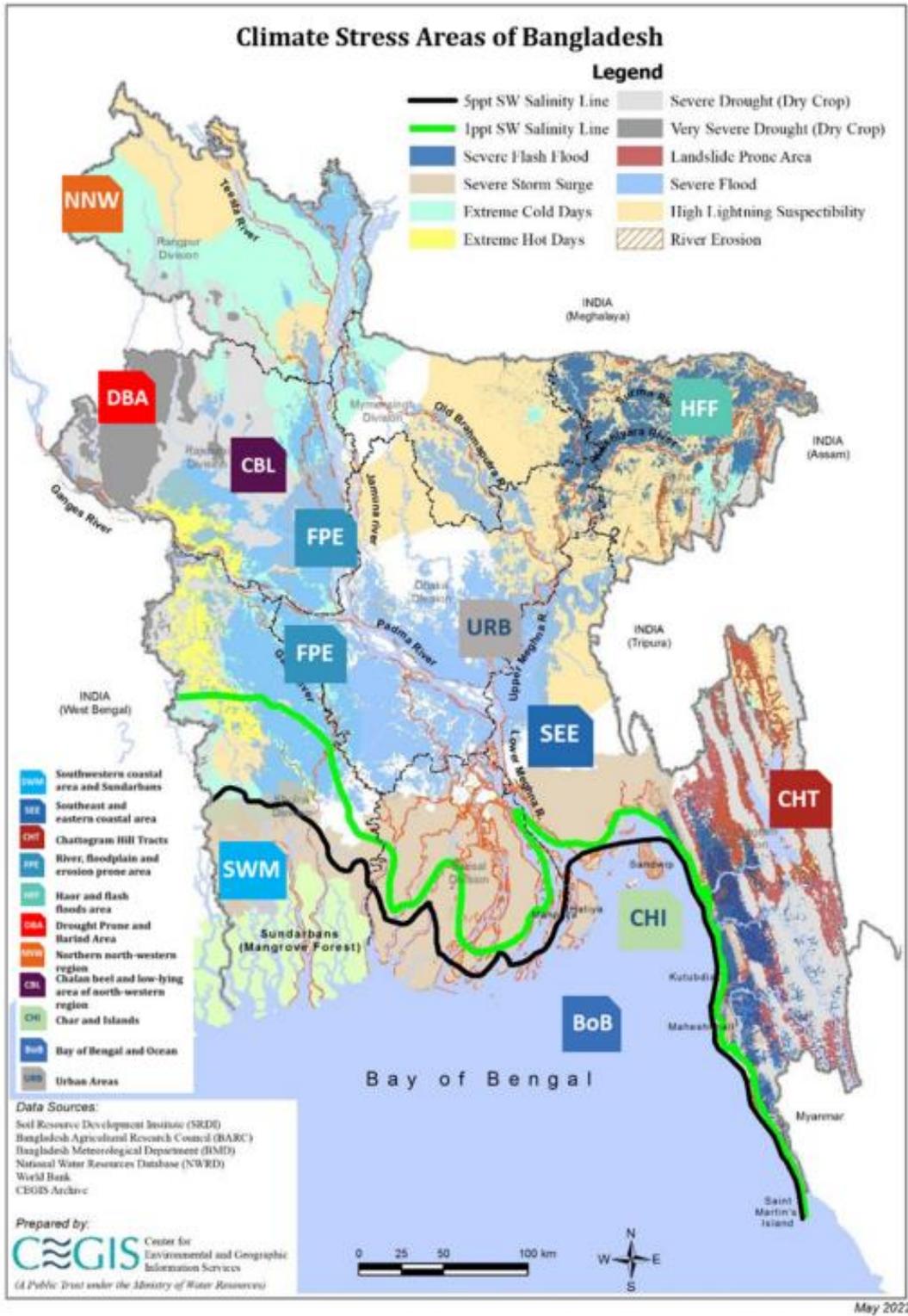
	Lakshmipur, Chattogram, Cox's Bazar			
Bay of Bengal and ocean (BoB)	Bay of Bengal (maritime boundary)	118,813	1.26	Rainfall variability, sea-level rise, tropical cyclone, tornado, storm surges, extreme heat waves, lightning, higher sea surface temperature, hypoxia and ocean acidification
Urban areas (URB)	43 cities	10,600	32.41	Rainfall variability, urban floods, sea- level rise, salinity, tropical cyclone, storm surges, drought, extreme urban heat waves, extreme cold and lightning

*\* The area and population are tentative estimates based on hazard information, climate stress areas and BBS data (BBS, 2022b).*

*\*\*Appendix I presents the alignment of climate stress areas with BDP2100 hotspot areas and hydrologic regions.*

# Appendix B: Map of Climate Stress Areas of Bangladesh\*\*

\*\*a reproduction of the map on page 34 of the National Adaptation Plan of Bangladesh.



## Appendix C: Table of climate stresses and climate stress impact levels relative to climate stress areas in Bangladesh\*\*\*

\*\*\*a reproduction of the table/image on page 35 of the National Adaptation Plan of Bangladesh.

Climate Stress Areas	Climate Stresses													
	Rainfall Variability	River Flood	Flash Flood	Urban Flood	Sea Level Rise	Salinity	Cyclonic Storm Surge	Drought	Erosion	Lightning	Extreme Heat	Extreme Cold	Landslide	SST & Ocean Acidification
SWM	High	Moderate	Moderate		High	High	High	Moderate	High	Moderate	High	Moderate		
SEE	Moderate				High	Moderate	High		High	Moderate	Moderate	High	Moderate	
CHT	High		High		Moderate	Moderate	High	High		High	High	Moderate	High	
FPE	Moderate	High					Moderate		High	Moderate	Moderate	Moderate		
HFF	High		High				Moderate		High	High	Moderate	High	High	
DBA	High						Moderate	High		Moderate	High	Moderate		
CBL	Moderate	High					Moderate		Moderate	Moderate	Moderate	Moderate		
NNW	High	High	High				Moderate	Moderate	High	High	Moderate	High	High	
CHI	Moderate	High			High	High	High		High	Moderate	High	Moderate		Moderate
BoB	Moderate				High	High	High			Moderate	Moderate	Moderate		High
URB	High			High	High	High	High	Moderate		Moderate	High	Moderate		

Note: The left-hand column “climate stress areas” (both abbreviation and coloring) corresponds to those reflected in the table in Appendix A and the map in Appendix B.