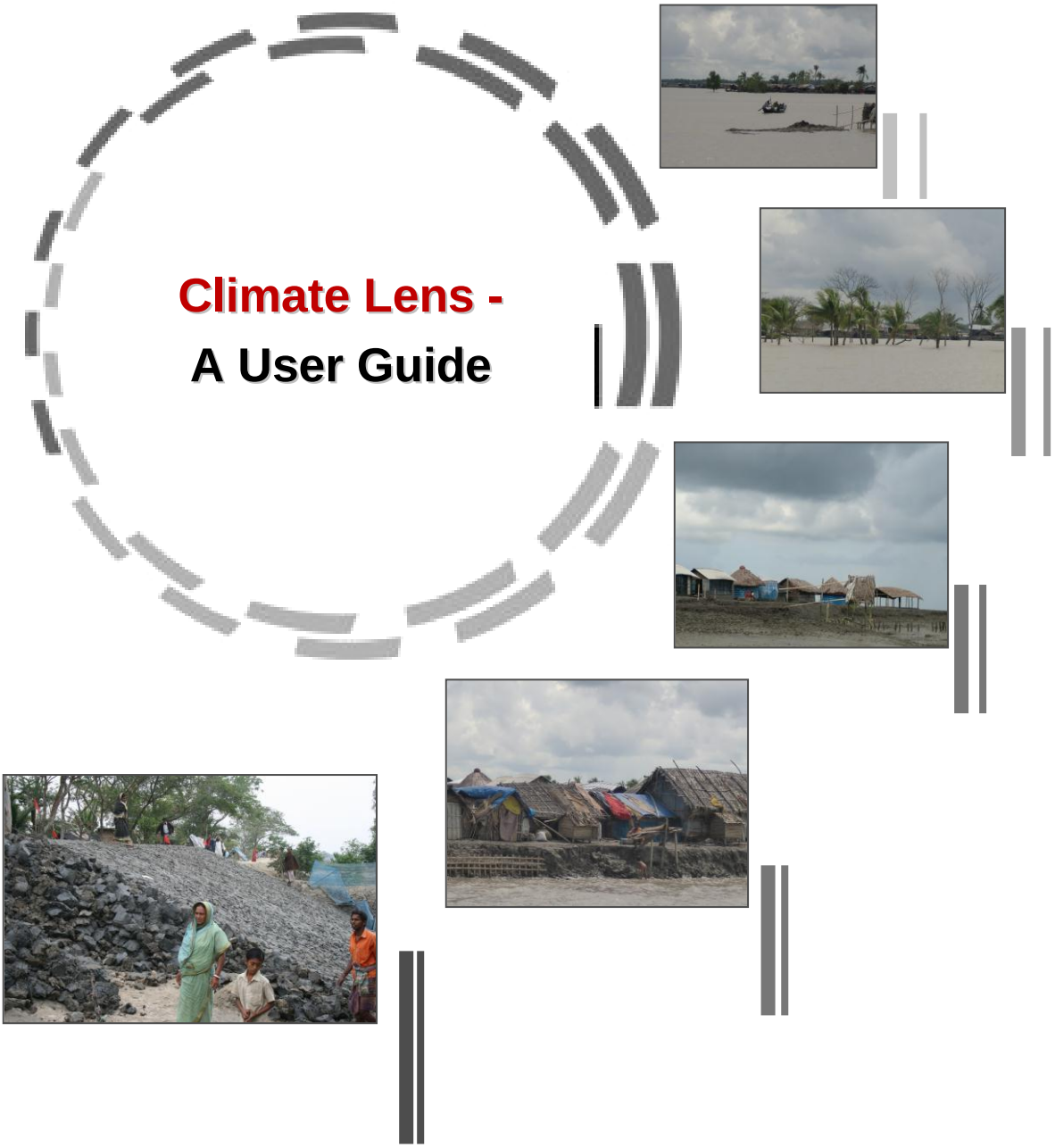
Disaster Management & Relief Division
Ministry of Food and Disaster Management



Climate Lens -
A User Guide

Comprehensive Disaster Management Programme (CDMP II)

CLIMATE LENS -
A USER GUIDE

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Comprehensive Disaster Management Programme (CDMP II)

Climate Lens - A User Guide

1. Background

Bangladesh is recognized as a country of recurring natural and human induced hazards that often result in disasters with a high loss of lives, assets and other resources. Frequent hazards such as floods, cyclones, drought, river bank erosion, water-logging, salinity intrusion significantly disrupt the development efforts of the country. Geographical location of the country, its topography combined with a large population living in the marginalized land has made the country even more vulnerable to natural disasters. At the same time, Bangladesh is one of the countries most at risk from the impacts of climate change.

Community Risk Assessment (CRA), developed in CDMP Phase I, is an effective risk assessment process where community people can participate and provide their ideas in the local development process. Major outcome of the CRA process is the development of Risk Reduction Action Plans (RRAPs). RRAPs are the local plan that includes local risks, vulnerabilities and specific actions to be undertaken.

Sensitizing RRAP with climate change considerations has been an important demand generated from the experience of Phase I. It calls for development of climate lens i.e. climate screening tools that can qualify the RRAPs and ensure that the plans are sensitized with climate change considerations.

1.1 Structure of the Guide

The user guide is consist of,

- Background of the Climate Lens
- Development of the Climate Lens and its use
- Using the Guide
- Useful References

2. The Climate Lens

2.1 Defining climate lens

The 'Climate Lens' is a set of criteria to judge or evaluate the local risk reduction options suggested by the DMCs and vulnerable people within the community, and identified through community risk assessment processes. The lens aims to test whether the suggested options meet the basic environmental concerns, are able to reduce the current and potential threats and risks from climate change, and/or increase community resilience. In preparing the local plan, the climate lens uses a scientific, evidence-based approach by taking into account appropriate data generated through expert modeling.

2.2 Development of the Climate Lens

One of the important requirements of the CRA process is to provide scientific and updated information and data on climate change and relevant areas to the participants. The purpose is that the CRA participants are aware about current and contemporary information and thus are able to use as and wherever required in the exercises and planning in particular. To support the CRA facilitator in this regard, preparation of Climate Lens was initiated.

In developing the Climate Lens, all the available CRA reports prepared by CDMP have been reviewed to identify the most common hazards faced by the communities in local level. Then the climate parameters/climate change impact associated with each hazards were identified. Once done, the predicted future scenario of different climatic parameters and climate change impact were collected from various available sources. As the available predicted future scenarios are only for district level, district profiles were prepared for hazards, associated climate parameters/impact and projected climate scenario.

The Climate lens was then used to revising the existing RRAPs for testing the Climate Lens as well as assess the RRAPs for climate change consideration.

2.3 Purpose

The climate lens user guide is to assist the CRA facilitators to incorporate the climate change considerations in the CRA process and make sure that the RRAPs prepared are climate sensitive. It is intended that that while the plans are executed, the climate change considerations are taken into account and followed accordingly.

In one hand it facilitates sensitizing the community people by instilling understanding of CC in the local context and also ensures incorporation of CC considerations in risk analysis and local plan preparation and eventual execution.

2.4 Scope

The guide is meant to be used by the CRA facilitators for conducting CRA sessions with the community people.

It can be used by CDMP, CDMP partners and other organizations who currently use the CDMP-CRA guide for community risk assessment. It may be relevant to the organizations involved in community based planning and management of natural resources where climate considerations are taken into account.

The guide can be used during the CRA sessions with the community people at the village, union, ward levels especially while RRAP is prepared. It is always applicable to review the RRAP (and similar plan) once prepared from the community assessment to synchronize with the climate considerations.

2.5 Limitation

One of the major limitation of the Climate Lens is that the projection scenarios for most of the climatic parameters as well as impacts are not available that influence the occurrence, intensity of hazards. On the other hand the available projection scenario that have been developed so far is only for the district level, upazila and union level projections are yet been developed.

2.2 Key requirements

2.2.1 Updated climate scenario

One of the important requirements of the CRA process is to provide scientific and updated information and data on climate change and relevant areas to the participants. Updated/contemporary climate and scientific information, data and technologies that can provide ready reference and/or recommendations for consideration and decision during the CRA process and RRAP preparation. As for example updated data and scenario on temperature, rainfall, flood, salinity etc and an approved/released crop variety that can tolerate and be grown in the area of increased risk of salinity.

[N.B Union profile/fact sheet – Union profile/fact sheet for the project unions contains some basic, environmental, climate information as well as demographic, physical data of the particular union. The union profile serves as a package of information and can be used as source of available secondary information in the CRA process and RRAP preparation. Once the union profiles are in hand the information described above might not be needed.]

2.2.2 List of improved, updated technologies and options

During the CRA exercises and plan preparation needs will be generated on various technologies and options. These sorts of needs will mainly be required as adaption options to address the local climate change risks like name of salinity tolerant varieties for saline coastal unions, alternative livelihood options during the flood seasons etc. A list of updated technologies and option menu are will be very handy tools to be used in the exercises.

2.2.3 Local/community knowledge

Lot of local knowledge and experiences are generated during the CRA exercises with the community people that are valuable to take into consideration. These can complement the updated scientific information and at the same time can facilitate decision for planning suitable to the local condition.

3. Step by step instructions for using the guide

3.1 Principles

- Scientific and contemporary information and data are required to use at different steps of CRA in order to complement local knowledge and understanding in order to make an informed decision during the preparation of local level risk reduction plan. Therefore, it is imperative that all these information and data are made available during the exercises.

3.2 Instructions

3.2.1 Preparation prior to the CRA exercises – A number of activities need to be accomplished which are,

- ✓ Collect and compile the secondary information and data relevant to the geographical local and place.
- ✓ Prepare and translate the climate scenario, trends, information and data which could easily be used during the CRA exercises.
- ✓ Prepare the district (and upazila, union profiles) profile incorporating the climate and other meteorological, relevant information. [*Once the union profile/factsheets of project unions are available, it can be used as a ready reference to use during the CRA session and RRAP preparation*].

3.2.2 View the risk statement by climate lens – Risk anticipated by the community is described and stated in the RRAP which is the core problem and the potential threat for the community. The statement itself is the basis of the recommended activities, measures and options of the plan (RRAP). While formulating the risk statement use the updated and contemporary scientific information generated from the model run and other research out puts as formulated in the box as under.

Risk statement proposed in the CRA sessions	**Risk statement reviewed with the climate lens**
In Satkhira, excessive rainfall will damage agricultural crops, earthen road, destroy *Katcha* Houses, washed away fish in pond, cause health problem; flood will inundate crop field, fish pond/gher, spread disases, damage katcha houses, inundate school rooms, cause fodder crisis.	It is predicted that there would be more rainfall during June-September due to climate change which would increase the incident of river erosion, flood, waterlogging. Model laso predicted by 2040, 2.17% more area will be inundated during normal flood. These will resulted in more damage to agricultural crops, earthen road, destroy Katcha Houses, wash away fish, cause fodder crisis, spread diseases and interupt schooling.
In Sirajganj, impending flood may cause damage to the standing crops,	Prediction and scenario on rainfall due to climate change is not available for Sirajganj

fish may go out of ponds, houses may be damaged and people may be forced to leave, water borne diseases may break out, road and embankments may go under water, bridge and culvert may be damaged, over all communication may be disrupted and the sick people and pregnant women may face difficulties to get the health services.	district. However, using the rainfall pattern of closer district Bogra, it is predicted that there would be more rainfall from the month of March to September and 11.12% more area will be inundated due to flood. It will damage crops, fish, earthen road, houses, education institutions, and other infrastructures. Heath services may be disrupted and livestocks may be killed.

3.3.3 Qualifying the plan with climate lens – Activities/interventions identified for implementation need to be finalized based on some CC considerations. The considerations are used as screening tools that qualify the activities and ensure that the activities are climate sensitive following the box below.

Risk reduction options/activities	**CC considerations to improve the options/activities**
• Excavate/re-excavate the rivers, canals and ponds • Build/repair the bridge, culvert and sluice gate according to plan • Build and repair flood control embankment • Raise the plinth height of homestead and compact the pond bank • Raise the road and make concrete • Construct cyclone, flood shelter • Build groyen embankment and cover the river bank with concrete blocks • Introduce and cultivate flood tolerant crops which could be harvested before the onslought of flood • Establish helath center with the public or private support	• Consider future rainfall pattern while exacavating and reexcavating the river, canal and ponds • Consider future rainfall pattern, depth and flow rate of flood water while constructing the culvert and sluice gates • Consider future rainfall pattern, potential flood affected area while raising the plinth level of homestead, education institutions, other institutions, embankment and roads • Consider future rainfall pattern and duration flood while introducing and cultivating new crop varieties

4 Quick references

4.1 Climate lens user matrix (Annex-1)
4.2 District profile (Annex-2)
4.3 Climate (model run) scenario (Annex-3)

Annex-1

CLIMATE LENS USER MATRIX

Geographical area/AEZ/ ecosystem	Community	Climatic hazard	Risk Statement	Impacted sector	Local plan/ Option	Climate Lens screening tools/consideration
Coastal area	Community in general, community at risk in particular	Cyclone, storm and upsurge	Cyclone and upsurge may damage the infrastructure, roads, dams, house, crops, trees, contaminate drinking water source	Agriculture	Introduce new/tolerant variety	▪ Predicted height of the upsurge, period/months and duration of upsurge (merge with the local experience) ▪ Period/days of submergence tolerance of the selected crop varieties
				Infrastructure	Build embankment, roads, house, cyclone shelter, service centers.	▪ Predicted height of the upsurge (merge with the local experience) that may be required to determine the height of the embankment, road, house, cyclone shelter, service centers etc.
				Forest	Tree plantation	▪ Tolerance of the selected tree species to wind speed. ▪ Quality/length of the tap root and height of the saplings
				Health (water and sanitation)	Harvest rain water	▪ Predicted period of the rain/no. of rainy days (merge with the local experience) ▪ Predicted range of high temperature (merge with the local experience) that may have impact on the quality of the water stored in the local container

		Salinity intrusion	Salinity intrusion may damage the crops, fishery, livestock, trees and induce health problems	Agriculture	Introduce new/tolerant variety	▪ Predicted level, extent, period/months and duration of salinity (merge with the local experience) ▪ Level of salinity tolerance of the selected crop variety/ies
				Fishery	Introduce new/tolerant variety	▪ Predicted level, extent, period/months and duration of salinity (merge with the local experience) ▪ Level of salinity tolerance of the fish variety/ies
				Livestock	Introduce new/tolerant species of livestock and new technologies	▪ Level of salinity tolerance of the new species variety/ies ▪ Level of salinity tolerance of the new fodder species variety/ies and technologies
				Infrastructure	Buildings, houses, shelters	▪ Durability/quality of the materials to withstand in the saline area/increased salinity
				Health (water and sanitation)	Harvest rain water	▪ Predicted period of the rain/no. of rainy days (merge with the local experience) ▪ Predicted range of high temperature (merge with the local experience) that may have impact on the quality of the water stored in the local container •

					Build pond sand filter	▪ Predicted range of high temperature (merge with the local experience) that may have impact on the quality of the water stored in the local container ▪ Predicted increment level of salinity in the pond water to be used for filtration
					Install deep tube well	▪ Predicted level and rate of salinity intrusion in the ground water (*if available*)
		Water logging (CC induced?)	Water logging condition may damage crops, houses, reduce the livelihood opportunities	Agriculture	Introduce new/tolerant variety, technologies	▪ Level of stagnancy tolerance of the crop varieties to be introduced ▪ Availability and suitability of technologies for alternative livelihood opportunities
				Livelihood	Introduce alternative livelihood options	▪ Availability and suitability of technologies for alternative livelihood opportunities ▪ Period/months of the year while climate induced hazards impact the livelihood opportunities of the community
				Water	Construct sluice gate and culvert	▪ Predicted rate of the siltation (merge with the local experience) that may have impact on the drainage facility/ congestion and be required to determine the height of the embankment
				Forest	Tree plantation along the embankment	▪ Tolerance of the tree species to salinity, wind and submergence to water
				Infrastructure	House	▪ Height of the house, buildings especially in the low lying area.

Geographical area/AEZ/ ecosystem	**Community**	**Climatic hazard**	**Risk Statement**	**Impacted sector**	**Local plan/ Option**	**Climate Lens/ Criteria (example)**
Flood prone area	Community in general, community at risk in particular	Seasonal/ monsoon flood	Flood may damage the infrastructure, roads, dams, house, crops, induce health problems, increase the river erosion	Agriculture	Introduce new/tolerant variety	▪ Predicted height of the flood water, flood period/months and duration (merge with the local experience) ▪ Period/days of flood submergence tolerance of the selected crop varieties, technologies
				Infrastructure	Build, raise embankment, roads	▪ Predicted height of the flood water (merge with the local experience) that may be required to determine the height of the embankment
					Raise house plinth, killa, bazar	▪ Predicted height of the flood water (merge with the local experience) that may be required to determine the height of the house plinth, killa and bazar
					Shift bazar, community center to a new location	▪ Predicted height of the flood water (merge with the local experience) that may be required to determine the height of the bazar ▪ Predicted extent/area of the particular union/upazila that flood may engulf in next season/year (merge with the local experience) ▪ Predicted rate of river erosion and loss of the area (merge with the local experience)
					Build/improve the flood shelter	▪ Predicted height of the flood water (merge with the local experience) that may be required to determine the height of the shelter, approach/connecting road

				Health (water and sanitation)	Install tube well	▪ Predicted height of the flood water (merge with the local experience) that may be required to determine the height of the tube well
					Raise height of the latrine	▪ Predicted height of the flood water (merge with the local experience) that may be required to determine the height of the latrine
			River erosion may induce land loss, crop loss and damage of institutions, structure	Infrastructure	Relocate the institution, bazar	▪ Early warning, report on the possible duration and days/time for heavy flood that cause erosion in the area, community under consideration ▪ Predicted riverbank erosion scenario of the area/location concerned.

Geographical area/AEZ/ ecosystem	**Community**	**Climatic hazard**	**Risk Statement**	**Impacted sector**	**Local plan/ Option**	**Climate Lens/ Criteria (example)**
Drought prone area, Barind tract	Community in general, community at risk in particular	Seasonal drought/ prolonged drought	Drought may delay crop cultivation, reduce crop yield, induce pest attack, enhance the drinking water crises, reduce the fish, livestock production	Agriculture	Introduce new/tolerant variety	▪ Predicted highest temperature range, drought period/months and duration (merge with the local experience) ▪ Drought, pest tolerance of the selected crop varieties, technologies, pattern ▪ Crop duration that may suit to the short/drought period of the year
					Install deep tube well	▪ Predicted rate of draw down of water, recharge potential and ground water level (merge with the local experience) that may be required to determine the length of the tube/pipe ▪ Potential impact of the uplifting of underground water (current/increased rate)
				Water	Excavate/ re-excavate ponds, water bodies	▪ Predicted period of the rain/no. of rainy days (merge with the local experience) ▪ Quality of the pond soil to retain the water for a longer period ▪ Predicted recharge potential (merged with local experience)
					Build concrete drainage facilities	▪ Range/period of high temperature that accelerate the evaporation of surface water ▪ Quality of soil that allows/restrict the leaching of loss of water
				Fishery	Culture/rare short	▪ Tolerance of fish varieties to high temperature ▪ Suitability of the fish species/varieties to the

					duration fish	drought/shorter period
				Livestock	Rare tolerant livestock, poultry	▪ Tolerance of livestock, poultry varieties to high temperature ▪ Flexibility of the livestock, poultry species/varieties to the available fodder ▪ Suitability of the (new/improved) fodder species to the drought prone area
				Forest	Tree plantation	▪ Tolerance of tree species/varieties to high temperature, drought condition ▪ Productivity of tree species/varieties in high temperature, drought condition

Geographical area/AEZ/ ecosystem	**Community**	**Climatic hazard**	**Risk Statement**	**Impacted sector**	**Local plan/ Option**	**Climate Lens/ Criteria (example)**
Flush flood area	Community in general, community at risk in particular	Seasonal flush flood	Flush flood may damage crop, houses, roads, culvert	Agriculture	Introduce new/tolerant variety	▪ Predicted flush period/months and duration (merge with the local experience) ▪ Submergence tolerance of the selected crop varieties, technologies, pattern ▪ Crop duration that may suit to the short/flush period of the year
				Infrastructure	Raise the house, road, culvert	▪ Predicted flush period/months and duration (merge with the local experience) ▪ Predicted height of the flood water (merge with the local experience) that may be required to determine the height of the house, road, culvert

Geographical area/AEZ/ ecosystem	**Community**	**Climatic hazard**	**Risk Statement**	**Impacted sector**	**Local plan/ Option**	**Climate Lens/ Criteria (example)**
Across the region	Community in general, community at risk in particular	Heavy rainfall	Heavy rainfall may damage crop	Agriculture	Introduce new/tolerant variety	▪ Predicted flush period/months and duration (merge with the local experience) ▪ Tolerance of the selected crop varieties, technologies, pattern to the heavy rainfall
			Heavy rainfall may cause land slide	Infrastructure		▪ Historical background and local experiences of the land slide trend/scenario.

Annex 2: District Profiles

Prediction of Climate Change Parameters/Impact related to Hazard/Disaster

District: Cox's Bazar

Hazard/Disaster	Related Climate Change Parameteres/Impact	Prediction of Climate Change Parameters/Impact	Reference
Excessive Rainfall Hilly Flood	Ranfall (Maximum)	• Predicted Maximum Rainfall by 2030 will be higher during April to July, which will be highest in July, about 11.20 mm/day.	*Generation of PRECIS scenarios for Bangladesh:Validation and Parameterization. CCC-DoE, CDMP.*
Drought	Ranfall (Minimum) Temperature (Maximum)	• Minimum Rainfall by 2030 will be decrese during October to November, which will be lowest in November, about 00.03 mm/day.	
Tornedo	Temperature (Maximum)	• Maximum Temperature by 2030 will be increse during April to June, which will be highest in June, about 32.36^0C.	
Flood River Erosion	Flood	• No Prediction results available for flood	
Water-logging	Flood Excessive Rainfall		
Storm Surge Tidal Surge	Sea Level Rise	• Predicted Sea Level Rise in Bangladesh (Based on IPCC AR4) by 2030 will be 12 cm, which will be 17 & 23 cm in 2040 & 2050 respectively.	*Impact Assessment of Climate Change and Sea Level Rise on Monsoon Flooding, CCC-DoE, CDMP*
Embankment Failure	Sea Level Rise Storm Surge		
Salinity	Sea Level Rise	• There will be no significant change in	*Investigating the Impact of Relative Sea-*

		the salinity situation due to Sea Level Rise.	*Level Rise on Coastal Communities and their Livelihoods in Bangladesh. UK-DEFRA, CEGIS, IWM*
Cyclone	Cyclone Temperature (Maximum)	• Fourth Assessment Report (AR4) of IPCC predicted more frequent and storng cyclone in Bay of Bengal.	*AR4 2007, IPCC.*
Mosquito/Rat attack	Temperature		
Hail Storm		• Not related to Climate Change/no relationship established.	
Elephant attack			
Population increase			
Hill cutting/slide			
Dowry			
Earthquake/Tsunami			

Prediction of Climate Change Parameters/Impact related to Hazard/Disaster: Faridpur District

Hazard/Disaster	Related Climate Change Parameteres/Impact	Prediction of Climate Change Parameters/Impact	Reference
Excessive Rainfall	Ranfall (Maximum)	• Predicted Maximum Rainfall by 2030 will be higher during May to September, which will be highest in July, about 17.87 mm/day.	*Generation of PRECIS scenarios for Bangladesh:Validation and Parameterization. CCC-DoE, CDMP.*
Drought	Ranfall (Minimum) Temperature (Maximum)	• Minimum Rainfall by 2030 will be decrese during October to December, which will be lowest in November-December, about 00.03 mm/day.	
Tornedo Heat Wave	Temperature (Maximum)	Maximum Temperature by 2030 will be higher during March to October, which will be highest in June, about 45.03^{0}C.	
Cold Wave Heavy Mist	Temperature (Minimum)	• Minimum Temperature by 2030 will be decrease during November to February, which will be lowest in December, about 10.81^{0}C.	
Flood River Erosion Water-logging	Flood Excessive Rainfall	• Model predicted that by 2040, 12.47% more area will be inundated (>0.30 m. depth) by normal flood (as flood of 2005).	*Impact Assessment of Climate Change and Sea Level Rise on Monsoon Flooding, CCC-DoE, CDMP*
Cyclone	Cyclone	• Fourth Assessment Report (AR4) of IPCC predicted more frequent and storng cyclone in Bay of Bengal, but no specific prediction for other regions.	

	Temperature (Maximum)		
Rat / Pest attack	Temperature		
Hail Storm/ Thunder Storm		• Not related to Climate Change/no relationship established.	
Fire			
Excessive Iron/ Arsenic in Water			

Prediction of Climate Change Parameters/Impact related to Hazard/Disaster: Lalmonirhat District

Hazard/Disaster	Related Climate Change Parameteres/Impact	Prediction of Climate Change Parameters/Impact	Reference
Excessive Rainfall	Ranfall (Maximum)	• No prediction available for Lalmonirhat; however predicted maximum rainfall of nearby Rangpur district by 2030 will be higher during March to September, which will be highest in July, about 21.50 mm/day.	*Generation of PRECIS scenarios for Bangladesh:Validation and Parameterization. CCC-DoE, CDMP.*
Drought	Ranfall (Minimum) Temperature (Maximum)	• No prediction available for Lalmonirhat; however predicted minimum rainfall of nearby Rangpur district by 2030 will be decrese during October to December, which will be lowest in November, about 00.04 mm/day.	
Tornedo	Temperature (Maximum)	• No prediction available for Lalmonirhat; however predicted maximum temperature of nearby Rangpur district by 2030 will be higher during April to August, which will be highest in June, about 39.58^{0}C.	
Cold Wave	Temperature (Minimum)	• No prediction available for Lalmonirhat; however predicted minimum temperature of nearby Rangpur district by 2030 will be decrease during November to January, which will be lowest in December, about 10.76 ^{0}C.	
Flood River Erosion Water-logging	Flood Excessive Rainfall	• No prediction results available for Lalmonirhat;	
Cyclone	Cyclone	• Fourth Assessment Report (AR4) of IPCC predicted more frequent and storng cyclone in Bay of Bengal, but no specific	

	Temperature (Maximum)	prediction for other regions.	
Pest attack	Temperature		
Hail Storm		• Not related to Climate Change/no relationship established.	
Thunder Storm			
Fire			
Population increase			
Dowry			
Earthquake			

Prediction of Climate Change Parameters/Impact related to Hazard/Disaster: Rajshahi District

Hazard/Disaster	Related Climate Change Parameteres/Impact	Prediction of Climate Change Parameters/Impact	Reference
Excessive Rainfall	Ranfall (Maximum)	• Predicted Maximum Rainfall by 2030 will be higher during May to September, which will be highest in July, about 18.66 mm/day.	*Generation of PRECIS scenarios for Bangladesh:Validation and Parameterization. CCC-DoE, CDMP.*
Drought	Ranfall (Minimum) Temperature (Maximum)	• Minimum Rainfall by 2030 will be decrese during October to November, which will be lowest in November, about 00.01 mm/day.	
Tornedo Heat Wave	Temperature (Maximum)	• Maximum Temperature by 2030 will be higher during March to August, which will be highest in June, about 44.46^0C.	
Cold Wave Heavy Mist	Temperature (Minimum)	• Minimum Temperature by 2030 will be less during November to January, which will be lowest in December, about 11.81^0C.	
Flood River Erosion Embankment Failure Water-logging	Flood Excessive Rainfall	• No Model Prediction Results avilable	
Cyclone	Cyclone	• Fourth Assessment Report (AR4) of IPCC predicted more frequent and storng cyclone in Bay of Bengal, but no specific prediction for other regions.	

	Temperature (Maximum)		
Pest/Rat attack	Temperature		
Hail Storm		• Not related to Climate Change/no relationship established.	
Fire			
Arsenic			

Prediction of Climate Change Parameters/Impact related to Hazard/Disaster: Satkhira District

Hazard/Disaster	Related Climate Change Parameteres/Impact	Prediction of Climate Change Parameters/Impact	Reference
Excessive Rainfall	Ranfall (Maximum)	• Predicted Maximum Rainfall by 2030 will be higher during July to September, which will be highest in July, about 16 mm/day.	*Generation of PRECIS scenarios for Bangladesh:Validation and Parameterization. CCC-DoE, CDMP.*
Drought	Ranfall (Minimum) Temperature (Maximum)	• Minimum Rainfall by 2030 will be decrese during October to December, which will be lowest in November, about 00.01 mm/day.	
Tornedo Heat Wave	Temperature (Maximum)	• Maximum Temperature by 2030 will be higher during March to October, which will be highest in June, about 46.24.36^{0}C.	
Cold Wave Heavy Mist	Temperature (Minimum)	• Minimum Temperature by 2030 will be decrease during November to January, which will be lowest in December, about 10.74^{0}C.	
Flood River Erosion Water-logging	Flood Excessive Rainfall	• Model predicted that by 2040, 2.17% more area will be inundated (>0.30 m. depth) by normal flood (as flood of 2005).	*Impact Assessment of Climate Change and Sea Level Rise on Monsoon Flooding, CCC-DoE, CDMP*
Storm Surge	Sea Level Rise	• Predicted Sea Level Rise in Bangladesh (Based on IPCC AR4) by 2030 will be 12 cm, which will be 17 & 23 cm in 2040 & 2050 respectively.	
Salinity	Sea Level Rise	• By 2050, salinity level in the lower part of Satkhira will be increase due to Sea Level Rise,	*Investigating the Impact of Relative Sea-Level Rise on Coastal*

		which will be upto 10-15 ppt during monsoon period and upto 16-20 ppt during dry season.	*Communities and their Livelihoods in Bangladesh. UK-DEFRA, CEGIS, IWM*
Cyclone	Cyclone Temperature (Maximum)	• Fourth Assessment Report (AR4) of IPCC predicted more frequent and storng cyclone in Bay of Bengal, but no specific prediction for other regions.	
Pest/Rat attack	Temperature		
Diarrhea/Cholera/ Malaria/Chickenpox/ Ham			
Shrimp Virus			
Hail/Thunder Storm		• Not related to Climate Change/no relationship established.	
Arsenic			
Dowry			
Earthquake			

Prediction of Climate Change Parameters/Impact related to Hazard/Disaster: Sirajganj District

Hazard/Disaster	Related Climate Change Parameteres/Impact	Prediction of Climate Change Parameters/Impact	Reference
Excessive Rainfall	Ranfall (Maximum)	• No prediction available for Sirajganj; however predicted maximum rainfall of nearby Bagura district by 2030 will be higher during March to September, which will be highest in July, about 20.95 mm/day.	*Generation of PRECIS scenarios for Bangladesh: Validation and Parameterization. CCC-DoE, CDMP.*
Drought	Ranfall (Minimum) Temperature (Maximum)	• No prediction available for Sirajganj; however predicted minimum rainfall of nearby Bagura district by 2030 will be less during October to December, which will be lowest in November (about zero).	
Tornedo	Temperature (Maximum)	• No prediction available for Sirajganj; however predicted maximum temperature of nearby Bagura district by 2030 will be higher during April to August, which will be highest in June, about 42.91^{0}C.	
Cold Wave Heavy Mist	Temperature (Minimum)	• No prediction available for Sirajganj; however predicted minimum temperature of nearby Bagura district by 2030 will be less during November to January, which will be lowest in December, about 11.26 ^{0}C.	
Flood River Erosion Water-logging	Flood Excessive Rainfall	• Model predicted that by 2040, 11.22% more area will be inundated (>0.30 m. depth) by normal flood (as flood of 2005).	*Impact Assessment of Climate Change and Sea Level Rise on Monsoon Flooding, CCC-DoE, CDMP*
Pest/Rat attack	Temperature		

Hail Storm/ Thunder Storm		• Not related to Climate Change/no relationship established.	
Fire			
Arsenic			

Prediction of Climate Change Parameters/Impact related to Hazard/Disaster: Sunamganj District

Hazard/Disaster	Related Climate Change Parameteres/Impact	Prediction of Climate Change Parameters/Impact	Reference
Excessive Rainfall Hilly Flood	Ranfall (Maximum)	• No prediction available for Sunamganj; however predicted maximum rainfall of nearby Sylhet district by 2030 will be higher during March to July, which will be highest in May, about 43.03 mm/day.	*Generation of PRECIS scenarios for Bangladesh:Validation and Parameterization. CCC-DoE, CDMP.*
Drought	Ranfall (Minimum) Temperature (Maximum)	• No prediction available for Sunamganj; however predicted minimum rainfall of nearby Sylhet district by 2030 will be less during October to December, which will be lowest in November, about 0.05 mm/day.	
Tornedo	Temperature (Maximum)	• No prediction available for Sunamganj; however predicted maximum temperature of nearby Sylhet district by 2030 will be higher during June to October, which will be highest in June, about 37.79^0C.	
Cold Wave Heavy Mist	Temperature (Minimum)	• No prediction available for Sunamganj; however predicted minimum temperature of nearby Sylhet district by 2030 will be less during November to January, which will be lowest in December, about 11.66^0C.	
Flood River Erosion	Flood	• Model predicted that by 2040, 4.37% more area will be inundated (>0.30 m. depth) by normal	*Impact Assessment of Climate Change and Sea Level Rise on*

Water-logging	Excessive Rainfall	flood (as flood of 2005).	*Monsoon Flooding, CCC-DoE, CDMP*
Flash Flood	Heavy Rainfall in short duration at upstream	• No prediction available	
Embankment Failure	Flood (Normal, Flash, Hilly)		
Cyclone	Cyclone Temperature (Maximum)	• Fourth Assessment Report (AR4) of IPCC predicted more frequent and storng cyclone in Bay of Bengal, but no specific prediction for other regions.	
Pest/Rat attack	Temperature		
Hail /Thunder Storm		• Not related to Climate Change/no relationship established.	
Arsenic			
Earthquake			

Annex-3: Model generated flood inundation projection (Ref. CCC, 2009a)

District	Area (Km^2)	Inundated area (>= 0.3m) (km^2)		
		Average Flood 2005	Climate Change Condition	% increase due to Climate Change
Faridpur	2072.72	643.3	723.5	12.47
Sirajganj	2497.92	1536.8	1709.2	11.21
Sunamganj	3669.58	2722.0	2841.0	4.37
Satkhira	3858.33	2358.3	2409.5	2.17
Barisal	2790.51	1802.9	1946.8	8.00
Gaibandha	2179.27	999.0	1129.8	13.09
Pabna	2371.50	1386.9	1613.3	16.33

PRECIS generated Rainfall (mm/d) scenario in 2030 (Ref. CCC, 2009b)

District	**2030 m1**	**2030 m2**	**2030 m3**	**2030 m4**	**2030 m5**	**2030 m6**	**2030 m7**	**2030 m8**	**2030 m9**	**2030 m10**	**2030 m11**	**2030 m12**
Barisal	0.25	0.90	1.24	2.55	2.89	2.52	18.39	5.67	4.81	0.19	0.00	0.03
Bhola	0.25	0.82	1.80	3.05	3.47	2.19	19.09	4.84	3.60	0.23	0.00	0.04
Bogra	1.16	2.61	4.06	4.41	10.57	4.23	20.95	6.90	8.87	0.15	0.00	0.06
Chandpur	0.39	0.97	1.66	3.21	4.54	2.37	17.40	4.32	4.80	0.19	0.00	0.02
Chittagong	0.31	0.51	1.67	4.49	5.96	1.56	15.43	3.00	0.76	0.06	0.02	0.10
Comilla	0.95	1.12	3.98	4.62	5.58	2.70	20.41	4.88	4.69	0.32	0.01	0.04
Coxbazar	0.39	0.37	0.80	4.03	3.83	1.32	11.20	1.00	0.39	0.22	0.03	0.07
Dhaka	2.11	1.62	3.52	4.85	9.57	3.00	21.98	5.99	9.34	0.23	0.02	0.03
Dinajpur	0.66	1.03	5.27	3.51	9.23	4.49	22.39	7.96	8.17	0.31	0.03	0.07
Faridpur	1.05	1.20	1.87	2.47	5.28	2.24	17.87	6.24	7.50	0.20	0.03	0.03
Feni	0.35	1.09	3.07	5.58	6.67	2.42	22.50	5.73	3.40	0.19	0.03	0.07

Hatiya	0.31	0.87	3.15	4.82	3.78	2.19	19.13	2.53	1.58	0.08	0.00	0.05
Ishurdi	1.58	3.77	2.08	1.77	5.00	2.96	18.53	6.65	8.66	0.08	0.03	0.02
Jessore	0.50	0.92	1.02	1.64	2.43	2.33	17.58	6.10	5.79	0.22	0.02	0.02
Khepupara	0.24	0.57	1.39	2.56	1.82	2.77	18.80	6.32	3.68	0.18	0.00	0.06
Khulna	0.29	0.84	0.66	1.17	1.45	2.39	16.94	6.90	5.03	0.23	0.00	0.02
Kutubdia	0.39	0.43	1.04	3.85	4.71	1.11	12.13	1.49	0.55	0.17	0.02	0.08
M'court	0.35	1.10	3.00	4.25	4.98	2.66	22.96	5.22	3.78	0.27	0.00	0.02
Madaripur	0.45	1.04	1.45	3.22	4.16	2.38	18.73	5.13	6.44	0.18	0.01	0.02
Mongla	0.29	0.84	0.66	1.17	1.45	2.39	16.94	6.90	5.03	0.23	0.00	0.02
Mymensingh	1.10	1.21	10.27	13.08	19.44	5.10	23.03	5.44	7.92	0.28	0.03	0.07
Patuakhali	0.24	0.57	1.39	2.56	1.82	2.77	18.80	6.32	3.68	0.18	0.00	0.06
Rajshahi	1.48	4.94	2.36	2.40	6.35	3.16	18.66	7.21	8.63	0.04	0.01	0.03
Rangamati	0.45	0.82	1.26	2.86	5.56	2.34	11.47	5.11	2.84	0.29	0.01	0.03
Rangpur	0.65	0.80	8.08	5.79	13.07	5.77	21.50	7.53	8.96	0.38	0.04	0.09
Sandwip	0.32	0.93	3.24	8.03	5.65	2.02	19.12	3.18	1.64	0.12	0.01	0.10
Satkhira	0.38	1.13	0.73	1.06	1.05	2.42	15.98	8.19	4.70	0.27	0.01	0.02
Sitakunda	0.90	1.33	3.96	5.05	7.01	3.40	21.12	6.04	4.35	0.27	0.04	0.11
Srimongal	1.56	1.40	8.83	9.74	13.20	3.43	17.87	5.25	5.76	0.41	0.03	0.11
Syedpur	0.66	1.03	5.27	3.51	9.23	4.49	22.39	7.96	8.17	0.31	0.03	0.07
Sylhet	1.48	2.95	24.58	38.51	43.03	7.52	32.82	10.62	9.11	0.65	0.05	0.06
Tangail	1.53	2.49	3.59	4.70	10.29	3.91	19.11	5.38	8.77	0.19	0.02	0.05
Teknaf	0.21	0.33	0.80	3.55	5.79	2.14	16.95	3.87	0.69	0.30	0.02	0.03
Country	0.70	1.29	3.57	5.09	7.24	2.99	19.04	5.63	5.22	0.23	0.02	0.05
Normal	**0.51**	**0.66**	**1.74**	**4.70**	**9.32**	**16.48**	**17.39**	**13.39**	**10.01**	**4.96**	**1.28**	**0.25**

PRECIS generated Maximum Temperature (^{0}C) scenario in 2030 (Ref. CCC, 2009b)

	2030	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**
	m1	**m2**	**m3**	**m4**	**m5**	**m6**	**m7**	**m8**	**m9**	**m10**	**m11**	**m12**

Barisal	24.50	28.11	31.49	33.48	35.77	42.17	30.97	33.23	33.83	35.81	29.85	25.79
Bhola	24.29	27.82	30.69	32.04	34.05	39.72	30.63	32.71	33.23	35.20	30.00	25.64
Bogra	22.97	26.99	32.83	39.39	37.63	42.91	31.03	34.45	32.13	33.33	27.94	24.76
Chandpur	24.42	28.20	31.56	33.70	35.16	41.84	31.13	34.27	34.19	36.03	30.25	25.76
Chittagong	24.99	28.81	31.94	32.93	33.70	39.91	30.08	34.04	33.99	36.17	31.60	26.20
Comilla	24.07	27.92	30.75	32.83	34.03	41.89	30.49	34.29	34.08	35.59	29.87	25.51
Coxbazar	23.62	26.23	28.63	30.16	30.72	32.36	29.10	29.26	28.97	29.28	27.46	24.88
Dhaka	23.01	27.31	31.94	36.59	37.10	43.60	30.71	34.36	33.38	35.16	29.09	24.68
Dinajpur	23.64	27.75	31.15	36.02	33.17	40.09	30.93	33.87	31.09	31.67	27.28	25.16
Faridpur	23.78	28.07	33.71	38.62	39.51	45.03	31.60	34.54	34.05	35.39	28.93	25.12
Feni	24.87	28.25	30.50	31.64	32.47	40.99	29.60	33.70	33.97	35.82	30.50	26.03
Hatiya	23.52	26.50	29.10	30.49	31.46	35.05	29.61	30.88	30.79	31.77	28.31	24.91
Ishurdi	23.75	27.82	35.64	42.33	42.19	45.54	31.71	33.99	33.37	34.15	28.08	24.92
Jessore	24.36	28.55	34.69	39.31	40.98	45.89	32.08	33.75	34.24	35.35	28.56	25.34
Khepupara	24.59	27.96	30.88	32.36	35.01	40.66	30.89	32.48	33.37	35.53	30.06	25.91
Khulna	24.78	28.53	33.63	37.48	40.00	45.35	32.12	33.30	34.30	35.45	28.80	25.78
Kutubdia	24.09	27.35	30.33	31.61	32.28	36.06	29.69	31.72	31.34	32.63	29.34	25.33
M'court	24.54	28.08	30.63	31.93	33.33	40.50	30.24	33.88	34.10	35.92	30.26	25.82
Madaripur	24.22	28.06	32.18	35.06	36.56	43.26	31.21	34.03	34.03	35.70	29.62	25.52
Mongla	24.78	28.53	33.63	37.48	40.00	45.35	32.12	33.30	34.30	35.45	28.80	25.78
Mymensingh	22.23	25.88	29.11	32.50	32.97	40.74	29.66	34.14	31.63	34.35	29.10	23.98
Patuakhali	24.59	27.96	30.88	32.36	35.01	40.66	30.89	32.48	33.37	35.53	30.06	25.91
Rajshahi	23.49	27.05	34.56	41.89	40.53	44.46	31.28	33.93	32.54	32.92	28.05	25.32
Rangamati	25.08	28.69	31.24	32.80	33.87	40.76	28.88	33.50	33.87	34.97	31.35	26.69
Rangpur	23.34	27.50	30.60	34.68	32.69	39.58	31.01	34.27	31.12	32.20	27.77	25.03
Sandwip	23.54	26.55	29.19	30.62	31.30	35.95	29.39	31.00	30.86	31.74	28.24	24.91
Satkhira	24.75	28.77	34.82	39.16	41.59	46.24	32.39	33.04	34.25	35.13	28.40	25.57

Sitakunda	24.13	27.82	30.11	31.75	32.45	41.28	29.38	33.66	33.31	35.01	29.74	25.46
Srimongal	23.22	27.12	30.03	32.23	32.81	41.89	30.18	34.45	32.82	35.38	30.23	25.23
Syedpur	23.64	27.75	31.15	36.02	33.17	40.09	30.93	33.87	31.09	31.67	27.28	25.16
Sylhet	21.95	24.76	26.59	28.00	29.13	37.79	28.19	31.77	29.70	32.53	29.66	24.60
Tangail	22.87	27.15	32.79	38.99	38.46	43.83	31.08	34.90	32.91	34.68	28.60	24.59
Teknaf	25.05	28.10	30.06	30.97	31.88	34.81	28.66	30.65	32.26	32.68	29.80	26.57
Country	23.96	27.63	31.43	34.47	35.18	41.10	30.54	33.27	32.80	34.25	29.18	25.39
Normal	**25.67**	**28.07**	**31.63**	**33.07**	**32.74**	**31.43**	**30.79**	**31.04**	**31.35**	**31.03**	**29.12**	**26.24**

PRECIS generated Minimum Temperature (^{o}C) scenario in 2030 (Ref. CCC, 2009b)

	2030	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**
	m1	**m2**	**m3**	**m4**	**m5**	**m6**	**m7**	**m8**	**m9**	**m10**	**m11**	**m12**
Barisal	12.85	18.22	24.01	27.25	28.43	30.51	27.97	26.88	25.89	24.02	15.68	10.91
Bhola	13.66	18.59	24.40	27.44	28.50	30.55	27.98	27.11	26.18	24.52	16.97	12.35
Bogra	11.88	16.00	23.59	26.86	27.92	31.53	27.89	27.49	26.35	20.99	13.56	11.26
Chandpur	12.27	17.80	23.98	27.33	28.29	30.56	28.04	27.14	26.31	23.87	15.86	10.75
Chittagong	10.97	17.05	22.43	26.53	27.97	30.35	27.62	27.24	26.59	24.96	17.63	11.66
Comilla	11.92	17.12	23.37	26.74	27.60	30.09	27.59	26.70	25.91	22.56	14.90	10.42
Coxbazar	19.92	22.99	26.38	28.61	29.37	30.55	28.24	27.99	27.21	26.78	24.23	21.37
Dhaka	12.29	17.24	23.77	27.09	28.02	30.79	27.94	27.15	26.36	22.88	15.30	11.09
Dinajpur	11.41	15.40	22.56	24.40	25.47	29.36	27.49	27.59	25.96	20.06	12.34	10.56
Faridpur	12.72	17.77	24.33	27.66	28.86	31.29	28.34	27.37	26.65	23.08	15.05	10.81
Feni	11.57	16.88	23.05	26.41	27.36	29.72	27.21	26.39	25.64	22.73	15.52	10.86
Hatiya	15.93	20.43	25.59	28.22	28.91	30.63	28.14	27.66	26.80	25.31	19.83	16.11
Ishurdi	12.44	16.76	24.12	27.75	29.50	32.27	28.34	27.32	26.73	21.81	14.30	11.39

Jessore	13.07	18.13	24.55	27.80	29.22	31.33	28.33	27.15	26.45	22.97	14.64	10.43
Khepupara	13.18	18.33	24.07	27.15	28.60	30.55	27.93	26.83	25.73	24.13	15.31	11.50
Khulna	13.51	18.73	24.62	27.77	29.13	31.13	28.24	27.08	26.21	23.08	14.64	10.65
Kutubdia	14.92	19.66	24.53	27.72	28.75	30.50	27.94	27.65	26.81	25.69	20.28	15.75
M'court	11.59	17.09	23.51	26.91	27.76	30.07	27.52	26.66	25.88	23.06	15.11	10.18
Madaripur	12.43	17.95	24.03	27.35	28.39	30.62	28.07	27.05	26.22	23.74	15.63	10.66
Mongla	13.51	18.73	24.62	27.77	29.13	31.13	28.24	27.08	26.21	23.08	14.64	10.65
Mymensingh	12.54	16.63	22.61	25.88	26.77	29.82	27.20	26.99	25.76	21.83	15.43	11.77
Patuakhali	13.18	18.33	24.07	27.15	28.60	30.55	27.93	26.83	25.73	24.13	15.31	11.50
Rajshahi	11.93	16.02	23.66	27.34	28.96	32.13	28.14	27.28	26.49	20.93	13.83	11.81
Rangamati	11.14	16.13	21.13	25.03	26.32	29.07	26.49	25.76	24.98	22.33	16.14	11.81
Rangpur	11.42	15.35	22.52	24.60	25.56	29.06	27.52	27.70	25.93	20.30	12.63	10.76
Sandwip	15.39	19.94	25.21	27.91	28.66	30.33	27.76	27.35	26.55	24.89	19.51	15.77
Satkhira	13.68	18.65	24.69	27.84	29.40	31.55	28.37	27.05	26.32	22.91	14.49	10.74
Sitakunda	12.16	16.99	22.67	26.00	26.84	29.50	27.08	26.23	25.43	22.08	15.51	11.53
Srimongal	11.79	16.54	22.72	26.08	27.04	30.27	27.65	27.13	25.88	22.03	14.77	11.13
Syedpur	11.41	15.40	22.56	24.40	25.47	29.36	27.49	27.59	25.96	20.06	12.34	10.56
Sylhet	12.04	16.03	21.11	24.30	25.20	28.48	26.45	26.16	24.78	21.03	15.28	11.66
Tangail	12.25	16.77	23.84	27.31	28.37	31.54	28.05	27.52	26.58	21.91	14.20	10.98
Teknaf	14.20	18.11	22.58	26.26	27.45	29.11	26.75	26.34	26.06	25.30	20.04	15.23
Country	12.88	17.63	23.66	26.81	27.93	30.43	27.76	27.07	26.14	23.00	15.78	11.96
Normal	**13.07**	**15.11**	**19.61**	**23.17**	**24.44**	**25.41**	**25.46**	**25.53**	**25.29**	**23.40**	**18.86**	**14.20**

Model generated predicted Salinity intrusion scenario in monsoon season (Ref. DEFRA, 2007)

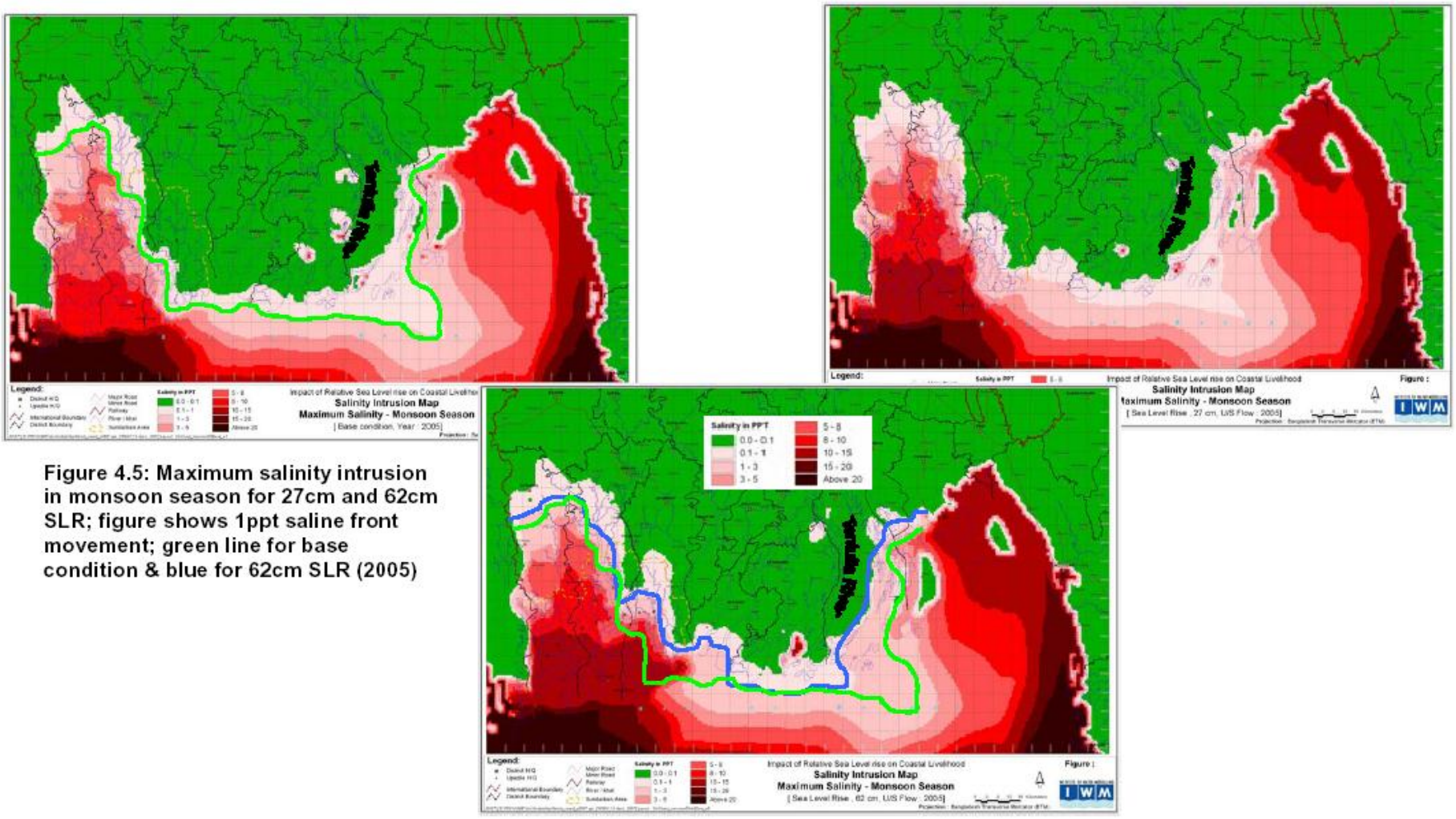

Figure 4.5: Maximum salinity intrusion in monsoon season for 27cm and 62cm SLR; figure shows 1ppt saline front movement; green line for base condition & blue for 62cm SLR (2005)

Model generated predicted Salinity intrusion scenario in dry season (Ref. DEFRA 2007)

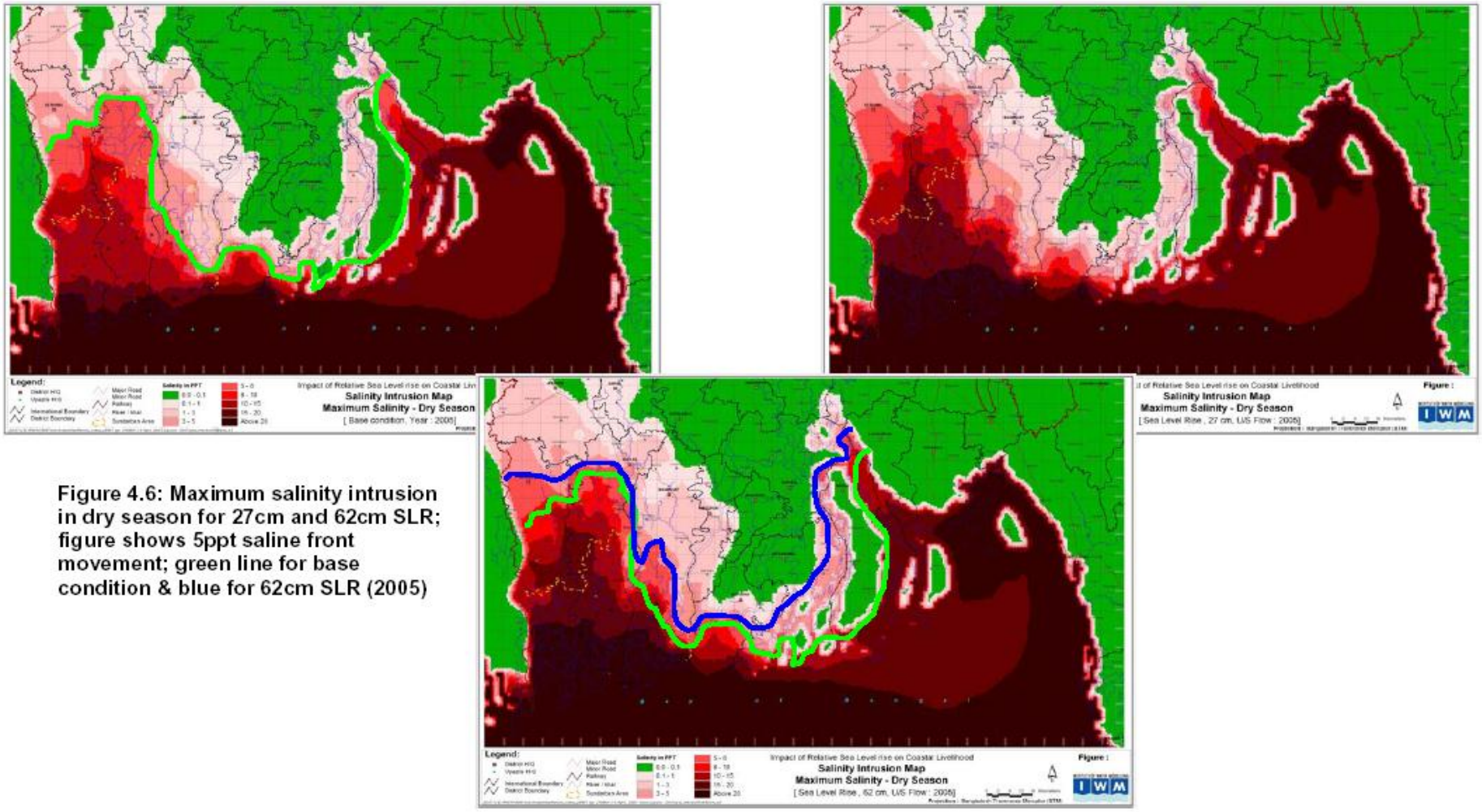

Figure 4.6: Maximum salinity intrusion in dry season for 27cm and 62cm SLR; figure shows 5ppt saline front movement; green line for base condition & blue for 62cm SLR (2005)