LoGIC Project

Local Government Initiative on Climate Change (LoGIC) Project

Climate Risk and Vulnerability Assessment

10 Upazilas of Rangamati and Bandarban Districts

with support from

EMBASSY OF DENMARK

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Content

Climate Risk and Vulnerability Assessment:

Climate Risk and Vulnerability Assessment: Bandarban Sadar Upazila

1. Introduction

The Chittagong Hill Tracts (CHT), like many other regions in Bangladesh, is facing the challenges of climate change which include erratic rainfall patterns, heavy rainfall leading to landslides, drought, and flash floods. Bandarban Sadar Upazila, situated in the Bandarban district within the CHT, is experiencing the adverse effects of climate change, which will intensify the vulnerability of the local population. Changes in weather patterns can affect agricultural productivity, water availability, and the overall well-being of the communities residing in Bandarban Sadar Upazila.

2. Brief About Bandarban Sadar Upazila

Location: 21.55 to 22.22 North Latitude and 92.08 to 92.22 East Longitude

Total Area: 495.35 sq km

Population: 68693 people (Male: 39,026; Female: 29,667)

Source: (GoB, 2024a).

Figure 1: Location of Bandarban Sadar Upazila

3. Existing Vulnerability of the Upazila

As per MJF (2020), people living across the CHT (including Bandarban Sadar) over the last several years have been experiencing:

- Shortened winter season,
- Rising temperature in summer,
- uneven seasonal change
- Increased thunderstorm

Climate Vulnerability Index of Bandarban Sadar Upazila
Moderate (0.54)

Source: (LoGIC and LGD, 2024)

Table 1: Existing Vulnerability of Bandarban Sadar Upazila for different types of hazards/ Climate stresses

Hazard	Cyclone	Flash Flood	Heat wave	Cold Wave	Storm Surge	Max Rainfall (Observed)	Kharif Drought	Pre-kharif Drought	Landslide
Vulnerability Index	Very High	No risk	Very Low	Low	Low	Very Low	Very high	Very high	Moderate
Source	(BUET, 2020)						(ADB, 2021)		

4. Projection of Climate Change and Future Vulnerabilities

4.1 Projected Changes in Climate Parameters

Different studies show that the climate situations are likely to aggravate in the future. The projected changes in climate parameters for Bandarban Sadar obtained by BUET (2020) show that there will be a rise in maximum and minimum temperature in all seasons; while rainfall and number of rainy days show erratic pattern.

Table 2: Projected Changes in Climate Parameters under RCP 4.5

Timeline/ Season[1]	Parameter	Pre-monsoon	Monsoon	Post-monsoon	Winter
2030	Maximum Temperature	1.1°C ↑	1.0°C ↑	1.1°C ↑	1.3 °C ↑
	Minimum Temperature	0.9 °C ↑	1.0 °C ↑	0.5 °C ↑	0.9 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↓
	Number of Rainy Days	10% ↓	10% ↕	10% ↓	10% ↕
2050	Maximum Temperature	1.6°C ↑	1.4°C ↑	1.6°C ↑	1.3°C↑
	Minimum Temperature	1.6 °C ↑	1.4 °C ↑	1.7 °C ↑	1.5 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10% ↓
	Number of Rainy Days	10% ↕	10% ↕	10% ↓	10% ↑
2070	Maximum Temperature	1.9°C ↑	1.4°C ↑	1.8°C ↑	2.2 °C ↑
	Minimum Temperature	1.7°C ↑	1.8 °C ↑	2.3°C ↑	2.1°C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↑	10%↓
	Number of rainy Days	10% ↓	10% ↑	10% ↓	10%↓

Note: Base period considered as 1970-2000

4.2 Projected Impact due to Climate Change

Rainfall variability, flash flood, cyclonic storm surge, drought, lightning, extreme heat and landslide already pose high impact in CHT and projected climate change are likely to aggravate the risk and impact (MoEFCC, 2022). The domino effect of projected climate change, as described in various studies, are briefly mentioned below:

- **Affecting a balanced water supply** due to change in rainfall pattern (Chakma, 2023).
- **More risk in terms of water supply for agriculture** due to ratio of precipitation (P) to potential evapotranspiration (PET) being less than 1 and unfavorable changes in Standard Precipitation Index (SPI) as shown in Figure 2 (BUET, 2020) - leading to **decline in agricultural yield.**
- **Reduced access to clean water** for residents (Chakma, 2023) [1]

1 There are four prominent climatic seasons in Bangladesh: winter (December – February), pre-monsoon (March-May), monsoon (June–September) and post-monsoon (October–November) (MJF, 2020).

- **Increased occurrence of thunderstorms**, leading to more violent storms, more lightning strikes due to rising temperature (Kirsty McCabe, 2023) – causing more casualties

- **Increased incident of Flash Flood and land slide** causing environmental degradation, destruction of infrastructure hampers communication, disrupts crop sales, and hinders access to essential services (Chakma, 2023)

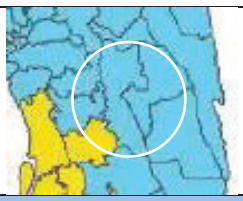
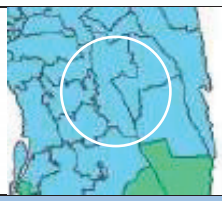
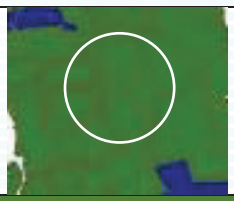
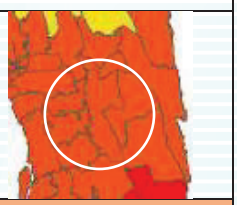
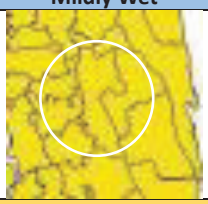
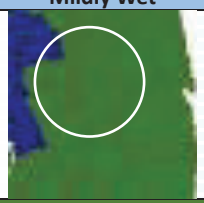
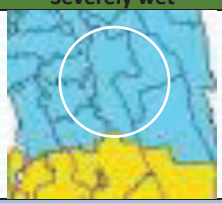
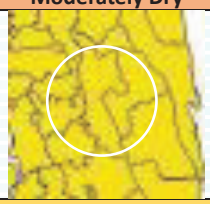
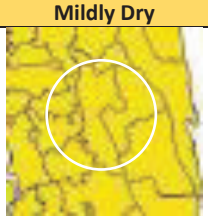
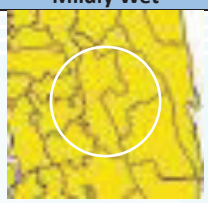
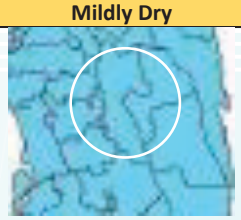
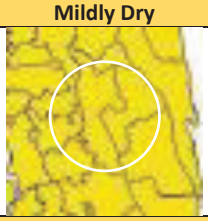
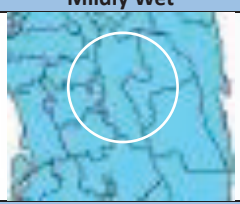
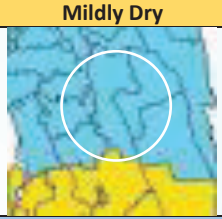
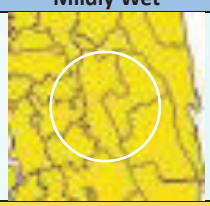
Timeline/ Season	Pre-monsoon	Monsoon	Post-monsoon	Winter
Observation in Normal Rainfall Year(s)				
	Mildly Wet	Mildly Wet	Severely wet	Moderately Dry
2030				
	Mildly Dry	Severely wet	Mildly Wet	Mildly Dry
2050				
	Mildly Dry	Mildly Wet	Mildly Dry	Mildly Wet
2070				
	Mildly Dry	Mildly Wet	Mildly Wet	Mildly Dry

Figure 2: Projected Impact (Changes in SPI[2]) under RCP 4.5 (Source: Figure 5.1-5.6 of BUET (2020))

2 The Standardized Precipitation Index (SPI) is a widely used index to characterize meteorological drought on a range of timescales and is closely related to soil moisture, groundwater and reservoir storage (NCAR_CDG, 2024)

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Climate Risk and Vulnerability Assessment: Lama Upazila

1. Introduction

The Chittagong Hill Tracts (CHT), like many other regions in Bangladesh, is facing the challenges of climate change which include erratic rainfall patterns, heavy rainfall leading to landslides, drought, and flash floods. Lama Upazila, situated in the Bandarban district within the CHT, is experiencing the adverse effects of climate change, which will intensify the vulnerability of the local population. Changes in weather patterns can affect agricultural productivity, water availability, and the overall well-being of the communities residing in Lama Upazila.

2. Brief About Lama Upazila

Location: 21.38 - 21.59 N latitude and 92.04 - 92.23 E longitude

Special Geographical feature:

- 29.8 m above sea level.
- Height of the hills is about 200 to 300 m

Total Area: 671.84 sq km

- Cultivable Land: 260.85 sq km
- Reserved forest area: 332.628 sq km

Population: 1,43,413 people (male: 58,904; Female:54,509)

Livelihood:

- Agricultural work (73.27%),
- Animal husbandry and fishing (5.84%)
- Agricultural labor (15.54%)
- Day labor (6.27%)

Source: (GoB, 2024b).

Figure 1: Location of Lama Upazila

3. Existing Vulnerability of the Upazila

As per MJF (2020), people living across the CHT (including Lama) over the last several years have been experiencing:

- Shortened winter season,
- Rising temperature in summer,
- uneven seasonal change
- Increased thunderstorm

Climate Vulnerability Index of Lama Upazila
Moderate (0.56)

Source: (LoGIC and LGD, 2024)

Table 1: Existing Vulnerability of Lama Upazila for different types of hazards/ Climatic stress

Hazard	Cyclone	Flash Flood	Heat wave	Cold Wave	Storm Surge	Max Rainfall (Observed)	Kharif Drought	Pre-kharif Drought	Landslide
Vulnerability Index	Very High	No risk	Very Low	Low	Low	Very Low	Very high	Very high	Moderate
Source	(BUET, 2020)						(ADB, 2021)		

4. Projection of Climate Change and Future Vulnerabilities

4.1 Projected Changes in Climate Parameters

Different studies show that the climate situations are likely to aggravate in the future. The projected changes in climate parameters for Lama obtained by BUET (2020) show that there will be a rise in maximum and minimum temperature in all seasons; rainfall and number of rainy days are likely to decrease in pre-monsoon, post-monsoon, and winter while increasing in monsoon season.

Table 2: Projected Changes in Climate Parameters under RCP 4.5

Timeline/ Season[1]	Parameter	Pre-monsoon	Monsoon	Post-monsoon	Winter
2030	Maximum Temperature	1.0°C ↑	1.0°C ↑	1.1 °C ↑	1.3 °C ↑
	Minimum Temperature	0.8 °C ↑	1.0 °C ↑	0.5 °C ↑	0.8 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10%↓
	Number of Rainy Days	10% ↓	10% ↑	10% ↓	10%↓
2050	Maximum Temperature	1.6°C ↑	1.4°C ↑	1.7°C↑	1.3°C↑
	Minimum Temperature	1.6 °C ↑	1.3 °C ↑	1.6 °C ↑	1.4 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↕
	Number of Rainy Days	10% ↓	10% ↑	10% ↕	10%↕
2070	Maximum Temperature	1.8°C ↑	1.4°C ↑	1.8 °C ↑	2.0 °C ↑
	Minimum Temperature	1.7 °C ↑	1.7°C ↑	2.2°C ↑	2.2°C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10%↓
	Number of rainy Days	10% ↓	10% ↑	10% ↓	10%↓

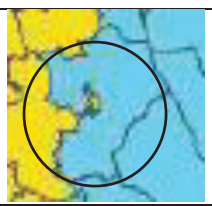
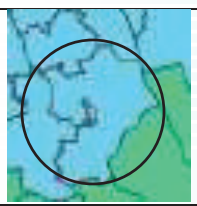
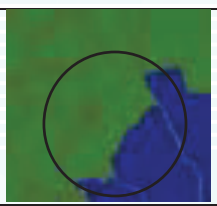
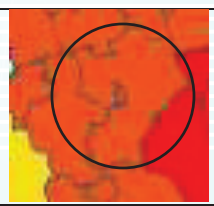
Note: Base period considered as 1970-2000

4.2 Projected Impact due to Climate Change

Rainfall variability, flash flood, cyclonic storm surge, drought, lightning, extreme heat and landslide already pose high impact in CHT and projected climate change are likely to aggravate the risk and impact (MoEFCC, 2022). The domino effect of projected climate change, as described in various studies, are briefly mentioned below:

1 There are four prominent climatic seasons in Bangladesh: winter (December – February), pre-monsoon (March-May), monsoon (June–Sep-

- **Affecting a balanced water supply** due to change in rainfall pattern (Chakma, 2023).
- **More risk in terms of water supply for agriculture** due to ratio of precipitation (P) to potential evapotranspiration (PET) being less than 1 and unfavorable changes in Standard Precipitation Index (SPI) as shown in Figure 2 (BUET, 2020) **-** leading to **decline in agricultural yield.**
- **Reduced access to clean water** for residents (Chakma, 2023)
- **Increased occurrence of thunderstorms**, leading to more violent storms, more lightning strikes due to rising temperature (Kirsty McCabe, 2023) – causing more casualties
- **Increased incident of Flash Flood and land slide** causing environmental degradation, destruction of infrastructure hampers communication, disrupts crop sales, and hinders access to essential services (Chakma, 2023)

Timeline/ Season	Pre-monsoon	Monsoon	Post-monsoon	Winter
Observation in Normal Rainfall Year(s)				
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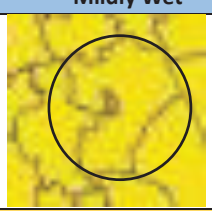
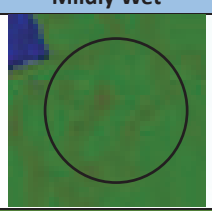
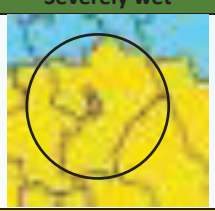
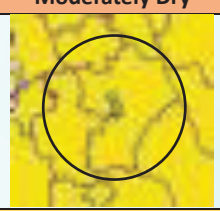
2030				
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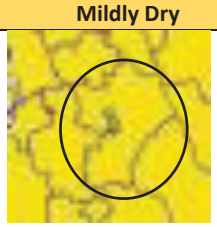
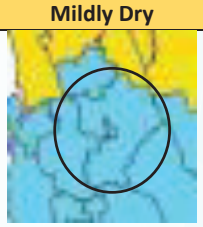
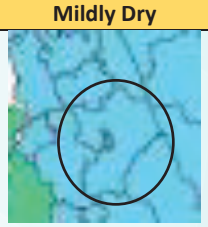
2050				
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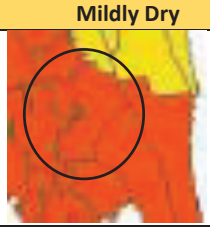
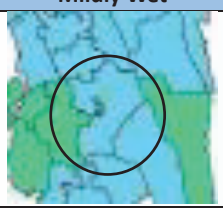
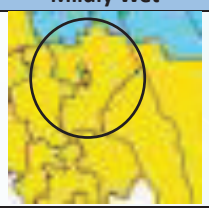
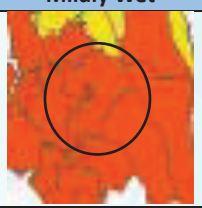
2070				
	Moderately Dry	Mildly Wet	Mildly Dry	Moderately Dry

Figure 2: Projected Impact (Changes in SPI[2]) under RCP 4.5 (Source: Figure 5.1-5.6 of BUET (2020))

tember) and post-monsoon (October–November) (MJF, 2020).

[2] The Standardized Precipitation Index (SPI) is a widely used index to characterize meteorological drought on a range of timescales and is closely related to soil moisture, groundwater and reservoir storage (NCAR-CDG, 2024)

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Climate Risk and Vulnerability Assessment: Rowangchari Upazila

1. Introduction

The Chittagong Hill Tracts (CHT), like many other regions in Bangladesh, is facing the challenges of climate change which include erratic rainfall patterns, heavy rainfall leading to landslides, drought, and flash floods. Rowangchari Upazila, situated in the Bandarban district within the CHT, is experiencing the adverse effects of climate change, which will intensify the vulnerability of the local population. Changes in weather patterns can affect agricultural productivity, water availability, and the overall well-being of the communities residing in Rowangchari Upazila.

2. Brief About Rowangchari Upazila

Location: 22°03' and 22°20' north latitudes and in between 92°14' and 92°30' east longitudes (Banglapedia, 2024c)

Special Geographical feature:

- Rowangchari Upazila is geographically a remote hilly natural forest area

Total Area: 443 sq km

- Cultivable Land: 39.63 sqkm (3,963 hectare)

Population: 22,629 people (Male: 12,622; Female: 9,967)

Livelihood:

- **Agriculture (Zoom cultivation)**

Source: (GoB, 2024c).

Figure 1: Location of Rowangchari Upazila

3. Existing Vulnerability of the Upazila

As per MJF (2020), people living across the CHT (including Rowangchari) over the last several years have been experiencing:

- Shortened winter season,
- Rising temperature in summer,
- uneven seasonal change
- Increased thunderstorm

Climate Vulnerability Index of Rowangchari Upazila
Moderate (0.56)

Source: (LoGIC and LGD, 2024)

1 There are four prominent climatic seasons in Bangladesh: winter (December – February), pre-monsoon (March-May), monsoon (June–September) and post-monsoon (October–November) (MJF, 2020).

Table 1: Existing Vulnerability of Rowangchari Upazila for different types of hazards/ climatic stress

Hazard	Cyclone	Flash Flood	Heat wave	Cold Wave	Storm Surge	Max Rainfall (Observed)	Kharif Drought	Pre-kharif Drought	Landslide
Vulnerability Index	Very High	No risk	Very Low	Low	Low	Very Low	Very high	Very high	Moderate
Source	(BUET, 2020)						(ADB, 2021)		

4. Projection of Climate Change and Future Vulnerabilities

4.1 Projected Changes in Climate Parameters

Different studies show that the climate situations are likely to aggravate in the future. The projected changes in climate parameters for Rowangchari obtained by BUET (2020) show that there will be a rise in maximum and minimum temperature in all seasons; while rainfall and number of rainy days show erratic pattern.

Table 2: Projected Changes in Climate Parameters under RCP 4.5

Timeline/ Season[1]	Parameter	Pre-monsoon	Monsoon	Post-monsoon	Winter
2030	Maximum Temperature	1.1°C ↑	1.0°C ↑	1.1°C ↑	1.3 °C ↑
	Minimum Temperature	0.9 °C ↑	1.0 °C ↑	0.5 °C ↑	1.0 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↓
	Number of Rainy Days	10% ↓	10% ↕	10% ↕	10% ↕
2050	Maximum Temperature	1.6°C ↑	1.4°C ↑	1.5°C ↑	1.3°C↑
	Minimum Temperature	1.7 °C ↑	1.4 °C ↑	1.8 °C ↑	1.5 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10%↓	10%↓
	Number of Rainy Days	10% ↑	10%↓	10%↓	10% ↑
2070	Maximum Temperature	1.9°C ↑	1.4°C ↑	1.8°C ↑	2.2°C ↑
	Minimum Temperature	1.8°C ↑	1.8 °C ↑	2.3°C ↑	2.1°C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10%↓
	Number of rainy Days	10% ↓	10% ↑	10% ↓	10%↓

Note: Base period considered as 1970-2000

4.2 Projected Impact due to Climate Change

Rainfall variability, flash flood, cyclonic storm surge, drought, lightning, extreme heat and landslide already pose high impact in CHT and projected climate change are likely to aggravate the risk and impact (MoEFCC, 2022). The domino effect of projected climate change, as described in various studies, are briefly mentioned below:

- **Affecting a balanced water supply** due to change in rainfall pattern (Chakma, 2023).
- **More risk in terms of water supply for agriculture** due to ratio of precipitation (P) to potential evapotranspiration (PET) being less than 1 and unfavorable changes in Standard Precipitation Index (SPI) as shown in Figure 2 (BUET, 2020) - leading to **decline in agricultural yield.**
- **Reduced access to clean water** for residents (Chakma, 2023)
- **Increased occurrence of thunderstorms**, leading to more violent storms, more lightning strikes due to rising temperature (Kirsty McCabe, 2023) – causing more casualties
- **Increased incident of Flash Flood and land slide** causing environmental degradation, destruction of infrastructure hampers communication, disrupts crop sales, and hinders access to essential services (Chakma, 2023)

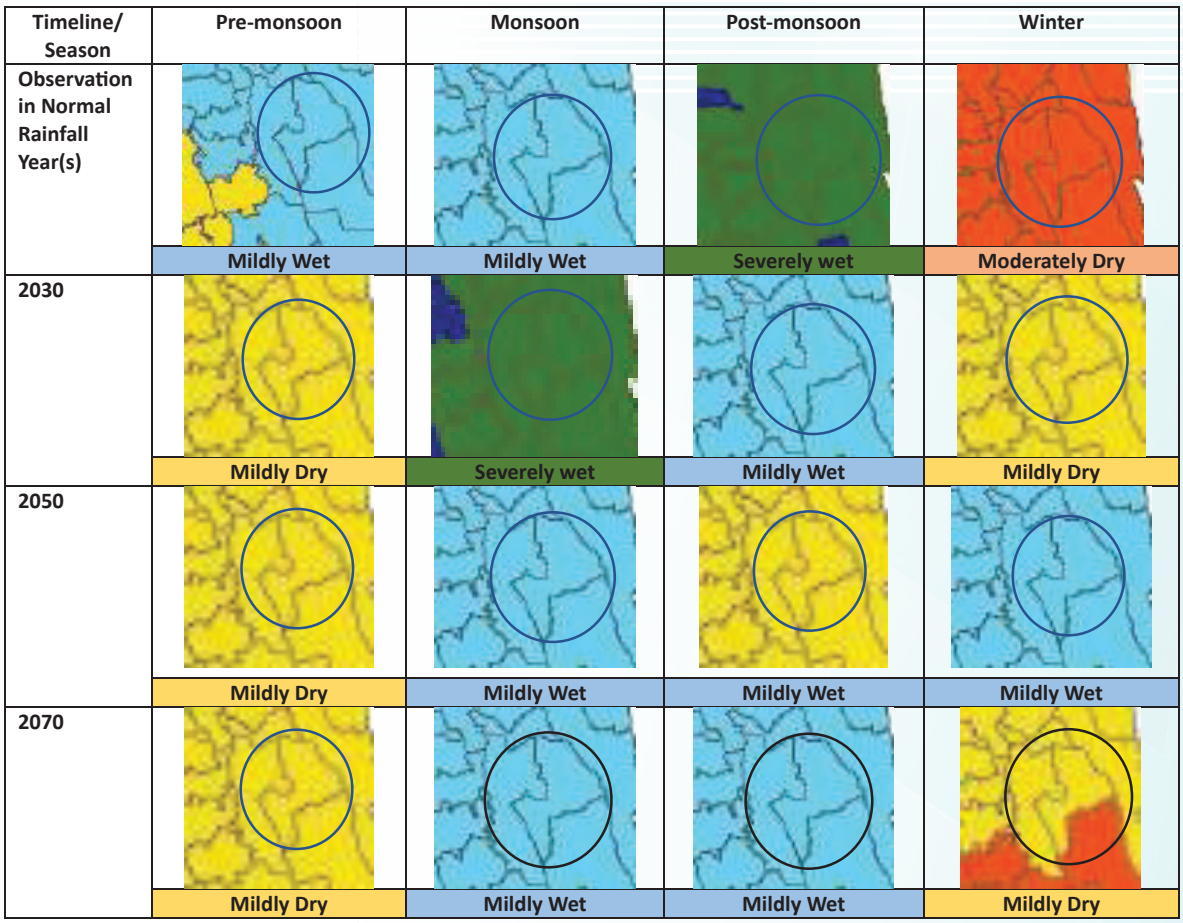

Figure 2: Projected Impact (Changes in SPI[1]) under RCP 4.5 (Source: Figure 5.1-5.6 of BUET (2020))

1 The Standardized Precipitation Index (SPI) is a widely used index to characterize meteorological drought on a range of timescales and is closely related to soil moisture, groundwater and reservoir storage (NCAR_CDG, 2024)

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Climate Risk and Vulnerability Assessment: Ruma Upazila

1. Introduction

The Chittagong Hill Tracts (CHT), like many other regions in Bangladesh, is facing the challenges of climate change which include erratic rainfall patterns, heavy rainfall leading to landslides, drought, and flash floods. Ruma Upazila situated in the Bandarban district within the CHT, is experiencing the adverse effects of climate change, which will intensify the vulnerability of the local population. Changes in weather patterns can affect agricultural productivity, water availability, and the overall well-being of the communities residing in Ruma Upazila.

2. Brief About Ruma Upazila

Location: in between 21°53' to 22°10' north latitudes and 92°17' and 92°34' east longitudes (Banglapedia, 2024d)

Total Area: 492.09 sq km (GoB, 2024d).

Population: 29,098 people (male 15469, female 13629) ((GoB, 2024d), (Banglapedia, 2024d))

Livelihood:

- Agriculture (84.79%)
- Non-agricultural labourer (0.88%)
- Industry (0.42%)
- Commerce (5.7%)
- Transport and communication (0.1%)
- Service (3%)
- Construction (0.15%)
- Religious service (0.15%)
- Rent and remittance (0.13%)
- Others (4.68%)

Source: (Banglapedia, 2024d))

Figure 1: Location of Ruma Upazila

3. Existing Vulnerability of the Upazila

As per MJF (2020), people living across the CHT (including Ruma) over the last several years have been experiencing:

- Shortened winter season
- Rising temperature in summer
- uneven seasonal change
- Increased thunderstorm

Climate Vulnerability Index of Ruma Upazila
Moderate (0.56)

Source: (LoGIC and LGD, 2024)

1 There are four prominent climatic seasons in Bangladesh: winter (December – February), pre-monsoon (March-May), Monsoon (June–September) and post-monsoon (October–November) (MJF, 2020).

Table 1: Existing Vulnerability of Ruma Upazila for different types of hazards/ Climatic stress

Hazard	Cyclone	Flash Flood	Heat wave	Cold Wave	Storm Surge	Max Rainfall (Observed)	Kharif Drought	Pre-kharif Drought	Landslide
Vulnerability Index	Very High	No risk	Very Low	Low	Low	Very Low	Very high	Very high	Moderate
Source	(BUET, 2020)						(ADB, 2021)		

4. Projection of Climate Change and Future Vulnerabilities

4.1 Projected Changes in Climate Parameters

Different studies show that the climate situations are likely to aggravate in the future. The projected changes in climate parameters for Ruma obtained by BUET (2020) show that there will be a rise in maximum and minimum temperature in all seasons; while rainfall and number of rainy days show erratic pattern.

Table 2: Projected Changes in Climate Parameters under RCP 4.5

Timeline/ Season[1]	Parameter	Pre-monsoon	Monsoon	Post-monsoon	Winter
2030	Maximum Temperature	1.1°C ↑	1.0°C ↑	1.1°C ↑	1.3 °C ↑
	Minimum Temperature	0.9 °C ↑	1.0 °C ↑	0.5°C ↑	0.9 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10%↓
	Number of Rainy Days	10% ↓	10% ↕	10% ↑	10%↕
2050	Maximum Temperature	1.6°C ↑	1.4°C ↑	1.7°C↑	1.3°C↑
	Minimum Temperature	1.7 °C ↑	1.4 °C ↑	1.7 °C ↑	1.5 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10%↓	10%↕
	Number of Rainy Days	10% ↕	10%↕	10% ↕	10% ↑
2070	Maximum Temperature	1.9°C ↑	1.4°C ↑	1.8 °C ↑	2.1 °C ↑
	Minimum Temperature	1.7 °C ↑	1.7°C ↑	2.3°C ↑	2.1°C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10% ↑
	Number of rainy Days	10% ↓	10% ↑	10% ↓	10%↓

Note: Base period considered as 1970-2000

4.2 Projected Impact due to Climate Change

Rainfall variability, flash flood, cyclonic storm surge, drought, lightning, extreme heat and landslide already pose high impact in CHT and projected climate change are likely to aggravate the risk and impact (MoEFCC, 2022). The domino effect of projected climate change, as described in various studies, are briefly mentioned below:

- **Affecting a balanced water supply** due to change in rainfall pattern (Chakma, 2023).
- **More risk in terms of water supply for agriculture** due to ratio of precipitation (P) to potential evapotranspiration (PET) being less than 1 and unfavorable changes in

Standard Precipitation Index (SPI) as shown in Figure 2 (BUET, 2020) - leading to **decline in agricultural yield.**

- **Reduced access to clean water** for residents (Chakma, 2023)
- **Increased occurrence of thunderstorms**, leading to more violent storms, more lightning strikes due to rising temperature (Kirsty McCabe, 2023) – causing more casualties
- **Increased incident of Flash Flood and land slide** causing environmental degradation, destruction of infrastructure hampers communication, disrupts crop sales, and hinders access to essential services (Chakma, 2023)

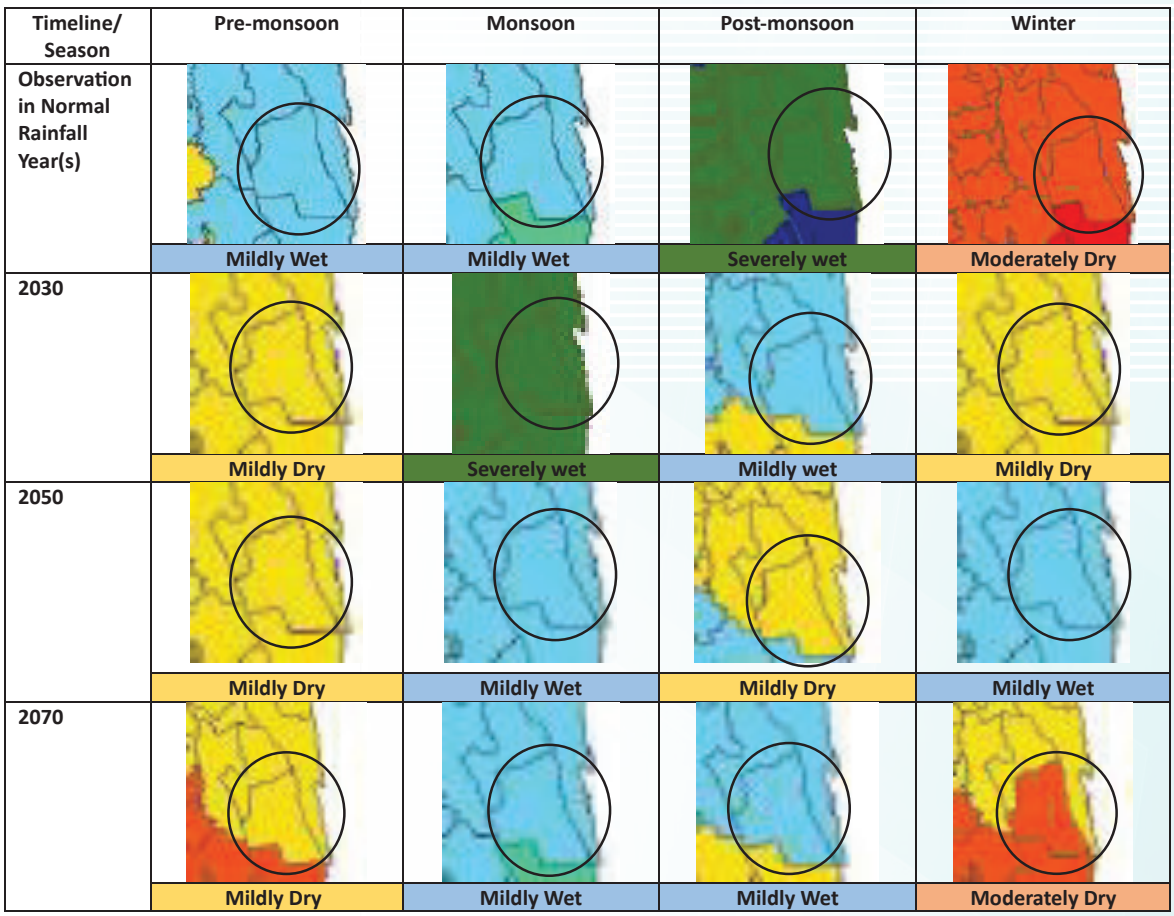

Figure 2: Projected Impact (Changes in SPI[1]) under RCP 4.5 (Source: Figure 5.1-5.6 of BUET (2020))

2 The Standardized Precipitation Index (SPI) is a widely used index to characterize meteorological drought on a range of timescales and is closely related to soil moisture, groundwater and reservoir storage (NCAR_CDG, 2024)

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Climate Risk and Vulnerability Assessment: Thanchi Upazila

1. Introduction

The Chittagong Hill Tracts (CHT), like many other regions in Bangladesh, is facing the challenges of climate change which include erratic rainfall patterns, heavy rainfall leading to landslides, drought, and flash floods. Thanchi Upazila, situated in the Bandarban district within the CHT, is experiencing the adverse effects of climate change, which will intensify the vulnerability of the local population. Changes in weather patterns can affect agricultural productivity, water availability, and the overall well-being of the communities residing in Thanchi Upazila.

2. Brief About Thanchi Upazila

Location: In between 21°15' and 21°57' north latitudes and in between 92°20' and 92°41' east longitudes (Banglapedia, 2024e)

Special Geographical feature:

Total Area: 1,020.8 sq km (GoB, 2024e).

Population: 27,586 people (Male:55.61%; Female:44.39%) (GoB, 2024e).

Livelihood:

- Agriculture -25.13%
- Forest based - 8.55%
- Agricultural workers - 51.45%
- Day laborer - 2.69%
- Business - 2.51%
- Jobs -2.91%

Source: (GoB, 2024e).

Figure 1: Location of Thanchi Upazila

3. Existing Vulnerability of the Upazila

As per MJF (2020), people living across the CHT (including Thanchi) over the last several years have been experiencing:

- Shortened winter season,
- Rising temperature in summer,
- uneven seasonal change
- Increased thunderstorm

Climate Vulnerability Index of Thanchi Upazila
Moderate (0.55)

Source: (LoGIC and LGD, 2024)

Table 1: Existing Vulnerability of Thanchi Upazila for different types of hazards/ Climatic Stress

Hazard	Cyclone	Flash Flood	Heat wave	Cold Wave	Storm Surge	Max Rainfall (Observed)	Kharif Drought	Pre-kharif Drought	Landslide
Vulnerability Index	High	No risk	Very Low	Low	Low	Very Low	Very high	Very high	Moderate
Source	(BUET, 2020)						(ADB, 2021)		

4. Projection of Climate Change and Future Vulnerabilities

4.1 Projected Changes in Climate Parameters

Different studies show that the climate situations are likely to aggravate in the future. The projected changes in climate parameters for Thanchi obtained by BUET (2020) show that there will be a rise in maximum and minimum temperature in all seasons; while rainfall and number of rainy days show erratic pattern.

Table 2: Projected Changes in Climate Parameters under RCP 4.5

Timeline/ Season[1]	Parameter	Pre-monsoon	Monsoon	Post-monsoon	Winter
2030	Maximum Temperature	1.0°C ↑	1.0°C ↑	1.2°C ↑	1.3 °C ↑
	Minimum Temperature	0.8 °C ↑	1.0 °C ↑	0.5 °C ↑	0.8 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10%↓
	Number of Rainy Days	10% ↓	10% ↕	10% ↑	10% ↓
2050	Maximum Temperature	1.6°C ↑	1.5°C ↑	1.6°C ↑	1.3°C↑
	Minimum Temperature	1.7 °C ↑	1.3 °C ↑	1.6 °C ↑	1.4 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10%↑
	Number of Rainy Days	10% ↕	10% ↕	10% ↕	10% ↕
2070	Maximum Temperature	1.8°C ↑	1.3°C ↑	1.8°C ↑	2.0 °C ↑
	Minimum Temperature	1.7°C ↑	1.7 °C ↑	2.3°C ↑	2.0°C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10%↓
	Number of rainy Days	10% ↓	10% ↕	10% ↓	10%↓

Note: Base period considered as 1970-2000

4.2 Projected Impact due to Climate Change

Rainfall variability, flash flood, cyclonic storm surge, drought, lightning, extreme heat and landslide already pose high impact in CHT and projected climate change are likely to aggravate the risk and impact (MoEFCC, 2022). The domino effect of projected climate change, as described in various studies, are briefly mentioned below:

1 There are four prominent climatic seasons in Bangladesh: winter (December – February), pre-monsoon (March-May), monsoon (June–September) and post-monsoon (October–November) (MJF, 2020).

- **Affecting a balanced water supply** due to change in rainfall pattern (Chakma, 2023).
- **More risk in terms of water supply for agriculture** due to ratio of precipitation (P) to potential evapotranspiration (PET) being less than 1 and unfavorable changes in Standard Precipitation Index (SPI) as shown in Figure 2 (BUET, 2020) - leading to **decline in agricultural yield.**
- **Reduced access to clean water** for residents (Chakma, 2023)
- **Increased occurrence of thunderstorms**, leading to more violent storms, more lightning strikes due to rising temperature (Kirsty McCabe, 2023) – causing more casualties
- **Increased incident of Flash Flood and land slide** causing environmental degradation, destruction of infrastructure hampers communication, disrupts crop sales, and hinders access to essential services (Chakma, 2023)

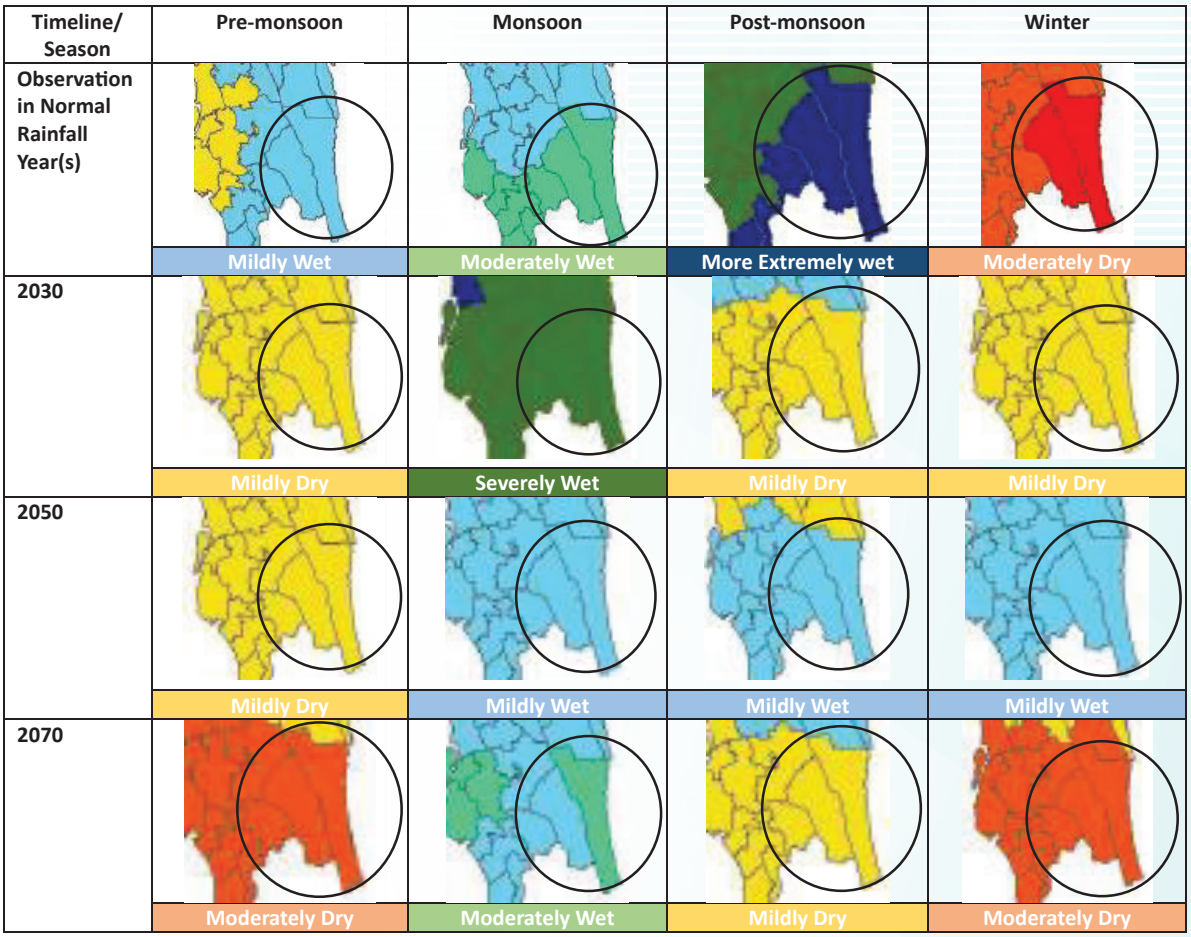

Figure 2: Projected Impact (Changes in SPI[2]) under RCP 4.5 (Source: Figure 5.1-5.6 of BUET (2020))

2 The Standardized Precipitation Index (SPI) is a widely used index to characterize meteorological drought on a range of timescales and is closely related to soil moisture, groundwater and reservoir storage (NCAR_CDG, 2024)

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Climate Risk and Vulnerability Assessment: Rangamati Sadar Upazila

1. Introduction

The Chittagong Hill Tracts (CHT), like many other regions in Bangladesh, is facing the challenges of climate change which include erratic rainfall patterns, heavy rainfall leading to landslides, drought, and flash floods. Rangamati Upazila, situated in the Rangamati district within the CHT, is experiencing the adverse effects of climate change, which will intensify the vulnerability of the local population. Changes in weather patterns can affect agricultural productivity, water availability, and the overall well-being of the communities residing in Rangamati Upazila.

2. Brief About Rangamati Sadar Upazila

Location: 22.30–22.49N latitude and 92.04 - 92.22 E longitude

Special Geographical feature:

- The Kaptai Lake occupies one third area of the upazila

Total Area: 546.48 sq kilometers.

- Cultivable land: 31.83 sq km

Population: 124,728 people (male:66,212; Female: 58,516)

Livelihood:

- Agriculture: 23.23%
- Forestry: 1.92%
- Fisheries: 3.19%
- Agricultural Laborers: 5.4%
- Non- Agricultural Laborers: 6.91%
- Business: 16.64%
- Transport: 2.08%
- Employment: 25.81%
- Others: 14.82%

Source: (GoB, 2024f).

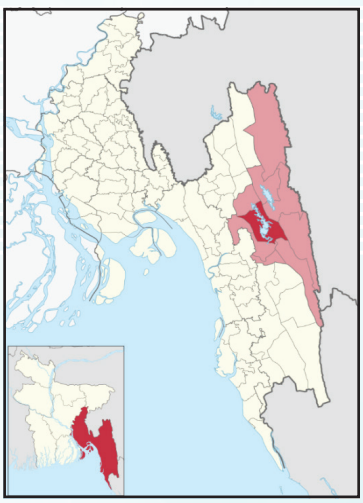


Figure 1: Location of Rangamati Sadar Upazila

3. Existing Vulnerability of the Upazila

As per MJF (2020), people living across the CHT (including Rangamati Sadar) over the last several years have been experiencing:

- Shortened winter season,
- Rising temperature in summer,
- uneven seasonal change
- Increased thunderstorm

Climate Vulnerability Index of Rangamati Sadar Upazila
Moderate (0.51)

Source: (LoGIC and LGD, 2024)

Table 1: Existing Vulnerability of Rangamati Sadar Upazila for different types of hazards/ Climatic Stress

Hazard	Cyclone	Flash Flood	Heat wave	Cold Wave	Storm Surge	Max Rainfall (Observed)	Kharif Drought	Pre-kharif Drought	Landslide
Vulnerability Index	Moderate	No risk	Very Low	Low	Low	Very High	High	High	Low
Source	(BUET, 2020)						(ADB, 2021)		

4. Projection of Climate Change and Future Vulnerabilities

4.1 Projected Changes in Climate Parameters

Different studies show that the climate situations are likely to aggravate in the future. The projected changes in climate parameters for Rangamati Sadar upazila obtained by BUET (2020) show that there will be a rise in maximum and minimum temperature in all seasons; rainfall and number of rainy days show erratic patterns.

Table 2: Projected Changes in Climate Parameters under RCP 4.5

Timeline/ Season[1]	Parameter	Pre-monsoon	Monsoon	Post-monsoon	Winter
2030	Maximum Temperature	1.3°C ↑	1.1°C ↑	1.0°C ↑	1.3 °C ↑
	Minimum Temperature	1.0 °C ↑	1.1 °C ↑	0.6 °C ↑	1.1°C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↓
	Number of Rainy Days	10% ↓	10% ↕	10% ↑	10%↓
2050	Maximum Temperature	1.7°C ↑	1.5°C ↑	1.7°C ↑	1.3°C↑
	Minimum Temperature	1.6 °C ↑	1.5 °C ↑	1.9 °C ↑	1.6 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10%↕
	Number of Rainy Days	10% ↕	10% ↑	10% ↓	10%↑
2070	Maximum Temperature	2.1°C ↑	1.5°C ↑	1.9°C ↑	2.4 °C ↑
	Minimum Temperature	1.8°C ↑	1.8°C ↑	2.4°C ↑	2.3 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↓
	Number of rainy Days	10% ↕	10% ↑	10% ↓	10% ↓

Note: Base period considered as 1970-2000

4.2 Projected Impact due to Climate Change

Rainfall variability, flash flood, cyclonic storm surge, drought, lightning, extreme heat and landslide already pose high impact in CHT and projected climate change are likely to aggravate the risk and impact (MoEFCC, 2022). The domino effect of projected climate change, as described in various studies, are briefly mentioned below:

1 There are four prominent climatic seasons in Bangladesh: winter (December – February), pre-monsoon (March-May), monsoon (June–September) and post-monsoon (October–November) (MJF, 2020).

- **Affecting a balanced water supply** due to change in rainfall pattern (Chakma, 2023).
- **More risk in terms of water supply for agriculture** due to ratio of precipitation (P) to potential evapotranspiration (PET) being less than 1 and unfavorable changes in Standard Precipitation Index (SPI) as shown in Figure 2 (BUET, 2020) **-** leading to **decline in agricultural yield.**
- **Reduced access to clean water** for residents (Chakma, 2023)
- **Increased occurrence of thunderstorms**, leading to more violent storms, more lightning strikes due to rising temperature (Kirsty McCabe, 2023) – causing more casualties
- **Increased incident of Flash Flood and land slide** causing environmental degradation, destruction of infrastructure hampers communication, disrupts crop sales, and hinders access to essential services (Chakma, 2023)

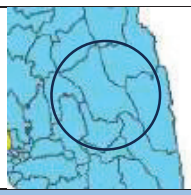
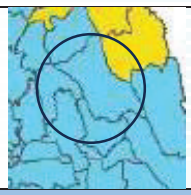
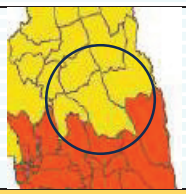
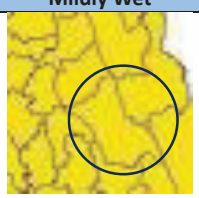
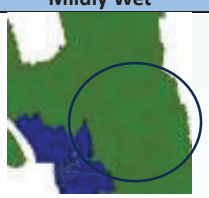
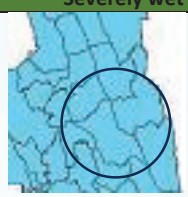
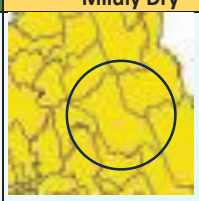
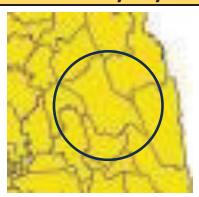
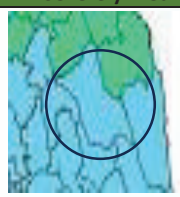
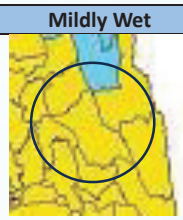
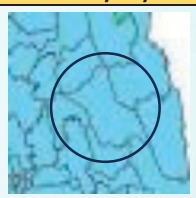
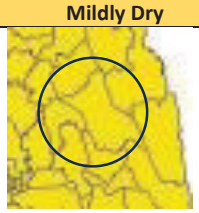
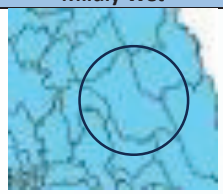
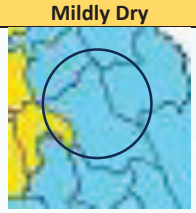
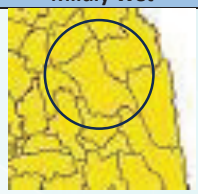
Timeline/ Season	Pre-monsoon	Monsoon	Post-monsoon	Winter
Observation in Normal Rainfall Year(s)				
	Mildly Wet	Mildly Wet	Severely wet	Mildly Dry
2030				
	Mildly Dry	Severely Wet	Mildly Wet	Mildly Dry
2050				
	Mildly Dry	Mildly Wet	Mildly Dry	Mildly Wet
2070				
	Mildly Dry	Mildly Wet	Mildly Wet	Mildly Dry

Figure 2: Projected Impact (Changes in SPI[2]) under RCP 4.5 (Source: Figure 5.1-5.6 of BUET (2020))

2 The Standardized Precipitation Index (SPI) is a widely used index to characterize meteorological drought on a range of timescales and is closely related to soil moisture, groundwater and reservoir storage (NCAR_CDG, 2024)

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Climate Risk and Vulnerability Assessment: Langadu Upazila

1. Introduction

The Chittagong Hill Tracts (CHT), like many other regions in Bangladesh, is facing the challenges of climate change which include erratic rainfall patterns, heavy rainfall leading to landslides, drought, and flash floods. Langadu Upazila, situated in the Rangamati district within the CHT, is experiencing the adverse effects of climate change, which will intensify the vulnerability of the local population. Changes in weather patterns can affect agricultural productivity, water availability, and the overall well-being of the communities residing in Langadu Upazila.

2. Brief About Langadu Upazila

Location: in between 92°05' and 92°19' east longitudes (Banglapedia, 2024g)

Special Geographical feature:

- Lake
- Big and small hills

Total Area: 388.49 sq km

- Lake Area: 25.27 sqkm (6360 acres)
- Cultivable Land: 79.41 Sqkm (19822 acres)

Population: 84477 people (Male: 43,846; Female: 40,831)

Source: (GoB, 2024g).

Livelihood:

- Agriculture 69%,
- non-agricultural labourer 5.35%,
- commerce 9.27%,
- others 8.35%.

Source: (Banglapedia, 2024g)

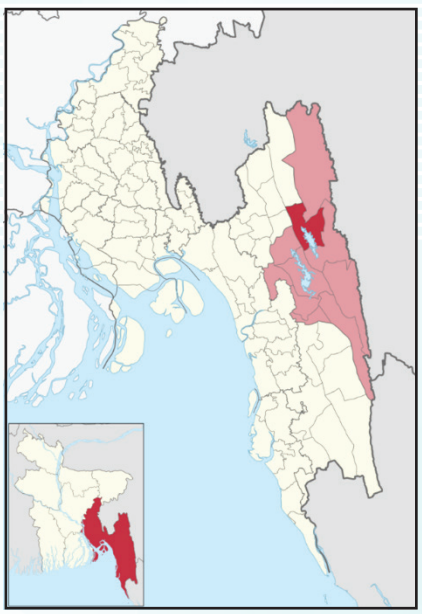

Figure 1: Location of Langadu Upazila

3. Existing Vulnerability of the Upazila

As per MJF (2020), people living across the CHT (including Langadu) over the last several years have been experiencing:

- Shortened winter season,
- Rising temperature in summer,
- uneven seasonal change
- Increased thunderstorm

Climate Vulnerability Index of Langadu Upazila
Moderate (0.55)

Source: (LoGIC and LGD, 2024)

Table 1: Existing Vulnerability of Langadu Upazila for different types of hazards/Climatic Stress

Hazard	Cyclone	Flash Flood	Heat wave	Cold Wave	Storm Surge	Max Rainfall (Observed)	Kharif Drought	Pre-kharif Drought	Landslide
Vulnerability Index	High	No risk	Very Low	Low	Low	Moderate	High	High	Low
Source	(BUET, 2020)						(ADB, 2021)		

4. Projection of Climate Change and Future Vulnerabilities

4.1 Projected Changes in Climate Parameters

Different studies show that the climate situations are likely to aggravate in the future. The projected changes in climate parameters for Langadu obtained by BUET (2020) show that there will be a rise in maximum and minimum temperature in all seasons; rainfall and number of rainy days show erratic patterns.

Table 2: Projected Changes in Climate Parameters under RCP 4.5

Timeline/ Season[1]	Parameter	Pre-monsoon	Monsoon	Post-monsoon	Winter
2030	Maximum Temperature	1.4°C ↑	1.1°C ↑	1.0°C ↑	1.3 °C ↑
	Minimum Temperature	1.1 °C ↑	1.1 °C ↑	0.6 °C ↑	1.1 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↑	10%↓
	Number of Rainy Days	10% ↓	10% ↕	10% ↕	10% ↕
2050	Maximum Temperature	1.7°C ↑	1.5°C ↑	1.8°C ↑	1.3°C↑
	Minimum Temperature	1.7 °C ↑	1.5 °C ↑	2.0 °C ↑	1.7 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10% ↓
	Number of Rainy Days	10% ↓	10% ↑	10% ↓	10% ↑
2070	Maximum Temperature	2.2°C ↑	1.5°C ↑	2.0°C ↑	2.4 °C ↑
	Minimum Temperature	1.8°C ↑	1.9 °C ↑	2.5°C ↑	2.3°C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↓
	Number of rainy Days	10% ↑	10% ↑	10% ↓	10%↓

Note: Base period considered as 1970-2000

4.2 Projected Impact due to Climate Change

Rainfall variability, flash flood, cyclonic storm surge, drought, lightning, extreme heat and landslide already pose high impact in CHT and projected climate change are likely to aggravate the risk and impact (MoEFCC, 2022). The domino effect of projected climate change, as described in various studies, are briefly mentioned below:

1 There are four prominent climatic seasons in Bangladesh: winter (December – February), pre-monsoon (March-May), monsoon (June–September) and post-monsoon (October–November) (MJF, 2020).

- **Affecting a balanced water supply** due to change in rainfall pattern (Chakma, 2023).
- **More risk in terms of water supply for agriculture** due to ratio of precipitation (P) to potential evapotranspiration (PET) being less than 1 and unfavorable changes in Standard Precipitation Index (SPI) as shown in Figure 2 (BUET, 2020) - leading to **decline in agricultural yield.**
- **Reduced access to clean water** for residents (Chakma, 2023)
- **Increased occurrence of thunderstorms**, leading to more violent storms, more lightning strikes due to rising temperature (Kirsty McCabe, 2023) – causing more casualties
- **Increased incident of Flash Flood and land slide** causing environmental degradation, destruction of infrastructure hampers communication, disrupts crop sales, and hinders access to essential services (Chakma, 2023)

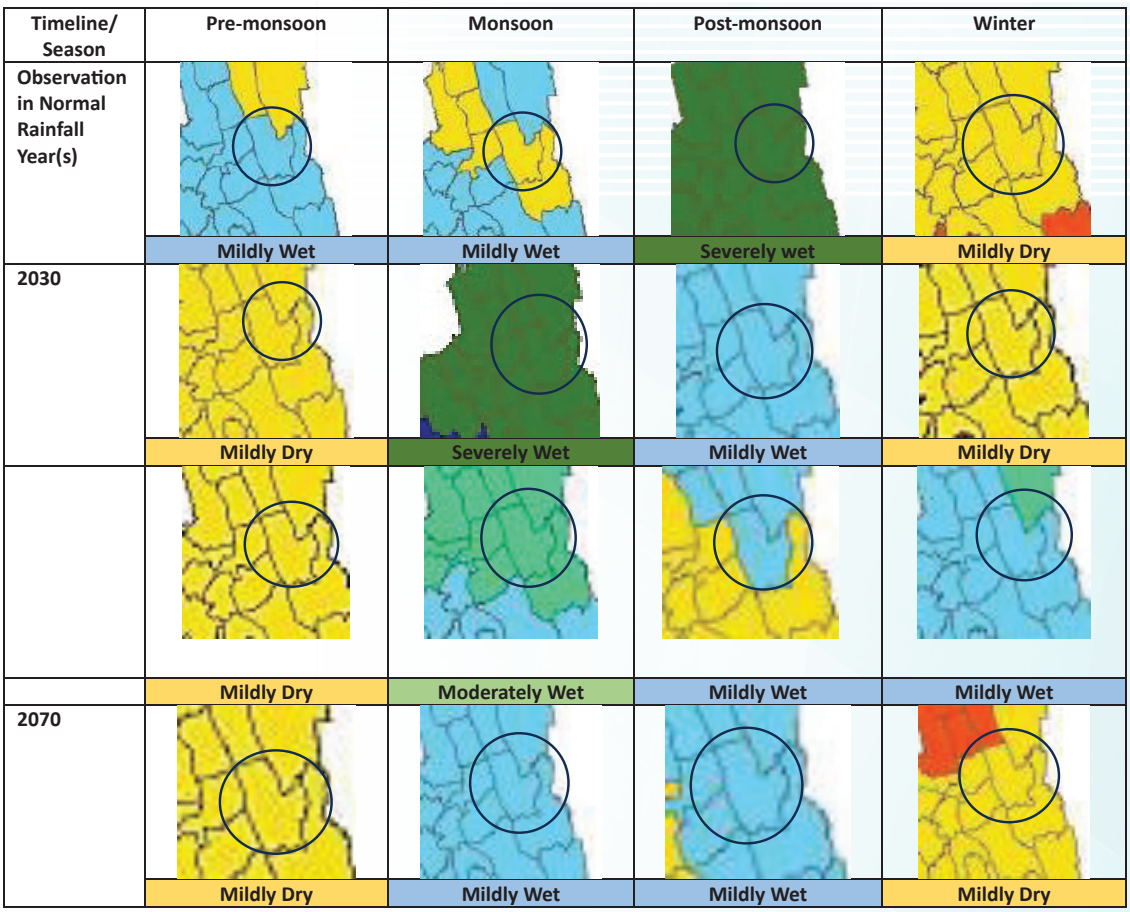

Figure 2: Projected Impact (Changes in SPI[2]) under RCP 4.5 (Source: Figure 5.1-5.6 of BUET (2020))

2 The Standardized Precipitation Index (SPI) is a widely used index to characterize meteorological drought on a range of timescales and is closely related to soil moisture, groundwater and reservoir storage (NCAR_CDG, 2024)

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Climate Risk and Vulnerability Assessment: Juraichhri Upazila

1. Introduction

The Chittagong Hill Tracts (CHT), like many other regions in Bangladesh, is facing the challenges of climate change which include erratic rainfall patterns, heavy rainfall leading to landslides, drought, and flash floods. Juraichhri Upazila, situated in the Rangamati district within the CHT, is experiencing the adverse effects of climate change, which will intensify the vulnerability of the local population. Changes in weather patterns can affect agricultural productivity, water availability, and the overall well-being of the communities residing in Juraichhri Upazila.

2. Brief About Juraichhri Upazila

Location: 22°27'- 22°44' N latitudes and 92°19'- 92°33' E longitudes (Banglapedia, 2024h)

Total Area: 605.047 sq km (GoB, 2024h)

Population: 27,786 (male 14839, female 12947)

Livelihood:

- Agriculture - 83.47%,
- Non-agricultural labourer - 4.36%,
- Commerce - 5.30%,
- Service - 4.21%,
- Others more **than 2.06%.**

Source: (Banglapedia, 2024h)

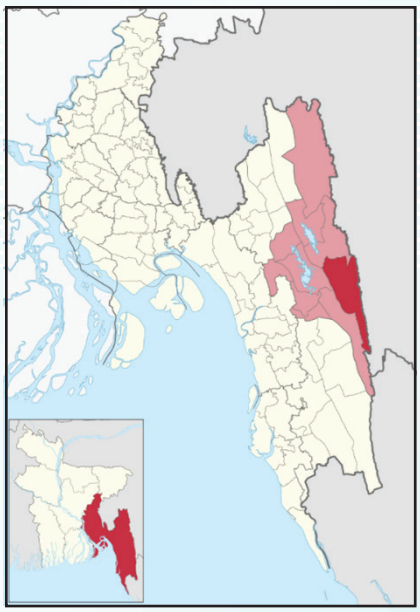

Figure 1: Location of Juraichhri Upazila

3. Existing Vulnerability of the Upazila

As per MJF (2020), people living across the CHT (including Juraichhri) over the last several years have been experiencing:

- Shortened winter season,
- Rising temperature in summer,
- uneven seasonal change
- Increased thunderstorm

Climate Vulnerability Index of Juraichhri Upazila
Moderate (0.56)

Source: (LoGIC and LGD, 2024)

Table 1: Existing Vulnerability of Juraichhari Upazila for different types of hazards/Climate stress

Hazard	Cyclone	Flash Flood	Heat wave	Cold Wave	Storm Surge	Max Rainfall (Observed)	Kharif Drought	Pre-kharif Drought	Landslide
Vulnerability Index	High	No risk	Low	Low	Low	Moderate	High	High	Low
Source	(BUET, 2020)						(ADB, 2021)		

4. Projection of Climate Change and Future Vulnerabilities

4.1 Projected Changes in Climate Parameters

Different studies show that the climate situations are likely to aggravate in the future. The projected changes in climate parameters for Juraichhri obtained by BUET (2020) show that there will be a rise in maximum and minimum temperature in all seasons; rainfall and number of rainy days show erratic patterns.

Table 2: Projected Changes in Climate Parameters under RCP 4.5

Timeline/ Season[1]	Parameter	Pre-monsoon	Monsoon	Post-monsoon	Winter
2030	Maximum Temperature	1.2°C ↑	1.1°C ↑	1.0°C ↑	1.3 °C ↑
	Minimum Temperature	1.0 °C ↑	1.1 °C ↑	0.5 °C ↑	1.1 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↓
	Number of Rainy Days	10% ↓	10% ↕	10% ↕	10% ↕
2050	Maximum Temperature	1.7°C ↑	1.5°C ↑	1.7°C ↑	1.3°C↑
	Minimum Temperature	1.7 °C ↑	1.5 °C ↑	1.9 °C ↑	1.6 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10% ↓
	Number of Rainy Days	10% ↕	10% ↑	10% ↓	10% ↑
2070	Maximum Temperature	2.1°C ↑	1.5°C ↑	1.9°C ↑	2.3 °C ↑
	Minimum Temperature	1.8°C ↑	1.8 °C ↑	2.4°C ↑	2.3°C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↓
	Number of rainy Days	10% ↓	10% ↑	10% ↓	10% ↓

Note: Base period considered as 1970-2000

4.2 Projected Impact due to Climate Change

Rainfall variability, flash flood, cyclonic storm surge, drought, lightning, extreme heat and landslide already pose high impact in CHT and projected climate change are likely to aggravate the risk and impact (MoEFCC,2022). The domino effect of projected climate change, as described in various studies, are briefly mentioned below:

1 There are four prominent climatic seasons in Bangladesh: winter (December – February), pre-monsoon (March-May), monsoon (June–September) and post-monsoon (October–November) (MJF, 2020).

- **Affecting a balanced water supply** due to change in rainfall pattern (Chakma, 2023).
- **More risk in terms of water supply for agriculture** due to ratio of precipitation (P) to potential evapotranspiration (PET) being less than 1 and unfavorable changes in Standard Precipitation Index (SPI) as shown in Figure 2 (BUET, 2020) - leading to **decline in agricultural yield.**
- **Reduced access to clean water** for residents (Chakma, 2023)
- **Increased occurrence of thunderstorms**, leading to more violent storms, more lightning strikes due to rising temperature (Kirsty McCabe, 2023) – causing more casualties
- **Increased incident of Flash Flood and land slide** causing environmental degradation, destruction of infrastructure hampers communication, disrupts crop sales, and hinders access to essential services (Chakma, 2023)

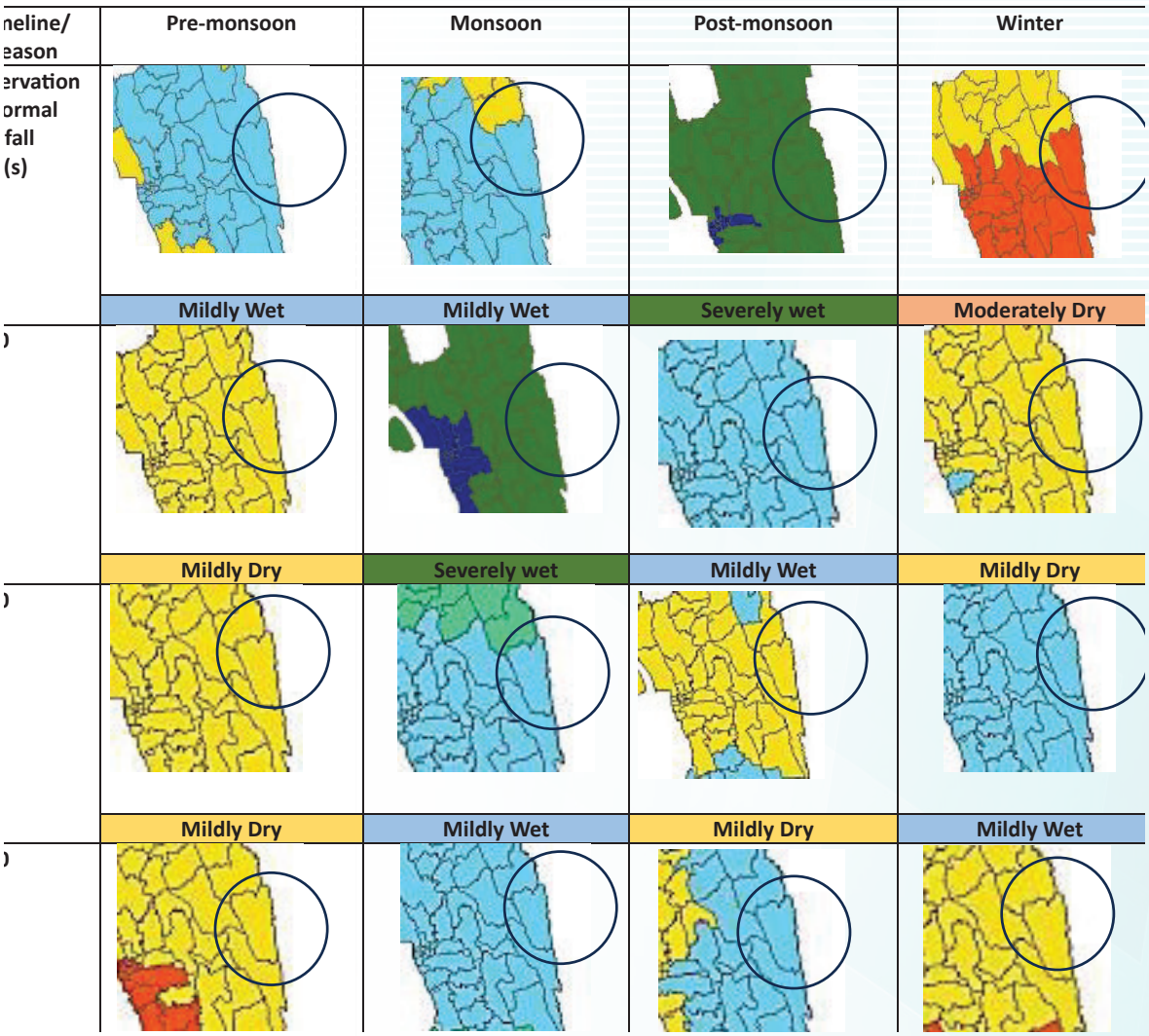

Figure 2: Projected Impact (Changes in SPI[2]) under RCP 4.5 (Source: Figure 5.1-5.6 of BUET (2020))

2 The Standardized Precipitation Index (SPI) is a widely used index to characterize meteorological drought on a range of timescales and is closely related to soil moisture, groundwater and reservoir storage (NCAR_CDG, 2024)

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Climate Risk and Vulnerability Assessment: Belaicchari Upazila

1. Introduction

The Chittagong Hill Tracts (CHT), like many other regions in Bangladesh, is facing the challenges of climate change which include erratic rainfall patterns, heavy rainfall leading to landslides, drought, and flash floods. Belaicchari Upazila, situated in the Rangamati district within the CHT, is experiencing the adverse effects of climate change, which will intensify the vulnerability of the local population. Changes in weather patterns can affect agricultural productivity, water availability, and the overall well-being of the communities residing in Belaicchari Upazila.

2. Brief About Belaicchari Upazila

Location: 21°54'- 22°33' N latitudes and 92°17'- 92°36' E longitude (Banglapedia, 2024i)

Total Area: 746 sq km (GoB, 2024i).

Population: 28,525 people (male 15174, female 13351) (Banglapedia, 2024i), (GoB, 2024i).

Livelihood:

- Agriculture - 73.79%,
- Non-agricultural laborer - 2.92%,
- Commerce - 9.29%,
- Service - 5.82%,
- Others – more than 7.32%

(Banglapedia, 2024i)

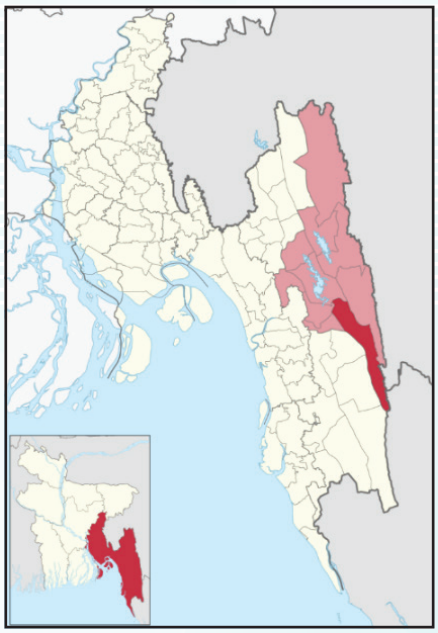


Figure 1: Location of Belaicchari Upazila

3. Existing Vulnerability of the Upazila

As per MJF (2020), people living across the CHT (including Belaicchari) over the last several years have been experiencing:

- Shortened winter season,
- Rising temperature in summer,
- uneven seasonal change
- Increased thunderstorm

Climate Vulnerability Index of Belaicchari Upazila
Moderate (0.54)

Source: (LoGIC and LGD, 2024)

Table 1: Existing Vulnerability of Belaicchari Upazila for different types of hazards/ Climatic Stress

Hazard	Cyclone	Flash Flood	Heat wave	Cold Wave	Storm Surge	Max Rainfall (Observed)	Kharif Drought	Pre-kharif Drought	Landslide
Vulnerability Index	High	No risk	Low	Low	Low	Moderate	High	High	Low
Source	(BUET, 2020)						(ADB, 2021)		

4. Projection of Climate Change and Future Vulnerabilities

4.1 Projected Changes in Climate Parameters

Different studies show that the climate situations are likely to aggravate in the future. The projected changes in climate parameters for Belaicchari obtained by BUET (2020) show that there will be a rise in maximum and minimum temperature in all seasons; rainfall and number of rainy days show erratic pattern.

Table 2: Projected Changes in Climate Parameters under RCP 4.5

Timeline/ Season[1]	Parameter	Pre-monsoon	Monsoon	Post-monsoon	Winter
2030	Maximum Temperature	1.2°C ↑	1.1°C ↑	1.1°C ↑	1.3 °C ↑
	Minimum Temperature	1.0 °C ↑	1.1 °C ↑	0.5 °C ↑	1.1 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↓
	Number of Rainy Days	10% ↓	10% ↕	10% ↕	10% ↕
2050	Maximum Temperature	1.7°C ↑	1.5°C ↑	1.7°C ↑	1.3°C↑
	Minimum Temperature	1.7 °C ↑	1.4 °C ↑	1.8 °C ↑	1.5 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10% ↓
	Number of Rainy Days	10% ↕	10% ↑	10% ↓	10% ↑
2070	Maximum Temperature	2.0°C ↑	1.4°C ↑	1.8°C ↑	2.2 °C ↑
	Minimum Temperature	1.8°C ↑	1.8 °C ↑	2.4°C ↑	2.2°C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↓
	Number of rainy Days	10% ↕	10% ↑	10% ↓	10%↓

Note: Base period considered as 1970-2000

4.2 Projected Impact due to Climate Change

Rainfall variability, flash flood, cyclonic storm surge, drought, lightning, extreme heat and landslide already pose high impact in CHT and projected climate change are likely to aggravate the risk and impact (MoEFCC, 2022). The domino effect of projected climate change, as described in various studies, are briefly mentioned below:

1 There are four prominent climatic seasons in Bangladesh: winter (December – February), pre-monsoon (March-May), monsoon (June–September) and post-monsoon (October–November) (MJF, 2020).

- **Affecting a balanced water supply** due to change in rainfall pattern (Chakma, 2023).
- **More risk in terms of water supply for agriculture** due to ratio of precipitation (P) to potential evapotranspiration (PET) being less than 1 and unfavorable changes in Standard Precipitation Index (SPI) as shown in Figure 2 (BUET, 2020) - leading to **decline in agricultural yield.**
- **Reduced access to clean water** for residents (Chakma, 2023)
- **Increased occurrence of thunderstorms**, leading to more violent storms, more lightning strikes due to rising temperature (Kirsty McCabe, 2023) – causing more casualties
- **Increased incident of Flash Flood and land slide** causing environmental degradation, destruction of infrastructure hampers communication, disrupts crop sales, and hinders access to essential services (Chakma, 2023)

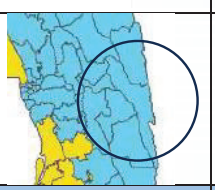
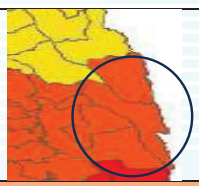
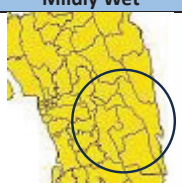
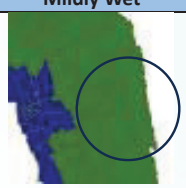
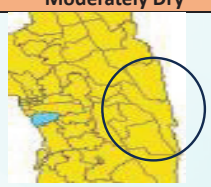
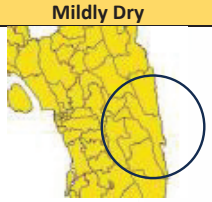
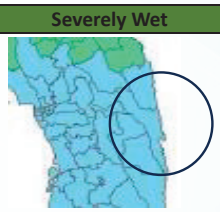
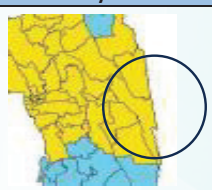
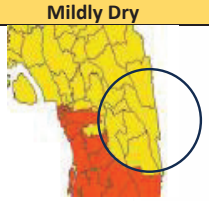
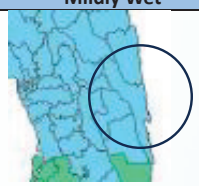
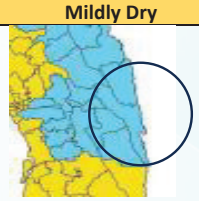
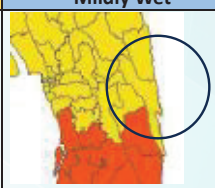
Timeline/ Season	Pre-monsoon	Monsoon	Post-monsoon	Winter
Observation in Normal Rainfall Year(s)				
	Mildly Wet	Mildly Wet	Severely Wet	Moderately Dry
2030				
	Mildly Dry	Severely Wet	Mildly Wet	Mildly Dry
2050				
	Mildly Dry	Mildly Wet	Mildly Dry	Mildly Wet
2070				
	Mildly Dry	Mildly Wet	Mildly Wet	Mildly Dry

Figure 2: Projected Impact (Changes in SPI[2]) under RCP 4.5 (Source: Figure 5.1-5.6 of BUET (2020))

2 The Standardized Precipitation Index (SPI) is a widely used index to characterize meteorological drought on a range of timescales and is closely related to soil moisture, groundwater and reservoir storage (NCAR_CDG, 2024)

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Climate Risk and Vulnerability Assessment: Barkal Upazila

1. Introduction

The Chittagong Hill Tracts (CHT), like many other regions in Bangladesh, is facing the challenges of climate change which include erratic rainfall patterns, heavy rainfall leading to landslides, drought, and flash floods. Barkal Upazila, situated in the Rangamati district within the CHT, is experiencing the adverse effects of climate change, which will intensify the vulnerability of the local population. Changes in weather patterns can affect agricultural productivity, water availability, and the overall well-being of the communities residing in Barkal Upazila.

2. Brief About Barkal Upazila

Location: 22.39 - 23.14 N latitude and 92.11 - 92.29 E longitude

Total Area: 760.88 sq kilometers.

Source: (GoB, 2024j).

Population: 47,523 (male 25,614; female 21,909)

Livelihood:

- Agriculture - 83.46%,
- Non-agricultural labourer - 2.19%,
- Commerce - 5.87%,
- Service - 2.54%,
- Others – more than 5.76%.

Source: (Banglapedia, 2024j)

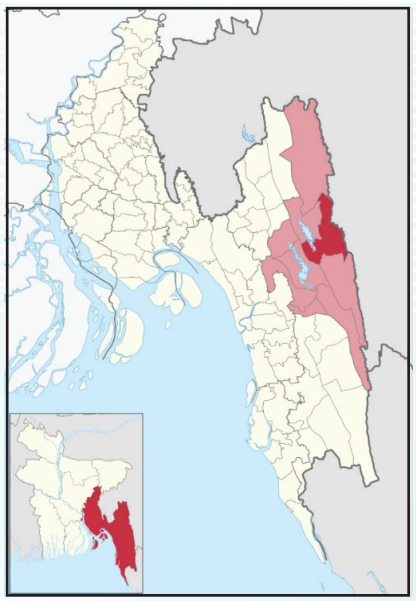

Figure 1: Location of Barkal Upazila

3. Existing Vulnerability of the Upazila

As per MJF (2020), people living across the CHT (including Barkal) over the last several years have been experiencing:

- Shortened winter season,
- Rising temperature in summer,
- uneven seasonal change
- Increased thunderstorm

Climate Vulnerability Index of Barkal Upazila
Moderate (0.52)

Source: (LoGIC and LGD, 2024)

Table 1: Existing Vulnerability of Barkal Upazila for different types of hazards/Climate Stress

Hazard	Cyclone	Flash Flood	Heat wave	Cold Wave	Storm Surge	Max Rainfall (Observed)	Kharif Drought	Pre-kharif Drought	Landslide
Vulnerability Index	High	No risk	Low	Low	Low	Moderate	High	High	Low
Source	(BUET, 2020)						(ADB, 2021)		

4. Projection of Climate Change and Future Vulnerabilities

4.1 Projected Changes in Climate Parameters

Different studies show that the climate situations are likely to aggravate in the future. The projected changes in climate parameters for Barkal obtained by BUET (2020) show that there will be a rise in maximum and minimum temperature in all seasons; however, rainfall and number of rainy days show erratic patterns.

Table 2: Projected Changes in Climate Parameters under RCP 4.5

Timeline/ Season[1]	Parameter	Pre-monsoon	Monsoon	Post-monsoon	Winter
2030	Maximum Temperature	1.3°C ↑	1.1°C ↑	1.0°C ↑	1.3 °C ↑
	Minimum Temperature	1.1 °C ↑	1.1 °C ↑	0.6 °C ↑	1.2°C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↓
	Number of Rainy Days	10% ↓	10% ↕	10% ↕	10%↓
2050	Maximum Temperature	1.7°C ↑	1.5°C ↑	1.8°C ↑	1.3°C↑
	Minimum Temperature	1.7 °C ↑	1.5 °C ↑	2.0 °C ↑	1.7 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↓	10%↕
	Number of Rainy Days	10% ↓	10% ↑	10% ↓	10%↑
2070	Maximum Temperature	2.2°C ↑	1.5°C ↑	1.9°C ↑	2.4 °C ↑
	Minimum Temperature	1.8°C ↑	1.9°C ↑	2.5°C ↑	2.3 °C ↑
	Change in Rainfall	10% ↓	10% ↑	10% ↕	10%↑
	Number of rainy Days	10% ↑	10%↕	10% ↓	10%↓

Note: Base period considered as 1970-2000

4.2 Projected Impact due to Climate Change

Rainfall variability, flash flood, cyclonic storm surge, drought, lightning, extreme heat and landslide already pose high impact in CHT and projected climate change are likely to aggravate the risk and impact (MoEFCC, 2022). The domino effect of projected climate change, as described in various studies, are briefly mentioned below:

1 There are four prominent climatic seasons in Bangladesh: winter (December – February), pre-monsoon (March-May), monsoon (June–September) and post-monsoon (October–November) (MJF, 2020).

- **Affecting a balanced water supply** due to change in rainfall pattern (Chakma, 2023).
- **More risk in terms of water supply for agriculture** due to ratio of precipitation (P) to potential evapotranspiration (PET) being less than 1 and unfavorable changes in Standard Precipitation Index (SPI) as shown in Figure 2 (BUET, 2020) **-** leading to **decline in agricultural yield.**
- **Reduced access to clean water** for residents (Chakma, 2023)
- **Increased occurrence of thunderstorms**, leading to more violent storms, more lightning strikes due to rising temperature (Kirsty McCabe, 2023) – causing more casualties
- **Increased incident of Flash Flood and land slide** causing environmental degradation, destruction of infrastructure hampers communication, disrupts crop sales, and hinders access to essential services (Chakma, 2023)

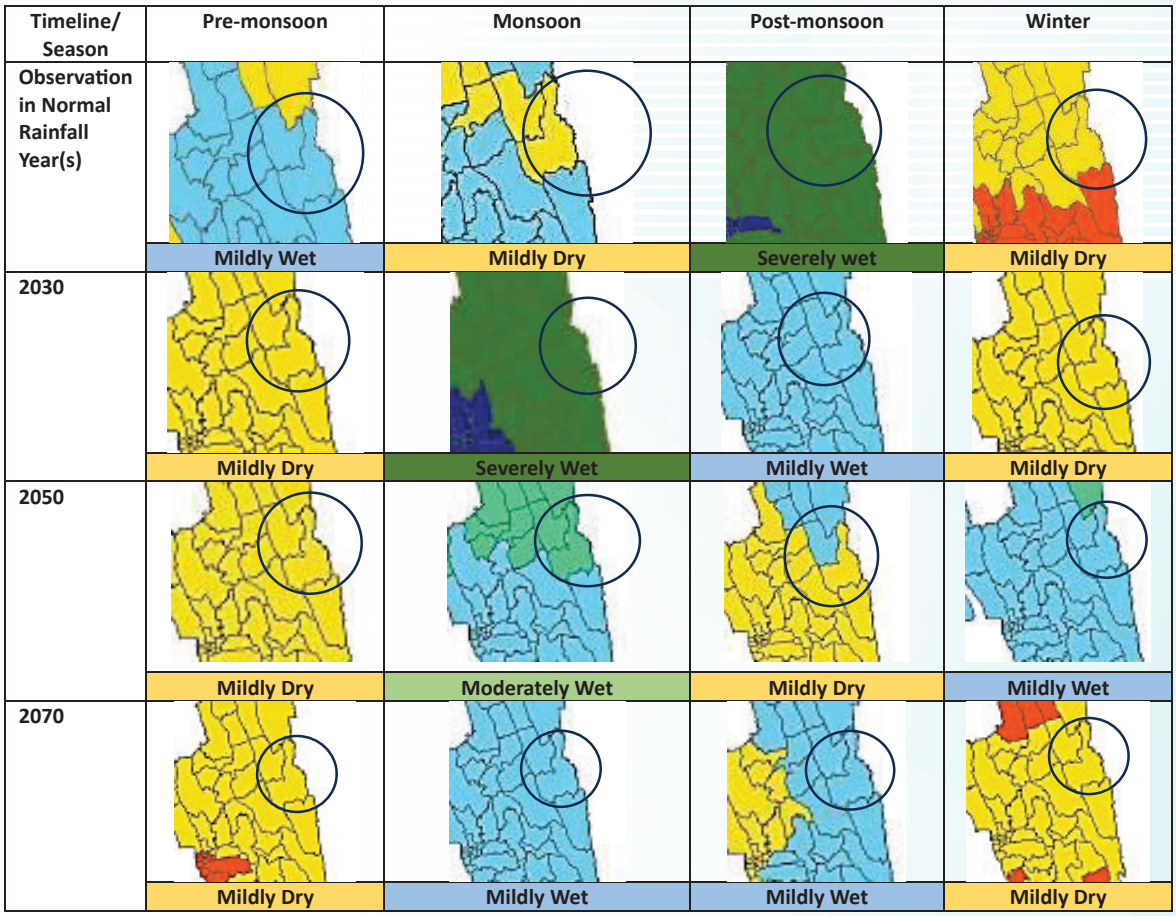

Figure 2: Projected Impact (Changes in SPI[2]) under RCP 4.5 (Source: Figure 5.1-5.6 of BUET (2020))

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Climate Risk

Local Government Initiative on Climate Change (LoGIC) Project

E/8-A, IDB Bhaban, Level-8, Sher-e-Bangla Nagar, Agargaon, Dhaka-1207, Bangladesh.
Phone: +88-02-55667788
www.logicbd.org

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