

Climate Change Adaptation and Water Nexus Bangladesh Context

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Climate Change Impact over Bangladesh

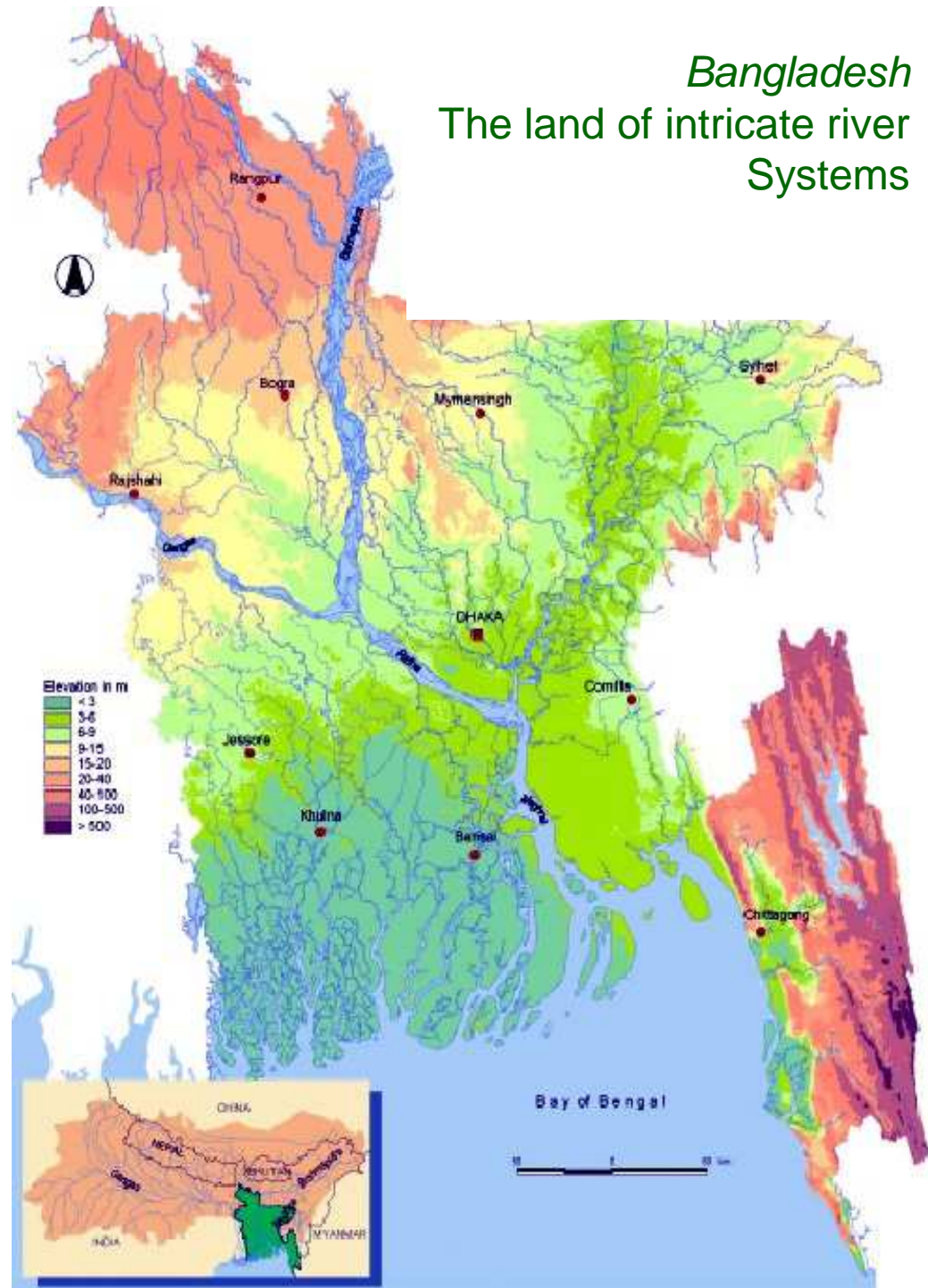
- ❖ Bangladesh is recognized as one of the countries that are **most vulnerable** to the impacts of **climate change and climate variability**.
- ❖ Almost every year one or more severe **natural disasters** upset people's lives in some part of the country.
- ❖ **Flood** is a recurring phenomenon in the country, which brings untold sufferings to millions of people.
- ❖ **Cyclone and storm surges** occur frequently and cause significant destruction in the coastal areas.
- ❖ The climate of Bangladesh is characterized by **high temperature, heavy rainfall, often excessive humidity and fairly marked seasonal variations** (Alam, 2003).

Because of **geographical location, low topography, deltaic plain, complex river system, high population, agriculture dominated economy, huge losses due to flood, , Lightning, landslide, flash flood, river bank erosion, present level of preparation etc**

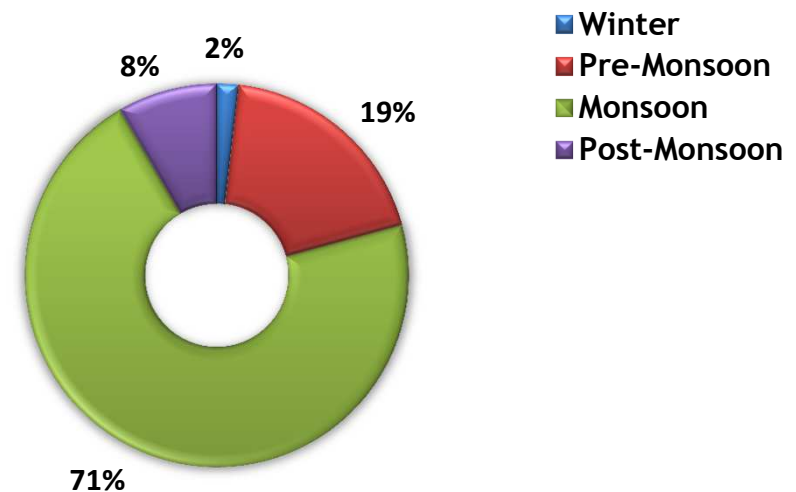
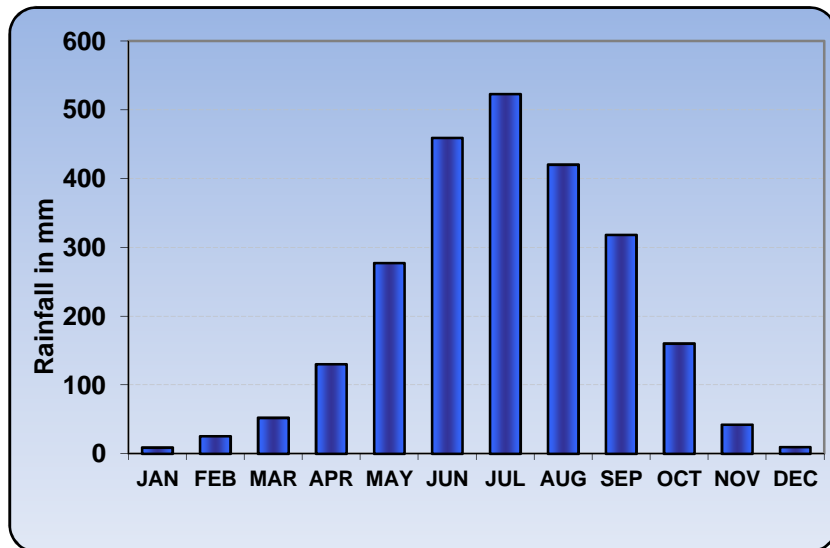
International bodies including UNDP has identified Bangladesh to be the most vulnerable country in the world with respect to climate change

Joint probability of flood and cyclone surge...

Bangladesh The land of intricate river Systems

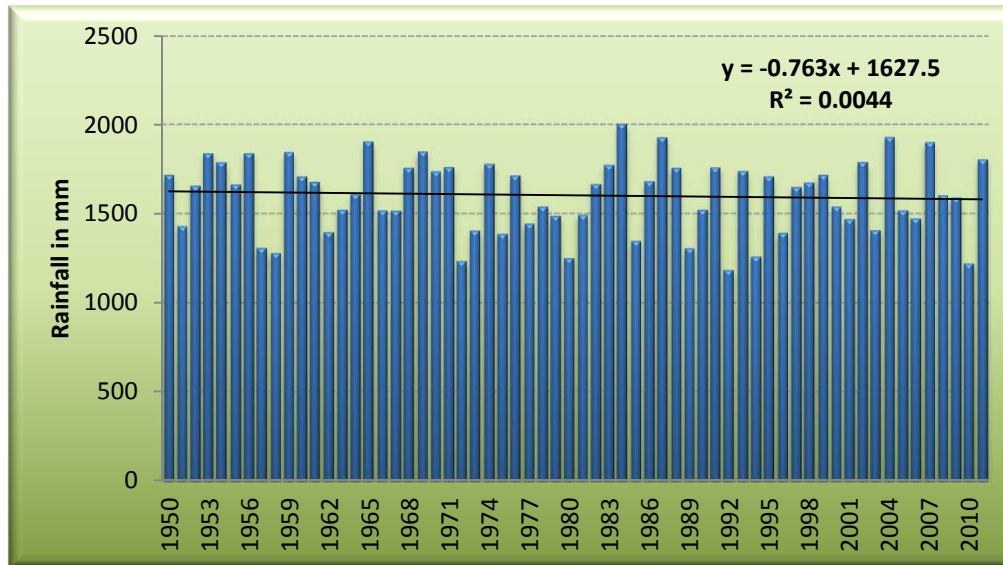


Monthly and Seasonal Rainfall distribution over Bangladesh

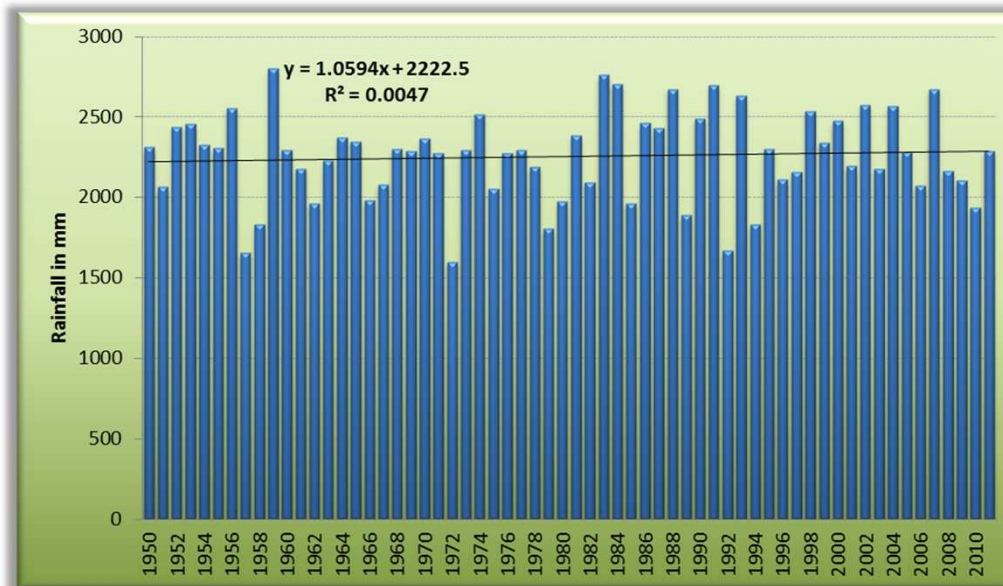


Bangladesh has a subtropical **monsoon climate** characterized by wide seasonal variations in rainfall, moderately warm temperatures, and high humidity. The maximum rainfall occurs in the month of July and minimum in January. In Monsoon season (June – September) **71%** of annual rainfall occurs.

Variation and Trend of Monsoon and Annual Rainfall over Bangladesh (1950-2011)

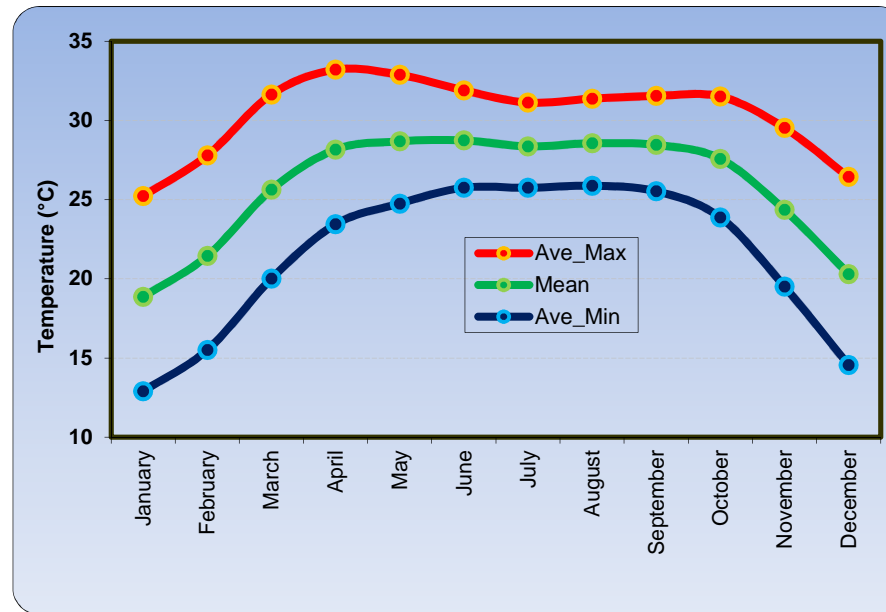


Monsoon rainfall over Bangladesh has a decreasing trend. Monsoon rainfall over Bangladesh is **decreasing 7.6 mm** per decade.



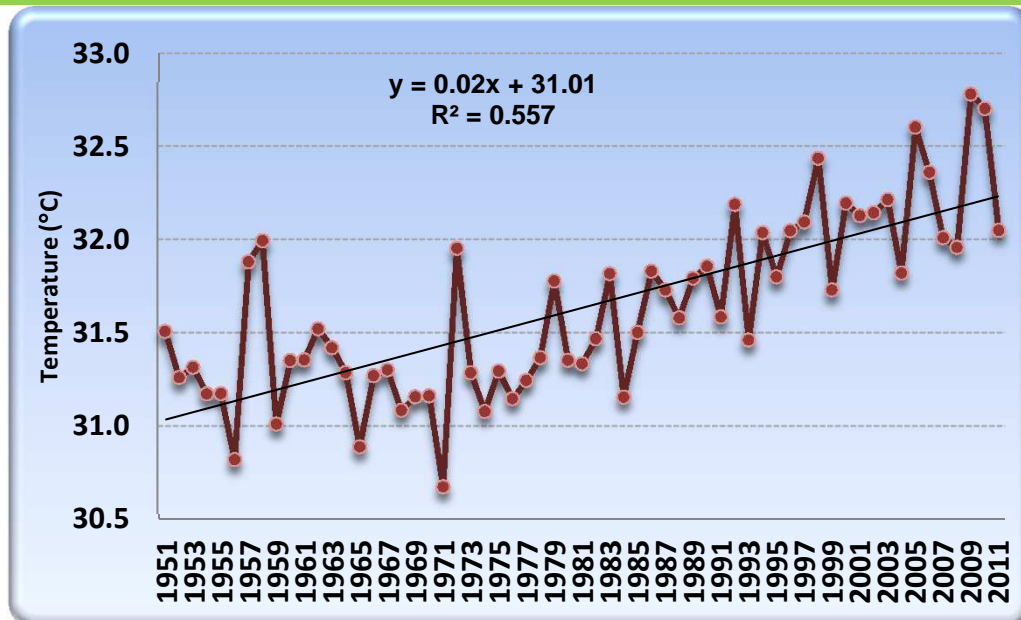
The **annual average rainfall** over Bangladesh has a rising trend. The annual average rainfall over Bangladesh is **increasing by about 10.6 mm** per decade.

Monthly Maximum, Mean & Minimum Temperature over Bangladesh

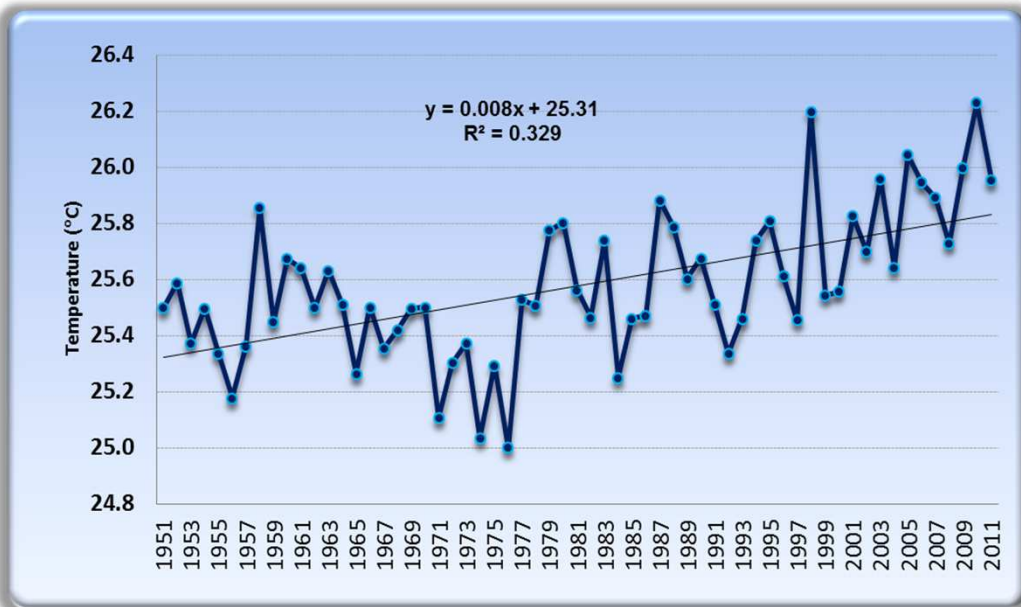


April is the hottest month and January is the coldest month in Bangladesh

Variation and trend of **maximum and minimum temperature** in **monsoon** season during 1951-2011

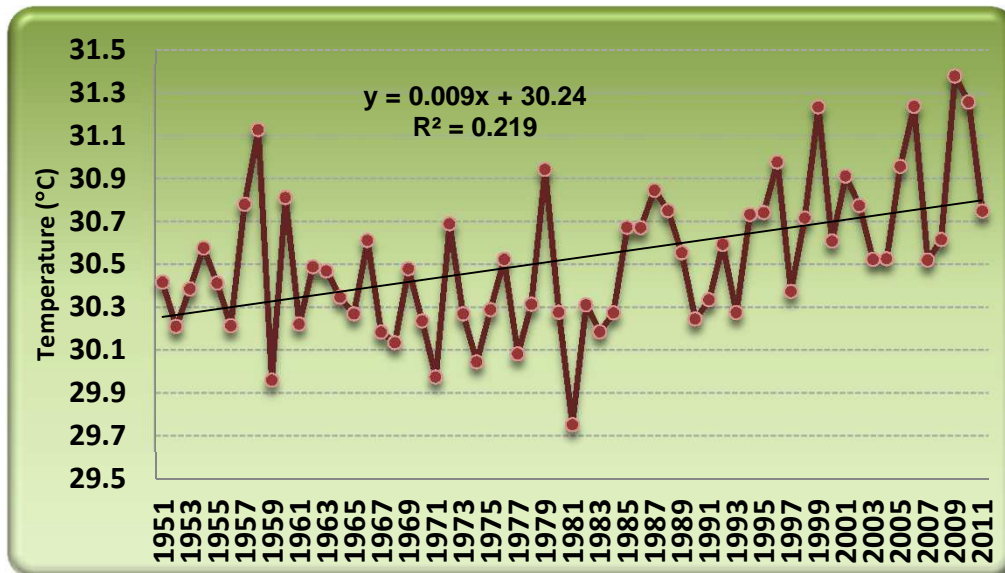


The trends of **maximum temperature** in **monsoon** over Bangladesh during 1951-2011 is in rising trend. In monsoon season the maximum temperature is **rising by 0.2°C** per decade, **which is statistically significant.**

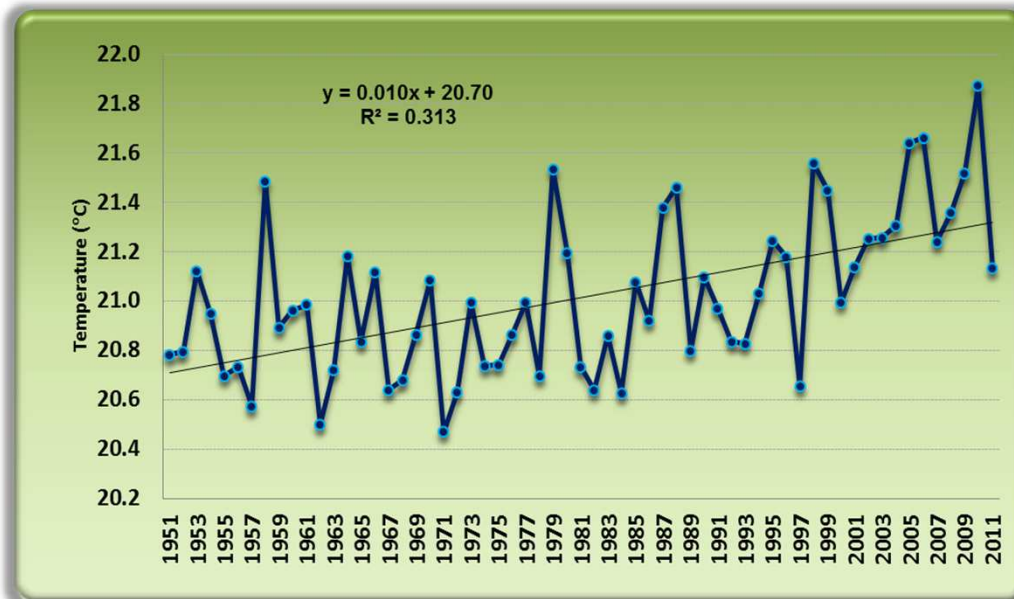


The trends of **minimum temperature** in **monsoon** over Bangladesh during 1951-2011 are in rising trend. The minimum temperature in this season is **rising by 0.08°C** per decade.

Variation and trend of **Annual maximum and minimum temperature** during 1951-2011

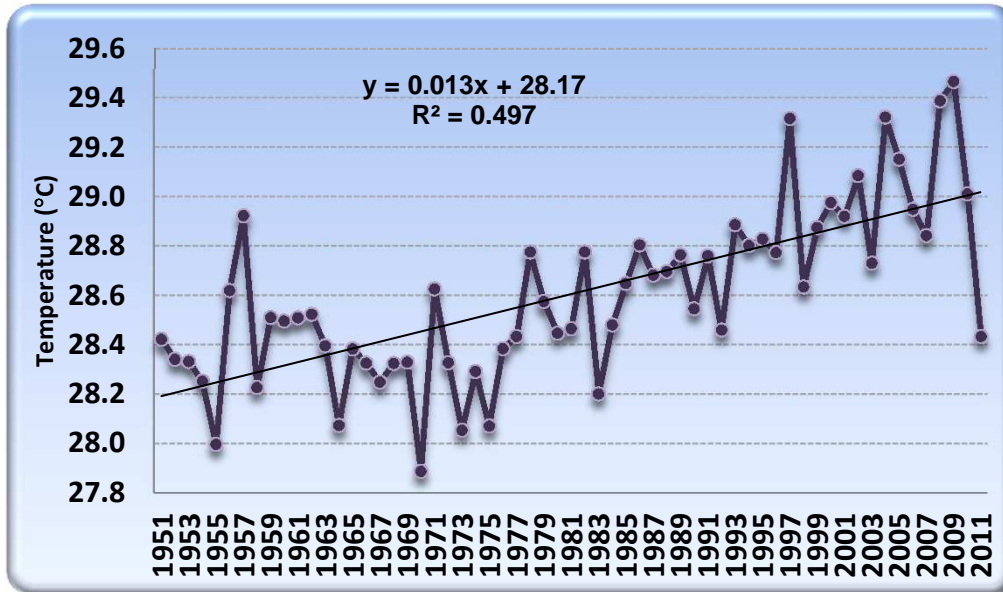


The trends of **Annual maximum temperature** over Bangladesh during 1951-2011 are in rising trend. Annual maximum temperature over Bangladesh is **rising by 0.09°C**.

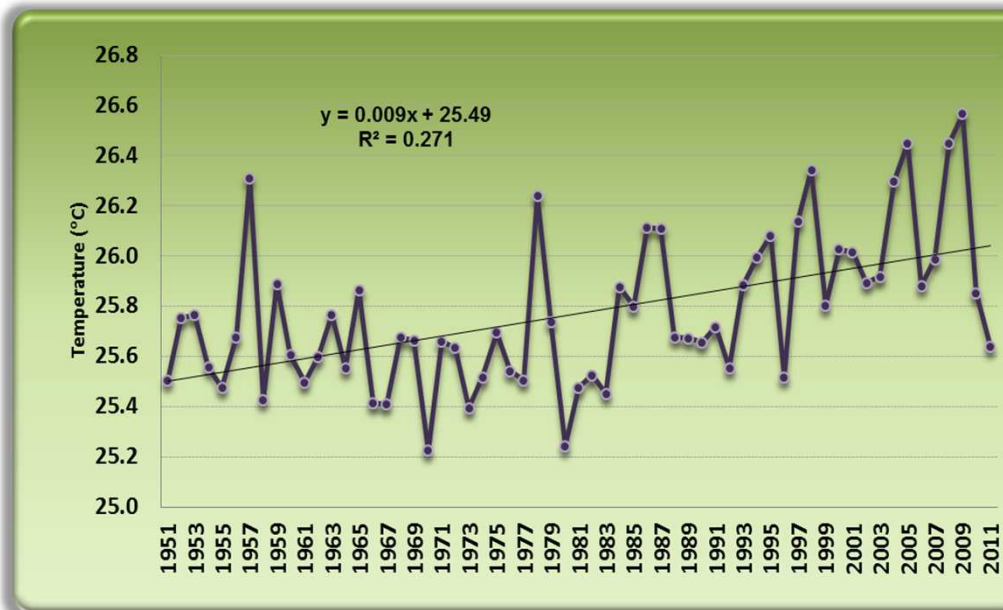


The trends of **Annual minimum temperature** over Bangladesh during 1951-2011 are in rising trend. Annual minimum temperature is **rising by 0.1°C per decade**.

Variation and trend of **mean temperature** during 1951-2011



The trends of **mean** temperature in **monsoon** season over Bangladesh during 1951-2011 are in rising trend. The rate of increasing trend of mean temperature in monsoon season is **0.13 °C**.



The trends of **Annual mean** temperature over Bangladesh during 1951-2011 are in rising trend. The rate of increasing trend of annual mean temperature is **0.09 °C**.

Predicted Climate Change Scenarios in Bangladesh

Year	Temperature change (°C)			Precipitation change (%)			Sea level rise (cm)
	Annual	Dec-Feb	Jun-Aug	Annual	Dec-Feb	Jun-Aug	
2030	1.0	1.1	0.8	5	-2	6	14
2050	1.4	1.6	1.1	6	-5	8	32
2100	2.4	2.7	1.9	10	-10	12	88

General Circulation Model (GCM)

- **Average increase in temperature: 1.3°C and 2.6°C for the years 2030 and 2070, respectively.**
- **Seasonal variation in changed temperature: 1.4°C change in the winter and 0.7°C in the monsoon months in 2030.**
- **For 2070, variation would be 2.1°C and 1.7°C in winter and monsoon, respectively.**
- **Precipitation: winter precipitation would decrease to a negligible rate in 2030, while in 2075 there would not be any appreciable rainfall in winter.**

Dryness and Drought: Consequence of aberrant rainfall and temperature

- ❖ Increase in temperature and **decrease in seasonal rainfall** are the principal reasons for **dryness in Bangladesh**.
- ❖ In recent years, **dryness and drought** (extreme dry condition) has become one of the important climatic events in the country, because it directly affects the socio-economic life through the changes in abundance and availability of food and fiber, **water resources and energy supply** and also through the adverse impacts on weather dependent agricultural activities.
- ❖ It can be noted here that **agriculture** is the single most and the largest sector of Bangladesh economy which accounts for about **35% of the GDP and about 70% of the labor force (BBS, 2006)**.
- ❖ Therefore **dryness and drought assessment** is very important to mitigate its adverse impacts as well as to adapt with the **changed climatic scenario** in our country.

Dryness and Drought: Consequence of aberrant rainfall and temperature

- ❖ Though Bangladesh is predominantly a **riverine country**, northwestern region is threatened by desertification.
- ❖ The ratio of **cultivable land to rural population** (acre/ person) has decreased in the northwestern region (Rajshahi Division) by **23.2%** as compared to a decreased ratio of **17.2%** in the whole of the country.
- ❖ The northwestern part is prone to **drought** mainly because of **rainfall variability** in the **pre-monsoon and the post-monsoon periods**.
- ❖ Inadequate pre-monsoon showers, a delay in the onset of the rainy season or an early departure of the monsoon may create **drought conditions in Bangladesh, and adversely affect crop output**.

Flood and Agricultural Land

Table 1.1.4 Floodplains, as Part of the Total Net Cultivable Area (NCA), Categorized, according to the Depth of Flooding

Sl. No.	Category	Depth of Flooding
1	F ₀	Highland with 0-30 cm of flooding
2	F ₁	Shallow-flooded area with 30-90cm of flooding
3	F ₂	Medium-flooded area with 90-180cm of flooding
4	F ₃	Deeply-flooded low land with more than 180cm of flooding
5	F ₄	Deeply-flooded low land with more than 180cm of flooding

Source : MPO (1986)

Note : 1. Master Plan Organization (MPO)

2. For the purpose of fisheries production assessment, F₃ and F₄ categories, both being greater than 180cm of flooding, are lumped together (MPO, 1987b)

Table 1.1.5 Net Cultivable Areas Under Different Levels of Flooding

Floodplain Category	Total NCA (ha)	Total NCA Not ^a Under FCD (ha)	Total NCA Under FCD (ha)
F ₁	3,151,247	2,640,000	511,247
F ₂	1,431,932	1,300,000	131,932
F ₃ and F ₄	1,180,935	1,010,000	170,935
Active floodplains	536,609	536,609	
Subtotal	6,300,723	5,486,609	814,114
F ₀	3,261,679	2,020,000	1,241,679
Total	9,562,402	7,506,609	2,055,679 ^a
Total	12,824,081	9,526,609	2,055,679^a

Sources : MPO (1986); MPO (1987b)

Note : 1.^a This corresponds to the total land under FCD, including land protected by the Brahmaputra Right Embankment (240,000ha)

2. FCD: Flood Control a3. NCA: Net cropped Area

Rice (High Water Demanding Crop) Production

Table 1.2.1 Rice (Paddy) Production and Yield in Selected Countries of the World in 2000

Country	Area under Rice Cultivation (1000 ha)	Yield Rate (kg/ha)	Total Rice Production (1000 MT)
World	153766	3895	598852
Asia	137600	3964	545477
Bangladesh	10700	3348	35821
China	30503	6234	190168
India	44600	3008	134150
Indonesia	11523	4426	51000
Japan	1770	6702	11863
Italy	221	5886	1300
Australia	145	9655	1400
Colombia	440	4773	2100
USA	1232	7037	8669
Egypt	660	9086	5997

Source : FAO (2001)

Note : ha : Hectare; MT : Metric Ton

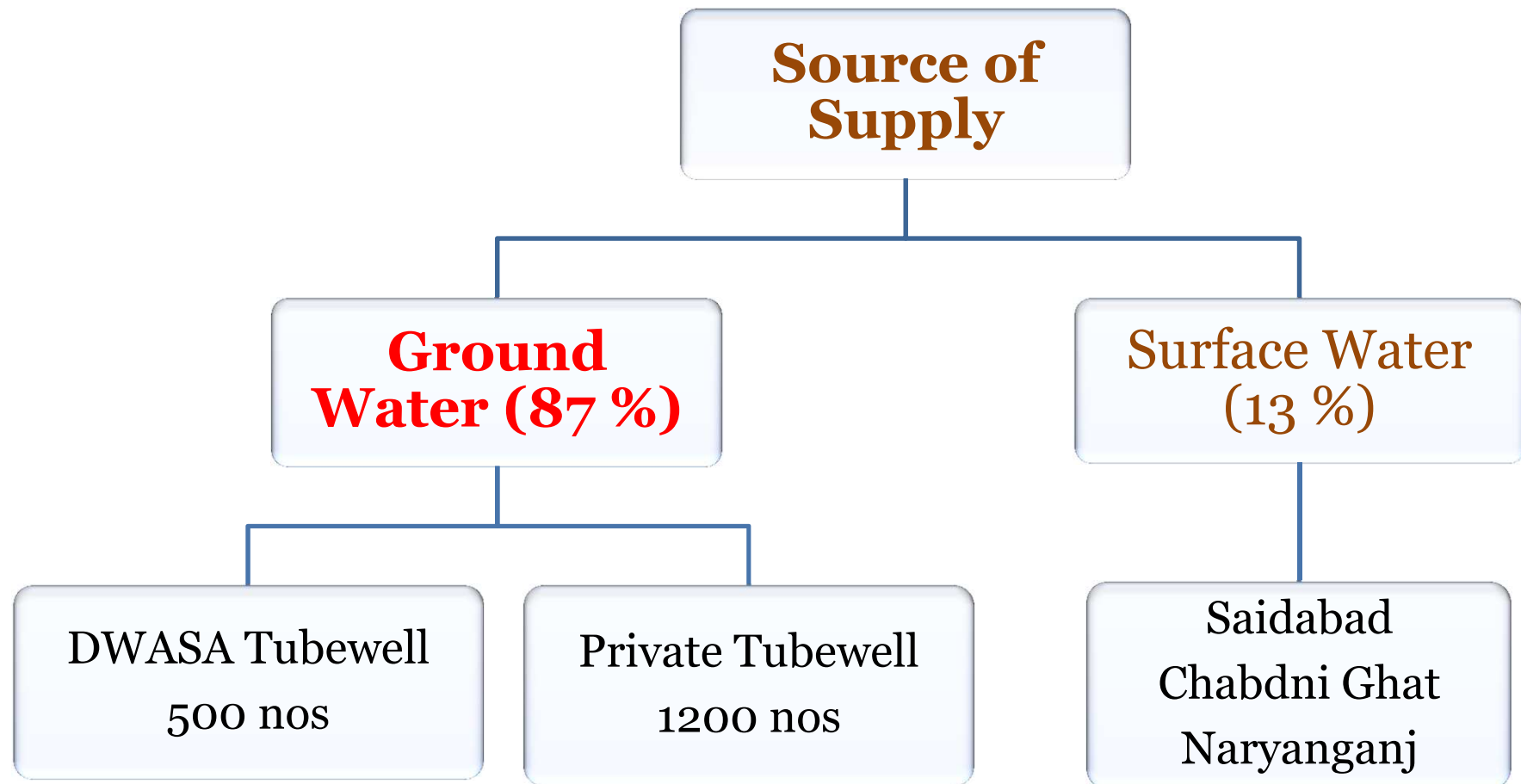
Crop Water Requirement

- ❖ The growing **imbalance between water demand** and supply during the dry season is expected to deteriorate further due to urbanization of more areas, agricultural expansion, increasing population, rapid industrialization and economic development.
- ❖ The **changing hydrological conditions** and agricultural practices in Bangladesh have gradually **converted it into a drought prone country**, which means in general terms, that **water shortage conditions in the dry period is adversely affecting the social and economic development of Bangladesh** (Ahmed, A.U. and M. Alam 1999).
- ❖ So it is very important to examine water demand and **water availability** in agriculture sector and also analyze drought prone area of high population density.

Making Policy: Adaptation & Mitigation

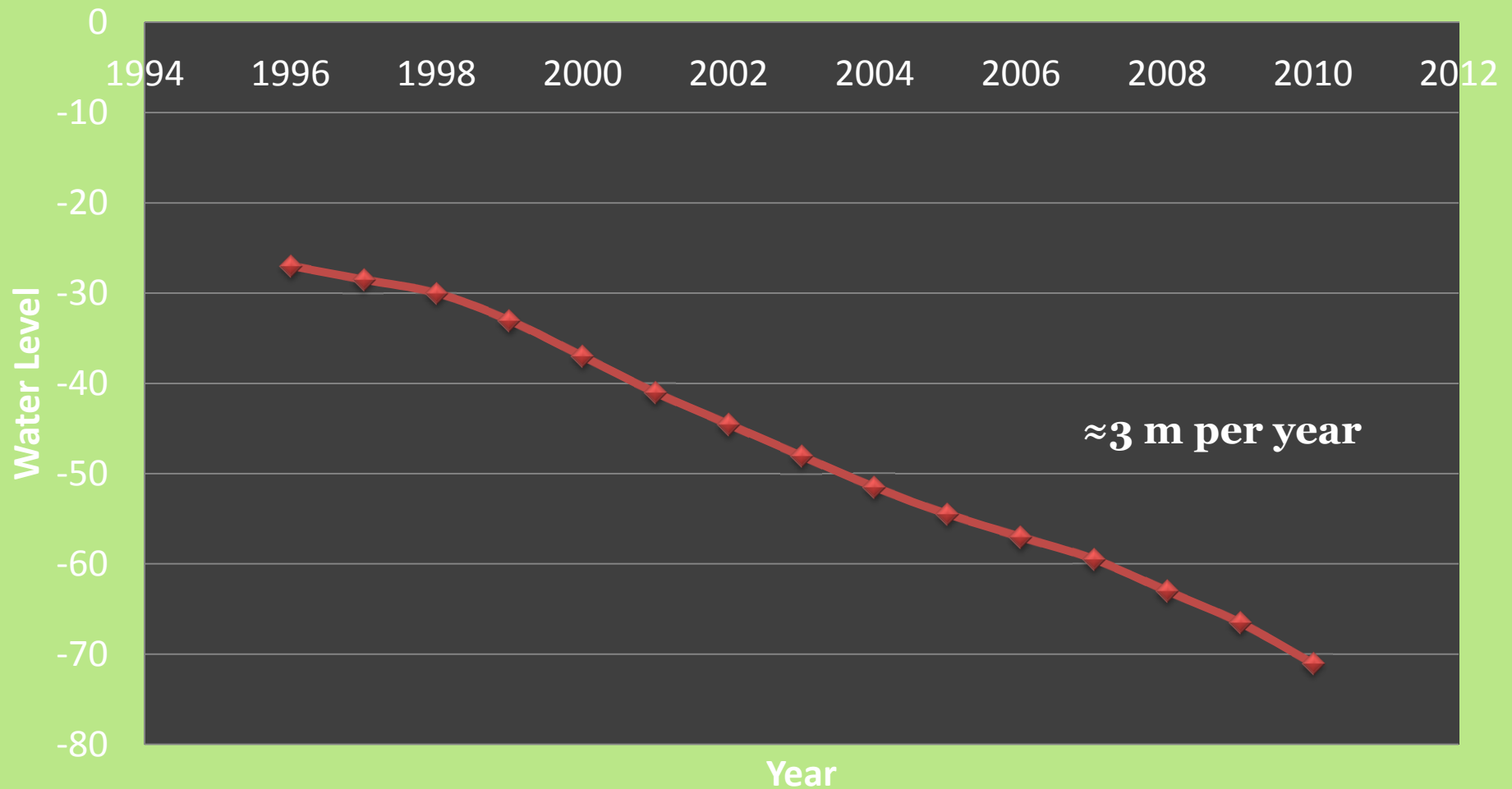
- ❖ Climate change will affect all natural and man-made systems to some extent. The impacts of climate change will often be specific to individual sectors or regions thus making some sectors and regions more vulnerable than others. However, the impacts on individual sectors or regions will vary depending on the sensitivity of the system and its adaptive capacity.
- ❖ Proper and **timely taken mitigation policies and adaptation measures can prevent further deterioration of climate and enable us to cope with the changed climatic condition.**
- ❖ A developing country, like Bangladesh, which still **depends mostly on weather dependent agriculture, should give proper attention to the climate change** issue as well as develop feasible mitigation and adaptation strategies.

Water Source (Dhaka City)



Source: Dr. Delwar Hossain (2010)

Urban Area: Water Level Declination Rate (Example: Dhaka City)



DWASA ,2010

Adaptations : Urban Area

Influx of Surface Water

- **Transport from big rivers**
- Peri-Urban river water

Integrate Rain Water Harvesting

- Residential use
- **GW recharge**

Waste Water Reclamation and Reuse

- Reduction of Demand
- Reuse based on the investment and applicability

Adaptations : Rural Area

Integrated use of SW and GW

- Reduction of demand on GW
- **Dedicated pond at each Union for Drinking water**

Renewable Energy

- Micro Hydro Power Projects
- Solar Energy

Rain Water Harvesting

- Domestic Use
- **Supplementing agricultural Demand**

Thanks for your kind attention

Impact on Water Availability (Brahmaputra Basin)

