Current Challenges and Some Best Practices for Sustainable Water Resource Management in Bangladesh.

APCTT Asian and Pacific Centre for Transfer of Technology

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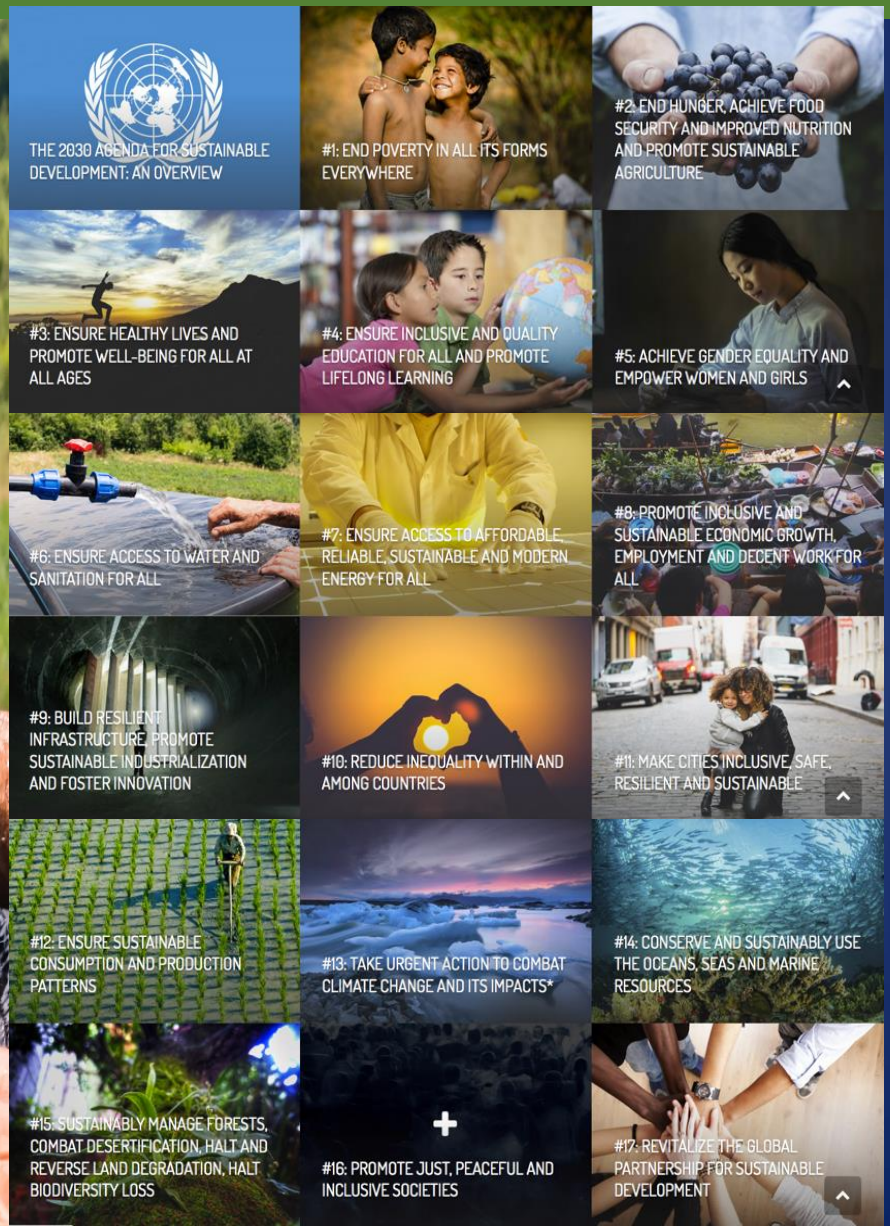
UNITED NATIONS ESCAP Economic and Social Commission for Asia and the Pacific

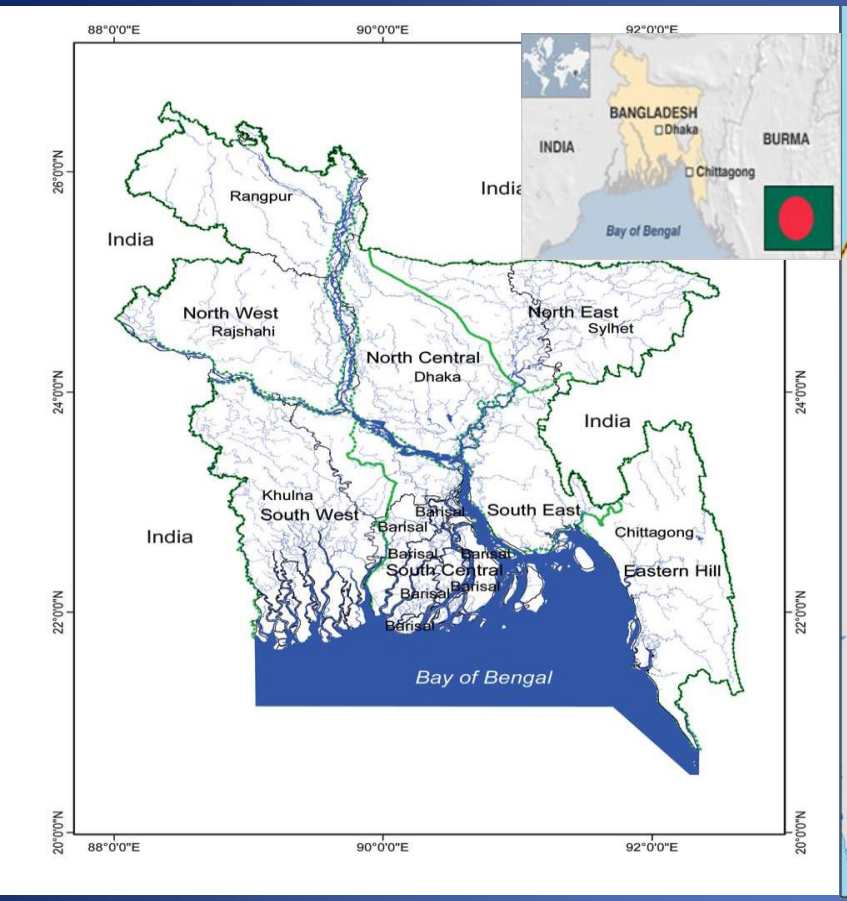
Structure of the talk

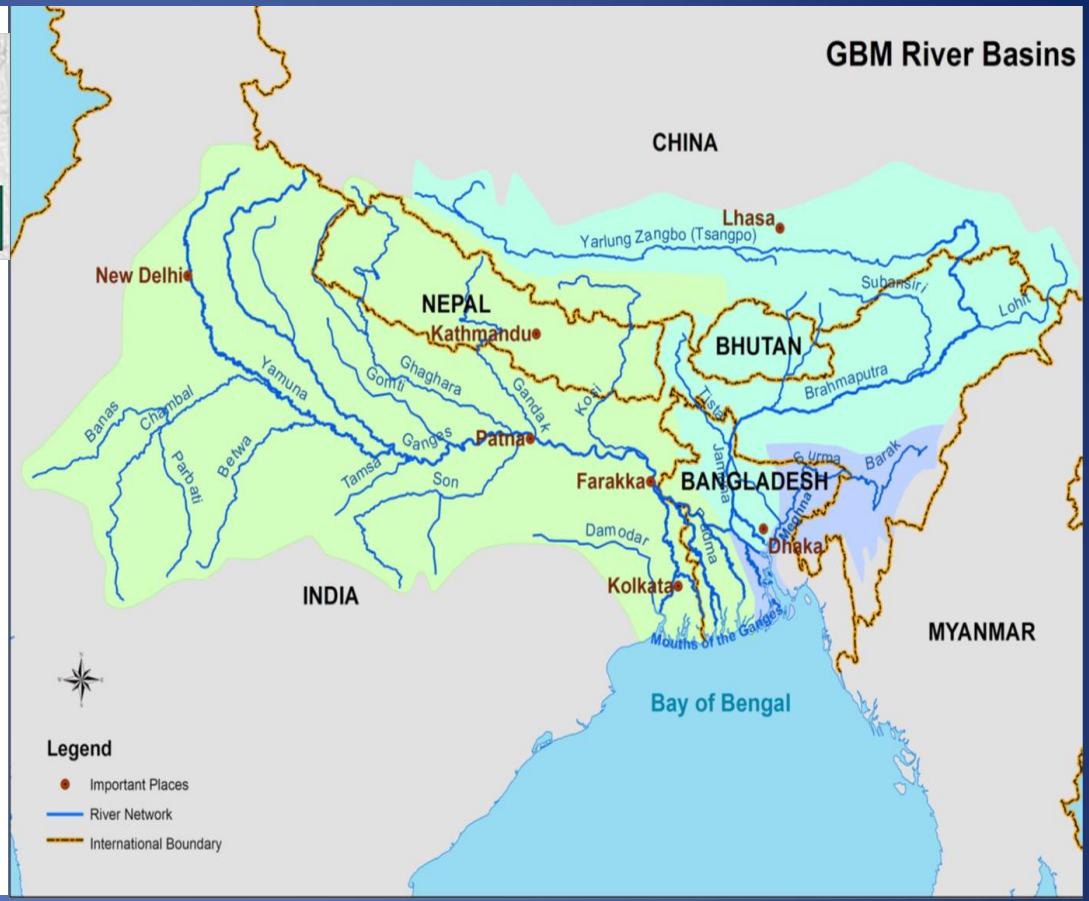
- Water Resources & Water Crisis in BD.
- Current Isues & Major Challenges of WRM in Bangladesh
- Common Practices to Manage Water Resouces
- Climate & Water Resources of Bangladesh
- Water Hazards & WRM
- Best Practices & Future Directions??
- Conclusions

SDG GOAL#6: Ensure access to water and sanitation for all



BANGLADESH –COUNTRY PROFILE & HYDROLOGICAL RIGIONS





Bangladesh
Country in South Asia

Bangladesh, to the east of India on the Bay of Bengal, is a South Asian country marked by lush greenery and many waterways. Its Padma (Ganges), Meghna and Jamuna rivers create fertile plains, and travel by boat is common. On the southern coast, the Sundarbans, an enormous mangrove forest shared with Eastern India, is home to the royal Bengal tiger.

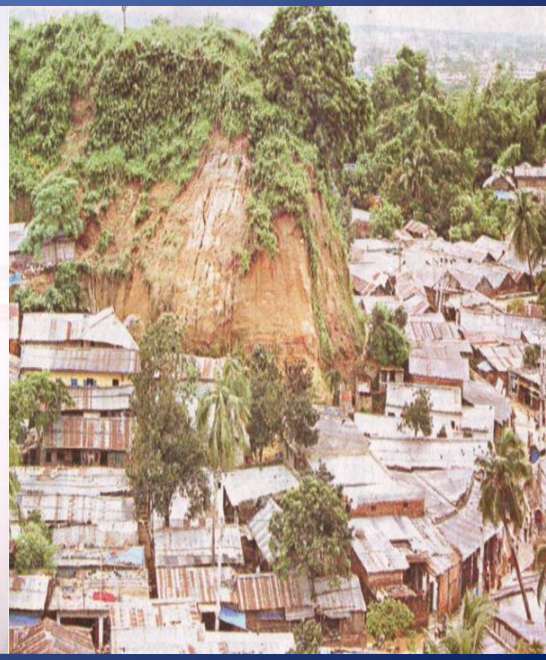
Capital: Dhaka Currency: Bangladeshi taka
Population: 156.6 million (2013) Language: Bengali

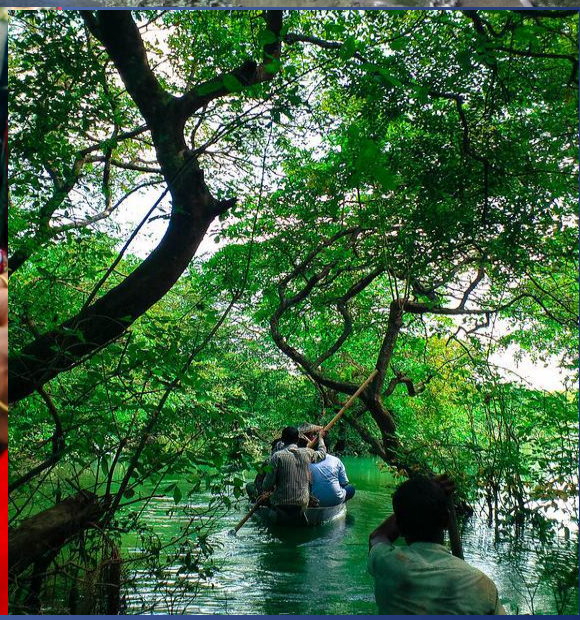
BANGLADESH COUNTRY PROFILE

- Bangladesh is the lowest riparian of three major river systems of the Himalayan Range – the Ganges, the Brahmaputra, and the Meghna (GBM), which drain a huge volume of water generated in the GBM region and pass through Bangladesh on to the Bay of Bengal. About 92% of the run-off Bangladesh has to deal with, enters the country from upstreams annually outside of the country. Bangladesh occupies only 7% of the GBM catchment area with a network of rivers criss-crossing the country.

Water Related Issues & Problems

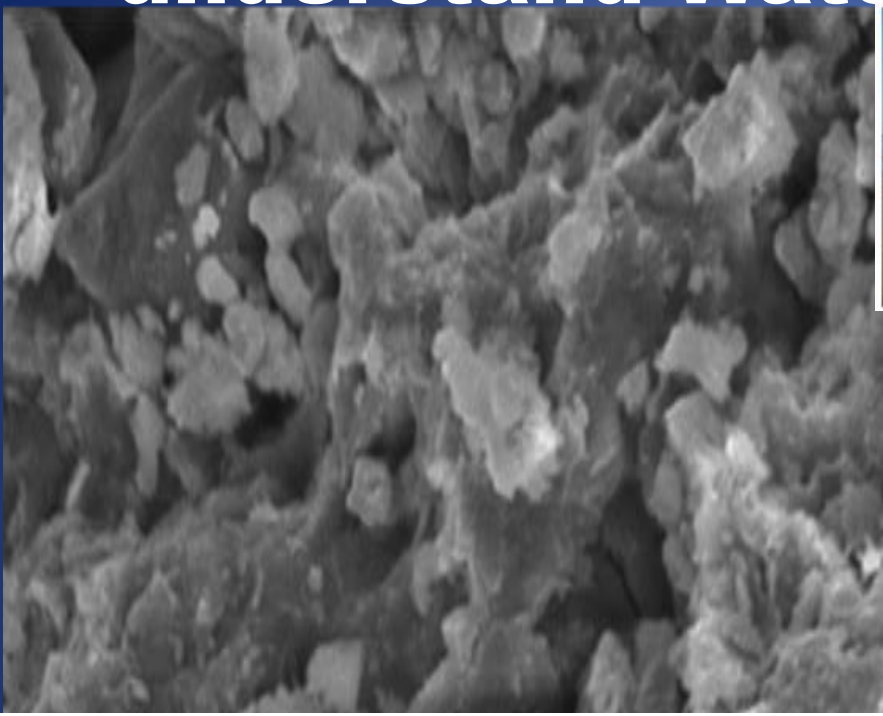
INUNDATION ,WATER LOGGING, URBAN WATER CONGESTION, FLODDING, WATER RELATED HYDRO-METEOROLOGICAL HAZARDS VIZ. LANDSLIDE HAZARDS, RIVER BANK EROSIONAL HAZARDS DUE TO EXTREME RAINFALL ARE COMMON PROBLEMS..

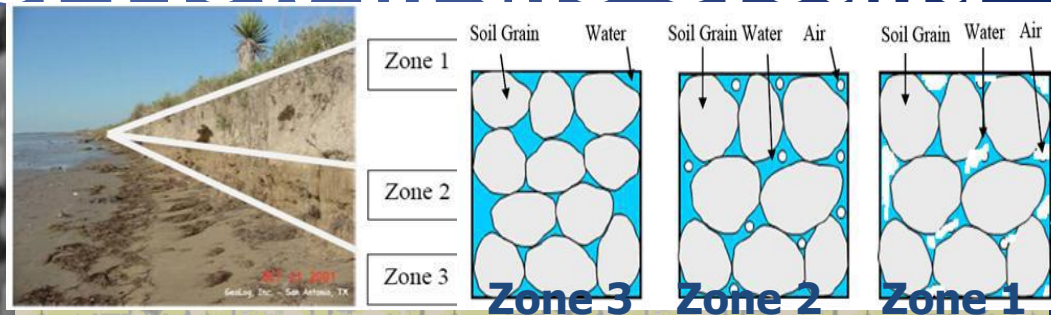


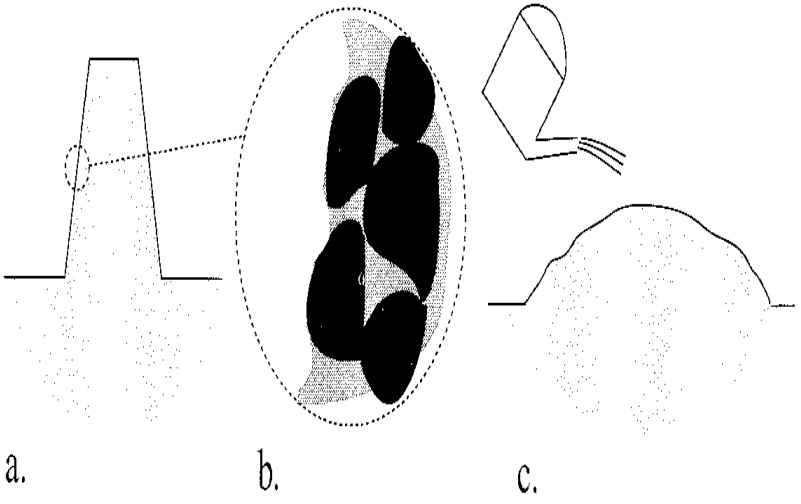


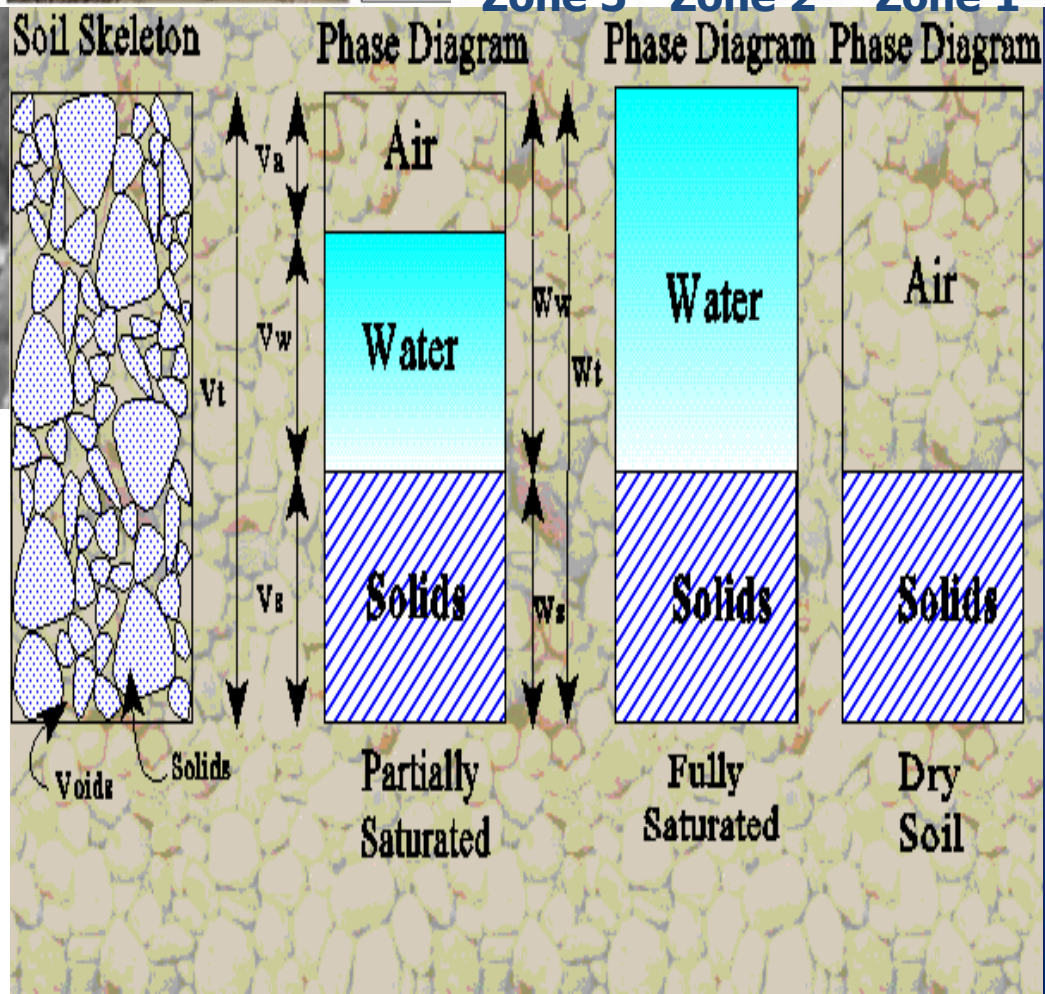
Current Issues & challenges of water depletion and degradation

Ground Fabric & Soil Phases to understand Water Flow in the Ground









SOURCES OF WATER IN BANGLADESH

- **1.TRANSBOUNDARY (74%/)/SURFACE WATER , WETLAND & FLOOD PLAIN**
- **2. RAINFALL**
- **3. GROUNDWATER (24%)**

1. Surface water

Surface water sources are categorized as rainfall, transboundary flow, water on standing water bodies (water storage in reservoir, water bodies such as river, lake and pond), water on seasonal wetlands, and in-stream storage. These are describes below:

2) Rainfall

Average annual rainfall of the country is about 2360 mm (1960-1997).

3) **Transboundary flow**

Bangladesh shares 57 transboundary rivers, 54 incoming from India, 3 from Myanmar. Among the rivers, the Ganges, the Brahmaputra and the Meghna drain about 1.08 million sq.km., 0.58 million sq.km. and 0.09 million sq.km. respectively. Total annual volume of water that enters into the country from the transboundary rivers is about 1000 billion cubic meters.

Key Issues For Sustainable Water Resource Management In Bangladesh

- Water Allocation
- Increasing Vulnerability to severe Events/Climate Change
- River Basin Planning
- Stakeholders participation
- Urban Demand
- Unrestricted Extractions
- Land-use Changes
- Pollution Control
- Monitoring, analyses and Assessments
- Economic and Financial Management
- Data Availability and Information Management
- Modelling capabilities of Water Resources

Depletion & Degradation of Water Resources

- WATER SCARCITY
- TRANSBOUNDARY WATER FLOW
- GROUND WATER POLLUTION & ARSENIC CONTAMINATION
- CONFLICT BETWEEN IRRIGATED AGRICULTURE & FISHERIES
- DRINKING WATER SUUPLY & SANITATION
- WATER INTENSITY IN INDUSTRY
- WATER RELATED DISASTERS
- ENVIRONMENT AND ECOSYSTEM HEALTH

Principal Water-related Issues/2

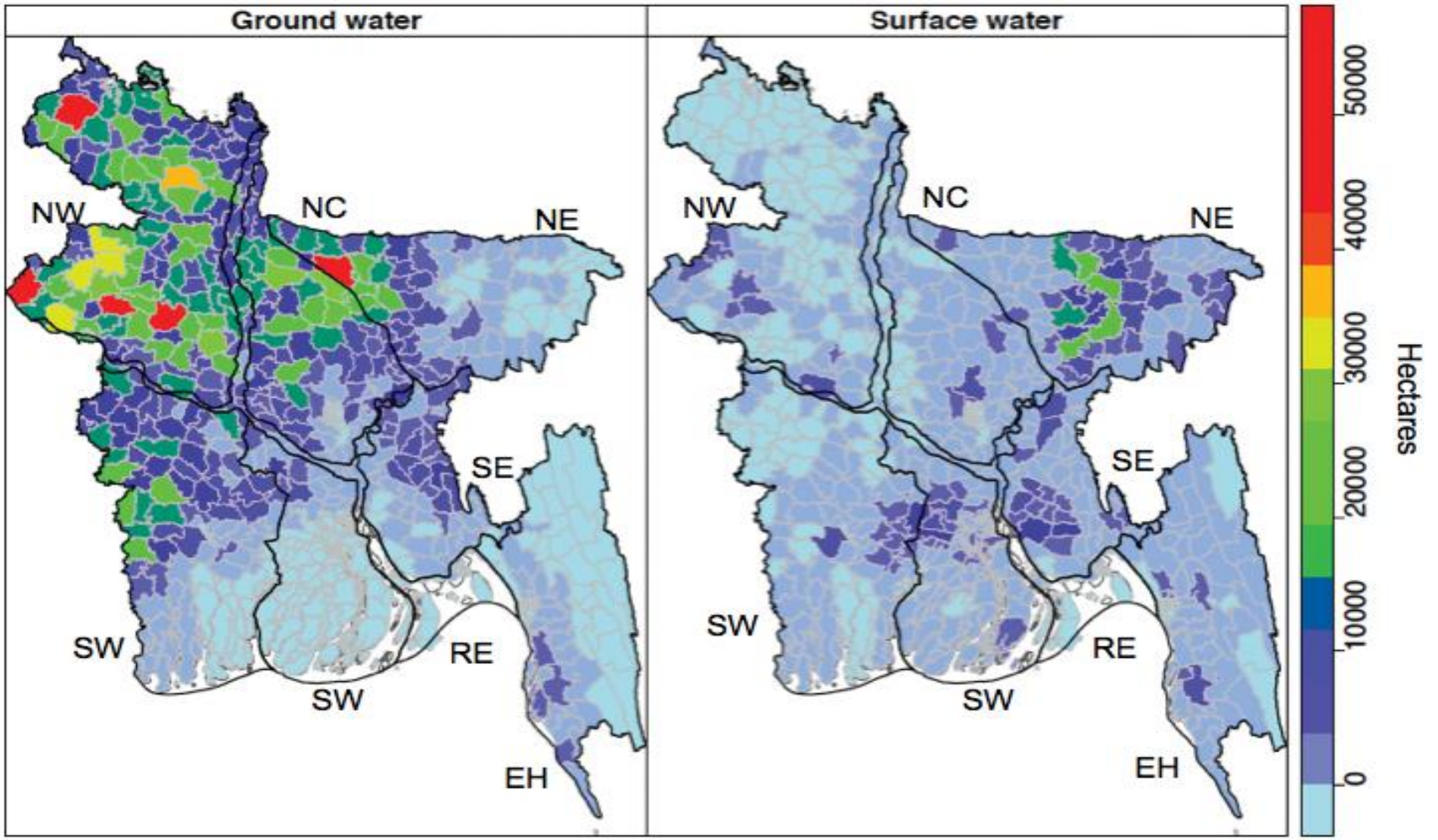
South West Region

- Preservation of the Sundarbans
- Restoration of dry season freshwater inflows to the region
- Maintenance the coastal embankment system
- Alleviation of coastal drainage congestion

- **North East Region**
  - Environmental management of the Haor Basin
  - Flood proofing of villages in the Haor Basin
  - Erosion of old Brahmaputra left bank
  - Local development of irrigation

- **North Central Region**
  - Bulk water supplies and pollution clean-up for Dhaka City
  - Flooding and drainage problems in parts of the region
  - Flood proofing needs in the charlands and low lying areas

Hectares irrigated by groundwater and surface water by sub-district in the eight hydrological regions of Bangladesh (USAID, 2015)
(Data: BADC 2012). NW: Northwest. SW: Southwest. SC: South Central. RE: River and Estuary. EH: Eastern Hills.SE: South East. NE: North East. NC: North Central.



CHALLENGES of SWRM

- **Water Sharing bet. neighbouring count.**
- **The Ganges Water Sharing**
- **Indian River Linking Project**
- **The Teesta Water Sharing**
- **The Teepaimukh Dam Project**
- **Environmental Impacts of Upstrem water Diversons**
- **Embankment Construction & Drainage Congestion**
- **Environmental Refugees & migration**
- **Any impacts of Current climate change on Hydrologic cycle?**

Diversion of Bangladesh Water by India

54 cross border rivers carry water to Bangladesh from China, Nepal, Bhutan and India

Out of total surface water in Bangladesh

-Brahmaputra contributes = 51 %

-Ganges contributes = 28 %

-Meghna contributes = 14%

Total GBM= 93%

Rainfall within Bangladesh contributes = 7 %

Total = 100%

Indian Projects for Water Diversion

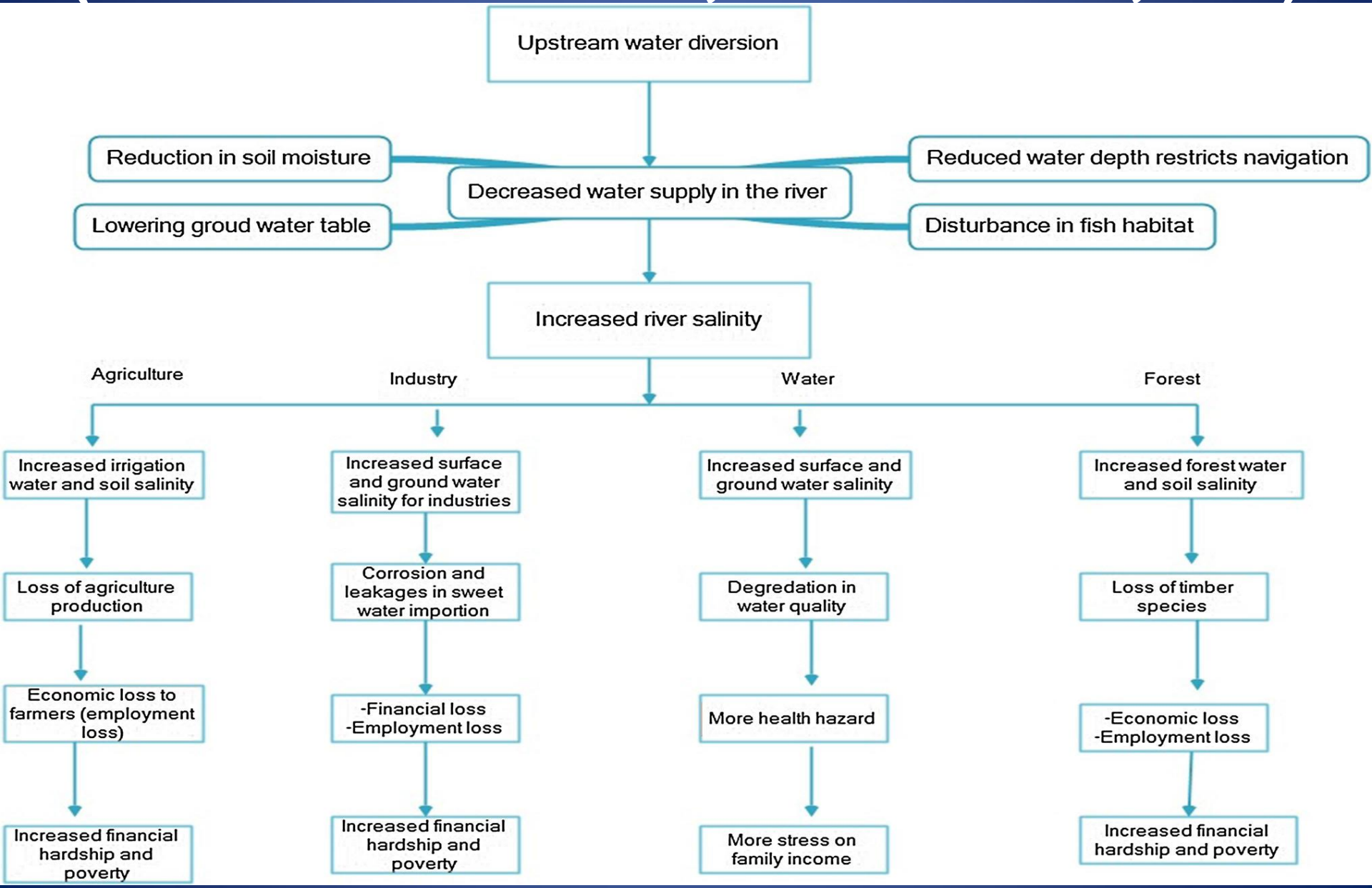
- India has already diverted water of 34 cross-border rivers of 54 rivers
- Farakka Barrage and Inter Basin River Linking Project India plans to divert all Ganges water both during rainy and dry seasons
- Plans to construct a dam near Dhubriin Assam to divert all Brahmaputra water under Inter Basin River Linking Project
- Construction of a dam at Tipaimukh upstream of Meghna river in India which will cut off major river.

Consequences of Diversion of Water from GBM

As a result of diversion of water by India

- Sea water will enter deep inside Bangladesh and gradually turn Bangladesh into desert & salinity effect
- Surface and groundwater are not be available for drinking, household use, irrigation, fisheries, livestock, industrial use and for other purposes
- Vegetation,bio-diversity, environment and ecological balance will be destroyed
- Natural fish habitat will be destroyed
- Plunge entire nation into poverty, hung.

Impacts of upstream water diversion to Bangladesh (Source: Crow et al. 1995; Baten & Titumir, 2015)



INITIATIVES TAKEN BY BD GOVT. (Gupta ,2007)

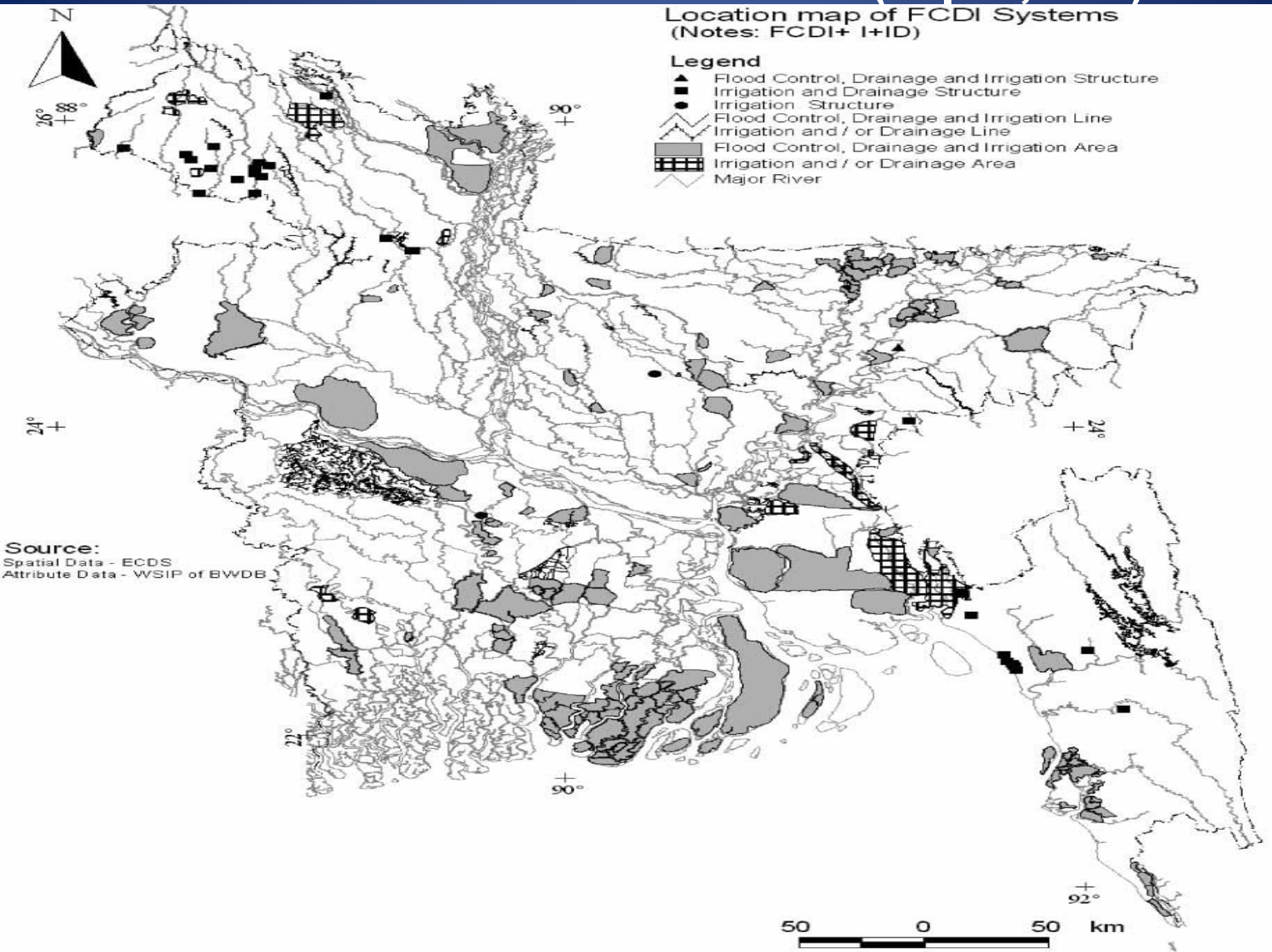
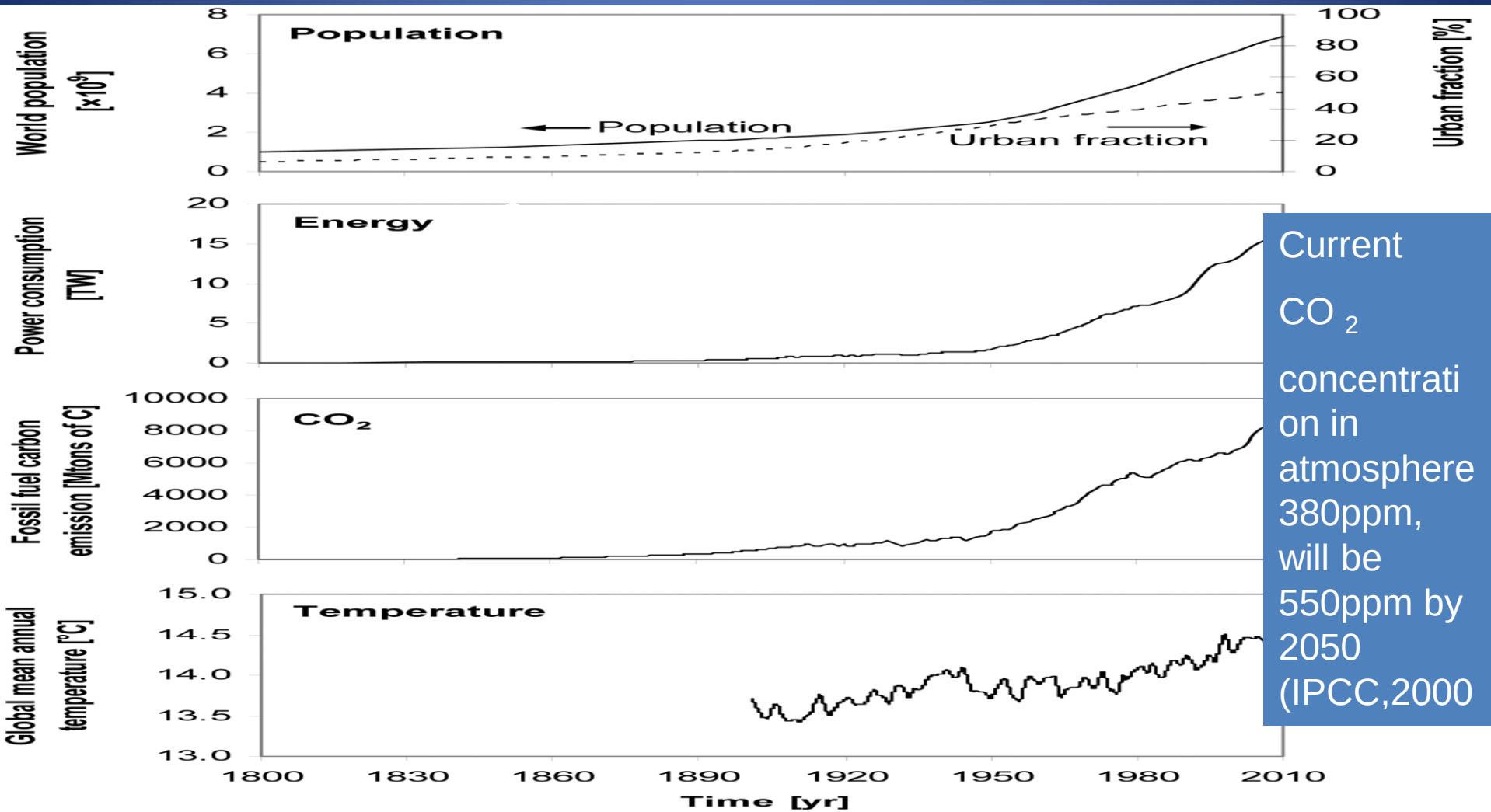
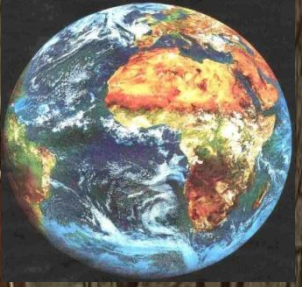


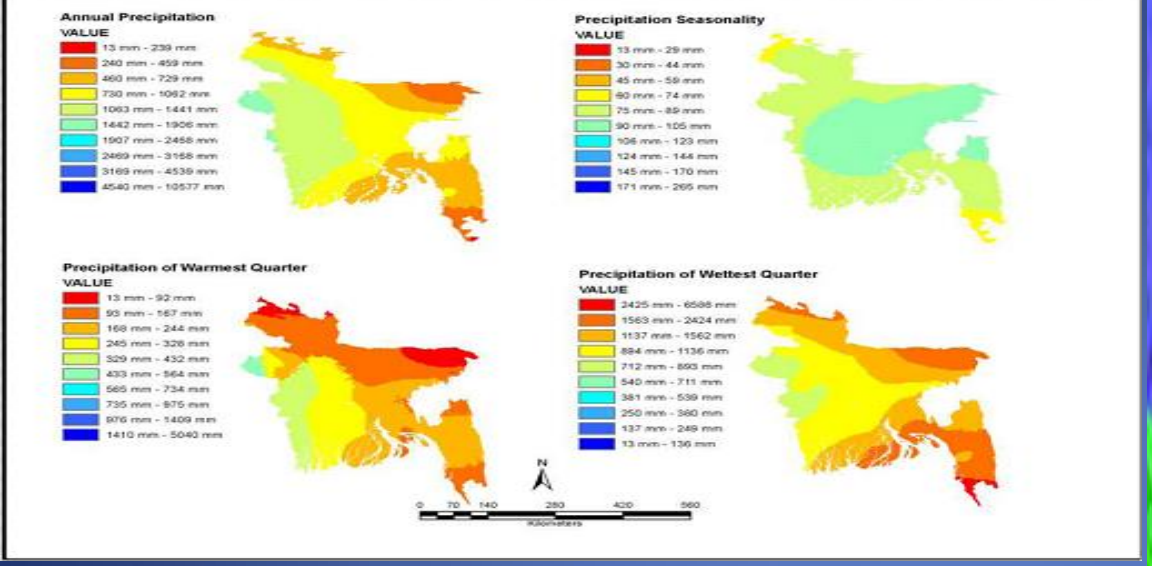
Fig: Population, Power Consumption, Carbon Emissions and Global Mean Annual Temperature Trends for the Last Two Centuries (Data from United Nations-http://esa.un.org/unpp, Agency of Natural Resources and Energy, and Climate Research Unit in University of East Anglia-http://www.cru.uea.ac.uk/cru/.)

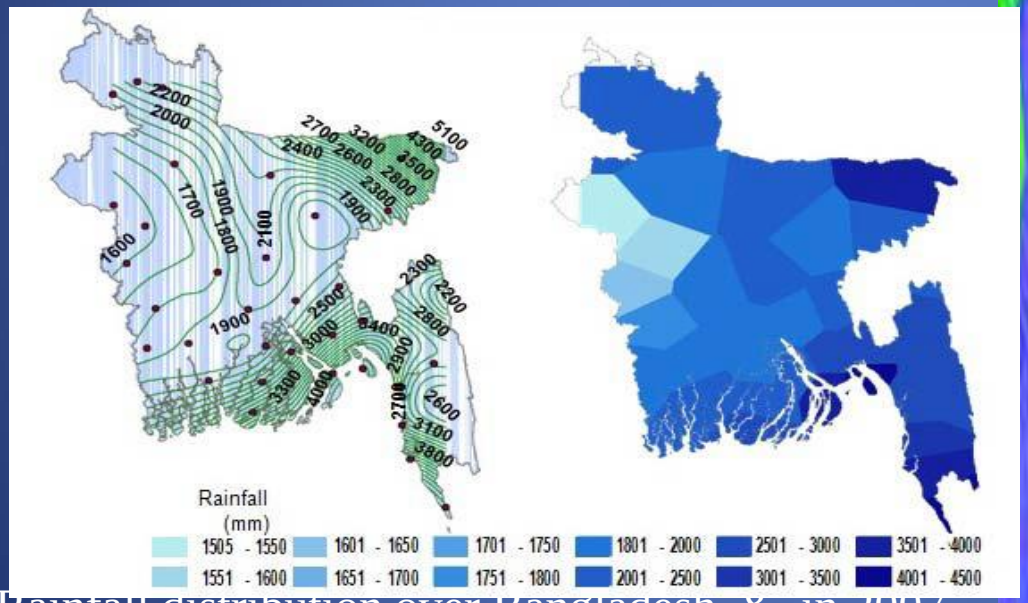


Current CO_2 concentration in atmosphere 380ppm, will be 550ppm by 2050 (IPCC,2000



Real world issues & crisis related to sustainability (Earth system problems)





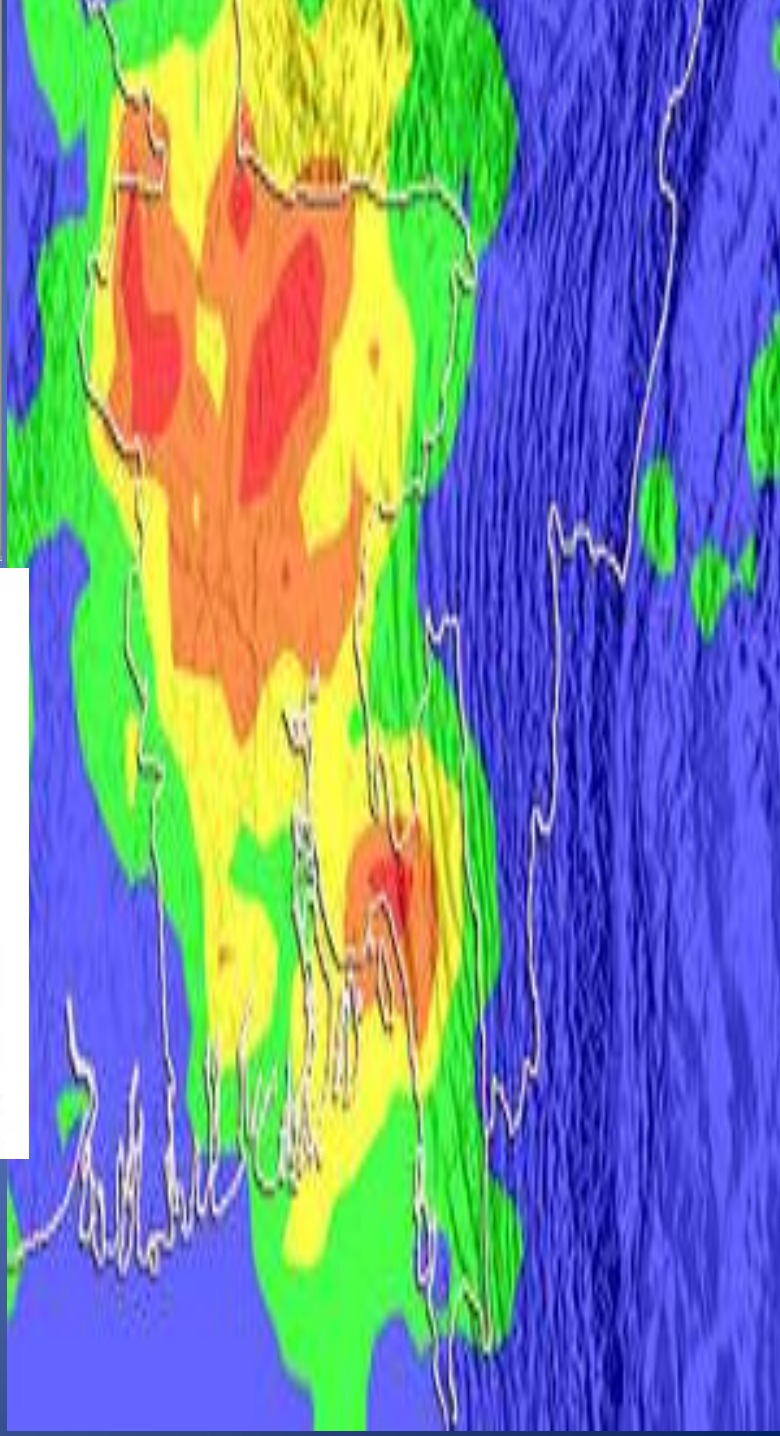
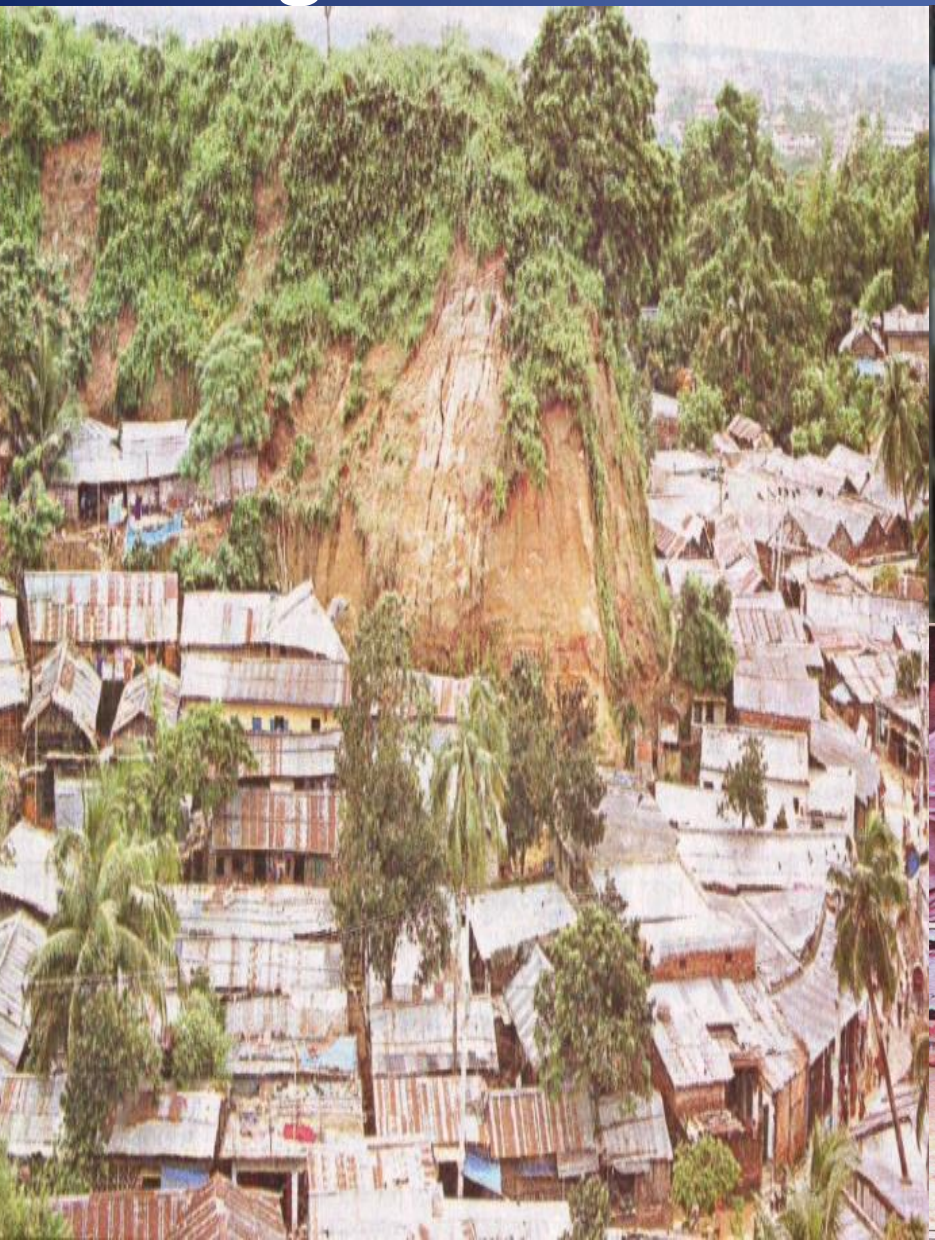
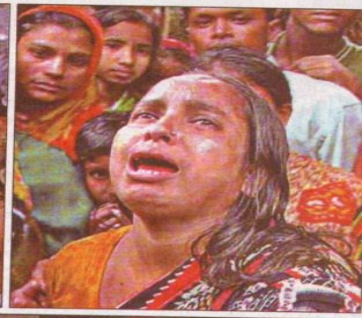
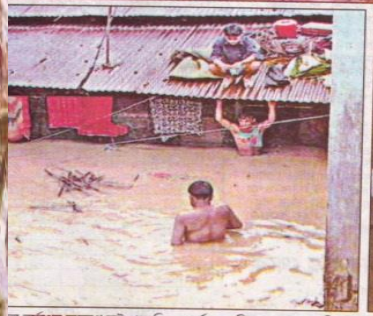


Fig.. Rainfall distribution over Bangladesh & in 2007 (Source : Internet &Tropical Rainfall Measuring Mission Satellite image). The heaviest rainfall, of up to 500 mm, is shown in red. Orange, yellow, green and blue indicate rainfall up to 400, 300, 200 and 100 mm respectively)

Monsoonal Rainfall & water Hazards in CTG, Bangladesh killed many People Every year



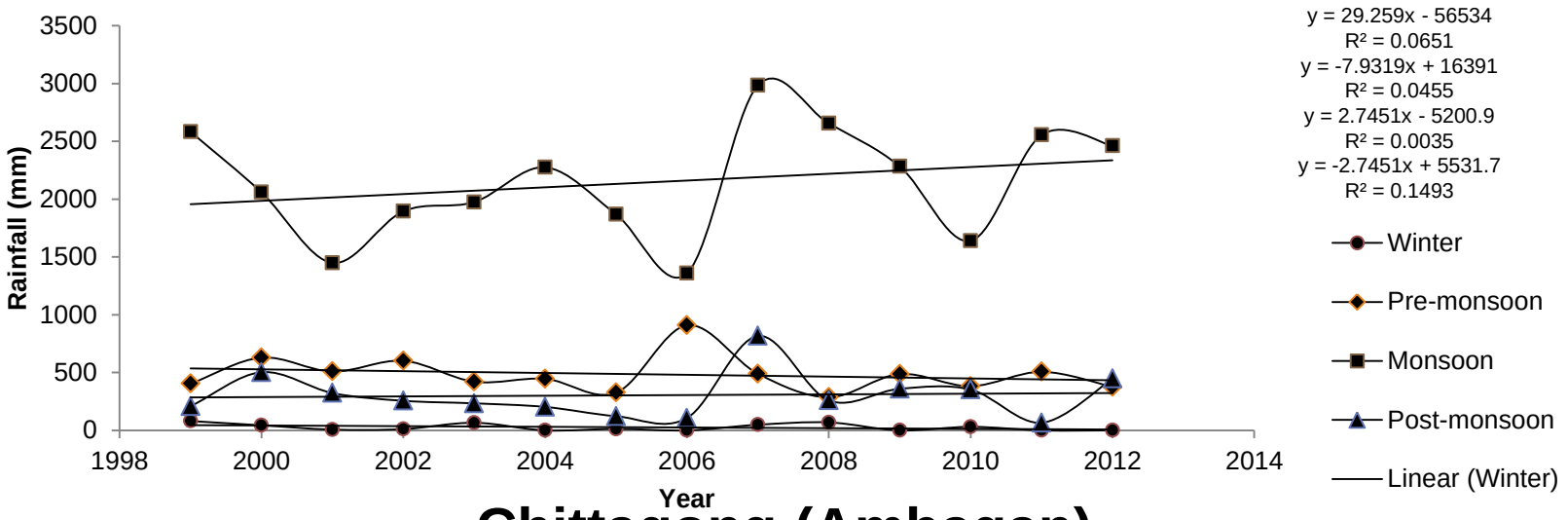




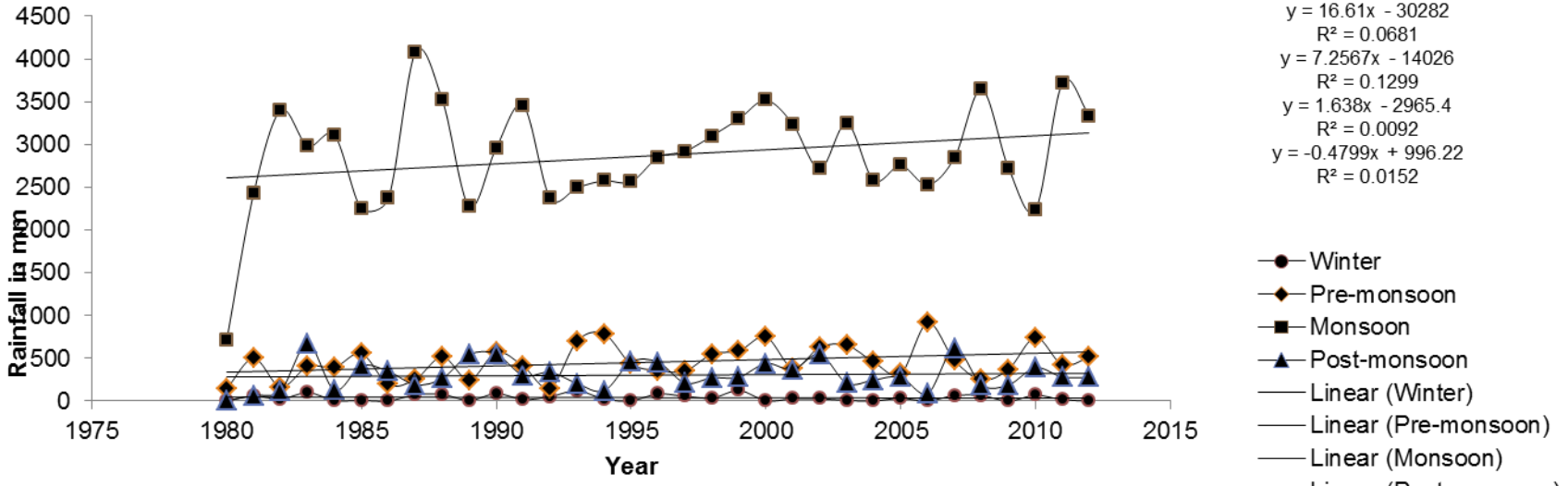
Problems of The South Eastern coastal Part, Bangladesh

The world's Longest Beach and Salinity Poblem in the south eastern part of BANGLADESH

Seasonal Rainfall Analysis

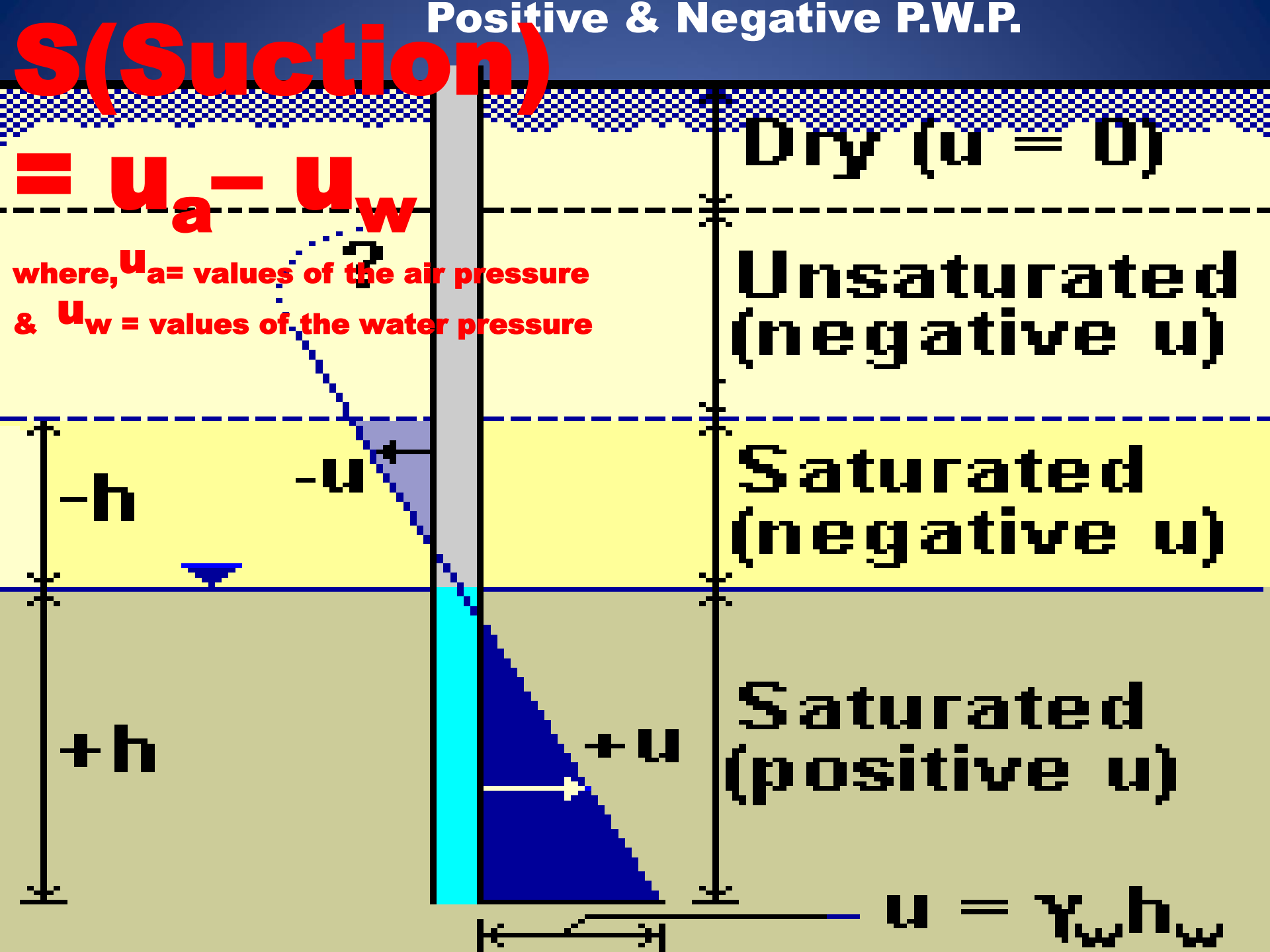


Chittagong (Ambagan)

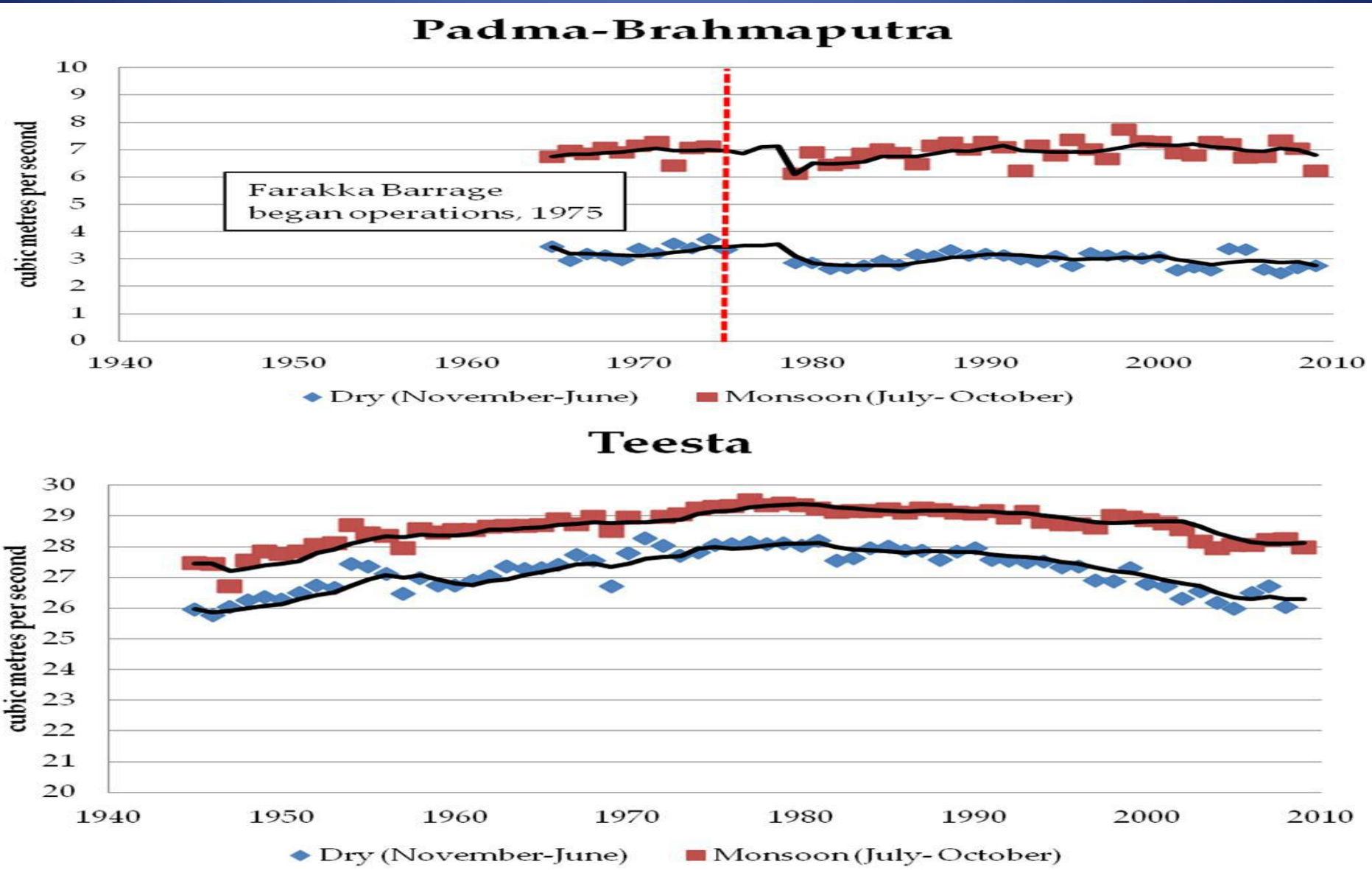


Cox’sbazar

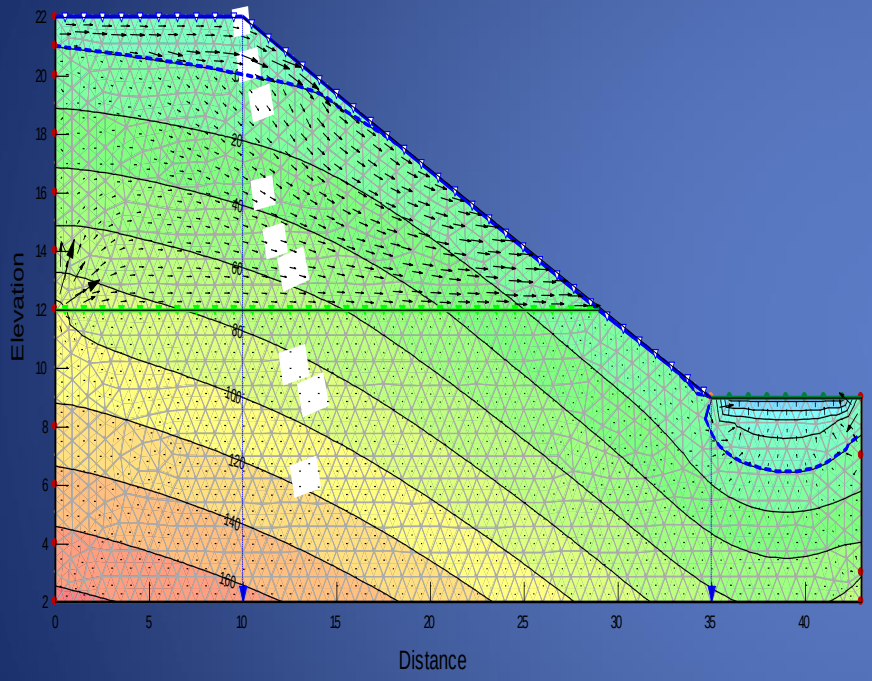
Positive & Negative P.W.P.



Average annual monsoon and dry season river flows in the Brahmaputra River, measured at the Bauria station, Kushtia & the Teesta River, measured at the Kaunia station, Rangpur(Souce: PRIO,2013).



Scenario 4/425 mm.total rainfall for a single day at an intensity 17.7 mm/h



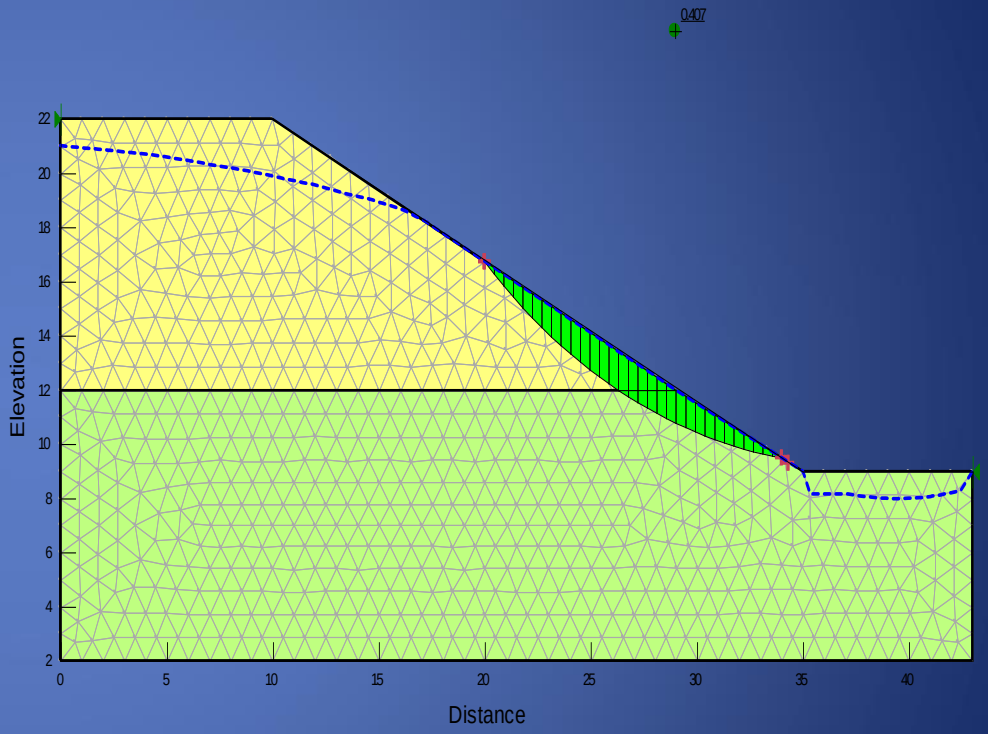
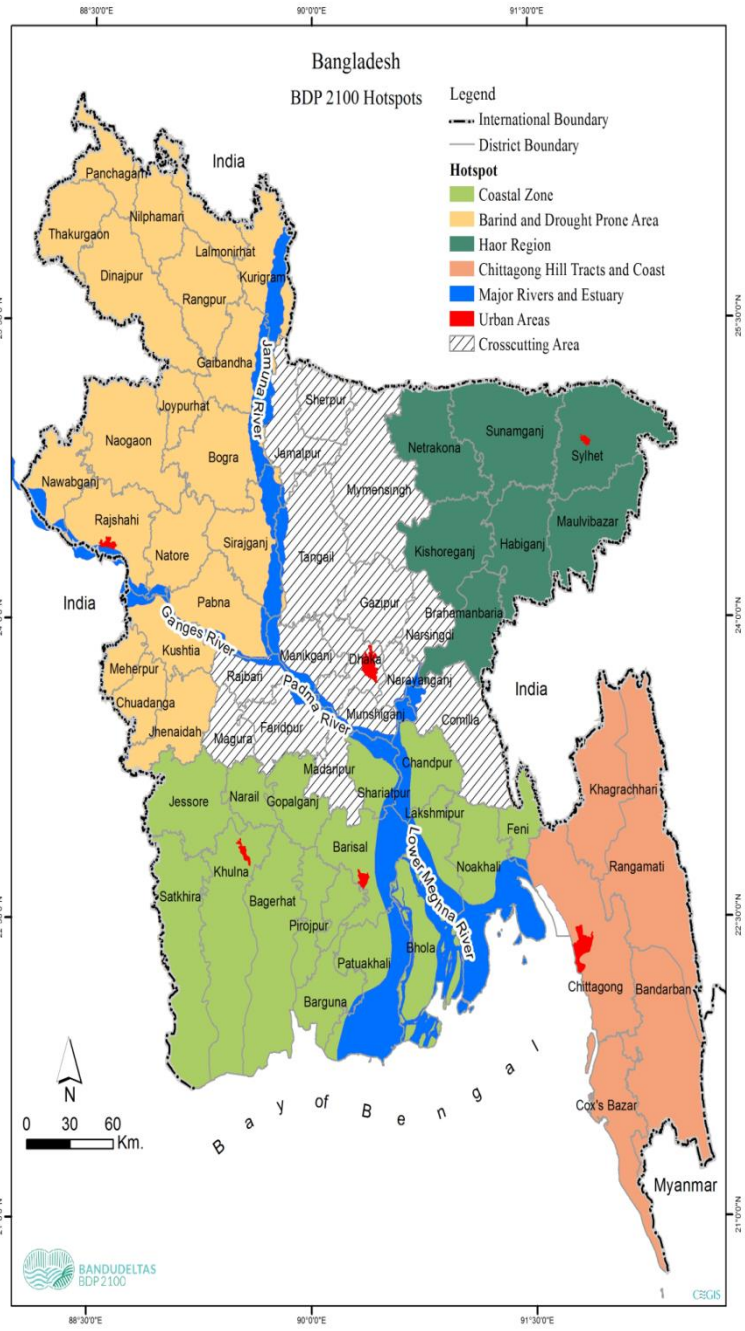


Fig. Seepage condition for Scenario 4 (425 total Rainfall @intensit17.7mm/h

Fig.. Slope condition for Scenario 4 (425 mm total rainfall for a day at intensity 17.7 mm./h (Fs=0.41)

Water Modelling can give sustainable solutions to these issues driven complex problems including rainfall amount and water availability & water related hazards. These need to be considered for the sustainable water resources management.



Major Rivers and Estuaries

- River management through channelization,dredging and protective works
- Land Reclamation in the Meghna Estuaries
- Abstraction of surface water from major rivers through barrages & reservoirs

Coastal Zone

- Improvement of coastal defenses forclimate change & sea-level rise
- Improved water management programs

Barind & Drought Prone Areas

- Revitalization and restoration of beels and water bodies

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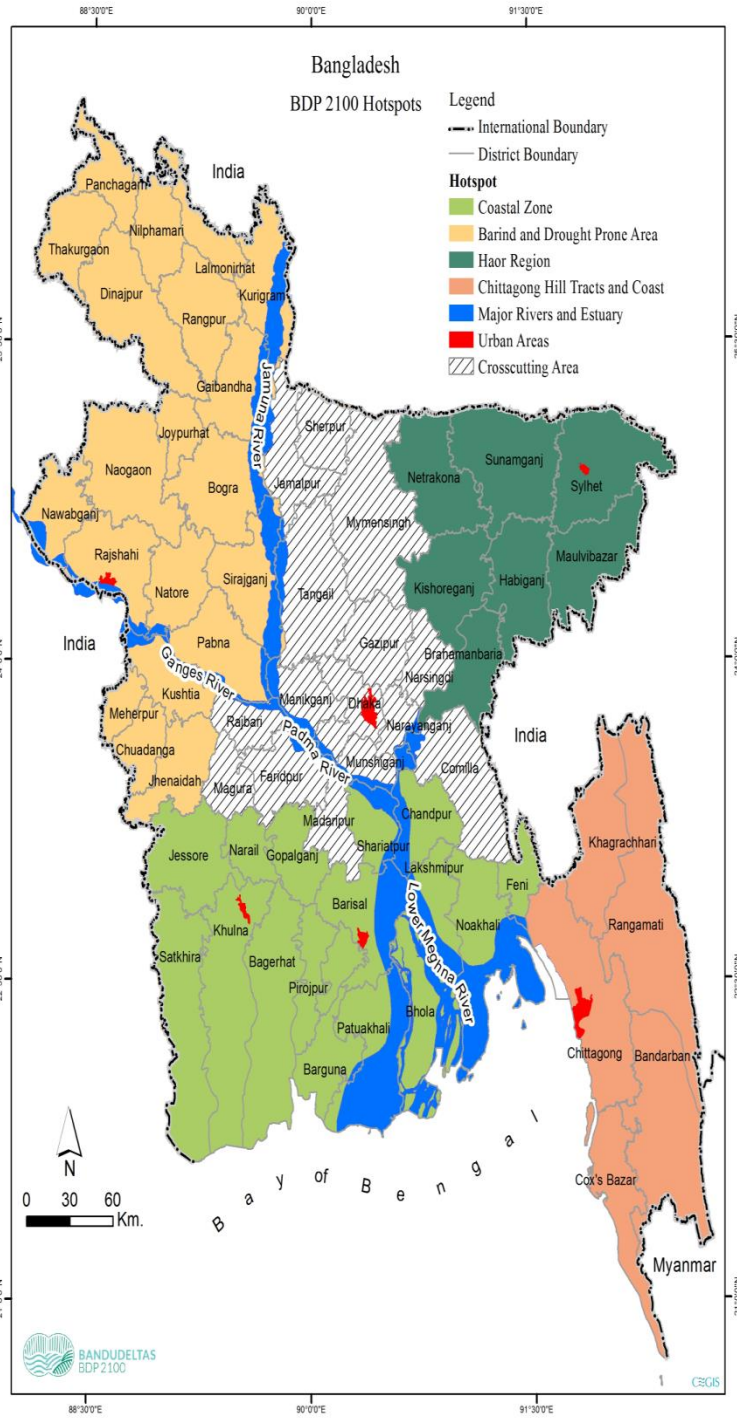


BEST PRACTICES FOR SWRM

Haor and Wetlands

- Integrated Haor Management Program
- Village protection against wave action Program

Urban Areas

- Improved flood protection and drainage improvement program
- Integrated Water and Sewage Management Program

CHT and Coasts

- Integrated Eastern Hills Resources Management Program

Alternative Approaches ?

Alternative sources of water

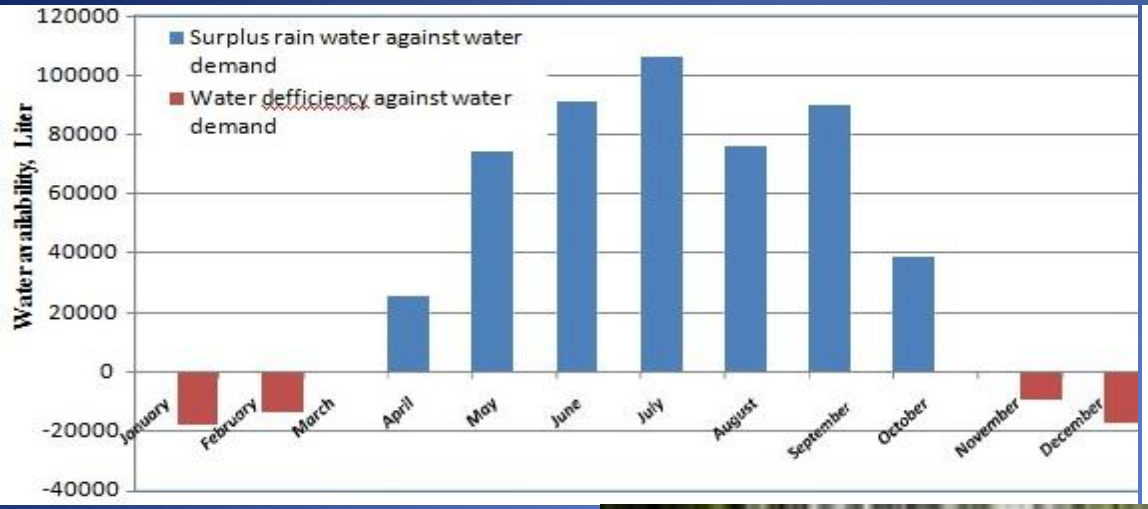
It has become clear that most of the rural people can neither be depending upon shallow ground water nor they have access to deep tube well. Most of the urban people are in shortage of water. Furthermore heavy extraction of ground water causing the water level down by about one-three meter every year .From the above facts it is understood that from now on we should not be fully dependent uponground water as the only source of water. We must look for its alternative sources. Among the alternatives, there are only three other options. These are:

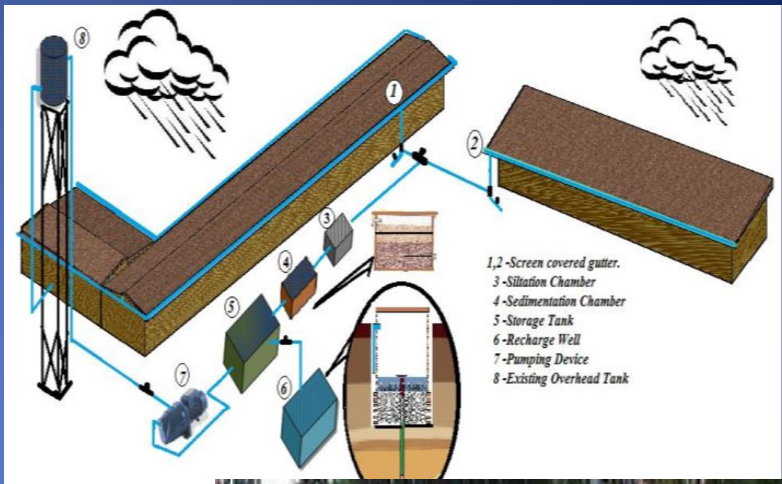
i) Treated wastewater / recycled wastewater

ii) Treated surface water

iii) Community based rainwater Harvesting

Rainwater Harvesting Potential & Demand



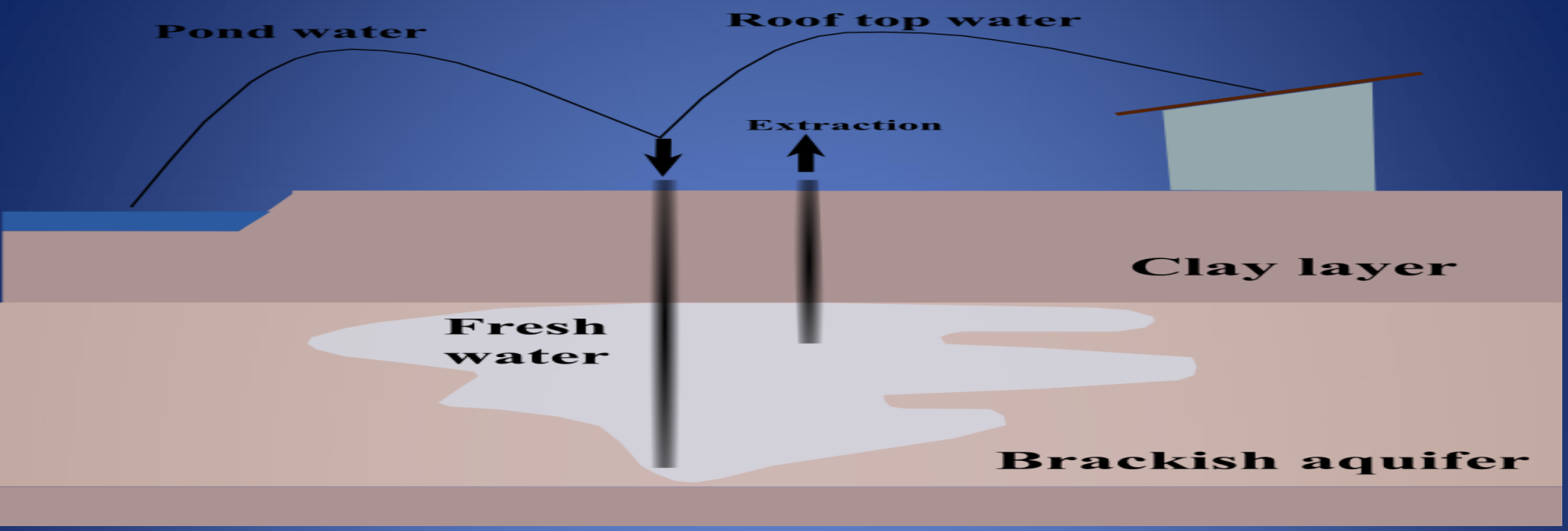


Water Treatment Plants in Bangladesh

Surface Water Treatment Plant Lama, Banderban can treat 200 m3/hr..

Surface Water Treatment Plant CPA can treat 400 m3/Hr.

Artificial Recharge In the SW part, Bangladesh



The system as it looks on the surface. Left – the recharge well and monitoring wells surrounding the handpump used by the community for abstraction. Middle – the recharge well. Right – Construction of the system. Source: Acacia Water Report.

CONCLUSIONS & RECOMMENDATIONS

 # Water may be shared among all riparian countries by signing a treaty in spirit of regional cooperation including Nepal, India, China, Bangladesh & Bhutan.

 # UN Charter, Helsinki Convention and other International laws must be honoured,

 # To facilitate drainage of flood water an integrated flood drainage channel network is to be developed by deepening the rivers. Dredging, explosives and river training works may be used.

This will require both mathematical and physical model study.

For Sustainable Water Resource Managemet

Geotechnical Instrumentations for precipation & climate data, P.W.P, River Discharge, water level monitoring, water related hazard Monitoring is also Essential in addition to the other approaches . A open data base need to be established to evaluate the negative impacts and to take immediate actions.

Conclusion Contd.

- Rainwater harvesting is a part of integrated water management to mitigate the water crisis not only for the Bangladesh but also for the whole world. Water in the world is treated as an economic product and rainwater harvesting system is an efficient way to achieve a sustainable source of this most necessary product. But for the sustainability of the system research regarding quality & environmental evaluation should have to be done.
- Strong Monitoring & Open Data Base need to be established and must share with all neighbouring countries.
- We need new innovation and technological support to install plant to treat saline water to fresh water. Low cost seawater desalination station using solar energy need to be established to meet the water scarcity.
- And we also need to reuse or recycle the waste water by installing more treatment plant covering whole Bangladesh for sustainable water resource management **in terms of international technical collaboration by transfering affordable technologies to meet the new challenges and SWRM of Bangladseh.**

Conclusions Continued/

Beuraracts and technocrats must work together.

Thousands of ponds and reservoirs are to be constructed for monsoonal rainwater harvesting, which can be used for all purposes.

Water Quality monitoring for collected rain water is essential for safe drinking water.

Construction of Bay Cross Dam in the southen coastal part can prevent sea water intrusion & retain river water during dry season & protect against sealevel rise and other disasters.

There is an ugrent need to evolve a regional policy and mechanism on managing water resources involving all neighbouring countries in addition to other alternatives with technology transfer & support to meet up the challenges for sustainable water resources management of Bangladesh

JAHANGIRNAGAR UNIVERSITY CAMPUS

THANK YOU