Country Perspective: Bangladesh

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Bangladesh: General Information

- Area – 14.76 million ha
- Population - 160 million
  - density > 1000/ km²
- Lowest Per capita land availability
- Annual land loss: 8,700 ha.
- Agricultural land is reducing by 1% annually
- Per capita water availability: ≈ 1230 m³/year
- Flood Vulnerable Area: 11.7 million ha
- Irrigable Land: 8.2 million ha
- Irrigation Provided: 5.9 mha
- Land Reclamation: 1800 ha
- Sanitation coverage: 55%
- GDP: 533.7 billion US$
- Economic Growth (5 years compound): 6.2%
- Foreign Currency Reserve > 32 billion US$
- Life expectancy: 71.8 years
- Natural Disasters: Flood, Drought, Cyclone, Storm Surge, River Bank erosion.
Climate

- Subtropical monsoon, characterized by wide seasonal variations in rainfall
- Moderately warm temperatures, and high humidity
- Three seasons are recognized: a hot, humid summer (March-June); rainy (flood) monsoon season (June- Oct.); and a cool, dry winter (Nov.-March).
Hydrology and Water Resources

Bangladesh rivers receive runoff from a catchment of 1.72 million sq. km, around 12 times its land area.
India

RIVER SYSTEMS OF BANGLADESH

Riverine Country with 405 rivers

Brahmaputra

Q$^{\text{maxm.}} = 103,000 \text{ m}^3/\text{sec}$

Q$^{\text{minm.}} = 4000 \text{ m}^3/\text{sec}$

Ganges

Q$^{\text{maxm.}} = 78,000 \text{ m}^3/\text{sec}$

Q$^{\text{minm.}} = 700 \text{ m}^3/\text{sec}$

Meghna

(Lower Meghna)

Q$^{\text{maxm.}} = 180,000 \text{ m}^3/\text{sec}$

Q$^{\text{minm.}} = 4,000 \text{ m}^3/\text{sec}$

Trans-boundary Flow:

57 Rivers (54 with India, 3 with Myanmar)

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Hydrology and Water Resources

Rainfall
Annual Rainfall 2200 -2500 mm
Highly skewed
80% fall in June-September
1200 mm in NW, 5500 mm in NE

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STATE OF WATER RESOURCES

- Too much water during monsoon & too little in dry season
- No control over 57 transboundary rivers
- High rainfall in four months
- Flat Topography
- Salinity Intrusion
- Flooding, Erosion & Siltration are major problems
Water Use, Demand, Availability

**Use**
- Domestic and Municipal
- Agriculture and Forestry
- Fisheries
- Navigation
- Environment

**Demand**
- Dry season demand 147 BCM (estimated)
- Shortfall by about 40%

**Availability**
- Annual quantum available – 1,223 BCM
  - Cross border flows inflows – 1,053 BCM
  - Local Rainfall – 149 BCM
  - Available from Groundwater – 21 BCM
- Temporal Distribution
  - During Monsoon 1,000 BCM
  - During Dry Season - 90 BCM
- Groundwater is important component of water supply, especially for domestic purpose

Demands exceeds Availability
Some area experience drought condition even in Monsoon
Mostly flat
  - flood plains - 80%.
  - hilly areas - 12%
  - terrace areas - 8%

About 16% of the area Lies below 1.50 m of MSL

About 50% of the country is within 6-7 m of MSL

About 68% of the country is vulnerable to flood

25-30% of the area is inundated during normal monsoon
Coastal Zone of Bangladesh

Opportunities
- Sedimentation and Land Accretion
- Land development & settlement
- Agricultural & fishery Development
- Livelihood
- Tourism

Vulnerabilities
- Erosion
- Drainage congestion
- Salinity Intrusion
- Cyclone & Storm surge
- Climate Change Impact

32% of the land area,
28% of the population,
Water Induced Hazards and Disasters

Floods
- Cyclone/storm surge
- Riverbank Erosion
- Sedimentation
- Drought

Water Quality Deterioration

Salinity Intrusion

Climate Change provoke all Disasters

- Normal Flood
- Flash Flood
- Severe drought prone area
- Surge Height above 1 meter
- Surge Height less then 1 meter
- 1 ppt salinity Isoline
Water Resources Management Vulnerabilities

- Increase in precipitation in monsoon
- Increase in evaporation
- Increase in snow melt in the Himalayas
- Prolonged monsoon
- Increase in salinity intrusion
- Drought
- Decrease in precipitation in dry season
- Increase in precipitation in monsoon
- Increase in flooding intensity
- Submergence of coastal areas
- Impact on agriculture & fisheries

Sea level rise
Water Resources Management

Vulnerabilities: Flood
About 25% of the country suffer water stress in dry season.
Flood

- Flood occurs in Bangladesh regularly
- Being low-lying country, average 22% area is flooded every year
- In case of severe flood, 66% area inundated
Causes of Floods

- Unique Geographical Location
- Excessive run-off from upstream
- Low topography
- River siltation
- Sea swell during monsoon

Hydraulic Characteristics

- Low gradients of major rivers
  - Ganges: 4 cm/km, B.Putra: 8 cm/km, Meghna: 3 cm/km
Flood Management

Structural measures

- Embankments
- Hydraulic structures, etc.

Non-structural measures

- **Flood forecasting and warning**
  - Flood preparedness,
  - Erosion prediction
- Environmental Monitoring
- Watershed Management
Flood Forecasting and Warning System in Bangladesh

DATA COLLECTION

Indian Data
- WMO
- JRC
- WARPO

BMD
- Weather forecast
- Synoptic charts

Boundary estimation
- Rainfall
- Water level

GIS data layers

Radio Tower

Satellite dish

DATA ENTRY & PROCESSING

Modelling & Mapping

SPARRSO
- Satellite images

BMD
- Weather forecast
- Synoptic charts

Boundary estimation
- Rainfall
- Water level

24, 48, 72 hr forecasts
- water level
- flood extent maps
- thana inundation maps

DISSEMINATION

To the public
- Internet
- Radio
- Television
- Fax Modem
- Telephone

To various agencies
- Bulletin
- Telemetry/Data box/Voice
Flash Flood 2017

Southwest monsoon (June-September) 74%

Northeast monsoon (December-March) 2%

Spring reversal (April-May) 18%

Autumn reversal (October-November) 6%

Wind
Flash Flood in Sunamganj (April 02 2017): Erratic rainfall In the face of Climate change

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Catchments that contribute flash flood

- Meghalaya River catchments
- Barak River catchment
- Tripura River catchments

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Accumulated Rainfall:
1/4/17 to 5/4/17
(Ref: RIMES)
Comparison of 3 days cumulative rainfall (Mid March-April 20) 1997-2017 at Karaighat

3 day max at Kanaighat (Mar 15- Apr 20)

<table>
<thead>
<tr>
<th>Year</th>
<th>Rainfall (mm)</th>
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<tbody>
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<td>1997</td>
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</table>
Comparison of 3 days cumulative rainfall (Mid March-April 20) 1997-2017 at Sylhet
Comparison of 3 days cumulative rainfall (Mid March-April 20) 1997-2017 at Sunamganj

3 day max at Sunamganaj (Mar 15- Apr 20)

Rainfall (mm)

Year


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Comparison of 3 days cumulative rainfall (Mid March-April 20) 1997-2017 at Sheola

3 day max at Sheola (Mar 15- Apr 20)

Rainfall (mm)

Year


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Comparison of Water level (Mid March-April 20) 2017 with Historical Flash flood year; Surma at Sylhet
Comparison of Water level (Mid March-April 20) 2017 with Historical Flash flood year; Surma at Sunamganj

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Comparison of Water level (Mid March-April 2020) 2017 with Historical Flash flood year; Kushiyara at Sheola

Sheola: Kushiyara at Sheola - 3 hourly WL

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Findings

- Flash Flood 2017 in the North-Eastern part of the country was unprecedented in terms of:
  - Accumulated Rainfall
  - Water Level
  - Timing of flash flood & Duration

- Climate Change/Variability/Erratic rainfall could be the possible reason.

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Monsoon Flood 2017
Hydrograph comparison of Brahmaputra River at Bahadurabad Station
# Loss and Damages

<table>
<thead>
<tr>
<th>Damage Types</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Affected Districts</td>
<td>32</td>
</tr>
<tr>
<td>Affected Population</td>
<td>319702 (partly) 8011165 (Fully)</td>
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<tr>
<td>Affected Houses</td>
<td>80537 (Partly) 676426 (Fully)</td>
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<tr>
<td>Crop Damage Agricultural land (Hector)</td>
<td>102864 (Partly) 504287 (Fully)</td>
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<td>Number of Death (People)</td>
<td>144</td>
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<tr>
<td>Affected Road</td>
<td>885 Km (partly) 10211 km (Fully)</td>
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<tr>
<td>Damage Bridge /Culvert (number)</td>
<td>843</td>
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</tbody>
</table>
Bangladesh’s Catastrophic Flood of 1998

100,000 sq. km, approx 70% of country’s land mass was inundated for 2 months

30 million people affected, $45 Billion in damages.

¾ million hectares of agri lands submerged ruining most of the autumn rice crop
1.2 million of Grameen’s 2.3 million customer affected.
Benefits from the Flood Forecasting System

- Crop cutting/harvesting/seedling/plantation
- Save/shift movable property
- Save cattle/Poultry
- Take precaution
- Move to safe place
- Avoid disaster
- Relief & rescue operation
- Maintenance of Embankments/structures
- Assist policy makers & Disaster managers.
Concluding Remarks

Specific Needs/Products to increase prediction/forecast lead-time to minimize/limit loss and damages due to Flood & Drought.

- Establish GBM (Ganges, Brahmaputra & Meghna) basin flood forecast and drought prediction system.
- GBM basin outlook (Hydrological & Meteorological) with reasonable precision.
- Data sharing within GBM basin
- Down-scaled Satellite products (SRE, QPF, Soil moisture).
- Addressing the Challenges needs to be inclusive, global and participatory.
- WMO can play vital role to increase resilience of flood and drought affected millions poor people of Bangladesh.
"If you fail to plan, then you plan to fail"

Thanks for Patience Hearing