Operationalization of South Asia Drought Management and Monitoring System (SADMS)

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Outline

- Drought Background and Events in Bangladesh
- Driving Force and Impacts of Drought
- Drought Monitoring and Mitigation Initiatives in BD
- Functioning of SADMS in BD
- Considerations for SADMS Implementation
- Way Forward

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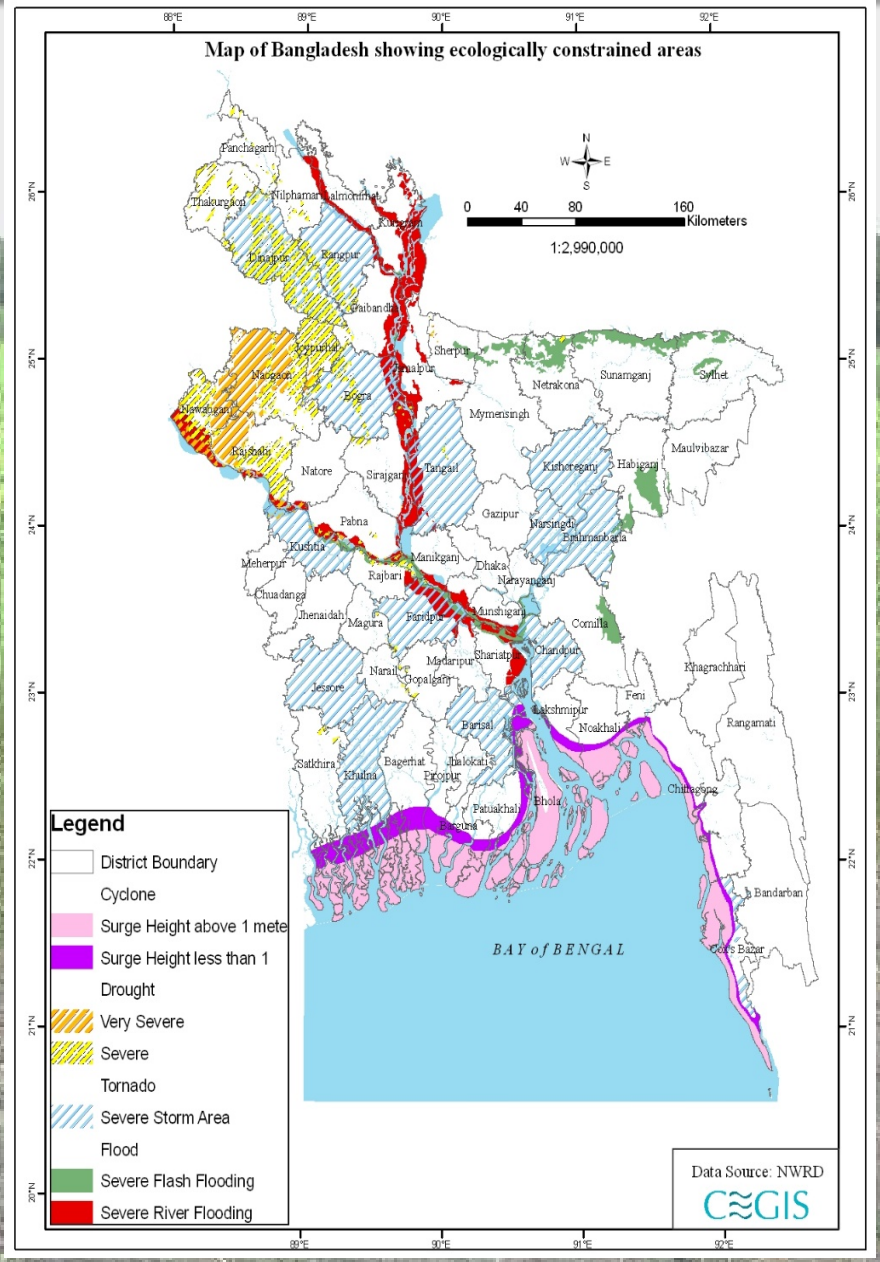
Droughts Background in BD

- The northern region of Bangladesh has been affected by recurrent and severe droughts in every year
- It considered in three cropping periods of the year:
  - Rabi (November to June) and pre Kharif (March to May) period, and
  - Kharif period (July to October)
- Too little water and less rainfall during the dry seasons creates drought situations in Bangladesh



Drought Events in Bangladesh

- Major Drought events occurred in Bangladesh 1961, 1973, 1975, 1978, 1979, 1981, 1982, 1989, 1992, 1994 and 2000

1973 Drought - The worst in recent history → 1979 Drought - The worst in living memory → 1994-95 Drought - The worst in this century

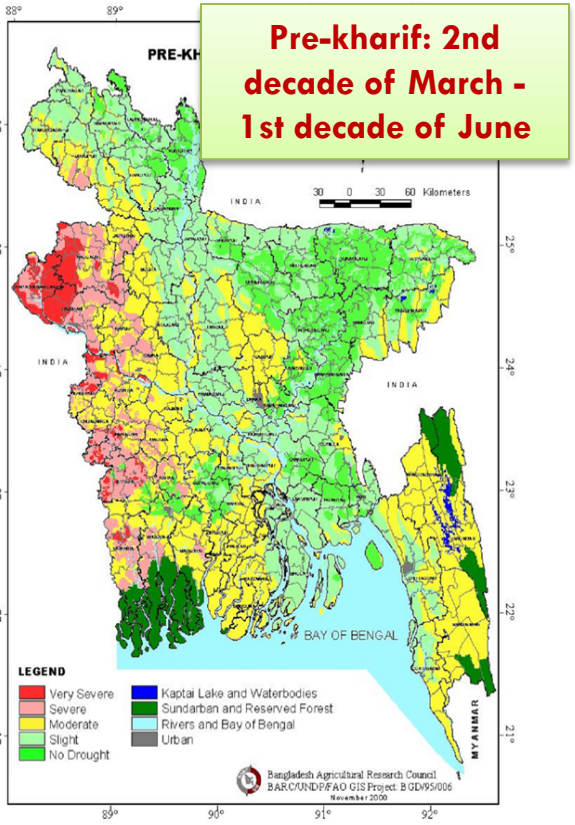
- The 1979 drought reduced **rice production** about **two million tons** which directly affected about 42% of the cultivated land and 44% of the population. The 1989 drought damaged about **2.18 million tons** of rice

- Between 1960 and 1991, number of drought events is 19 and affect the 53% of population over 47% of the country

Drought Prone Areas of BD (2003)

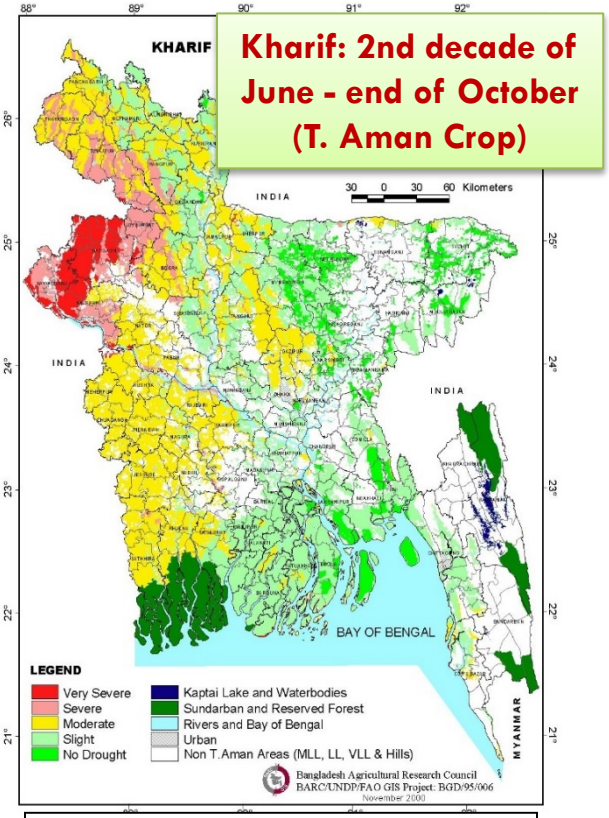
Drought classification maps were updated by BARC by utilizing GIS during 2003

Pre-kharif: 2nd decade of March - 1st decade of June



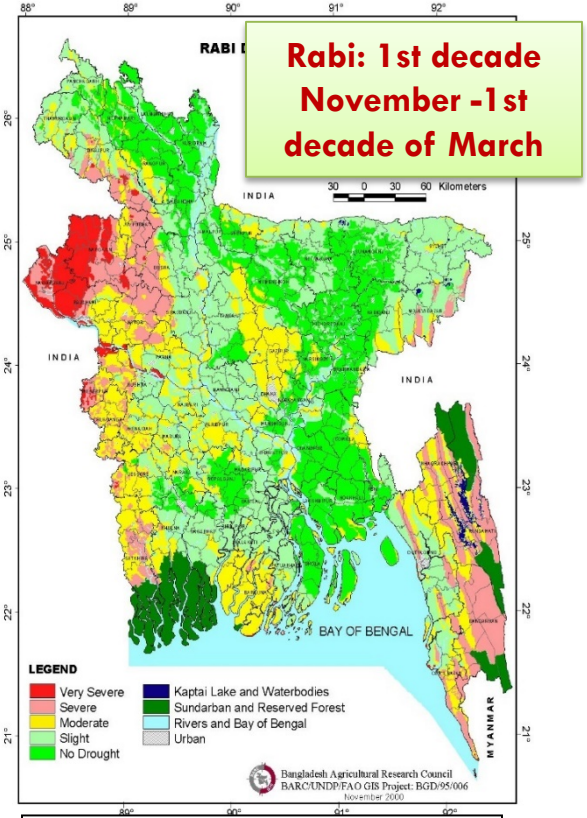
Percentage of area (%)	
No Drought	– 14
Slight	– 28
Moderate	– 34
Severe	– 8
Very Severe	– 3
Other Areas	– 13

Kharif: 2nd decade of June - end of October (T. Aman Crop)



Percentage of area (%)	
No Drought	– 5
Slight	– 20
Moderate	– 22
Severe	– 5
Very Severe	– 2
Non T. Aman	- 33
Other Areas	– 13

Rabi: 1st decade November -1st decade of March



Percentage of area (%)	
No Drought	– 23
Slight	– 29
Moderate	– 20
Severe	– 12
Very Severe	– 3
Other Areas	– 13

Drought and its Major Driving Forces

- Drought is a creeping phenomenon with slow onset with unusual dry period which results in a shortage of water
- It indicates dryness or lack of precipitation or water refers to a deficiency of adequate water
- Complex, multi-causal natural disaster with large temporal extent
- Impact of droughts is highly depending on regional or even local geographic and meteorological conditions

Impacts of Drought

Drought is one of the major environmental stresses that drastically limits the grain yield of agricultural crops especially the rice.

Agro-Environmental Impacts

- Agricultural production
- Soil moisture depletion and compaction
- Salt water intrusion
- Wildlife
- Runoff and decreasing Groundwater Level
- Dust storm, pathogen growth

Socioeconomic Impacts

- Community income
- Daily life of community
- Tourism
- Hygienic practices
- Hydroelectric power generation
- High prices of essentials goods and services

Human Health Impacts

- Stress/mental health
- Vector borne diseases
- Food-water insecurity and malnutrition
- Respiratory health: allergies ,inflammatory diseases
- Heat stroke

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Drought Monitoring and Mitigation Initiatives in BD

- Drought Assessment (DRAS) frame work for assessment of drought at national and upazila level during period 1998 and 2001 by CEGIS and BARC.
- The Capacity Building for Drought Monitoring and Studying in Monsoon Asia Under the Framework of Asian Water Cycle Initiative (AWCI) in Bangladesh by APN - BUET
- Satellite-based drought monitoring and early warning system – Bangladesh by Institutes of Industrial Science, University of Tokyo
- Proposal for Establishment of Drought Monitoring Center at BMD and DOE under consideration by GoB
- Rain water harvesting and storing monsoon water through construction of pond, re-excavation of canal, rubber dam etc. by BWDB, BADC and BMDA
- Increase irrigation efficiency through AWD method, buried pipe system and Smart Card System in DTW by BADC and BMDA
- Derivation and introducing the Drought Tolerant Varieties (e.g. Rice, Wheat and Pulses etc.) by BRRI and BARI
- Participation of Bangladeshi Scientists in **Regional training workshop on climate data analysis for drought monitoring in South Asia**

Functioning of the SADMS in BD

- Conceptualization and identification of arena of SADMS application in Bangladesh
- Exploring and evaluation SADMS
  - Model domain
  - Software platform and system requirement analysis
  - Identification and generation of Input Data Parameters
- Collection and Preparation of Input Data Parameters for SADMS
- Customization of the SADMS for Bangladesh
- Calibration and testing the SADMS for Bangladesh
- Validation of the SADMS
- Identification of relevant stakeholders
- Organize training programme on customized SADMS inviting relevant stakeholders
- Implementation of SADMS in Bangladesh involving the identified stakeholders

Potential Stakeholders of SADMS

Agricultural Organization

- BMDA
- BADC
- BARC
- BARI
- D

Meteorological Organizations

- BMD

Water and Environment Related Organization

- BWDB
- WARPO
- DoE

Other Organizations

- Knowledge based organization (CEGIS
- Universities)
- NOGs
- Interna

- BARC produced drought maps in 1990 using AEZ database categorizing as (i) Kharif and (ii) Pre-Kharif & Rabi seasons drought.
- Drought maps were updated in 2003 using geo-spatial technology by BARC
- Drought classification maps were updated by BARC by utilizing GIS during 2003
- CEGIS and BARC developed Drought Assessment (DRAS) framework for management of drought at Upazila level during 1998-2001.

Considerations for SADMS Implementation

- Keep the input data simple and ensure that there is an understanding on what basis drought risk are being generated for SADMS to gain acceptance by users
- Include ground verification of the results
- Uncertainly to be communicated clearly to the users
- Efforts have to be made to use the outputs of the SADMS by planners and decision makers
- Involvement and ownership of government agencies and the users from the beginning in SA DMS development
- SADMS to have the potential to be used as a South Asia Drought Early Warming (SADEWS)
- Develop and test a mobile phone application to collect, share and analyze socio-economic information for SADMS dissemination

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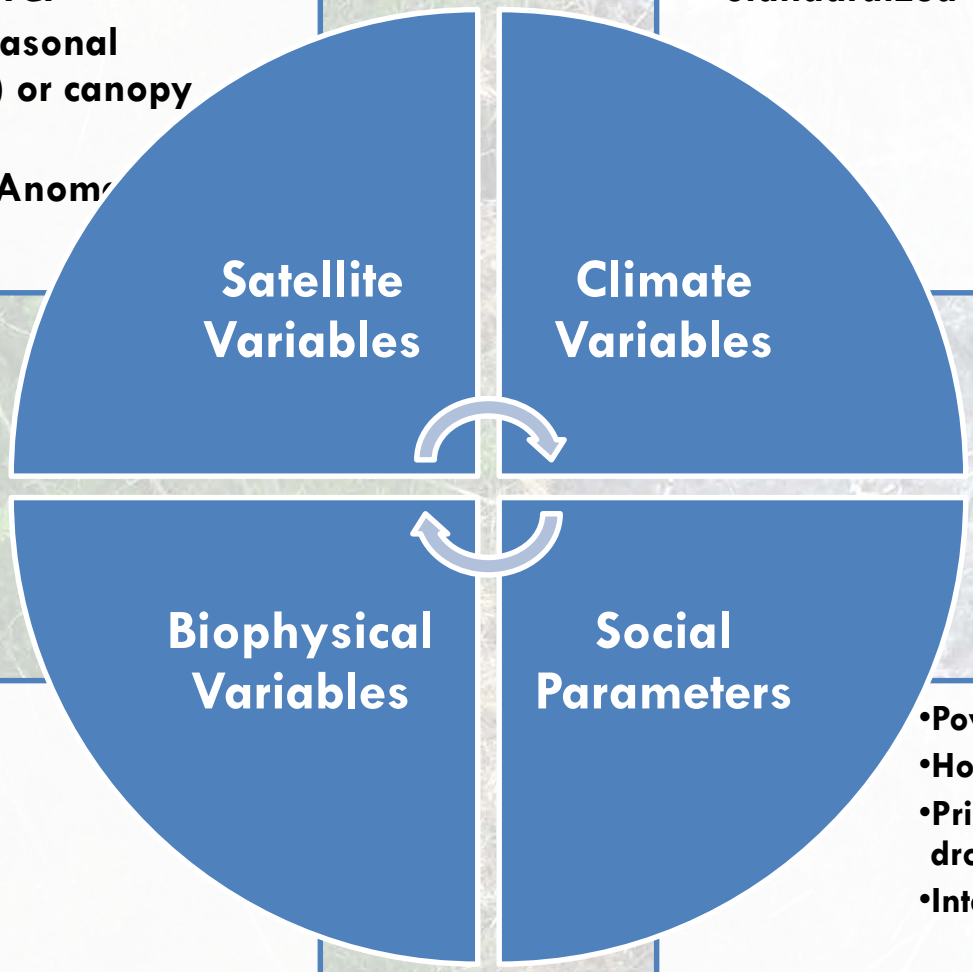
Way Forward

- Establishment of linkage between SADMS with existing drought management in Bangladesh
- Collection of data and information from both primary and secondary sources
- Customization of SADMS by Hydrological Region and Upazila Level
- Develop a mobile apps to disseminate share the drought information to the farmers and community
- Identification, consultation and training with relevant stakeholders
- Implementation and deployment of SADMS at different stakeholders organization to get maximum or more benefits
- Develop Drought Early Warning (DEW) and establishment of Linkage between SADMS and DEW at Upazila level
- Identify hot-spot areas or most drought prone areas and train farmers about the models and assess the perception of farmers on the SADMS performance
- Capacity building, customization for national needs and dissemination of the monitoring product in the region according to the country needs


Thank You

Input Data Parameters for customized SADMS for BD



- **NDVI, EVI, NDWI, TCI**
- **Percent Annual Seasonal Greenness (RASG) or canopy coverage**
- **Start of Seasonal Anom (SOSA)**

- **Standardized Precipitation Index (SPI)**

- **Land use/ land cover**
- **Soli available water Capacity (SAC)**
- **Eco-region type**
- **Irrigation Area**
- **Elevation**

- **Poverty level**
- **Household income sources**
- **Prices of essential goods during drought and normal time**
- **Internal migration**

NDVI –Normalized Difference Vegetation Index; **VCI** –Vegetation Condition Index; **TCI** –Temperature Condition Index ; **PCI** - Precipitation Condition Index; **IDSI** –Integrated Drought Severity Index

SADMS: Objectives, Function and Benefits

Objective:

- To explore the existing SADMS to understand its products and possible outputs
- How to link existing SADMS to current drought management plans of the country
- How the knowledge products can be explored for various thematic applications
- Drought preparedness using SADMS and climate change resilience in South Asia
- Applying an integrated approach to design, monitor and evaluate institutional change.

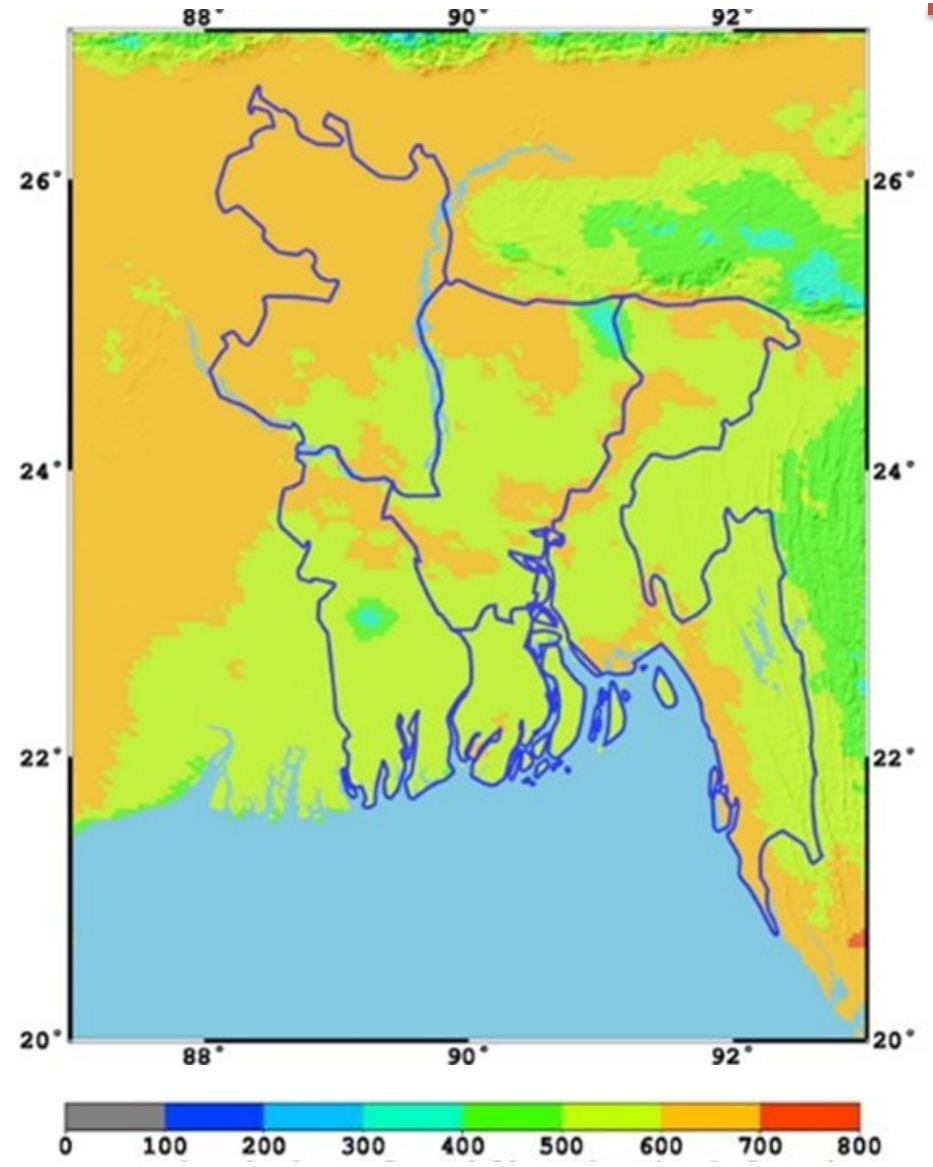
Major functions:

- SPI calculation
- Weekly and Monthly Drought Index and Extent Calculation

Future benefits and field of Applications in BD:

- Periodical drought monitoring of drought
- Customize SADMS for monitoring drought at Upazila
- Develop community based drought warning and monitoring system

Satellite based Drought Index Map: Japan and BD Initiatives



The Capacity Building for satellite based Drought Monitoring under the Framework of Asian Water Cycle Initiative (AWCI) in Bangladesh by - BUET

Drought Index Severity (Unit less)

SPI Calculation

Standardized Precipitation Index (SPI), (Tom Mckee *et al., 1993*), a measured of meteorological drought has been calculated from the available rainfall data collected by the Bangladesh Meteorological Department. SPI is calculated based on the following equation

$$SPI = \frac{(Xi - Xm)}{\sigma}$$

Where, *Xi* is monthly rainfall recorded of the station
Xm is rainfall mean and
σ is the standard deviation

Meteorological Drought Risks Classification Using SPI Values (Mckee *et al.*, 1993)

SPI Values	Class	Probability
2.0 and more	Extremely wet	0.977-1.000
1.5 to 1.99	Very wet	0.933-0.977
1.0 to 1.49	Moderately wet	0.841-0.933
-0.99 to 0.99	Near normal	0.841-0.933
-1.0 to -1.49	Moderately dry	0.067
-1.5 to -1.99	Severely dry	0.023
-2 and less	Extremely dry	0.000-0.023

BACK

Intensity of Kharif drought and yield reduction of T. Aman crop

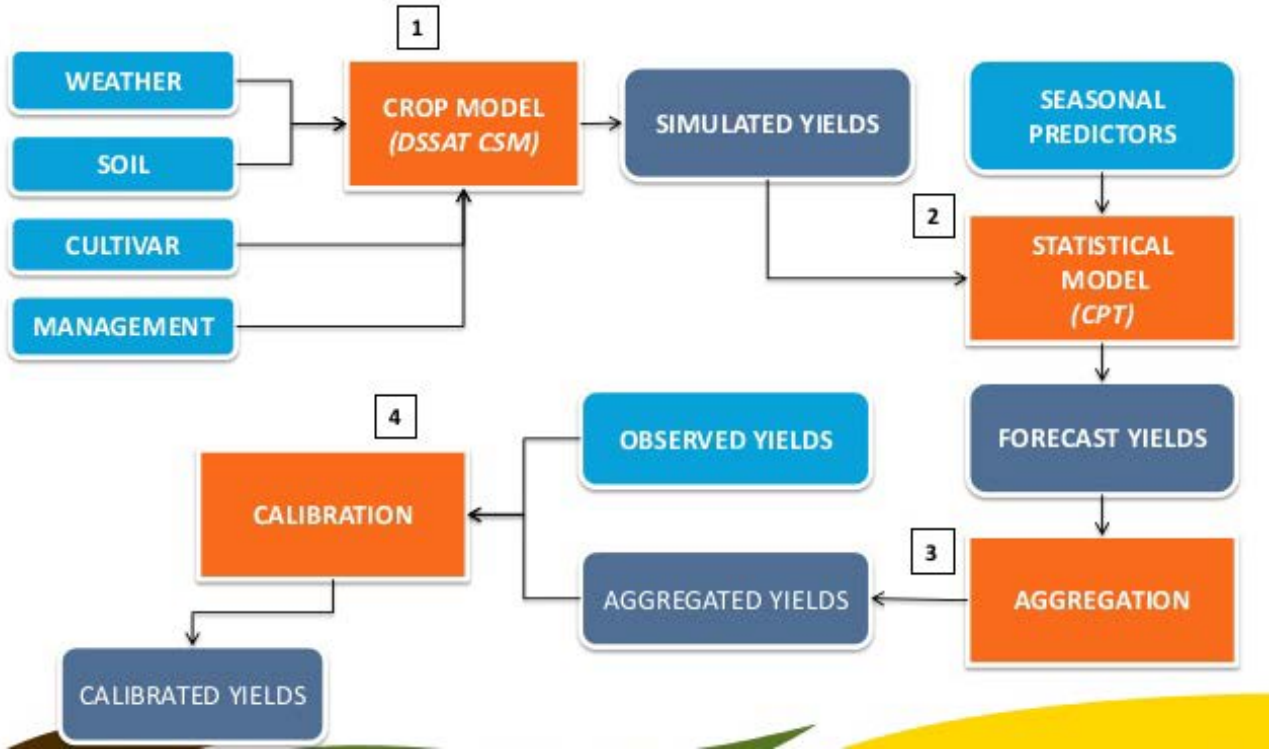
Drought prone classes	Yield with no stress (t/ha)	Reduction over no stress yield (%)
Very severe	4.5 – 5.5	> 45
Severe	4.0 – 5.0	35 – 45
Moderate	4.5- 5.5	20 – 35
Slight	3.5 – 5.0	< 20

Intensity of Rabi and pre-Kharif droughts and yield reduction of crops

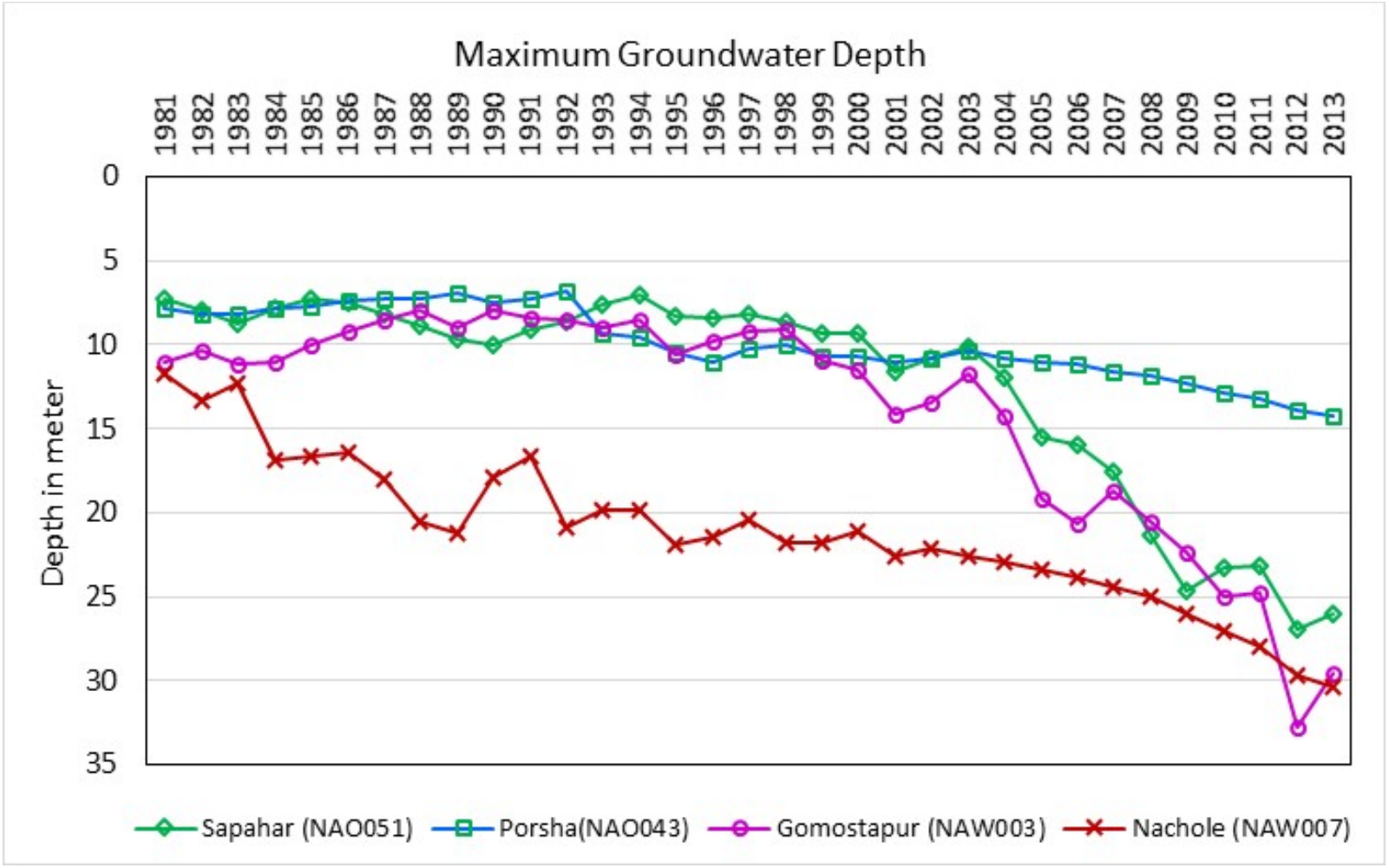
Drought prone classes	Percent of yield reduction of crops		
	Wheat	Potato	Mustard
Very severe	60 – 70	> 70	> 50
Severe	50 – 60	60 – 70	40 – 50
Moderate	40 – 50	50 – 60	30 – 40
Less moderate	30 – 40	40 – 50	20 – 30
Slight	< 30	30 – 40	< 20

Support to Development, Evaluation and Application of CRAFT Toolkit for Bangladesh

CRAFT: CCAFS Regional Agricultural Forecasting Toolbox



Ground Water Problems

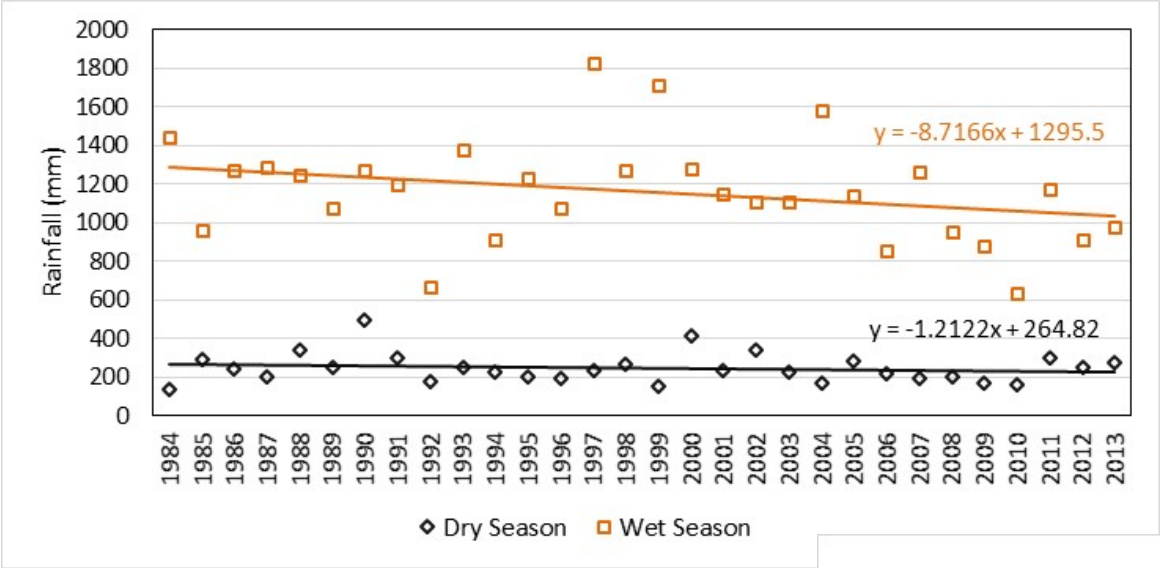


Ground water table is depleted down from

- **11m to 30 m in Nachole and Gomastapur upazilas,**
- **7 m to 25 m in Sapahar**
- **7 m to 14 m in Porsha upazila**

Ground Water Problems

Variation of Annual Rainfall (BMD Station: Rajshahi)



Variation of Non Rainy Days (BMD Station: Rajshahi)