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Country report on Recent Signs of Water-related Disasters

Md. Abdul Quadir, Engineer Adviser
Ministry of Defence
Government of the People's Republic of Bangladesh
quadiroyn@yahoo.com

Recent Signs of Water-related Disasters in Bangladesh

Md. Abdul Quadir,

Engineer Adviser

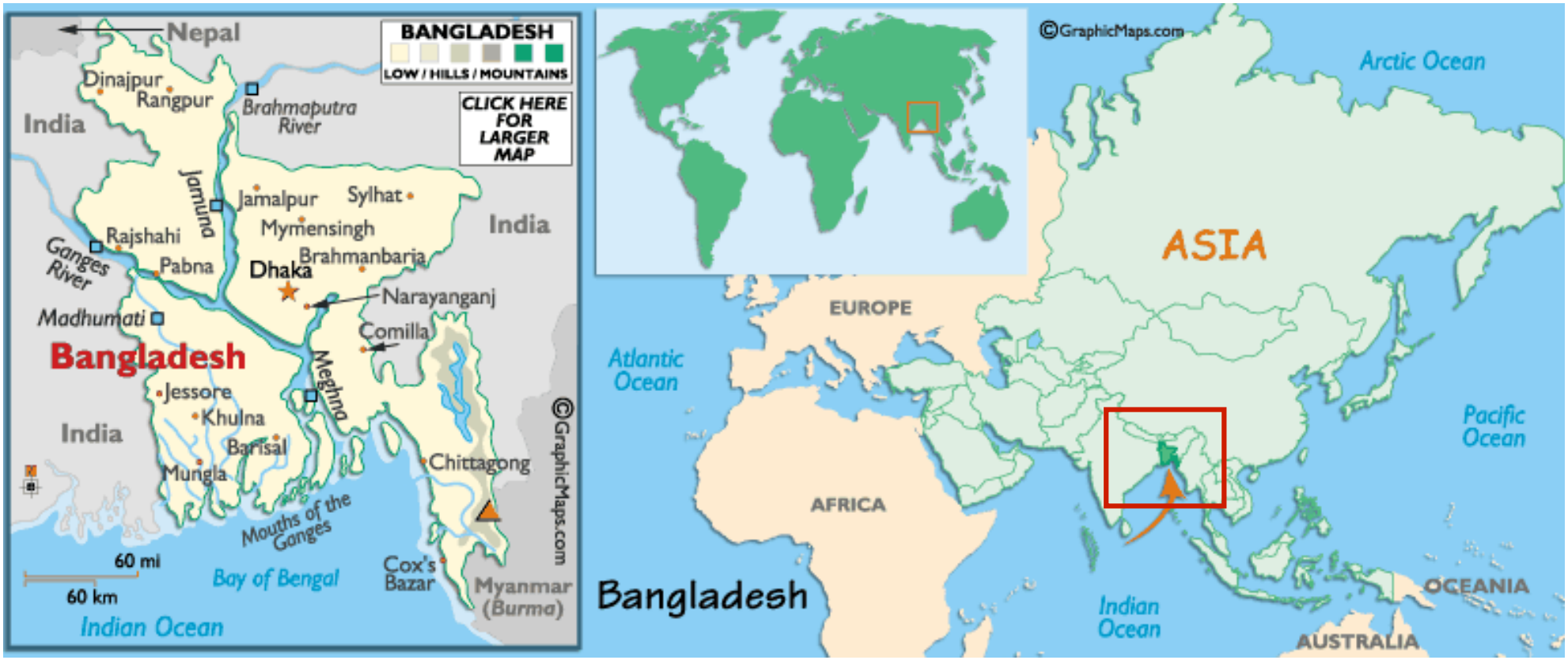
Ministry of Defence

Govt. of the People's Republic of Bangladesh

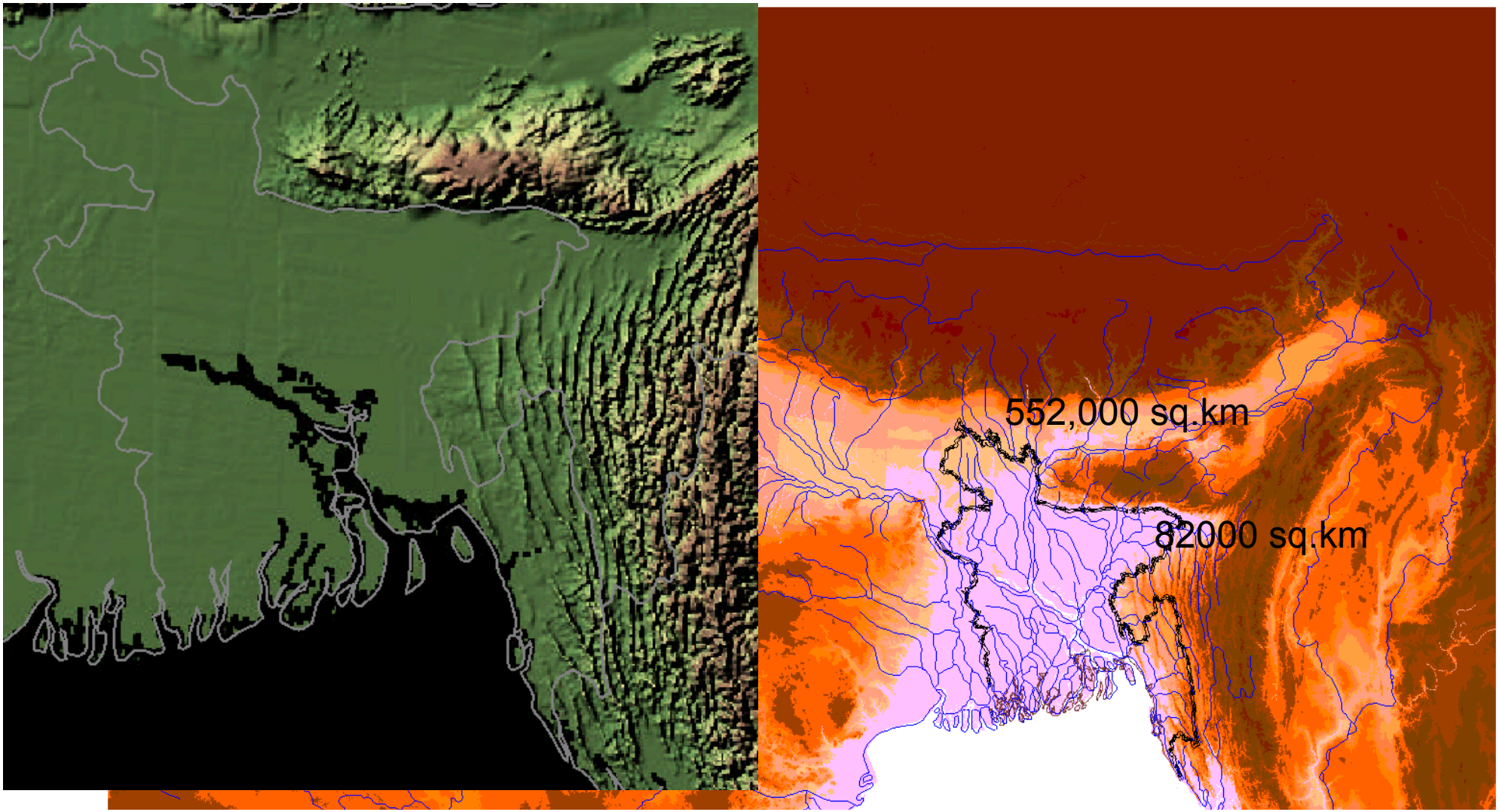
Location of Bangladesh

Location of Bangladesh

(in the World Map and in the Asia Map)

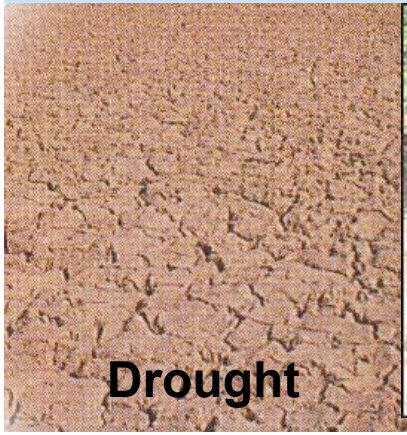


Topography - surrounding Bangladesh



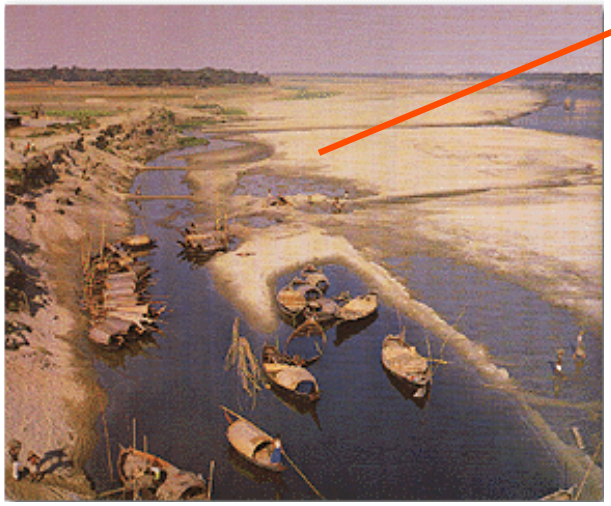
Water related disasters in Bangladesh

- Flood
- Cyclone
- Drought
- Land slide
- Erosion
- Water Logging
- Drainage congestion
- Salinity intrusion
- Cold Wave



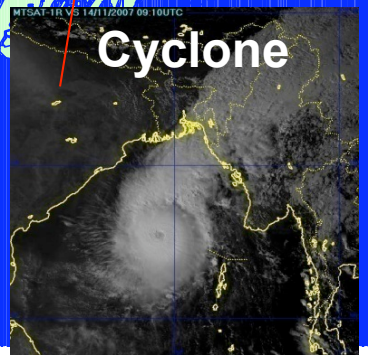
Bangladesh – Location of Major water related Diaster

Bank erosion



Sedimentation

Salinity intrusion



Bay

Impact of water related disaster-Bangladesh

- Agriculture
- Food Security
- Urban/Town Planning and Construction
- Energy
- Water Resource Management
- Fisheries/Marine
- Forestry
- Human Health and Social Services, Disaster Management
- Policy making
- Transportation (air, land, water)
- Tourism, Sports and Leisure

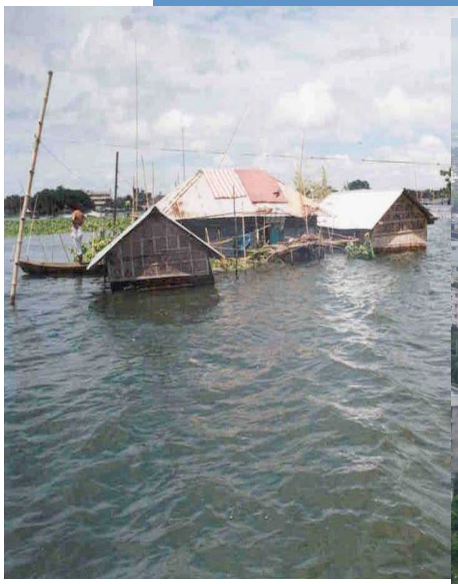
Mostly it affects on the General Population and Particularly to the Poor

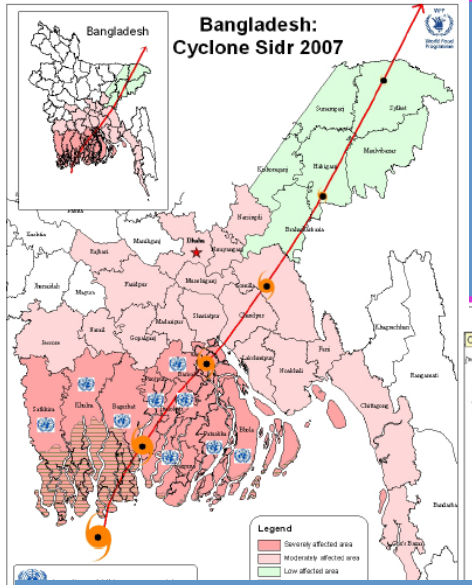
খাল দখল করে তৈরি অন্যদের স্থাপনা উচ্ছেদ করলেও চট্টগ্রাম সিটি করপোরেশন নিজেই নগরীর বহদ্দারহাটে চাক্তাই খালের ওপর তৈরি করেছে চারতলা বাণিজ্যিক ভবন —ছবি : রাশেদ মাহমুদ

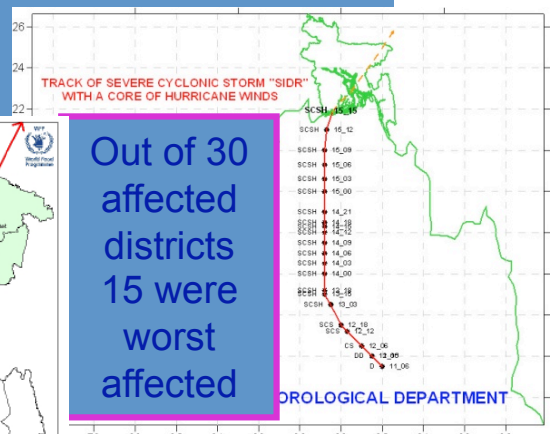
গুঁড়ি গুঁড়ি বৃষ্টি। তার ওপর তীব্র শীত। বৃষ্টি ও শীতে জনজীবনে বাড়তি দুর্ভোগ। রাজধানীর মহাখালী ফ্লাইওভার থেকে গতকাল ছবিটি তোলেন জাহিদুল করিম

Recent Water related disasters in Bangladesh

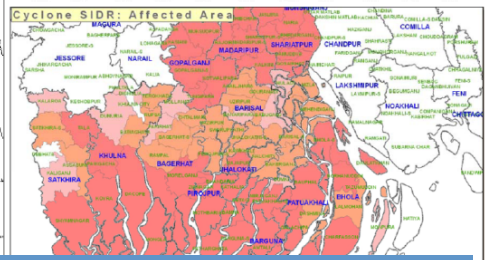
- Flood: 1987, 1988, 1998, 2004,2005 & 2007.(June-Sep)
- Cyclone: Apr-1991, Nov, 2007.
- Landslide: 11 June 2007
- Drought: 1994,1995 & 1998.







Out of 30 affected districts 15 were worst affected



Cyclone SIDR Storm surge flooding

Impact of water related disaster-Bangladesh

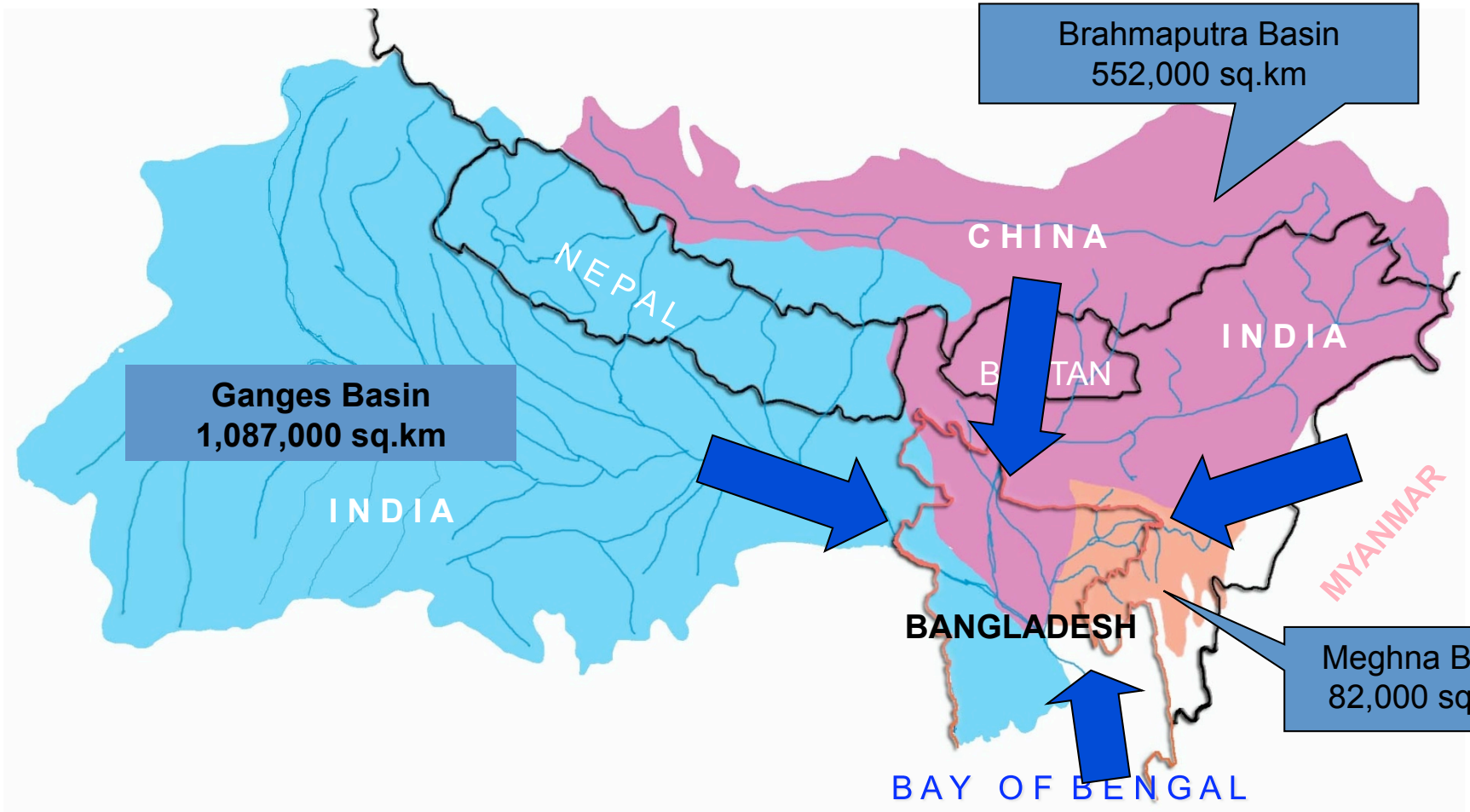
- Agriculture *Food Security *Urban/Town Planning and Construction*Energy*Water Resource Management *Fisheries/ Marine*Forestry*Human Health and Social Services, Disaster Management*Policy making*Transportation (air, land, water)
- Tourism, Sports and Leisure

Floods in Bangladesh

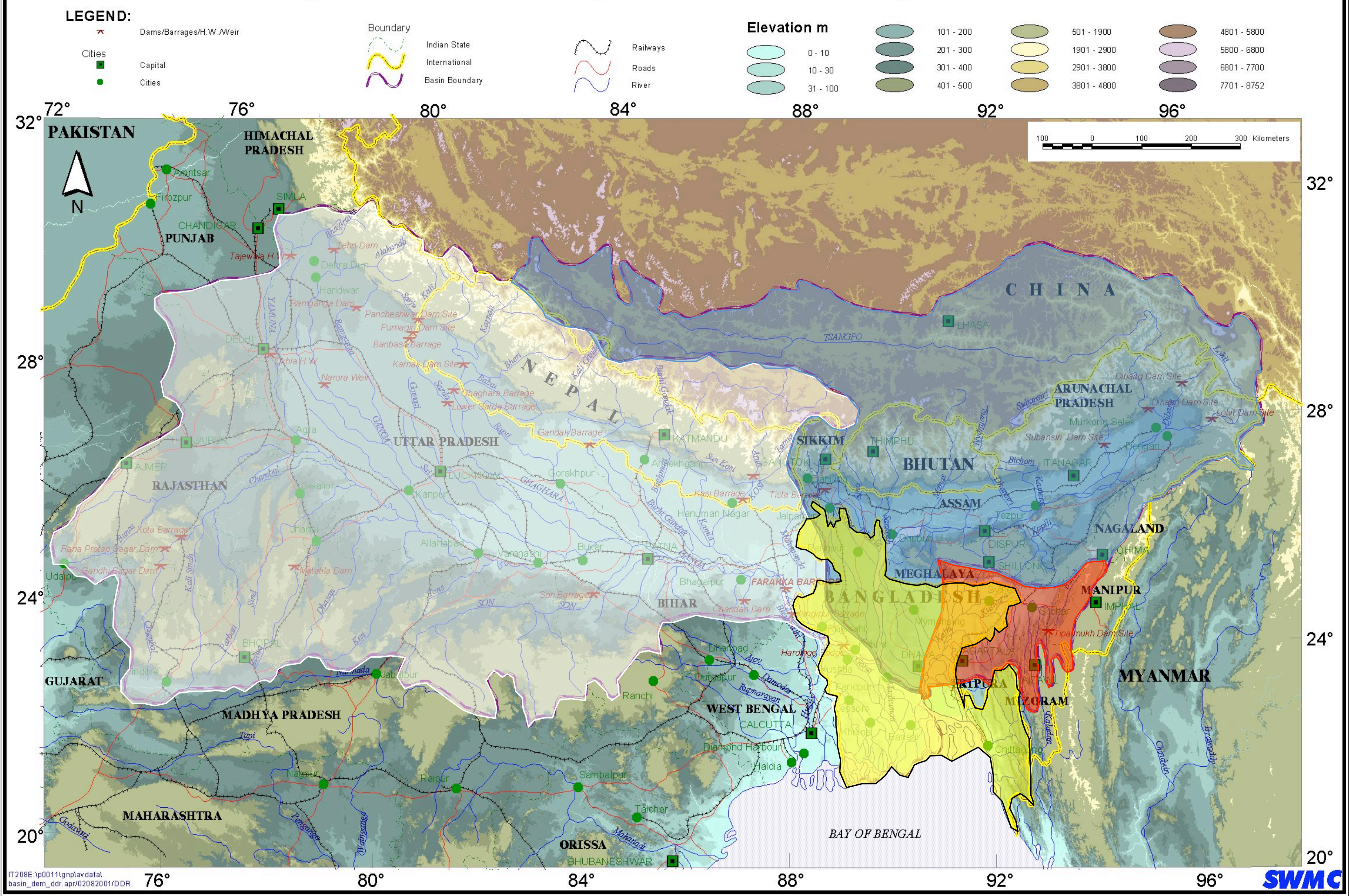
The Monsoon finally arrives
with Flood

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

About 80% of the catchment area is outside the international boundary



The Ganges, The Brahmaputra and The Meghna River Basin



- **River System :**

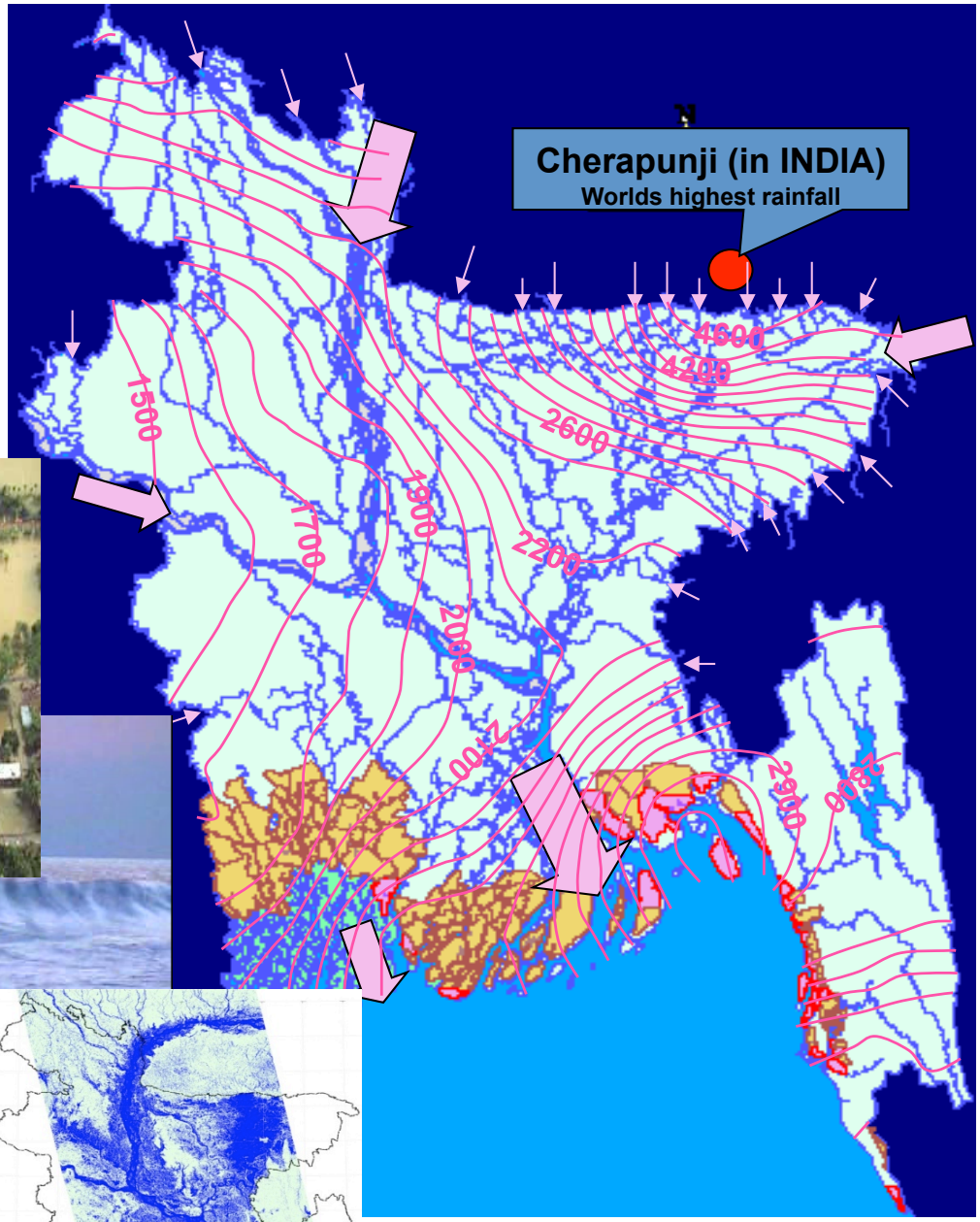
  24,000 km

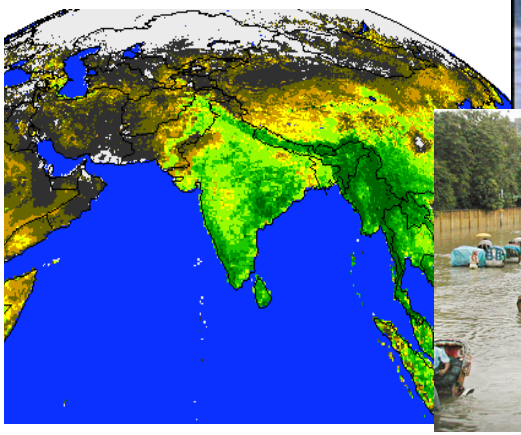
- **Annual Average Rainfall:**

  2300 mm

- **Trans-boundary Flow:**

  57 rivers

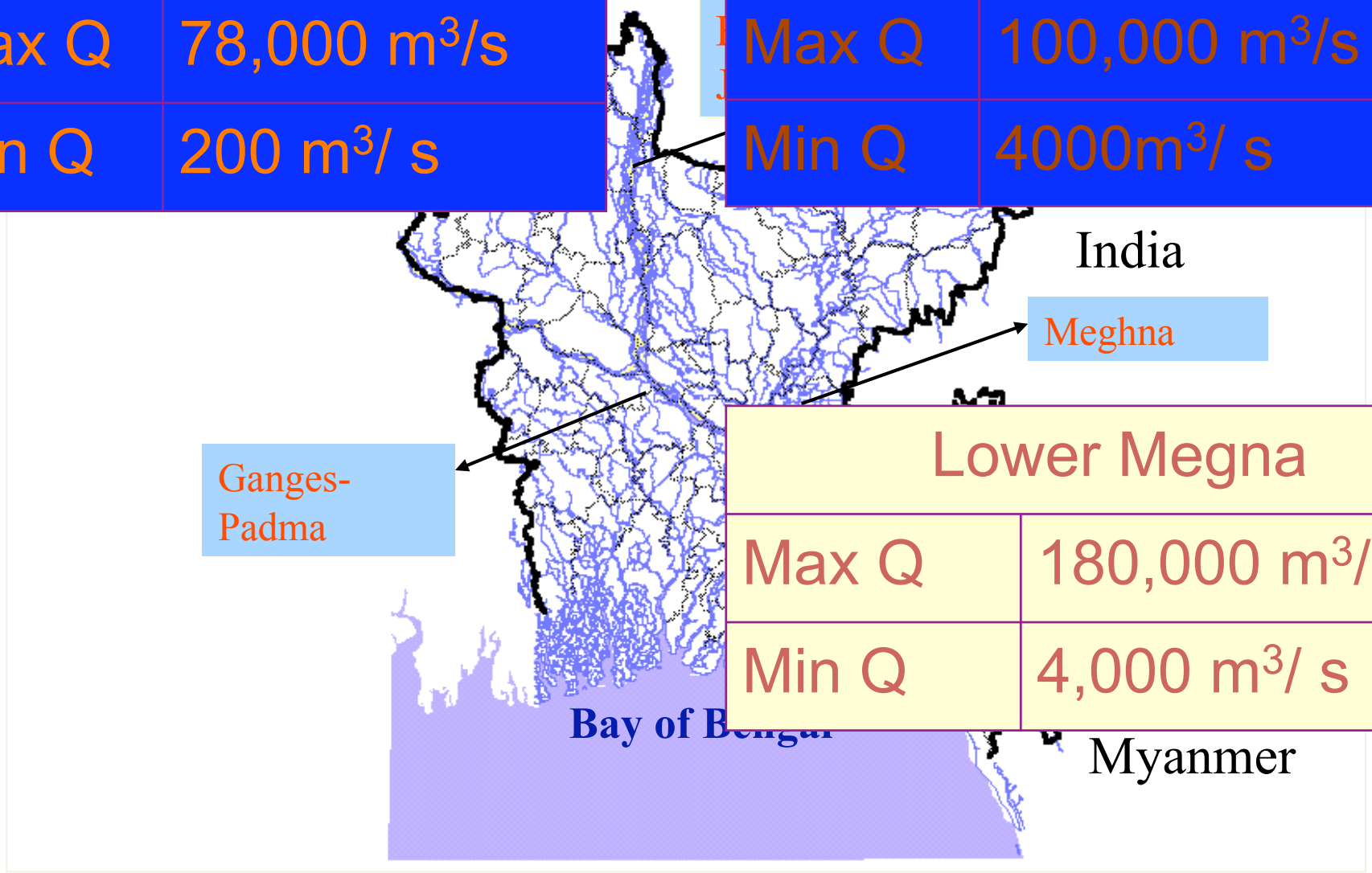




Status of Water Flow through the main River System

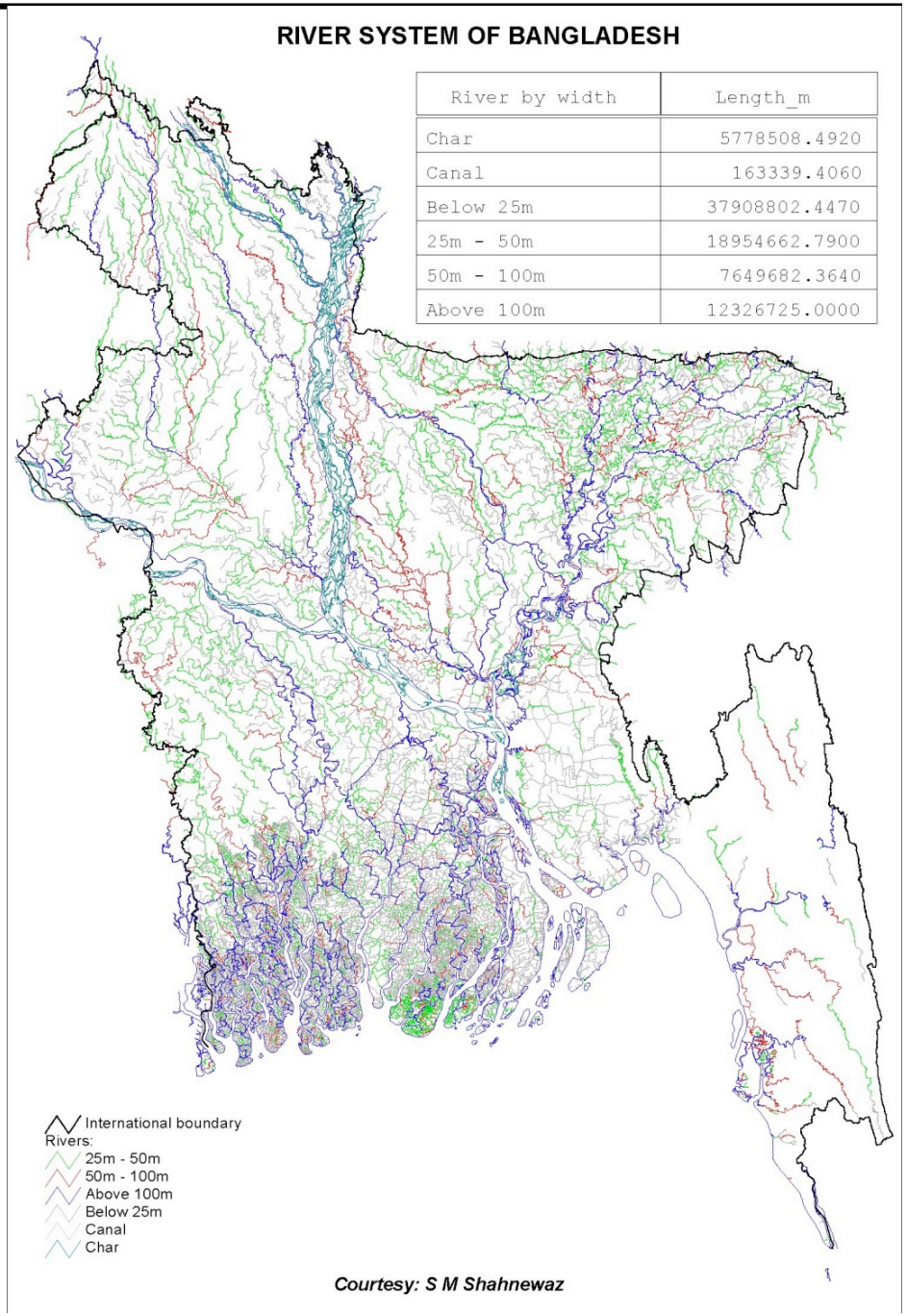
Ganges	
Max Q	78,000 m^3/s
Min Q	200 m^3/s

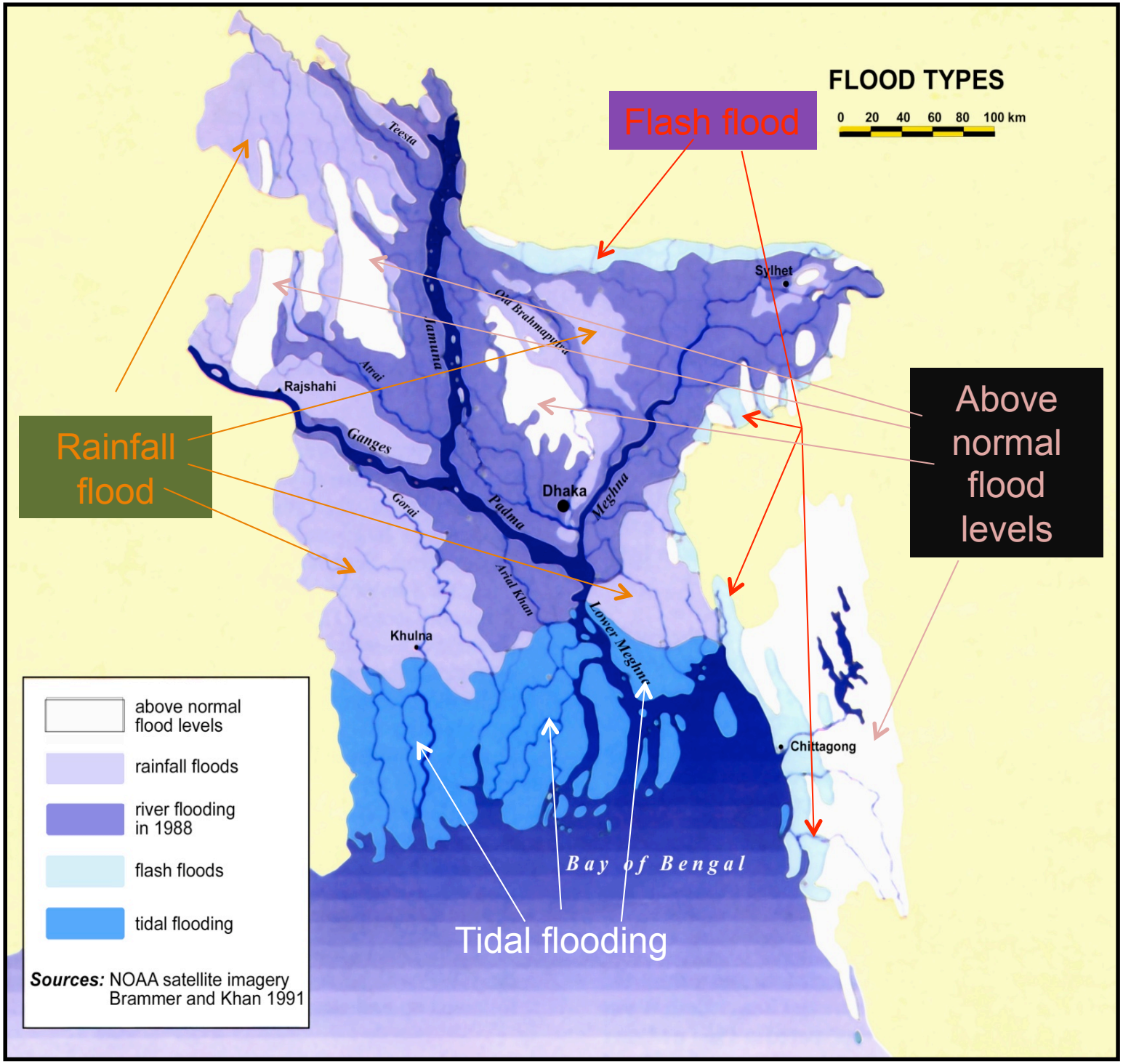
Brahmaputra	
Max Q	100,000 m^3/s
Min Q	4000m^3/s



Lower Megna	
Max Q	180,000 m^3/s
Min Q	4,000 m^3/s

Floods in Bangladesh & Complex Drainage System




FLOOD TYPES
0 20 40 60 80 100 km
Flash flood
Rainfall flood
Above normal flood levels
Tidal flooding
Teesta
Jamuna
Old Brahmaputra
Atrai
Rajshahi
Ganges
Gorai
Padma
Arial Khan
Meghna
Lower Meghna
Dhaka
Sylhet
Khulna
Chittagong
Bay of Bengal
above normal flood levels
rainfall floods
river flooding in 1988
flash floods
tidal flooding
Sources: NOAA satellite imagery
Brammer and Khan 1991

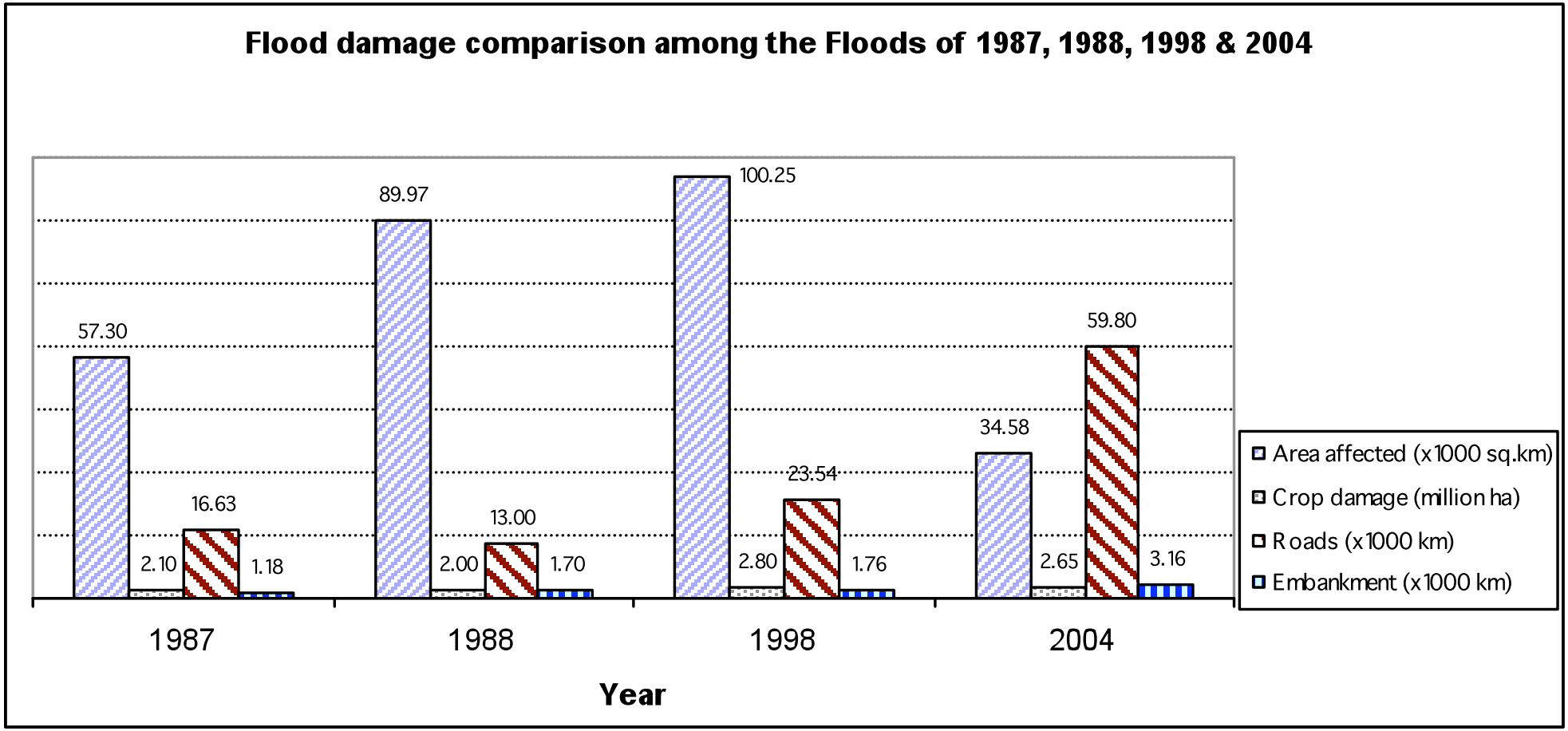
Recent Major Floods

- The country experienced the most devastating floods in recent years; 1987, 1988, 1998 and 2004 in the context of percent of area inundated and financial losses incurred

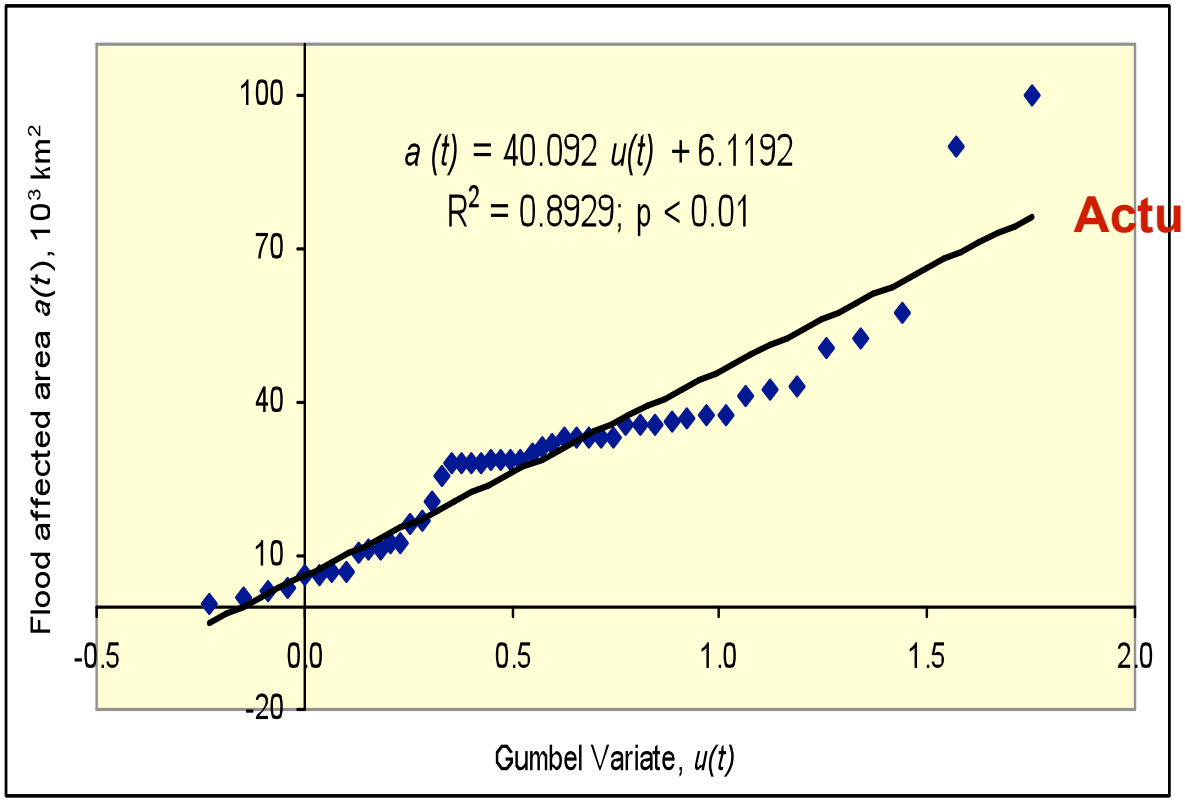
Duration above DL (days)	Flood Year			
	1987	1988	1998	2004
a. Bahadurabad (Jamuna)	13	27	66	16
b. Hardinge Bridge (Padma)	55	23	27	0
c. Chandpur (Meghna)	16	27	49	32

Comparison of major flood

1.Parameters		1.Flood Year				
		1987	1988	1998	2004	2007*
1.Flood Duration (days)	a. Bahadurabad (Jamuna)	13	27	66	16	14
	b. Serajganj (Jamuna)	31	44	48	19	20
	c. Hardinge Br. (Ganges)	55	23	27	0	0
	d. Goalundo (Padma)	54	41	68	23	41
	e. Bhagyakul (Padma)	56	47	72	34	42
	f. Bhairab Bazar (Meghna)	30	68	68	39	18
	g. Chandpur (Meghna)	16	27	49	72	15
1.Flooded Area in Sq. Km. (% of the country area)		57,300 (39)	89,970 (61)	1,00,250 (68)	56,000 (38)	62,000 (42)
1.Number of districts affected		50	53	53	39	40


Flood damage comparison among the Floods of 1987, 1988, 1998 & 2004
57.30
2.10
16.63
1.18
89.97
2.00
13.00
1.70
100.25
2.80
23.54
1.76
34.58
2.65
59.80
3.16
1987
1988
1998
2004
Year
Area affected (x1000 sq.km)
Crop damage (million ha)
Roads (x1000 km)
Embankment (x1000 km)

Flood Frequency Analysis



Actual data plot and regression line

Flood Return		
Years	*t*	(000 skm)
****	2	27
1955	5	50
1974	8	52
1987	10	58
1988	30	90
1998	50	100

$$f = \exp\left[- e^{- u(t)} \right]$$

u(t): Gumbel Variate, ***f*** **:** Cumulative frequency

t (Return period) = **1/ (1-*f*)**

Frequency analysis of flooding has been determined from 50 years of recorded flood-affected areas since 1954, which provides, on a year-by-year basis, major input for flood-frequency analysis. Among the various distributions, it was found the Gumbel distribution best fitted the available data particularly in regard to larger magnitude floods.

Historical Flood damage lists in Bangladesh

Loss	1988	1998	2004
Number of livestock killed	172,000	26,564	8,318
Crop damage (mha)	2.12	1.74	1.30
People Death (Nos)	2300	1100	747
Rice production loss (MT)	1.65	2.06	1.00
Number. of affected people	45 million	31 million	36 million
Road damaged (km)	13,000	15,927	27,970
Land inundation (%)	60	68	38
Number. damaged/ destroyed homes	7.2 million	980,000	4 million
Total Damage	TK: 82.6 billion USD: 1.6 Billion	TK: 118 billion USD: 2 Billion	TK: 134 Billion USD: 2.3 Billion
Duration of flood	23 days	72 days	21 days

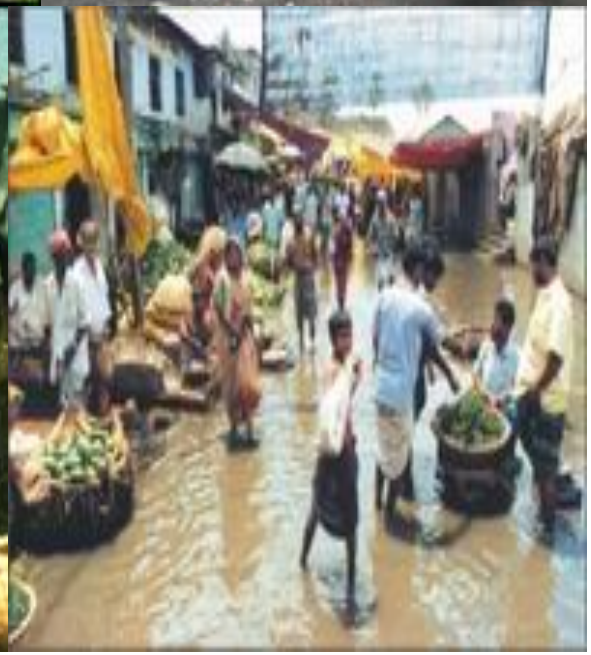
Flood in Bangladesh- Few Signs

Flood in Bangladesh


M. G. AZIZ
11-Sep-05 14:47


ঔষধ


চিকিৎসা চাই



Land Slide in Bangladesh

Severe Land Slide Occurred at Chittagong Tolling Death of 77 Pers Due to Heavy Rain Fall and Hill cutting.

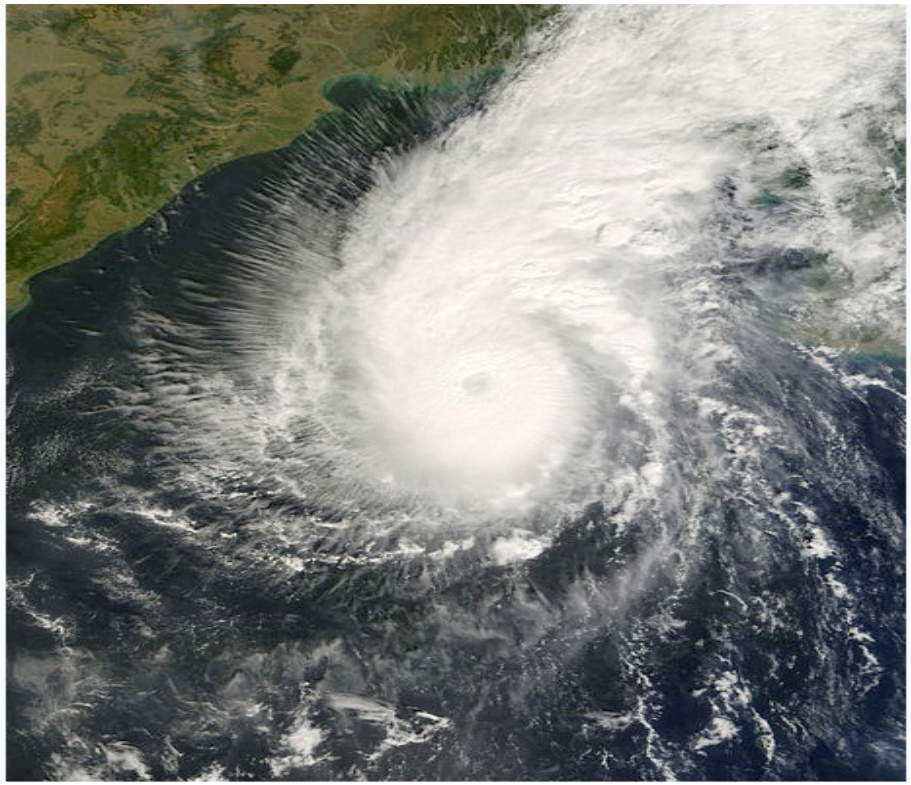
চট্টগ্রাম নগরীর মতিঝর্ণা এলাকায় পাহাড়ের পাদদেশে জীবনের ঝুঁকি নিয়ে আবারও বসবাস শুরু করেছে ছিন্নমূল মানুষ —প্রথম আলো

Bangladeshi rescue workers recover the body of a child after a landslide 11 June 07 in Chittagong. Landslides and lightning strikes have left dozens dead in Bangladesh as torrential monsoon rains pounded the disaster-prone country. At least 77 people have been killed when weekend rains flooded the southeastern port city of Chittagong and set off landslides in surrounding areas.

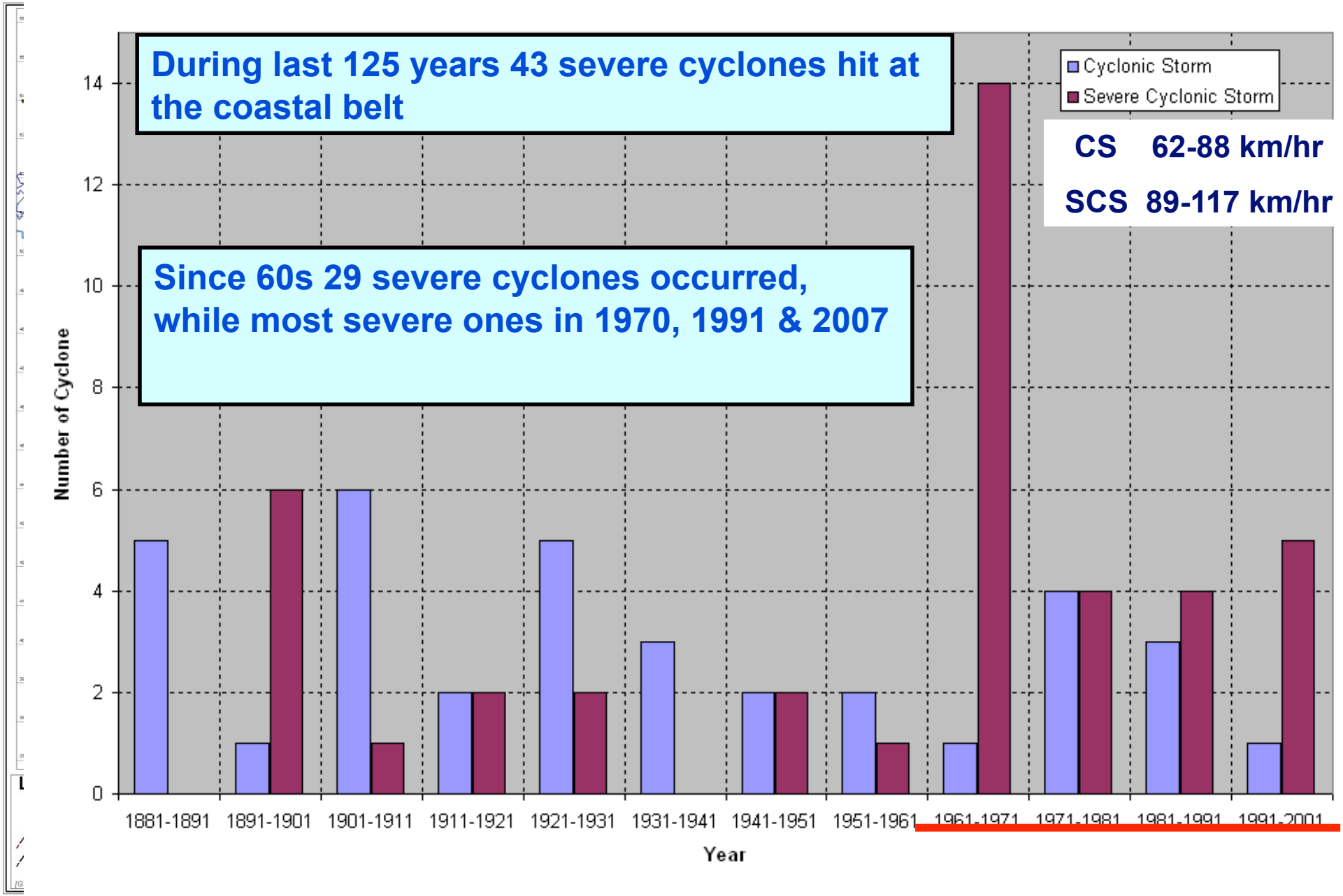
Land slide hazard at Chittagong in Bangladesh on 11 June 2007

Monsoon rains, mudslides and floods kill over 100 pers in Bangladesh-07

Cyclone in Bangladesh - Most Common Disaster After Flood

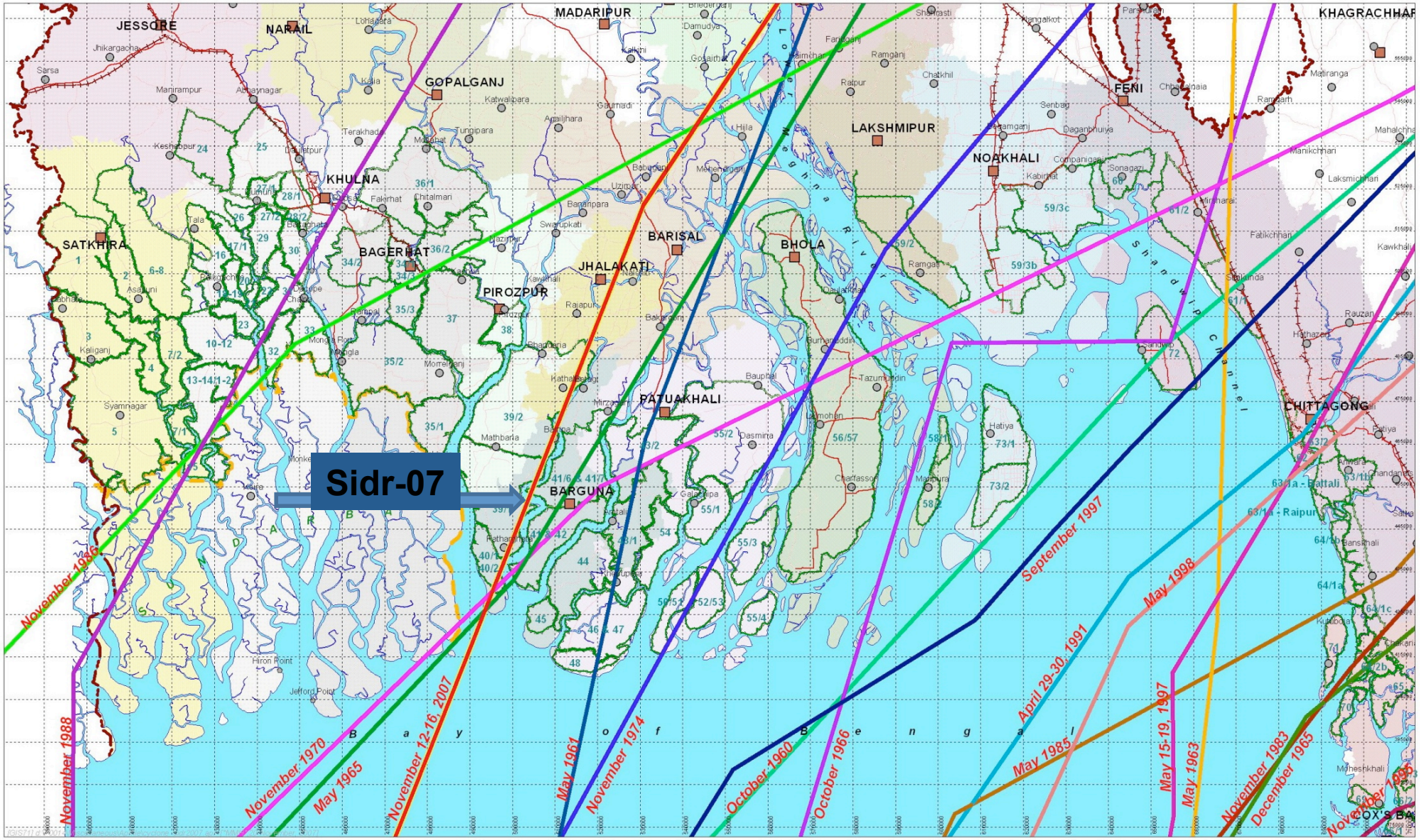


Past cyclones attacked Bangladesh coast



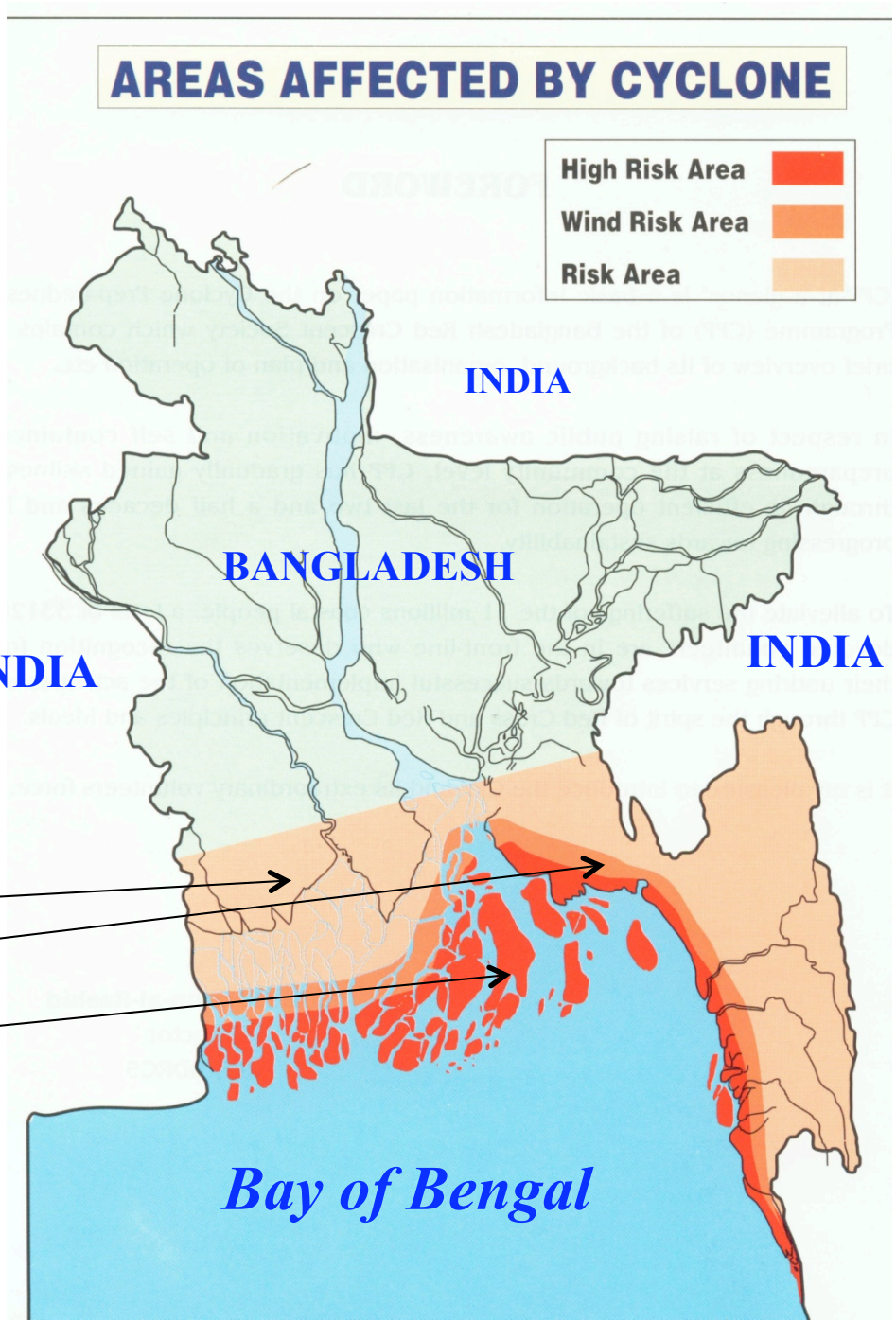
Cyclone	Location	Max. Wind Speed (kph)	Loss of Life
Oct-1960	Shitakunda	208	5,149
May-1961	Kalapara	142	11,468
May-1963	Shitakunda	175	11,520
May-1965	Patharghata	161	19,270
Dec-1965	Cox's Bazar	175	873
Oct-1966	Mirsharai	145	850
Nov-1970	Bhola-Noakhali	**222**	**300,000**
Nov-1974	Char Rangabali	161	20
Nov-1983	Chakaria	122	-
May-1985	Bashkhali	145	20
Nov-1986	Sundarban	116	14
Nov-1988	Sundarban	150	1,498
Apr-1991	Patenga	**224**	**138,000**
Nov-1995	Cox's Bazar	110	-
May-1997	Patenga	200	-
Sep-1997	Shitakunda	150	-
May-1998	Patenga	165	-
Nov-2007	Patharghata	**240**	**3,363**

Record of Cyclone Hazard



18 cyclones hit the coast of Bangladesh from 1960 to 2007

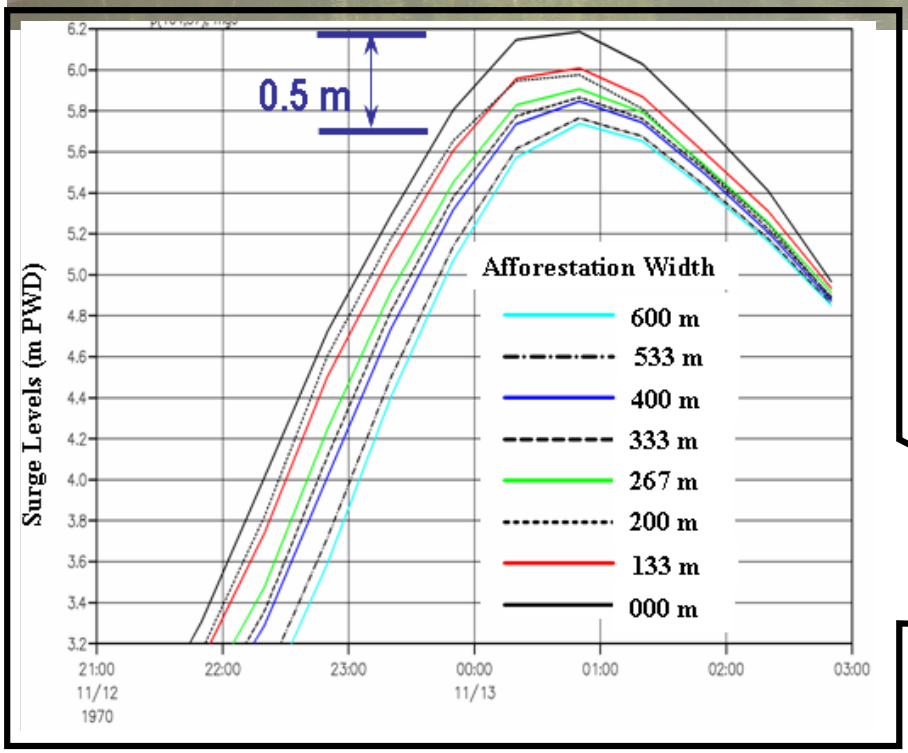
Cyclone Affected Area according to Previous Records of Bangladesh



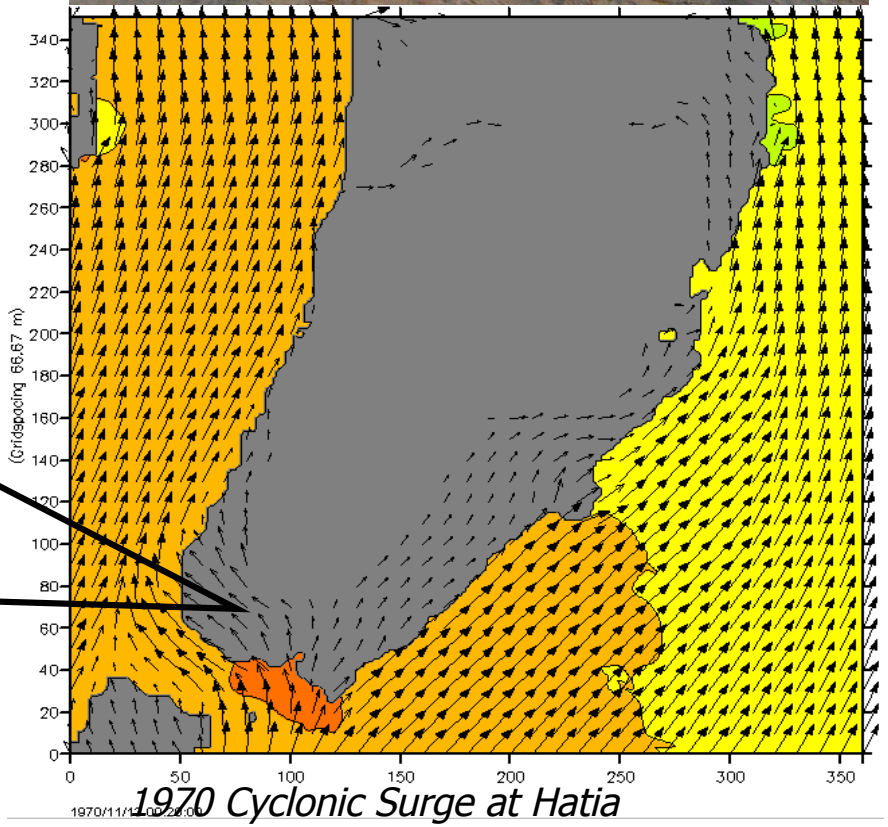
Risk Area

Wind Risk Area

High Risk Area

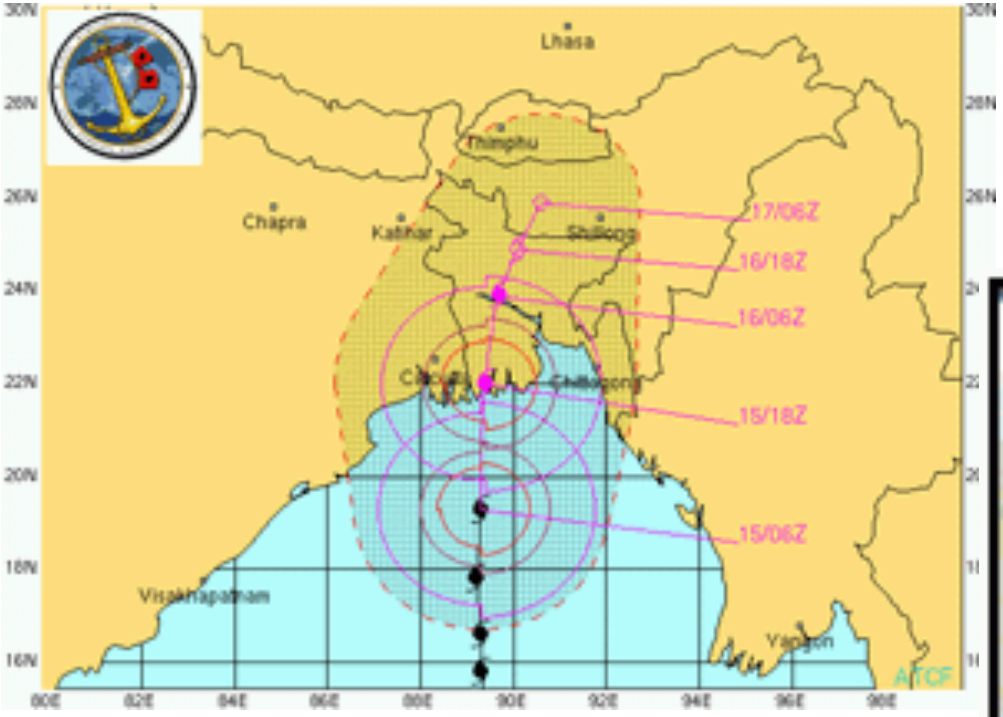


Surge Level Attenuation



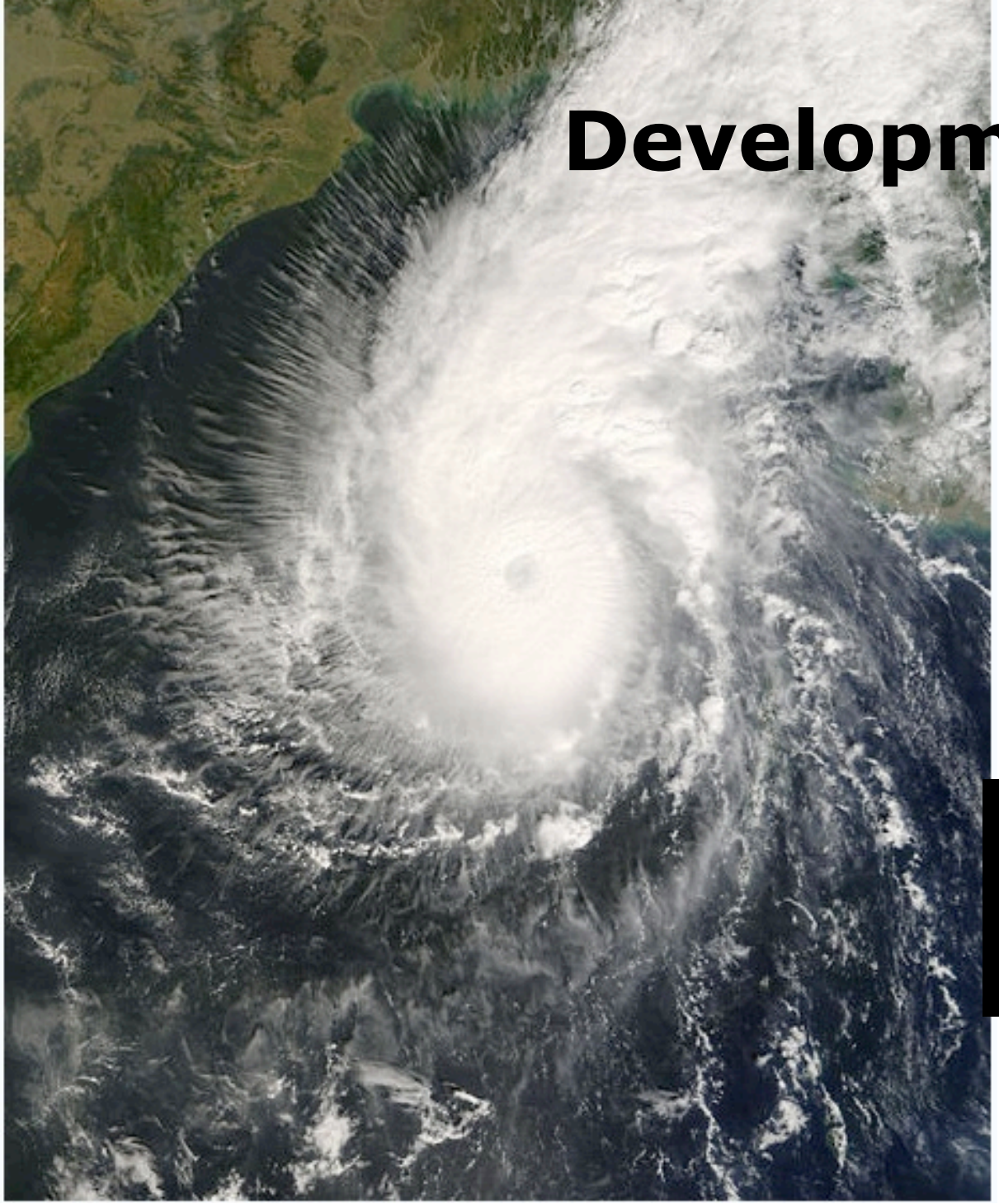
1970 Cyclonic Surge at Hatia

Cyclone -SIDR,12-16 Nov,07



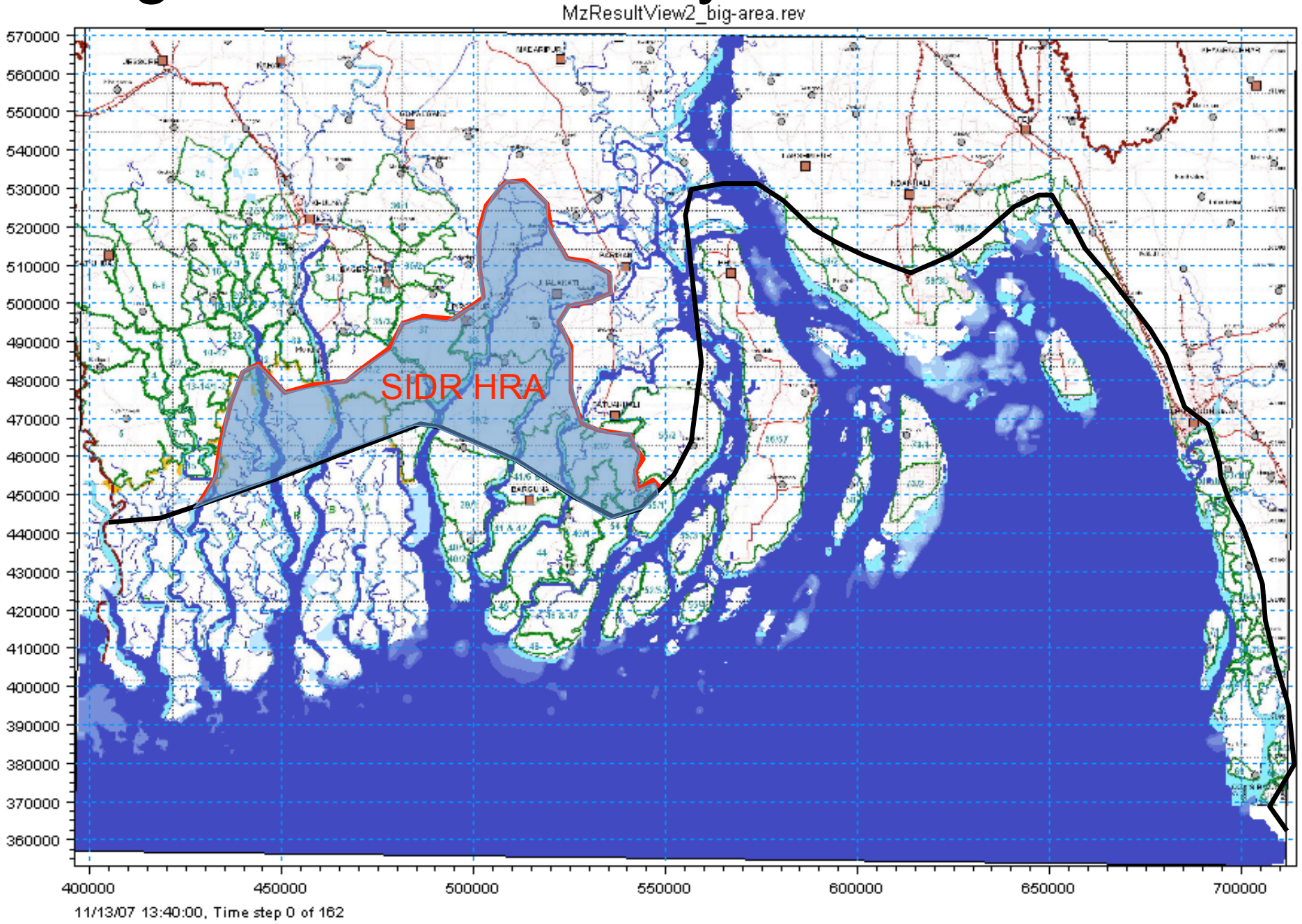
Major districts affected by Cyclone 'SIRD'

Development of SIDR



Cyclone SIDR Made Landfall on 9pm Bangladesh time with wind speed of 215-240 km/h on November 15, 2007

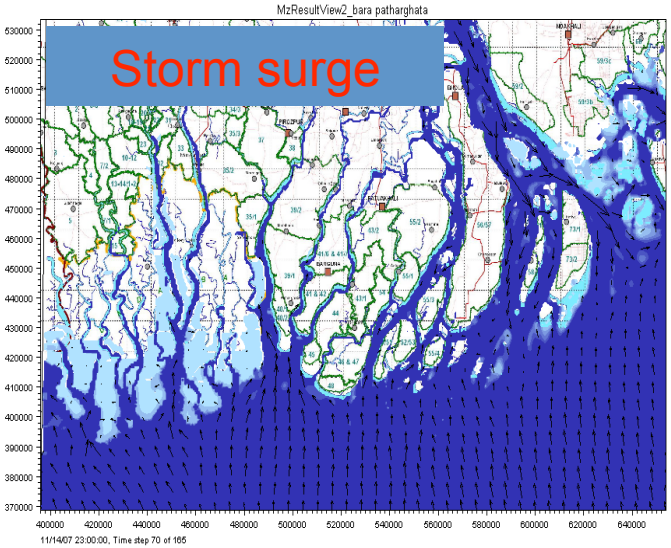
High Risk Area for Cyclone SIDR



Damage of Cyclone SIDR :


Damage of Protective works by SIDR
22 11 2007

Signs of Damage by Sidr-07

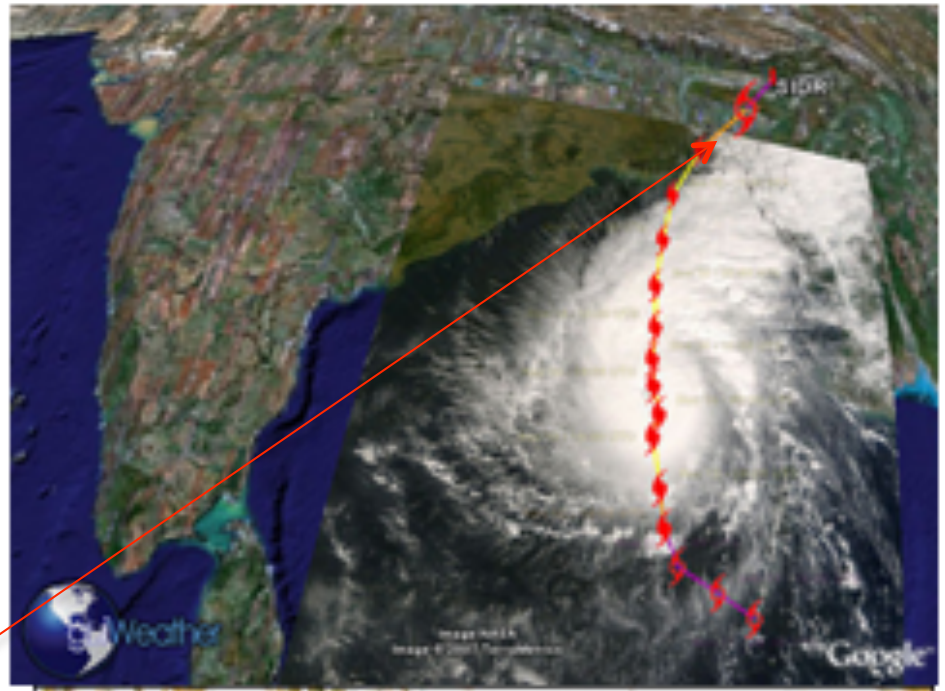


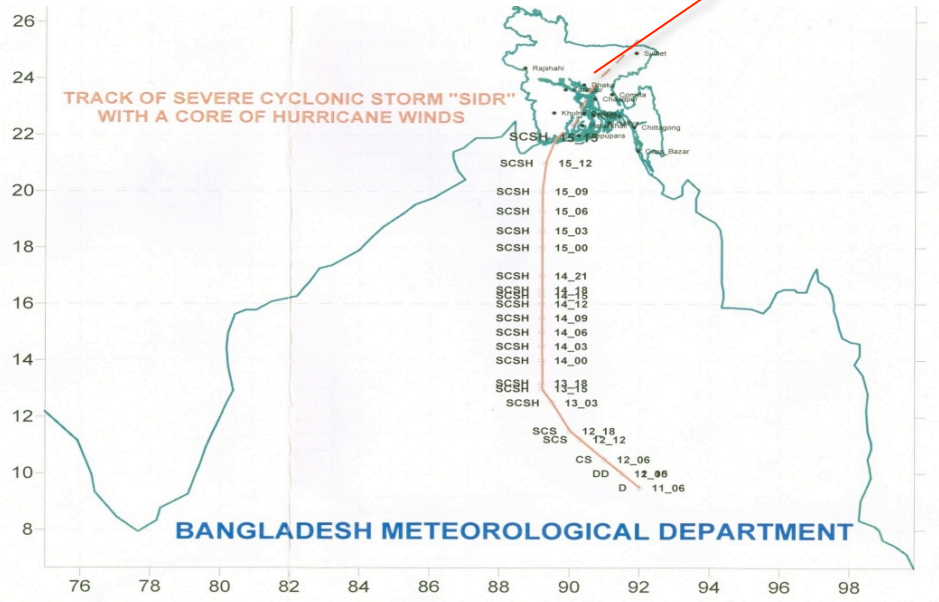
hool children foreground, a flattened school building in the backdrop.

Small shops, businesses, market areas, damaged along the road side.

Cyclone SIDR during 10-15 November in Bangladesh

- Cyclcone SIDR has devastating affect on Bangladesh but due to timely and accurate forecast death toll reduced remarkably.





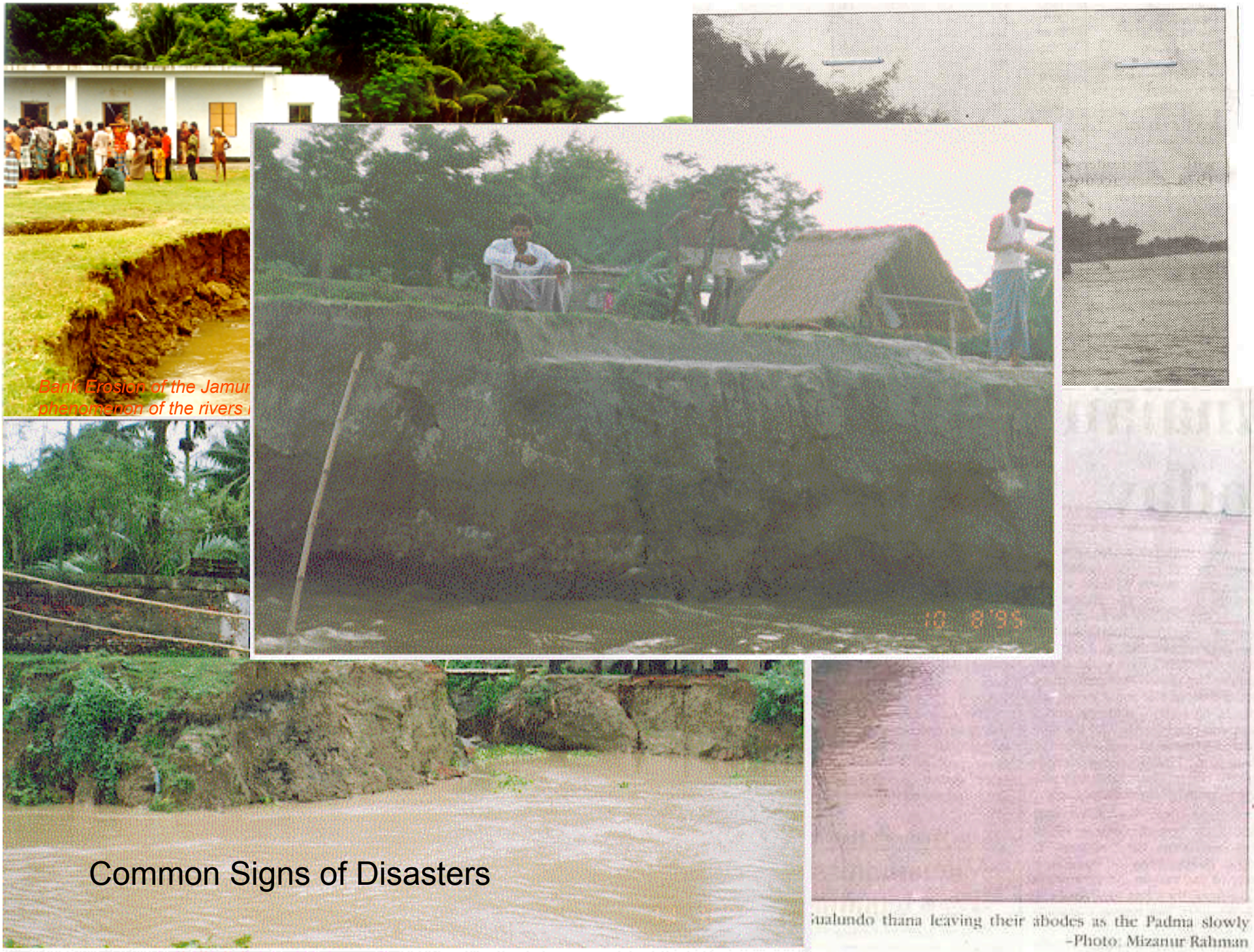
Causalities in Cyclone SIDR in Bangladesh

1.	Total Death (Nos)	3,363
2.	People missed (Nos)	871
3.	Family affected (Nos)	19,28,265
4.	People affected (Nos)	85,45,470
5.	Houses damaged (Nos)	14,49,157
6.	Crop damaged (Tons)	20,77,226
7.	Trees destroyed (Nos)	40,65,316

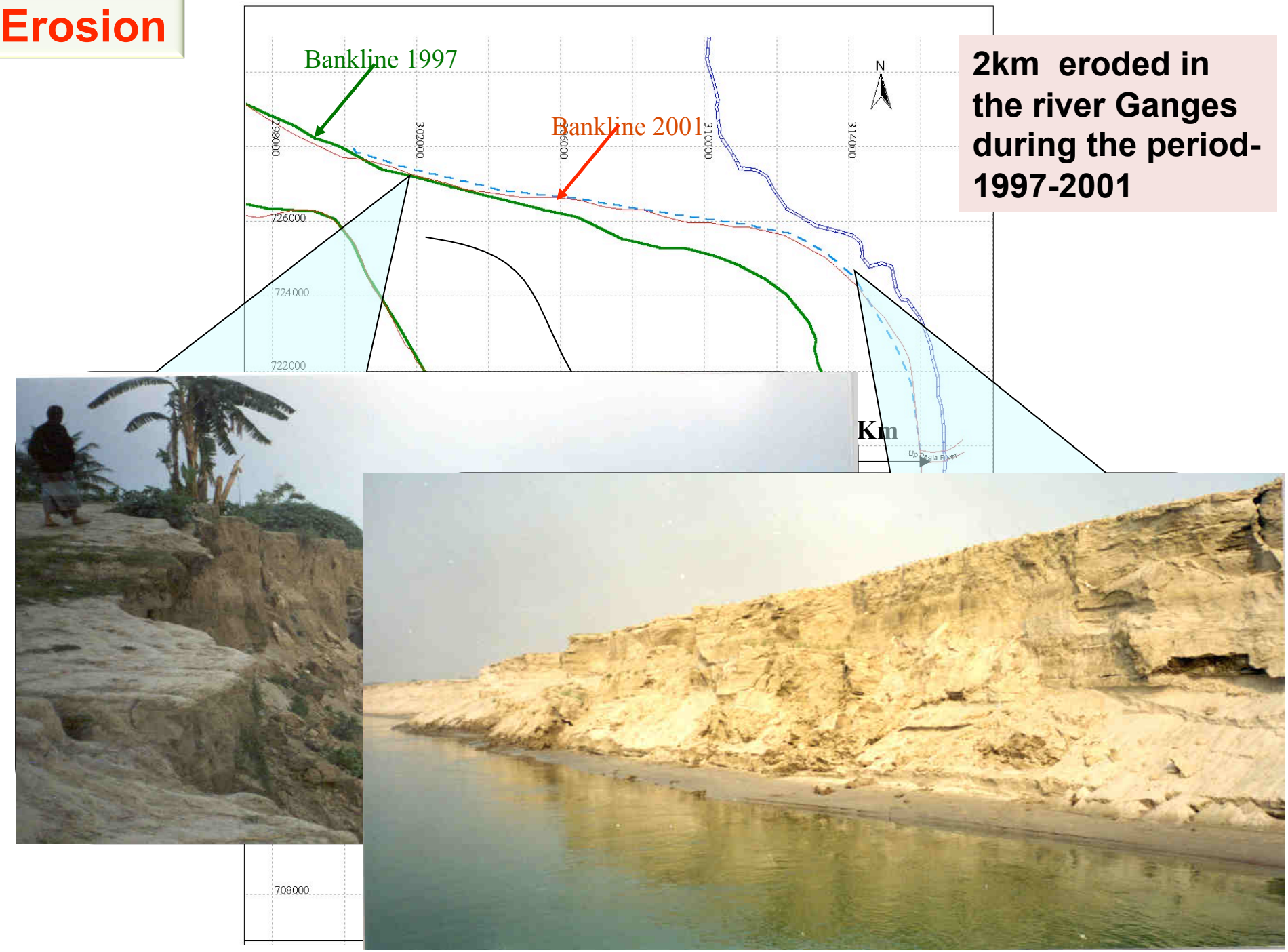
Total Damage Cost in USD: 450 million

Erosion in Bangladesh

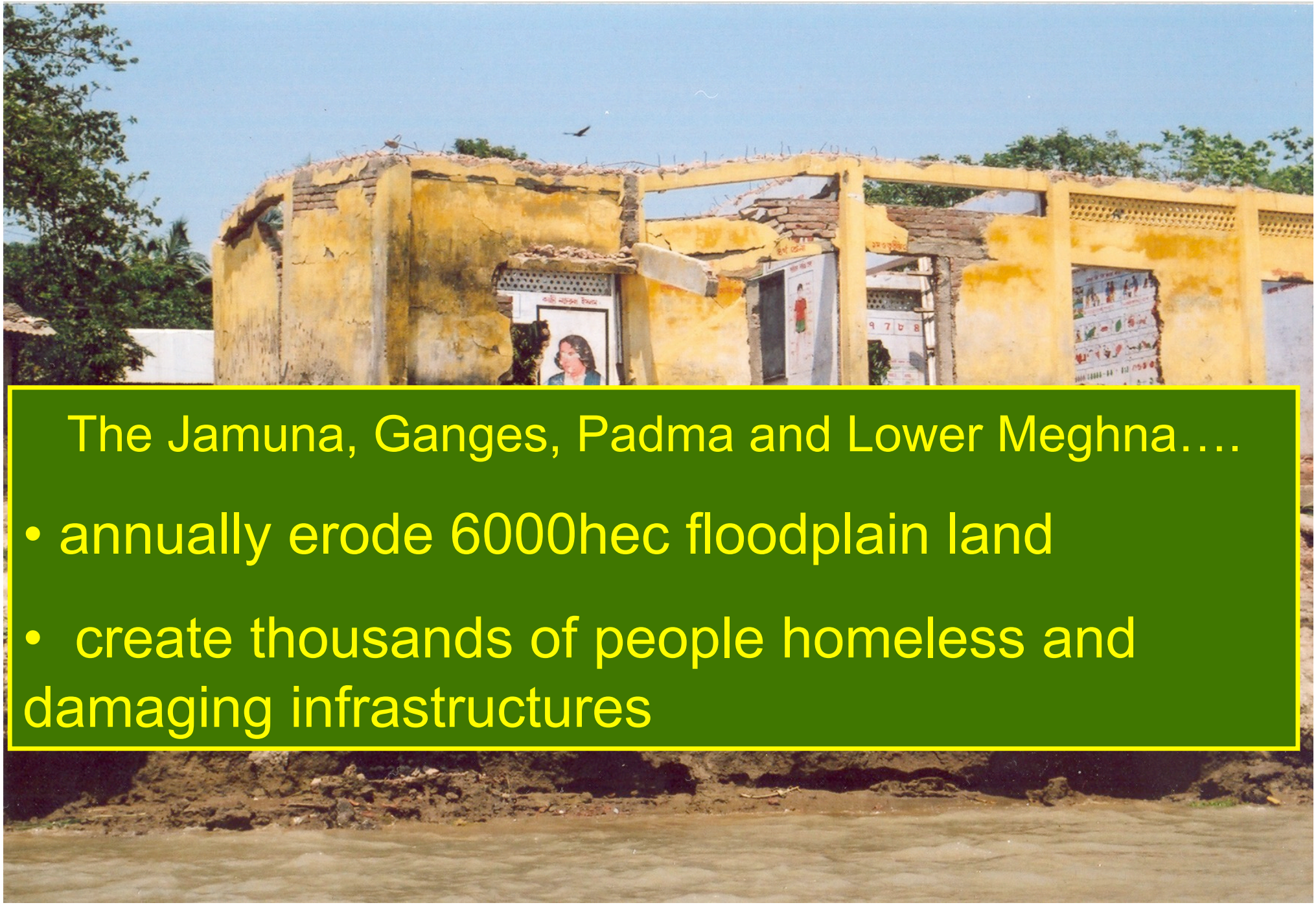
River Erosion Occurs Every year in monsoon causing sever disaster


Bank Erosion of the Jamur
phenomenon of the rivers
Common Signs of Disasters
gualundo thana leaving their abodes as the Padma slowly
-Photo: Mizanur Rahman

Erosion

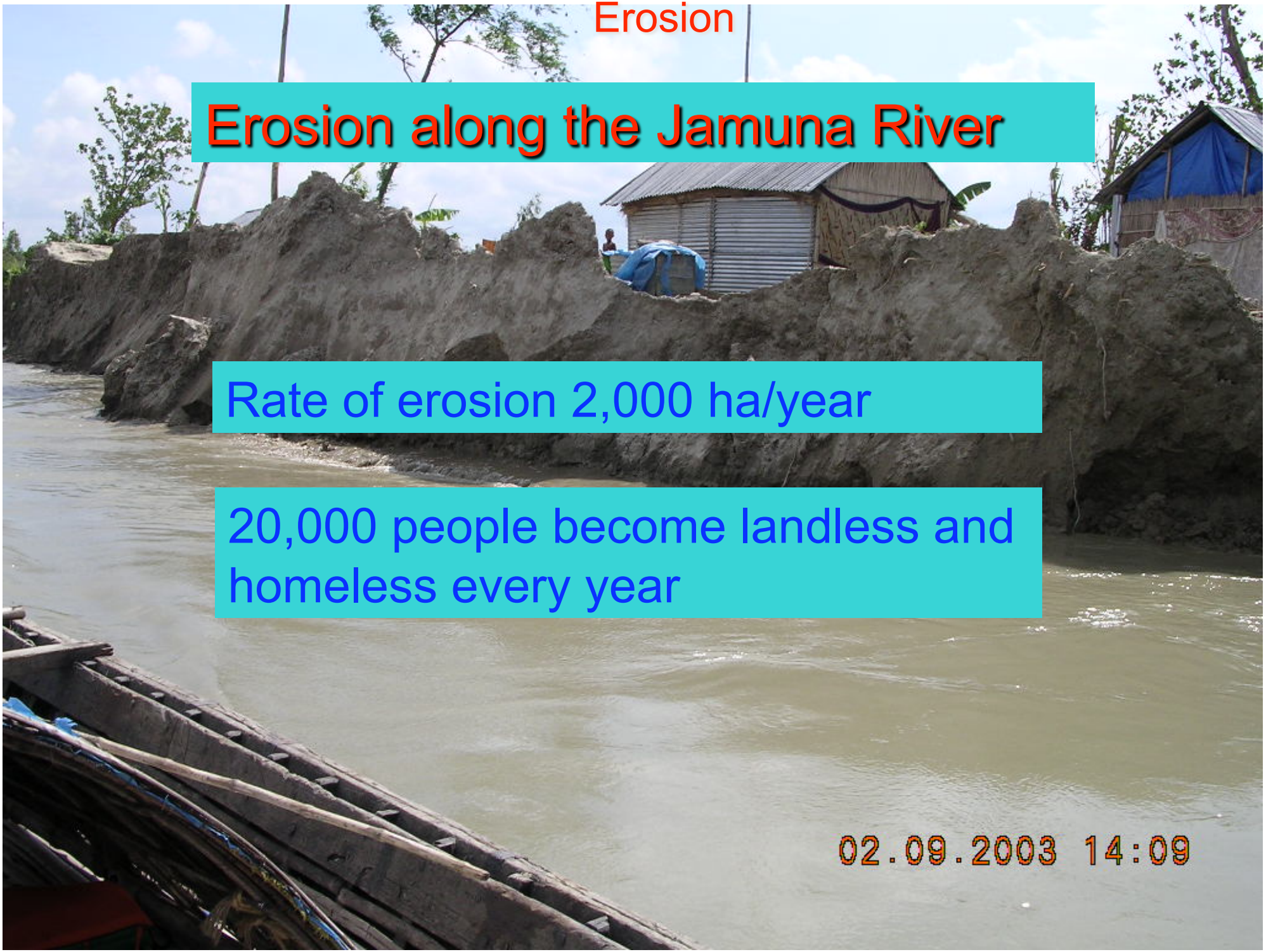


2km eroded in the river Ganges during the period-1997-2001



The Jamuna, Ganges, Padma and Lower Meghna….

- annually erode 6000hec floodplain land
- create thousands of people homeless and damaging infrastructures



Erosion along the Jamuna River

Rate of erosion 2,000 ha/year

20,000 people become landless and homeless every year

Erosion

Erosion along the Ganges River

Rate of erosion 1,000 ha/year

10,000 people become landless and homeless every year


Erosion along the Padma River
Rate of erosion 1,500 ha/year
15,000 people become landless and homeless every year

Comparison of erosion prediction and occurrence

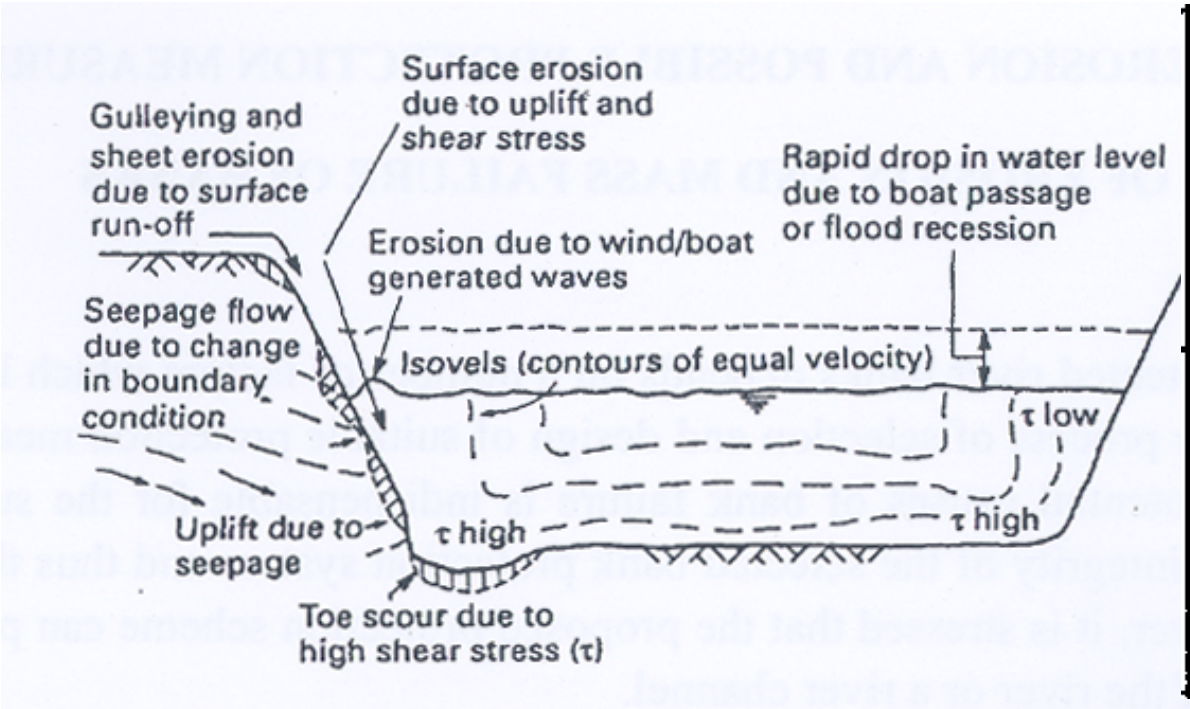
Jamuna River

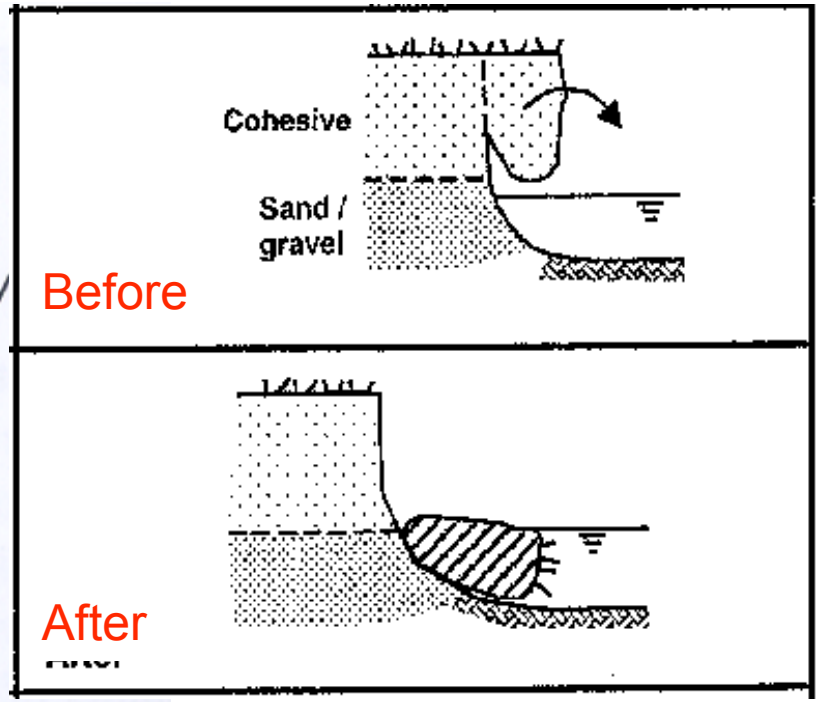
Features	Year 2004		Year 2005		Year 2006	
	Predicted	Occurred	Predicted	Occurred	Predicted	Occurred
No. of locations	16	20	29	36	29	23
Land (ha)	860	960	1400	1790	1380	1140

Padma River

Features	Year 2005	
	Predicted	Occurred
No. of locations	6	7
Land (ha)	970	890

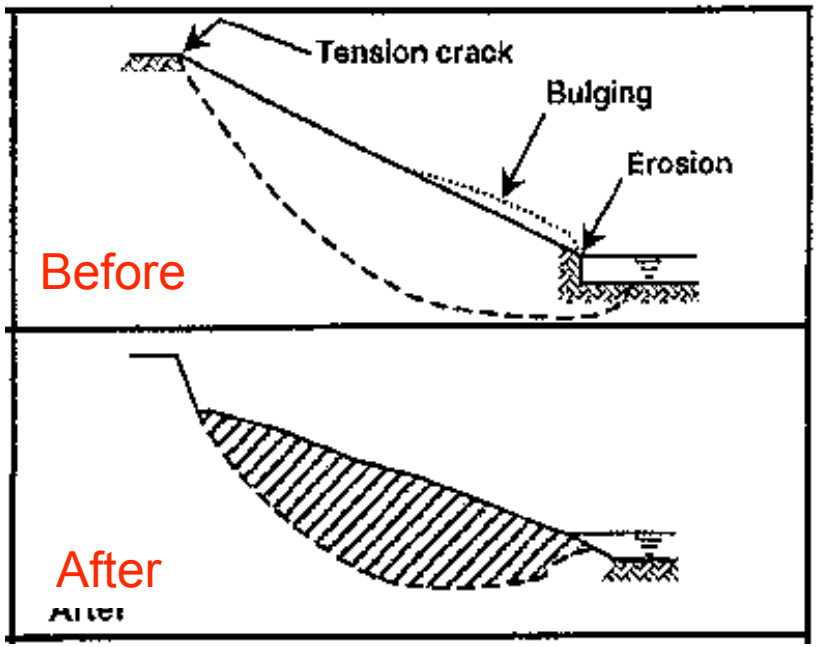
Process of Erosion in Bangladesh





River Bank Scour

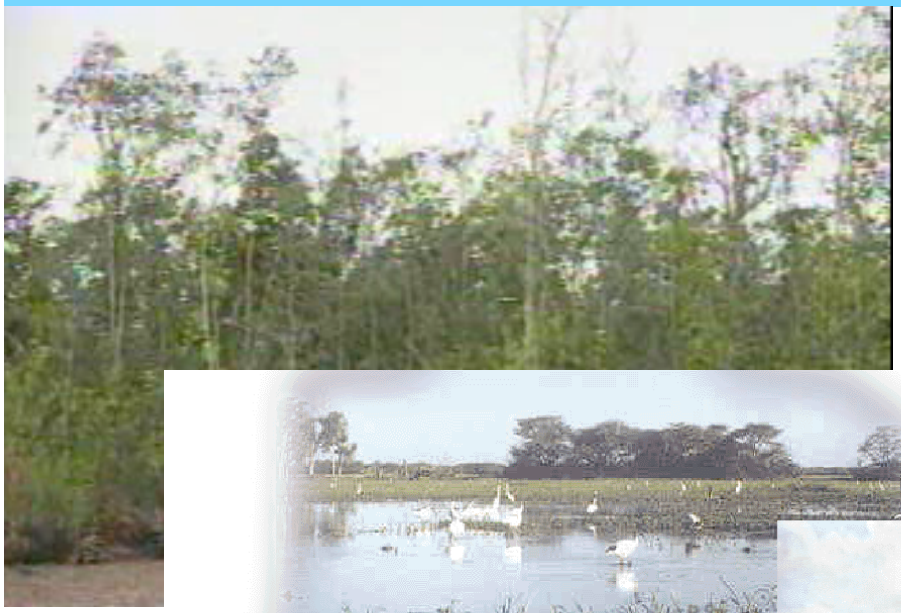
Mass Failure



Sedimentation

Sedimentation Causing Rise of River Bed, Affecting Navigation, Water Logging, Drainage Congestion and Flooding in Bangladesh

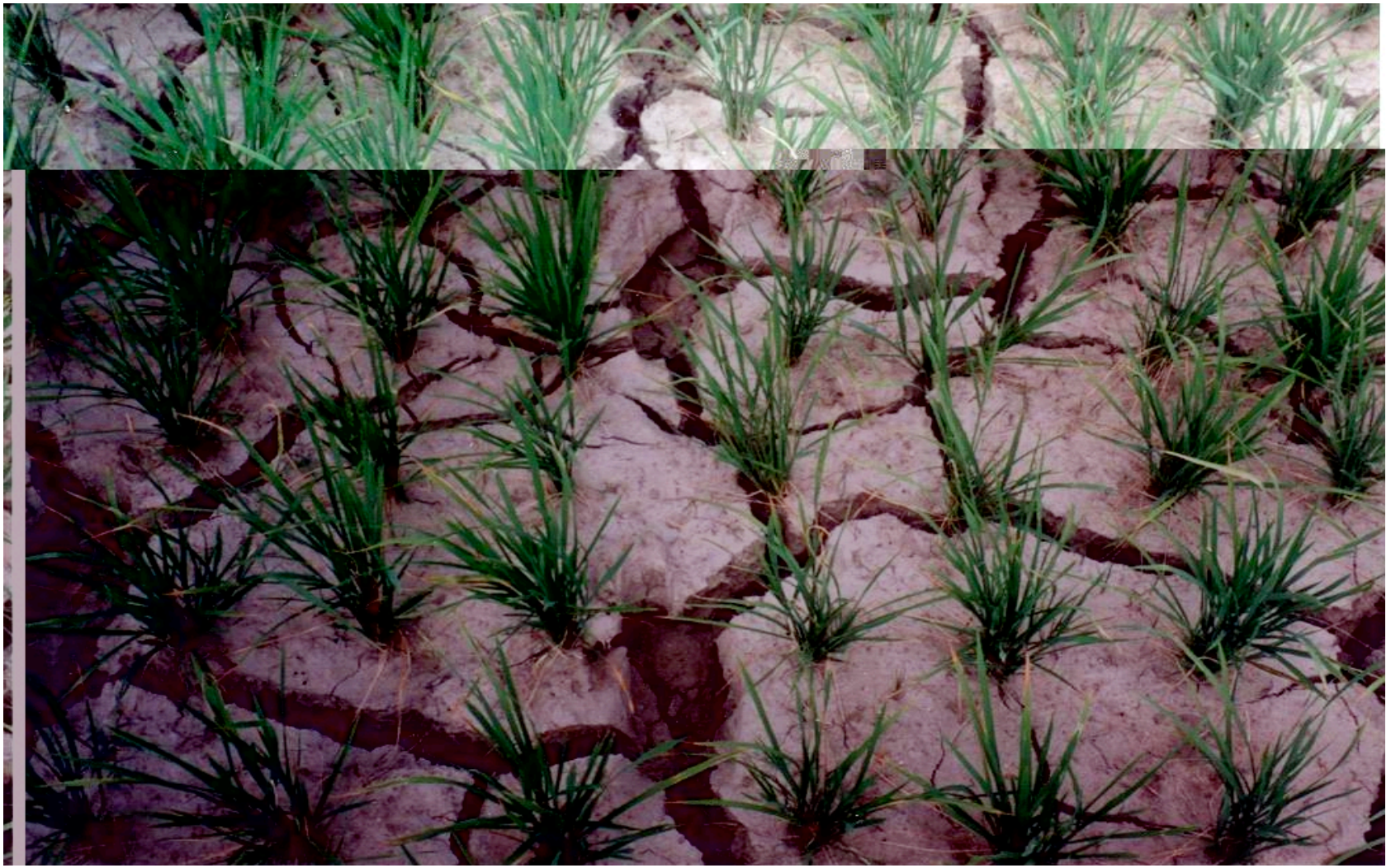
Environmental Degradation Due to Siltation



Drainage congestion

Drought/Water Stress

Dry Weather and River flow declination brought disasters in cultivation



Historical Drought Occurrences in Bangladesh

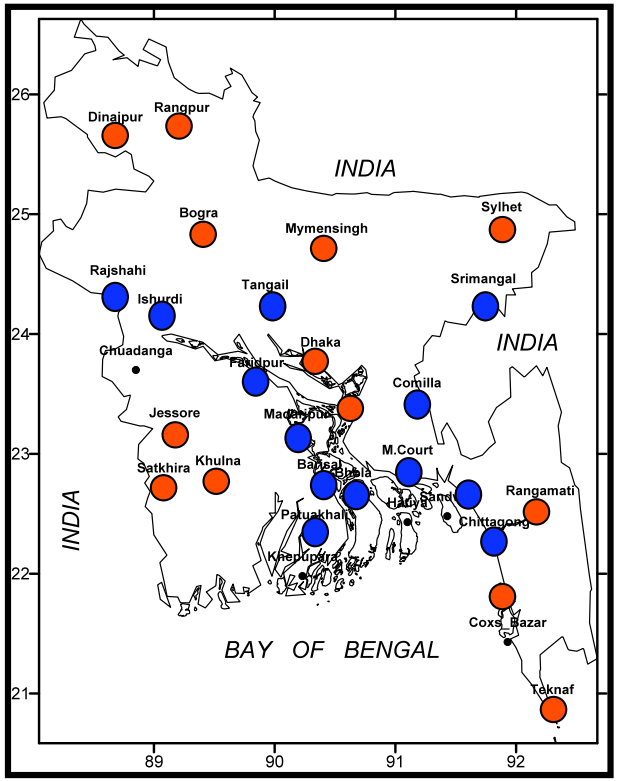
SEVERE	MODERATE
1966, 1969, 1972, 1978, 1979, 1982, 1989, 1992, 1994, 1995, 1998	1961, 1962, 1967, 1968, 1970, 1977, 2002

*About 2.18 million tons of rice was damaged due to drought during the period 1973-87

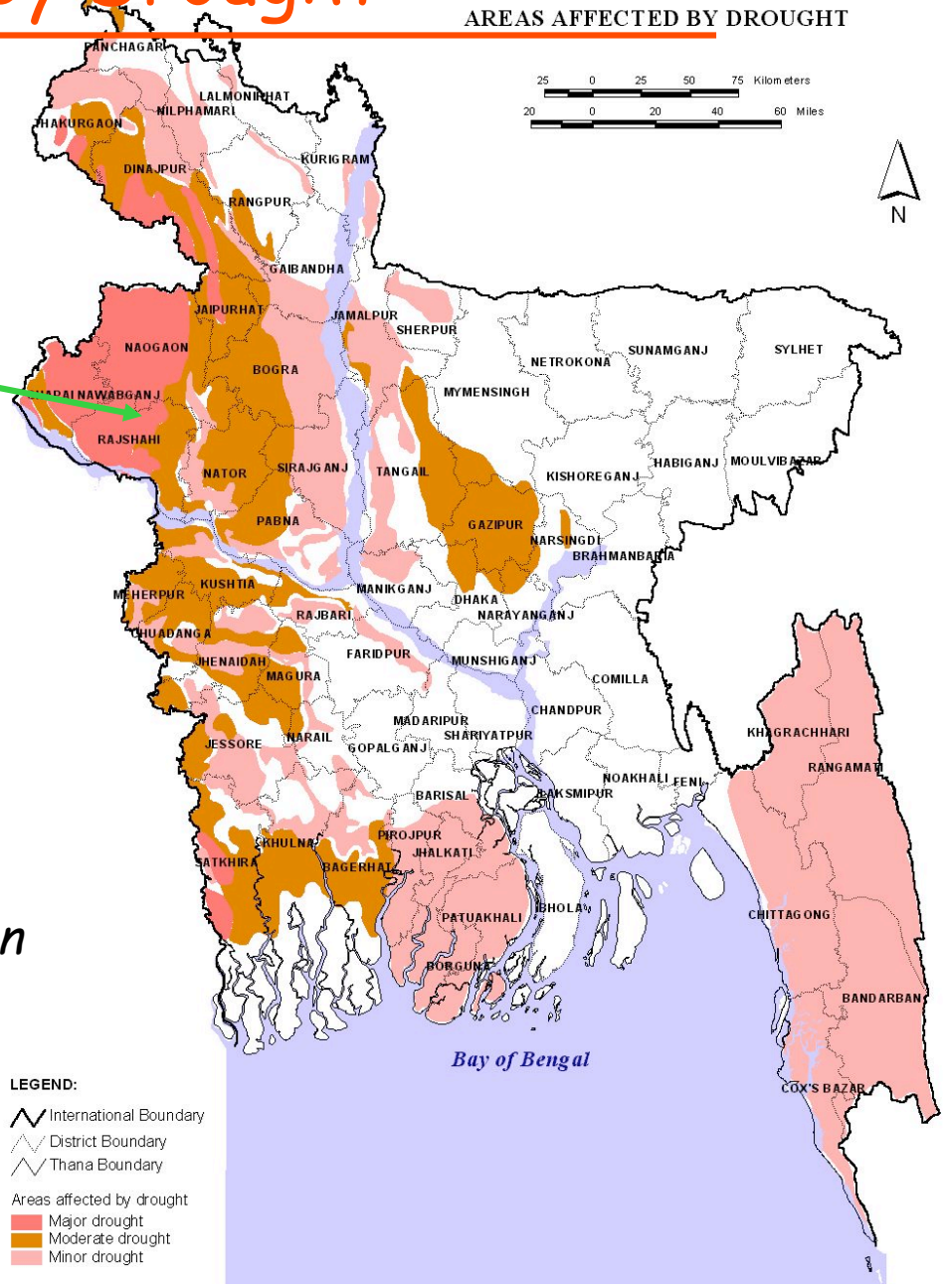
Spatial distribution of the trend of drought indices.

LEGEND:
- Decreasing Trend of SPI
- Increasing trend of SPI

Trend of Drought index of Bangladesh is =0.0025/year



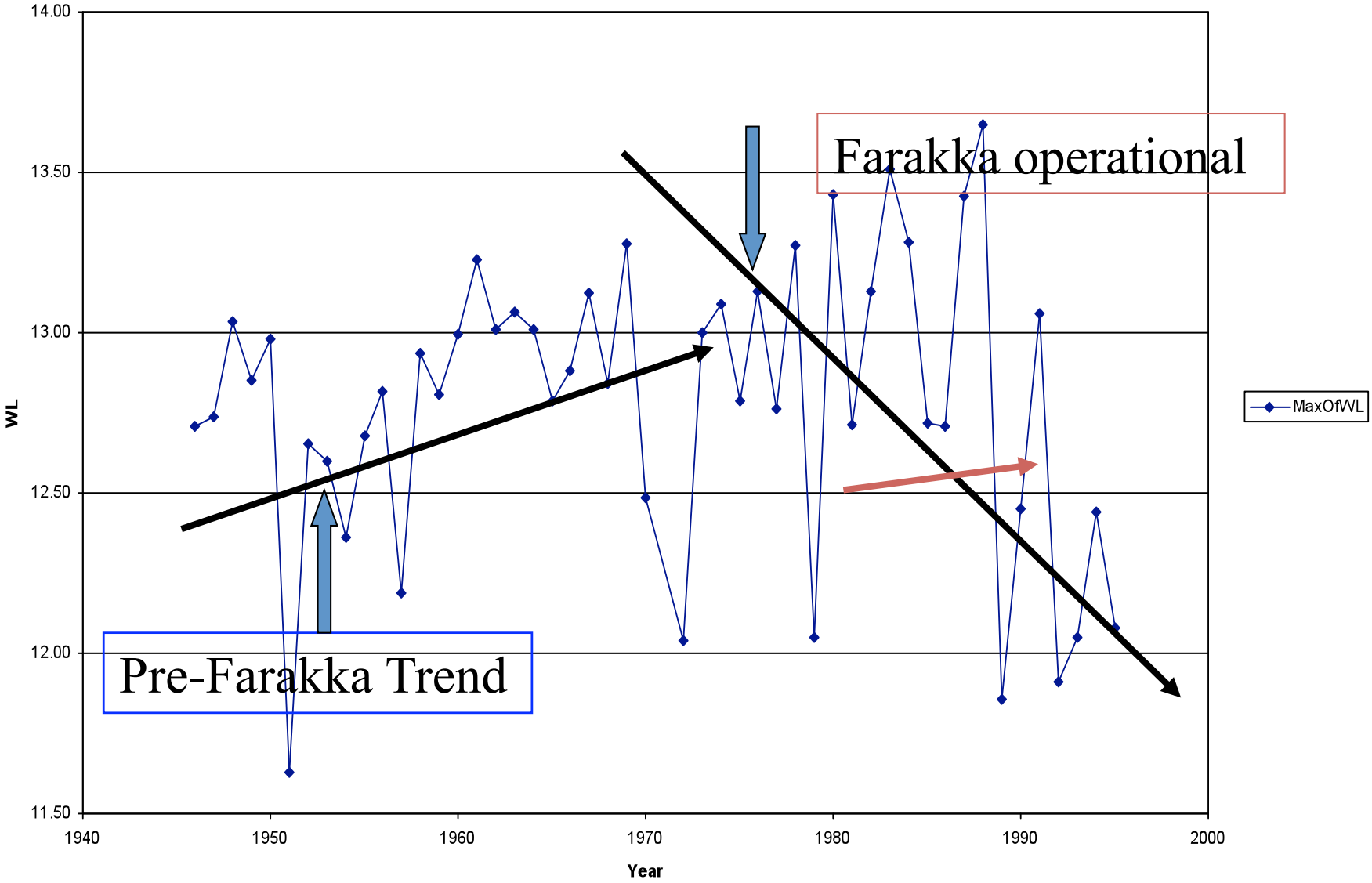
Area Affected by Drought



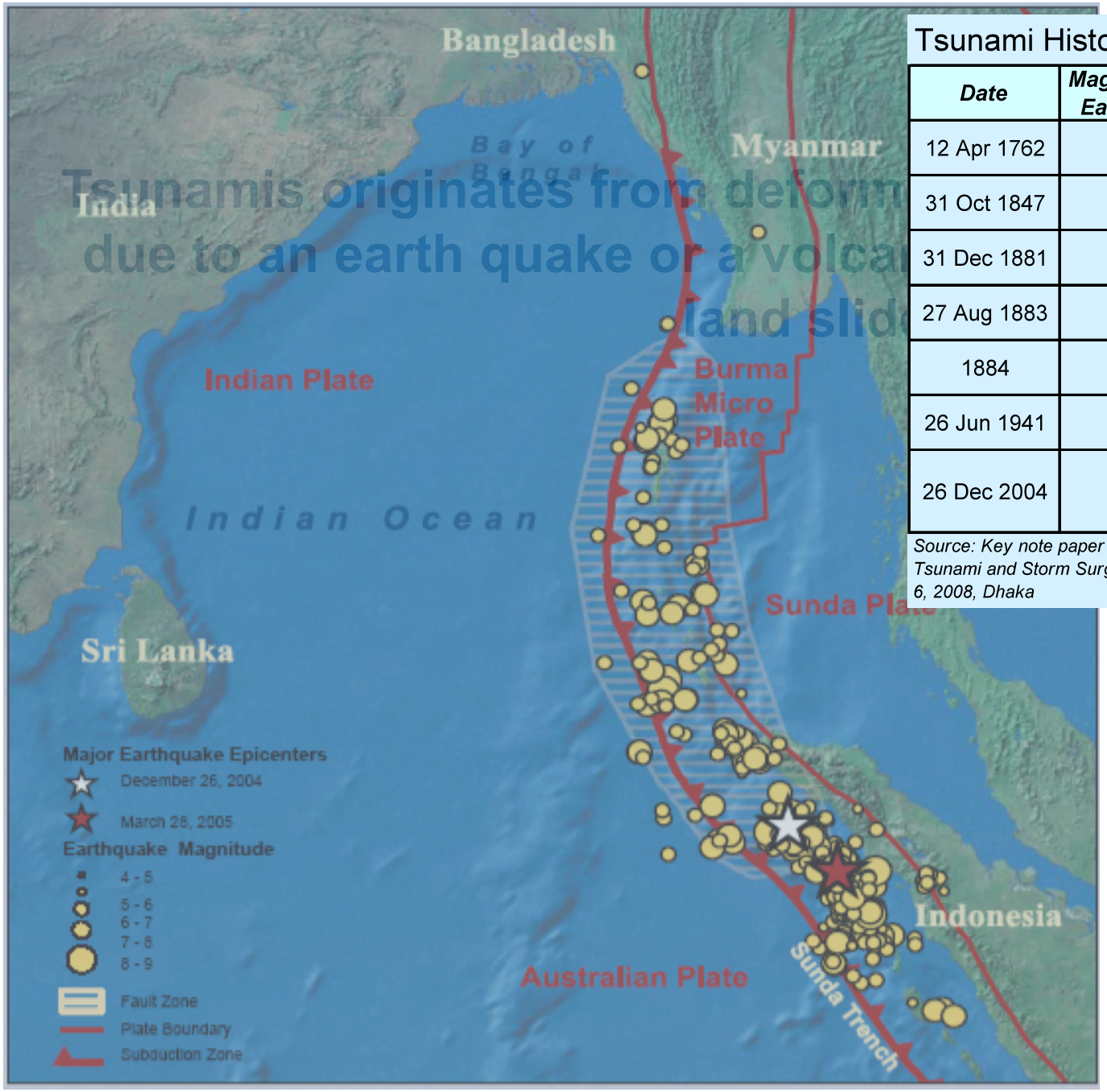
Water Stress

About 1/4 th of the country suffer water stress in dry season

WL Trend of Ganges at Hardinge Bridge



Tsunami Hazard-Bangladesh

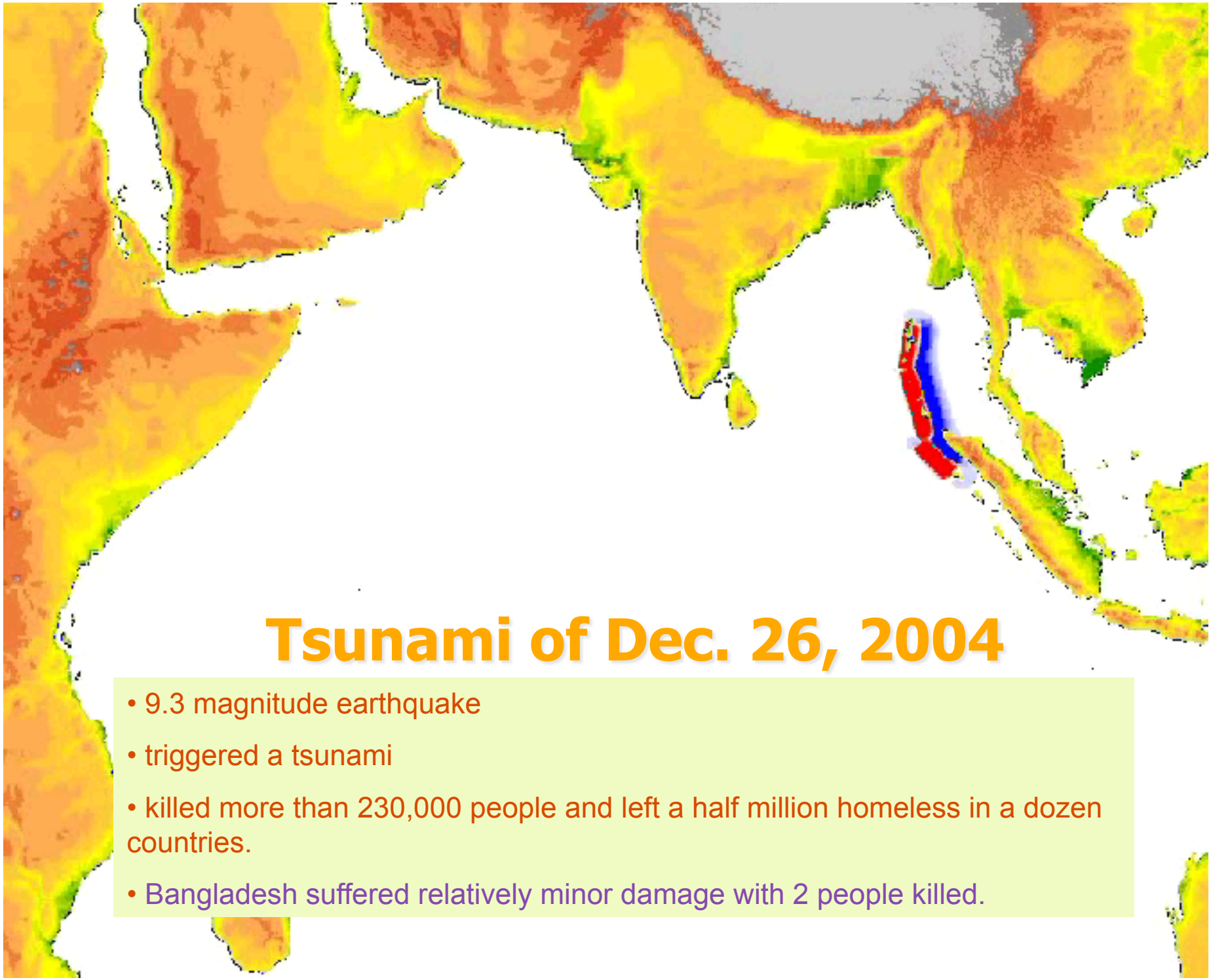


Tsunami History:

Date	*Magnatude of Earthquake*	*Location*	*Loss of Life*
12 Apr 1762	7.5	Arakan Coast, Myanmar	**100** in Buriganga, Dhaka.
31 Oct 1847	-	Great Nicobear Island	-
31 Dec 1881	7.9	Car Nicobar Island	-
27 Aug 1883	-	Karakatoa Volcanic Eruption	-
1884	-	Western part of Bay of Bangal	-
26 Jun 1941	8.1	Andaman Sea at 12.9 N, 92.5 E	-
26 Dec 2004	9	Sumatra, Indonesia	**2** in Andharmanik River, Patuakhali.

Source: Key note paper of Professor Jamilu Reza Choudhury on "Risk of Earthquake, Tsunami and Storm Surge in Bangladesh and Mitigatory Measures", CDMP, February 6, 2008, Dhaka

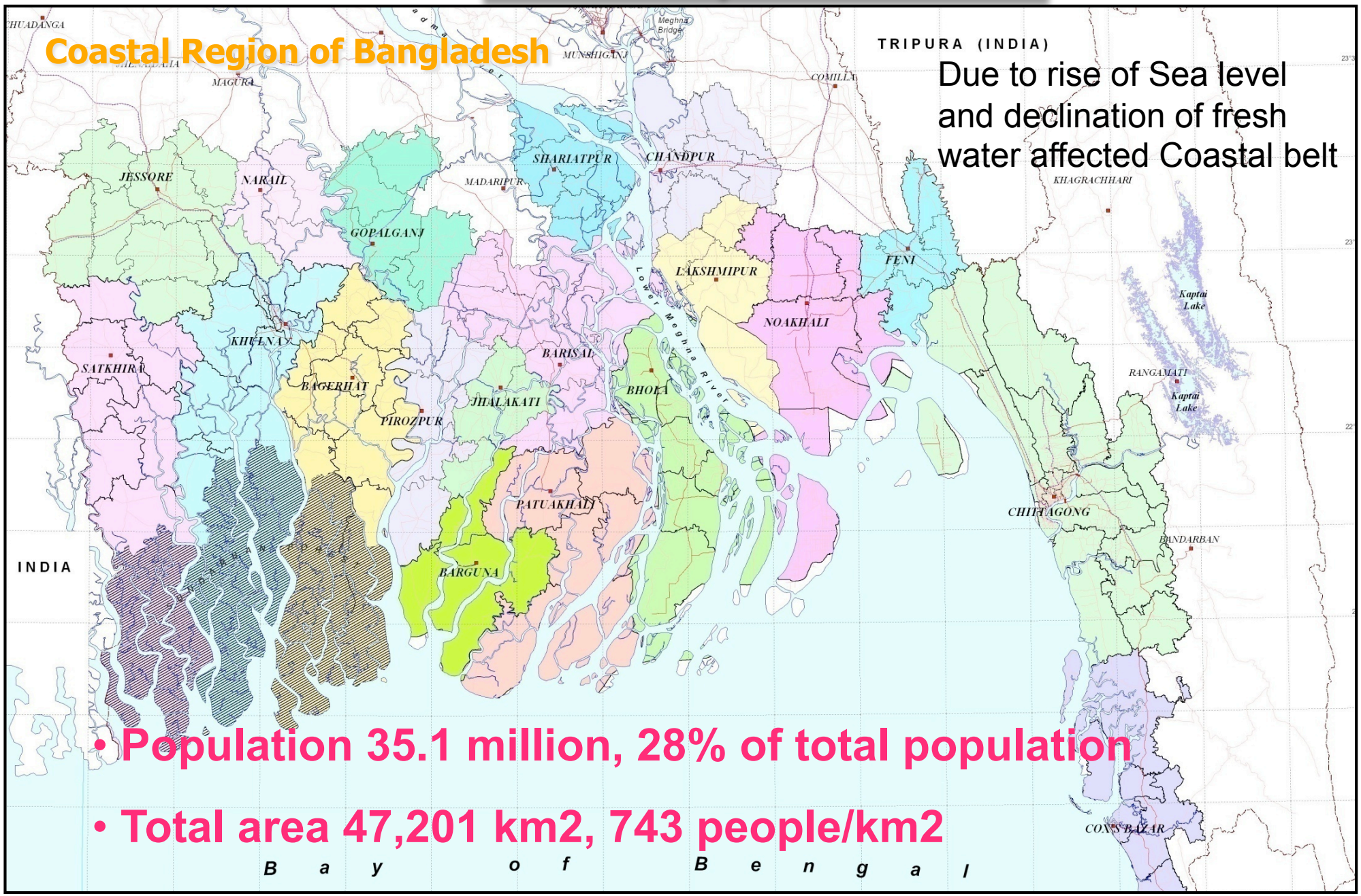
Only 2004 Tsunami affected very less



Tsunami of Dec. 26, 2004

- 9.3 magnitude earthquake
- triggered a tsunami
- killed more than 230,000 people and left a half million homeless in a dozen countries.
- Bangladesh suffered relatively minor damage with 2 people killed.

Salinity intrusion

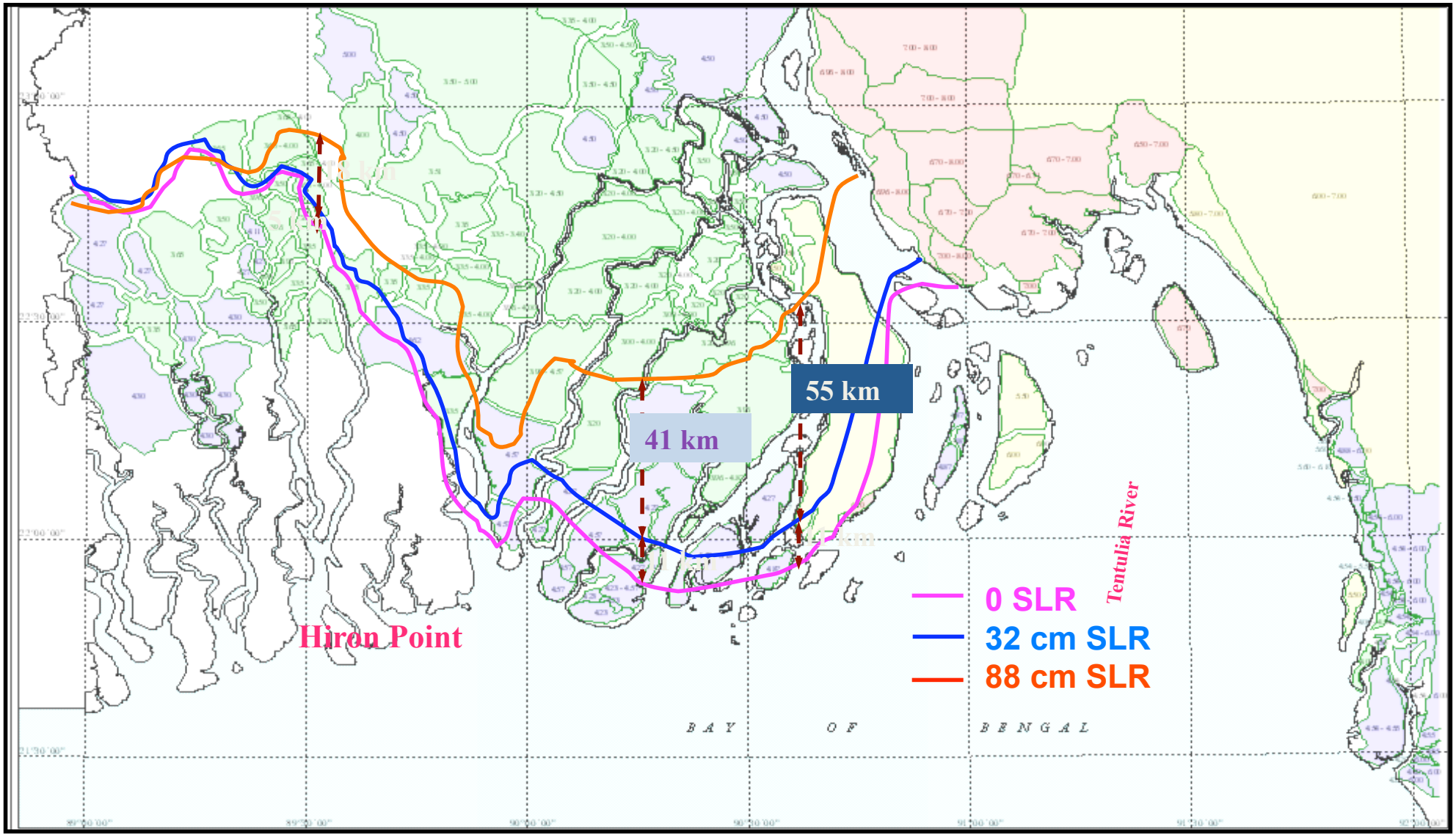


- Population 35.1 million, 28% of total population
- Total area 47,201 km2, 743 people/km2

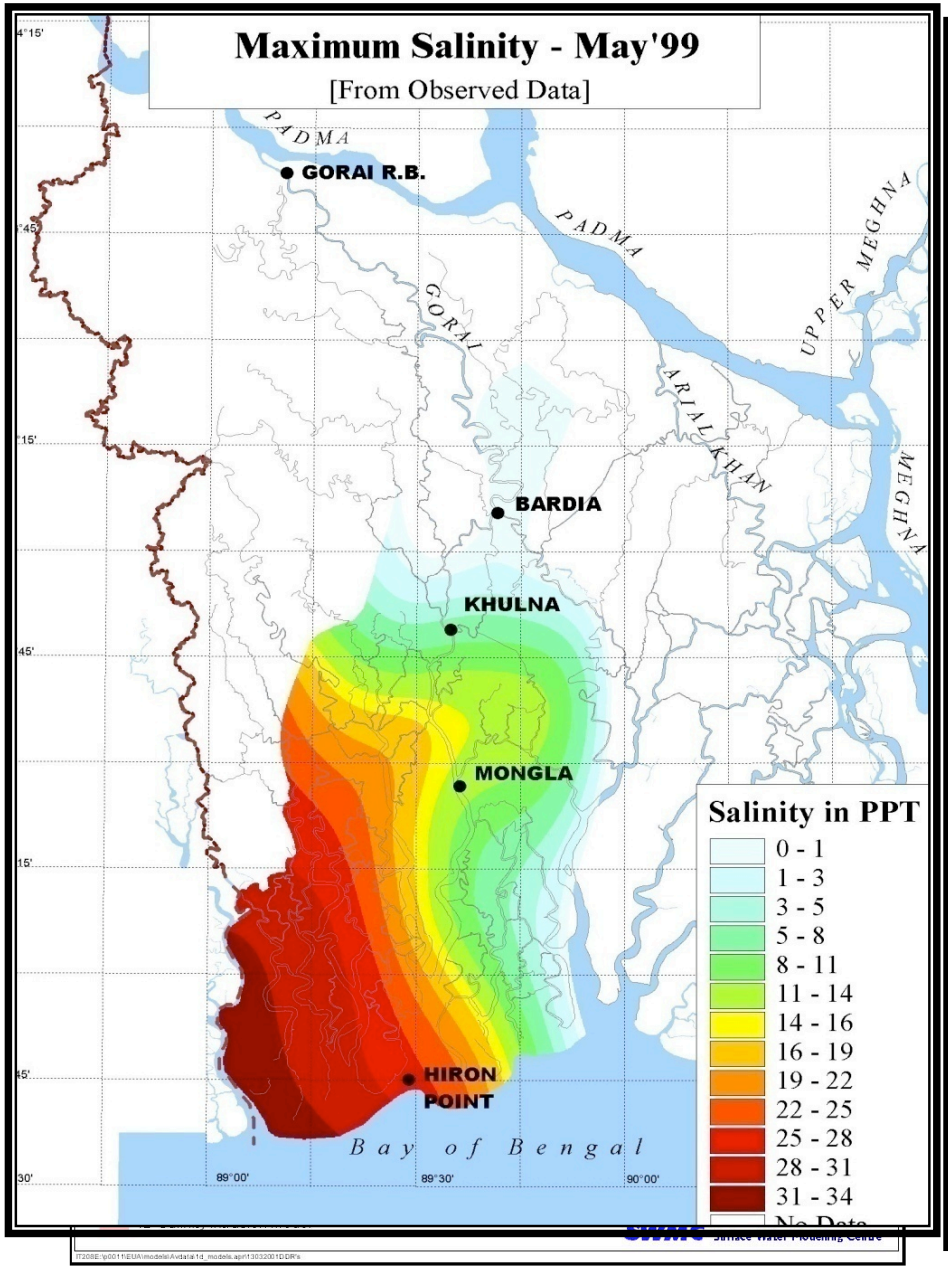
- **Bangladesh - highly vulnerable to Sea Level Rise**

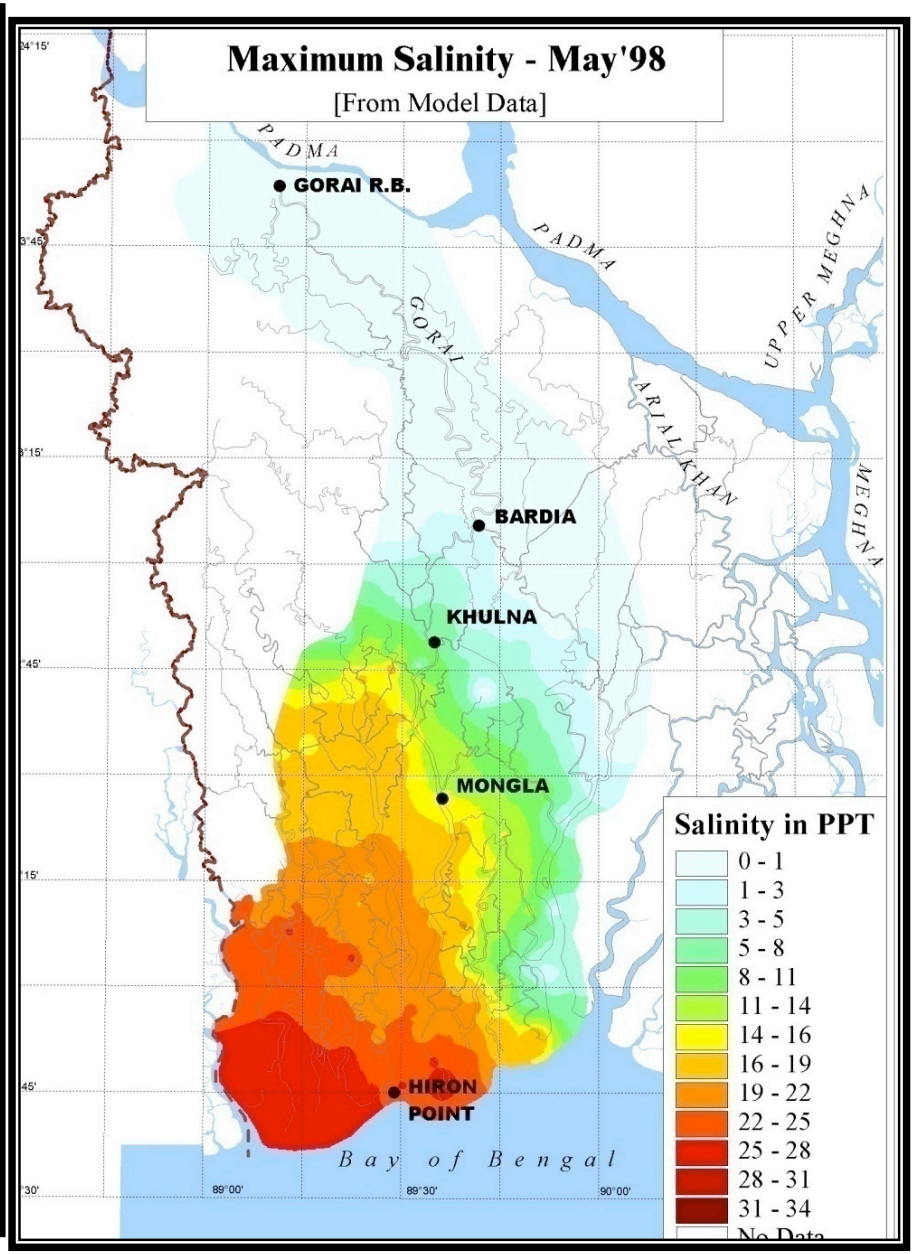
  - Geographical location on globe;
  - Low-lying coastal area;
  - Very dense population living in the coastal area;
  - Low adaptive capacity to climate change
  - Lack of awareness to climate change related hazards

Impact of Sea Level Rise in Bangladesh: Intrusion of 5ppt Salinity line Dry Season



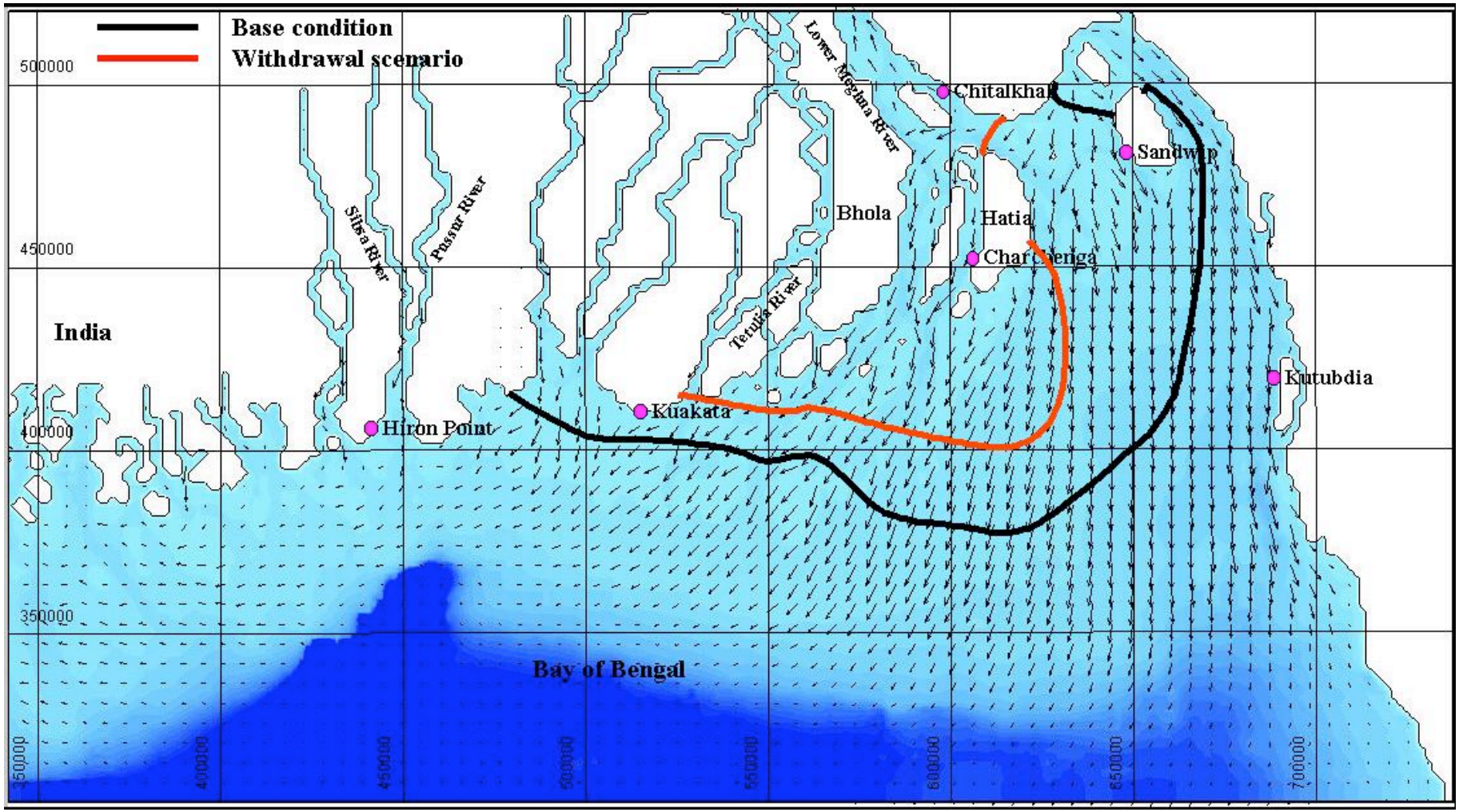
Maximum Salinity observed in May,99



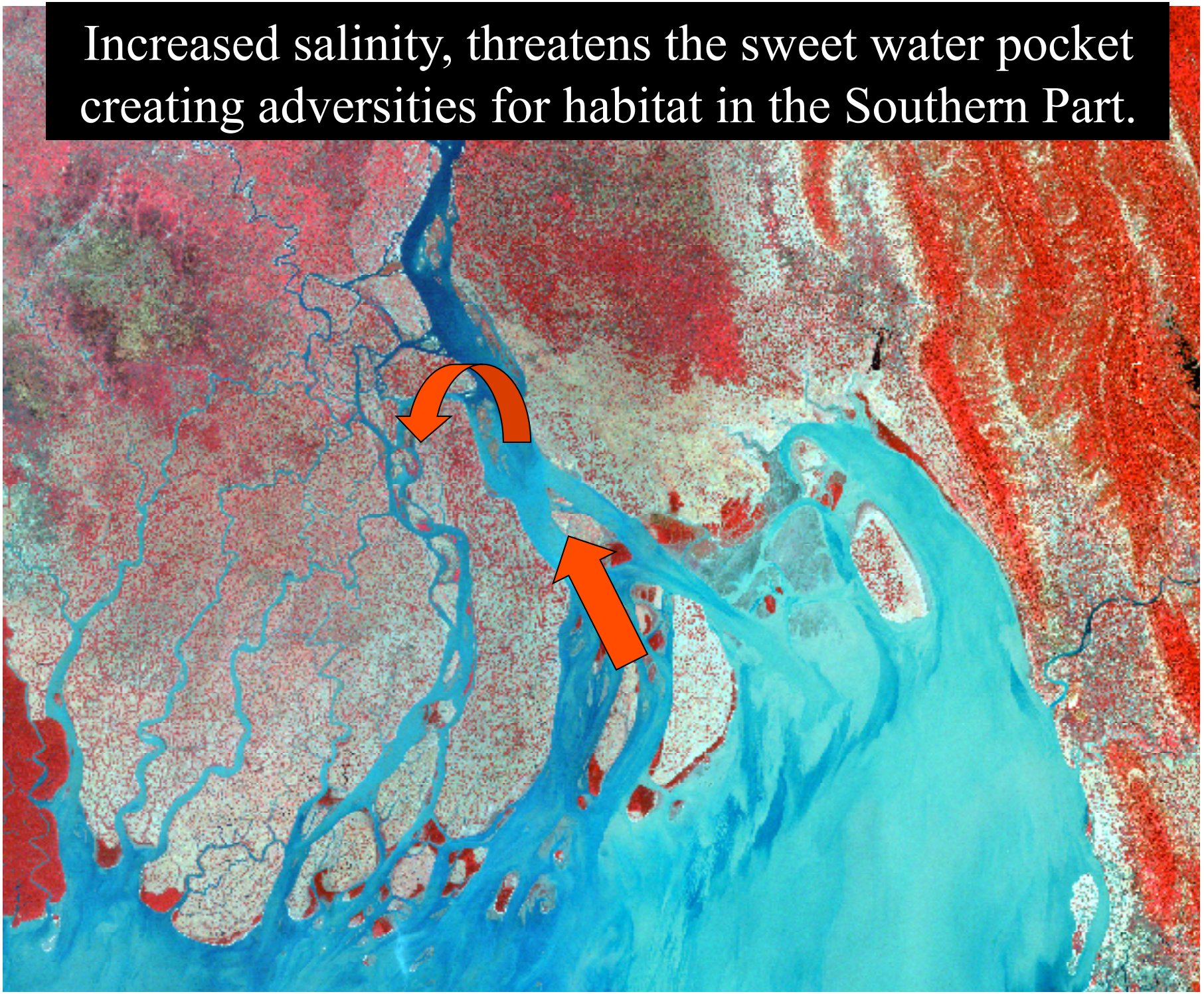


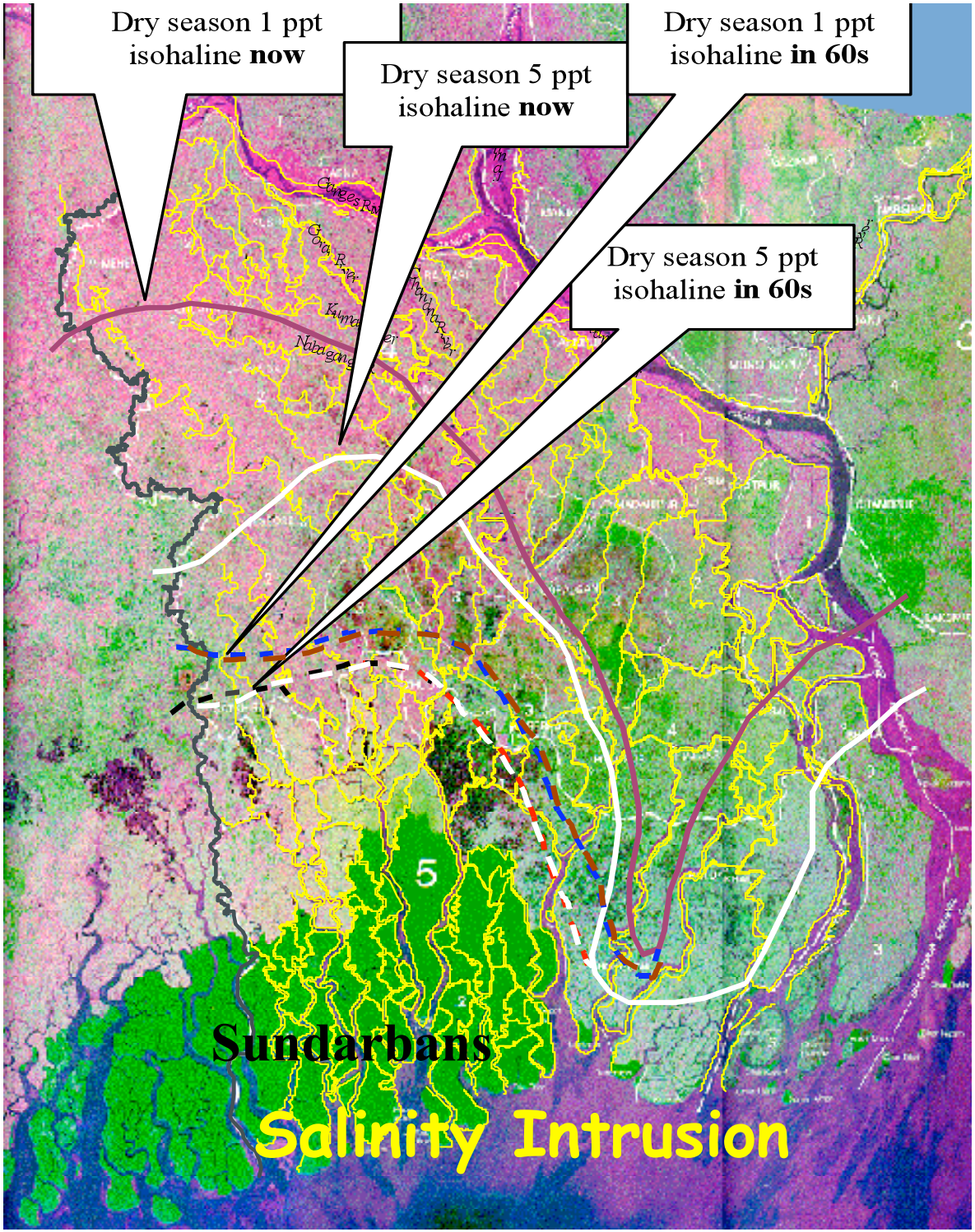
1 Dimensional Model

Simulated salinity fronts (2 ppt contour) due to withdrawal in upstream (Monsoon)



Increased salinity, threatens the sweet water pocket creating adversities for habitat in the Southern Part.





Upstream Propagation of Salinity due to lack of fresh water inflow

Channels and tidal creeks heavily silted up

drainage impaired

a disaster due to water logging

groundwater quality affected

environmental hazards

Salinity increased due to Damages of Coastal Polders

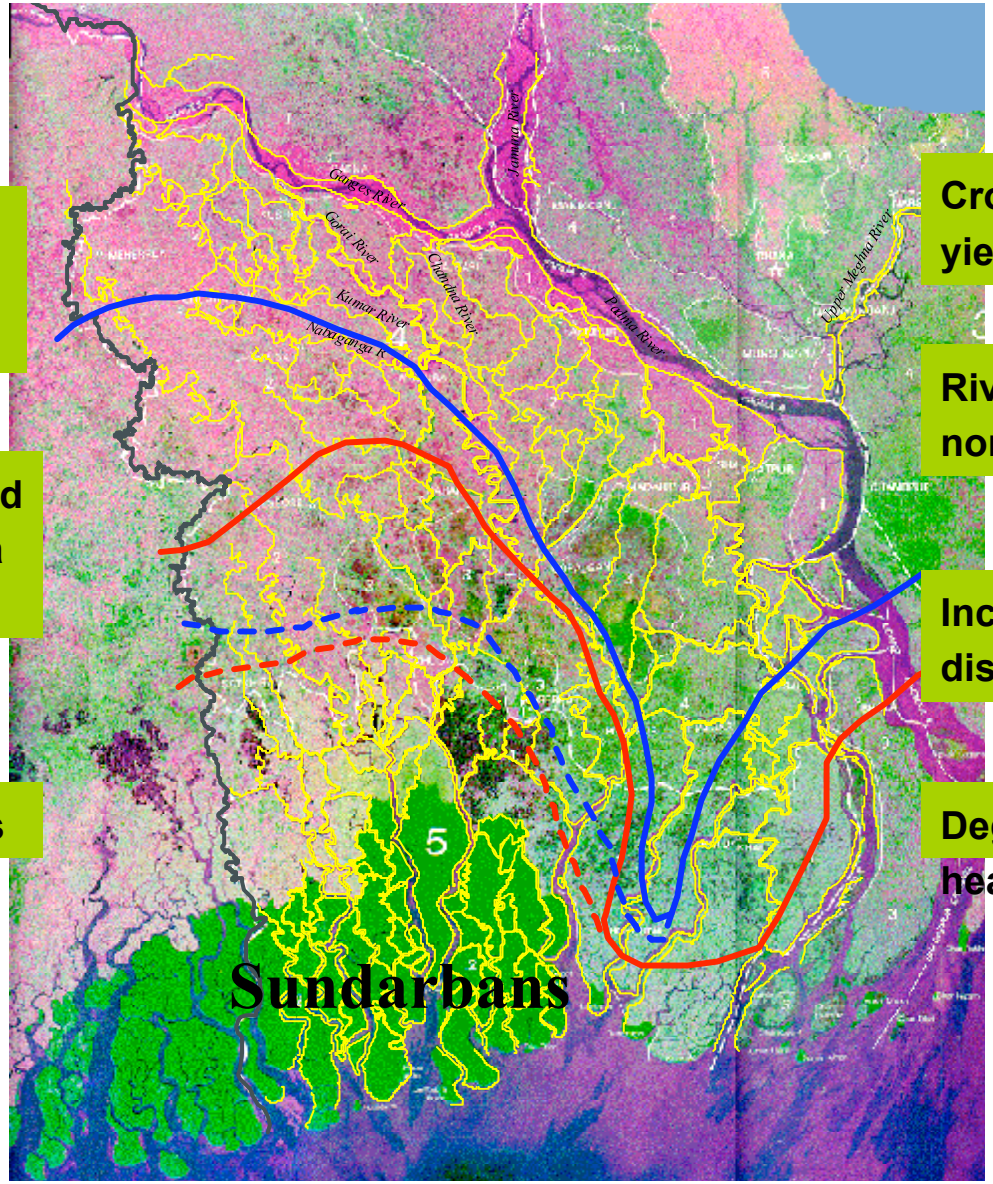
Damages at Nishanbaria

Impact of Salinity

Industrial units suffer a progressive damage due to increased corrosion

Industrial operation needed to carry fresh water from a long distance

Top-dying of Sundari trees



Crop damage and yield reduction

River water turned non-potable

Increased water borne diseases

Degradation of public health

Drainage Congestion And Water Logging

খাল দখল করে তৈরি অন্যদের স্থাপনা উচ্ছেদ করলেও চট্টগ্রাম সিটি করপোরেশন নিজেই নগরীর বহদ্দারহাটে চাক্তাই খালের ওপর তৈরি করেছে চারতলা বাণিজ্যিক ভবন —ছবি : রাশেদ মাহমুদ

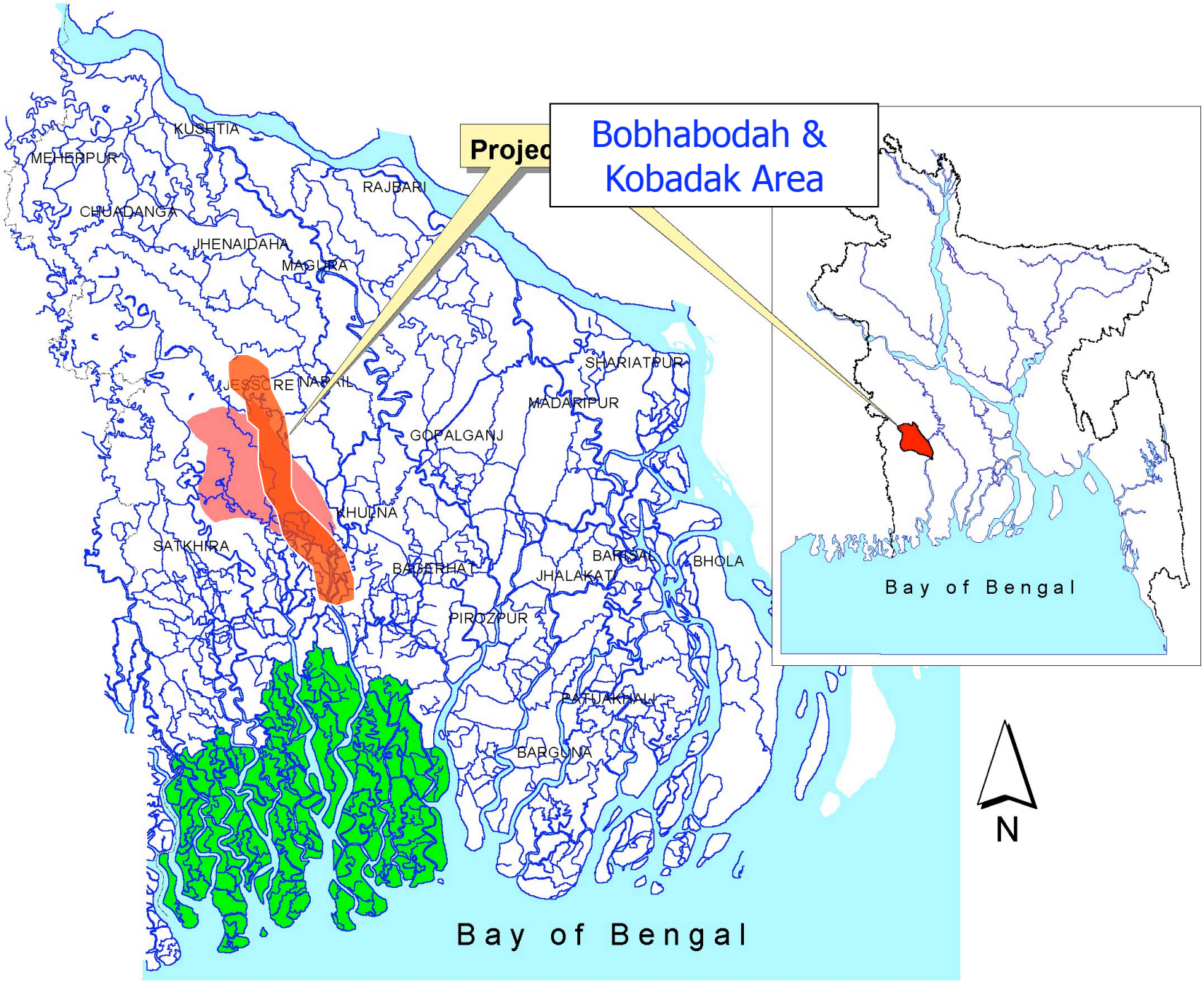
Flooding , water logging in city and urban area even for a short duration of rainfall occur in Bangladesh in certain area.

Basic Causes of Drainage Problem

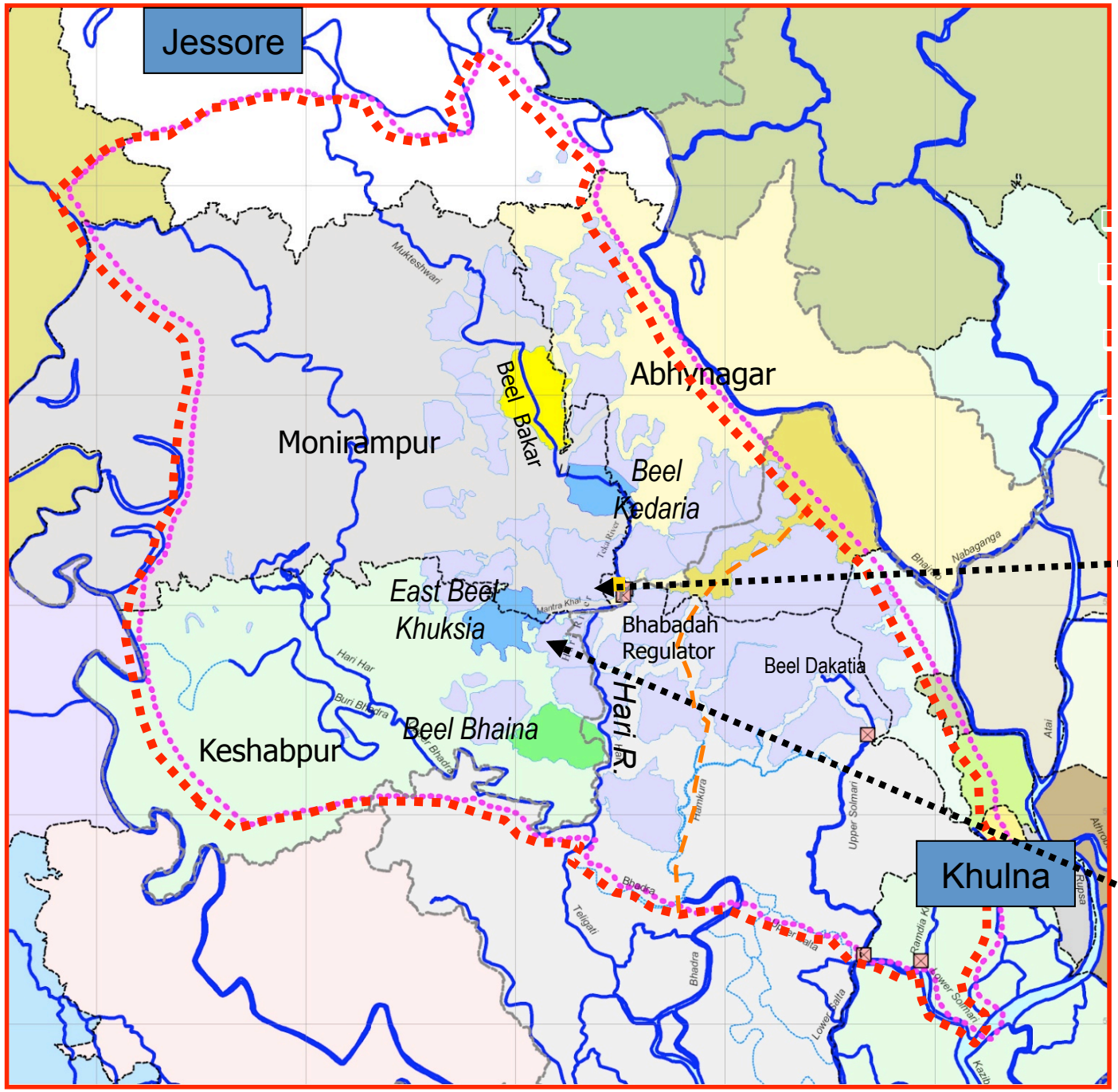
Poor Gravity Drainage!

- **Topographical**- Flat land area and foreland accretion by siltation
- **Low Gradient of Conveyance System**- Flat bed level gradient of different canals
- **Human Interference** - Making growth centre -bazar, shops, godown and fish barriers within different canals.
- **Hydrometeorological**- Excess rainfall due to south-west monsoon

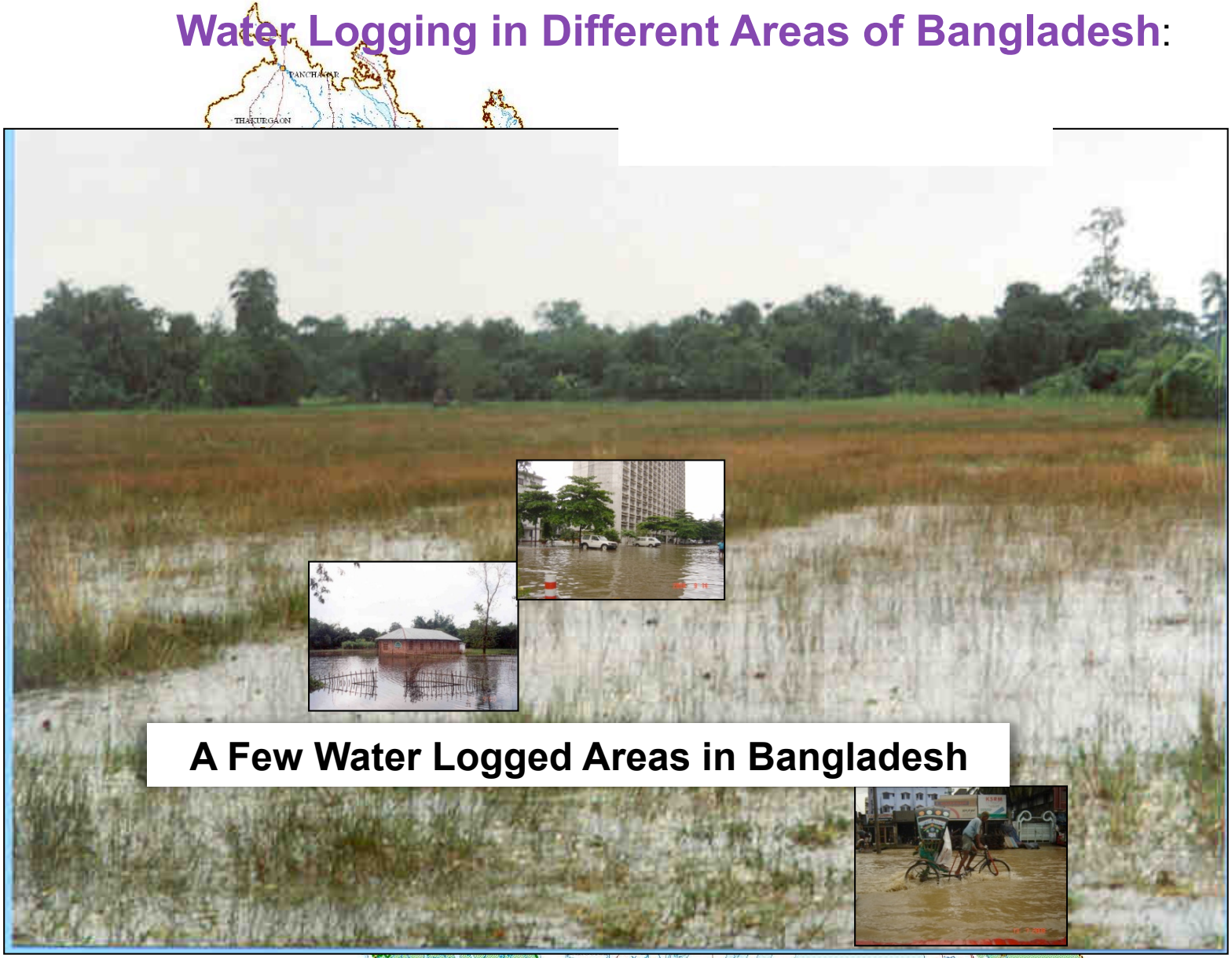
Drainage Congestion **Southwest Bangladesh**

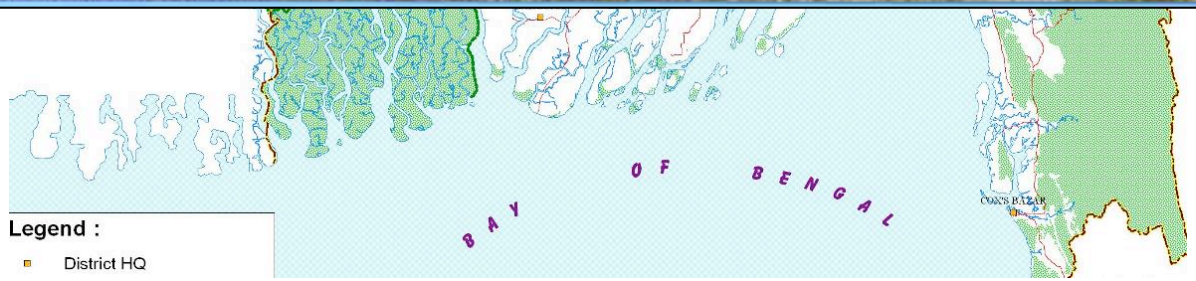


Drainage Congestion in **Southwest Bangladesh**

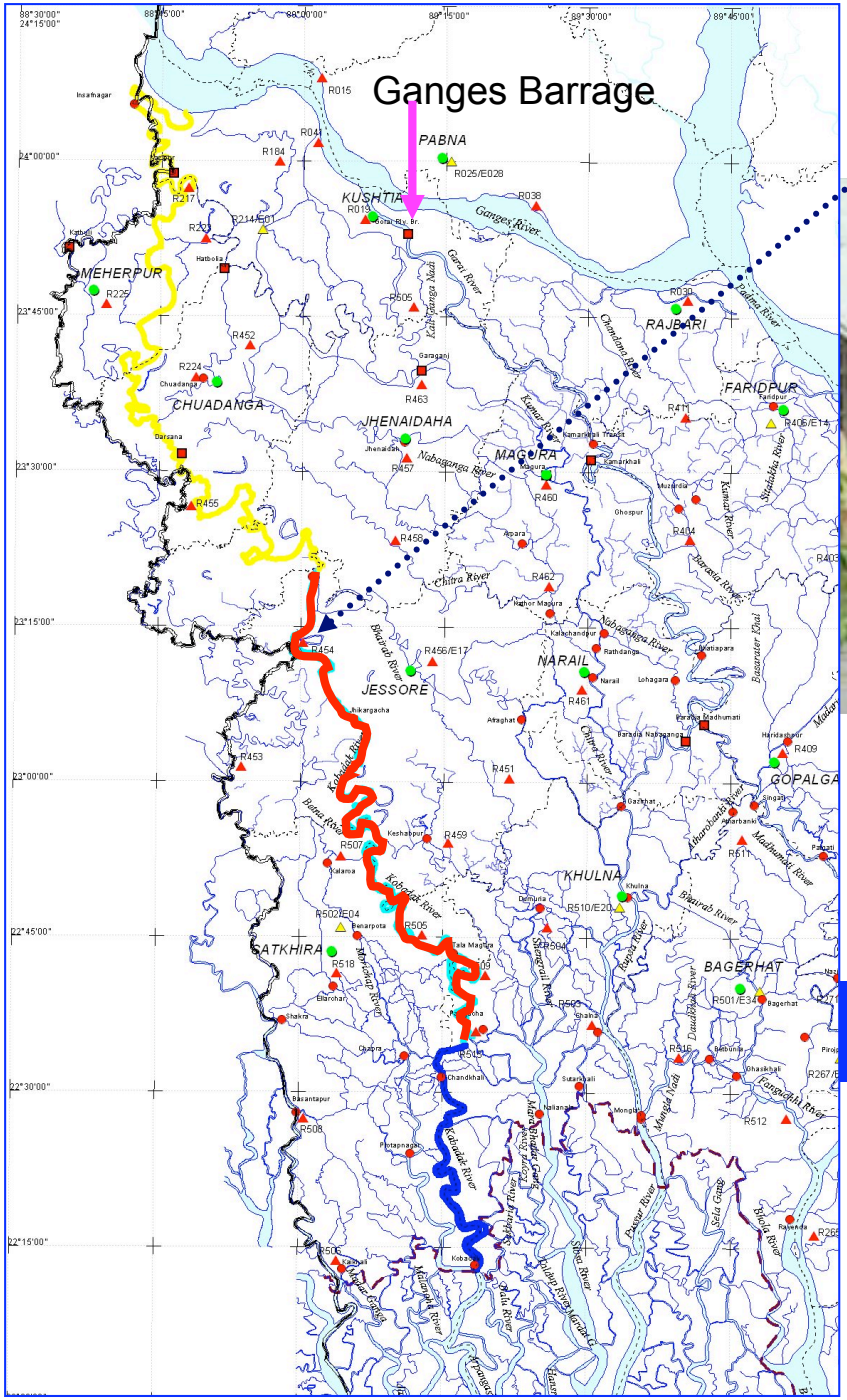


Water Logging in Different Areas of Bangladesh:





Water logging

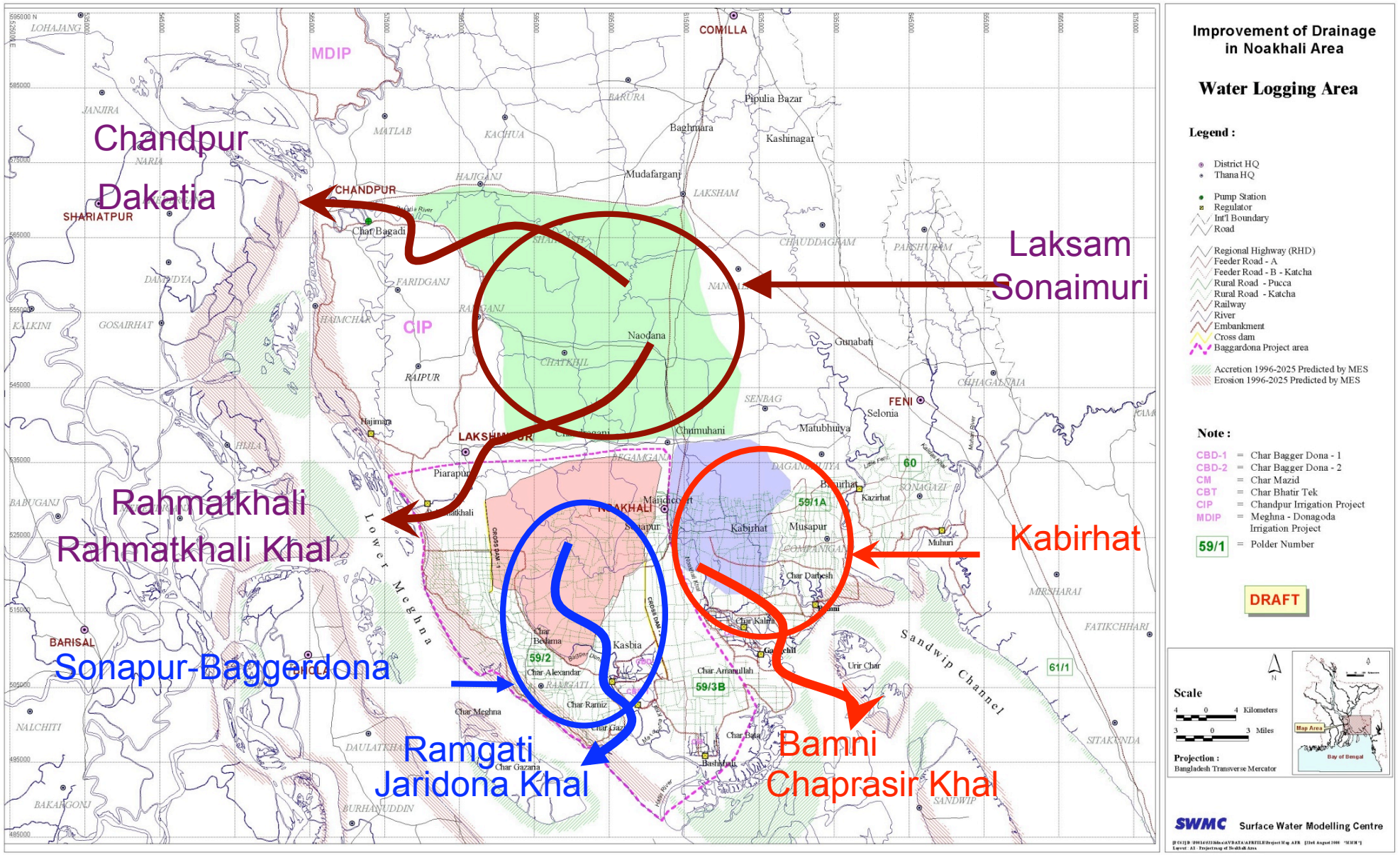


- 26 September2007

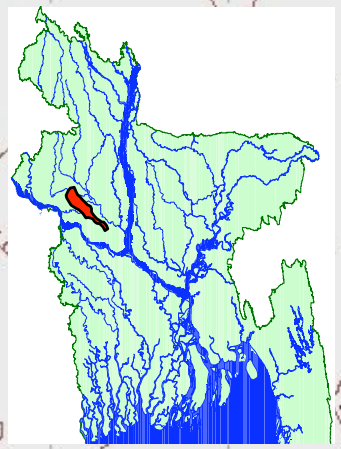
Water Logging in the Kabodak River Basin

Different Water Logging Area

Probable Drainage Routes



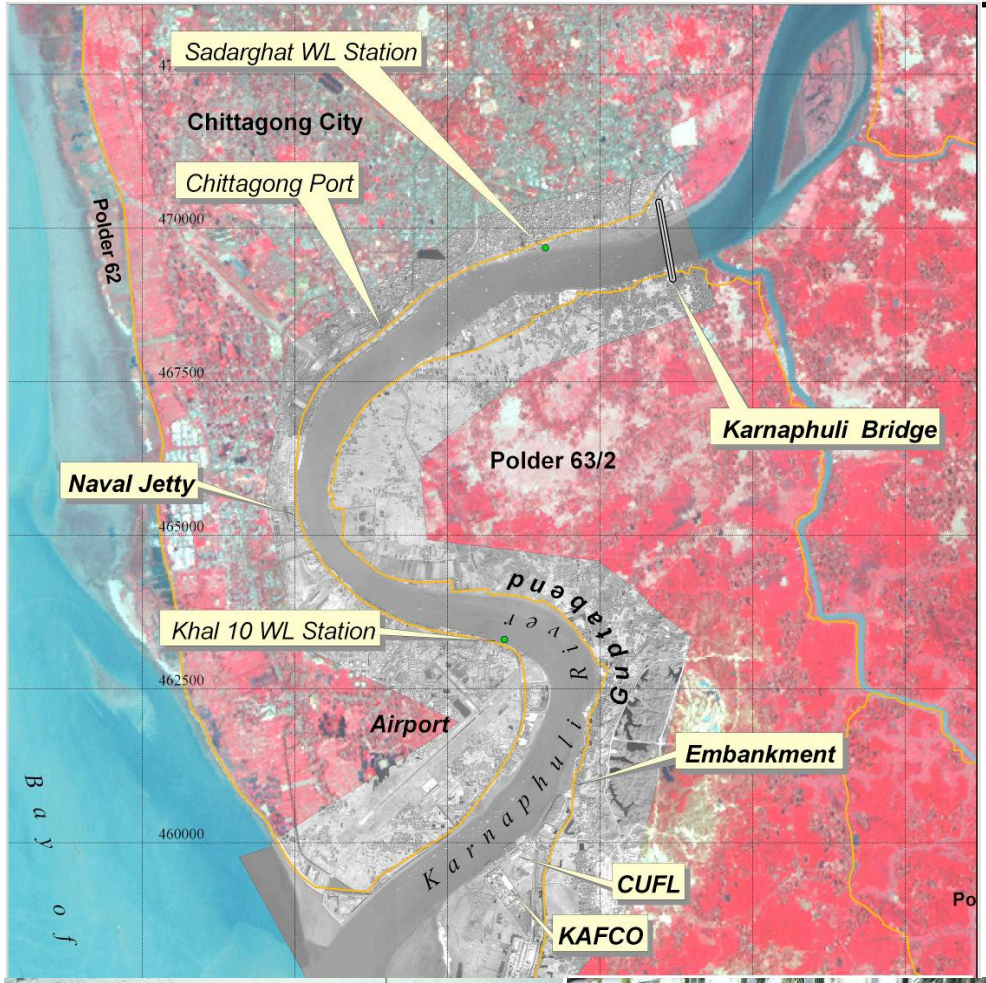
Water Logging at Sagarkhali Area in Kushtia



Water logging in Noakhali area

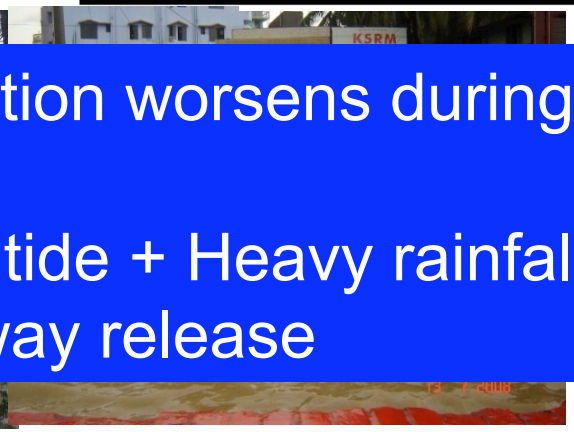
Dhaka CITY Water Logging

Chittagong City Water Logging(Hilly Area-Bangladesh



Causes of drainage problem

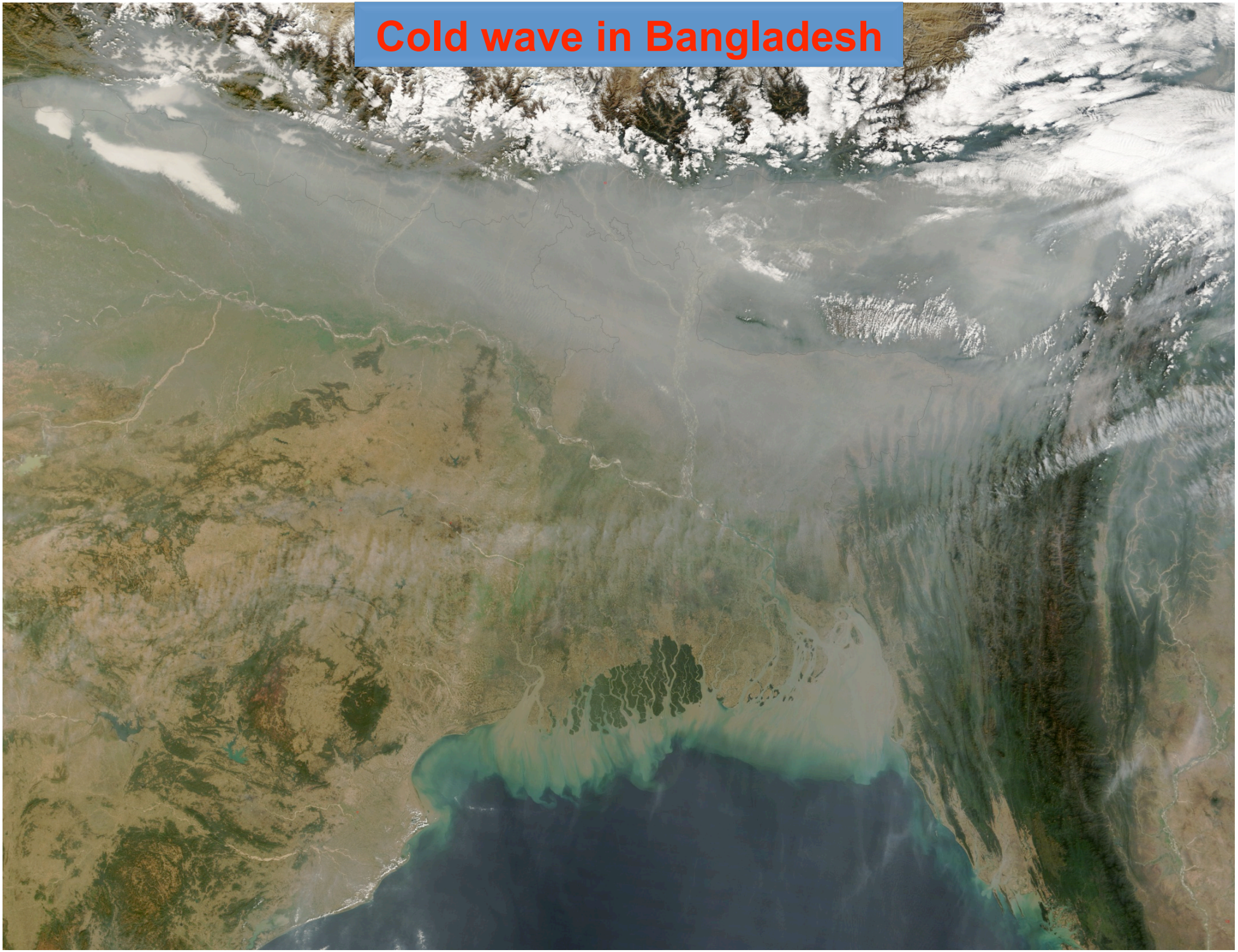
- Encroachment of drainage khals
- Solid waste disposal in drainage system
- Siltation by silts from hill runoff
- Tidal influx from the bay and karnafuli-Halda Rivers



Situation worsens during:

High tide + Heavy rainfall + Kaptai spillway release

Cold wave in Bangladesh



গুঁড়ি গুঁড়ি বৃষ্টি। তার ওপর তীব্র শীত। বৃষ্টি ও শীতে জনজীবনে বাড়তি দুর্ভোগ। রাজধানীর মহাখালী ফ্লাইওভার থেকে গতকাল ছবিটি তোলেন জাহিদুল করিম


THANK YOU