Disaster Management Using Space Technology in Bangladesh

United Nations International Conference on Space-based Technologies for Disaster Management "Risk Assessment in the Context of Climate Change"

7-9 November 2012, Beijing, China

Presented by: Md. Shahidul Islam / Probir Kumar Das

Ministry of Disaster Management and Relief

Bangladesh

UKaid · European Union · Norwegian Embassy · Sida · Australian AID · UNDP

Empowered lives. Resilient nations.

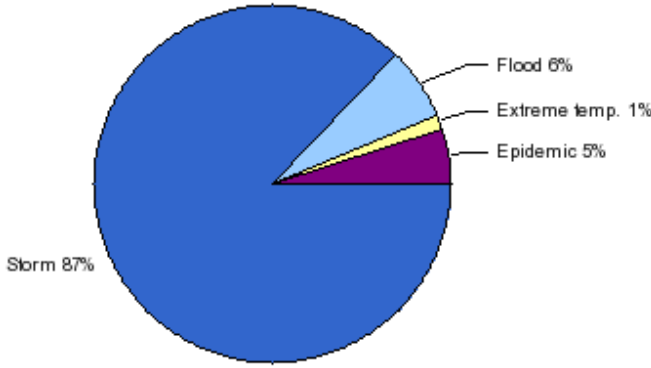
ABOUT BANGLADESH

1. Deltaic landscape, 80%flood plain with 20% hilly areas
2. Densely (1100/SqKm aprox) populated country (150 million)
3. High level of Poverty (32% Approx)
4. Natural resources based (predominantly agrarian) economy
5. Disaster prone, people are exposed to hazards
6. Victim to global Climate Change, most vulnerable country

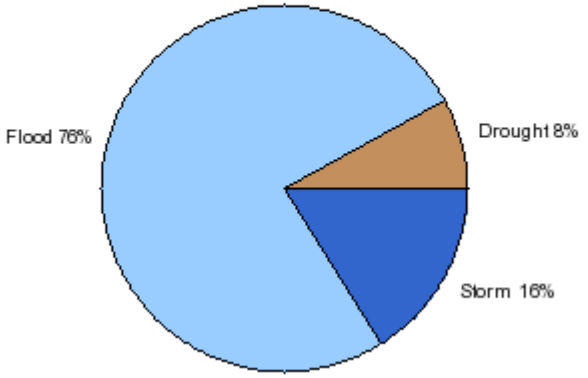
NATIONAL DISASTER CONTEXT

- Frequently hit by various natural disasters like Cyclones, Storm surges, Floods, Tornadoes, Earthquakes, Droughts and other calamities
- Monsoon flooding is an annual occurrence
- Climate change is likely to cause significant impact in the form of severe floods, cyclones, droughts, sea level rise and salinity affecting agriculture, livelihoods, natural systems, water supply, health etc.
- The disaster vulnerable people demonstrates strong coping capacity to face the disaster challenges

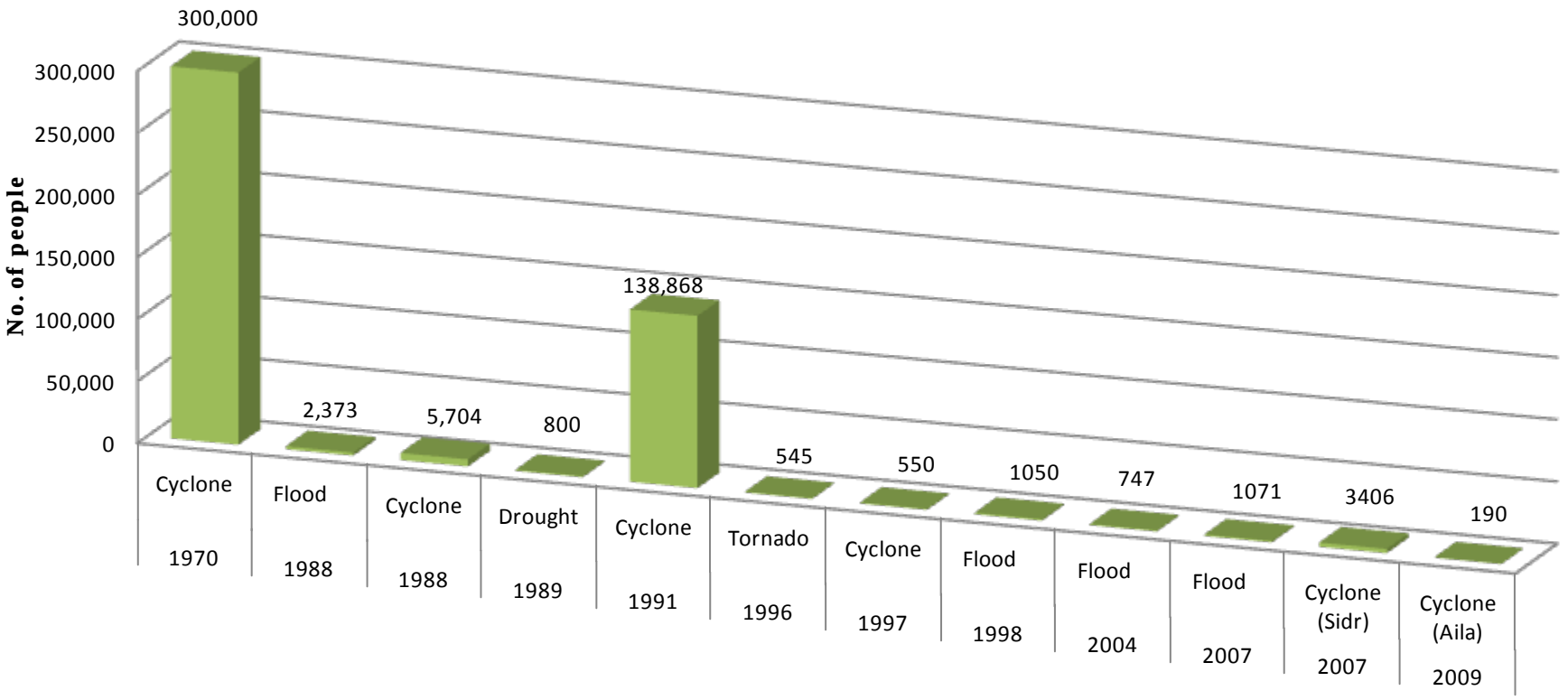
Percentage of reported people killed by disaster type



Percentage of reported people affected by disaster type



DEATH DUE TO DISASTERS



	1970	1988	1988	1989	1991	1996	1997	1998	2004	2007	2007	2009
	Cyclone	Flood	Cyclone	Drought	Cyclone	Tornado	Cyclone	Flood	Flood	Flood	Cyclone (Sidr)	Cyclone (Aila)
Death	300,000	2,373	5,704	800	138,868	545	550	1050	747	1071	3406	190

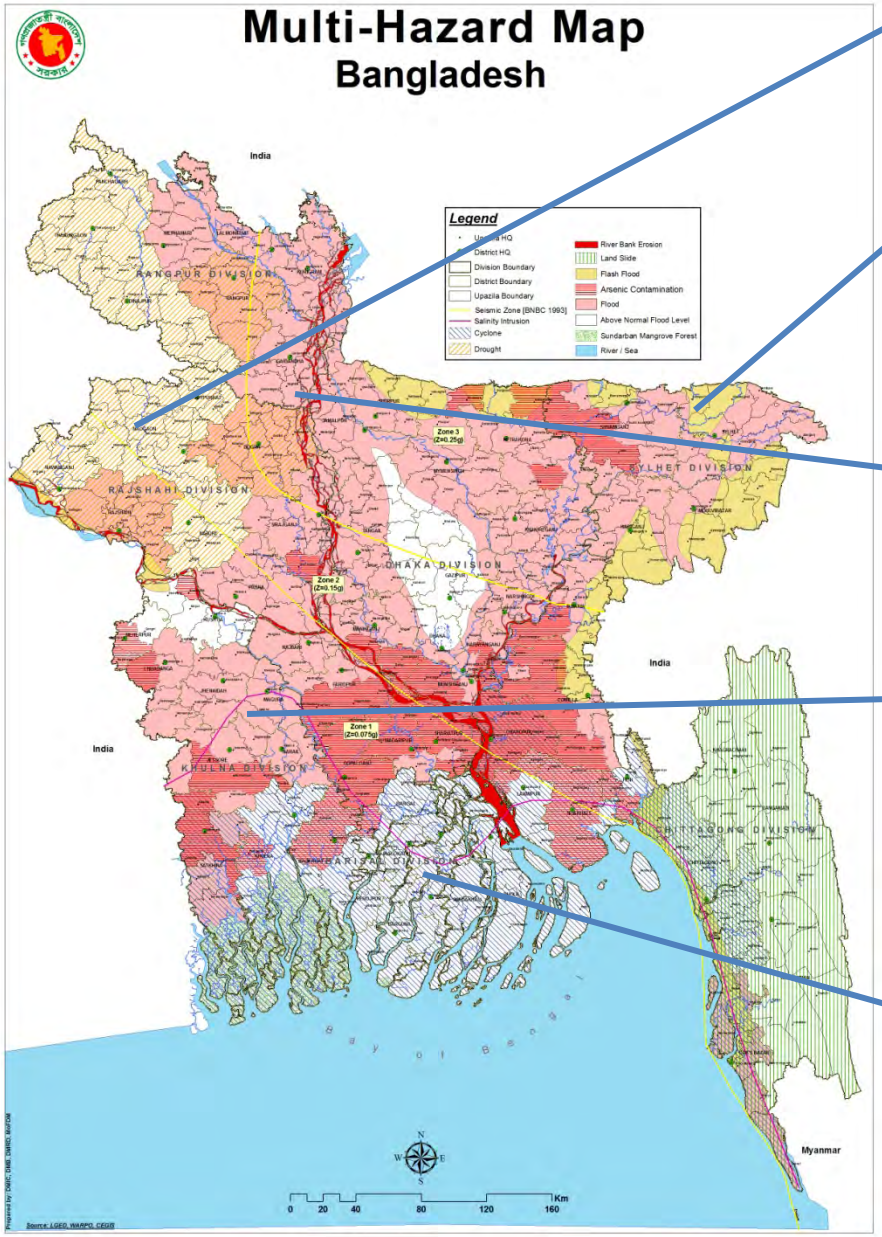
CLIMATE CHANGE SCENARIO

- **Extreme temperature in summer (44deg/c) and winter (5deg/c)**
- **Inconsistent Rainfall – more in wet season and less in dry season**
- **Sea level rise**

CLIMATE CHANGE IMPACT

- **Increased number of severe monsoon flood / flash flood.**
- **Increased frequency and intensity of cyclone and salinity intrusion**
- **Severe Drought**

HAZARD PROFILE



DROUGHT

Affects 8.3 million ha land
In 2006, reduced food grains by 1 million tons
Loss of grazing fields, dried ponds, water shortage

FLASH FLOOD

Damages standing crops
Damages infrastructures and facilities Unpredictable, uncertain

FLOOD

Inundates more areas, increases river erosion
Breaches embankments, damages infrastructures
Loss of crops, fisheries, livestock, biodiversity

SALINITY INTRUSION

Sea level rise, damage to Sundarbans watersheds
Damages crop lands
Spreading intrusion from 1.5 to 2.5 Mha (2007)
Lack drinking water, burden to women & children
Projected displacement: 6-8 m by 2050

CYCLONE

Remain to be the deadliest and most destructive hazard
Recurring event
Lingering aftermath, complex recovery
Improved preparedness (CPP, shelters, embankments)

VISION AND MISSION OF DM

GoB Vision

To reduce the vulnerability of people, especially the poor and disadvantaged, to the effects of natural, environmental and human induced hazards to an acceptable humanitarian level and to have an efficient emergency response management system

MoDMR Mission

To achieve a paradigm shift from conventional response and relief practice to a *more comprehensive risk reduction culture* and to promote food security as an important factor in ensuring the resilience of communities

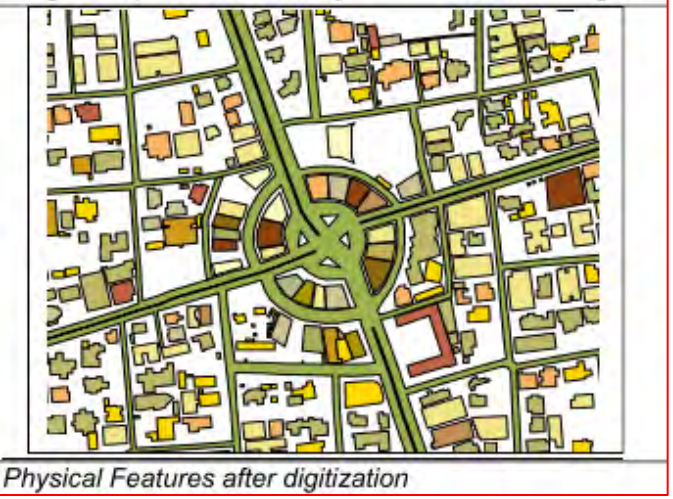
REMOTE SENSING

SEISMIC MICROZONATION
AND
VULNERABILTY / DAMAGE ASSESSMENT

EARTHQUAKE VULNERABILTY AND DAMAGE ASSESSMENT

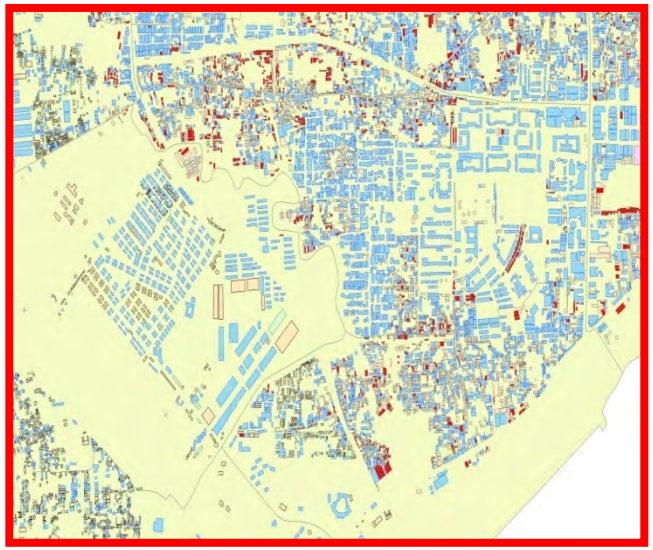
RS and GIS-based Building Inventory Database:

Image of a part of Dhaka City after Geo-referencing

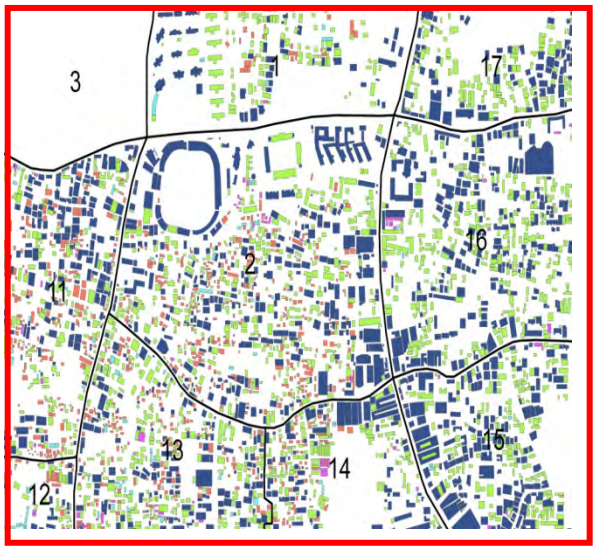


Physical Features after digitization

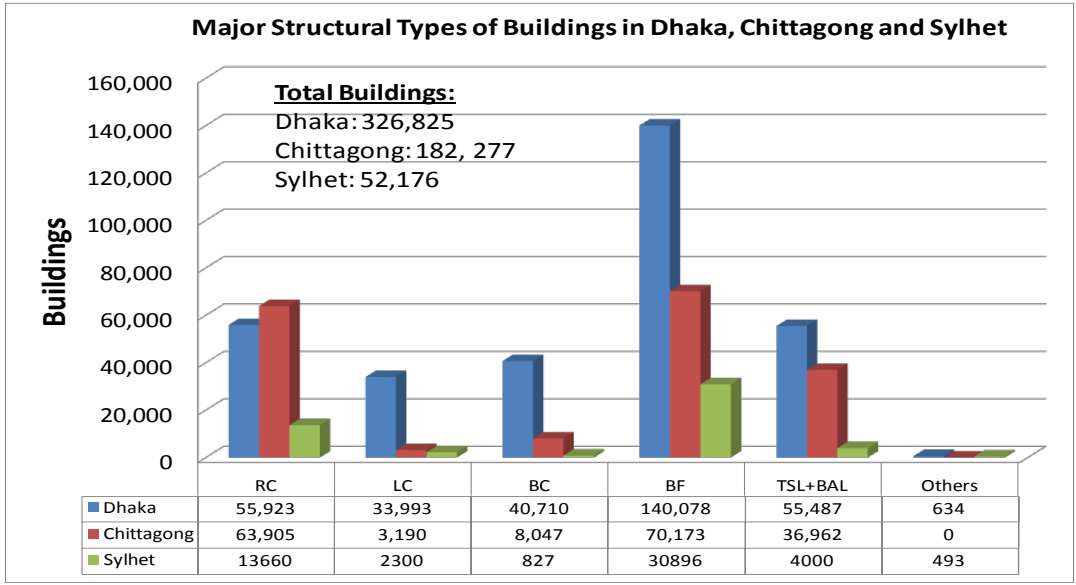
Dhaka : 327000



Chittagong : 183000



Sylhet : 52, 000

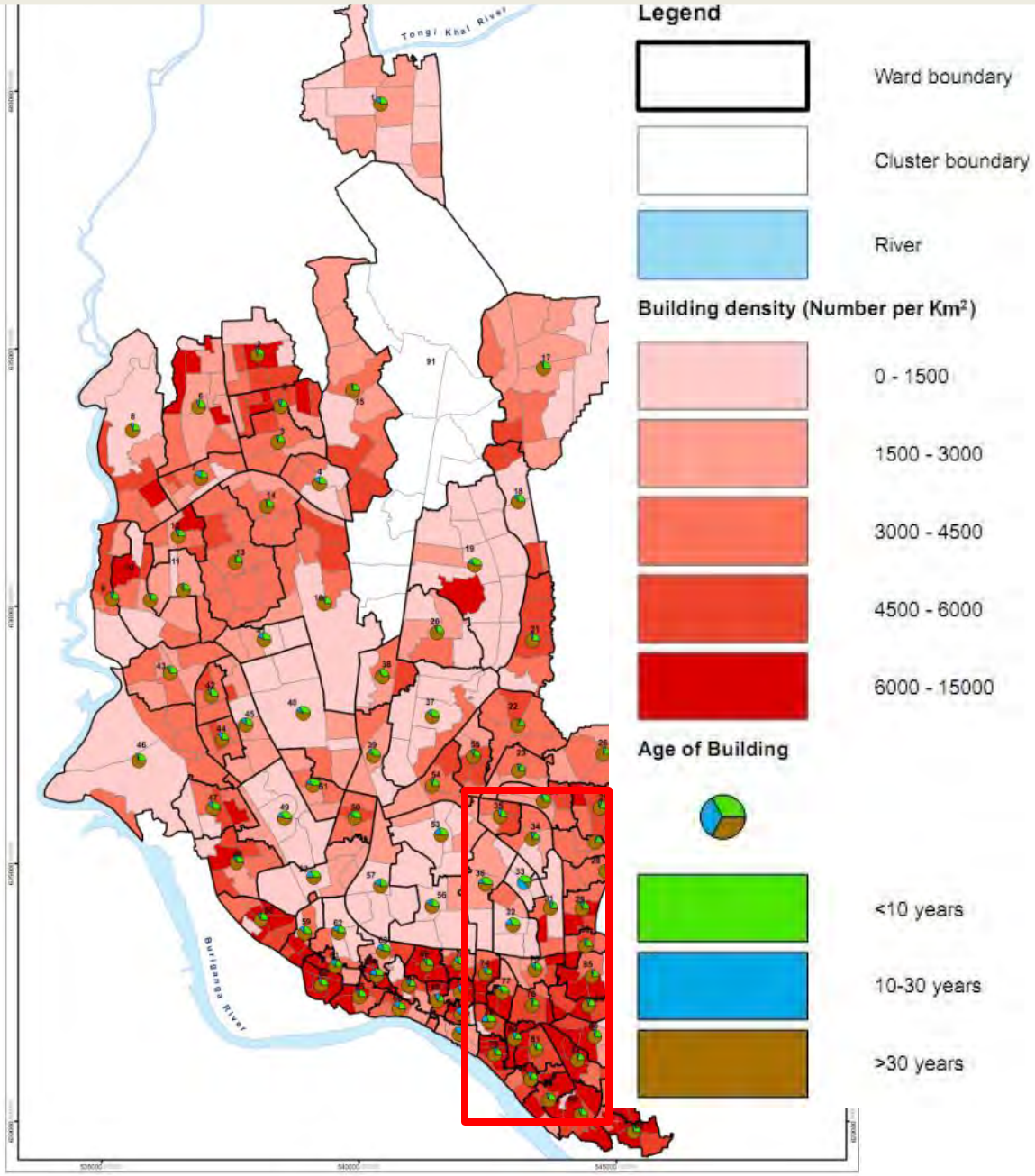


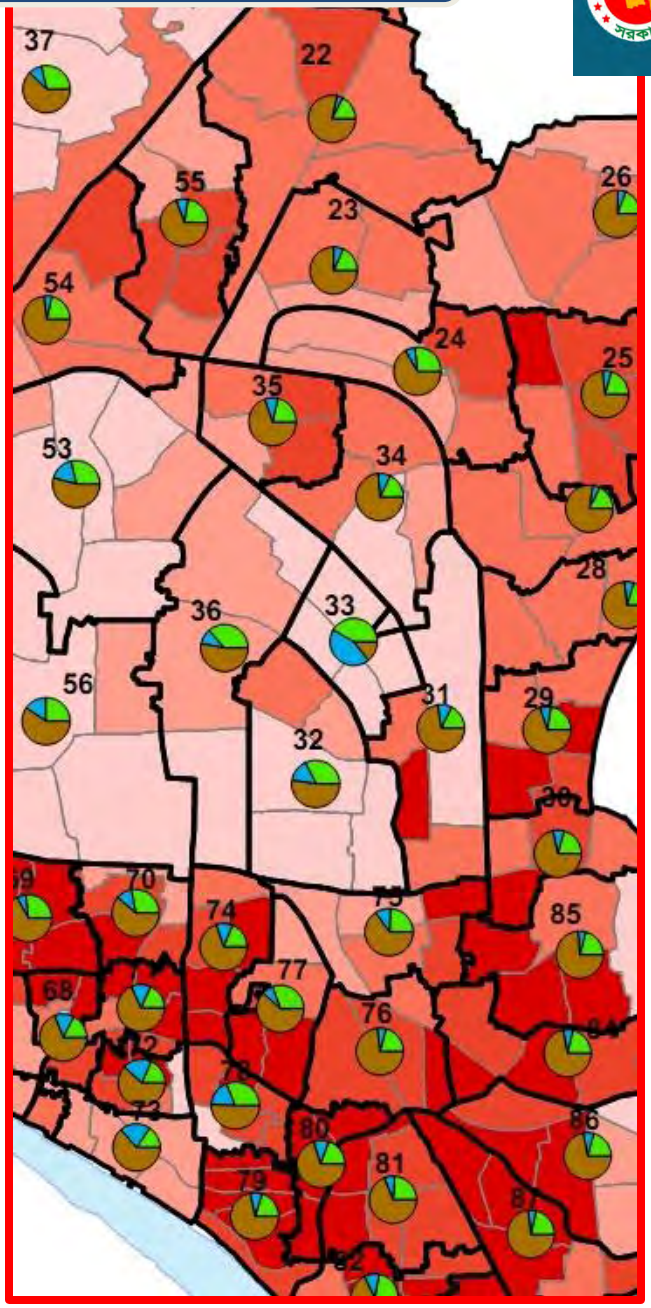
SAMPLE SIZE OF THE BUILDING SURVEY

Town	All Buildings in Database (No.)	Level I Survey		Level II Survey	
		No.	%	No.	%
Dhaka	326,825	8,741	2.67	875	0.27
Chittagong	182,277	6,175	3.39	494	0.27
Sylhet	52,176	3,536	6.78	507	0.97
Total	**561,278**	**18,452**	**3.29**	**1,876**	**0.33**

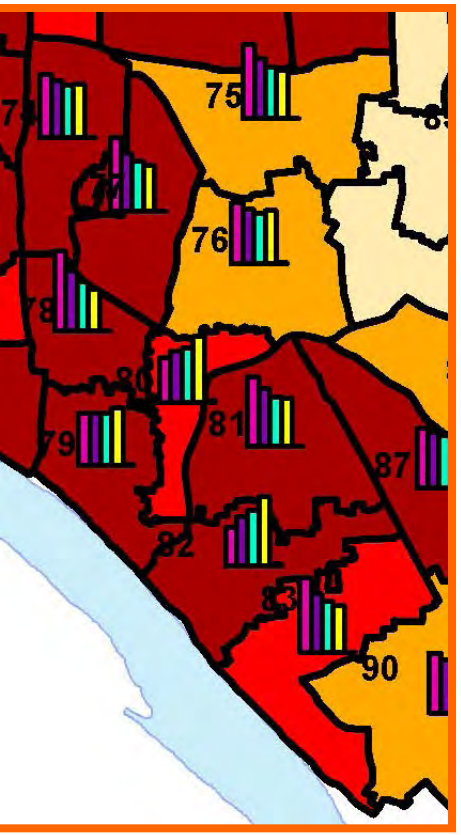
Note: Level I survey rate = 10 buildings/1 team/1 day
Level II survey rate = 1-2 buildings/1 team/1 day
1 team = 2 man, 1 day = 8 working hour (8.00-17.00)

BUILDING AGE AND BUILDING DENSITY OF DHAKA





BUILDING VULNERABILTY

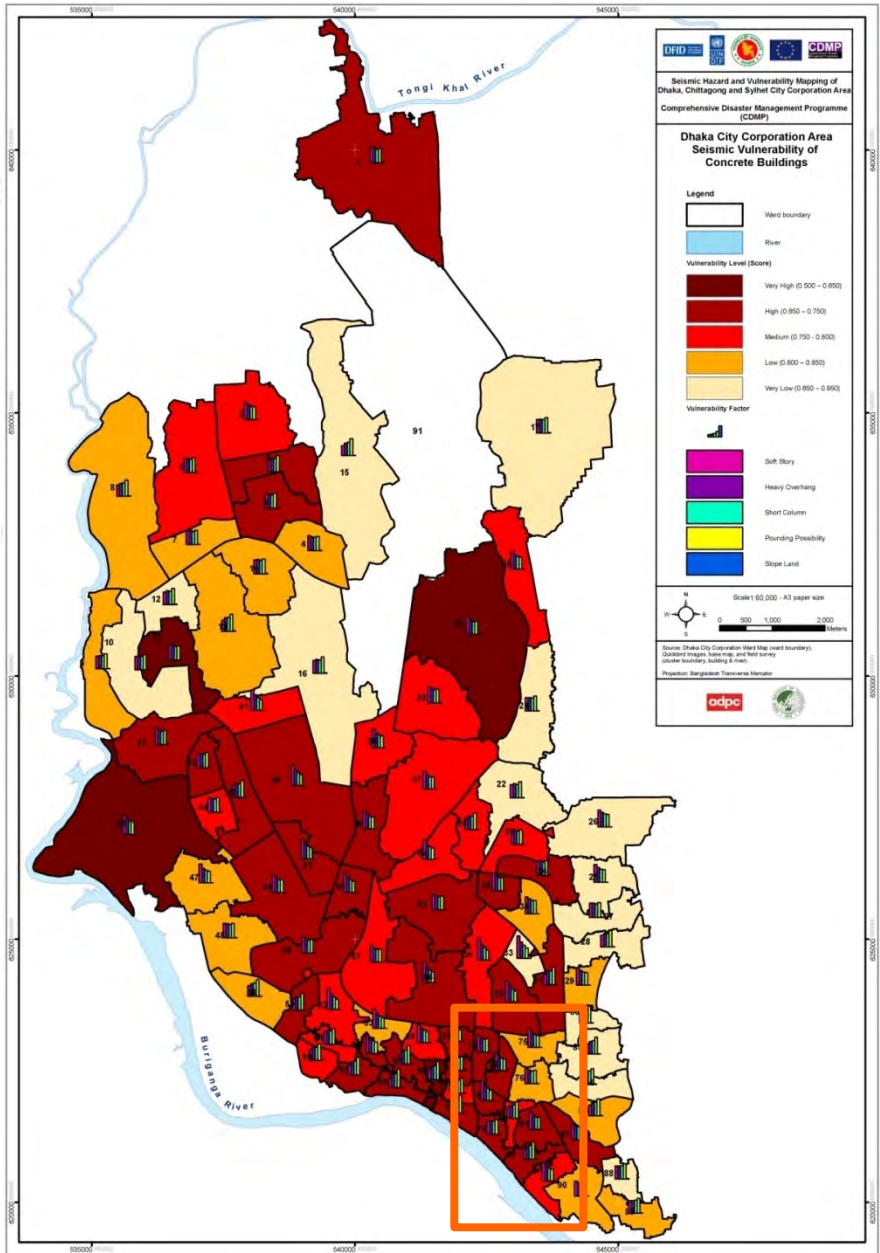


Vulnerability Level (Score)

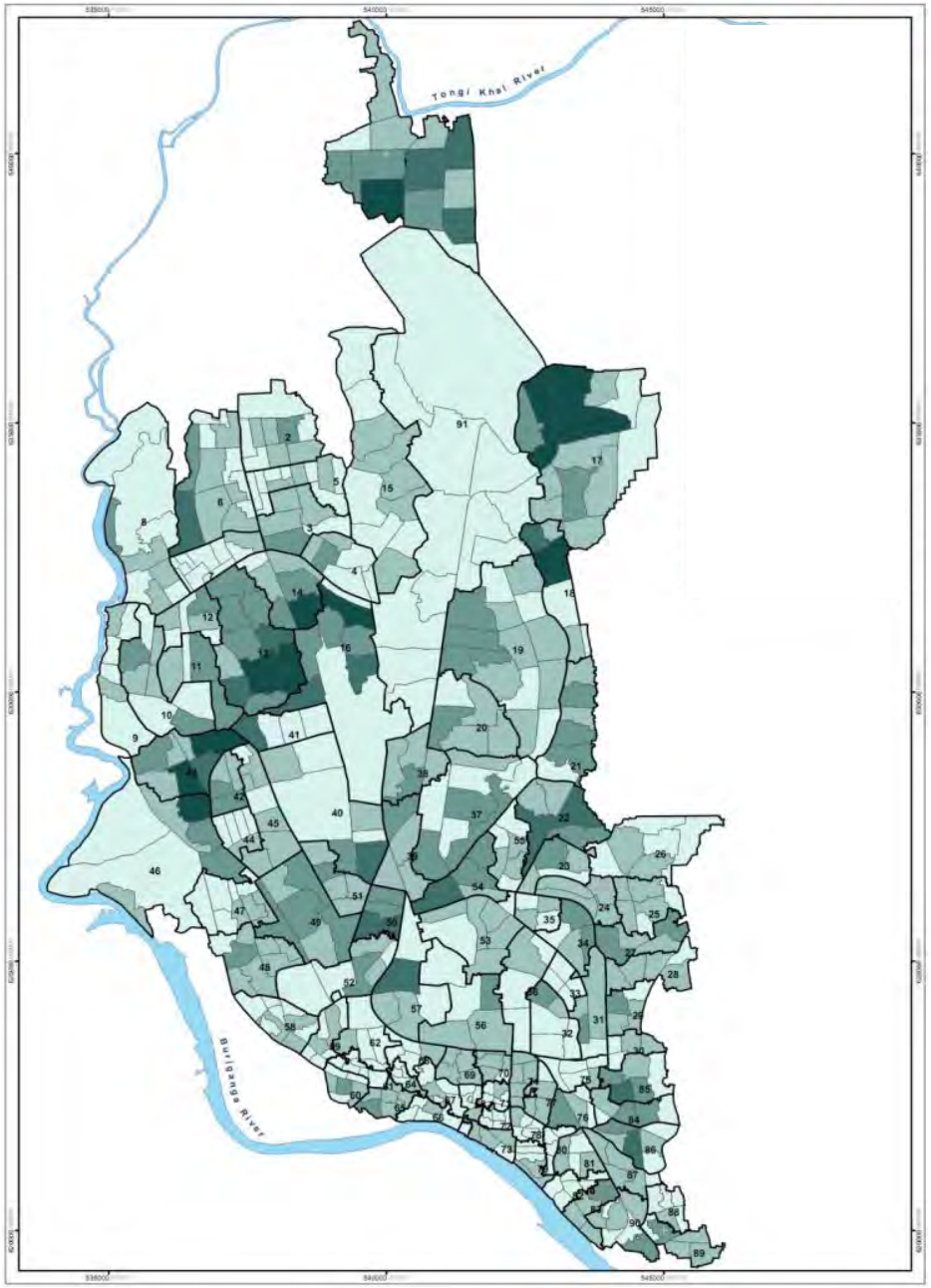
- Very High (0.500 – 0.650)
- High (0.650 – 0.750)
- Medium (0.750 - 0.800)
- Low (0.800 – 0.850)
- Very Low (0.850 – 0.950)

Vulnerability Factor

- Soft Story
- Heavy Overhang
- Short Column
- Pounding Possibility
- Slope Land



DEBRIS GENERATION SCENARIO



Legend

Ward boundary

Cluster boundary

River

Debris Expected

(in thounsands of tons)

0 - 100

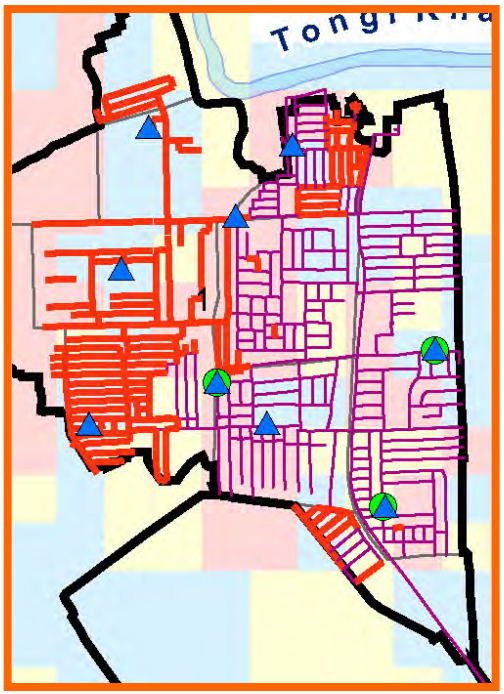
100 - 200

200 - 300

300 - 400

400 - 600

LIFELINE VULNERABILTY

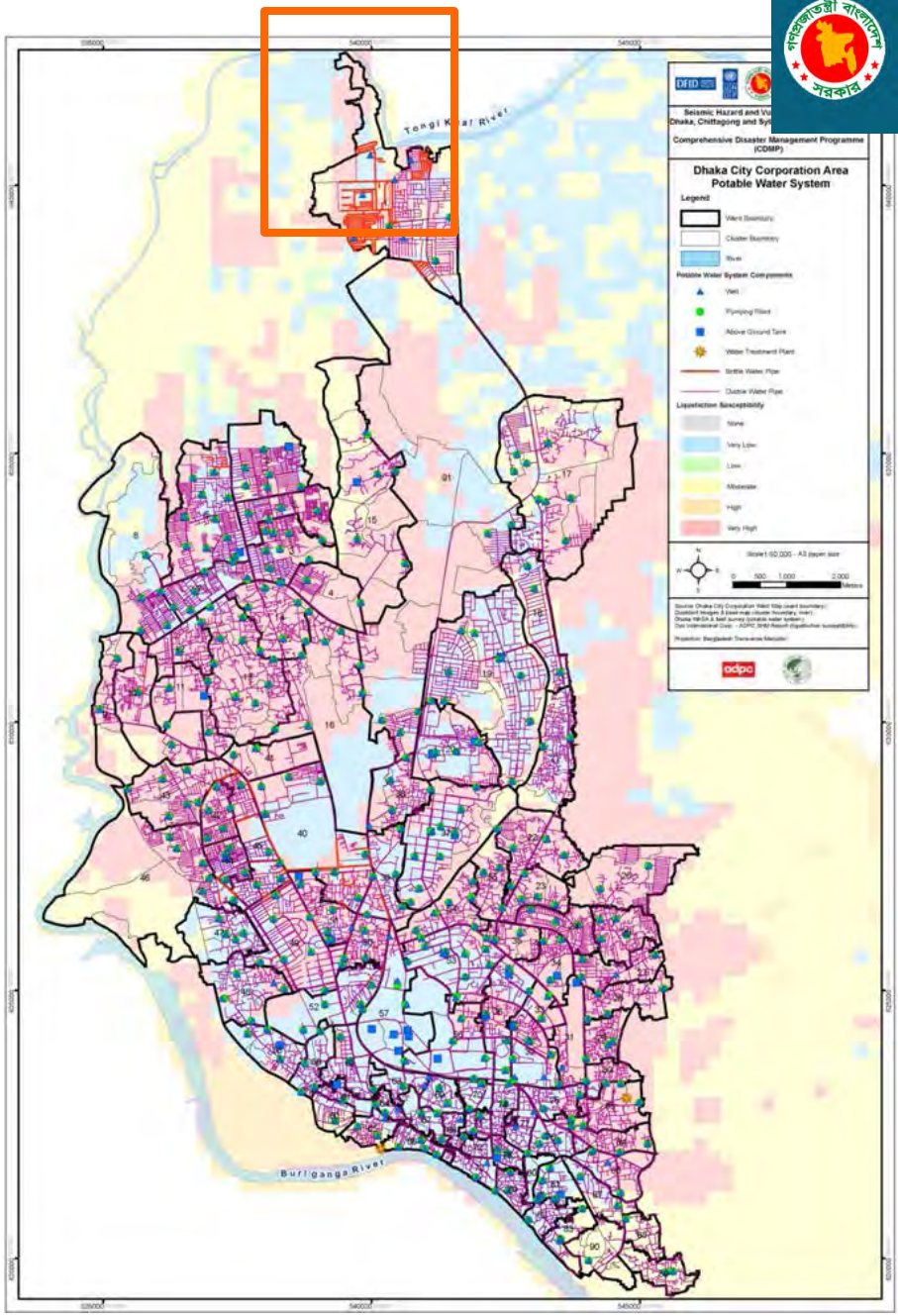


Potable Water System Components

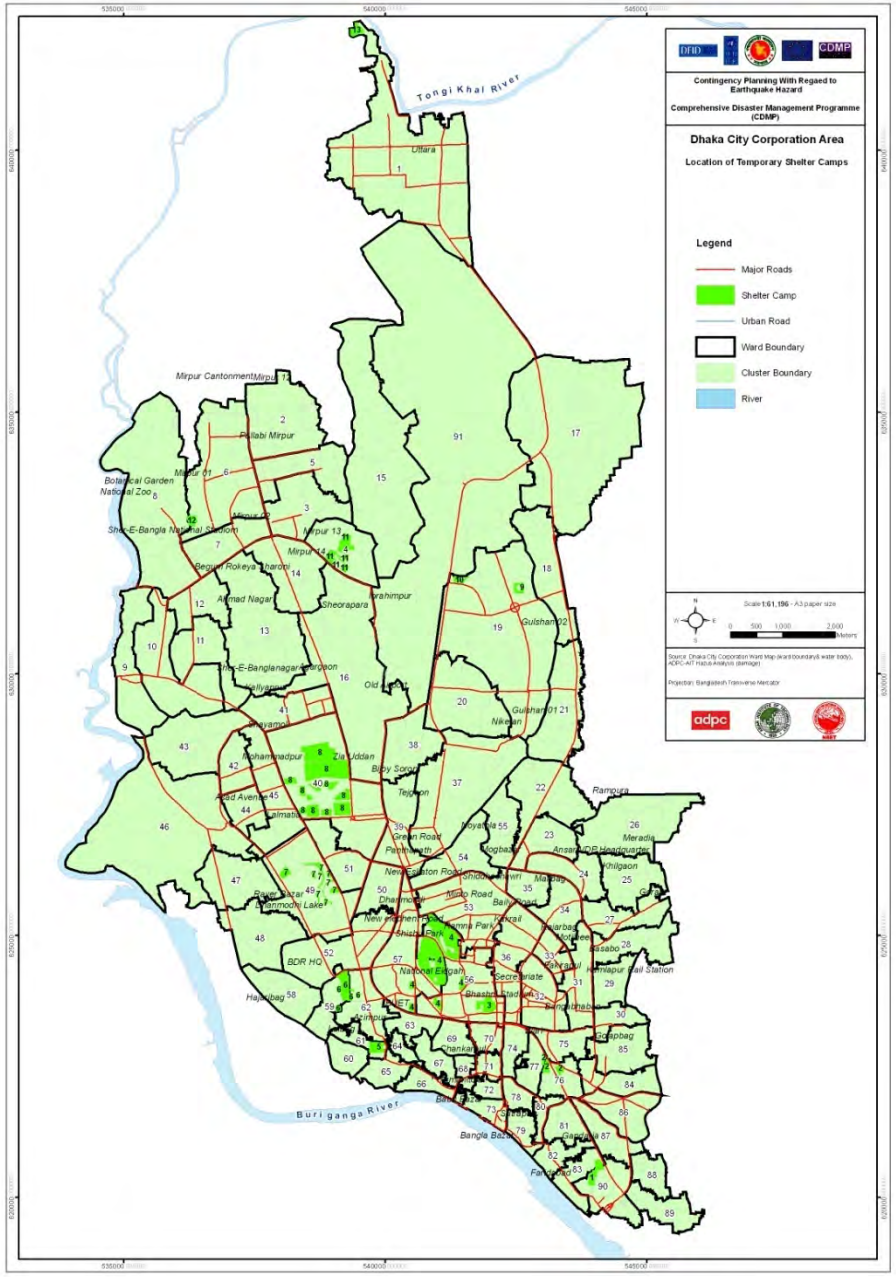
- Well
- Pumping Plant
- Above Ground Tank
- Water Treatment Plant
- Brittle Water Pipe
- Ductile Water Pipe

Liquefaction Susceptibility

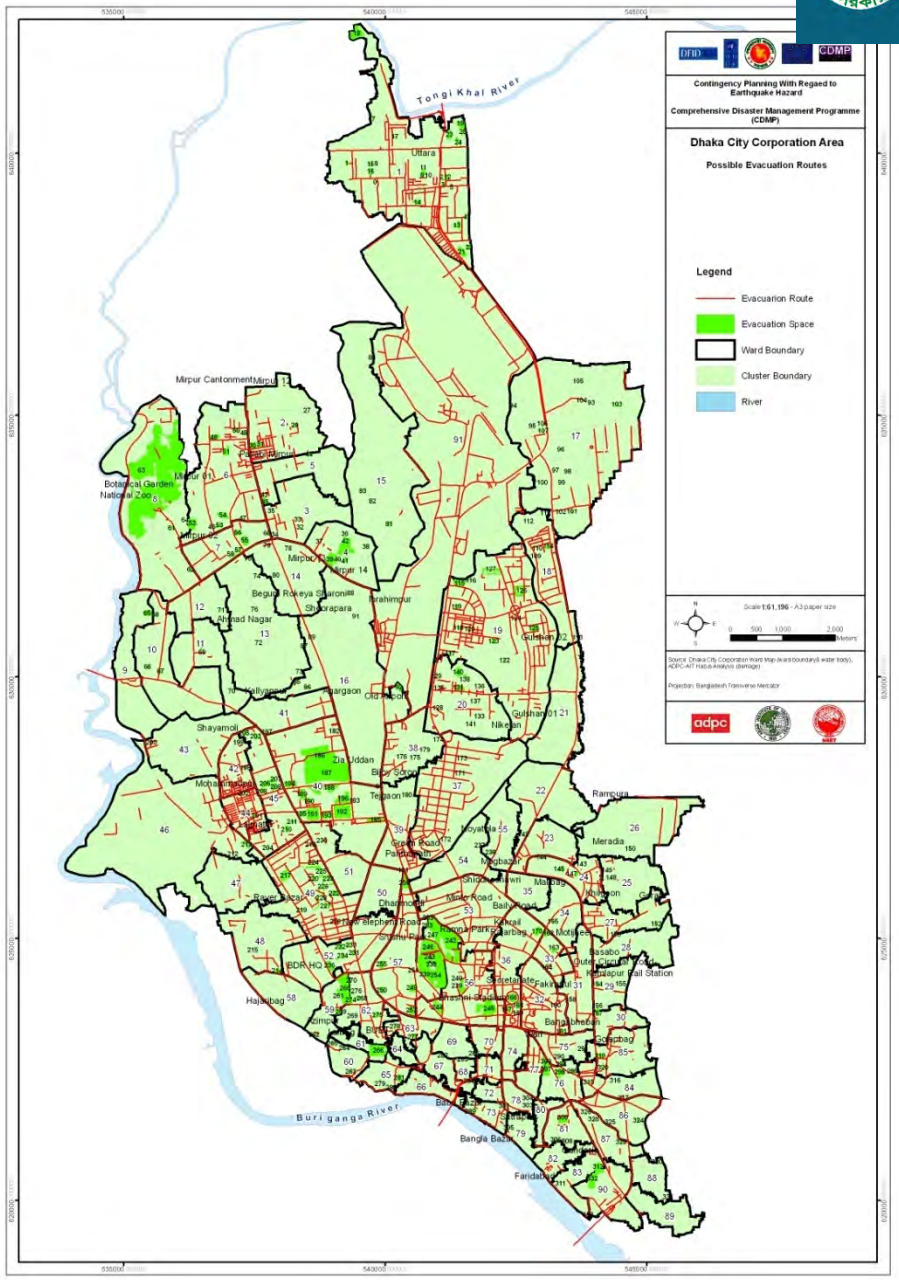
- None
- Very Low
- Low
- Moderate
- High
- Very High



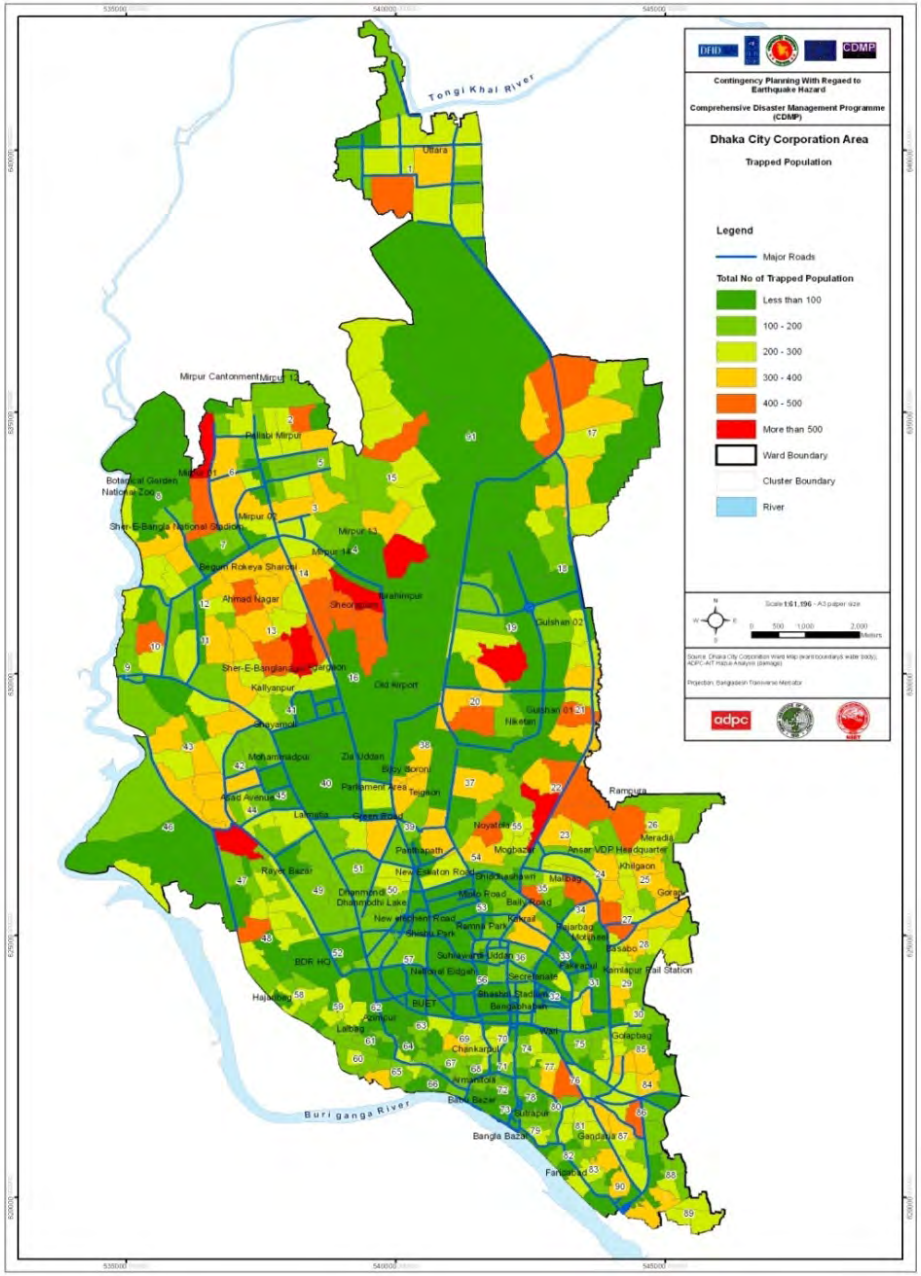
LOCATION OF TEMPORARY SHELTERS



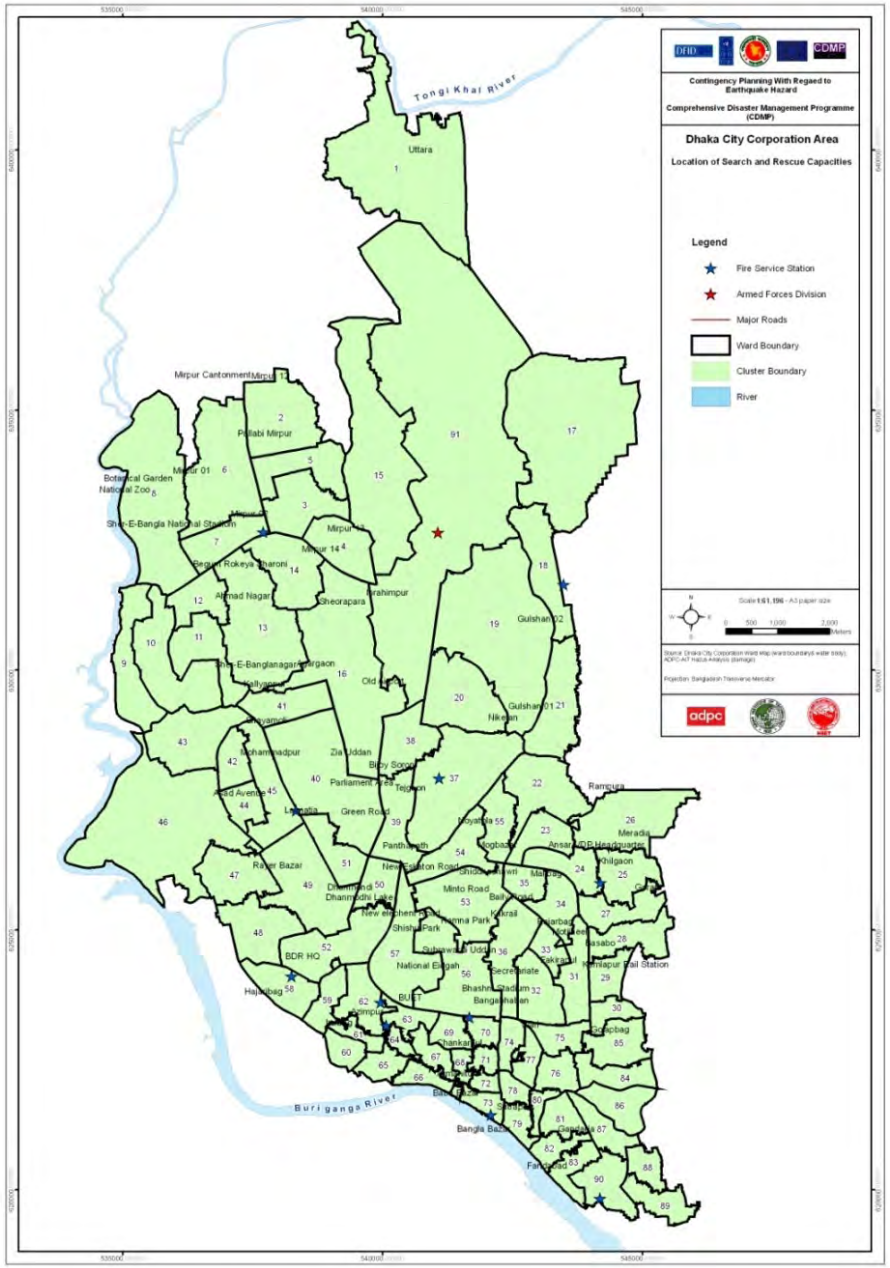
POSSIBLE EVACUATION ROUTE



TRAPPED POPULATION IN DHAKA CITY

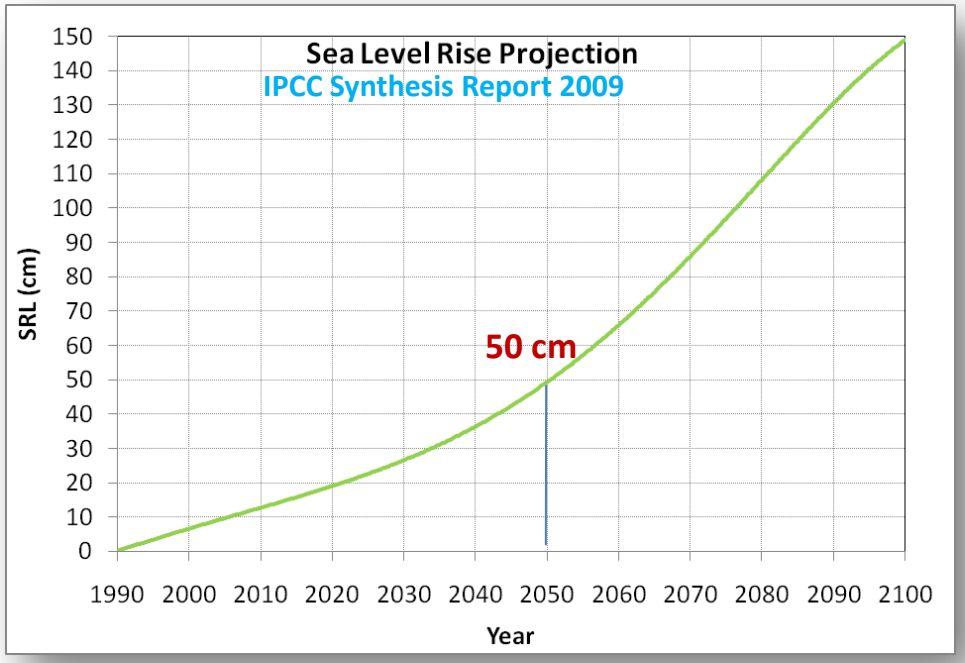


LOCATION OF SEARCH AND RESCUE CAMP



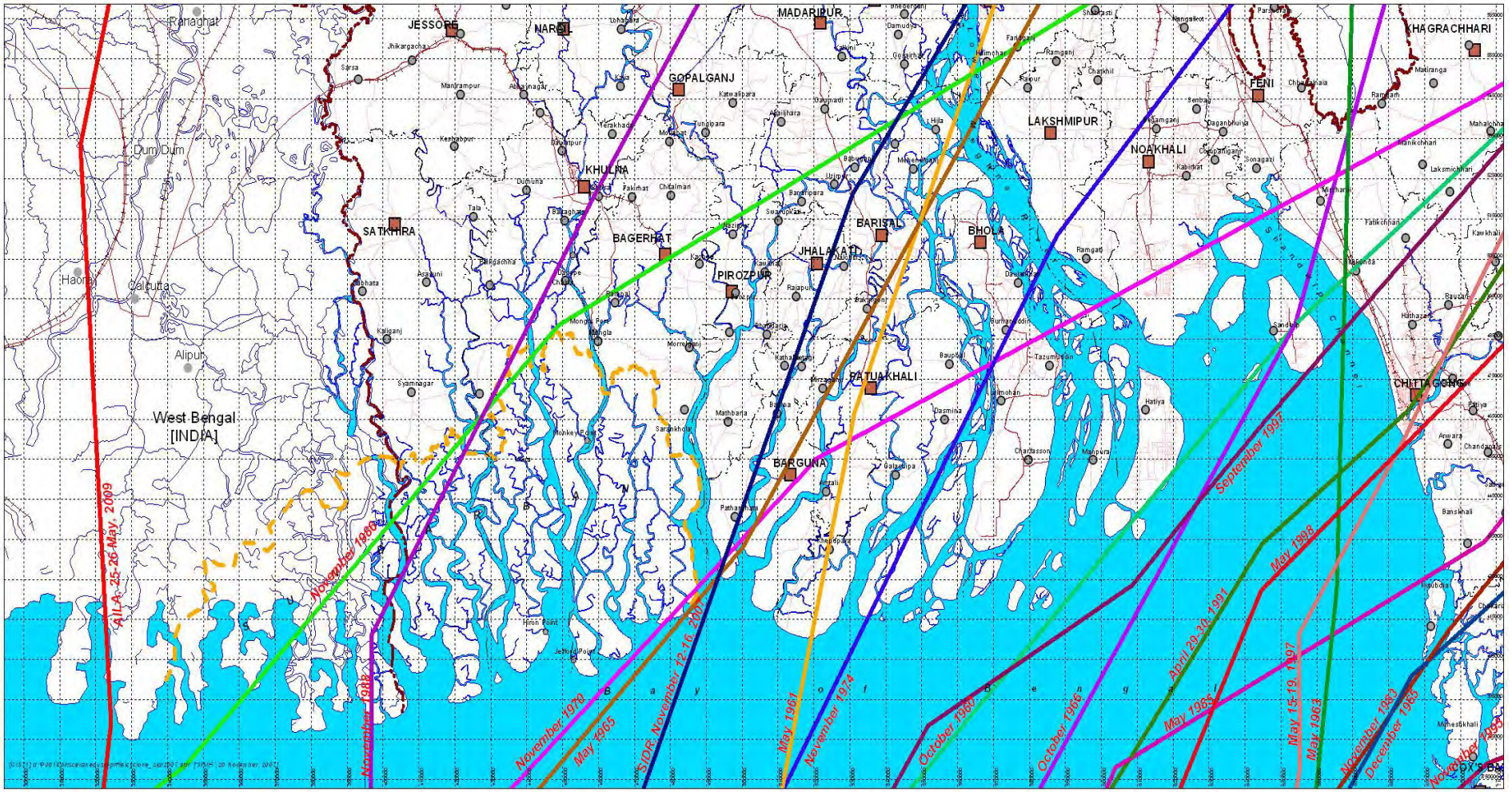
FLOOD , STORM SURGE AND SALINITY INTRUSION MAPPING TO FACILITATE COMMUNITY RISK ASSESSMENT (CRA)

SEA LEVEL RISE PROJECTION

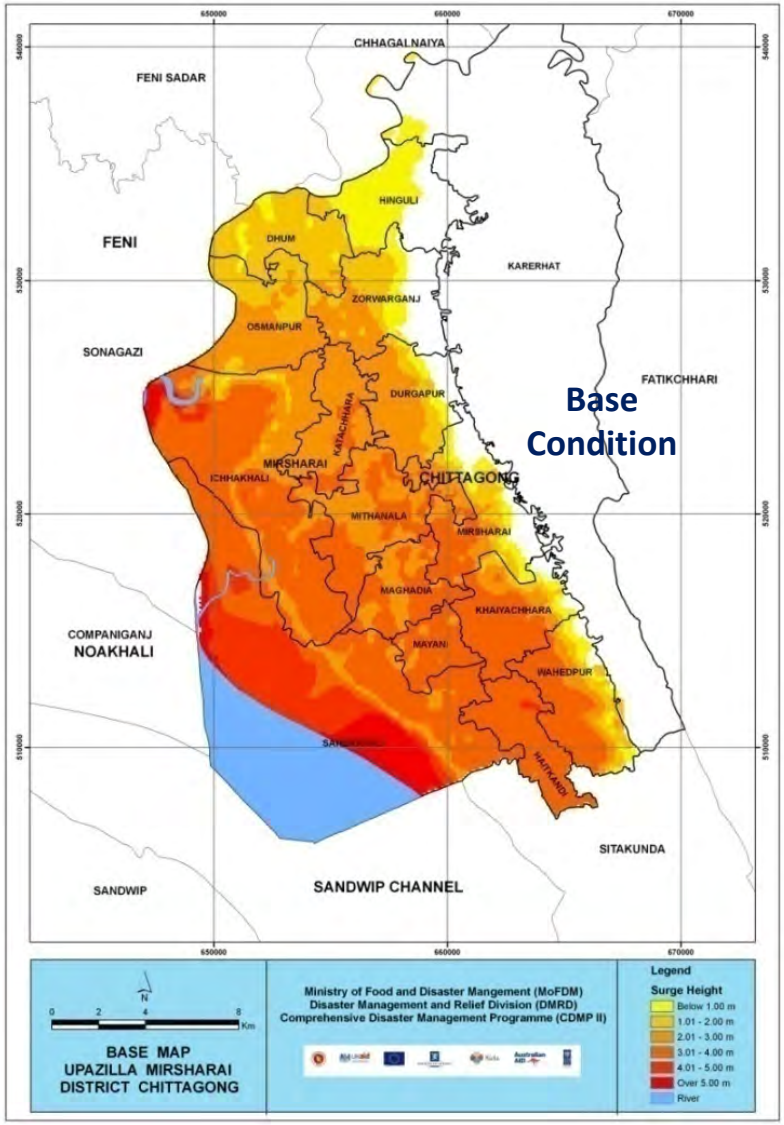


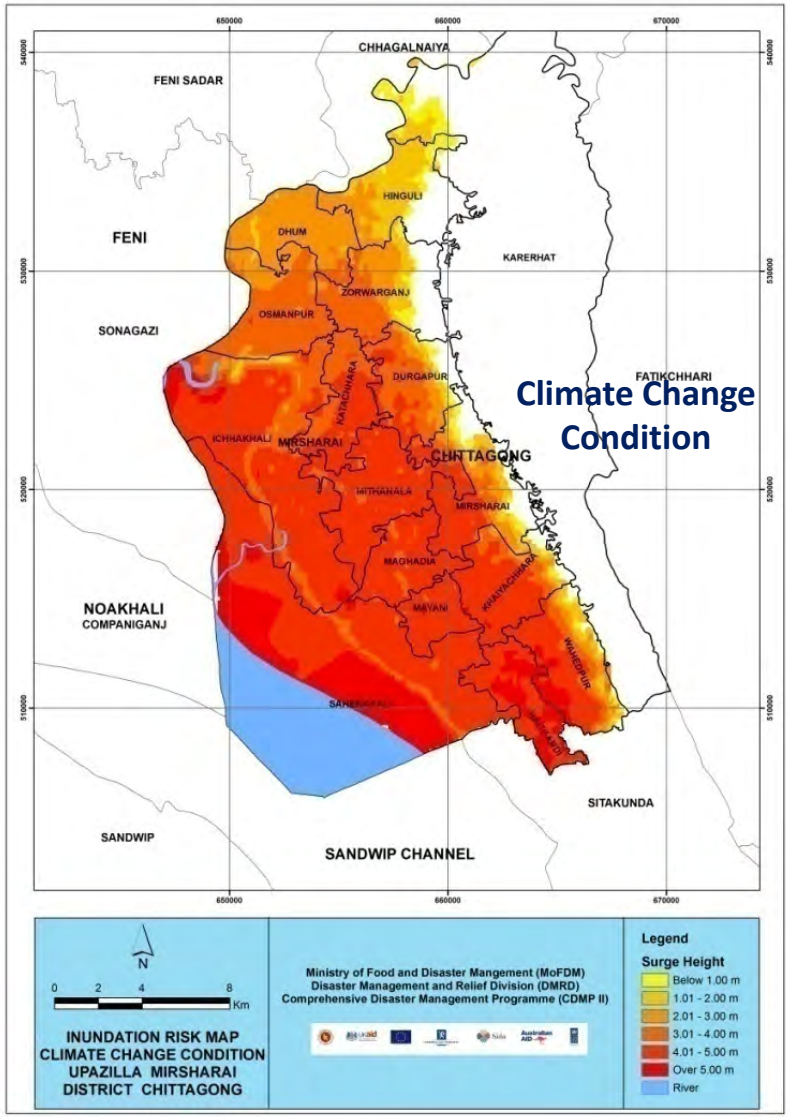
SLR 50cm was Selected for the Year 2050

PAST 19 CYCLONES WITH 3 SYNTHETIC TRACK



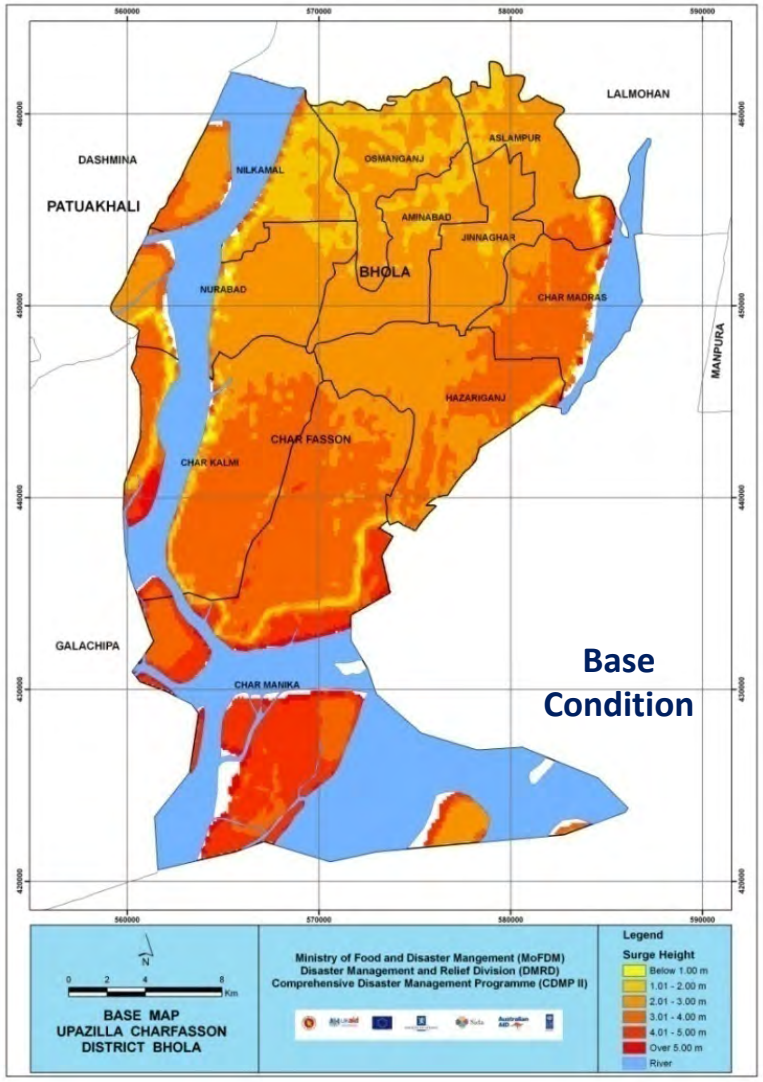
INUNDATION RISK MAPS

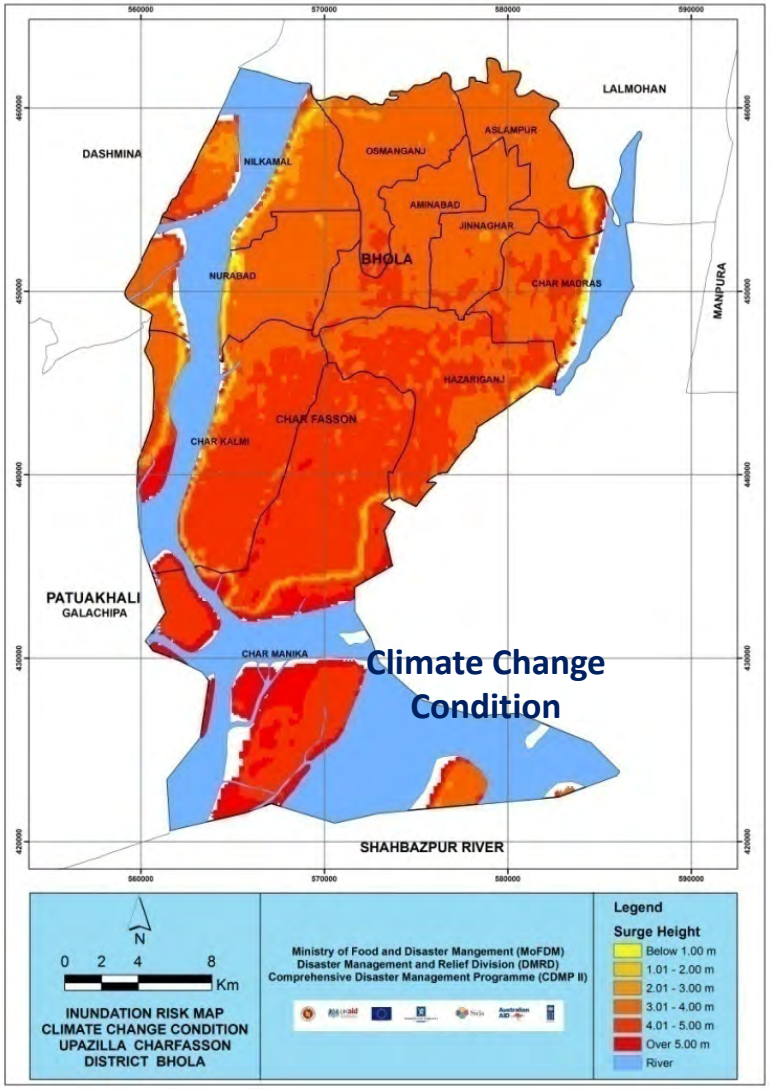




Sub-district: Mirsharai, District: Chittagong

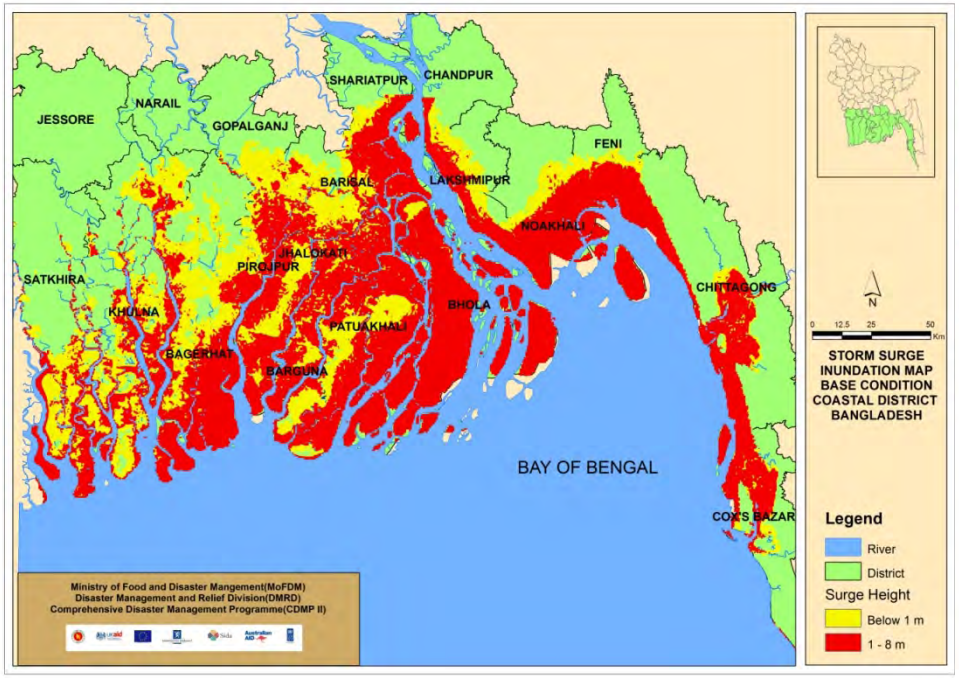
INUNDATION RISK MAPS



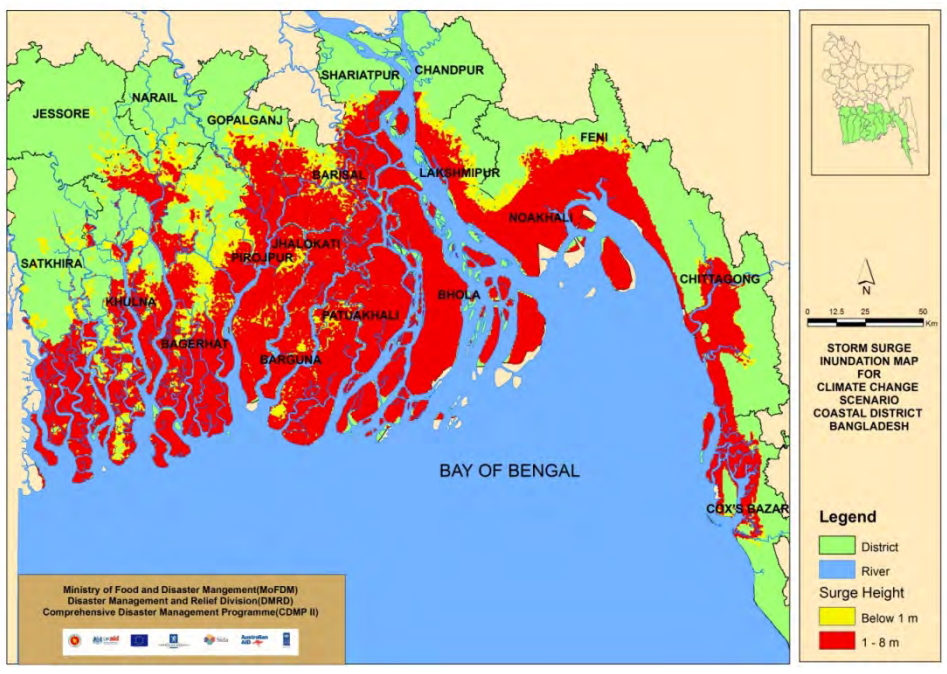


Sub-district: Charfasson, District: Bhola

INUNDATION RISK MAPS



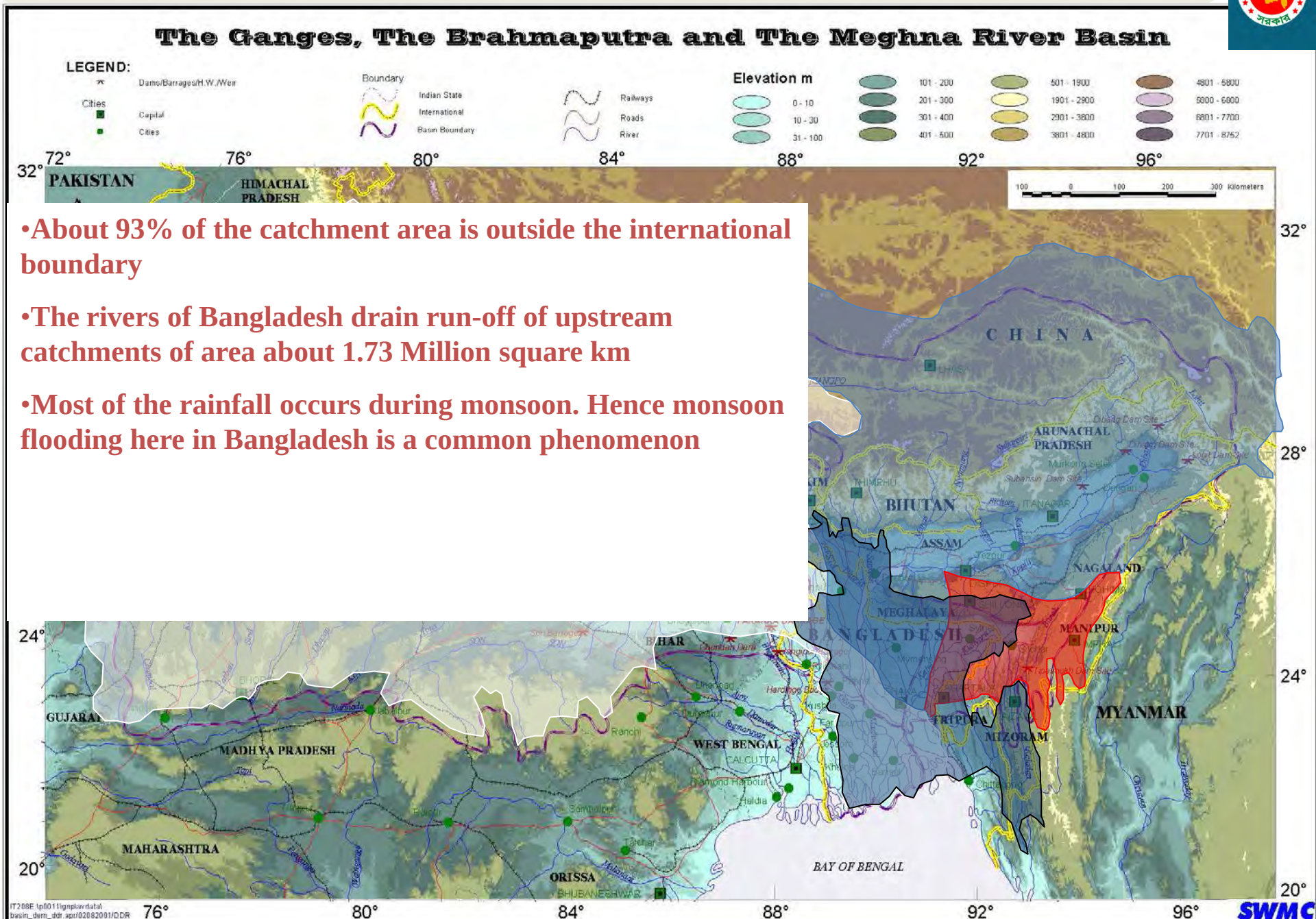
Base Condition



Climate Change Condition

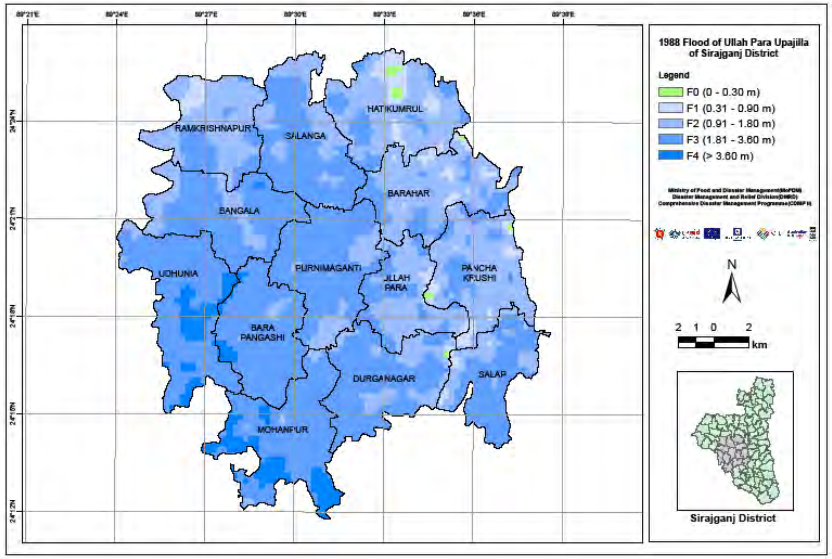
An area of 20,745 km^2 will be inundated by more than 1m water depth in the changing climate

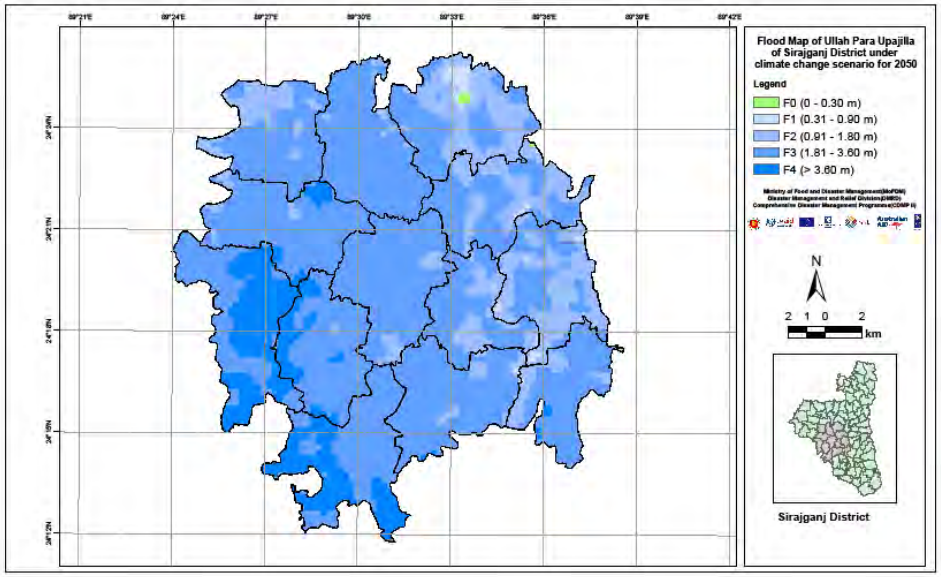
GANGES, BRAHAPUTRA AND MEGHNA RIVER BASIN



- About 93% of the catchment area is outside the international boundary
- The rivers of Bangladesh drain run-off of upstream catchments of area about 1.73 Million square km
- Most of the rainfall occurs during monsoon. Hence monsoon flooding here in Bangladesh is a common phenomenon

SAMPLE FLOOD INUNDATION MAP



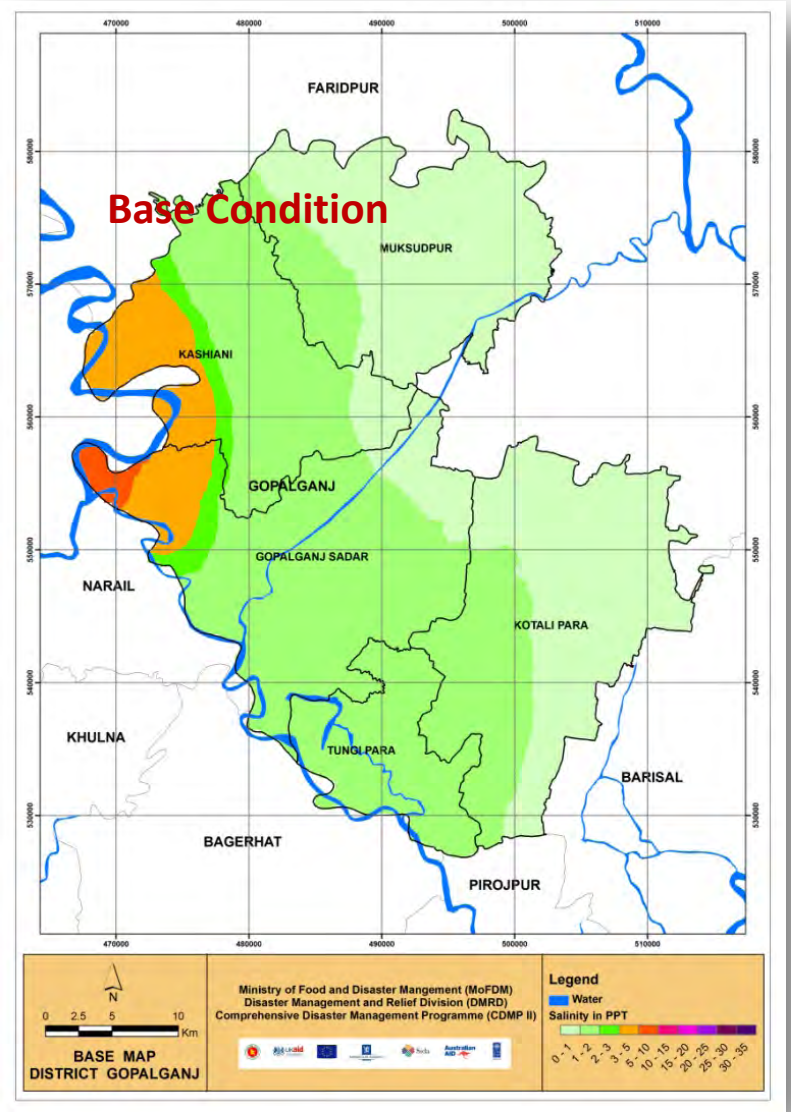


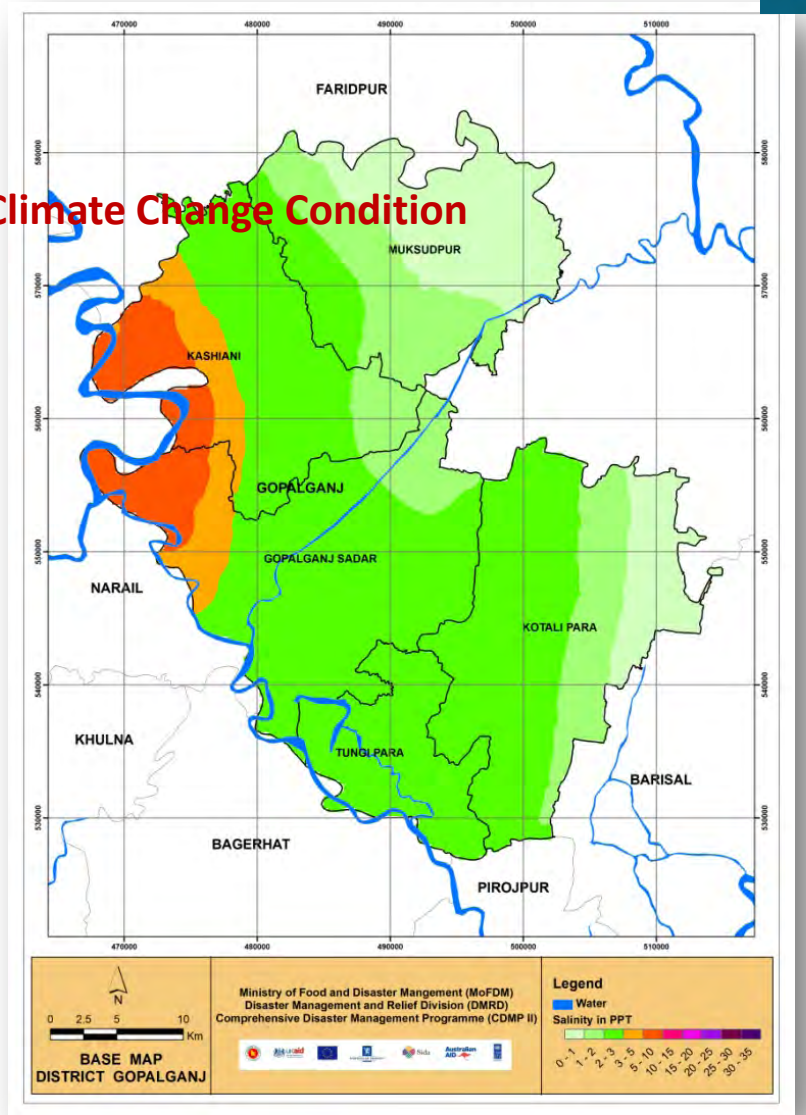
Flood Inundation for 1988

Flood Inundation for the Year 2050

Sub-district: Ullapara; District: Sirajganj

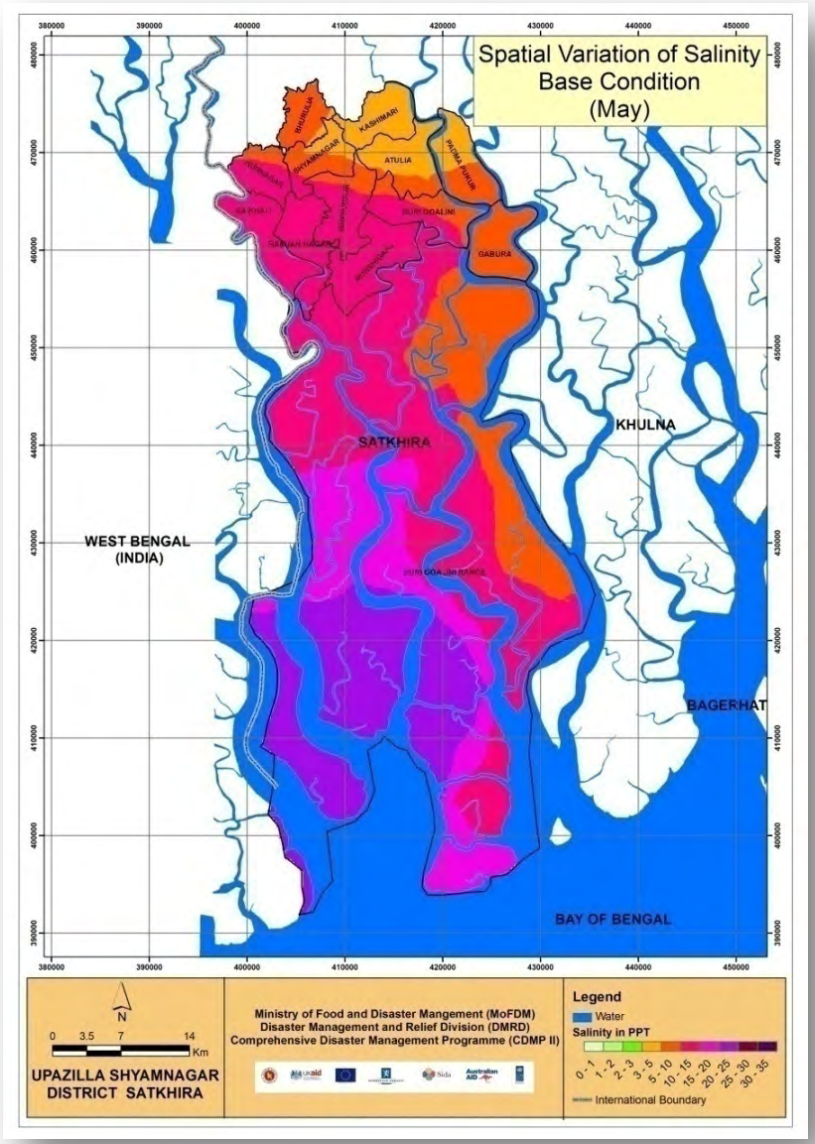
SALINITY DISTRIBUTION

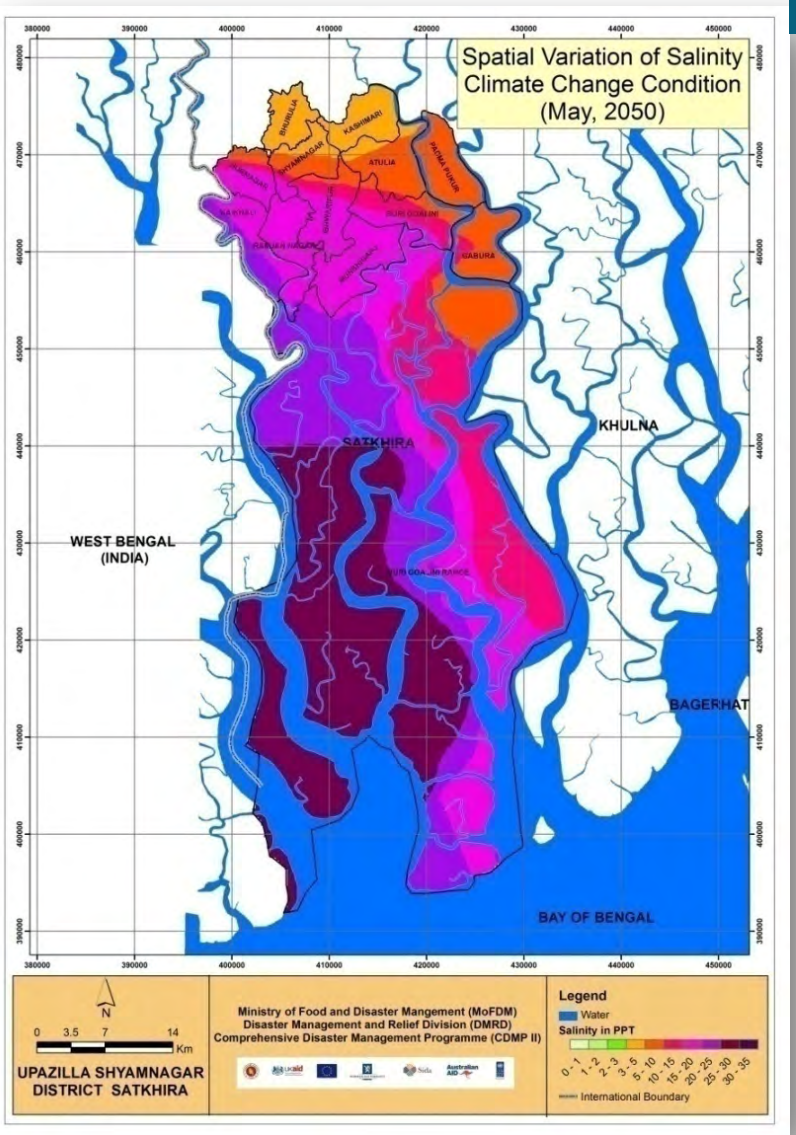




District: Gopalganj

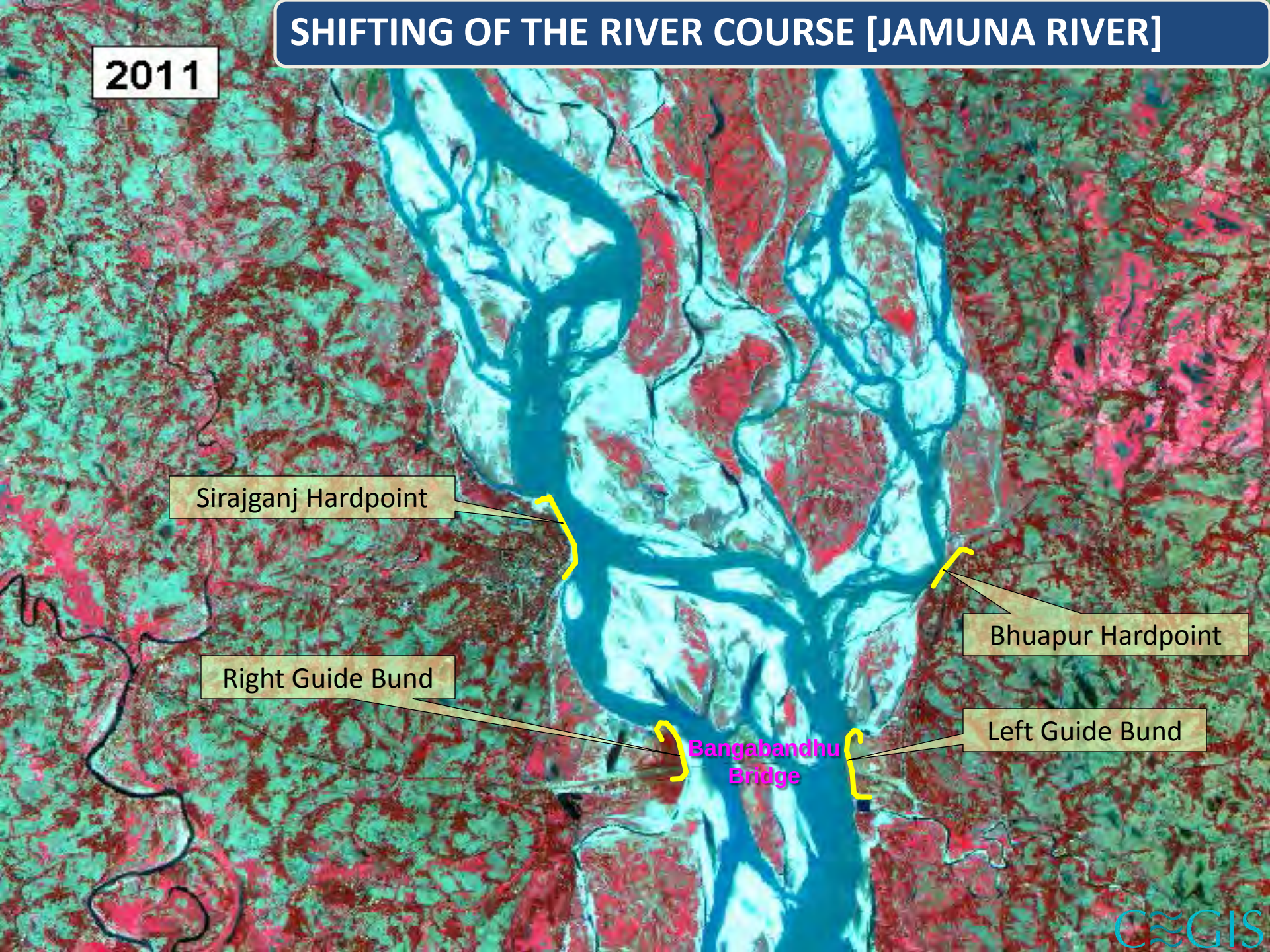
SALINITY DISTRIBUTION



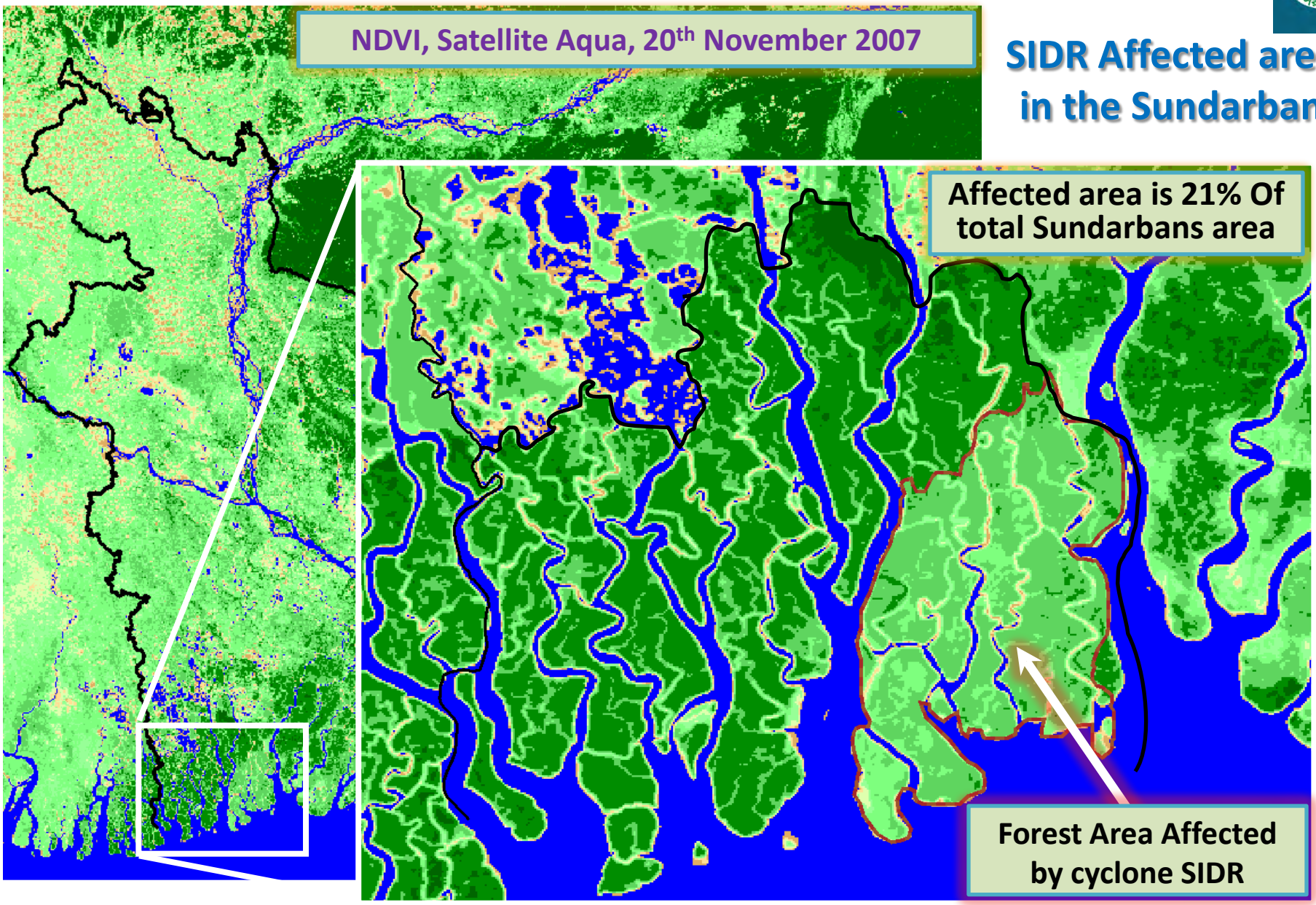


Sub-district: Shyamnagar; District: Satkhira

SHIFTING OF THE RIVER COURSE [JAMUNA RIVER]

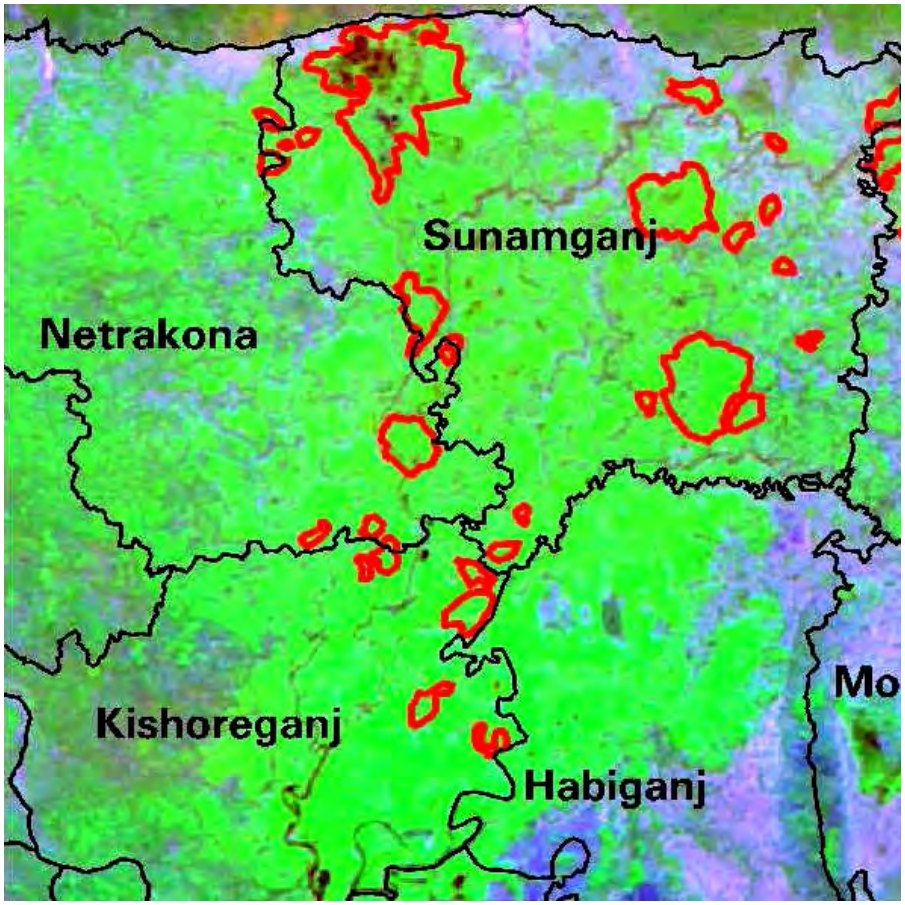


ASSESSMENT OF CYCONE DAMAGE

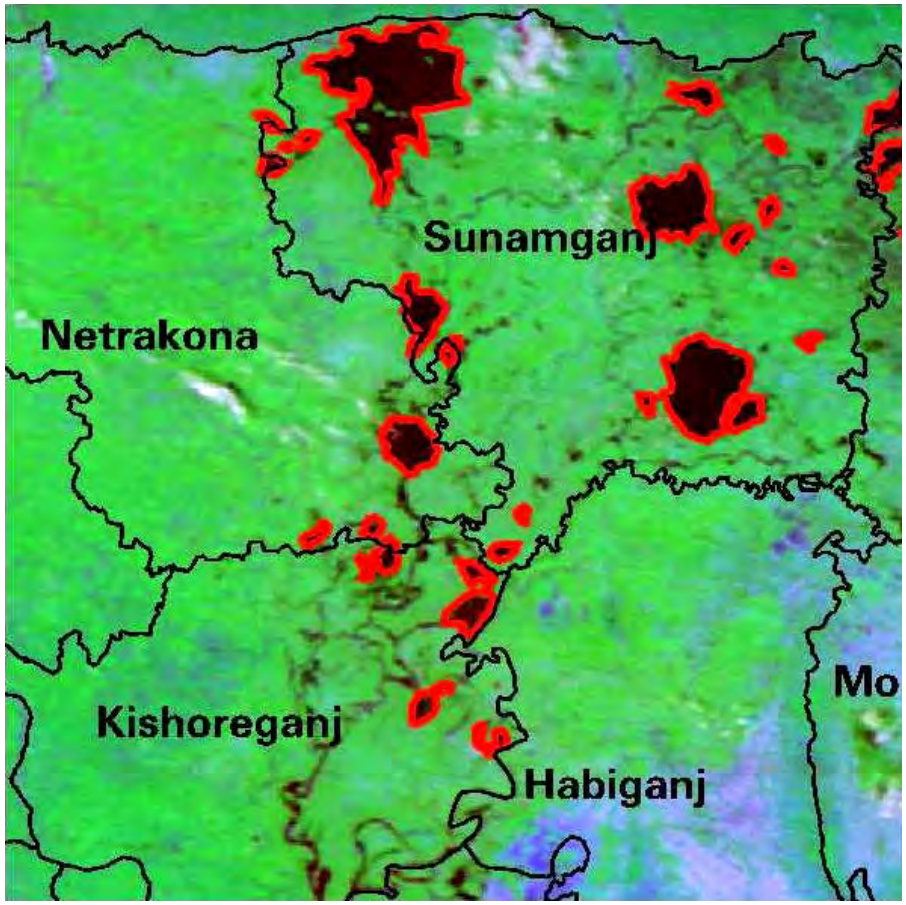


ASSESSMENT OF CROP DAMAGE

50,500 hectare Boro rice was damaged by flash flood in April 2010.

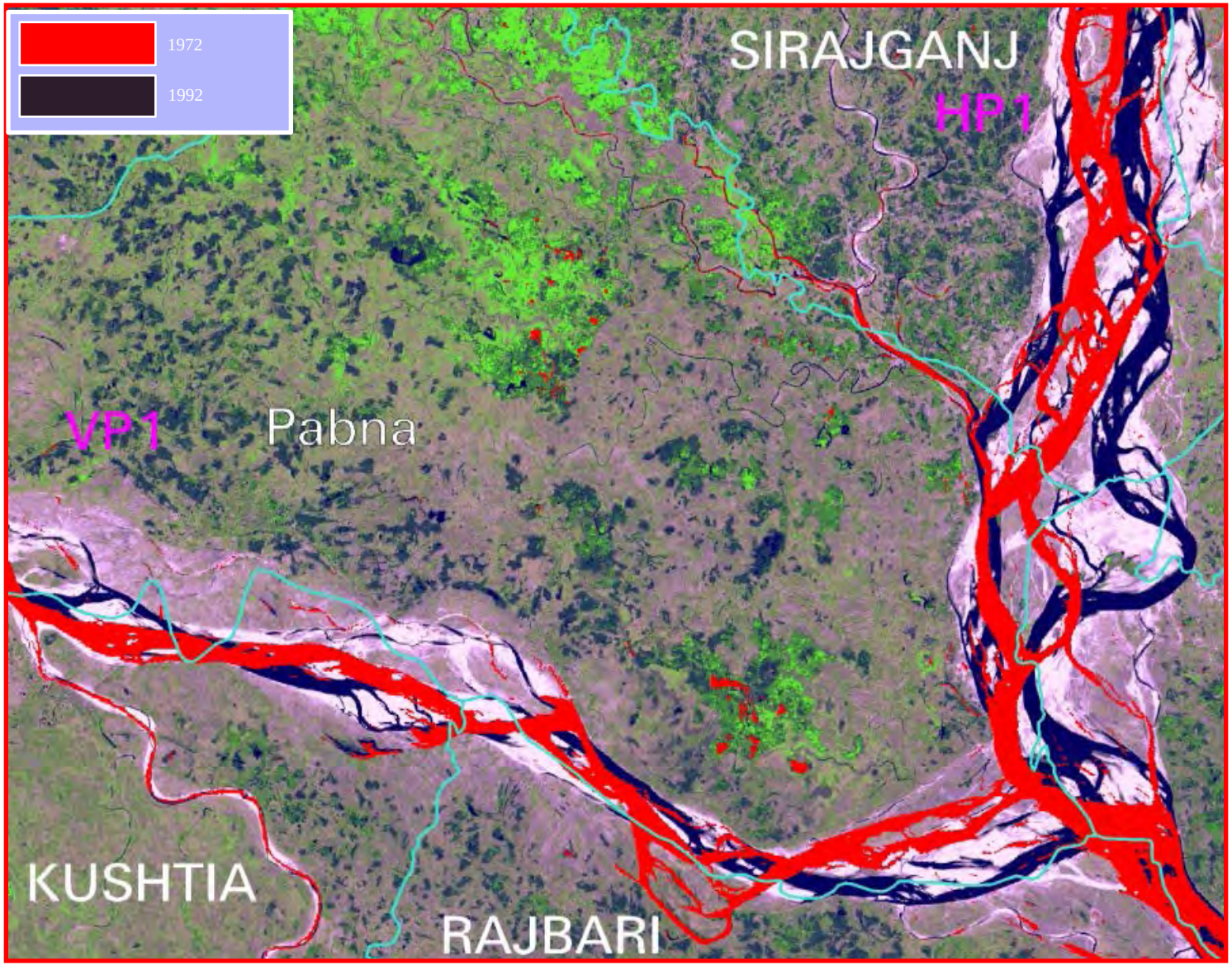


MODIS Pre-flood Image



MODIS Post-flood Image

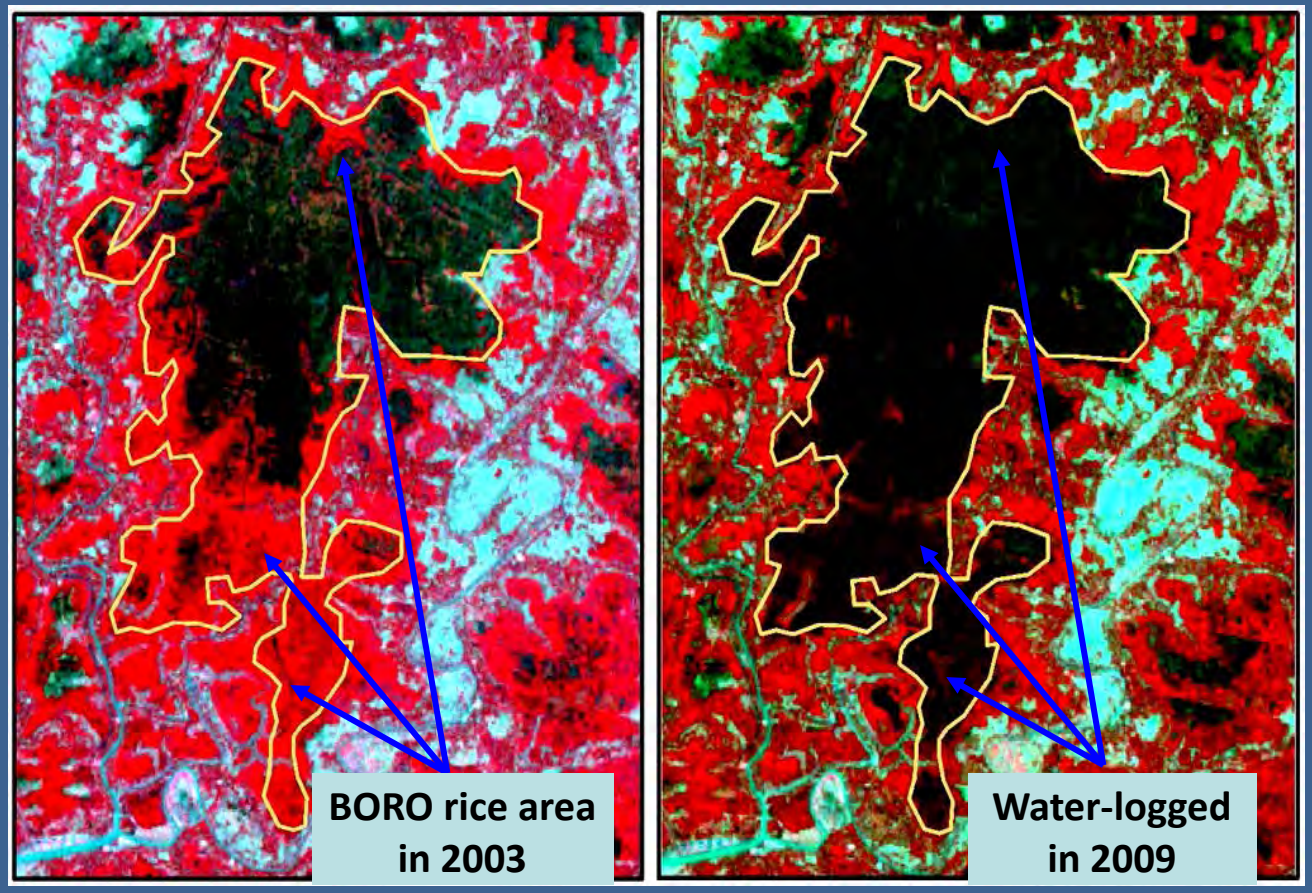
EROSION AND BANKLINE SHIFTING



River morphology

WATER LOGGING

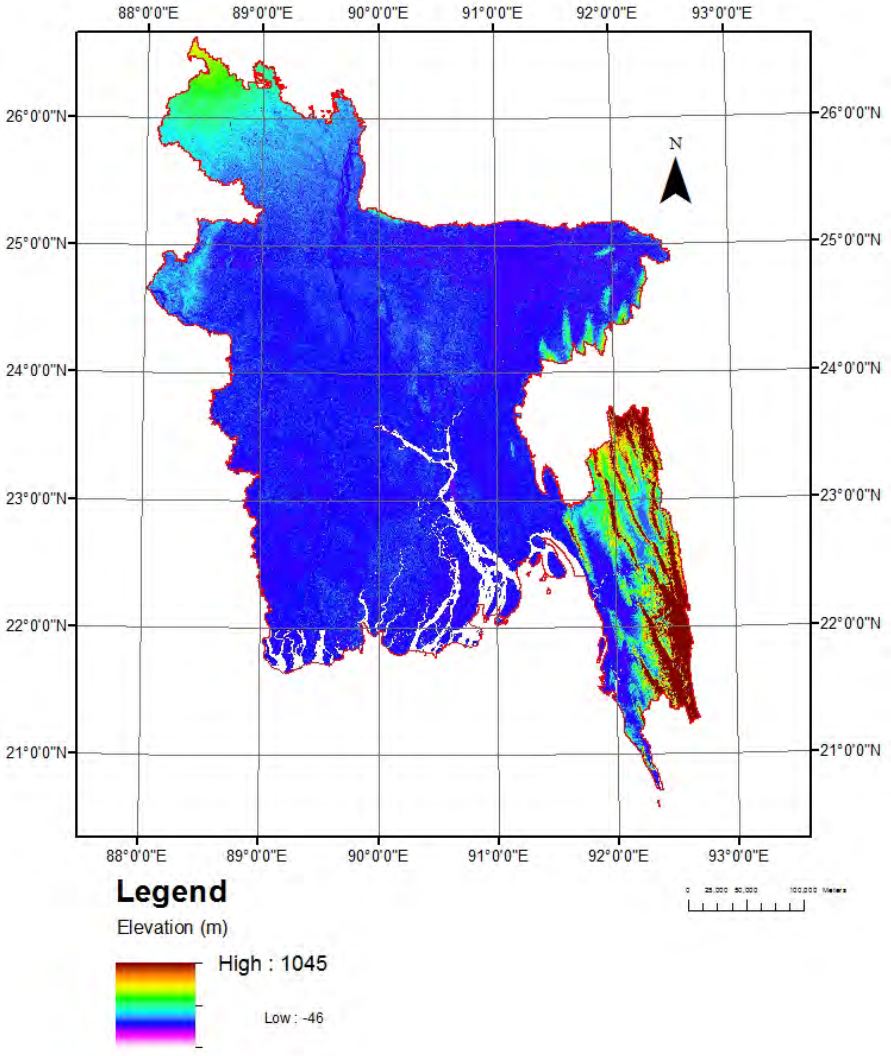
A silent disaster in Bangladesh



Water-logging Monitoring System ($WLMS_{RG}$) based on Remote Sensing and GIS Techniques.

ASTER Image for Digital Elevation Modeling (DEM)

- High spatial resolution DEM derived using the stereo satellite data of Advanced Space Borne Thermal Emission and Reflection Radiometer (ASTER) sensor on TERRA satellite.
- The resolution of the Image is at 30m.



GPS/ SATELLITE PHONE

ONLINE CYCLONE SHELTER DATABASE [GPS APPLICATION]

Name	Desc	Name	Desc	Name	Desc
Shelter ID	1002ZIA	Upazila S.N	2	Shelter Condition	PEDP-II
Shelter Name	Dabir Char Model GPS	GeoCode	1785547356	District	Patuakhali
Upazila	Dumki	Union	Lebukhali	Village	Dumki
Mouza	Dumki	Latitude	22°28'3.7"	Longitude	90°22'42"

FISHING BOAT TRACKING SYSTEM [EW]

CAPACITY BUILDING

RAPID RESPONSE MAPPING

TRAINING

- Training on Geographic Information System (GIS)

MISSION/WORKSHOP

- UN-SPIDER Technical Advisory Mission to Bangladesh
- Use of Space Technology for Disaster Risk Reduction

CHALLENGES

- No own satellite.
- Effective use of space information during emergency response and post-damage need assessment (PDNA)
- Early warning needs to be further strengthened by providing better and timely access to the space based information and related technologies
- Analysis of images should be backed by reliable database (baseline)
- Local capacity exists and needs to be enhanced
- Data duplication and redundancy

WAY FORWARD

- Launching of satellite in near future
- Capacity Development of both the organizations agencies responsible for earth observation and end users department
- Building network and platform with related International/Regional data/technology provider
- NSDI to avoid duplication and redundancy
- Incorporation of space technology for DRR/CCA to national policy and plan

CONCLUSIONS

- Space Science and RS Technology is still under development stage, but a considerable progress there so far.
- The association with the international entity (like International Charter on Space and Major Disaster, UN-SPIDER/UNOOSA) and regional initiatives (like Sentinel Asia, ICIMOD, etc.) can help getting required datasets timely and providing capacity building support.
- Lastly, Space information should be easily available for developing countries like Bangladesh and distributed in such a format that everybody could use without much effort and technical knowledge.


Thank you