Cropping Pattern Planning For A Flood Prone Area -A Study Using Remote Sensing and Gis to Reduce the Losses of Climate Change Impact

Presentation for APEC Climate Symposium 2012

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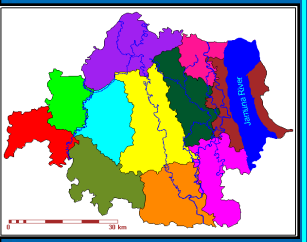
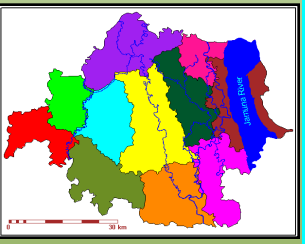
Motives

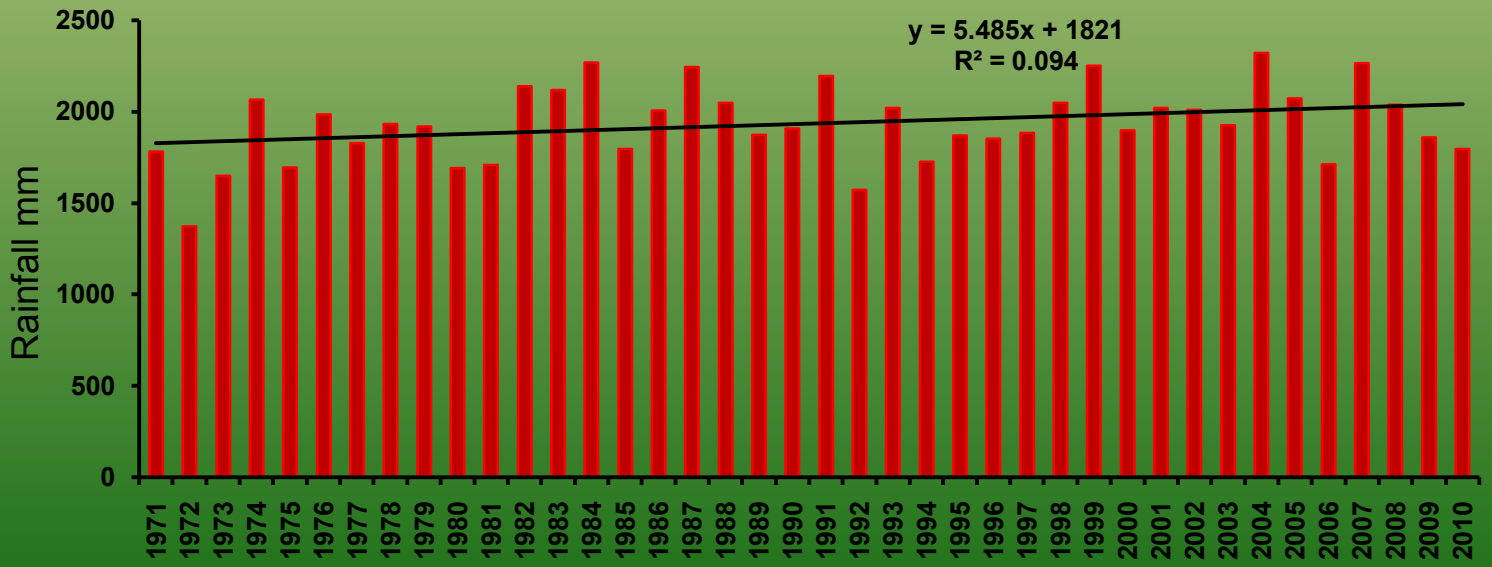


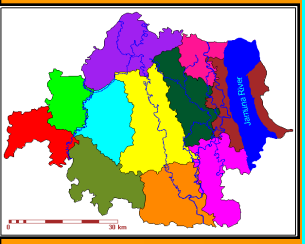
- Due to the global environment change, the climate in Bangladesh is changing and it is becoming more unpredictable recent years.
- Among other sectors, its agriculture will face the deadliest experience from the impact of climate change such as floods, droughts, tornados, cyclone, tidal surges and soil salinities.
- In Bangladesh temperature is increasing and the rate of increasing was more during the last 30 years and the annual rainfall shows an increasing trend during the period of last 40 years (1971-2010).
- Extreme rainfall in the rainy season over Bangladesh caused by monsoon climate can easily result in floods.
- So this study is an attempt to carry out land suitability for crops using MCE technique and decision roles for optimal cropping pattern planning for the flood and post flood seasons to reduce the climate change impact on agriculture.



Temperature (^{0}C/yr)	1971-2010 (40 yr)	1981-2010 (30 yr)	1991-2010 (20 yr)	2001-2010 (10 yr)
Mean	0.020	0.024	0.031	0.048
Mean Maximum	0.022	0.028	0.034	0.051
Mean Minimum	0.018	0.021	0.028	0.045
Average Rainfall (mm/yr)				
Annual	7.130	-5.616	0.005	-34.64
Pre-Monsoon	-0.750	-4.769	-2.567	-11.79
Post-Monsoon	-0.550	-1.296	-4.025	-1.283
Monsoon	5.490	-0.540	5.013	-18.58

Table: Trends of Temperature and Rainfall

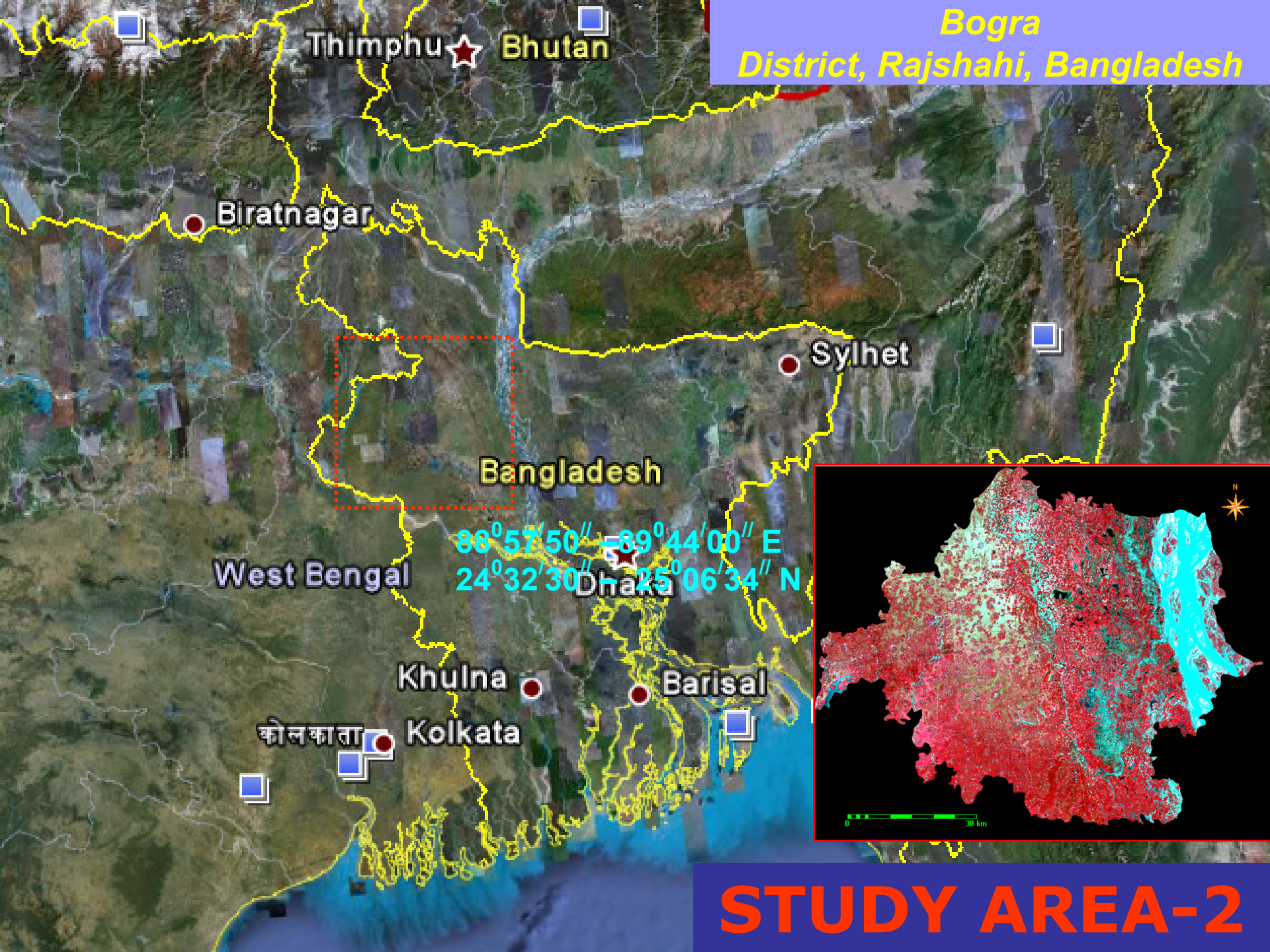


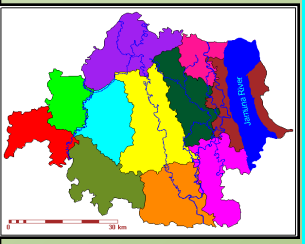


Objectives of the Study

1. to carry out land suitability analysis for crops for the flood and post flood seasons using GIS aided Multi Criteria Evaluation (MCE) technique with suitability prioritization, existing land use patterns, flood impact and expert knowledge.

2. to suggest suitable cropping pattern for land use planning to combat adverse effect of flood using GIS aided integrated analysis for flood and post flood seasons land suitability for crops.

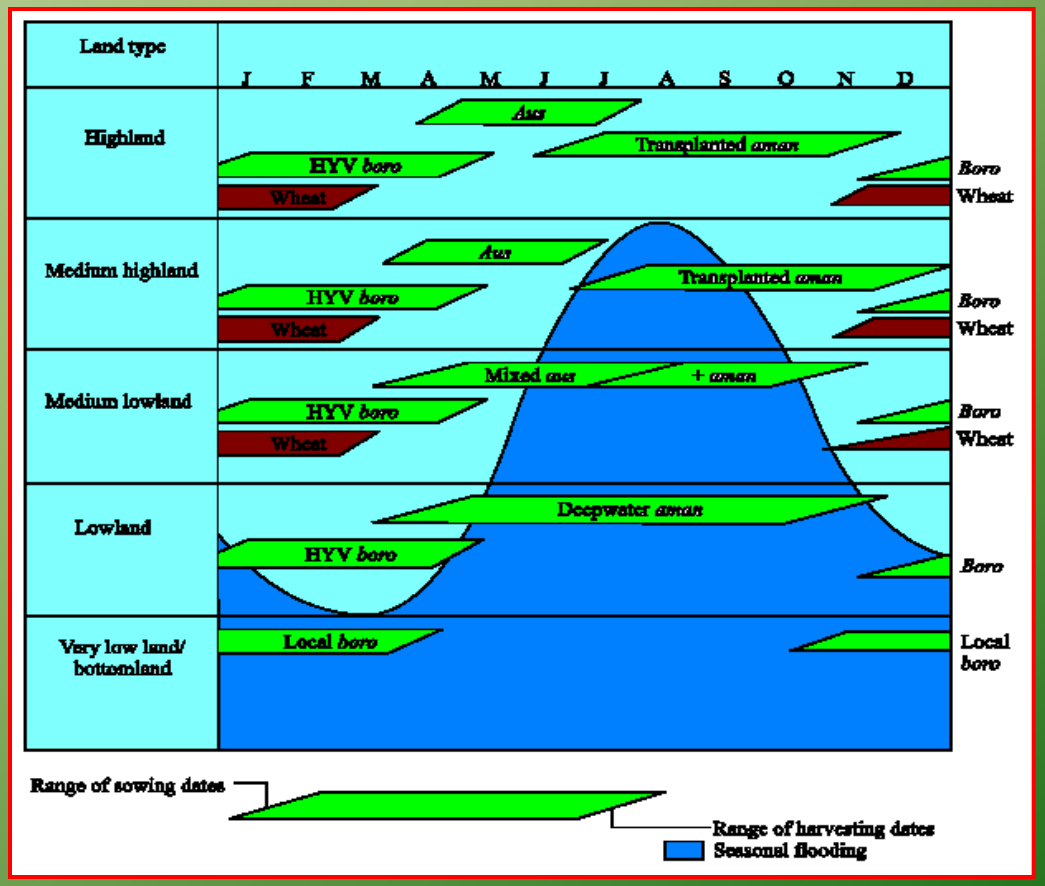

Bogra
District, Rajshahi, Bangladesh
Thimphu
Bhutan
Biratnagar
Sylhet
Bangladesh
West Bengal
88°57′50″ – 89°44′00″ E
24°32′30″ – 25°06′34″ N
Dhaka
Khulna
Barisal
कोलकाता
Kolkata
N
0
30 km
STUDY AREA-2



Major Cropping Pattern of the Study Area

Pre-Kharif Season	*Kharif* Season	*Rabi* Season
Fallow	*Aman* (Rice).	*Boro* (Rice)
Aus (Rice)	*Aman*(Rice).	Potato
Aus (Rice)	*Aman*(Rice)	*Boro* (Rice)
Aus (Rice)	*Aman*(Rice)	Mustard
Aus (Rice)	*Aman*(Rice)	Vegetable
Aus (Rice)	Fallow	Vegetable

Source: Thana Agricultural Office, Bogra



Data Used

- **Remote Sensing Data:**
  - IRS P6 LISS III
  - LANDSAT TM
  - SRTM

IRS-P6: LISS III Digital Datasets:

Date of Acquisition:

01 November' 2007

05 February' 2008

Bands Used: 2, 3 & 4. (Green, Red & Near-Infrared)

Spatial Resolution – 23.5 m

SRTM:

Date of Acquisition:

11 February' 2000

Band- C, microwave

Spatial Resolution- 90m

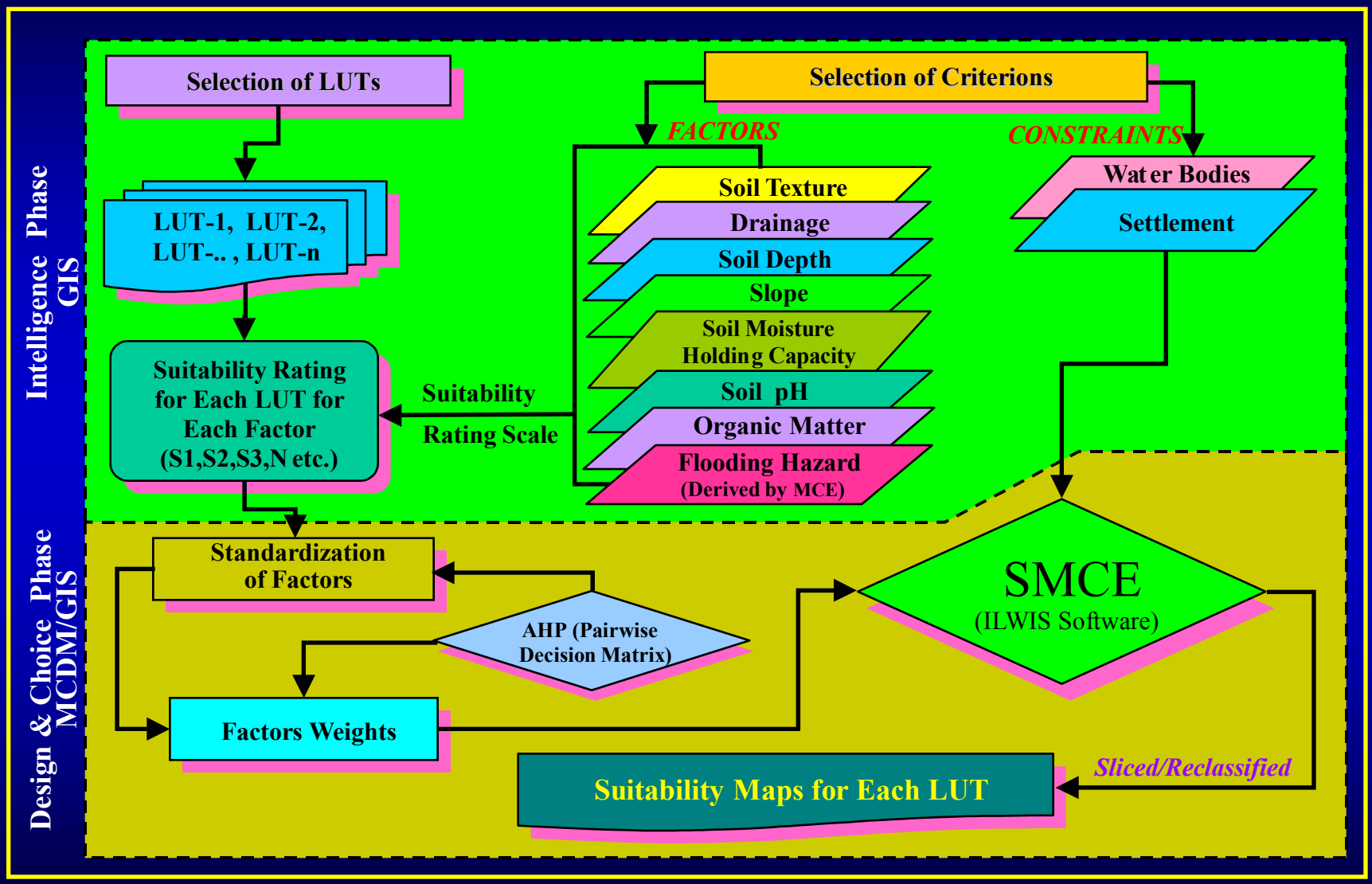
Ancillary and Ground Data:

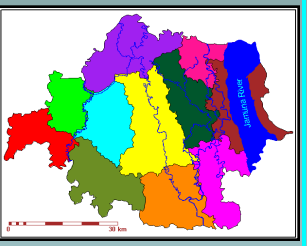
i. Flood Maps-2004, 1998 and 1988 prepared by Space Research and Remote Sensing Organization (SPARRSO) and WDB.
ii. Hydrological Data- Water Level (1965-2008).
iii. Soil Map and Attributes-Developed by Soil Resource Development Institute (SRDI), Bangladesh, Scale-1: 50,000
iv. Climate Data-Rainfall & Temperature (1971-2010)

Software Used:

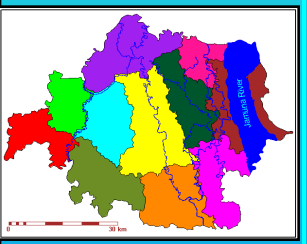
1. *Erdas Imagine, version-10*: Used for export/import data, Image registration and atmospheric correction of the images.
2. *eCognition, version 4.0*: Used for object based image classification.
3. *ILWIS (Integrated Land and water Information System), version-3.2*: Used for different layer creation, image analysis, flood modelling and MCE for land suitability.
4. *IDRISI-version 15:* Used for Multi-criteria Evaluation analysis for Flood Hazard Zonation.
5. Microsoft Excel-2000: Used for statistical analysis and data calculation.

Methodology

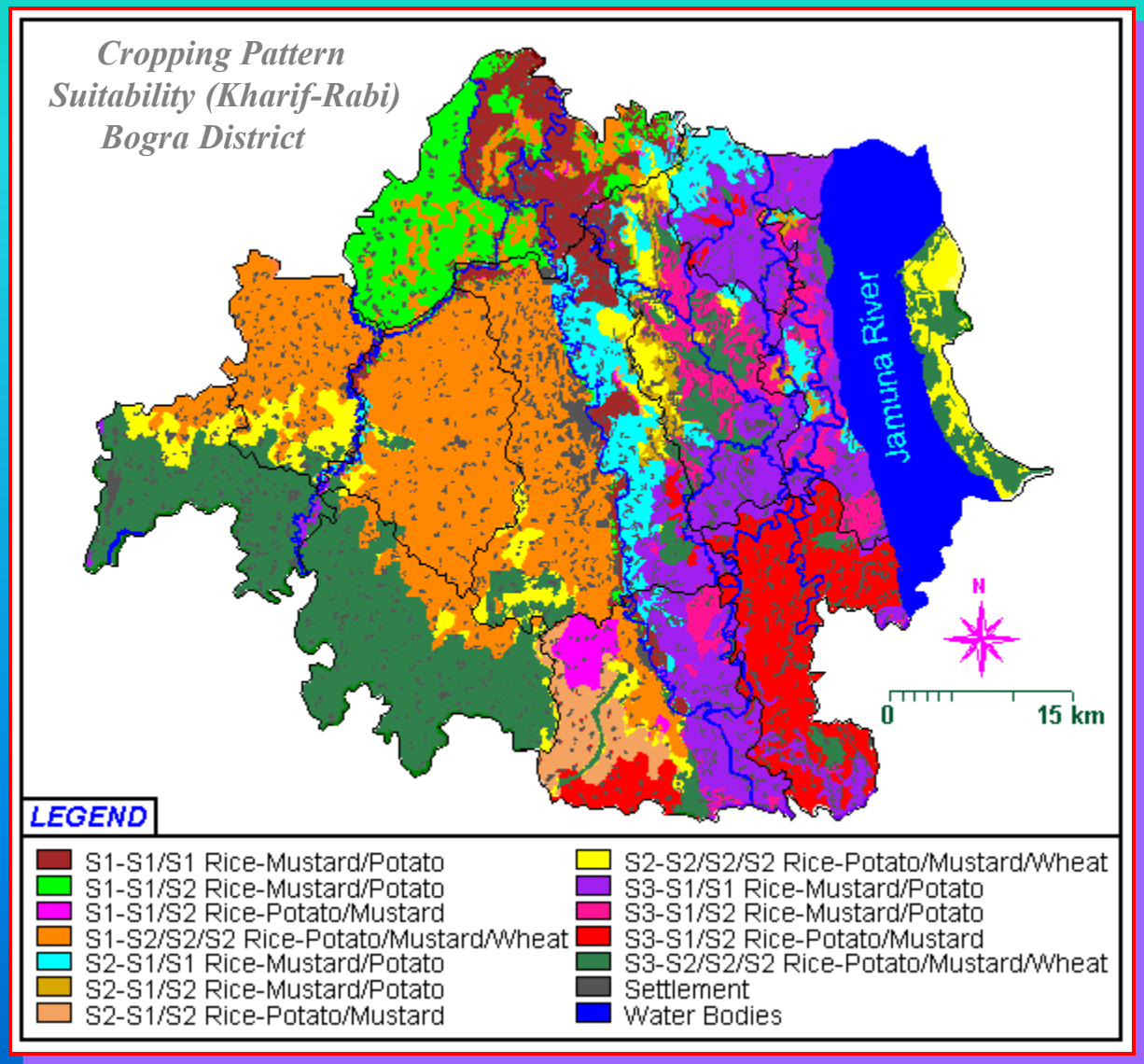




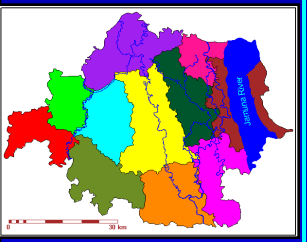
Results

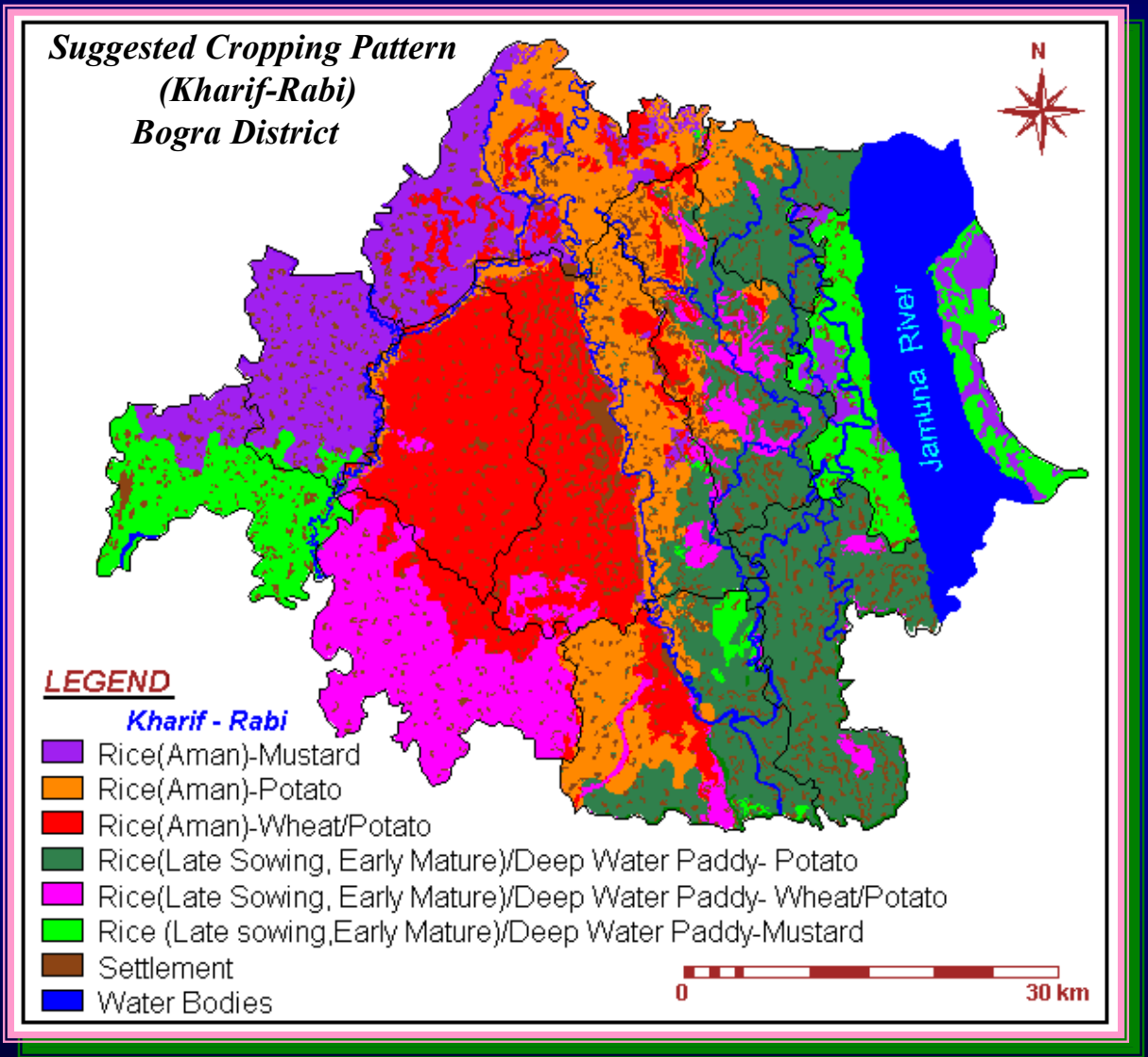


Cropping Pattern (Kharif-Rabi) Suitability



Suggested Cropping Pattern (Kharif-Rabi)





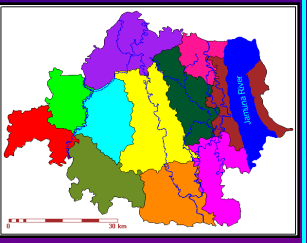
Area Statistic of Suggested Cropping pattern of the Study Area

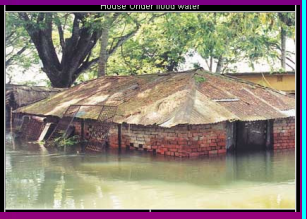
Suggested Cropping Pattern		Area (Hectare)	Area (Sq.Km)	% of the Total Agricultural Land
Flood Season *(Kharif)*	After Flood Season (*Rabi*)			
Rice (*Aman*)	Mustard	37031.49	370.31	15.56
Rice (*Aman*)	Potato	37405.35	374.05	15.72
Rice (*Aman*)	Wheat/Potato	52666.29	526.66	22.13
Rice (Late Sowing, Early Mature)/Deep Water Paddy	Potato	52165.51	521.66	21.92
Rice (Late Sowing, Early Mature)/Deep Water Paddy	Wheat/Potato	30907.57	309.08	12.99
Rice (Late sowing, Early Mature)/Deep Water Paddy	Mustard	27840.75	278.41	11.70
Settlement		25649.56	256.50	-
Water Bodies		27524.93	275.25	-
Total		**291191.44**	**2911.91**	**100.00**

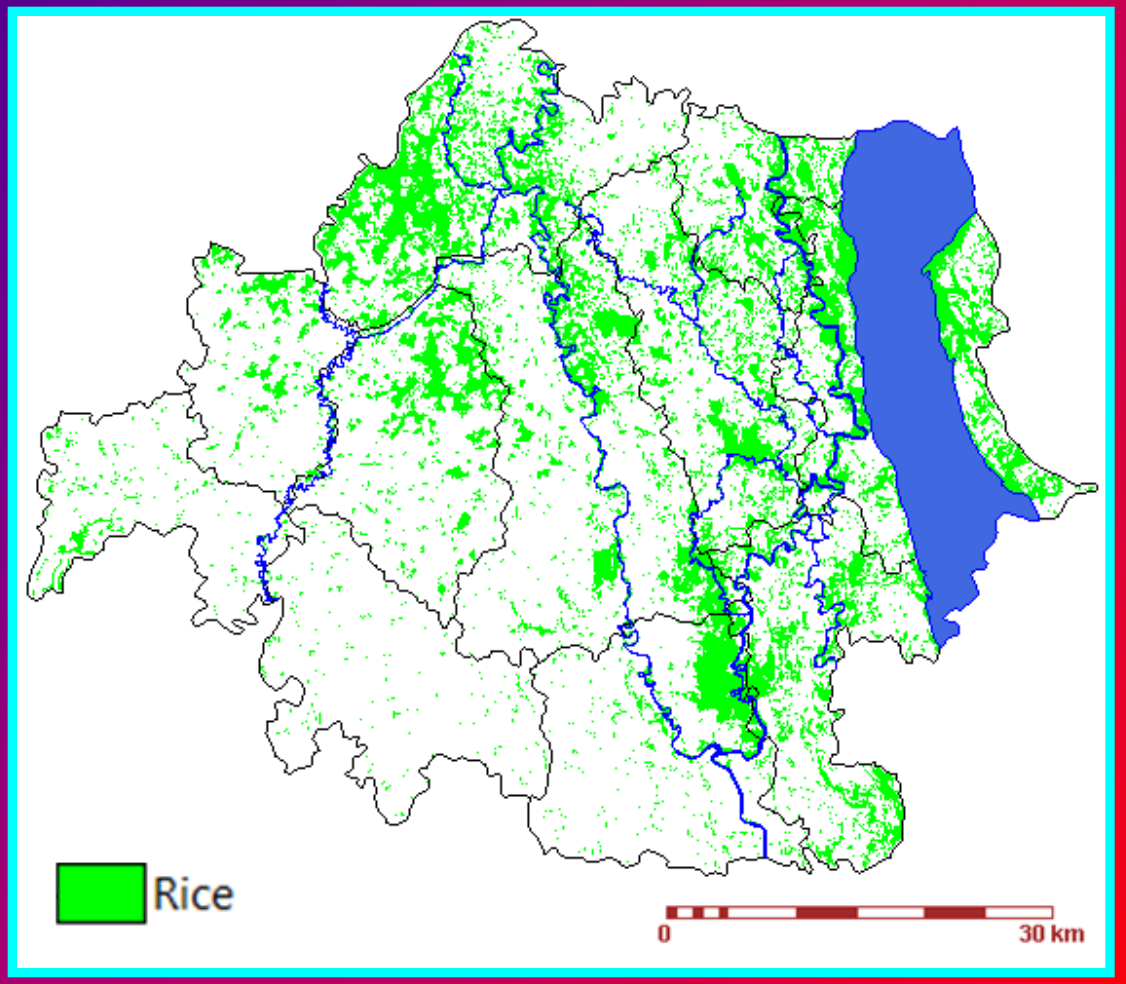
Existing and Suggested Cropped Area

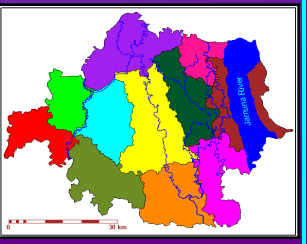
Crop Season	Observed Area (% of the Total Area)		Suggested Area (% of the Total Area)		Crop Suitability	Increased Suggested Area (%)
	Crops	%	Crops			
Kharif (Flood)	Rice	62.75	Rice	43.64	S1+S2	18.99
			Rice (Late Sowing, Early Mature)/ Deep Water Paddy	38.10	S3+S2	
			Total	81.74	-	
Rabi (Post Flood)	Mustard	7.27	Mustard	30.63	S1+S2	23.36
			Wheat/Potato	1.25	S2	1.25
			Total	31.88	-	24.61
	Potato	26.81	Potato	23.47	S1+S2	-3.34
			Wheat/Potato	26.39	S2/S2	26.39
			Total	49.86	-	23.05
	Total	34.08		81.74	-	47.66

Increased Suggested Area (Rice)

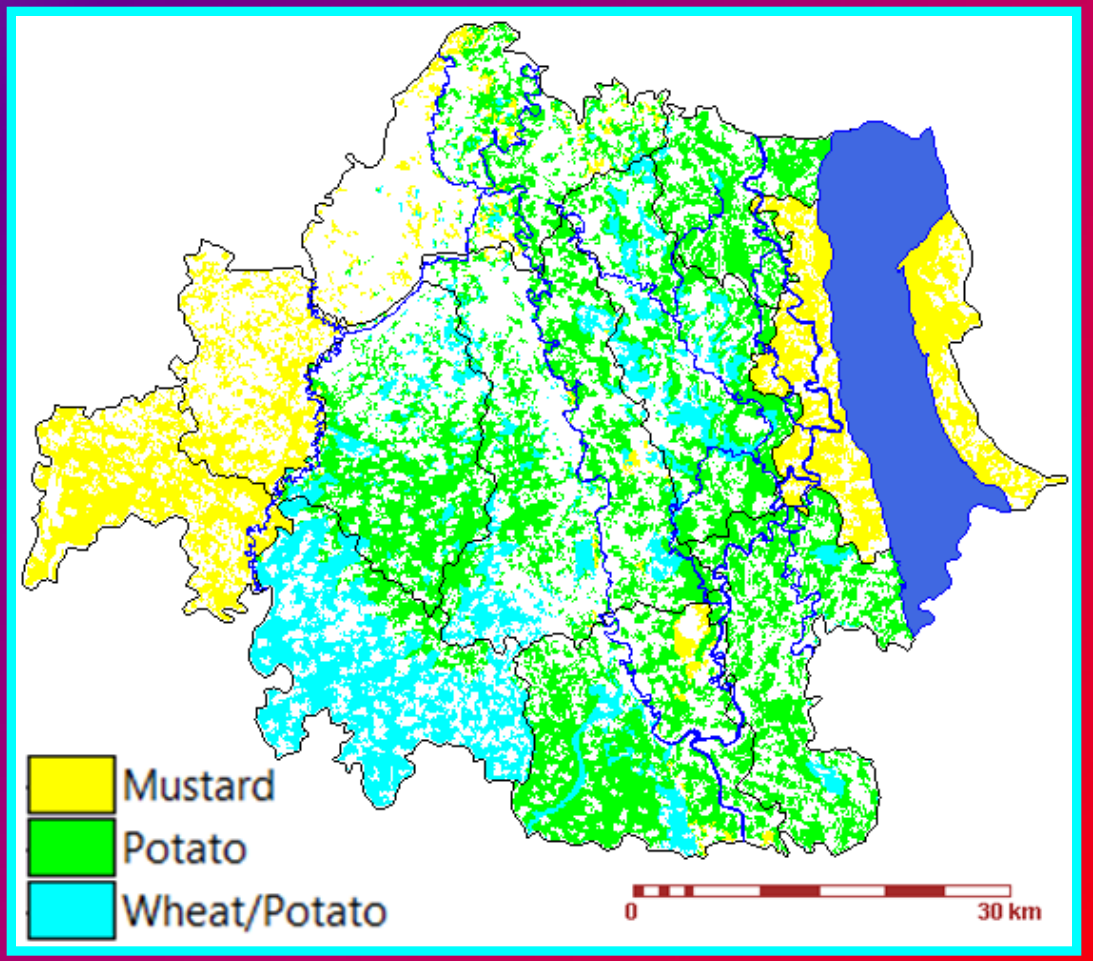








Increased Suggested Area (Mustard, Potato, Wheat/Potato)

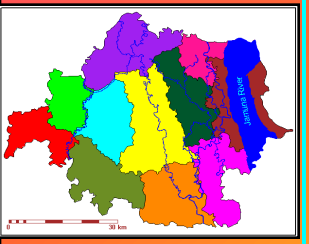


Findings

- Due to climate change, flood is a common devastating phenomenon and a major cause of crop loss or failure almost every year in the study area.
- Rainfall, especially the extreme rainfall in the rainy season over the study area and surroundings caused by monsoon climate can easily result in floods,
- Rice in flood followed by wheat/potato in post flood seasons, would be the most suitable patterns which covers 22.13 percent of the cultivated area.
- Rice (late sowing, early mature)/deep water paddy in flood and potato in post flood seasons could be taken up as a second most suitable patterns which covers about 22 percent of the total cultivated area.

- The cultivation of rice in flood followed by mustard in post flood seasons would be a suitable patterns for 15.56 percent and another 15.72 percent of the cultivated area would be a suitable pattern for rice in flood and potato in post flood seasons.

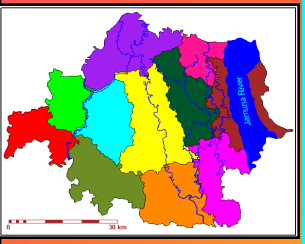
- Comparison statistics between existing cropping patterns and suggested cropping patterns further showed that 18.99 percent of the total area was additionally suggested for rice, and 23.36 and 23.05 percent of the total area were suggested for mustard and potato, respectively, which can increase the total crop production of the area.



Concluding Remarks

- Since Bangladesh is an agrarian country, flood has a great impact on agriculture and a major cause of crop loss or failure in the flood prone area.

- Natural disaster like flood cannot be stopped but can control some extend of it impact through proper planning and this study was an attempt to suggest suitable cropping patterns to reduce the adverse impact of floods in the area.



- Remote sensing and GIS data in a range of formats and from a variety of sources can be used effectively in land evaluation for crops. The SMCE technique, along with expert knowledge, can be utilized in an effective way for land suitability analysis for crops and cropping pattern planning for a flood prone area.

- It is expected that land-evaluation for crops will be useful for identifying areas suitable for crops in terms of efficient income generation and sustainable land management to overcome the climate change, particularly the natural hazard problem of the area.

Thank U All.....