Regional Conference on
Climate Change: Challenges and Opportunities for South Asia
Islamabad, Pakistan
January 13–14, 2009

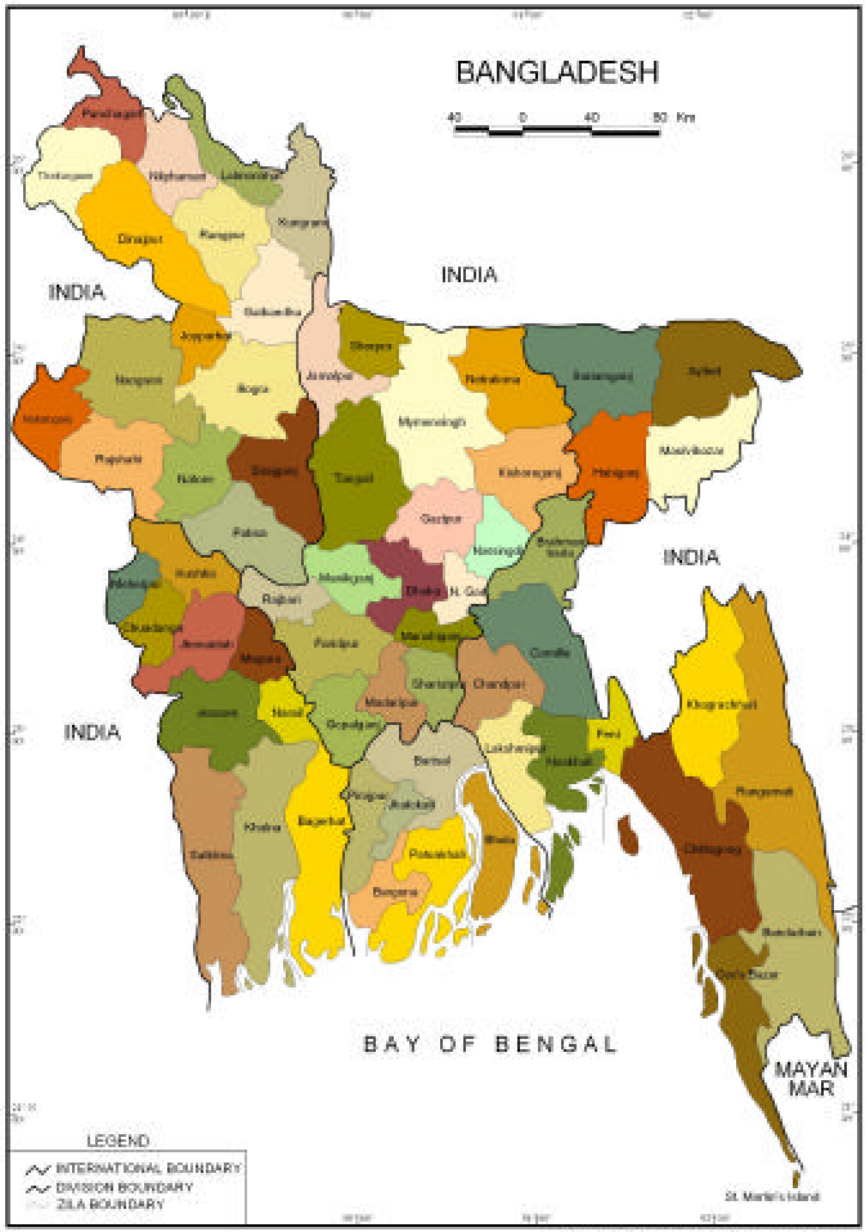
Impact of climate change on disasters and agriculture in Bangladesh

Ahmadul Hassan
ahassan@cegisbd.com

Center for Environmental and Geographic Information Services (CEGIS)
Bangladesh

CEGIS

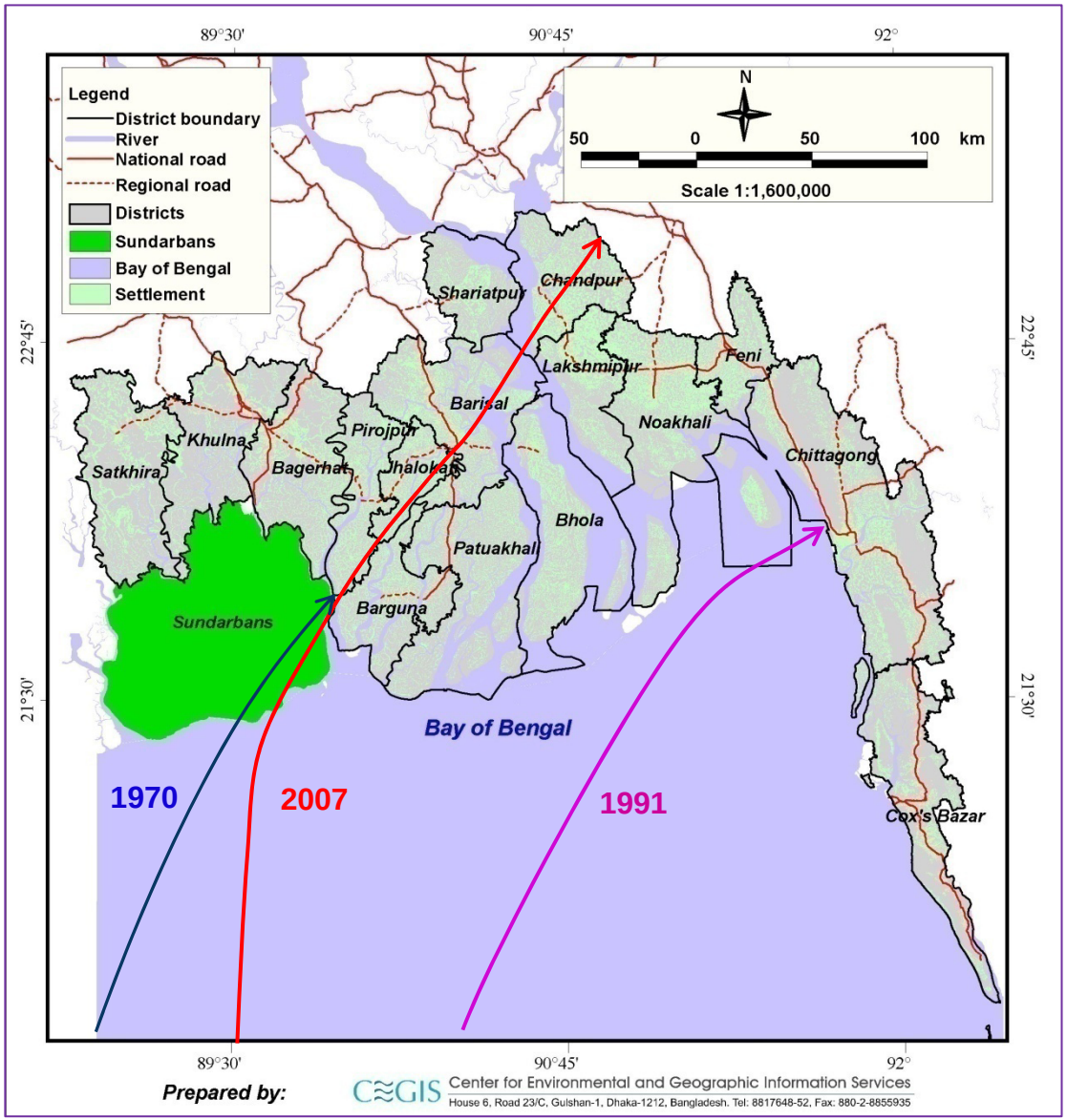
Bangladesh



- Total area 147,570 sq. km
- Population: 139.8 million (2005)
- GDP (per capita): $397 (per person, 2006)
- Major Disasters
  - Flood
  - Cyclone/Tornado
  - Drought
  - Erosion

CEGIS

Disasters in Bangladesh - Cyclone



- 16 coastal districts are vulnerable to Cyclone
- Total area: 42,500 km^2
- Total population: 31 million **(BBS, 2001)**

History of major cyclones

1970

Storm Surge: 6-9 m
Maximum Wind Speed: 223 km/hr
Affected District: 5
Affected People: 1,100,000
No of Dead People: 470,000

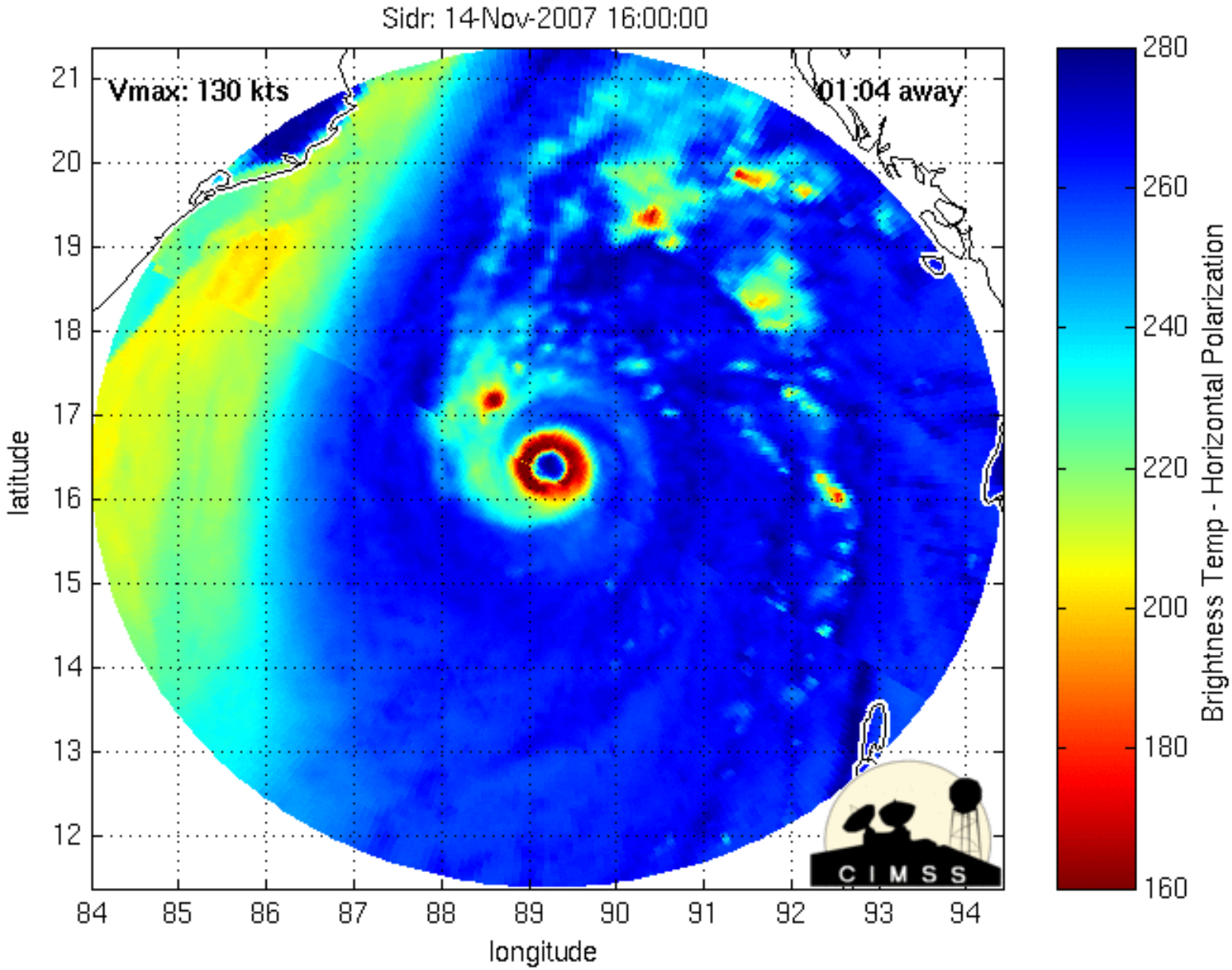
1991

Storm Surge: 6-7.5 m
Maximum Wind Speed: 225 km/hr
Affected District:19
Affected People: 13,798,275
No of Dead People:138,882

2007

Storm Surge: up to 10 m
Maximum Wind Speed: up to 240 km/hr
Affected District: 30
Affected People: 6,851,147
No of Dead People: 3,292
Total damage: BDT 115.6 billion (US$ 1.7 billion) which is equivalent to 2.8% of Bangladesh's GDP(GOB, 2008)

Cyclone Sidr



Source:http://cimss.ssec.wisc.edu/goes/blog/wp-content/uploads/2007/11/071115_sidr_mimic_anim.gif

Disasters in Bangladesh - Flood

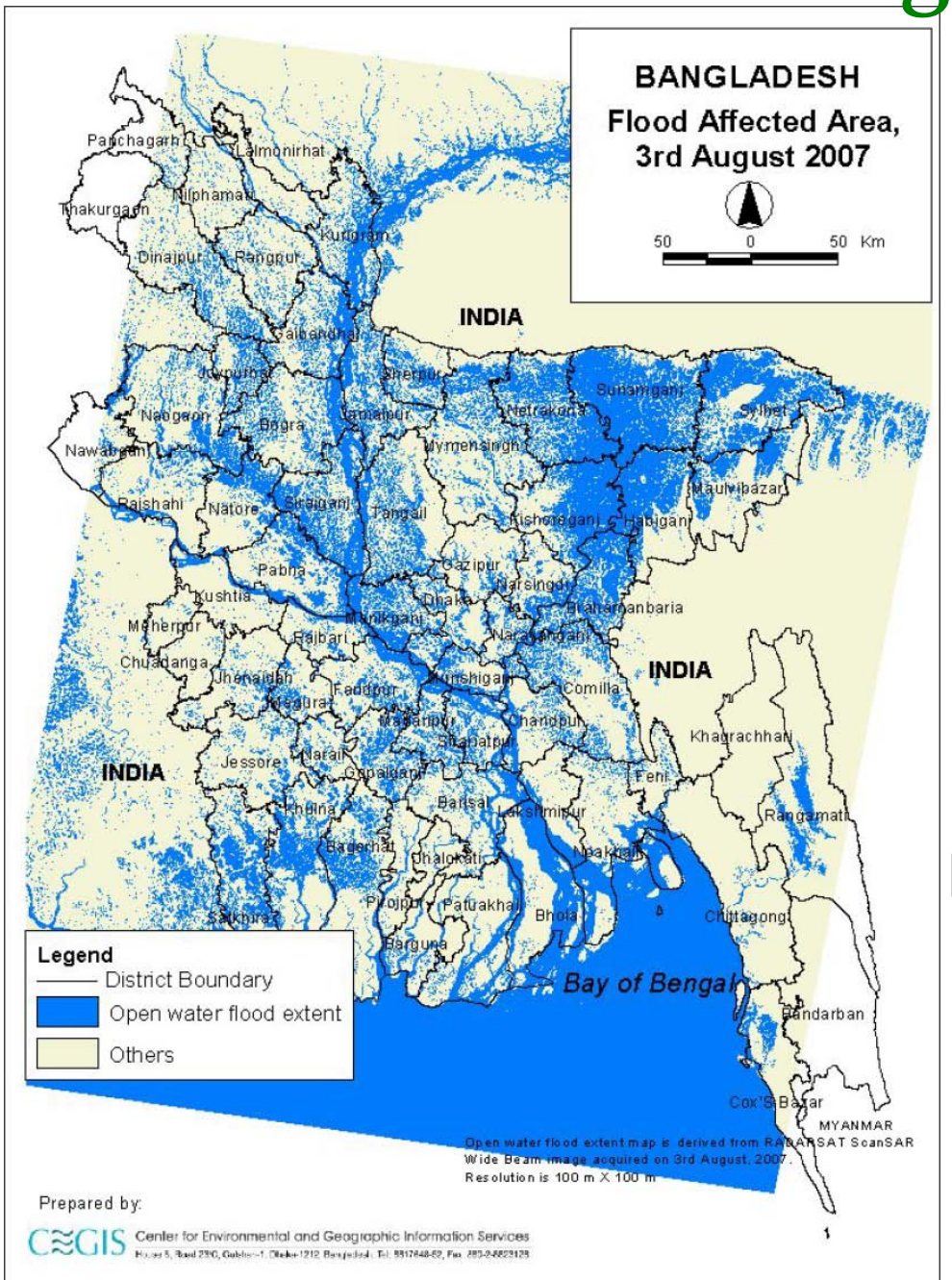
Sources of Flood

- Upstream flow
- Increase in rainfall
- Unplanned urbanization

- Normally inundated area: 22%.
- inundated area (In Extreme floods like,1988): about 60%.
- Exposed population: Around 10 million

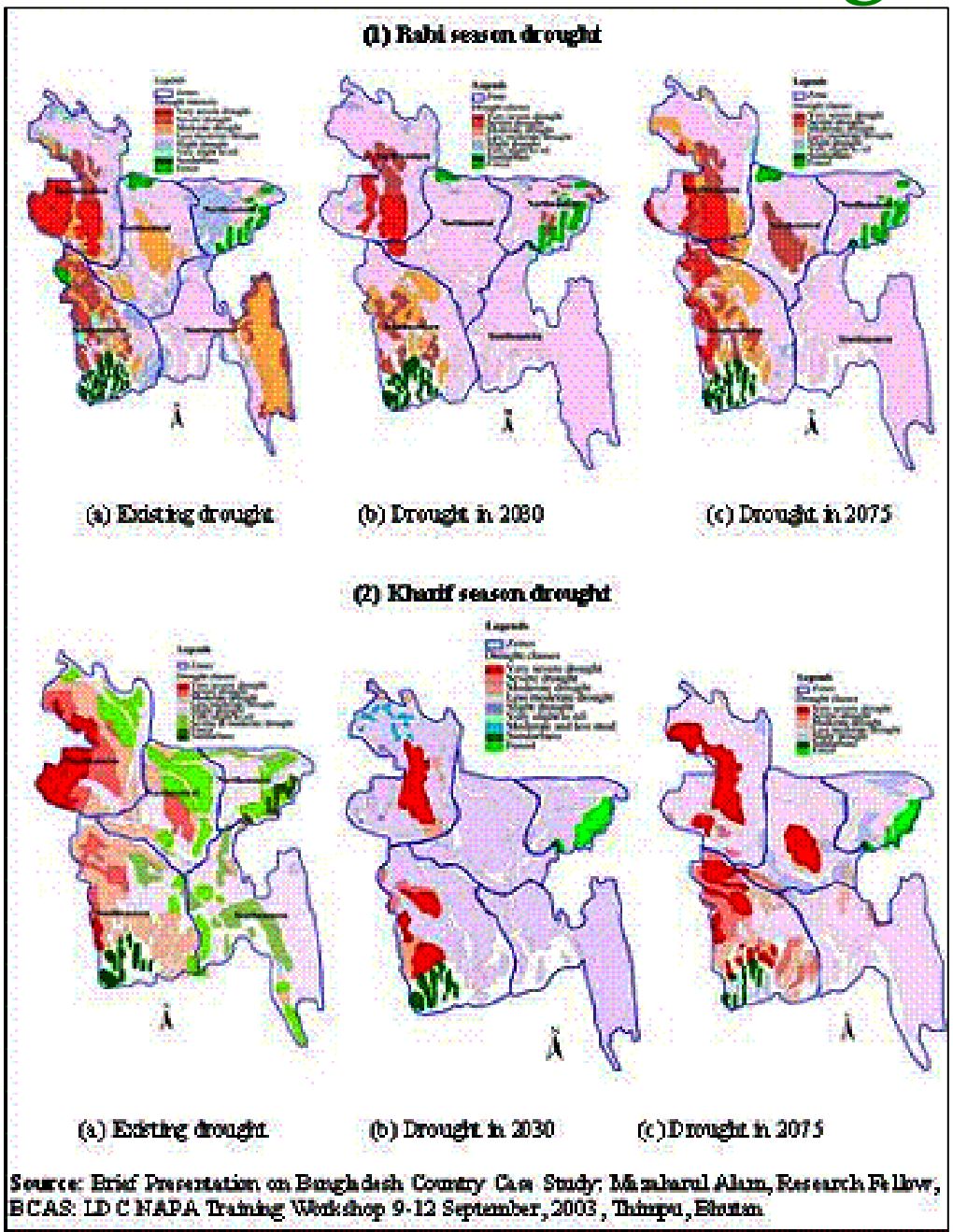
Year		1987	1988	1998	2004	2007
District		50	52	52	39	46
People		24823376	35732336	30916351	36337944	13771380
Crops damaged (Acre)	Fully	2983362	364258	1423320	1605958	890898
	Partially	1873207	9902967	1808401	1038176	1353366
No. of House damaged	Fully	71572	1030659	980571	894954	84321
	Partially	1691104	2265776	2446395	3389101	1003799
No. of Dead People		1470	1517	918	747	1092
No. of Dead Livestock		370129	348042	26564	15143	1459
No. of Damaged Institution	Fully	1155	2593	1718	1295	563
	Partially	2583	6506	23272	24276	8190
Road Damaged	Fully	12624	45840	15927	14271	3705
	Partially	11534	14016	45896	45528	27828

Disasters in Bangladesh - Flood



Flooded Area: about 44,000 sq. km.

Disasters in Bangladesh - Drought



19 droughts had occurred in Bangladesh during 1949 – 1991 (Mirza and Paul, 1992).

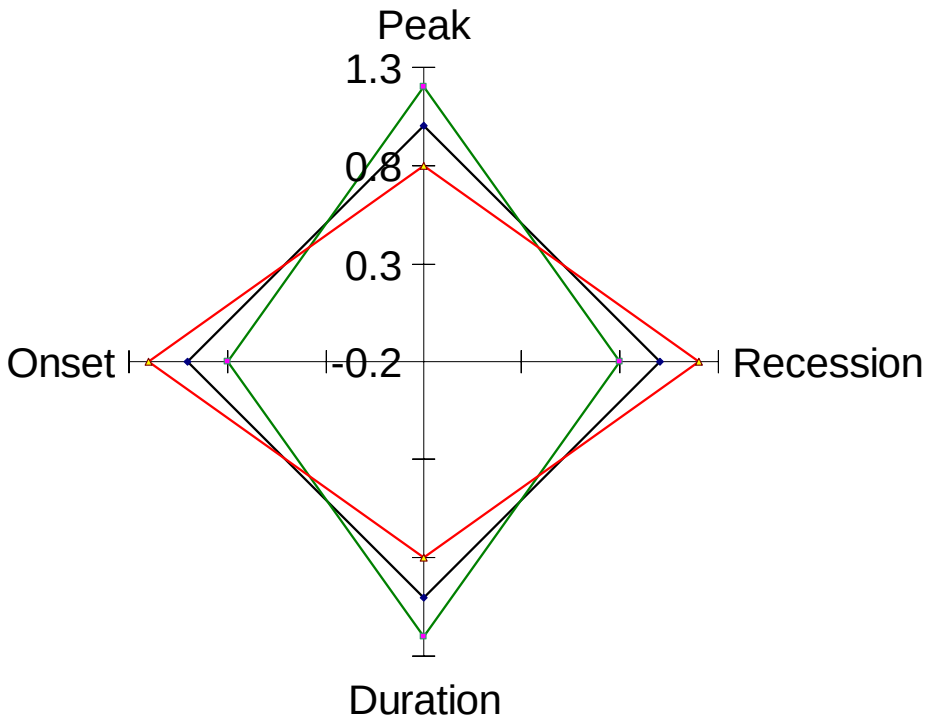
Typically affected

- About 47% area and 53% population are affected (Task Force, 1991).
- T Aman is mainly exposed to draught.

<u>Current trend:</u> increase in area affected (**6% in 28 years**)

Flood classification and characteristics

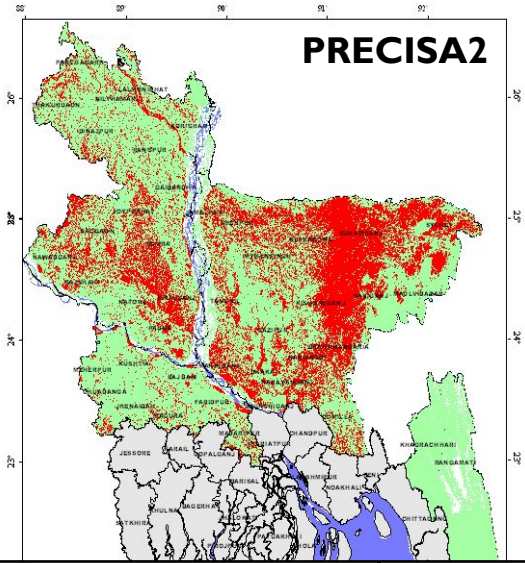
	Value	Meaning	Value	Meaning
Onset	>1 (moves Left)	Early flood	<1 (moves Right)	Late flood
Peak	>1 (moves upward)	Above normal	<1 (moves downward)	Below normal
Duration	>1 (moves downward)	Longer duration	<1 (moves upward)	Shorter Duration
Recession	>1 (moves Right)	Delayed Recession	<1 (moves Left)	Quick Recession

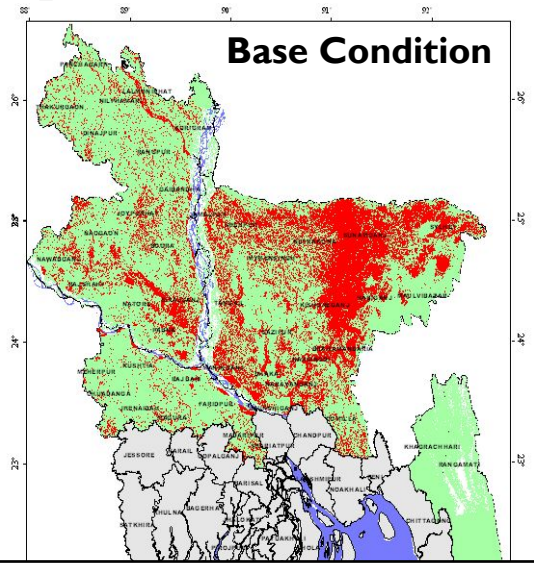


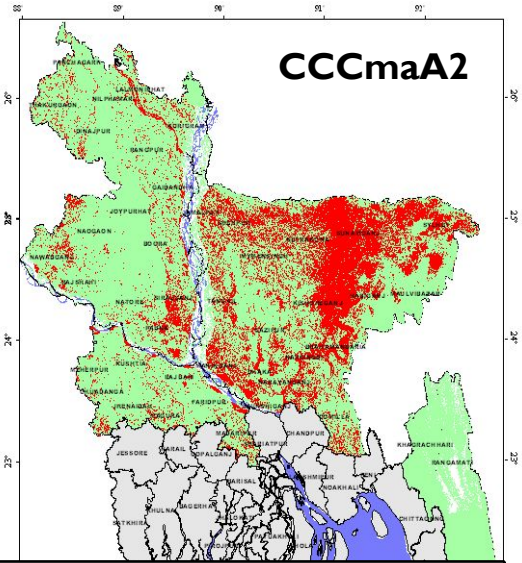
Impact Assessment using Flood Classification

Sector	Thematic	Onset	Peak	Recession	Duration
Agriculture	Aus		-		
	Aman			-	
	Boro	-			+
Fisheries	Capture	+	+	-	+
	Culture		-		-
Erosion	Main River		-	+	
	Regional River		-	+	

Predicted Impact – Flooded area



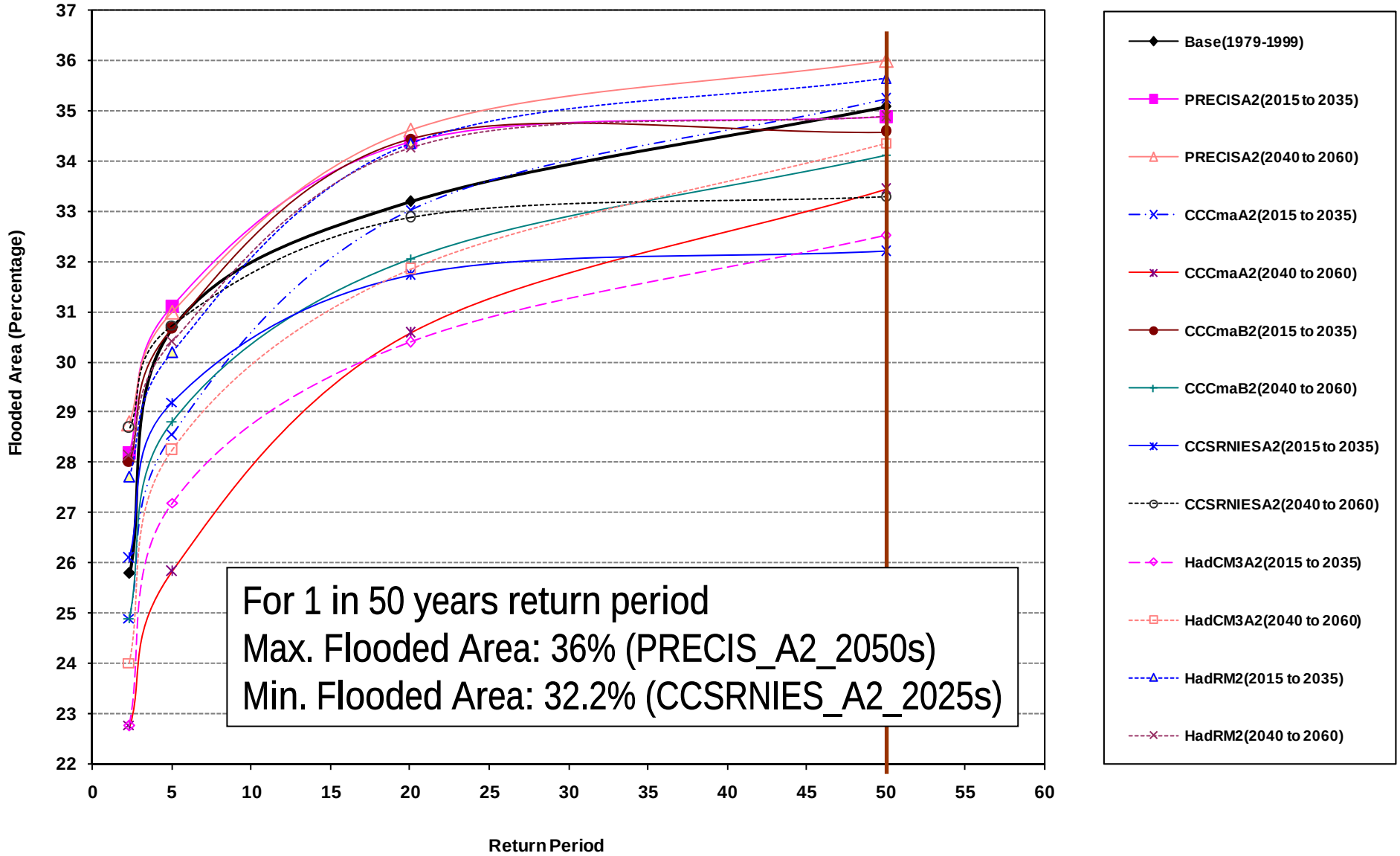




Hydrologic Region	Time Period: 2040-2060 Return Period: 1 in 2.33 year		
	PRECISA2	Base (1979-1999)	CCCmaA2
	Flooded Area (%)		
North Central	32	32	29
North East	58	56	54
North West	24	18	12
South Central	18	16	16
South East	45	39	36
South West	20	18	15

CEGIS

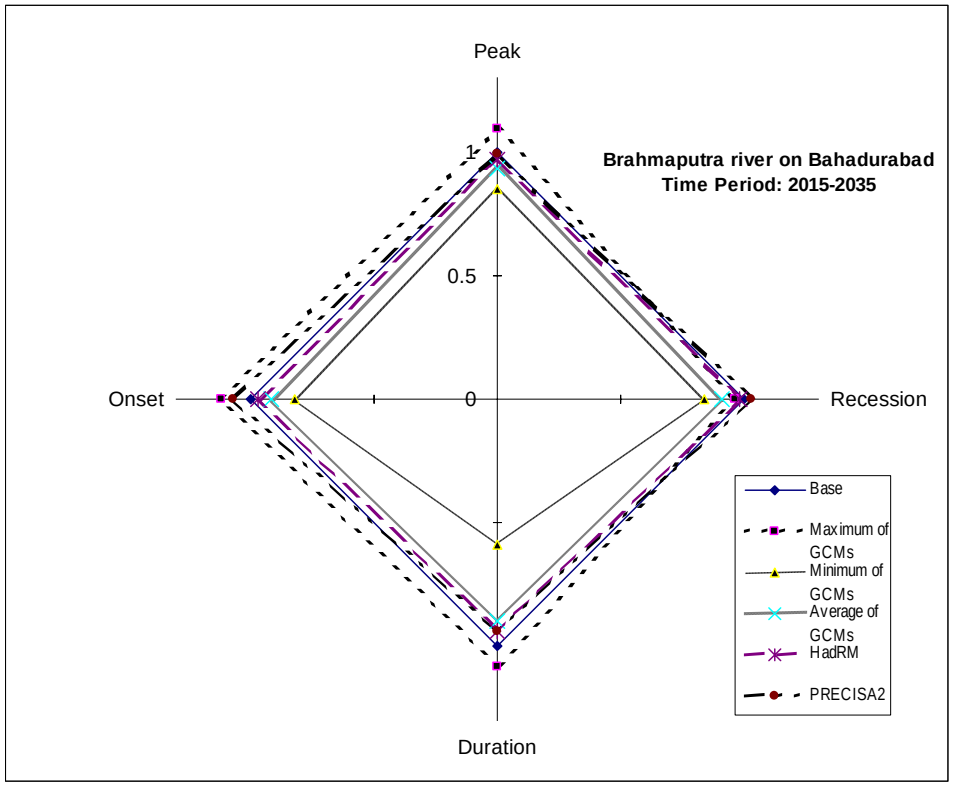
Predicted impacts – Change in Frequency



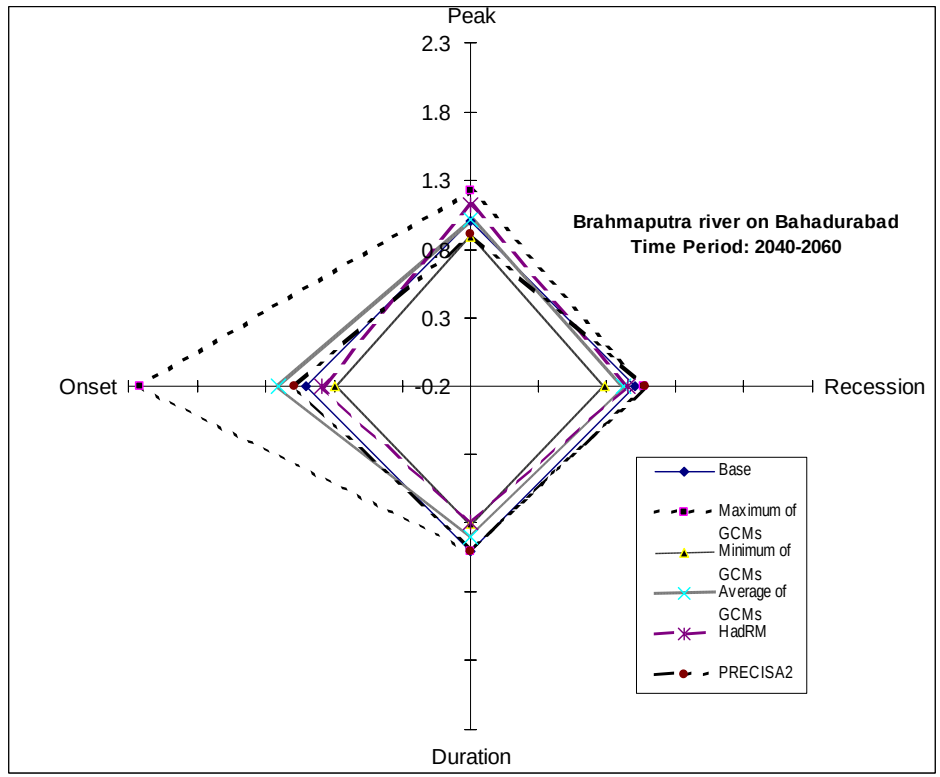
CEGIS

Changing Flooding Characteristics

Brahmaputra Dependent Area



Time period: 2015-2035

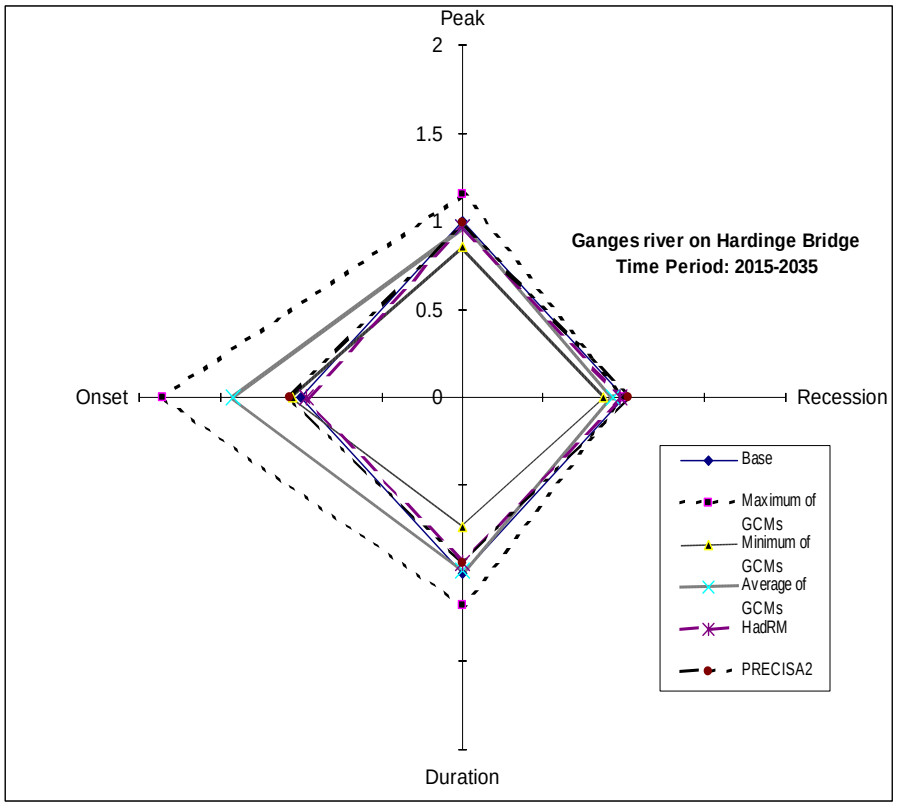


Time period: 2040-2060

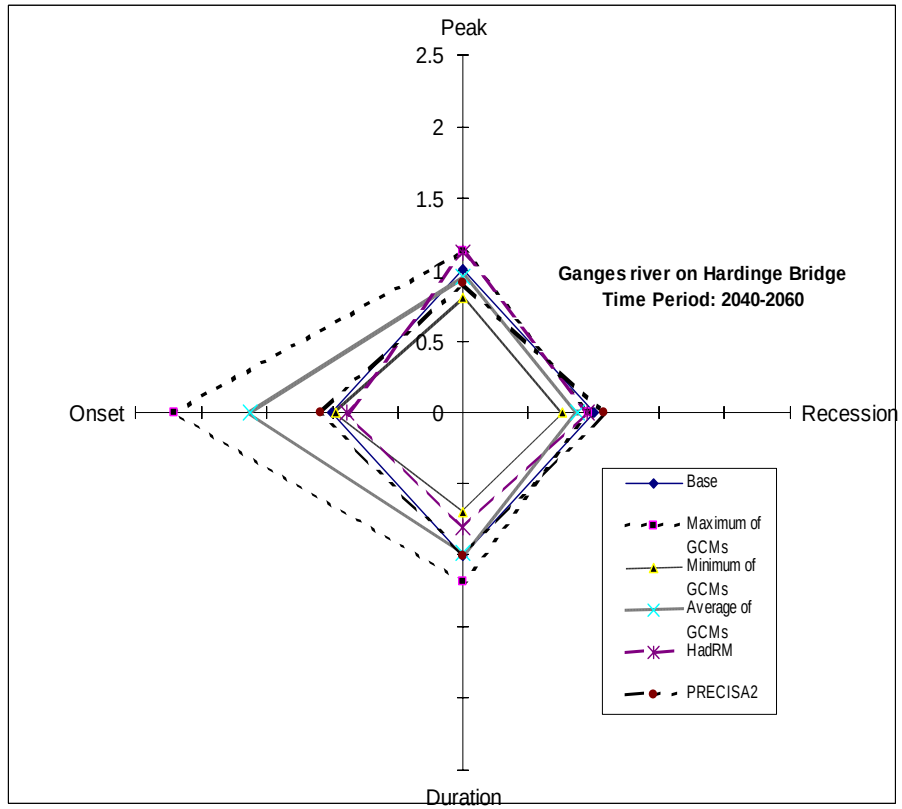
CEGIS

Changing Flooding Characteristics

Ganges Dependent Area



Time period: 2015-2035

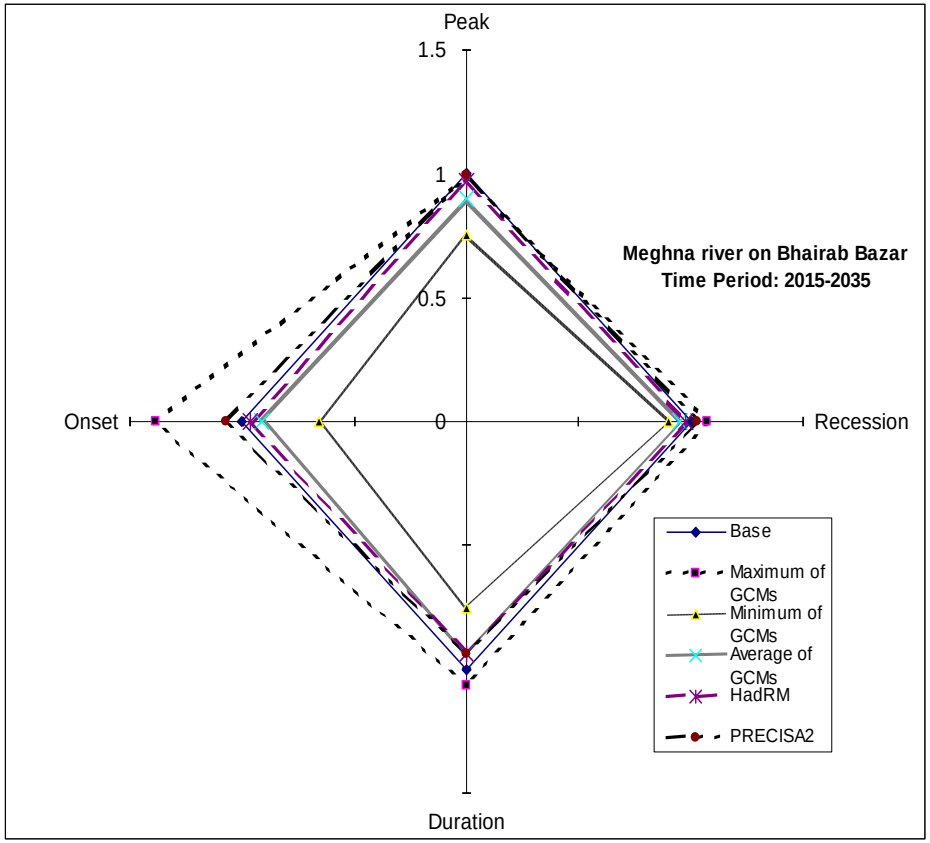


Time period: 2040-2060

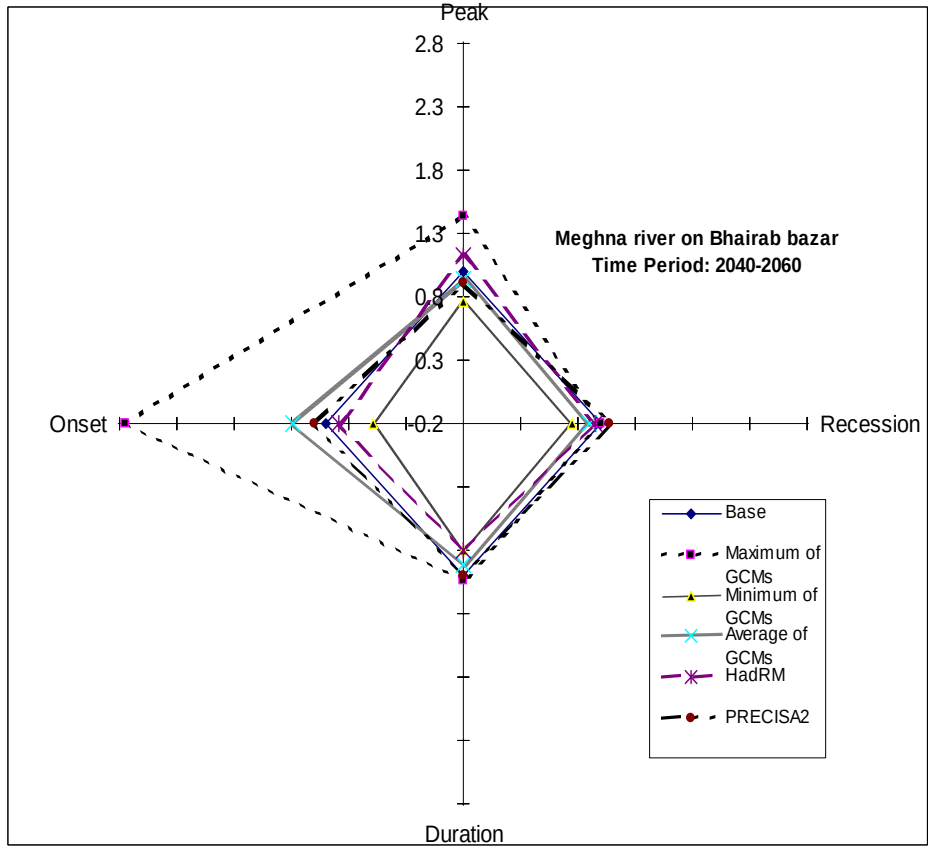
CEGIS

Changing Flooding Characteristics

Meghna Dependent Area



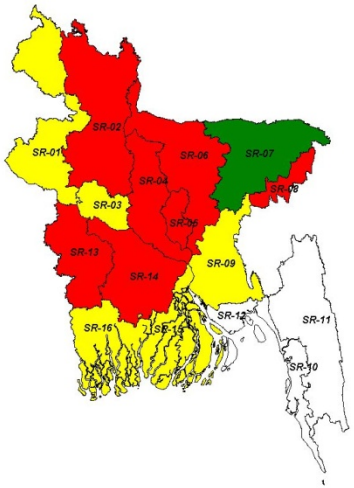
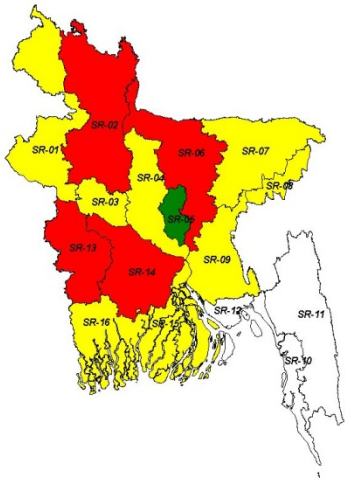
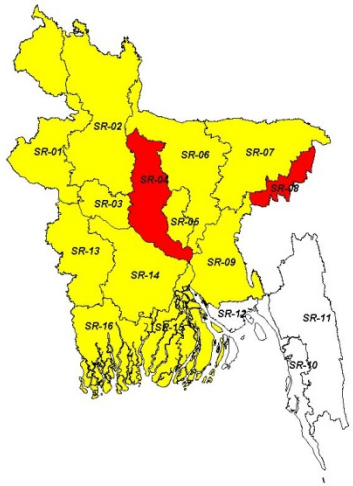
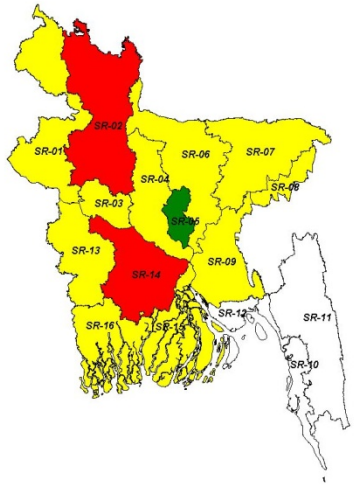
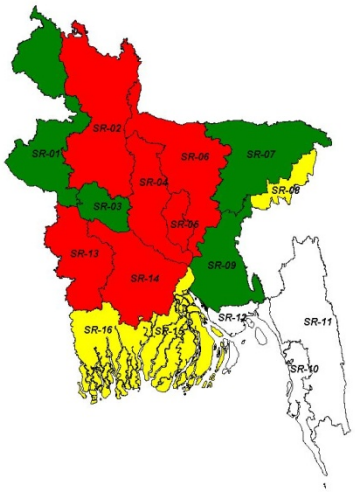
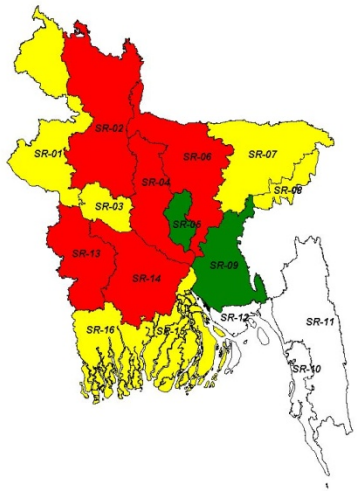
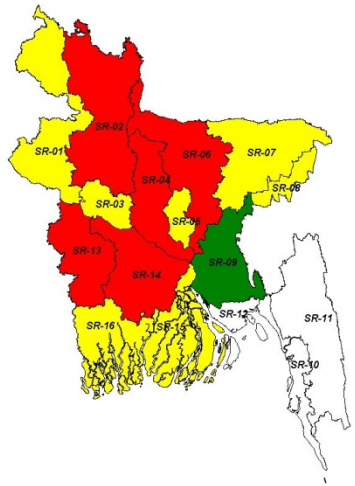
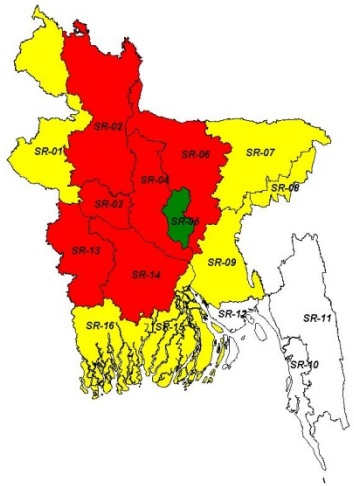
Time period: 2015-2035



Time period: 2040-2060

CEGIS

Change in Flood Characteristics in Bangladesh
GCM: CCSM, Scenario: A2

Time Period	Onset	Peak	Recession	Duration
F1 (Yr: 2020-2049)				
F2 (Yr: 2040-2069)				

Legend

Change in Flood Characteristics
- Positive
- Negative
- No Change
- No Data

N

30 0 30 60 km

Scale 1:4,600,000

Prepared by:

C≈GIS

Center for Environmental and Geographic Information Services

House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8855935

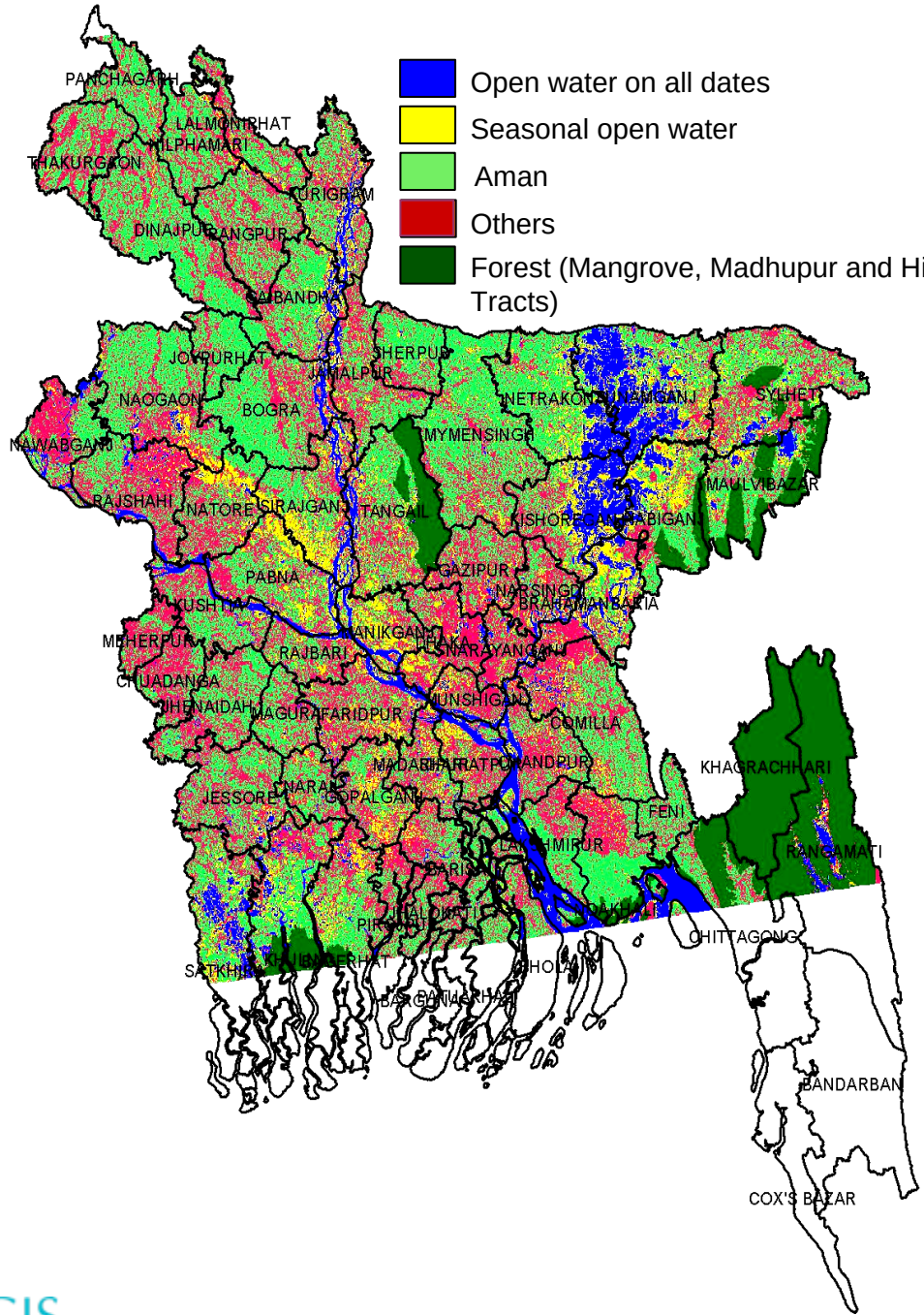
C≈GIS

Agricultural Production in Bangladesh

Dependent Area	Aus		Aman		Boro	
	Area (Sq Km)	Production ('000' metric ton)	Area (Sq Km)	Production ('000' metric ton)	Area (Sq Km)	Production ('000' metric ton)
Brahmaputra dependent area	1,005	128	7,314	1,303	7,443	2,622
Ganges dependent area	5,299	766	19,446	3,513	10,968	3,922
Meghna dependent area	3,318	478	23,051	4,232	20,979	6,916
Other rivers dependent area	636	128	2,988	771	1,249	357
Total	10,258	1,500	52,799	9,819	40,639	13,817

Agriculture

Aman Rice

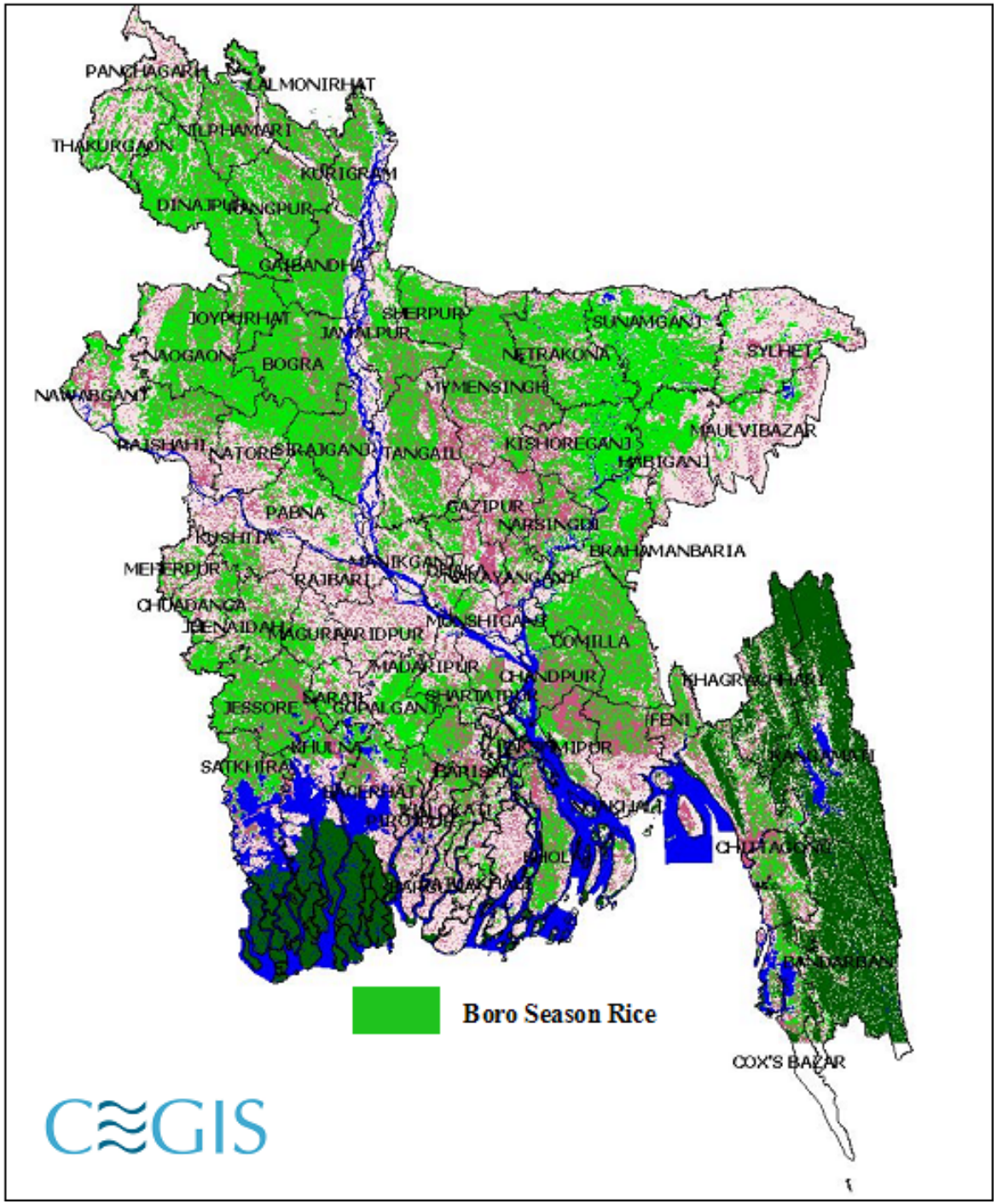


The total Aman (monsoon rice) Area is 4.487 million hectares (using RS).

CEGIS

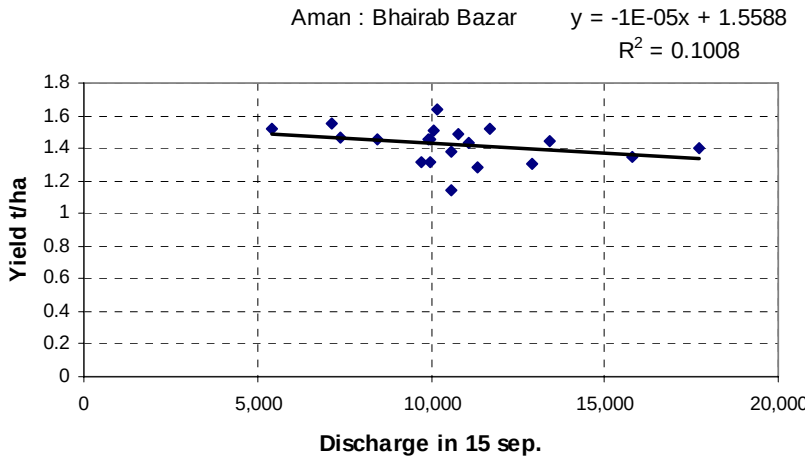
Agriculture

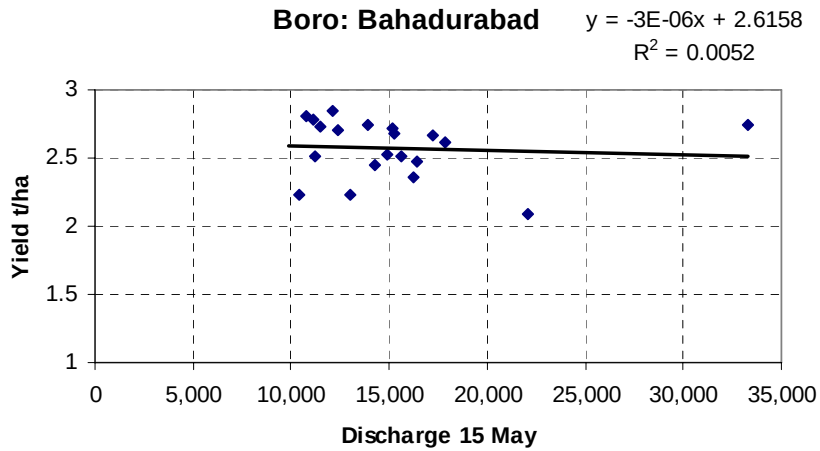
Boro Rice



The total Boro (winter rice) area is about 4.5 million hectares (CEGIS, 2008).

Agriculture: Production Loss



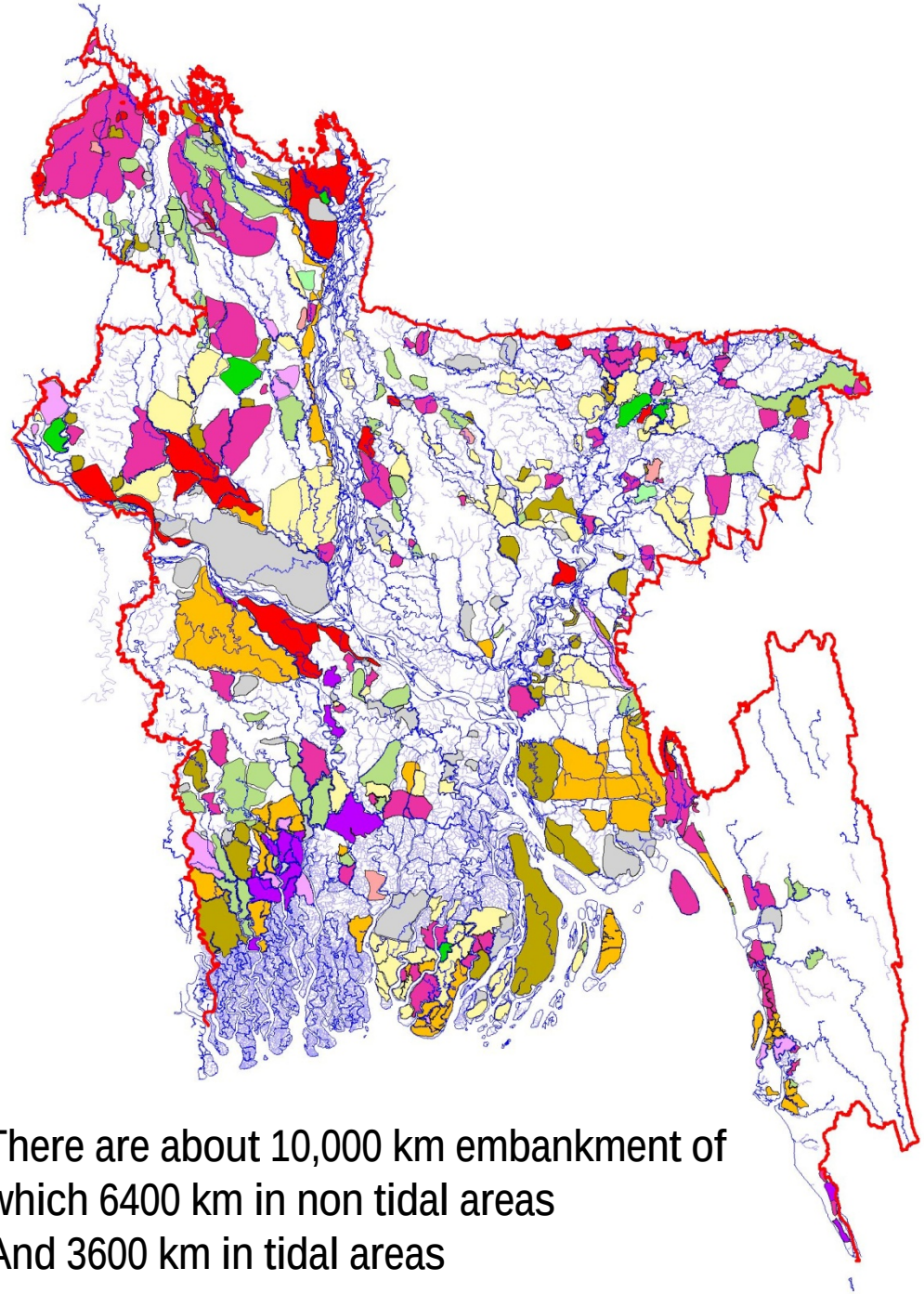


Model	Location	Boro Production Loss (%)		Aman Production Loss (%)	
		2025s	2050s	2025s	2050s
GCM_{max}	Hardinge Bridge	9.91	11.54	0.04	-0.76
GCM_{mean}		4.84	10.15	-1.22	-2.13
GCM_{min}		0.61	-0.31	-2.12	-4.05
GCM_{max}	Bahadurabad	0.20	2.12	-0.05	0.09
GCM_{mean}		-0.15	0.36	-0.13	-0.10
GCM_{min}		-0.31	-0.36	-0.21	-0.30
GCM_{max}	Bhairab Bazar	1.54	6.97	2.62	-0.02
GCM_{mean}		-0.35	1.14	-1.70	-3.82
GCM_{min}		-1.37	-1.67	-3.45	-8.92

CEGIS

Water Management Infrastructure Development

- Up to 1955
- Up to 1960
- Up to 1965
- Up to 1970
- Up to 1975
- Up to 1998
- Up to 1995
- Up to 1990
- Up to 1985
- Up to 1980



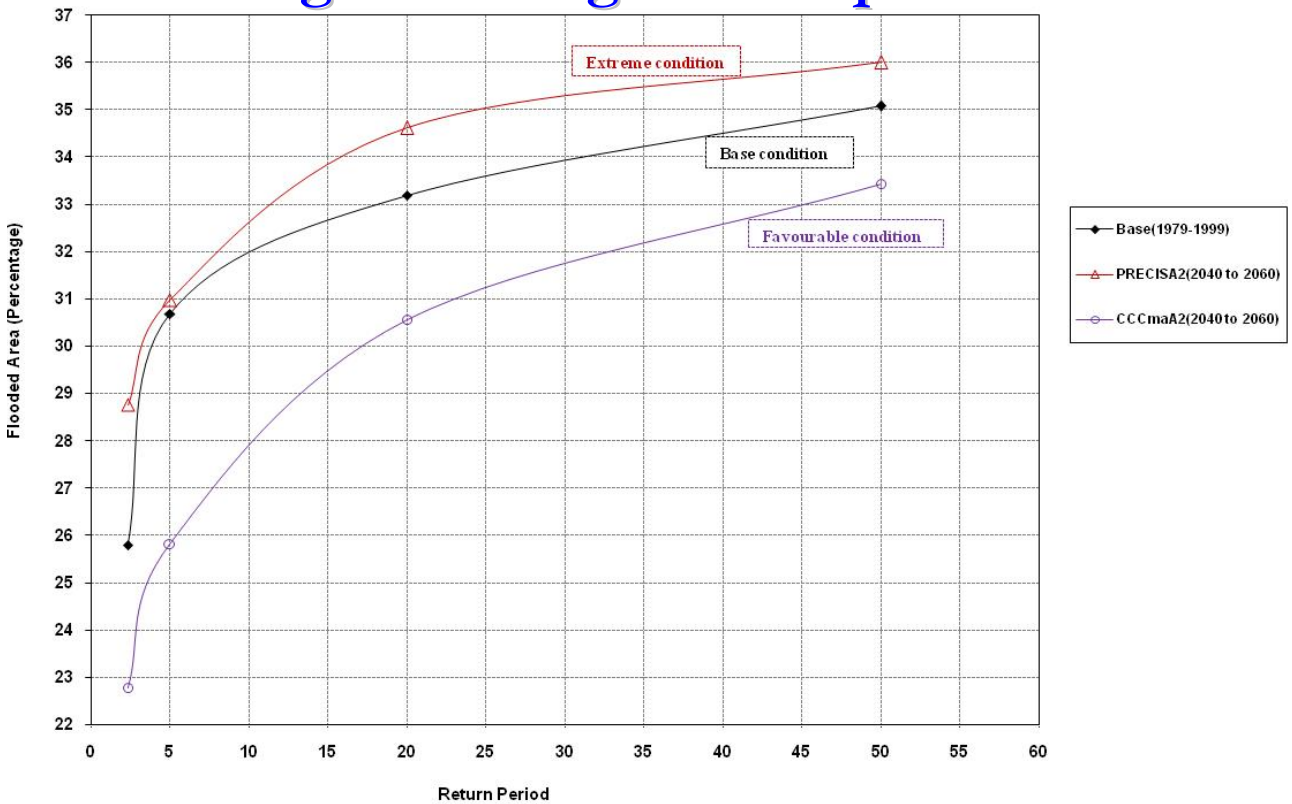
Project Type	1951-1998	
	No	Area in Sq.Km
Drainage	21	1606
Flood Control	16	3587
Flood Control & Drainage	102	11899
Flood Control Drainage/ Irrigation	176	20552
Irrigation & Drainage	22	1628
Irrigation	40	5383
Bank Protection	11	73
B'desh Total	388	44729

There are about 10,000 km embankment of which 6400 km in non tidal areas
And 3600 km in tidal areas

CEGIS

Water Management Infrastructures

Changes in design return periods for embankments

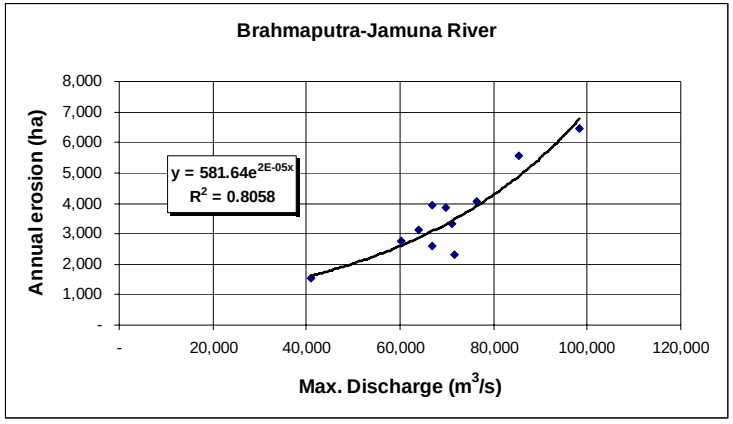


To provide same level of Safety Embankments need to be raised around 30 cm

Station Name	Embankment	Present Design Return Period	Return Period due to climate change in 2050	Additional height need to raise
		(yr)	(yr)	m
Hardinge Bridge	Major River	1 in 50	1 in 25	0.28
	Regional River	1 in 30	1 in 15	0.31
Bahadurabad	Major River	1 in 50	1 in 25	0.22
	Regional River	1 in 30	1 in 15	0.23

River Bank Erosion

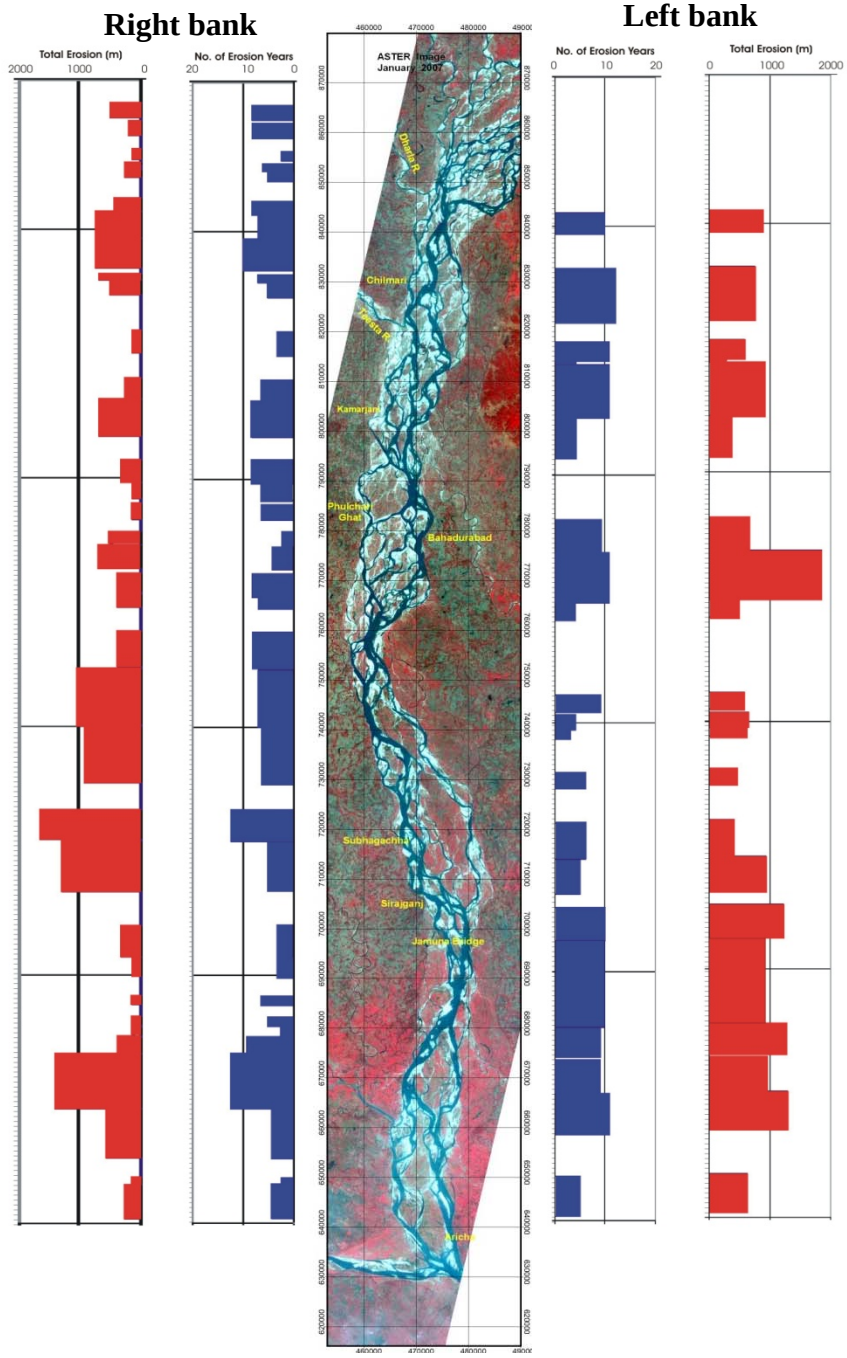
Present Erosion: 2200 ha => 20,000 people permanently displaced every year.



CC impacts:

- 10% increase in extreme flood resutls
- 20% increase in erosion

Brahmaputra/Jamuna River



CEGIS

Conclusion

- Climate change is causing increased frequency of Disasters like Flood, Cyclone, Drought, Erosion etc.
- These are ultimately impacting on Food security and Livelihoods of the people.

Thank You