Environmental Change and Migration from Indian Sundarban :
The Need for an adaptation policy:

Prof. Sugata Hazra,, Tuhin Ghosh, Rituparna Hajra
School of Oceanographic Studies
Jadavpur University

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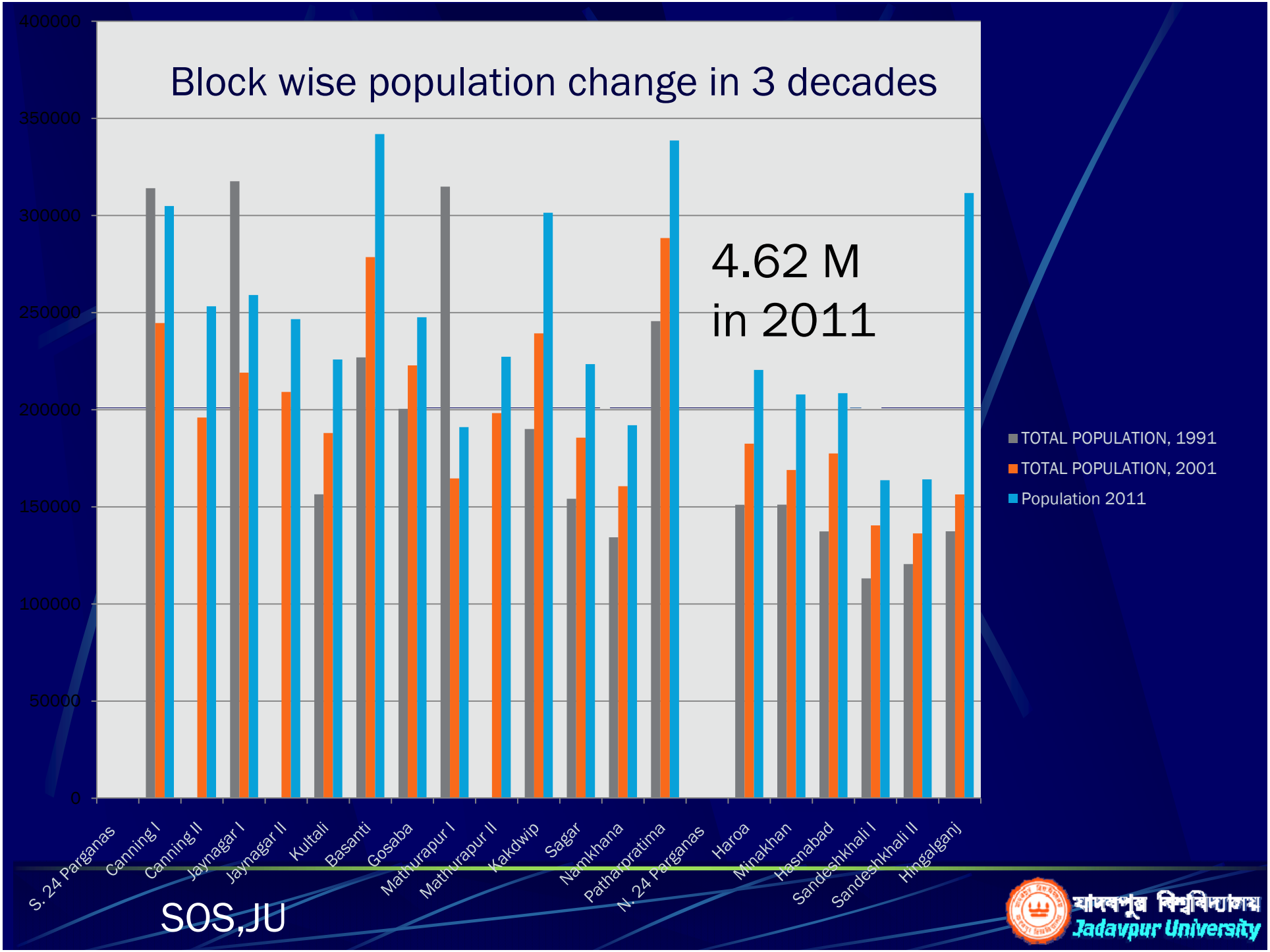

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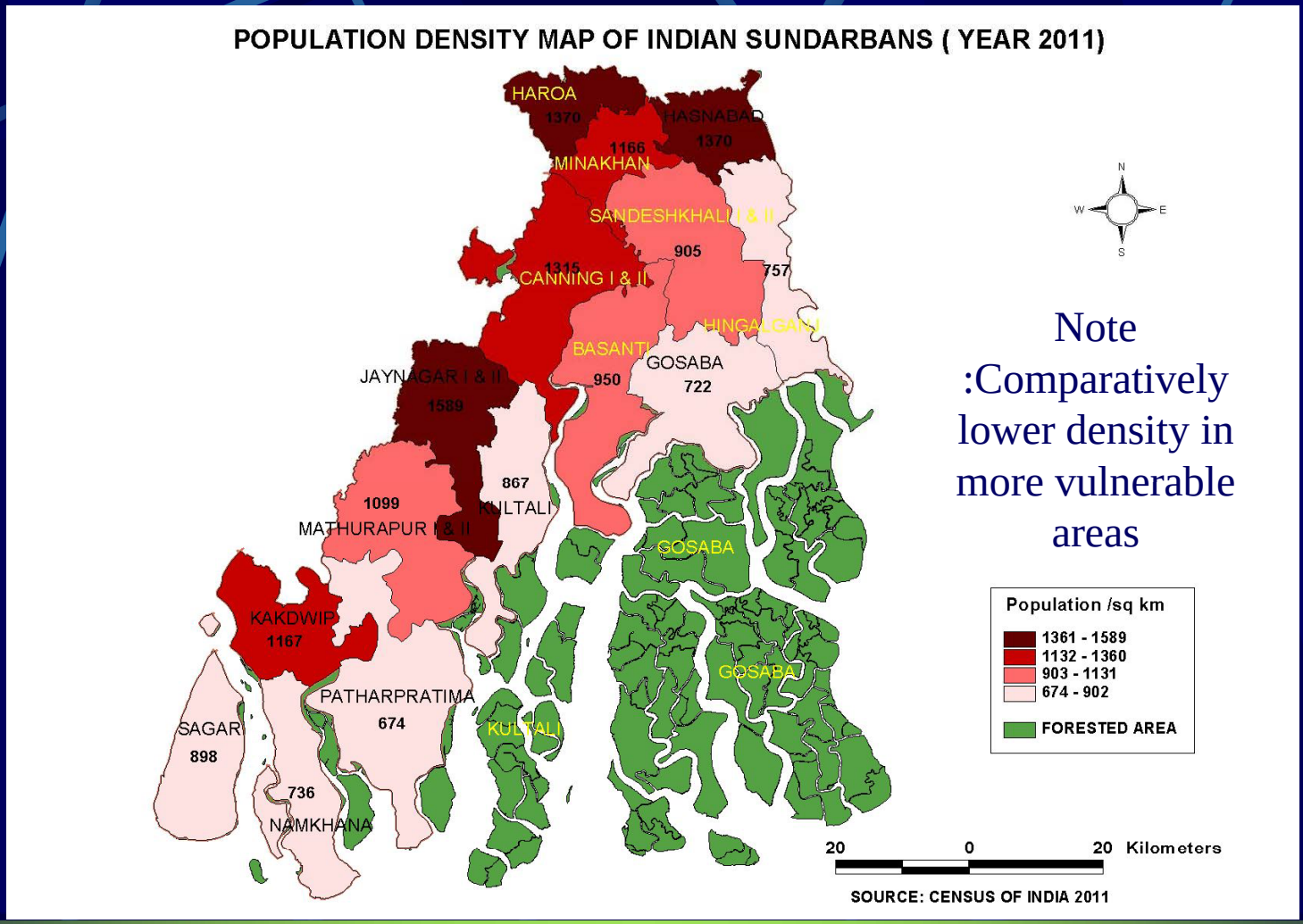
High population Density in Climate Sensitive Sundarban

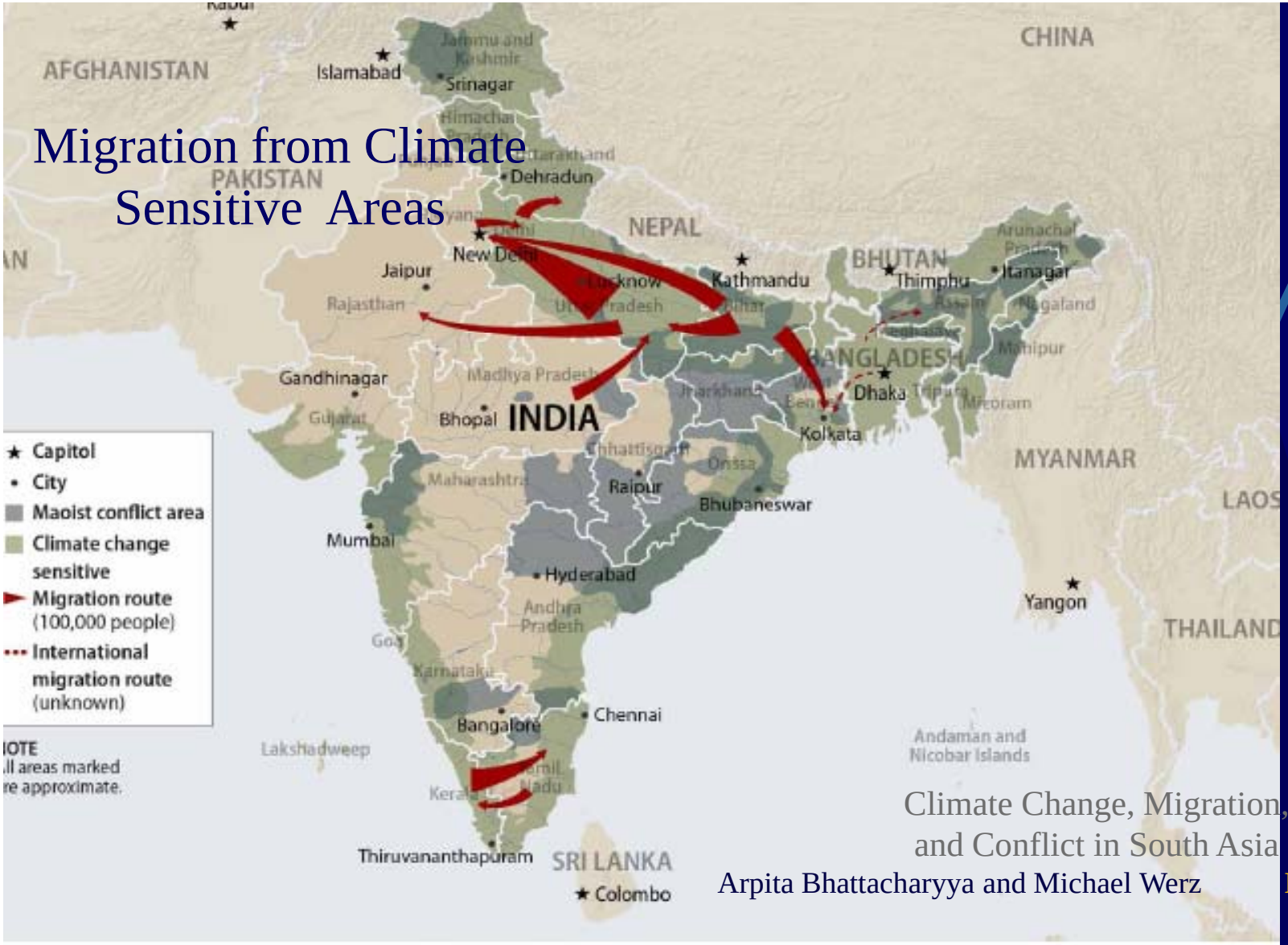


John Hutton ,1994 in "**Global Warming**"

'0.5M SLR would make 6 M and 1m rise would make 15 M Climate refugees by 2050 from Bangladesh'

Around 3 M from Indian Sundarban !!

Migration from Climate Sensitive Areas

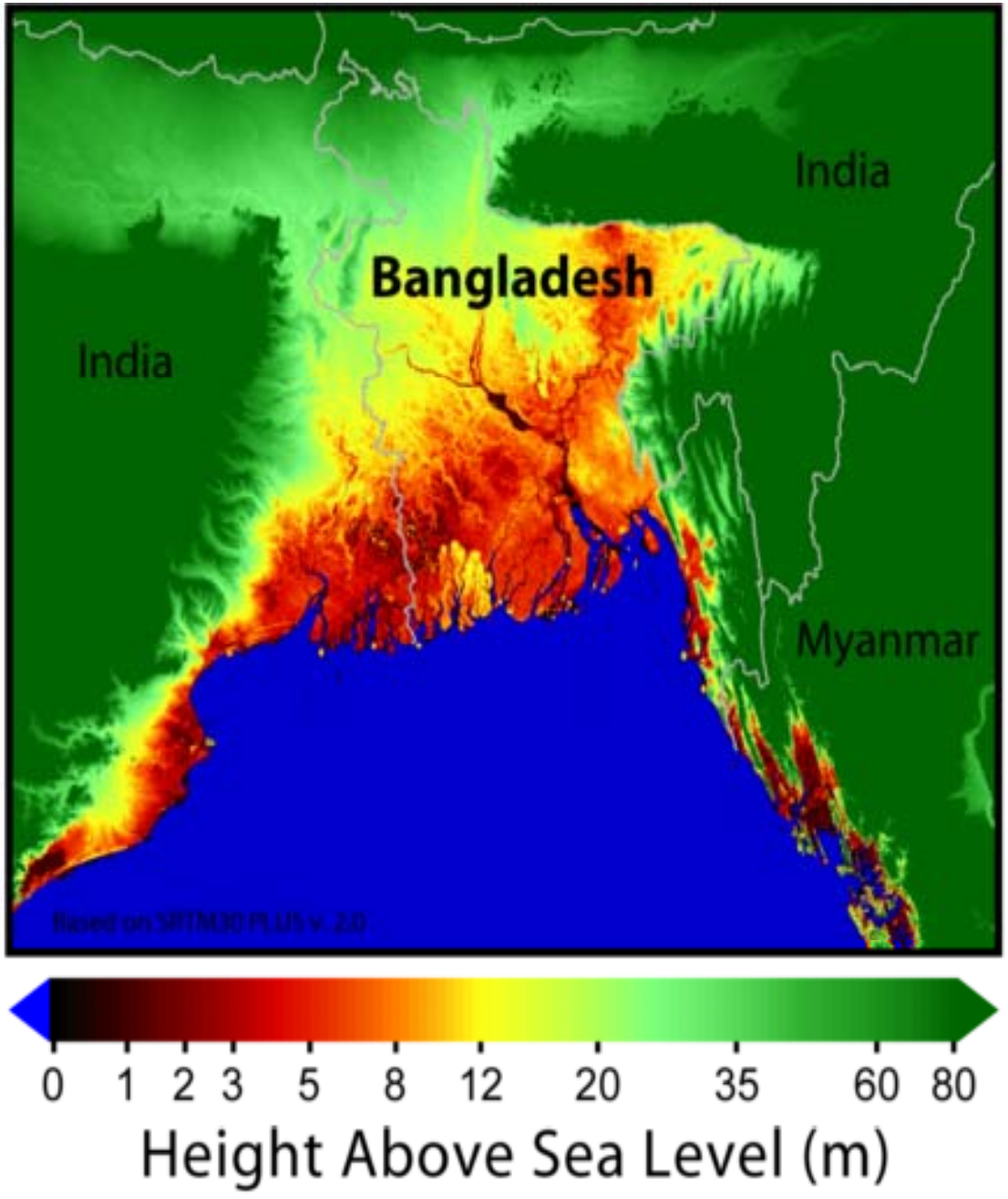


Climate Change, Migration, and Conflict in South Asia

Arpita Bhattacharyya and Michael Werz

December 2012

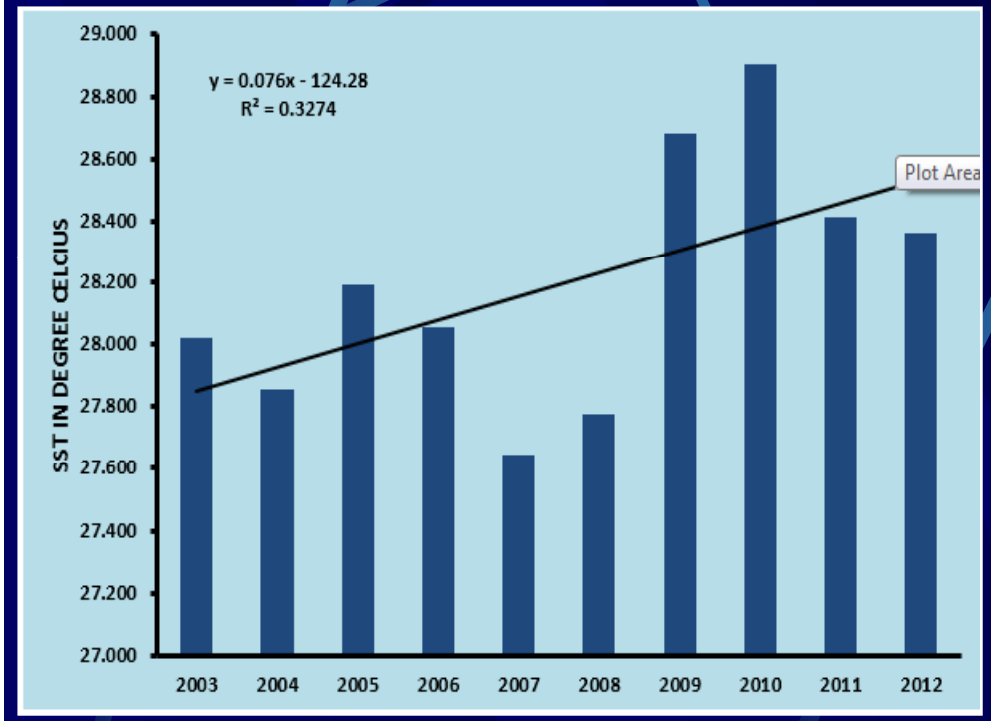
Map Sources: Government of India, Ministry of Environment & Forests, "Climate Change and India: A 4x4 Assesment" (2010), Modified from

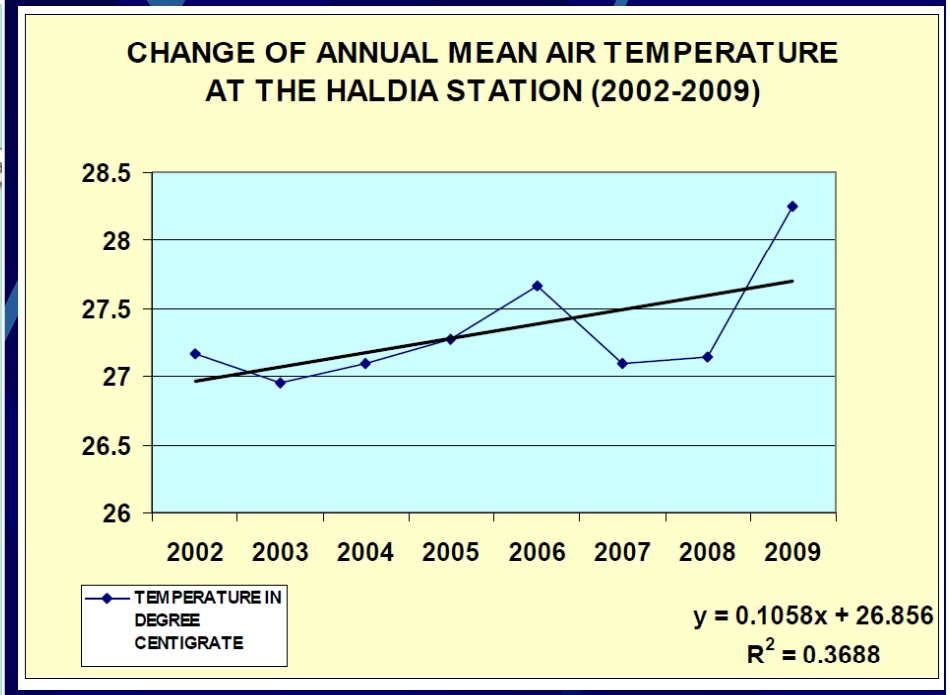


Detailed in situ studies needed to avoid gross overestimation of the impact and consequent quantum of migration

Change in SST in northern BOB

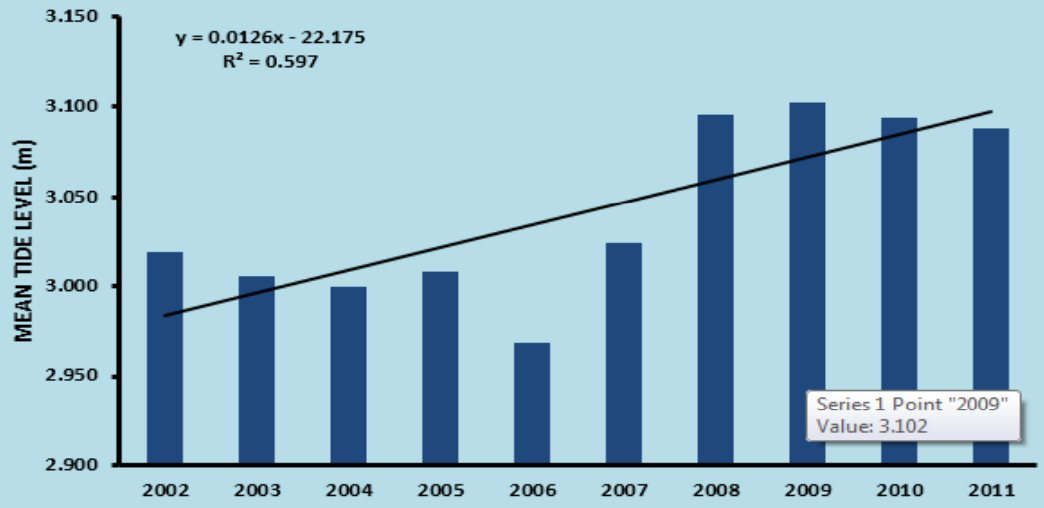
from Modis Aqua

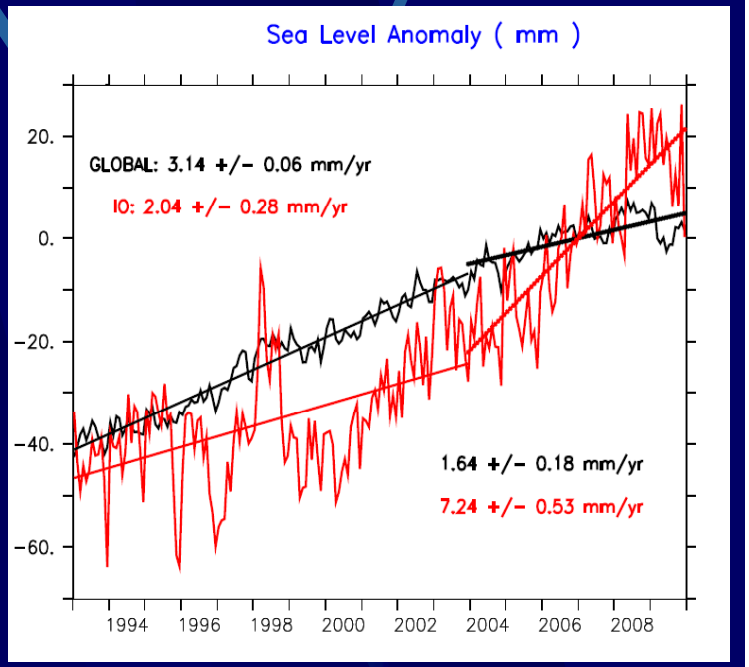




Sea Level Rise at Sagar tide station
(non compensated)

SLR 8 mm/Year, New World Bank Report

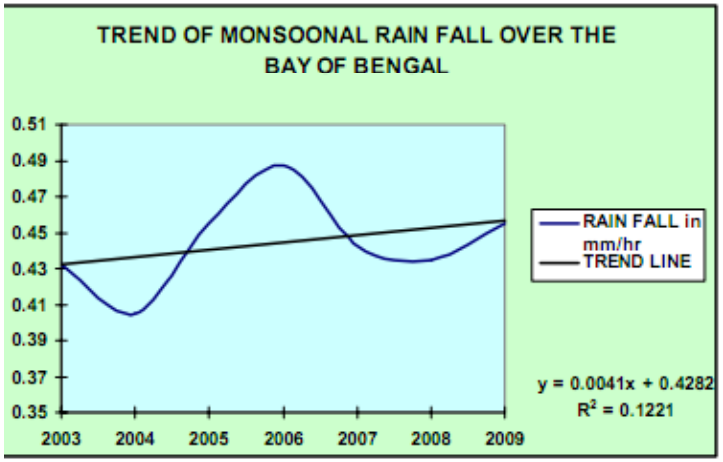


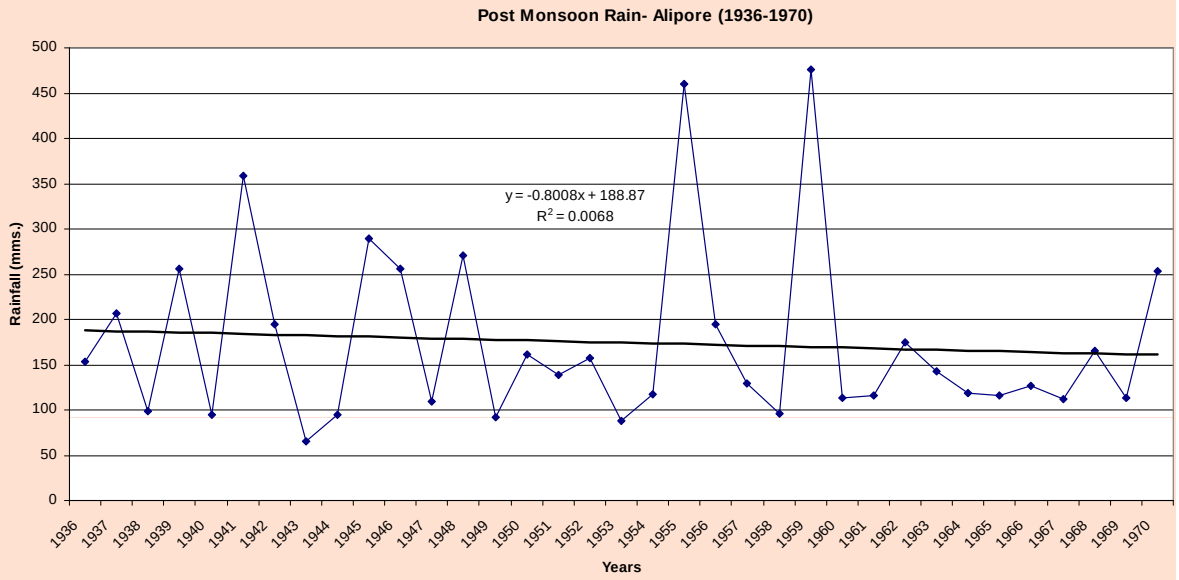


M.Ravichandran, INCOIS,Personal Communication

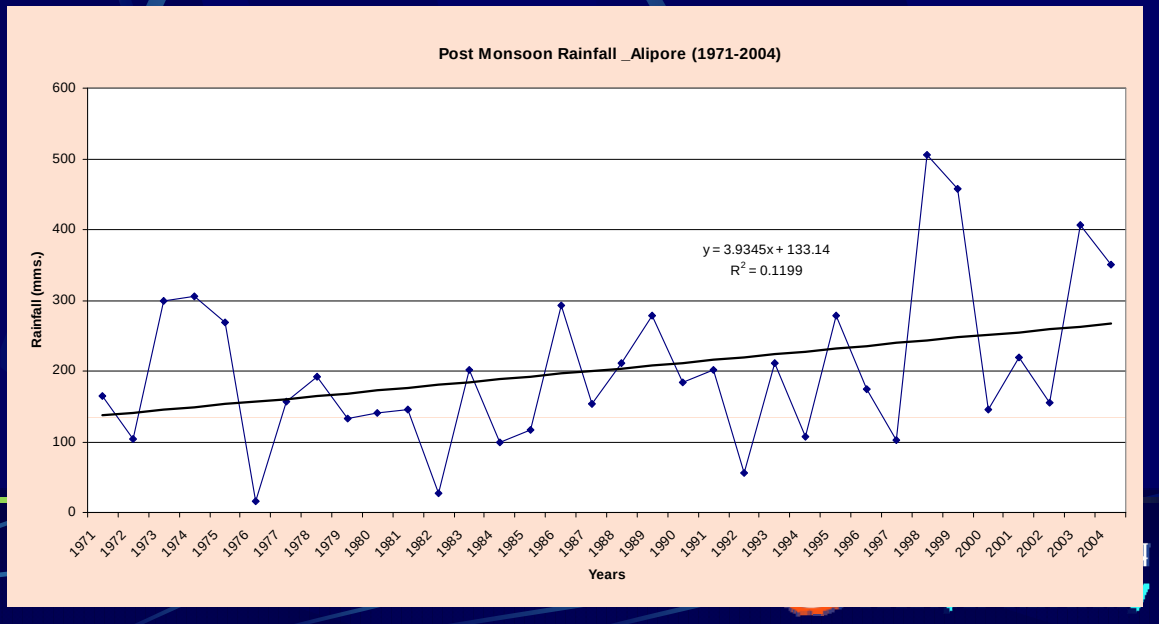
Monsoon Rainfall

Post 70s trend reversal in post monsoon rainfall

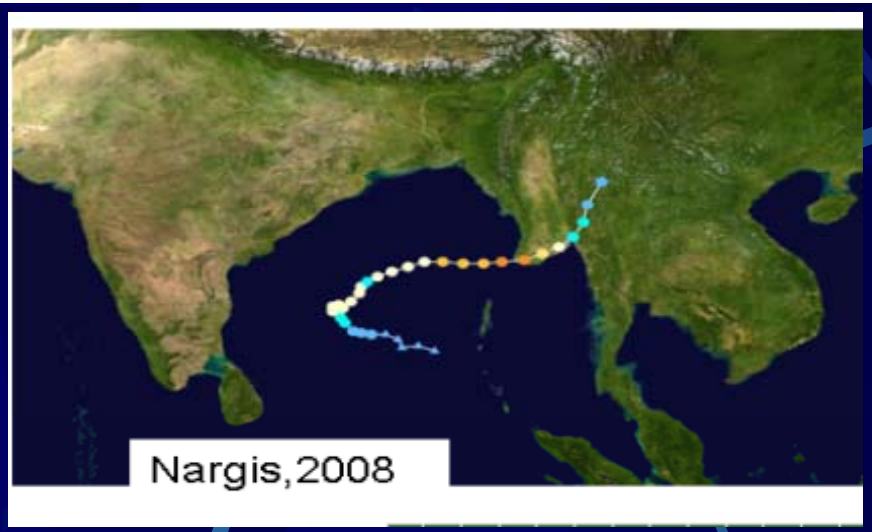


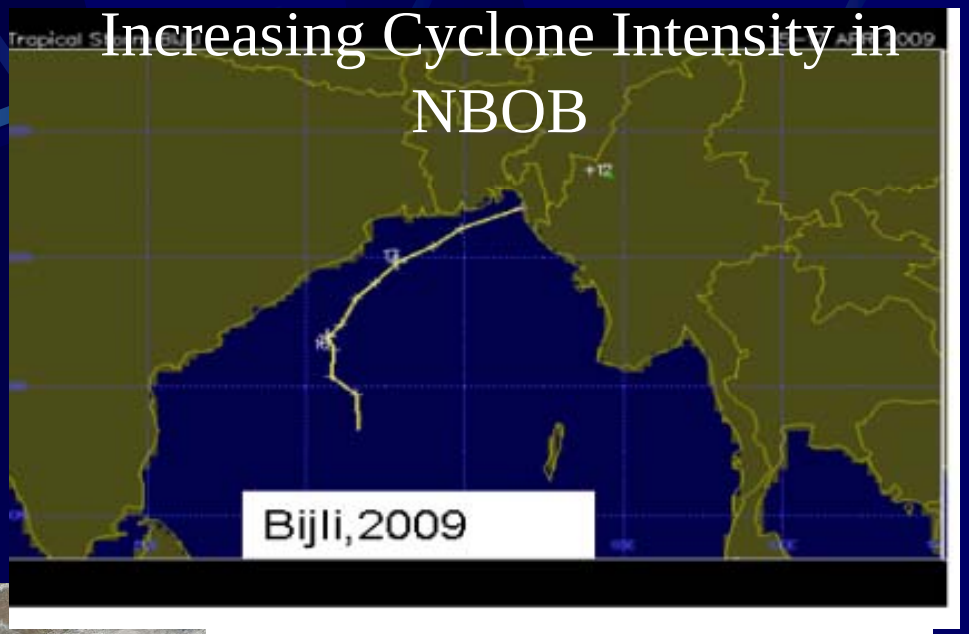


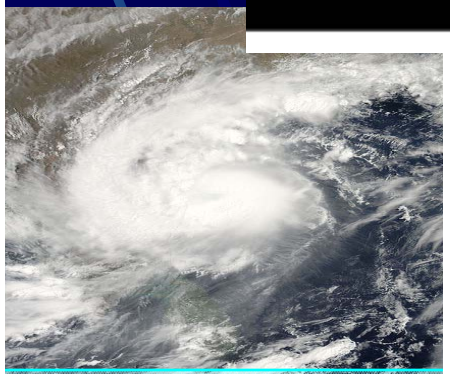
Onset of Monsoon erratic and often delayed by 15-20 days



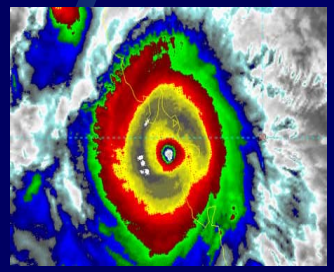
Increasing Cyclone Intensity in NBOB

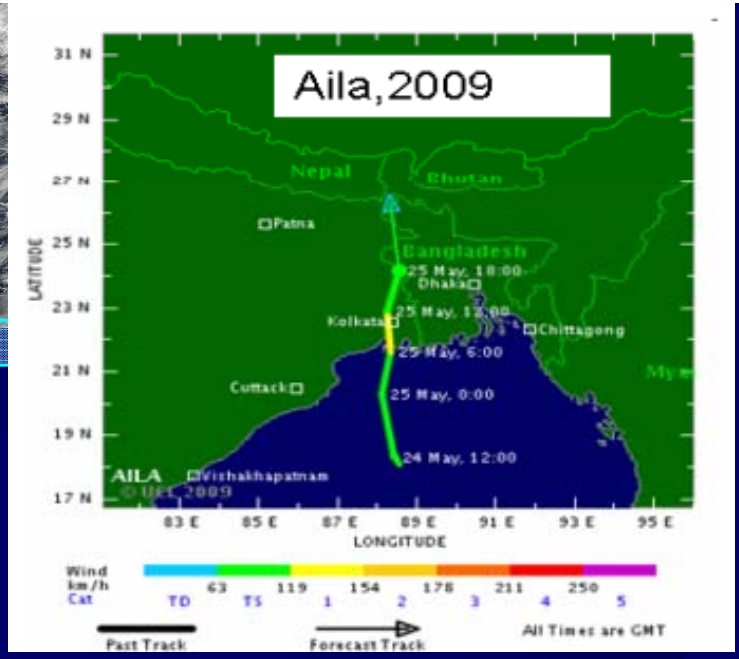






Cyclone Laila,May 2010



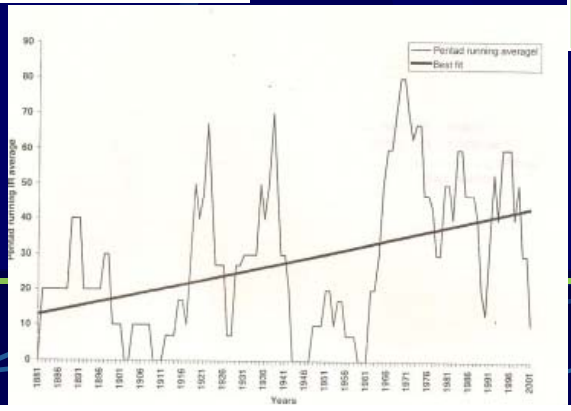


Giri,October,2010

Sl no.	Year	Name
1	2005	HIBARU
2	2005	PYARR
3	2005	BAAZ
4	2005	FANOOS
5	2006	MALA
6	2006	OGNI
7	2007	AKASH
8	2007	SIDR
9	2008	NARGIS
10	2008	RASHMI
11	2008	KHAIMUK

Increasing High Intensity Events

Sl no.	Year	Name
12	2008	NISHA
13	2009	BIJLI
14	2009	AILA
15	2009	WARD
16	2010	LILA
17	2010	GIRI
18	2010	JAL
19	2011	THANE
20	2012	NILAM
21	2013	PHAILIN



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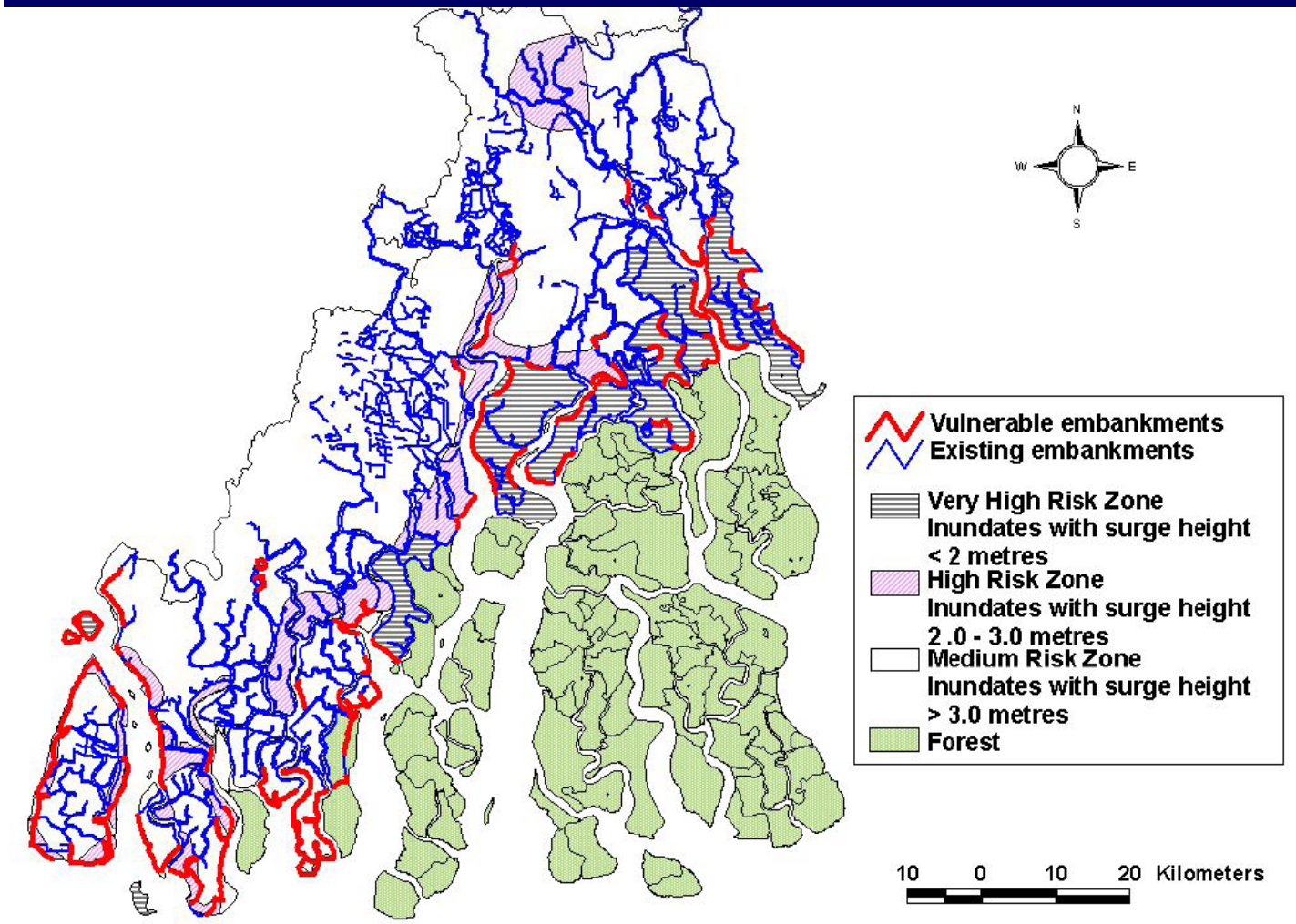
Embankments and Risk Zone Map of Indian Sundarban



Submitted to
NATCOM 2003

Mud and Brick Embankment being built by NABARD on 8.8.2008 At Mousuni Island

Overtopped on 16.8.2008

Courtesy :WWF

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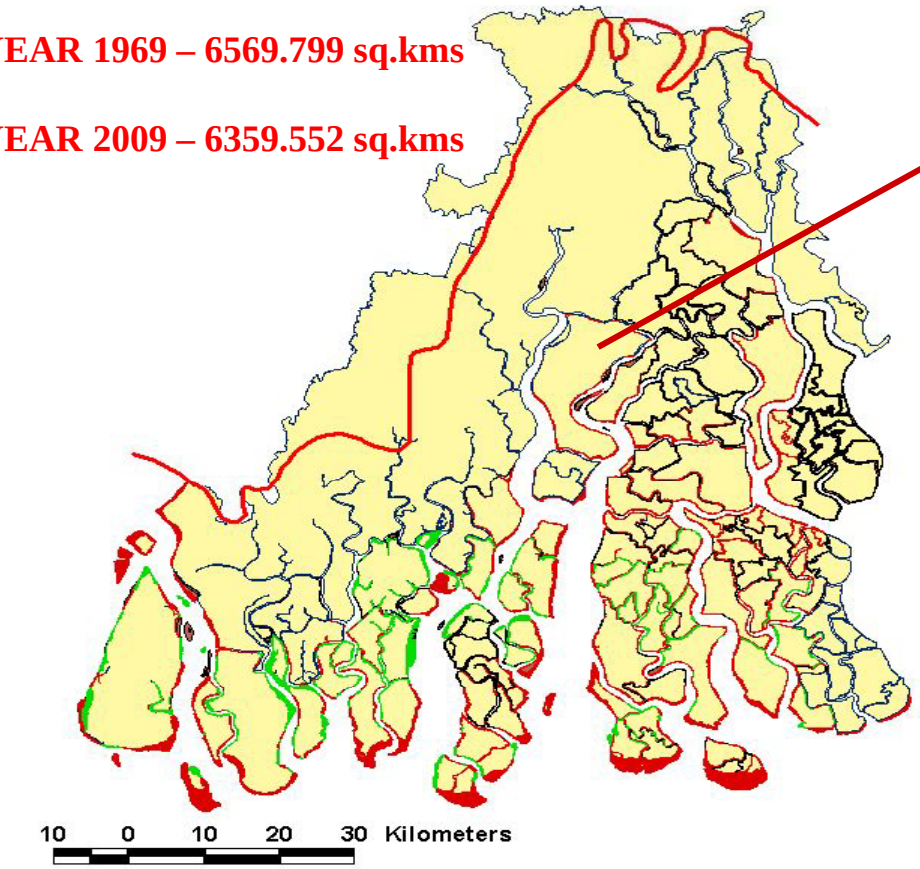
ZONES OF EROSION AND ACCRETION IN THE INDIAN SUNDARBANS (1969-2009)

YEAR 1969 – 6569.799 sq.kms

YEAR 2009 – 6359.552 sq.kms



Lohachara, the first inhabited island

Vanished by 1996

Making thousands

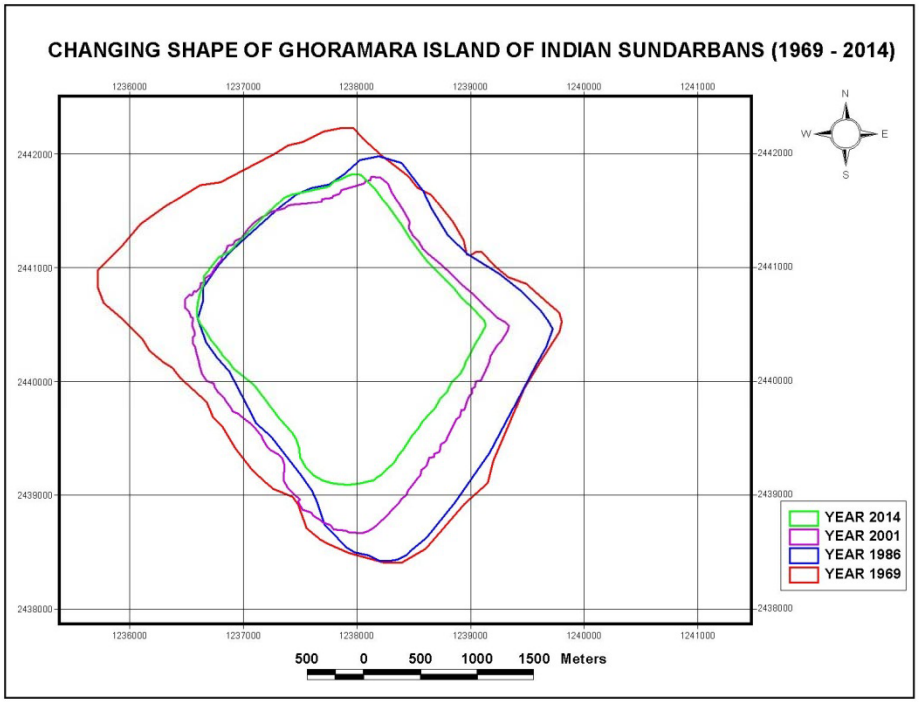
Environmental Refugees

EROSION
ACCRETION
NO CHANGE AREA

LOSS ESTIMATION:

1. **Total areal loss of Indian sundarbans from 1969 – 2009 – 211.751 sq. kms**
2. **Total areal loss of Indian sundarbans from 1969 – 2001 – 167.709 sq. kms**
3. **Total areal loss of Indian sundarbans from 2001 – 2009 – 84.207 sq.kms**

SOSJU,WWF2010

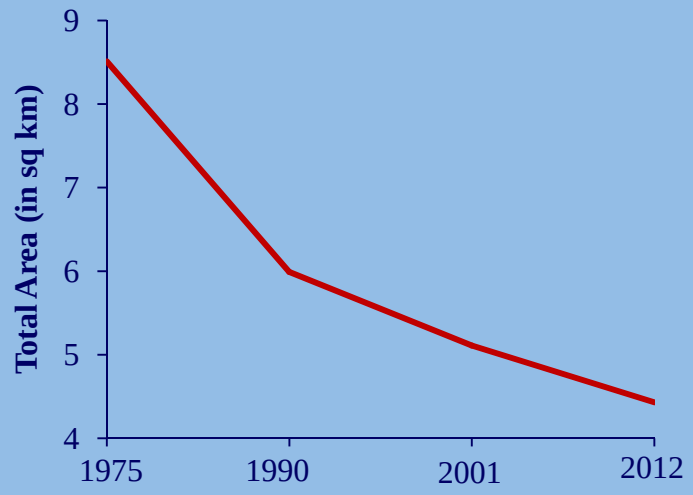


VANISHING ISLANDS

Year	Total Area (in sq km)
1975	8.51
1990	5.99
2001	5.11
2012	4.43
2014	4.202

During the 1990s **Lohachara**, *Suparibhanga and Bedford Islands* got **submerged** along with the Khasimara, Khasimara Char, Lakshmi Narayanpur, Bagpara, Baishnabpara villages of **Ghoramara Island**

EROSION OF LAND AREA DURING 1975 TO 2012



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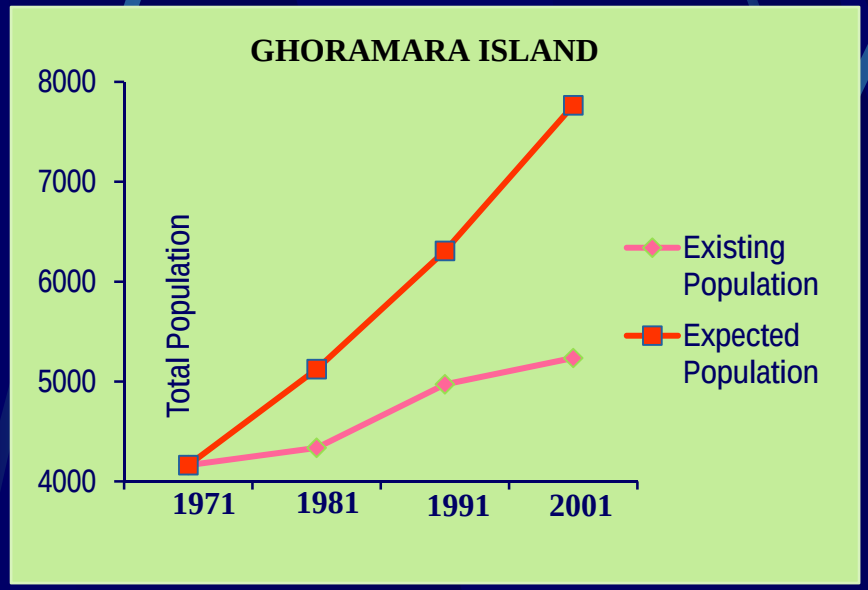
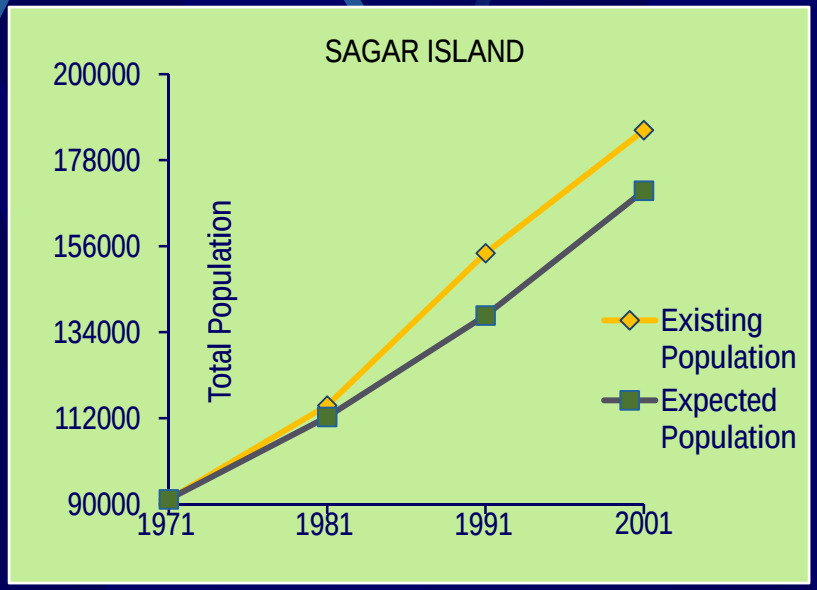
MIGRATION:

- Inhabitants of Lohachara Island were 374 in 1971, 220 in 1981 and 'zero' in 1991 (Census of India)
- All the 374 residents of Lohachara Island were forced to migrate to nearby stable islands or main land
- Due to severe coastal erosion, Ghoramara island lost five villages forcing around 6000 people to leave the island who can be recognized as 'Environmental Migrants'
- The population decreased further from 5236 to 5193 during the year 2001 to 2011 , as opposed to block wise increase elsewhere

- The rate of population growth (1971-2001) in Ghoramara Island is 0.55% while the growth rate of the entire administrative block is much higher, 2.1%.
- In Ghoramara Island, migration is a prime factor for which the actual population is lower than the expected (in terms of block level growth rate). = sending area ?
- On the contrary, the population of Sagar Island is showing higher population than the expected (as per the block level growth rate). = receiving area ?





Environmental Degradation Accentuates Migration

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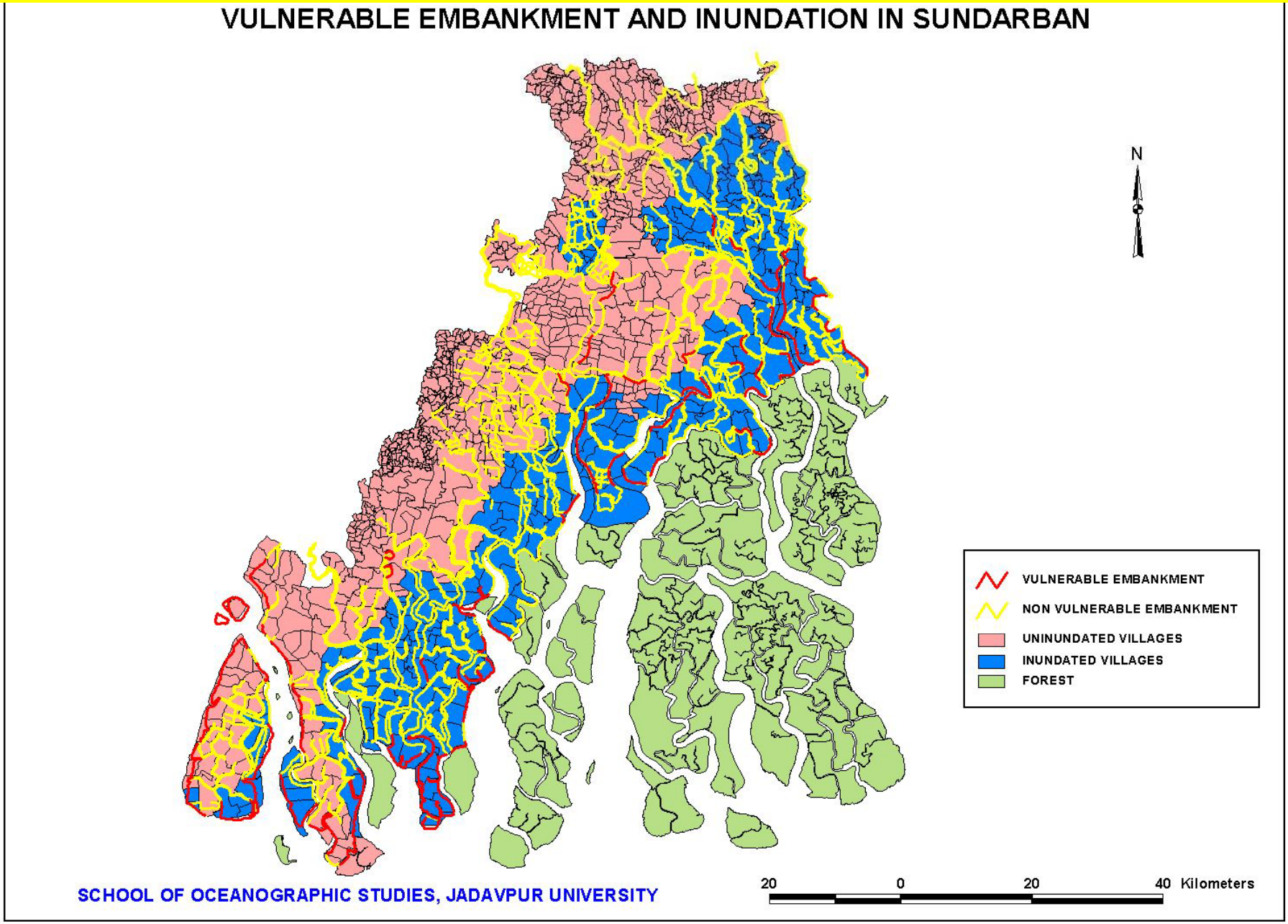
people and created 60,000 environmental migrants often leaving behind the women, infirms and children



PROJECTED NO. OF ENVIRONMENTAL MIGRANTS DUE TO SLR AND EROSION BY 2020

- Ghoramara –1600
- Mousuni –5700
- G-Plot –6000
- Dakshin Surendranagar 12,700
- Sagar –28000
- Namkhana –15000
- TOTAL 69000

- SOS JU : NATCOM REPORT :2003

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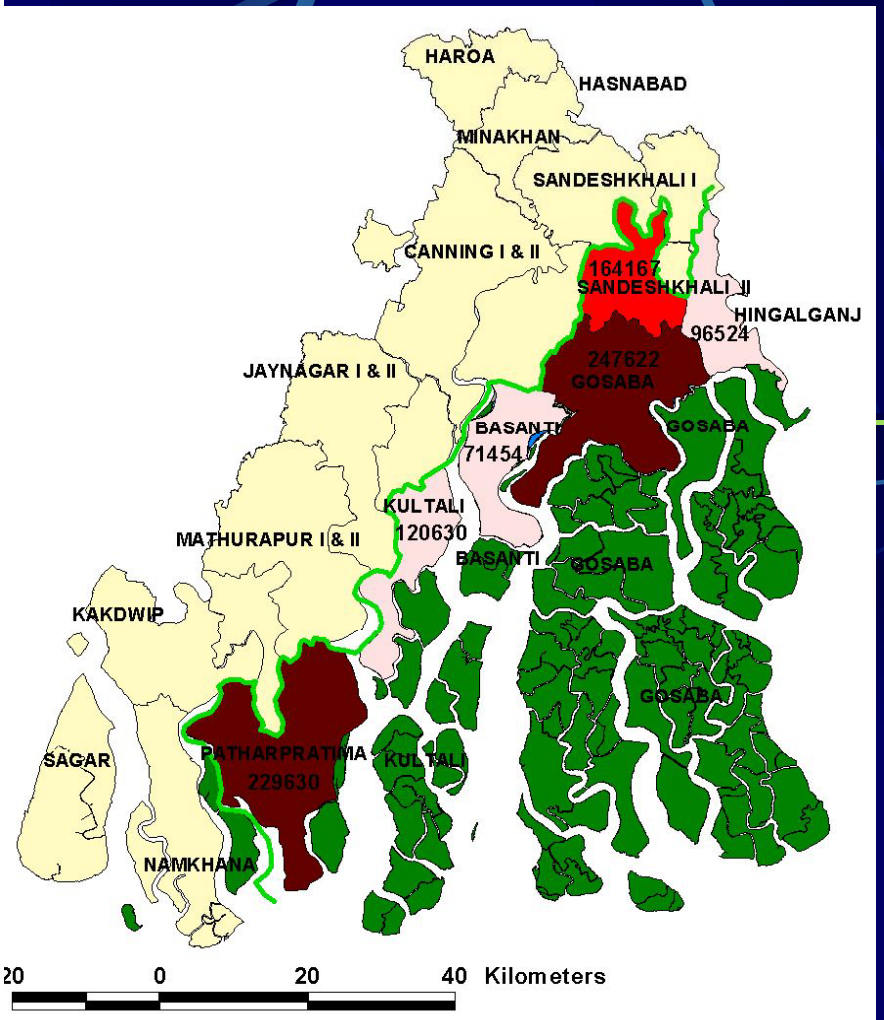
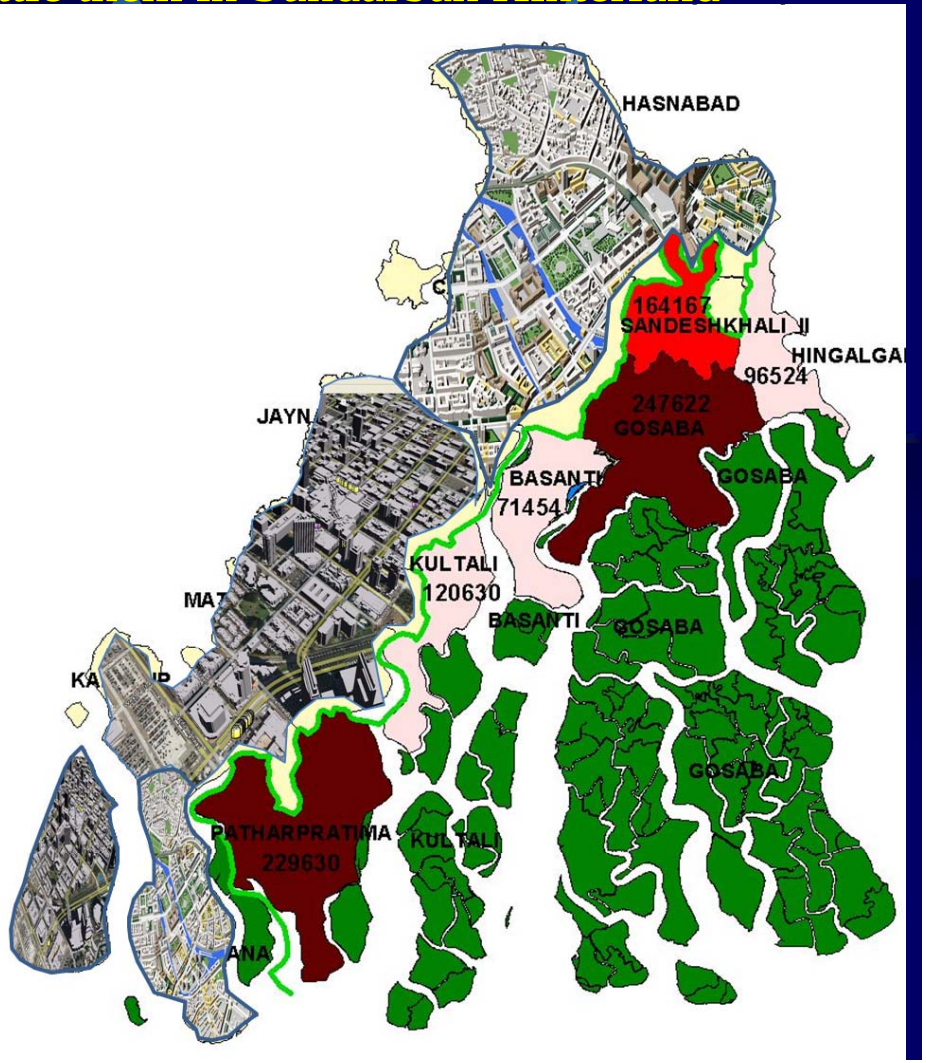
The more sustainable alternative, for Sundarban , will be a planned migration and resettlement of 1 million people from extremely vulnerable low lying areas (east of green line)and to resettle them in Sundarban Hinterland





Towards new Adaptation policies

- Anticipate migration due to slow and fast onset environmental change
- Develop methods of gender sensitive adaptation for Climate Change Impacts. India may need to incorporate policies of recognition, compensation , rehabilitation in the NAPCC for internally displaced persons due to climate change
- There should be scientific methods of recording migration from 'sending area' and 'receiving area'
- People of the sending area may be trained in ' non farm skills' enabling them to settle away from farm lands

Migration as adaptation ?

"Giving urgent policy attention to migration in the context of global environmental change now will prevent a worse and more costly situation in the future." Foresight Report, 2011

Thank you