

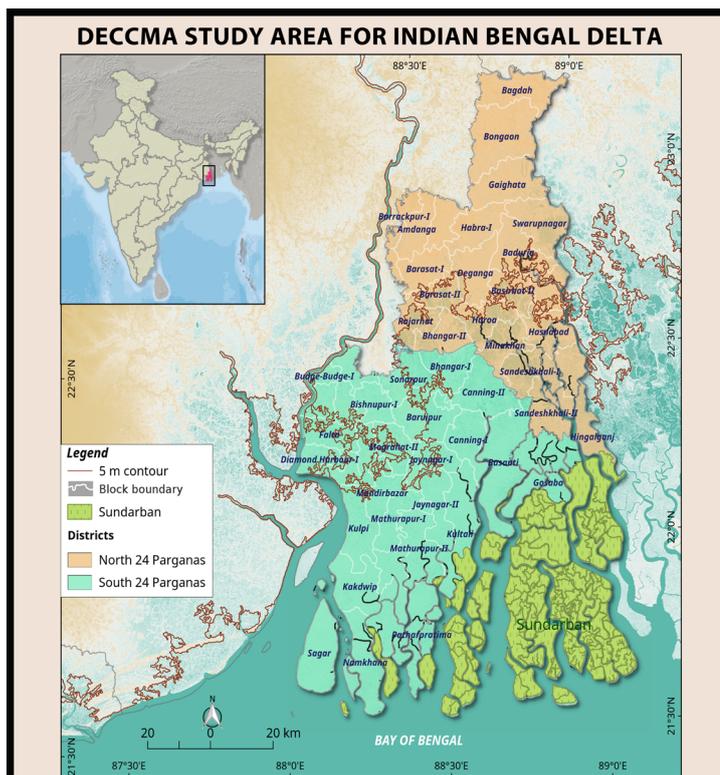


New Insights: Climate Change, Migration and Adaptation in the Indian Bengal Delta

Which parts of the Indian Bengal delta are at greatest risk from climate change?

Major risks come from flooding. SWAT hydrological modelling shows a projected higher runoff coefficient for the Hooghly, which is expected to increase incidence of flooding.

Based on analysis of exposure to climate hazards, sensitivity, and socio-economy-driven adaptive capacity, the community development blocks at highest risk are **Gosaba, Basanti, Sandeshkhali-II, Kultali, Hingalganj, Patharpratima, Canning-II, Sandeshkhali-I, Namkhana, Sagar, Minakhan, Jaynagar-II, Mathurapur-II, Hasnabad, Kakdwip** (Figure 1). These blocks have high levels of agricultural dependency and so are sensitive to climate hazards such as floods and high salinity.



In DECCMA the seaward portion of this Ganges-Brahmaputra-Meghna (GBM) delta, within 5m of mean sea level, is considered with studies in Bangladesh and India. **The Indian national study area is called the Indian Bengal Delta (IBD)**
Study Area: 14054 sq.km
Districts: 2 – North 24 Parganas and South 24 Parganas
Blocks (sub-districts): 51
Population: 18 million (2011 Census)
Population Density : 2463 persons/ sq.km. for North 24 Parganas
 819 persons/ sq.km. for South 24 Parganas
Famous for:
 • natural habitat of the Royal Bengal Tiger
 • complex ecosystem formed by an intricate network of tidal waterways, mudflats, and small islands of salt-tolerant mangrove forests

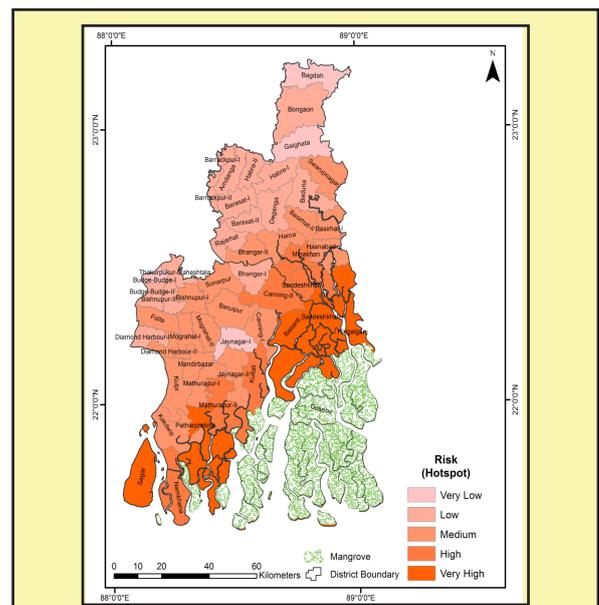


Figure 1: Block level risk map of IBD

How are livelihoods affected by climate risk?

Natural resource-based livelihoods such as agriculture and fishing predominate in the IBD. Due to paucity of fresh ground water resources, **mono-cropping is common** (Figure 2), which increases vulnerability to climate hazards.

Inland fishing is a common practice for subsistence, while a smaller proportion of men are engaged in marine fishing. Increasing salinity of soil and river water resulting from embankment breaching and subsequent inundation also negatively affect the fertility of soil, yield of crops and amount of fish catch.

Table 1 outlines the extent of agricultural land that has been flooded between 2005 and 2014, as extracted from Land cover mapping and flood data.

Block (sub-district)	Area of agricultural land flooded (in sq.km) between 2005 and 2014
Gosaba	47.48
Sandeshkhali II	27.59
Patharpratima	20.67
Basanti	28.04
Canning-I	28.55
Canning-II	24.97
Kulpi	26.46
Sagar	23.78
Mathurapur	21.69

Table 1: Area of agricultural land flooded in IBD between 2005-2014

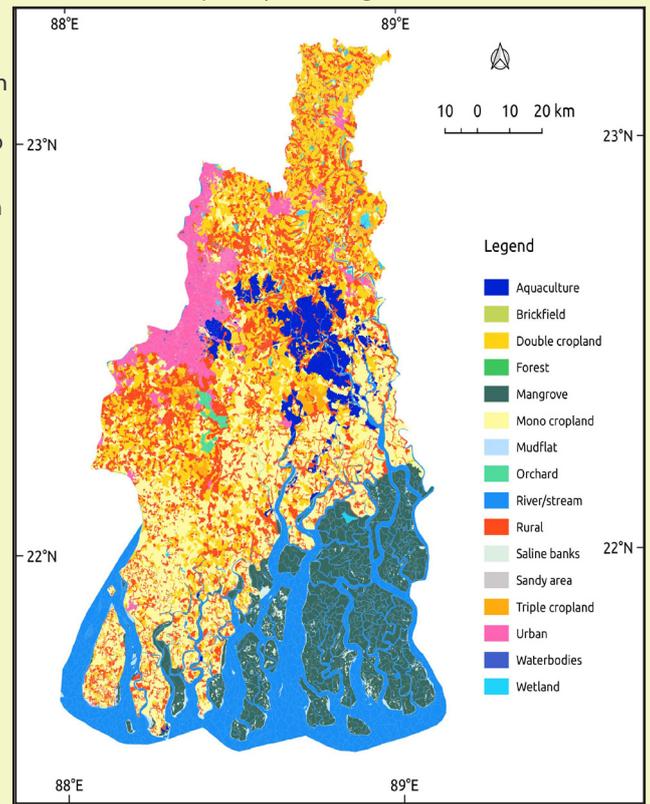


Figure 2: Land cover map of IBD (2011-12)

What are the effects on the economy?

The IBD has a lower Gross Domestic Product (GDP) per capita compared to the country as a whole: approximately \$2350 compared with \$3160 in 2011). Analysis of the impact of climate change on agriculture highlights the direct loss of 16.6% of total GDP of the delta. In the IBD, integration with other sectors gives rise to losses of 1.23% of the total delta GDP.

Different environmental factors affect different sectors of the economy

Conceptual models were developed to assess fluctuation of household income from Non-Timber Forest Products (NTFPs) and riverine fish catch in different climatic and bio-geo-chemical conditions. Mangrove forestry is particularly sensitive to salinity whilst, for riverine fisheries, salinity and temperature are the most relevant influences. There is a 70% likelihood of increase in salinity and 60% likelihood of temperature increase based on initial analysis of past environmental and climate data. The models also show decreasing trend in production of NTFP (honey) and total fish catch in the delta.

Migration

Migration is higher in areas at high risk of climate stresses

Based on a survey of 1315 households, 18% currently have migrants. The proportions of migrant sending households is high from the coastal districts identified as having high or moderate risk levels.

Male migration predominates, but female migration is increasing

The largest proportion of migrants is males aged between 21-30 years (Figure 3). However, numbers of female migrants are increasing. Although both tend to migrate seasonally, their patterns differ. Both men and women migrate to Kolkata, although men typically to the centre where they work in construction, with women mainly to the peri-urban areas for employment as domestic workers. Female migrants with higher levels of education mostly move with their family members. Male migrants also venture further afield, including to Maharashtra, Tamil Nadu, Kerala and Gujarat.

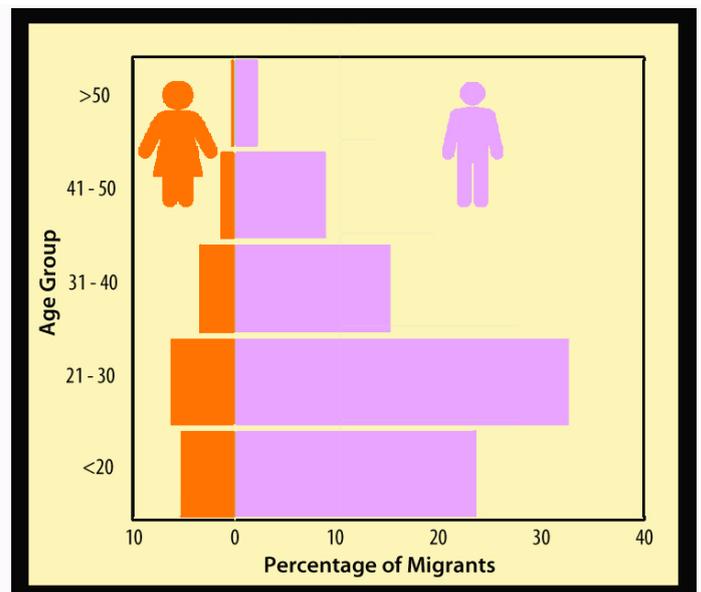


Figure 3: Age-sex pyramid of migrants from Indian Bengal Delta

Most migration is economically-driven

Almost two thirds of migrants state that they are moving to seek better employment opportunities, followed by family obligations (12.3%), while 10% of respondents mentioned that the migrant left to pursue a degree or obtain training in a new skill. Only a very small percentage of the respondents (3.0%) cited environmental stresses as the direct cause of migration (Figure 4). However, environmental stresses disrupt livelihood security and can contribute to economic circumstances that necessitate migration.



Figure 4: Reasons for migration in IBD

Not everyone has the same capability or desire to migrate

Barriers to migration come from economic and family reasons. 23% of the current non-migrant households have the intention to migrate in the future, which would lead to migration rates of 37% in the IBD. Those who do not intend to migrate cited family commitments and the fear of leaving family members on their own.



Adaptation

Agricultural adaptations are common among male- and female-headed households

The most commonly-practiced adaptations by men and women are agricultural, including applying fertilizer and irrigation. Male-headed households also employ mixed farming, use climate tolerant crops, and employ farming tools or equipment. Adaptations among female-headed households typically build on social capital, for example through joining self help groups and cooperatives, and exploit opportunities for alternative income sources, such as through working outside the village.

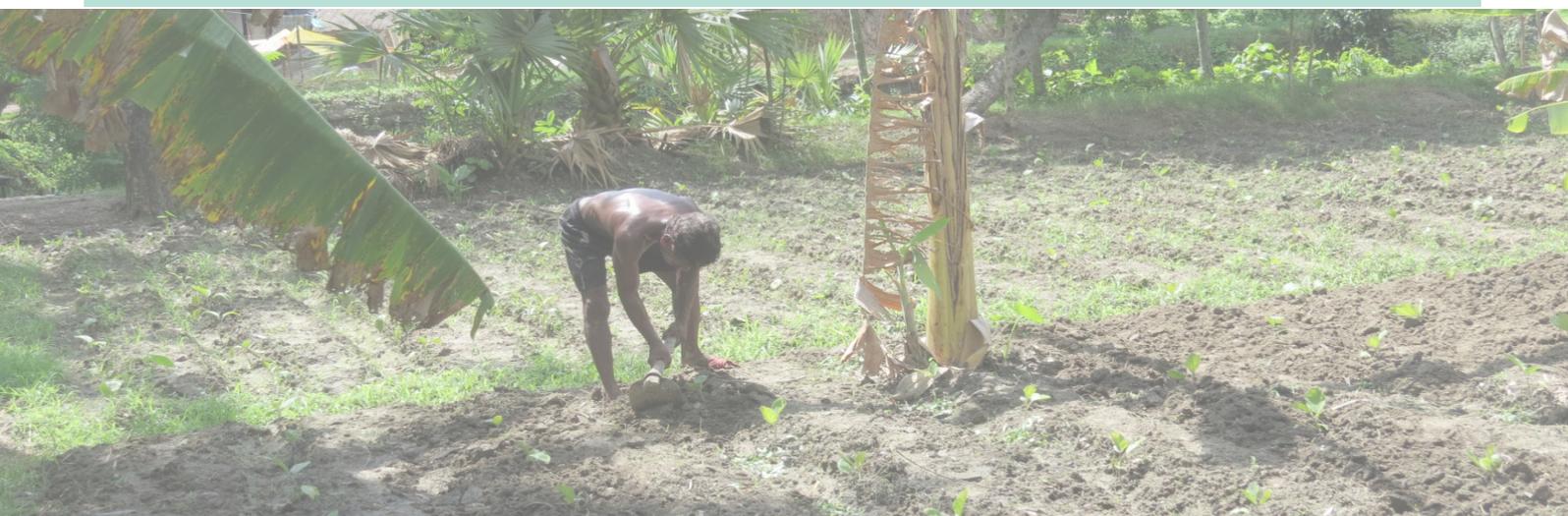
Adaptation policy is imperfectly implemented

Climate change impacts are reflected in a number of relevant policies and plans, for example the National Action Plan on Climate Change (NAPCC) and the West Bengal State Action Plan on Climate Change (WBSAPCC), which specifically refers to the Sundarbans as extremely vulnerable. However, various barriers exist to effective implementation of these policies. Despite a recommended budget allocation from 2012-22 there is no information on release of it, nor any progress report on the activities carried out under the WBSAPCC.

Haphazard implementation also exists for other related policies that recommend adaptation practices for the delta populations. Under the Prime Minister's National Relief Fund, Integrated Coastal Zone Management Project, and National Cyclone Risk Mitigation Project, building/strengthening of cyclone shelters has taken place, but unsystematically, despite being recommended in the WBSAPCC. Although reconstruction of embankments has taken place, no more than 20% of Rs. 5000 crore approved by the then-National Planning Commission has been used for reconstructing the intended 1300 km of damaged embankments. Faulty reconstruction methods and current policy of land acquisition for embankment building are becoming major obstacles to achieve the target.

Policy recommendations

1. Future climate risks to livelihood activities in the delta require proactive approaches to ensure adaptations by farmers, fishers and forest product collectors. This can include formation of cooperatives to link farmers directly to markets, encouraging climate-resilient crop production (in line with the commitment sustainable agriculture under the National Action Plan on Climate Change), and crop insurance options (consistent with the Prime Minister's stated policy).
2. Embankments are a critical hard adaptation and appropriate strategies are required for their reconstruction, together with an effective policy of land acquisition for embankment building.
3. There is an urgent need for a West Bengal State Water Policy. Groundwater is the primary source of freshwater in the IBD and it is at risk of saltwater intrusion due to uncontrolled abstraction.
4. There is a need to address the current policy gap around migration. Currently there is no rehabilitation and resettlement policy for populations displaced by climate and environmental stresses. Gender-sensitive approaches to livelihood support for resettled populations are necessary.
5. With few exceptions that highlight the need for women's participation and empowerment, most policy documents are gender blind. There is a need for greater inclusion of gender-sensitive approaches to reduce climate risk, reflecting the different ways in which men and women are vulnerable.



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