10. COASTAL PROTECTION FROM CYCLONE IMPACTS IN SW BANGLADESH

The Living Deltas Hub research has been used to identify where resource allocation and planning should be targeted to best raise community resilience in coastal Bangladesh in the face of increasing numbers of cyclonic disasters. The coastal social-ecological system of South West Bangladesh is struggling to cope with recurrent cyclonic disasters and climate change will only amplify infrastructural damage with adverse impacts on delta lives and livelihoods.

Foreign, Commonwealth & Development Office

- Climate change & biodiversity
- Science, research, technology
- Trade & economic development
- Humanitarian preparedness & response

SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
6 CLEAN WATER AND SANITATION
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
13 CLIMATE ACTION
15 LIFE ON LAND
17 PARTNERSHIPS FOR THE GOALS

Achievements

The impact of a cyclonic event is principally controlled by location of landfall, cyclone track, landfall timing (flood/ebb tide, spring/neap tide), and intensity. The impact of poor maintenance and recurrent cyclonic events in the coastal regions of SW Bangladesh have led to a reduction in structural strength of embankments and lowering of embankment heights below safe levels; this means that in many areas, embankments are extremely vulnerable to cyclonic events. Hub researchers have identified that embankments are in a dilapidated condition in many places and concluded that a slight increase in the surge height of cyclones (such as the 1-1.8m experienced from both Amphan and Yaas) and a moderate thrust force will lead to widespread damage, loss of lives and livelihoods.

Our results indicate a development dilemma for coastal protection. Major initiatives such as the Bangladesh Delta Plan 2100 advocate large-scale infrastructural development requiring big budgets - in a nation where resource is often scarce. Bangladesh Government's plan to increase the height of embankments in a large number of polders in phases under the Coastal Embankment Improvement Project (CEIP) will require a considerable period for implementation, by which time if the current observed trend continues, several more damaging cyclones will have occurred, causing potential devastation to delta livelihoods. A predicted outcome of climate change is major degradation of structures, leading to substantial development and sustainability challenges. Living Deltas will work with its network of government and NGO partners to support a move towards strategic strengthening of existing structures as a better use of resource with a more beneficial impact on lives and livelihoods.

As the COVID-19 pandemic recedes, our work in 2021-22 will examine socio-economic and livelihood impacts of environmental shocks. Specifically:

- How socio-economic vulnerability dynamically changes with time;
- How different groups respond to disasters with different patterns of resilience, coping capacities, livelihood strategies, and

livelihood tipping points;

- How people-centric, ecosystem-based systems and natural-cultural heritage based approaches can lead to optimal use of resources in efficient livelihood recovery and prioritization of adaptations, amid recurrent multi-hazard or disaster situations.

The timely nature and relevance of the Hub's work on the GBM delta is succinctly summarized by The Telegraph of India (8th July 2021):

"*Resilience building in flood-prone areas requires capacity-building of the community so that people can anticipate, absorb, adapt, mitigate and transfer disaster risk… to build resilience in flood-prone areas, there is a need to reimagine embankments*".

The Hub is bringing its research expertise on resilience-building in cyclone prone areas in SW Bangladesh to other countries in the region experiencing similar problems - the Sundarbans on the West Bengal Delta in India where similar cyclone impacts are felt, and in the Mekong River Delta in Vietnam where Hub experts are researching semi- and full-bunding for flood management and where the mangrove 'bioshield' from storms and inundation is severely degraded.

Who benefits?

Cyclones and their associated storm surges are the most devastating of all disasters in coastal Bangladesh, with the country experiencing 9 damaging cyclones in the last 14 years. Since November 2019, the region has been hit by three damaging cyclones (Bulbul, Amphan, Yaas) with overlapping impacts as subsequent events hit before recovery can take place. This has been exacerbated by the devastating effects of the COVID-19 pandemic on the livelihoods of the poorest and most marginalized in the region.

Bangladesh University of Engineering and Technology's expertise in water resource engineering and management means the Hub has built on a deep knowledge base of where and how embankments will fail in the face of climate extremes and storms, and what are the levels of cyclone intensity they can withstand. This is crucial for a policy and adaptive management in terms of concentrating often scarce resources in areas to avoid weak points and avoid cascade effects.

Living Deltas field research post-Amphan and during the Covid-19 pandemic in Koyra Upazila in Khulna District Bangladesh shows that people demand protection, but they want their dilapidated protection measures, such as engineered embankments, rehabilitated and strengthened so they can withstand future cyclone disasters with reasonable reliability. In their own words, "We do not want relief; just repair our embankment and make them strong. That is all we need." Our research demonstrates more investments are required to strengthen embankments and regular maintenance to keep them at least at original design heights, supported by efficient and stronger structural recovery in cognizance of recurrent nature of disasters due to climate change, as opposed to the massive spending plan in raising the height of embankments.

The Hub brings together decades of knowledge on polders (used for tidal flood management) and embankments, engineering and landscape-scale water resource management, coupled with indigenous knowledge from the delta communities to understand community response to disasters and priorities for raising resilience. We combine globally leading expertise on multi-hazard modelling, on oral histories, intergenerational aspects of indigenous knowledge, community resilience and the key role of natural cultural heritage. Our Household surveys generate information on delta communities' hopes, fears and aspirations for the future allied to their socioeconomic and behavioral responses. Our work on youth and gender means we are developing solutions co-designed with coastal communities which are typically the most vulnerable and marginalized, emphasizing women, who play a key role in generating income, and youth who will endure the worst impacts of climate change.

The Hub has long standing partnerships with the Bangladesh Water Development Board (BWDB) and the General Economics Division (GED) of the Ministry of Planning, Government of Bangladesh. These are a strong link to decision makers in Bangladesh and make the Hub a key partner in devising future coastal protection policy. Key delivery partners in previous large research consortia (ESPA Deltas, DECCMA, REACH), BUET build on long-term relationships with local and national government and several high profile and active NGOs working in the coastal zone, including UTTARAN, Jagrata Jubo Sangha (JJS) and the Ashroy Foundation.

Summary of development impact of this work

Instituional & policy gap	Living Deltas contribution	Pathways to impact
Prioritization of investments in coastal protection; more emphasis given on big spending infrastructures, e.g., massive plan of increasing heights of embankments in phases.	Identification of actual reasons for damage and socio-economic impacts due to cyclonic storm surges, via simulation of many historical cyclones and linking with corresponding impacts	Dedicated one-to-one meetings with stakeholders, jointly organized workshops, formation of committee of focal points representing key stakeholders, policy briefs.

People involved in this work

Name	Gender	Discipline	Work Package	Institution	Country
Ishtiaque Chowdhury	N	Environmental engineering; water pollution	Delta Baselines Delta-level Interventions	BUET	BN
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Tuhin Ghosh	M	Coastal geomorpholoy & disaster management	Delta Baselines Delta-level Intervention	Jadavpur University	IN
Anisul Haque	M	Water resources engineering and management	Delta Social Ecological Systems	BUET	BN
Asad Hussain	M	Water resources engineering and management	Delta Social Ecological Systems	BUET	BN
Md. Shah Alam Khan	M	Water resources engineering and management	Delta Social Ecological Systems Delta Baselines Delta-level Interventions	BUET	BN
Sonia Binte Murshed	F	Water resources engineering and management	Delta Social Ecological Systems Delta-level Interventions	BUET	BN
Sara Nowreen	F	Water Resources Engineering and Management	Delta Voices	BUET	BN
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Van Pham Dang Tri	M	Integrated water resources management	Delta Baselines	Can Tho University	VN