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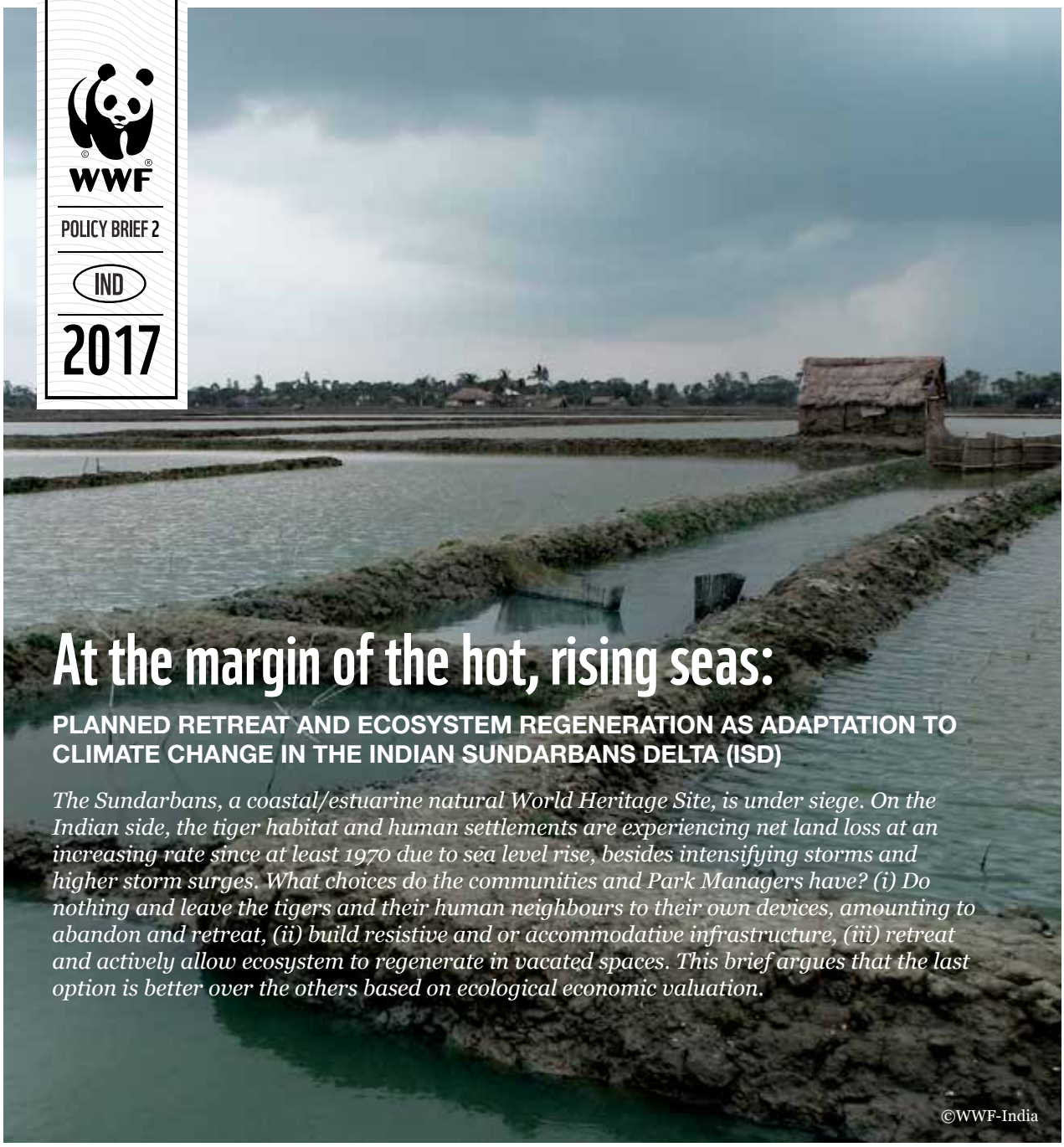
POLICY BRIEF 2

IND

2017



At the margin of the hot, rising seas:

PLANNED RETREAT AND ECOSYSTEM REGENERATION AS ADAPTATION TO CLIMATE CHANGE IN THE INDIAN SUNDARBANS DELTA (ISD)

The Sundarbans, a coastal/estuarine natural World Heritage Site, is under siege. On the Indian side, the tiger habitat and human settlements are experiencing net land loss at an increasing rate since at least 1970 due to sea level rise, besides intensifying storms and higher storm surges. What choices do the communities and Park Managers have? (i) Do nothing and leave the tigers and their human neighbours to their own devices, amounting to abandon and retreat, (ii) build resistive and or accommodative infrastructure, (iii) retreat and actively allow ecosystem to regenerate in vacated spaces. This brief argues that the last option is better over the others based on ecological economic valuation.

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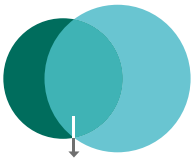
THE PREMISE ...

The Sundarbans Delta is under siege. The delta, located on the Bay of Bengal spread across the state of West Bengal in India and Bangladesh, is known for an exceptionally rich diversity of aquatic and terrestrial flora and fauna, and is the only mangrove tiger habitat in the world (Fig. 1). The Indian Sundarbans Delta (ISD) spreads over an area of about 9630 sq. km in the state of West Bengal in India.

FIG. 1

Increase in RMSL

Rise in the cyclone frequency



Land loss

During the last decade, Relative Mean Sea Level (RMSL) of the Bay of Bengal in the Indian Sundarbans Delta increased at the rate of 12 mm/year, which is significantly higher than the rate of 3.14 mm/year observed during the previous decade. This has been associated with a rise in surface air temperatures over the Bay of Bengal which has been reported to be rising at a rate of 0.019°C per year.

On the other hand, analyses of cyclonic events over the last 120 years indicate a 26 percent rise in the frequency of high to very high intensity cyclones over the recent times, possibly as a result of rising sea surface temperatures. The Indian Sundarbans Delta (ISD) has already faced the ferocity of the cyclone Aila in 2009, while Bangladeshi Sundarbans Delta was exposed to an even more violent cyclone Sidr in 2007. The losses to life and property were huge.

The extent of land loss over the 45-year period ranging from 1970 to 2015 due to relative sea level rise is as much as 250 sq km. With atmospheric temperature increases envisaged in the future that will accentuate sea-level rise, in-situ adaptation will no more be possible for the vulnerable regions as given in the figure 2.

What is the way out from this impasse?

A LONG-TERM ADAPTATION STRATEGY

In the face of this ferocity of climate change, a long-term strategy for adaptation and mitigation for ISD is proposed in the form of planned retreat of population from the vulnerable zone by 2050, and regeneration of mangrove forests in the vulnerable zone. It is believed that only when a safer habitat is provided to the people of the region along with proper source of livelihood, it is possible to restore mangrove forests in the vulnerable zone which will provide greater benefits to human community through various ecosystem services.

This strategy is divided into four distinct phases over time till 2050. Phase 1 involves a clear-cut identification and demarcation of the area of the ISD as a single administrative unit. The Sundarban Biosphere Reserve (SBR) can be construed as a 'Biosphere District' with 'scheduled area' status in order to restrict the outsiders from acquiring land. Within the 'Biosphere District', a high vulnerability zone is identified spread across six sub-districts comprising of 207 revenue villages on various islands constituting 45 village councils or Gram Panchayats (Fig. 2). All the sub-districts within this zone share similar geo-morphological characteristics and are partly or totally disconnected from mainland by tidal channels.

Phase 2 should focus on the development of adequate physical infrastructure in the outer margin of the 'Biosphere District' (the stable zone), away from the high vulnerability zone. This has a great significance as it is expected that population from within the vulnerable zone would gradually immigrate to the nearby regions. Thus, adequate infrastructure is necessary to absorb these people and thereby allow regeneration of mangrove ecosystems in the

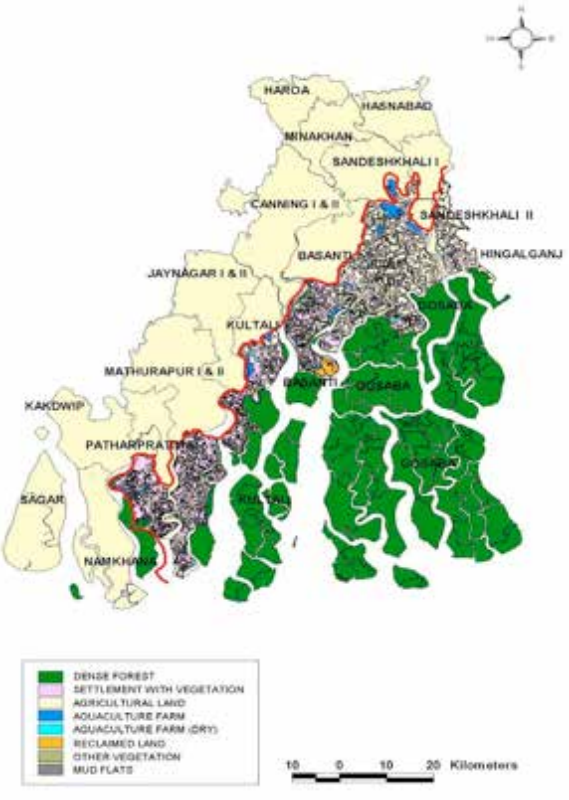
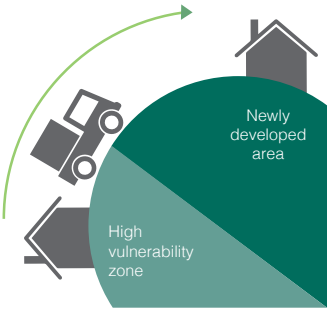


FIG. 2

vulnerable zone. This infrastructure should not only include secure housing and other civic amenities, but should also provide adequate opportunities for alternative livelihoods for these immigrants.

Phase 3 envisages preparing the residents for this change in order to minimise their psychological barrier towards the movement, through counselling and strong financial incentives. However, they should have the choice to decide whether they want to relocate or live in their current location.

Phase 4 visualises relocation of the population from the high vulnerability zone to the newly developed areas, and restoration of unused land as mangrove forests. It is estimated that by 2050, the total restored area should be around 1190 km2. However, ownership over vacated land remains with the people who have relocated.



COSTS AND BENEFITS WITH "IN-SITU" AND "EX-SITU" ADAPTATION ....

To answer the question on whether pursuing such a vision can prove beneficial over the current or the business-as-usual scenario, we arrive at the various costs and benefits, and eventually net benefits associated with the four scenarios as below.

1) Business-As-Usual (BAU) Scenario: This is a scenario where the community does not relocate and stays back in the vulnerable region. While assuming that the economic condition of the vulnerable zone remains as prevalent, the BAU scenario is affected by natural disasters.

2) Planned Retreat: This is a scenario where we assume that the population has moved to the stable zone by 2050, and the land in the vulnerable zone is abandoned. The community extracts benefits only from their voluntary relocation to the stable zone through the various forces of development.

3) Planned Retreat + Ecosystem Regeneration (without carbon sequestration values): In this scenario, we assume that the population has moved to the stable zone by 2050, and mangrove forest regeneration takes place in the vulnerable zone. The forest regeneration helps the community to obtain ecosystem benefits in the form of various provisioning and regulating services, without the monetization of the carbon sequestration benefits.

4) Planned Retreat + Ecosystem Regeneration (with Carbon Sequestration values): This scenario adds up the carbon sequestration values to the previously described scenario.

Table 1 below presents the net benefits across the various scenarios.

TABLE 1: NET VALUES OF BENEFITS ACROSS SCENARIOS

SCENARIO	CURRENT VALUES OF FLOWS OF EXPECTED BENEFITS FROM 2050 - 2100	MULTIPLE OF BUSINESS-AS-USUAL
Business-As-Usual	172306.27	1.00
Planned Retreat	996312.55	5.78
Planned Retreat + Ecosystem Regeneration (with zero value of Carbon Sequestration)	1507469.44	8.75
Planned Retreat + Ecosystem Regeneration (with Carbon Sequestration)	2202759.08	12.78

In Table 1, all the benefits flow from 2050 till 2100. The cost of mangrove regeneration, residential constructions, constructions of hospitals, schools, training institutes, as also the corpus, are one-time-incurred sunk costs expressed as prevailing in 2050. By all means, it is clear that the vision scenario of "planned retreat and ecosystem regeneration with carbon sequestration benefits" yields 12.78 times higher value than the BAU scenario.

POLICY IMPLICATIONS

With this plan, while the vulnerable community moves to the safer or "stable" zone thereby ensuring safety, communities will further benefit from the various increased ecosystem services As estimated, considering all the costs of implementing the plan the net benefit of this new plan or vision is 12.8 times than that of entailing the community staying in the vulnerable zone and earning their livelihoods through traditional fishing and agriculture.

As such, planned retreat is globally envisaged as a plausible adaptation strategy. Further, IPCC assessments and scientific papers in cherished journals like *Science* and *Nature* have emphasised the importance of restoring valuable coastal systems like mangroves to act as natural barriers to extreme events. This approach is applicable not merely for adaptation in vulnerable coastal zones, but also in other vulnerable zones where the business-as-usual mode of survival is rendered unsustainable by climate change impacts.

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