

Briefing · November 2022

Loss and Damage in the Sundarbans

Key points:

- The Sundarban region, home to 7.2 million of the world's most vulnerable people and the largest single mangrove forest in the world, is increasingly at threat from catastrophic impacts of climate change
- Climate change is contributing to the absence of employment opportunities, the destruction of property from extreme weather events and the loss of vital mangroves and land from sea level rise. With homes and livelihoods under threat, many are left with no choice but to migrate elsewhere
- The increasing scale and frequency of climate impacts mean the limits of adaptation have already been reached in many cases. The most affected argue that the extensive loss and damage needs to be addressed by those responsible with the financial means to do so.

What are the Sundarbans?

The Sundarbans are a cluster of low-lying islands in the Bay of Bengal, spread across India and Bangladesh. The region is recognised internationally for its unique biodiversity and ecological importance - including the single largest mangrove forest in the world, encompassing a [total area of 10,200 km²](#).

The Sundarbans ecosystem offers a [wide range of vital ecological services](#), including cyclone protection for millions of people, wildlife habitat, food and natural resource provision, and carbon sequestration. It is also home to [about 7.2 million people](#) (4.5 million in India and 2.7 million in Bangladesh), including some of South Asia's [poorest and most vulnerable communities](#). Around [half the population](#) lives below the poverty line.

Due to a [lack of employment opportunities](#), most are dependent on the land and natural resources that are increasingly being depleted by climate change. Most rely [on subsistence agriculture, supplemented with fishing, crab and honey collection](#). Millions [are unable to meet their basic nutritional requirements](#), leading to health issues such as anaemia, malnutrition and childhood stunting. At the same time, climate impacts are [exacerbated by other factors](#), such as poverty, lack of livelihood options, reliance on land, uneven land ownership and limited government support.

The Sundarbans were declared a reserve forest before the partition of India in 1875, and UNESCO declared the Indian and Bangladesh portions of the Sundarbans [World Heritage Sites in 1987 and 1997](#), respectively. The region is also recognised under the [Ramsar Convention on Wetlands](#). Despite this recognition, including conservation obligations under international conventions and treaties, the Sundarbans are under threat from climate change, along with a combination of natural factors and human impacts.

Climate impacts in the Sundarbans

Land mass is declining year by year

In 2015–16, the total area of the Sundarbans had shrunk by [210 km² since 1967](#), and by [451 km² since 1904](#). This declining trend holds true whether the Indian and Bangladesh portions of the Sundarbans are [considered separately or grouped together](#). The main reason is the surrounding sea level, which is rising more than [twice as fast as the global average](#). Satellite imagery shows the sea level has risen in the Sundarbans by an [average of three centimetres a year](#) over the past twenty years, and the area has [lost almost 12% of its shoreline](#) in the last forty. In addition to sea level rise, a [gradual reduction in sediment flow](#) from rivers to the Sundarban region has resulted in loss of land mass.

Due to these factors, the rate of retreat of coastlines is [as high as 40m a year](#) for some of the islands, which will disappear completely within the next 50–100 years at the current rate. Already some islands [have been submerged](#) and it is predicted that many more will vanish if sea level rise maintains its current pace.

Salinisation is threatening agriculture and health

Where land is not yet lost, frequent flooding with [salty water](#) from rising sea levels and extreme weather events renders affected land unproductive. Increasing water and soil salinity are also caused by climate-induced changes in temperature and rainfall, along with reduced freshwater flows from the Himalayas in the dry season. In the last 40 years, [approximately 25% of glacial ice has been lost](#) in the mountain range, posing a [significant risk](#) to stable and reliable freshwater supplies to major rivers, such as the Ganges and Brahmaputra, that flow into the Sundarbans.

In the Sundarban region, water and soil salinity has increased dramatically, with projections that [many parts of the region will reach near ocean-level salinity](#) by 2050. In Bangladesh, soil salinity increased [six times, and up to fifteen times](#) in certain areas, from 1984 to 2014. The salinisation of soil ruins crops and devastates farmer livelihoods. Research estimates a one metre increase in sea level would cause losses as high as [USD 597 million](#) in agriculture from salinity-induced land degradation. Some villages [no longer support agriculture](#) due to recurrent salt water inundation. When households are no longer able to grow crops on land due to lack of access or salty soil, they are unable to engage in subsistence farming and are [exposed to the cash economy](#), increasing their risk of food insecurity.

Progressive salinisation of rivers and groundwater has also resulted in the [decline of available fresh drinking water](#), with numerous adverse effects on mother-child health, including dehydration, hypertension, prenatal complications and increased infant mortality. Collection of data from drinking wells in the Indian Sundarbans found that [17 out of 50 wells sampled contained salinity levels unsuitable for drinking](#). Increased saline water levels also cause high blood pressure and fever, as well as respiratory and skin diseases. A vulnerability assessment of Mousuni Island in the Sundarban region found that [80% of the villagers experienced skin disease](#) caused by salty water. Additionally, [42% of households suffered infectious](#) diseases, such as malaria and dengue fever, during flooding. Under high emissions scenarios, climate change is expected to make the [prevalence of disease, particularly water-borne illnesses, even higher](#).

Mangroves and biodiversity are being depleted

Mangrove forests are a crucial natural blockade against cyclones, storm surges and tides, and sustain the high levels of biodiversity in the region. One study estimates that between 2000 and 2020, [110 km² of mangroves disappeared](#) from the reserve forest of the Indian Sundarbans due to erosion. While [81km² of mangroves were gained](#) through plantation and regeneration, the gains were all outside the existing mangrove forest. Another study looking at the coverage of mangrove forests between 1975 and 2020 found that mangrove forests have been [decreasing in density by an estimated annual rate of 1.3%](#).

Researchers also observed a [deterioration in the health of mangrove forests](#) over the last twenty years due to increased salinity, temperature rise and rainfall reduction in pre and post-monsoon periods. While mangroves are known for their resilience, they are [sensitive to changes in the salinity of water and soils](#), which is already resulting in shifts away from high-value timber species towards more salt-tolerant mangrove species. This is reducing the quality and overall availability of timber stocks, with [implications for those relying on the forest](#) for their livelihoods. Researchers estimate that there has been a [loss of USD 3.3 billion](#) in ecosystem services of the Sundarban Biosphere Reserve during the last 30 years, [over 80% of which is provided by mangroves](#).

In a changing climate, it is expected that the Sundarbans landscape will undergo [significant fragmentation](#), causing habitat loss for many endangered species, including tigers and venomous snakes, and this is [increasing the risk of human-wildlife conflicts in the region](#). Sea level rise is resulting in habitat loss for many terrestrial and amphibian species. [Habitats for freshwater fish are also shrinking](#) as water becomes more salty, threatening many small, indigenous freshwater species. This has adverse impacts on the livelihoods of fishermen, as well as on human health as fish is a critical source of protein and nutrients in the Sundarbans. For example, in regions with high levels of fish species loss, chronic and acute malnutrition among mothers and children is [higher than the thresholds set by the World Health Organization](#) for public health emergencies.

Extreme weather events are more frequent and severe

While the Sundarban region has always been affected by cyclones and extreme weather events, the rate and intensity of these events are increasing. In the last 23 years, the area has witnessed [13 supercyclones](#). In the Bay of Bengal along the Sundarbans, the occurrences of cyclones [increased by 26%](#) between 1881 and 2001. Additionally, research has shown there has been a [significant rise in the frequency of very severe cyclones](#) in the post-monsoon season from 2000 to 2018. Scientists project an [increase of about 50% in the frequency of post-monsoon cyclones](#) by 2041-2060.

The rise in cyclone frequency and severity is in part attributed to the increase in sea surface temperature, which rose in the Indian Sundarbans at [0.5°C per decade from 1980 through to 2007](#) – around eight times higher than the globally-observed warming rate of 0.06°C per decade. Land surface temperature in Sundarban region has [already increased about 1°C](#) over the past century and is projected to warm by [up to 3.7°C by 2100](#).

Due to the low elevation of the Sundarbans and reduced protection from mangroves, cyclones can cause catastrophic damage. Four major cyclones have hit the Sunderbans in the last three years, killing [nearly 250 people and causing losses of nearly USD 20 billion](#). Cyclone Amphan in 2020 was estimated to have destroyed 28% of the Indian Sundarban region and [caused USD 12 billion of damage](#). The Cyclone displaced [2.4 million people in India and 2.5 million people in Bangladesh](#). While many returned soon afterwards, damage

to more than [2.8 million homes and lack of evacuation centres](#) resulted in homelessness and prolonged displacement for many thousands.

Following Amphan, the government estimates [over 100,000 farmers](#) experienced heavy losses as salt water in fields and ponds killed off fish and rendered fields uncultivable. With hundreds and thousands of extra mouths to feed, [conflicts between humans and tigers spiked](#) as islanders began venturing deep into the forests in search of fish, crab, honey and firewood.

Livelihoods are being hit hard

About [five million people are dependent on the Sundarbans for their livelihoods](#). According to the World Bank, [almost 80% of households](#) in the Sundarbans pursue livelihoods that involve inefficient agriculture, fishing and aquaculture production methods. Dependence on the land and natural resources paired with a lack of alternative employment opportunities means livelihoods are extremely vulnerable to changing climatic conditions.

Salinisation is threatening agriculture. Fishermen are impacted by the decline in fish populations. Forest-based livelihoods are adversely impacted by changes in the composition of mangrove species, which is reducing the value of standing timber and honey production. A study of three villages in the Indian Sundarbans found that [62% of the workforce has lost their original livelihoods](#) and have been forced to rely on much more uncertain incomes.

Even though the impacts of climate change put their livelihoods at greater risk, some households continue to live in vulnerable locations due to high land prices and a lack of employment opportunities elsewhere. Due to a lack of job opportunities, others need to migrate to seek out employment, [temporarily or sometimes permanently](#).

Young men and women have had to leave for nearby cities, or even states over 1,000 kilometres away. There they face a [precarious existence](#) as daily wage labourers and contract workers at construction sites and factories. Some estimates suggest that [roughly 60% of the male workforce](#) in the Indian Sundarbans has migrated. Migration has also [increased the poverty](#) of the population left behind since it takes considerable time for low-skilled migrant family members to save sufficient funds to send back home.

Migration as a last resort

An estimated [1.5 million people will have to be permanently relocated](#) outside the Sundarbans because sea level rise will make it impossible for them to live there or earn a livelihood. As climate change is responsible for their forced migration, these people are climate refugees - however, the term is [not formally recognised internationally](#). Additionally, [extreme poverty both arises from and contributes](#) to their vulnerability to environmental hazards.

Over the past 25 years, four islands in the Indian Sundarbans - Bedford, Lohachara, Kabasgadi and Suparibhanga - have already disappeared, causing [6,000 families to become displaced](#). Lohachara became well-known as the [first inhabited island in the world to disappear](#). Neighbouring Ghoramara is already half underwater. Once home to 40,000 people, the 2011 census counted [only 5,000 people](#) still struggling on the island.

Many of those displaced relocated to nearby Sagar island with the aid of [government programmes in the 1980s and 1990s](#). However, with a population of [200,000 and growing](#), and with the island having [shrunk by a sixth of its original size](#), land and resources are being

severely depleted. One case study calculated the total value of damage to 31 households forced to move from inundated areas of the Sundarbans to the island of Sagar at [Rs 6,0742,225 crore](#) (USD 700,000), [98% of which was due to loss of land assets](#).

Back in 2002, it was estimated that climate change would [displace over 69,000 people from the Sundarbans by 2020](#). In 2018, about [60,000 people](#) had already migrated from the region.

Why adaptation is not enough

Climate adaptation is the process of [adjusting to current or expected effects of climate change](#). However, it is clear that adapting to some impacts of climate change will not be possible and, in some cases, the limits of adaptation have already been reached.

A key adaptation measure is the construction of storm surge walls and embankments. However, even with these measures, the loss and damage inflicted by a few hours' battering by waves, winds, and storm surges during a cyclone can [undo the gains from many years of measures to prevent flooding](#). After Cyclone Aila in 2009 [destroyed 778 km of embankments in the Sundarbans](#), it cost [Rs 5,032 crore](#) (USD 670 million) to rebuild them, only for them to be breached again ten years later by Cyclone Amphan. One Sundarban village, after embankments to hold back the rising sea collapsed during Cyclone Aila, attempted three times to build sea walls, [all of which collapsed against the power of the sea](#).

Another adaptation approach is the introduction of salt-resistant crops. This has been met with some success, but may prove to be [a temporary fix](#), with hurdles such as the [availability of seeds, knowledge of farming and relatively low yields](#).

Adaptation practices can also exacerbate and accelerate the ecological damage caused. For example, increasing salinity levels prevent the cultivation of rice or other crops, causing some to [shift towards shrimp farming](#), which requires salt water and can be more profitable. However, the conversion of land to shrimp farms further accelerates the salinisation of water while profits often only [benefit private investors](#). Workers – primarily women – receive little income and [suffer health issues, such as infections, problems with eyesight and skin disease](#).

For the people of the Sundarbans, lives depend upon the land on which they live, produce food and sustain their livelihoods. Some inhabitants have already had to [relocate multiple times](#). In the words of one resident: [“People are resilient, but how much resilience can they have?”](#) The outlook is bleak for the Sundarbans, with proposals that [‘managed retreat’](#) – the planned migration away from vulnerable regions over time – may be the only viable option.

Why financing for Loss and Damage is needed

Loss and damage is a term used to describe how [climate change is already causing serious and, in many cases, irrevocable impacts](#) around the world – particularly in vulnerable communities. According to the [most recent assessment of climate impacts from the Intergovernmental Panel on Climate Change \(IPCC\)](#), loss and damage can broadly be split into two categories – economic losses involving “income and physical assets”, and non-economic losses, including “mortality, mobility and mental wellbeing losses”.

For the people of the Sundarbans, the economic and non-economic losses, such as loss of land, livelihood, mortality, health, culture, are beyond what the region can afford. According to a 2009 study, the annual costs of the environmental damage and health

issues caused by climate change are [estimated at Rs 1290 crore annually](#) (USD 250 million) – equivalent to [10% of the Sundarbans GDP in 2009](#).

The Sundarbans bear little responsibility for global emissions (for example, the whole country of Bangladesh is [accountable only for only 0.56% of global emissions](#)), but are forced to suffer the consequences. Alongside many other developing nations and vulnerable communities, the region argues strongly that it should not be forced to pay for the excessive loss and damage already incurred, and anticipated in the future.