

IMPACT OF CLIMATE CHANGE ON THE SUNDARBANS

Nipa palm under threat

The biodiversity of Sundarbans is exposed to threats of deforestation and climate change impacts. Declining trend of Nipa is one of the major threats to the mangrove ecosystem.

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NIPA Palm (Golpata) is an indicator plant species of the Sundarbans biome albeit it is neither a true littoral nor a high saline resistant species. It grows in the mudflat and fertile riparian habitats where the water slowly rises up and then slowly falls back again. It can grow inland where the tide deposits the seeds.

Nipa can tolerate infrequent inundation, as long as the soil does not dry out. It occurs mostly in the fresh swamp and in the mixed fresh-brackish swamp forests. It also grows on low lands and depressions, at the base of eroding slopes and cliffs, or on sandy ridges or embankments of Mongla, Rampal, Morelganj, Shoronkhola, Bagerhat Sadar, Koyra, Paikgachha, Dacope, Sheyamnagar, Ashashuni, Pirojpur Sadar, Mathbaria, Pathorghata, Khepupara, Galachipa and Amtali Upazila. It is an under-shrub in the riparian zones and the ecological climax of Nipa or its associates occurs in pure stands on islets in the main channels or on depressions of the interior river meanders having silt loam soil texture. These deposits are enriched frequently by floods or surface run-off from nearby rivers during the monsoon.

The feathery leaves of the Nipa look like the coconut leaves. They are used as a roof material by the coastal inhabitants for their thatched houses and dwellings. The leaves are also widely used in the basket industry. Young leaf is used in the cigar industry to wrap the tobacco. It produces double biofuel compared to maize which

is almost equal to sugarcane. The sap and the young fruits can be decomposed to produce biogas. Sometimes large stems are used as a life buoy in water.

The sap of Nipa is fed to pigs to improve the flavour of meat. The inflorescence is tapped to capture the sweet sap in the Patuakhali coastal areas. The collected sap is boiled down to produce jaggery and sweet syrup (gur). The sap is also used to produce local alcoholic beverage called "Cholai Mod". Vinegar can be produced from this liquor by storing for several weeks. Young shoots are consumed as vegetable and the flower petals have aromatic value. Immature fruit is used to prepare dessert in many countries. The petals of the flower are also used as an aromatic tea.

They are important in preserving water quality and controlling the river erosion. They provide habitat for wildlife refuges especially for amphibians and reptiles. It provides shelter, shade and food for many aquatic animals. Nipa increases biodiversity, and provides wildlife corridors enabling aquatic and riparian organisms to move along river systems avoiding isolated communities. They provide forage for wildlife. It lowers nitrate contamination in surface runoff from agricultural fields. It works as windbreaks or shelterbelts to protect crops, water sources, soils and settlements. They are essential for dune stabilization as well. Nipa vegetation is the home of Crabs, Snails, Oysters, Mollusks, Brittle Star, Algae, Tortoises and Snakes. They provide excellent nurseries for Shrimps,

Hilsha Fish, Zebra Fish, Hamilton Fish, Asian Sea Bass, Black Sea Bass, Silver Pomfret, Crocodile and Dolphins. They are very important habitats for Fishing Cat, Bengal Monitor, Black Lizard, Yellow Monitor, Water Monitor, Grey Mongoose, Ring Lizard, Pangolin, and other threatened species. The Royal Bengal Tiger uses Nipa patches for resting, sleeping and dining spaces.

The biodiversity of Sundarbans is exposed to threats of deforestation and climate change impacts.

Declining trend of Nipa is one of the major threats to the mangrove ecosystem. The abundance of Nipa depends largely on soil type, salinity, duration and frequency of inundation and accretion of silt. The environmental parameters with the direct influences on Sundarbans in terms of global climate change are sea-level rise, natural calamities like cyclones, rising temperature, salinity and drought.

The obvious impacts of relative sea-level rise in the ecosystems of Sundarbans are permanent inundation, salinization and coastal erosion. One-metre rise of sea level will destroy the whole ecosystem of Sundarbans. Nipa vegetation will be submerged under water. The shift in the position of the land/sea boundary in the Sundarbans territory is complicated by high sedimentation rates in some areas and extensive coastal erosion in others. The coastal sediments are mobilized by tides and currents to the canals and the rivers. High siltation occurs in the dry season due to low flow of water. The water bodies are being silted quickly and the Nipa is losing the habitat day by day.

Nipa is very sensitive to hydrological conditions and occur in areas of low water salinity (<10ppm), where the mean daily inundation period does not exceed 3 hours. Low flow of water from the upper stream of the Ganges also has a major impact on salinity conditions and hence on the



A Nipa stand captured from Harboursia by the writer

distribution of Nipa. The factors which contribute to the increase of salinity are tidal flooding during monsoon, direct inundation by brackish water, and horizontal movement of brackish ground water during dry season. The ecosystems of Sundarbans react with the increase of salt concentrations. Salinity is more devastating than any other parameter in this territory. It is very difficult to manage salinity because of the lasting nature of its effects on terrestrial and aquatic ecosystems. Saline water tides are highly crucial for Nipa's seed dispersal and germination.

Predictions from the Sundarbans territory show that salinity may be double over the next few decades posing risks for survival of Nipa. Nipa

is found only in the fresh swamp and the mixed fresh-brackish swamp.

Karamjal, Jongra, Mora Passur, Nandobala, Harboursia, Choraputia, Andharmanik, Tamulbunia, Supoti and Kochikhali forest areas are considered as the paradise habitats for Nipa. But declining trends in Nipa abundance has been observed in these areas over time. The inland Nipa is being disappeared rapidly. Due to increased salinity fresh water swamp is being converted into mixed fresh-brackish swamp while mixed fresh-brackish swamp into brackish swamp and brackish swamp into mangrove scrub. The littoral forests are becoming degraded forests due to higher mortality caused by higher salinity. With this change in the vegetation

type the Nipa is being disappeared from the past mixed fresh-brackish swamp. Salinity causes a major threat to the succession of Nipa. Salinity weakens the potentiality of natural regeneration by reducing the viability of seeds, seedling germination and seedling recruitment. The Nipa mortality rate is being accelerated due to increased salinity. The production of new leaves, leaf longevity and the leaf area, net photosynthesis rate, stomata conductance and transpiration rate of leaves are being reduced.

The changes in the composition and abundance of this sensitive indicator species provide the specific biological signal of the climate change impacts.

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Biodiversity decline causes concern

Global Biodiversity Outlook published in 2001 by UNEP to provide information on Biological Diversity, estimated that some 24% of mammal (1,130) and 12% of bird species (1,183) are globally threatened. There were many causes for the decline of biodiversity.

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BIODIVERSITY almost always refers to the diversity of species found in a given ecosystem. These are its structural components. Identifying the structural components is important, because function flows from structure, and it is the functioning ecosystem that provides the goods and services sustaining human life and enterprises. Can ecosystems lose some species and still retain their functional integrity? Research evidence indicates that it is the dominant plants and animals that determine major ecosystem processes such as energy flow and nutrient cycling.

How much biodiversity of species is there? Estimate ranges widely, and the fact is, no one knows. At least 726 animal and 90 plant species have become extinct since 1500. Most of the known extinctions of the past several hundred years have occurred on oceanic islands, where small land masses limit the size of populations and human intrusions are the most severe.

Global Biodiversity Outlook published in 2001 by UNEP to provide information on Biological Diversity, estimated that some 24% of mammal (1,130) and 12% of bird species (1,183) are globally threatened. There were many causes for the decline of biodiversity. Biologists have identified some of them as more responsible. These are physical alteration of habitats, population connection, pollution, exotic species, and overuse.

Physical alteration of habitats

When a forest is cleared, for example, plant and animal that occupied the destroyed ecosystem, also suffers. The idea that this wildlife simply will move "next door" and continue to live in an undisturbed section is erroneous.

Human-dominated landscapes, however, consists patches that frequently contrast highly with neighbouring patches. For continued

survival of any natural population, the number of individuals must never fall below a critical line, and that requires a certain minimum area that must be large enough to compensate for years of adverse weather. For many species, more area will be required during a dry year than during a normal year. If development reduces the habitat to a point where it cannot support the critical number during an adverse year, the entire population will perish.

Streams are sometimes "channelized" their beds are cleared of fallen trees and riffles, and sometimes the stream is straightened out by dredging. Such alterations inevitably reduce the diversity of fish and invertebrates that live in the stream.

Intrusion is one of the reasons to reduce biodiversity. Birds use the airways as highways. Recently, telecommunications towers have presented a new hazard to birds. Although television towers have been around for decades, new towers are sprouting up on hill-tops and countryside in profusion. The lights often placed on these tower can attract birds which usually migrate at night, and the birds simply collide with the towers wires. Some 45,000 towers over 200 feet high are now in place, and the number is expected to double within a decade (The U.S. Fish and Wildlife Services 'FWS'). The FWS has estimated that the towers kill somewhere between 5 and 50 million birds a year. In Bangladesh towers establishment is indiscriminately done and no estimation is yet made on the number of towers and also on the bird-killings occurred because of the tower placement.

Population connection

Past losses of biodiversity can be attributed to the expansion of the human population. Continuing human population growth will further alter natural ecosystems, resulting in the inevitable loss of more wild species. The losses will be greatest in

the developing world, where biodiversity is greatest and human population growth is highest. Africa and Asia have lost almost two-thirds of their original natural habitat. In East Africa, where human population growth has been explosive for several decades, the conversion of Savanna and woodlands to cultivation or intensive grazing by goats and cattle has driven most of the African ele-

phants from depths below 20 meters every summer. Shrimp, fish, crabs, and other commercially valuable sea life are either killed or forced to migrate away from this huge area along the Mississippi and Louisiana coastline. This type of pollution in the aquatic ecosystem in Bangladesh is too severe, but yet no proper corrective attempts have been made. Buriganga river near Dhaka city has

Instead, global climate change and pollution from toxic substances are the legacy of the already developed nations.

Exotic species

An exotic species is a species introduced into an area from somewhere else, often a different continent. Such introduced species frequently stands unsuccessful in establishing viable

major assault against wild species, responsible for 23% of their recent extinctions. Overuse is driven by a combination of greed, ignorance, and desperation. The plight of birds in Europe is a good example. In Greece, some 700,000 birds are shot each year. In Malta about 3 million a year are killed and eaten each year. Another prominent form of overuse is the trafficking in wildlife and in products derived from wild species.

Bangladesh is a glaring example of overuse of natural resources. Forests of the country are worst sufferers. Most vital examples may be cited the Sundarbans ecosystem and the some other forest ecosystem of Bangladesh. In Sundarbans forest areas major plants or dominating plants are pollinated by insects. The plants dominating the Sundarbans ecosystems mostly are with entomophilous pollens. This means that the plants are dependent on the insects mainly on the bees for their pollinations. The mawallis (professional honey-collectors) are allowed to enter into the forest during the period of April to June every year. It is the high flowering period for the dominating plants. Plant-animal interactions in the mangrove ecosystem is to be attentively maintained otherwise this most suitable site for biodiversity maintenance will be perished even if we take other several measures to maintain it.

The Satchari forest in Habiganj, Sylhet is a newly overexploited and overused forest ecosystem and it is most alarming situation in the country. The visitors are indiscriminately allowed to the forest. The damage made by the situation stands unreparable. One example could given here. One year ago, 15 "spot-hedges" were identified where the largest butterflies of Bangladesh (Birdwings) were naturally colonized. "Spot-hedge" is the smallest area (small suitable ecosystem) in the forest where the butterflies get their all necessities both biological and environmental. Studies reveal that out of the 15 marked "spot-hedges" six have been destroyed because over-use of the forest as a whole. It is now found that the population of the bird-wing butterflies has been dropped by 50% in the present year.

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Overuse of forest in Satchari National Park, Habiganj-Sylhet

phant population into the existing wildlife reserves, greatly reducing their numbers. The other large African mammals have experienced similar reductions, as the needs of the rural population inevitably conflict with those of the large wild animals of East Africa.

Pollution

Pollution is a major factor that can directly kill many kinds of plants and animals, seriously reducing their populations. For example, nutrients (phosphorus and nitrogen) from America's agricultural heartland traveling down the Mississippi River have created a 7,700-square mile "dead zone" in the Gulf of the Mexico where oxygen completely disappears

collapsed ecologically and become dead biologically long before. No plankton growth is there for lack of oxygen supply and increase of waste-deposition rate per year.

Pollution destroys or alters habitats, with consequences just as severe as those caused by deliberate conversions. Acid deposition and air pollution kill forests; sediments and nutrients kill species in lakes, rivers, and bays; and emissions cause depletion of the stratospheric ozone species. Global climate change, brought on by anthropogenic greenhouse gas emissions, is already having an impact on many species rates. In this case, however, the developing world, where population growth is such a problem, is not much to blame.

population and quietly disappears. This is the fate of many pet birds, reptiles, and fishes that escape or are deliberately released from their native habitats. Occasionally, however, an introduced species finds the new environment very much to its liking and can become an invasive species, thriving, spreading out, eliminating native species by predation or competition for space or food. Exotic species are major agents in driving native species to extinction and are responsible for an estimated 39% of all animal extinctions since 1600.

Overuse

Overuse is not only the excessive use but also indiscriminate use by the anthropogenic activities. Overuse is