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Eco Insights: Navigating Sustainability

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Eco Insights: Navigating Sustainability



It gives us immense pleasure to introduce the inaugural edition of Progyan Communique, the official newsletter of the Progyan Foundation for Research and Innovation. This newsletter marks a significant step in our journey of promoting research, innovation, and sustainable development across diverse landscapes. Through Progyan Communique, we aim to share insights from our ongoing projects, breakthroughs in research, and stories impacting the environment. We hope this platform will serve as a space for knowledge exchange, collaboration, and inspiration for all stakeholders working towards a sustainable and innovative future.

Welcome to the Progyan Communique.

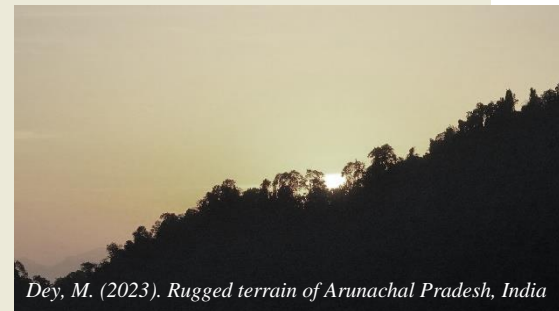
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Dey, M. (2024). Fuel wood collection. Indian Sundarban.



The 'Thunbergian' Theory of Climate Change

Dipayan Dey

Climate change may seem like anything today, a Friday fashion forward, an IPCC report, or an overcrowded marketplace for green climate fund, or even just a theory, but except for its awful impacts looming on the marginal poor, like an Armageddon. Those, who exists in the bottom of the pyramid inhabiting some of the most vulnerable areas of this planet and leverage the nature services to thrive, sustainability is still a myth for them and climate change – a rumour. Any blah blah blah of climate change on the global media wouldn't make much sense unless it ensures both life and livelihood in a circular complementarity. Superseding the urban-rural divide, inequities are now fermenting the broth of policy dichotomies that discerns this circularity. Inequities are refreshed by the digital divide. The divide is now between the vaccinated or non-vaccinated and it is still there between mitigation and adaptation. After the failure of COP 25 and amidst the delays in COP 26, policy wise mitigation is presumed to be a recurrence of quick resource disbursement against 'no guaranty' of intended results and adaptation has become a long-term brisk investment that has no political benefits, especially in the developing global south. The climate-sceptic bent to the pro-

adaptation argument on one hand let the fossil-fuel companies off the hook, whereas mitigation measures are the money spinners like the renewable energy interventions. Climate engineers and scientists had shown that mitigation (abating emissions) alone is insufficient as different administrations, trades and faculties have conflicting measures for carbon budgets and their vested interests get tempted in budgetary sleights-of-hand. Unfortunately, Glasgow is not going to debate anymore on this. The super COP26 would rather listen to Thunberg's theories on climate change that off let is taking centre stage in global media, while trying to seek concurrence over Article 6 on carbon market. Though there is no iota of doubt that economic stimulus and climate action can be orchestrated, ambitious climate actions in NDCs will be sparse in COP26, in the pretext of the pandemic setbacks. The economic recession owing to COVID crisis would apparently prevent in utilizing the USD 100 billion global carbon finance in adaptive low-carbon development path and rather create conduits to fund mitigation efforts. The Thunberg theory might hide foul global diplomacy of swinging the mitigation-adaptation ambiguity in the shadow of so-called climate activism, but realities wont. In this scenario the investment decisions would circumstantially depend on the strategic policy planning in developing countries but it would be pejorative if non-carbon finances undo the intended outcomes from carbon finance. Flashbacks from Madrid reveals that the failure COP25 had two major issues, one is the 'double count' allowances of Brazil & Australia, wherein old carbon credits can be cumulated over new credits, while the other bottleneck was the pull back efforts of India & China, the other two major BRICS nation. However, the global recession had already set in by the end of 2019 and events like demonetisation in India, Trumpian apathy on climate change, unemployment in Russia, as well the boiling Brexit issues were all on the table. Pandemic had hit just at this time. Regional collaborations for addressing climate change are crucial as political boundaries and boundaries of politics both delimits emission abatements and fragments adaptation ventures below its critical sustainability mass but SAARC is defunct. However, the global climate policy seems to have taken the same Thunbergian pathways as we find ahead through the path from COP28 in Dubai to COP30 in Balem.

Dubai to Belam via Baku - The transit: Post ante COP 28 in Dubai, global negotiators are slowly and steadily choosing transit camps for Baku and Balem. The dichotomy is clearly visible as short-term goals for negotiating in fossil fuel issues and as well economic decarbonization in Baku (COP 29 venue 2024) and then following it up with long-term goals of incorporating those negotiations in NDC 3.0 in Balem (COP 30 in 2025). It is observed that both the short and long-term goals are disproportionately spread in every sector (for example renewables, transport, farming and agroforestry, textile, plastics or oceans) that is either contributing to climate impacts factors like GHG and heat radiations or abating it, whereas issues like GESI, intersectionality and just-transition are still cosmetically garnishing these lobes, with low sustainability factors. It is presumed that the larger market economies have leveraged from the new Net-Zero implications that grossly allows to cross-subsidize the emission loads in allied sectors and thus the inapt apportions are market driven in entirety. There is no iota of doubt that the market focus is more

on non-farm secondary and tertiary production (manufacturing) sectors rather than primary sectors like agro-farming and forestry. Two simple examples that can clarify this are, firstly promoting solarization in the farming sector for irrigation with insignificant policy manoeuvring on water usage and secondly, highly subsidizing chemical fertilizers as yet, with mere 1-3% conversion targets to organic and natural farming in national budgets. This also inclines the economy towards mitigative measures rather than adaptive ones with minimal focus on net-zero stances, like renewables in cooling solutions. We, therefore, need to review the whole food system in the given scenario with a scientific lens, to which empirical evidences and multi-criteria policy analysis is a pre-requisite.

As we know, the primary focus of COP 29 is the first enhanced transparency framework and to establish a new collective quantified goal (NCQG) on finance, and as well propounding peace (conflict reduction) among several other critical climate issues and therefore, the pre-cop gatherings including SB60 were genuinely busy finalizing the same with global lobbies, undermining the nexus of vitals like water and energy, or disaster risk and poverty. Definitely, COP29 will build upon the agenda set in COP 28 in Dubai, that includes transitioning away from fossil fuels on one hand and to achieve net zero by 2050 on the other, as the two key elements of the agenda. However, while reviewing the 'TROIKA' approach of the previous, present and upcoming COP presidencies, it is anticipated that COP 29 in Azerbaijan will aim to guide countries toward consensus on addressing the

climate crisis, emphasizing the urgency of keeping global temperatures from rising more than 1.5°C above pre-industrial levels, but insist on new climate finance taxonomy that allows gaseous fuels to flow for the industrial EU and as well plead for peace to deal with Russian monopoly in fossil oil. NCQG will address another major issue herein that stayed unfulfilled since 2009, the commitment of developed countries to provide \$100 billion annually to developing countries for climate action. COP 29, would therefore be expected to set a new annual target much above \$100 billion, wherein the oil lords will be contributing for the first time and as well determine whether the funds will be grants or loans, to edify the consumer economy. The whole food system, though grossly impacted by these pronouncements, finds no prominent place in policy scenario, whilst climate critiques opine that food security and livelihood securities are intricately intertwined with such stratified decisions. This would therefore, necessarily create a whirlpool of exigencies to infuse the issues into NDCs by 2025 in Belem.

Azerbaijan is also aiming to shield the annual talks from geopolitical tensions by proposing a two-week COP truce. This initiative, inspired by the Olympic truce, is intended to unite countries in a collaborative effort to address the pressing issue of climate change, which also would create space for lobbying with common interests. Given that the current global political divide and regional bipolarity (which is even worse than the Cold War era) makes it hard to agree on climate action, when the host of COP 29, whose GDP solely depends on fossil fuel revenues, assumes that the climate crisis is a universal issue demanding an inclusive approach and refuses to join OPEC, a dialectically diverse polarization appears to be more real than the cognitive reality. Active engagements of nations in BRICS, MIKTA, IBSA, SCO, G20, OPEC and OPEC-plus truly captures the zeitgeist of this transit time. In this milieu, it's imperative that there will be shadowing of issues and interests and direct focus on the whole food system seems to get diffused in the clouded decision support mechanism, except for the fact that financing in this sector still has a potential take, since the threats of climate change is steadily looming upon food and livelihood security of the major consumer base and marketplace of global south. This would therefore need institutional capacities to be built for equitable negotiations and the taxonomy of innovative financing must also be effectively defined and incorporated in the NDCs. Nations are expected to revise their NDCs by COP 30, in 2025 and supposedly reach to an agreement at COP 29 in Baku, on a new, collective and quantified global climate-finance goal that will come into play after 2025, that both COP 29 & 30 would pave the ways for.

Coping with COP29: Along with technical issues, the COP29 presidency has highlighted issues concerning "Article 6" of Paris Agreement on voluntary carbon markets, as one of its priorities (https://unfccc.int/files/essential_background) that states 'The use of internationally transferred mitigation outcomes to achieve nationally determined contributions under this Agreement shall be voluntary and authorized by participating Parties.'. However, neither any discussion on Article 6 and nor on Article 7 that deals with 'Adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate

change, made much progress in Bonn SB60, suggesting the months ahead of COP29 will be challenging, more so the focus will also be in SB61 in New York in November'24, whence US will be the realm of presidential election. Many delegates in Bonn were frustrated that negotiations were still not reckoning with the need to ramp up global climate ambition. President-designate Mukhtar Babayev of the COP29

presidency figured few broad priorities for the new climate-finance goal at the presidency's spring meetings, those were sketchy. In the following months, other international events too will feed into the climate summit and give a sense of progress towards international financial system reforms. Brazil, as the G20 host will be fuelling continued discussions on hybrid finance in end July 2024 along with other members of BRICS, though China and India might differ strategically, since the financial agencies would doubly target these giant markets. The World Bank and IMF annual meetings will then take place in October, shortly before COP29. It is imperative to note that even now, the investments are more inclined towards mitigation funding and adaptation is again ostracized from the mainstream economy, owing to its longer breakeven period.



Hilsa, a veritable miracle for over five million people: Historical and contemporary circumstances

Malancha Dey

The hilsa fish holds a special place in the hearts and plates of people in South Asia. It has been celebrated in art, literature, and songs for centuries, symbolizing prosperity and good fortune. Its presence in traditional South Asian cuisine is a testament to its cultural significance.

Five species within the Genus *Tenualosa* have been identified in the estuaries and coastal waters of tropical Asia. Among these species, the Indian shad *T. ilisha*, and to some extent *T. toli*, can be found in Indian waters. Commonly known as Hilsa, this fish belongs to the subfamily Alosinae of the Clupeidae family. The Hilsa (*Tenualosa ilisha*) is highly prized for its delectable taste and is considered a seasonal delicacy, making it a significant catch for fishermen and a vital food source for wildlife. Its esteemed status is evident in Sanskrit and Bengali literature, where it is referred to as the 'Matsya Raja' or king of fishes. This fish holds a special place in Bengal's culinary history, being greeted as the cultural, social, and religious icon known as the 'Macher Raja' or King of Fish. The largest hauls of Hilsa come from the deltaic region of the Gangetic system in India and Bangladesh, where it is valued above all other fish species.

Spawning grounds

The total stretch of 523.59 km of the Bhagirathi-Hooghly River system.

- Between Diamond Harbour and Godakhali (Lat. 22°10.182'N, long. 88°12.034'E and Lat. 2°24.284'N, long. 88°08.548'E)
- Between Hooghly Ghat to Kalna (Lat. 22°25.115'N, long. 88°23.826'E)
- Between Lalbagh to Farakka (Lat. 24°05.243'N, Long. 88°27.942'E, and Lat. 24°27.253'N, long. 88°54.470'E)

The research conducted during the British era has proven to be invaluable for today's scientists and researchers. While there may be a limited number of reference materials available, 'Ganga' stands out as a reliable source of information on this particular fish. According to this book, in the past, groups of Hilsa fishers would travel from various parts of the country (undivided Bengal) such as Khulna, during the month of Bhadra (15th August to 15th September) to catch Hilsa. After Vijaya Dashami (October), they would then return to their hometowns. It's fascinating to think about the journeys these fishers would undertake in pursuit of their catch!

The Hilsa fish, a true traveller of the seas, is a fascinating creature that navigates through coastal waters with ease. From its anadromous tendencies to its impressive breeding habits, the Hilsa is a true marvel of nature. In the past, the Hilsa would journey up rivers as far as 1200 km, but nowadays it seems to prefer shorter trips of around 50 to 100 km. It used to be quite the prolific egg



Dey, M. (2022). Traditional fishing. Indian Sundarban.

producer, but sadly, its fecundity rate has taken a hit in recent years. Some Hilsa even venture as far as Assam, proving that they're not afraid of a little adventure. During the breeding season, which coincides with the southwest monsoon, the Hilsa puts on quite the show. In the major east and west coast rivers, dams and barrages act as physical barriers and adversely affect migration route to breeding grounds in riverine areas of this species. Cauvery, Mahanadi, Chilka Hilsa, are casualties of modern hydraulic structures in the Indian subcontinent. The decline in Hilsa catch in the Ganges is a clear sign that something fishy is going on.

Challenges

Habitat loss for hilsa

Barrages, dams, etc. built across major river systems in India deprived hilsa of its normal range of movements for breeding in – 1) Ganga, Mahanadi; 2) Godavari, Krishna, 3) Cauvery, Narmada, Tapi

Juvenile fishing

The rampant juvenile fishery in the estuary; about 10-20 million juveniles are caught annually; If reduced to 50% the production can go up 20-35%. Fishing of brooders in the marine and estuarine sector; not much is coming to the freshwater sector. Until the 1970s fishing was mostly traditional; mechanization increased fishing effort tremendously affecting the stocks. In the lower zone of the Hooghly alone 1500 mechanized and 2292 non-mechanized boats are fishing for hilsa alone. Each of these employs 60 to 400 pieces of gill nets (40 x 18 to 60 x 30 feet pieces laced together).

Climate change, altered river environments, and changes in nutrient flow are wreaking havoc on the Hilsa population. It's not just the Hilsa suffering either - other fish like Rohu, Catla, and Mrigala are feeling these effects too. In a nutshell, the Hilsa's disappearance from the region is a tragedy of epic proportions. Let's hope we can reel in a solution before it's too

late. Hilsa, a fascinating fish, spends its adult life thriving in the marine environment before embarking on a journey to freshwater riverine habitats for breeding purposes. The young ones then migrate back to the marine environment to continue their growth.



Dey, M. (2022), Subsistence fishing, Indian Sundarban.

However, the once lucrative commercial fisheries of this fish, particularly in the Hooghly estuary, have seen a drastic decline. This decline can be attributed to recruitment failure and the intensified exploitation of both adults and juveniles. Through population structure analysis and exploitation pattern assessments, it has become evident that there is overexploitation occurring beyond maximum sustainable yield levels. This has resulted in a continuous decline in the standing stock biomass of the fish. The spawning stock biomass (SSB) of the virgin stock indicates that the population is currently at a minimum sustainable level, with further decreases posing a serious threat to the stock. The identification of breeding grounds was achieved through the collection of data on brood stock availability, maturity conditions, mate size ratios, abundance of fertilized eggs and larvae, and environmental conditions. The highest breeding activities were observed in the freshwater tidal zone, followed by brackish water and upstream river stretches, with the high saline zone being the least important. The locations of spawning grounds varied with the seasons, with major breeding grounds identified at Godakhali on the main stream of Hooghly and Kolaghat on the Rupnarayan tributary during the monsoon season. During the winter season, the spawning grounds shifted upstream from the freshwater tidal zone to the river zone, with locations identified along Kolaghat, Godakhali, Dakshineswar, Bichulighat, Kalyani, Balagarh, and Farakka. This shift in breeding grounds highlights the adaptability and resilience of the Hilsa fish in the face of changing environmental conditions.

For the purpose of protection, the government department has established fish sanctuaries and implemented a ban on fishing during the specific breeding period of various fish species, with a

Laxman Biswas, a 35-year-old artisanal fisherman from Kshatriyanagar village in West Bengal, has long relied on the Ganga River's Hilsa fish for his livelihood. However, declining fish populations have forced many local fishers, including Laxman, to seek alternative income sources. He owns a small wooden boat, inherited from his father, and uses traditional fishing nets, though he cannot afford the costly monofilament nets. Fishing nearly 200 days a year, Laxman generally stays within 2-3 km of the riverbank, but ventures farther when fish are scarce, particularly from June to August. While Hilsa is his primary catch, he also fishes for various other species. When his catch is ample, he sells it at auction markets; for smaller catches, he sells directly to village retailers to avoid the expense and hassle of a long journey. Laxman observes that juvenile Hilsa are often caught with small-mesh nets, impacting the fish population. Although he knows of conservation rules, he lacks information on specific Hilsa sanctuary areas or bans on catching juveniles. Laxman also encounters the Gangetic River Dolphin (*Platanista gangetica*), which now follows fishing boats to feed on fish trapped in nets, leading to damaged nets and lost catches. This dolphin-fisherman interaction has intensified due to declining fish stocks, especially during the dolphins' breeding season from December to March. Laxman and other fishers fear that conflicts with dolphins over dwindling resources could worsen if fish populations continue to decline. Despite the challenges, Laxman remains committed to fishing, preserving his family's legacy, though the future remains uncertain as Ganga's aquatic biodiversity declines.

particular focus on the Hilsa fish. During this restricted fishing period, fishermen are requesting government agencies to provide grants in the form of food assistance, known as Vulnerable Group Feeding (VGF), and alternative income-generating (AIG) opportunities to supplement their income. A successful model for Hilsa conservation could be an 'incentive-based

Hilsa conservation' approach, which includes components such as raising awareness about Hilsa conservation, providing training on alternative income generation activities, supporting the implementation of AIG programs, enforcing Fish Act regulations, and offering vulnerable group feeding initiatives.

The AIG activities may involve providing support for rickshaw/van ownership, goat or cow fattening, sewing equipment, net making, duck or chicken rearing, vegetable cultivation, plant nursery management, cage fish farming with free seed, feed, and training from Indian Council of Agricultural Research (ICAR) research institutes viz. Central Institute of Brackish water Aquaculture (CIBA), Central Inland Fisheries Research Institute (CIFRI), and Central Institute of Fisheries Education (CIFE) as well as monetary grants for small businesses, among other options.

Prior to 1990, there were no mechanized boats in the lower stretch of the Ganga River. In the Sundarban region, farmers transitioned to the fishing profession for increased earnings. The complete ban on fishing within 12 nautical miles is at the discretion of the State Governments, implemented to protect the livelihoods of fishermen. Various coastal State Governments have enforced fishing bans for decades. For instance, West Bengal, Andhra Pradesh, Tamil Nadu, and Kerala have imposed a 47-day ban since 1988-89. Odisha has had a 60-day ban in place since 2000, while Gujarat, Maharashtra, and Goa have enforced a 67-day ban since 1989-90. Daman & Diu have a 75-day ban, and Karnataka enforces a 57-day ban.

Subimal Das, a 42-year-old Hindu fisherman from Frazergaunge village in West Bengal's 24 Parganas (South) district, has been in the fishing trade for over two decades. He lives with his family, including his wife, three sons, daughters-in-law, and grandson. Starting as a trawler labourer at 21, Subimal now spends around 25 days each month fishing on trawlers with a monofilament net of 80 mm, primarily targeting Hilsa but also catching Pomfret, Kalo Baul, and other species. June to September marks the peak season for Hilsa, when Subimal sells his catch at the Nagendra Market. However, during the January to April lean season, his catch typically includes only a few Hilsa, mixed with other fish. Subimal is aware of Hilsa's reproductive cycle and the government-imposed fishing bans from April 15 to June 15, a period when salinity drops and Hilsa migrate toward the rivers. He also knows about the restrictions on small mesh nets and the importance of not catching juvenile Hilsa. However, he is unaware of the additional ban from September 15 to October 24, a full moon period aimed at protecting spawning Hilsa. During the ban period, income of Subimal drops sharply from about 15,000-20,000 INR monthly in peak season to around 4,500 INR. To manage expenses, he works about 20 days a month weaving and mending nets, earning 150 INR daily. These income drops create financial strain, especially when covering medical expenses for his wife, who suffers from hypertension, and essential household costs. Often, Subimal has to borrow at high interest from his trawler's owner to cover these needs. Lacking formal training or awareness of sustainable fishing practices, situation of Subimal underscores the need for support to help small-scale fishers navigate financial and livelihood challenges, especially during lean periods and fishing bans, and improve their awareness of conservation practices for a more sustainable future.

In the Indian Exclusive Economic Zone (EEZ), beyond 12 nautical miles from the territorial waters of the East Coast and Andaman and Nicobar Islands, a 61-day ban is in effect from April 15 to June 14. On the West Coast, including the Lakshadweep islands, a 61-day ban is in place from June 1 to July 31 for the conservation

and management of fisheries resources and sea safety. The West Bengal government has recently prohibited Hilsa fishing during the peak breeding season, typically around the full moon in October. Three stretches on the Ganga have been designated as Hilsa sanctuaries — Godakhali near Diamond Harbour, Hooghly Ghat near Triveni, and Lalbagh-Farakka. This initiative mirrors the successful Hilsa management model in Bangladesh, although in West Bengal, the restrictions have mostly existed on paper.



Rethinking man-environment relationship: Green Economy, Political Ecology, and Deep Ecology

Chandreyi Sengupta

Environmental awareness and protection are vital for human survival in the contemporary climatic milieu. To assist in this essential activity, academicians have propounded several theoretical concepts dealing either directly or indirectly with ecological sustenance. The concepts of green economy, political ecology, and deep ecology are some of the best examples in this regard, sharing the common objective of fostering a healthy relationship between human beings and the natural environment. Out of

the three afore-mentioned approaches, green economy is probably the most commonly known. Emerging as the guiding principle behind most modern environmental movements, it promotes sustainable practices like energy conservation, recycling, wildlife protection, and renewable resource usage so that long-term ecological sustainability can be guaranteed. In accordance with the principle of sustainable development proposed by the World Commission on Environment and Development (WCED) in 1987, the green economic model ensures a peaceful co-existence between humans and nature without exhausting its resources for future generations.



Google Earth Image. (2024). Political considerations altering ecologies. Indian Sundarban.

Political ecology, a rarer concept popularised in the latter half of the twentieth century amidst a severe environmental crisis by proponents like Murray Bookchin (1962), Andre Gorz (1975) and Eric Wolf (1972), may be broadly defined as the interrelationship between natural, political, and social systems. In simple terms, the political ecology approach considers most ecological imbalances to be functions of both natural and man-made factors. Political ecologists encourage both administrators and general populations to consider all such factors to arrive at comprehensive solutions to environmental problems. It is also referred to as the 'politics associated with ecological concerns' by some.

Finally, deep ecology strives to achieve a fundamental shift in the ways nature is perceived. It advocates for the equality of all life forms on earth, thereby rejecting the dominance of human beings over other species and their right to control them. Supporters of the concept challenge humans to reflect on the harm their lifestyles cause to other species and recommend curtailing resource consumption for the collective well-being of all living organisms.

Together, these concepts inspire humans to act thoughtfully towards the environment through political action, sustainable practices, or a deeper respect for all life.



Land-use/Land-cover Changes in Relation to Tourism Development at Sagar Island in Indian Sundarbans

Soumik Sarkar

Tourism development is a major factor in changes in land-use patterns. The primary aim of this study is to explore the land-use changes related to tourism development at Sagar Island. Over recent years, the island has experienced significant land-use and land-cover changes driven mainly by the growing tourism sector. This transformation offers both opportunities and challenges for sustainable development in the region. Sagar Island, located in the western part of the Indian Sundarbans, boasts a unique ecosystem characterized by its rich biodiversity and complex mangrove forests.

Sagar Island, being sea-facing, is home to the famous Ganga Sagar, one of India's most renowned pilgrimage sites. The Kapil Muni Temple stands as the island's main tourist attraction, drawing millions of pilgrims annually from various parts of India who come to bathe during Makar Sankranti, also known as the Ganga Sagar Mela. The Ganga Sagar Tourist Centre is one of the oldest tourist attractions in the

Sundarbans. Today, Ganga Sagar is recognized not only as a pilgrimage destination but also as a popular tourist spot. The development of improved transportation, public and private accommodations, and quality food services has significantly enhanced the experience for visitors. While the Kapil Muni Ashram remains a focal point, other attractions like the beach, Tapoban, and Beguakhali lamp post also capture tourists' interest. With the rise in domestic and international tourism, especially during religious festivals and through eco-tourism initiatives, the demand for infrastructure and services has increased substantially.

Land-use changes on the island have been mapped using data from field surveys and satellite imagery for the years 1986 and 2014, utilizing GIS technology. Analysis revealed that the total land area decreased from approximately 254.42 km² in 1986 to 137.19 km² in 2014. Agricultural lands, about 29.43 km², and other vegetation areas, around 4.02 km², were converted into commercial zones, including land development, buildings, hotels, resorts, marketplaces, and other tourist facilities. This shift has led to the clearing of mangroves and other natural habitats to accommodate infrastructure development, significantly affecting biodiversity as areas once critical for wildlife breeding have been transformed. The construction of roads and transport facilities has further fragmented habitats, impacting both terrestrial and aquatic ecosystems. Increased human activity has also heightened pressure on natural resources, resulting in issues like salinization and depletion of local freshwater sources.



Dey, M. (2024). House Boat. Indian Sundarbans.

Tourism development has brought substantial socio-economic changes to the residents of Sagar Island. While it has generated job opportunities and stimulated the local economy through tourism-related activities, many locals have transitioned from traditional livelihoods to roles in hospitality and service industries. However, this economic uplift has not been equally beneficial for all. The influx of tourists has occasionally led to the commodification of local culture, causing a dilution of traditional practices. Moreover, the environmental degradation associated with unchecked tourism growth risks compromising the natural resources crucial for sustaining local livelihoods. The

environmental consequences of land-use changes tied to tourism development are significant. The reduction of mangrove forests, which serve as natural shields against storms and erosion, has increased the islands vulnerability to climate change effects. Additionally, pollution from tourism activities is degrading water quality and harming marine ecosystems. Efforts to mitigate these adverse impacts are underway, with local authorities and non-

governmental organizations advocating for sustainable tourism practices. Initiatives to preserve Sagar Islands ecological balance while encouraging responsible tourism are crucial for balancing economic growth with environmental conservation.

In conclusion, the land-use and land-cover changes at Sagar Island are closely linked to tourism dynamics. While tourism brings economic benefits, it also poses serious challenges to environmental sustainability and cultural integrity. To achieve a harmonious balance between tourism and the natural environment, it is essential to adopt sustainable practices that safeguard the islands unique ecological and cultural heritage. This approach will not only support the local community but also ensure the preservation of Sagar Islands biodiversity for future generations.



Harnessing Vertical Gardens: A Sustainable Solution to Mitigate Urban Heat Islands

Abhijit Sarkar

Vertical gardens, also known as living walls, are an innovative way of incorporating greenery into urban environments. These structures involve plants being grown vertically along walls or other surfaces, attached to buildings, providing various environmental, aesthetic, and health benefits. Vertical gardens help improve air quality by filtering pollutants and carbon dioxide, releasing oxygen, and enhancing the air quality in densely populated urban areas. They also assist in regulating temperature, mitigating the urban heat island effect by cooling surrounding areas, reducing the need for air conditioning, and conserving energy. Additionally, vertical gardens reduce noise pollution as the vegetation absorbs and

deflects sound, offering noise reduction benefits in busy cities. Green spaces in urban areas have been shown to enhance mental well-being, reduce stress, and improve the overall quality of life. Vertical gardens, being visually appealing, add beauty to cityscapes and can even boost property values. In cities with limited horizontal space for traditional parks, vertical gardens provide a space-efficient solution for introducing greenery without taking up much ground space. Furthermore, they contribute to biodiversity by serving as mini-habitats for birds, insects, and pollinators. Vertical gardens can also be utilized for urban agriculture, growing herbs, vegetables, and fruits efficiently, thereby supporting local food production.



Google Image. (2024). Effective space utilization through vertical gardening. Salt Lake, Kolkata, India

One notable example of vertical gardens in cities is India's biggest vertical wall garden installed at Sealdah station, Kolkata spanning 110 feet in length and 18 feet in height from ground level. The wall garden, consisting of 5,440 plants arranged in a multi-coloured unique pattern, uses state-of-the-art technology, including a drip irrigation system. However, there are certain challenges and considerations for vertical gardens.

Maintenance is essential, including irrigation, pruning, and regular plant care. Buildings must be evaluated for their structural capacity to support the added weight and moisture. Moreover, the initial setup and long-term maintenance costs of vertical gardens can be high, requiring careful consideration of the balance between costs and benefits. Vertical gardens play a significant role in reducing the urban heat island (UHI) effect, a phenomenon where urban areas experience significantly higher temperatures than their rural surroundings due to the extensive use of heat-absorbing materials like concrete and asphalt, and heat generated by human activities. These gardens help reduce the UHI effect through evapotranspiration, a process in which plants cool the air naturally by releasing moisture, which lowers the surrounding temperature. Vertical gardens also act as natural insulators by shading building façades and preventing sunlight from hitting heat-absorbing surfaces, thus reducing the amount of heat

entering buildings. This cooling effect lowers indoor temperatures, reducing the need for air conditioning. Furthermore, vertical gardens replace heat-retaining surfaces with plants, which do not store heat as concrete or asphalt does, leading to cooler surface temperatures. In densely built areas, vertical gardens can cool the immediate surroundings, contributing to a reduction in the overall urban temperature, especially when implemented on a large scale. By naturally cooling buildings, vertical gardens help save energy, reducing the demand for air conditioning, which in turn lowers greenhouse gas emissions from electricity use and helps mitigate climate change. They also contribute to carbon sequestration by capturing carbon dioxide from the atmosphere, which plays a long-term role in climate regulation and further mitigates the factors contributing to global warming and the UHI effect. In a notable case study, a nursery owner in South 24 Parganas West Bengal, India received training under a vertical gardens project in 2013-14. Following this, they began selling saplings to housing societies and corporate offices, while also conducting hands-on plantation training sessions in schools. The maintenance of these gardens has since become a regular source of income.

To effectively reduce the UHI effect, vertical gardens need to be implemented on a large scale across multiple buildings, in conjunction with other green infrastructure such as parks and green roofs. Plant selection is critical, as some species have higher evapotranspiration rates and can better tolerate urban pollution and harsh climates. Without proper maintenance, vertical gardens may lose their cooling efficiency, as dried-out or poorly maintained plants will not perform evapotranspiration effectively. By introducing more vegetation into urban spaces through vertical gardens, cities can mitigate the UHI effect. The cumulative cooling effect, especially when integrated with broader urban greening strategies, can make cities cooler and more habitable in the face of rising global temperatures.



Empowering Women: A Catalyst for Change in the Agriculture and Lifestyle of the Indian Sundarban

Shreya Ghosh

In the verdant landscape of the Sundarbans, where the natural environment flourishes in its untamed splendour, a quiet yet significant transformation is underway. Women, who have historically occupied peripheral roles in both agriculture and domestic spheres, are increasingly assuming leadership roles in agricultural practices and community initiatives. This shift in empowerment is not only crucial for achieving gender equality but also plays a vital role in determining the future trajectory of the region's agricultural practices and overall way of life. The Sundarbans, characterized by its distinct ecological and socio-economic challenges, have long relied on agriculture and fishing as fundamental components of their economy. Traditionally, these sectors have been male-dominated, with women primarily engaged as unpaid labourers and often lacking substantial decision-making authority. However, as both global and local movements advocate for enhanced gender equity, the necessity of empowering women in the Sundarbans has become increasingly evident.

Women empowerment in agriculture transcends the realm of social justice; it is essential for the sustainability and productivity of farming practices in the Sundarbans. Women are increasingly taking the lead in sustainable agricultural initiatives, including organic farming and the cultivation of saline-resistant crops, which are crucial in a region frequently affected by flooding and rising sea levels. Their profound relationship with the land and water, combined with innovative training and improved access to resources, has allowed women to enhance food security in the area significantly. Through the establishment of self-help groups and cooperatives, women are acquiring the necessary knowledge and financial autonomy to manage farms effectively, market their produce, and invest in advanced farming techniques. With improved access to microcredit and government support programs, they are emerging as entrepreneurs, launching small-scale enterprises that not only benefit their families but also bolster the local economy.

Women who are empowered serve as significant agents of transformation within their households and communities. The growing involvement of women in agriculture and related fields contributes to an increase in household incomes, resulting in enhanced nutrition and educational prospects for families. Research indicates that when women have control over household finances, a greater share of the family budget is allocated to health, nutrition, and education, which ultimately yields improved outcomes for children and society at large. In addition to the economic advantages, the empowerment of women is

driving social progress in the Sundarbans. Traditional gender roles are being challenged as women take on more prominent leadership positions within their communities. This transformation is dismantling existing inequalities and inspiring younger generations to imagine a future where both men and women have equal responsibilities and opportunities.



Dey, M. (2023). Digital literacy. Indian Sundarban.

Despite the undeniable progress, the road to full empowerment for women in the Sundarbans is still fraught with challenges. Deep-seated cultural norms, lack of access to education, and limited infrastructural support continue to pose barriers. Moreover, climate change and natural disasters disproportionately affect women, as they are often the primary caregivers and rely on natural resources for their livelihoods. To ensure the sustained empowerment of women in the Sundarbans, there is a pressing need for continued investment in education, healthcare, and skill development. Government policies must prioritize gender-sensitive approaches to rural development, and community-based organizations should continue to advocate for women's rights and provide platforms for their voices to be heard.

Currently, a survey conducted among residents of the Sundarbans reveals that a significant number of men have sought employment opportunities in other states, while the region is also known for its tiger population. As a result, the advancement of women in the Sundarbans has been hindered, leading to an educated subjugation among them. In the absence of male family members, women and girls often undertake arduous tasks, such as swimming several kilometres to collect firewood, which can take more than two hours. Additionally, girls are forced to go out to collect honey. Fortunately, numerous non-governmental organizations are actively working to improve the challenging lifestyles of these communities, providing support for health and

safety initiatives. Moreover, they are facilitating livelihood opportunities for women through agricultural projects, aquaculture, and other initiatives in the fertile coastal areas of the Sundarbans. Empowering women in

agriculture and lifestyle in the Sundarbans is not merely an option, it is a necessity for the holistic development of the region. As women take charge of their own futures, they are not only transforming their own lives but also reshaping the socio-economic fabric of their communities. The future of the Sundarbans is undeniably linked to the empowerment of its women, and supporting their growth will ensure a more resilient and prosperous tomorrow.



Freshwater Aquaculture: A Live or Let Live Dilemma for Coastal Communities

Uma Paul

Freshwater aquaculture plays a significant role in the daily life of coastal communities, providing both economic support and food security. Coastal people often depend on inland freshwater sources, such as ponds, rivers, and wetlands, to cultivate fish and other aquatic species. This is crucial, especially in areas where marine fishing is not always reliable due to seasonal changes, pollution, or overfishing. In recent times changes in climate and many more reasons we can see the specific aquatic species or fishes are lost or going to be lost, freshwater aquaculture is also can help to protect the local species.

This aquaculture provides both, such as a stable source of income and also a nutrient-rich diet for coastal populations. Rich in proteins, omega-3 fatty acids, and essential vitamins and minerals, fish is a crucial part of the diet for many coastal people. Regular access to farmed fish helps prevent

malnutrition, especially in regions where other sources of protein may be scarce. Fish farming is often practiced on a small scale, using local resources, allowing households to participate in the market economy. Many families rely on this as their primary or secondary source of income, selling fish like tilapia, catfish, carp, and prawns in local markets.



Dey, M. (2024). Fish feeding. Odisha Coast, India.

In coastal areas prone to climate change impacts like sea-level rise, salinity intrusion, and changing weather patterns, freshwater aquaculture offers a viable alternative to marine fishing. It allows communities to diversify their livelihoods and adapt to environmental changes that may affect traditional fishing practices. Freshwater aquaculture is often practiced in artificial ponds, rice paddies, or natural wetlands, which maximizes the use of available land and water resources. In regions with limited agricultural opportunities, aquaculture provides a sustainable way to use water resources for both farming and fishing. Many coastal communities can practice integrated fish farming, where aquaculture is combined with other agricultural activities like rice farming. Fish are raised in flooded rice fields, which not only increases productivity but also reduces the need for chemical fertilizers as fish waste provides natural nutrients to the crops.

Freshwater aquaculture creates a variety of job opportunities beyond fishing, including activities related to pond construction, maintenance, processing, and marketing. This helps reduce rural poverty, particularly among women and marginalized groups, who often play significant roles in these activities.

As the demand for seafood increases, marine stocks are under pressure from overfishing. Freshwater aquaculture provides a sustainable alternative to meet the demand for fish, reducing the strain on ocean ecosystems and helping to ensure long-term food security. In summary, freshwater aquaculture serves as a lifeline for coastal communities, offering both economic resilience and essential nutrition. It also provides a sustainable and adaptable approach to managing natural resources, making it an indispensable part of daily life for people living in coastal regions.



Agroecosystems: A Balanced Approach to Agriculture and Sustainability

Asit Kumar Roy

The concept of agroecosystems merges agriculture with ecology, offering a holistic view of farming as a managed ecosystem. Defined as ecosystems under agricultural management, agroecosystems reflect the intricate balance between natural processes and human intervention. Unlike natural ecosystems, agroecosystems depend on additional energy inputs in terms of fossil fuels and human effort, and their intentionally controlled biodiversity. At the core, the concept of agroecosystem is crucially based on the principles of sustainable agriculture, going

beyond mere yield and profit to embrace long-term environmental balance. By integrating ecological values into farming practices, agroecosystems support food production while maintaining essential ecosystem services such as nutrient cycling, pest regulation, and biodiversity conservation.



Dey, M. (2023). Monospecific agroecosystem practice. Arunachal Pradesh, India.

Agroecosystems differ from natural ecosystems in several ways. Human interference reduces species diversity and alters energy flows, but the benefits are significant with reference to the increased food security, higher productivity, and the ability to use biodiversity as a management tool. In India, the roots of agroecosystems trace back to the Neolithic period, particularly in South India, where traditional farming practices still flourish alongside modern advancements. Recent studies show that agroecosystems, such as paddy fields, offer vital habitats for species like the Sarus Crane (*Grus antigone*), highlighting the balance between agricultural productivity and ecological sustainability. Despite such benefits, agroecosystems also have challenges. The dependence on non-renewable energy, disruption of nutrient cycling, and reduced flexibility due to human management can hinder long-term sustainability. However, with a growing focus on integrating natural ecosystem processes, agroecosystems hold the potential to create more resilient food systems globally in the epoch of Anthropocene.



The Fate of the Ganga River in the Face of Climate Change

Bhaskar Deb Bhattacharya

The Ganga River, a critical freshwater source and the cultural backbone of northern India, is facing profound challenges due to climate change. Beyond its religious and historical significance, the Ganga supports the livelihoods of over 400

million people who depend on its waters for drinking, agriculture, and industrial activities. However, rising global temperatures, erratic weather patterns, and anthropogenic pressures are severely threatening the river's hydrological regime, ecosystem services, and the socio-economic stability of the region.

The Gangotri Glacier, a primary source of the Ganga, is experiencing accelerated melting due to rising global temperatures. Glaciers serve as natural water storage systems, releasing meltwater gradually throughout the year, balancing river flow. However, rapid glacial recession, driven by global warming, is altering this equilibrium. Increased glacial melt leads to higher river discharge during the monsoon, followed by decreased flow in dry months. This seasonal variability could result in critical water shortages during lean periods, especially for downstream populations reliant on the river for agricultural irrigation and drinking water.

The Ganga is primarily sustained by the South Asian monsoon, which has become increasingly unpredictable in both timing and intensity due to climate change. Altered rainfall patterns have led to both intensified flood events and prolonged droughts, disrupting water availability. Regions dependent on timely monsoon rains for agricultural cycles are facing the dual threat of devastating floods and subsequent droughts, which challenge not only crop production but also long-term water management strategies. For instance, the catastrophic floods in Uttarakhand in 2013 and Bihar in 2017 were compounded by erratic rainfall and glacial outburst,

highlighting the increasing risks posed by a warming climate.

The interconnectedness of groundwater and surface water systems in the Ganga Basin is another crucial factor. Over-extraction of groundwater, coupled with declining rainfall, has led to a significant drop in the water table across large parts of the basin. This has caused perennial tributaries such as the Yamuna and Gomti to run dry during summer months, further threatening water availability. Agriculture, which is heavily reliant on both surface water and groundwater from the Ganga, is increasingly vulnerable, with food security at stake due to reduced irrigation capacity and water stress during critical growing seasons.



Devi, M. (2022). Bank of Ganges. Kolkata, India.

Rising temperatures are not only affecting the flow of the Ganga but also its water quality. Higher ambient temperatures increase evaporation rates, reducing river volume, while warmer waters encourage the growth of harmful bacteria and algal blooms. These blooms deplete dissolved oxygen, leading to anoxic conditions detrimental to aquatic life and human consumption. Additionally, reduced water flow exacerbates the dilution capacity of the river, amplifying the impact of pollutants from untreated sewage, industrial discharge, and agricultural runoff.

The Ganga's ecological health is intricately linked to its seasonal flow patterns, which support diverse ecosystems from the Himalayas to the Sundarbans delta. Disruptions in water flow and quality are threatening the habitats of iconic species like the Ganga River dolphin (*Platanista gangetica*) and the critically endangered gharial (*Gavialis gangeticus*). These species, already facing habitat fragmentation and pollution, are now at higher risk of extinction as their ecological niches shrink. The cascading impacts of climate change are likely to reduce biodiversity and diminish the river's ability to provide critical ecosystem services.

Addressing these challenges requires an integrated approach that combines climate adaptation with ecosystem conservation. Initiatives like the Indian government's Namami Gange project are making strides in pollution control and river rejuvenation. However, these efforts must be complemented by climate-

resilient water management strategies, including sustainable agriculture, rainwater harvesting, and upstream interventions such as afforestation and glacial monitoring. Additionally, international climate agreements and domestic policies focused on reducing carbon emissions are essential to slow the progression of climate change and its effects on the Ganga.

In conclusion, the Ganga's fate in the context of climate change is not only a matter of environmental concern but also a critical issue of socio-economic stability and regional sustainability. Immediate and coordinated actions are imperative to preserve this vital resource and protect the millions of people, ecosystems, and cultures that depend on it.



Reviving Traditional Farming: A Path to Sustainable Agriculture

Muktaram Sardar

As the global population continues to grow, the pressure on farmers to boost crop yield and quality has never been greater. In their quest for better harvests, many farmers have turned to modern agricultural practices, often abandoning the traditional methods passed down through generations. This shift, while promising on the surface, has led to unexpected challenges and hardships in the farming community.

In the Indian Sundarban, several farmers have embraced advanced technologies, investing in high-cost seeds, fertilizers, and pesticides with the hope of transforming their yield. While this approach seems like a step forward initially, it comes at a steep price. The loss of soil fertility, declining crop quality, and unsatisfactory harvests have become common realities. The once-thriving fields now struggle to meet expectations, and financial setbacks weigh heavily on these farmers. In parallel, cold storage facilities and other agricultural enterprises have entered the scene, promoting new techniques with promises of increased vegetable production and profitability. Yet, for many, these assurances have fallen short, leaving farmers disheartened and their resources drained. Faced with dwindling income and repeated crop failures, numerous farmers have found themselves at a crossroads, forced to leave their land in search of better livelihoods elsewhere.



Dey, M. (2024), Salt-tolerant paddy, Indian Sundarban.

Amidst these challenges, there is a growing recognition of the value in returning to traditional agricultural wisdom. Some initiatives have started engaging with farmers, gathering insights from age-old cultivation practices and offering practical guidance. Their mission is to empower farmers to reconnect with nature-based solutions to achieve long-term environmental sustainability in the region. This approach is straightforward, where farmers are rediscovering the value of closely observing their seedlings, much like their ancestors did. By nurturing these plants with traditional seeds and allowing nature to play its role in managing weeds, they are finding ways to maintain a balanced ecosystem. This shift not only eases their reliance on expensive chemical inputs but also rejuvenates soil health, paving the way for more consistent and sustainable harvests.

This revival of traditional farming is more than just a return to old practices; it's a movement toward sustainability, resilience, and self-reliance in agriculture. As farmers rediscover the strengths of their heritage, they are also laying the foundation for a future where agricultural success is not just measured in quantity but in quality and long-term ecological balance.



The Role of Technology in Enhancing Financial Management in Non-Governmental Organizations

Abhay Das

Non-profit NGOs play a vital role in addressing social issues, advocating for change, and providing essential services in communities worldwide. However, effective financial management remains one of the biggest challenges they face. In recent years, technology has emerged as a game-changer, offering innovative solutions to streamline financial processes, enhance transparency, and ensure sustainability. One of the most significant benefits of technology in NGO financial management is the ability to streamline processes. Traditional methods often involve tedious paperwork and manual data entry, which can lead to errors and inefficiencies. With the advent of financial management software, NGOs can automate tasks such as budgeting, expense tracking, and reporting. These tools enable organizations to manage their finances in real time, providing a clearer picture of their financial health. Platforms like QuickBooks, Xero, and specialized NGO management software facilitate easy data entry,

invoicing, and reconciliation, allowing staff to focus on mission-critical activities rather than administrative tasks. Transparency is crucial for NGOs, particularly when it comes to maintaining donor trust and ensuring accountability. Technology enhances transparency by enabling real-time tracking of funds and expenditures. Cloud-based financial management systems allow stakeholders—be they board members, donors, or the public—to access financial reports and performance metrics anytime, anywhere. This accessibility fosters an environment of accountability, as organizations can easily demonstrate how funds are being utilized and report on their impact. Moreover, implementing blockchain technology is becoming increasingly popular among NGOs. Blockchain offers a decentralized and secure method for recording transactions, making it nearly impossible to alter or falsify records. This level of security can help NGOs build credibility with donors and stakeholders, assuring them that their contributions are being used appropriately.

Accurate and timely financial reporting is essential for decision-making and strategy development. Technology provides NGOs with advanced analytical tools that can transform raw financial data into insightful reports. Through data visualization and dashboard features, organizations can quickly analyse trends, monitor budget variances, and assess financial performance against goals. These insights empower NGOs to make informed decisions, adjust strategies, and allocate resources more effectively. Technology also plays a crucial role in enhancing fundraising capabilities. Online donation platforms, crowdfunding sites, and social media fundraising tools enable NGOs to reach a broader audience and generate funds more efficiently. Integrated payment systems streamline the donation process, making it easier for supporters to contribute. Additionally, Customer Relationship Management (CRM) systems help NGOs manage donor relationships and track engagement, allowing for personalized communication and targeted fundraising campaigns.

In a rapidly changing world, NGOs must adapt to new challenges and opportunities. Embracing technology in financial management is not just an option; it is a necessity for sustainability and growth. By streamlining processes, enhancing transparency, improving reporting, and facilitating fundraising, technology empowers NGOs to focus on their mission while ensuring sound financial practices. As the landscape continues to evolve, those organizations that harness the power of technology will be better positioned to make a lasting impact in their communities and beyond.



Google Image. (2024)



Extinct Indigenous Fish Species of Sundarbans

Jalad Kumar Gayen

Over the past few decades, the Sundarbans, one of the world's largest and most diverse mangrove ecosystems, has witnessed the alarming disappearance of several indigenous fish species.



Dey, M. (2024). Indigenous fish. Indian Sundarban

Once abundant in the region's water bodies, species such as Pabda (*Ompok bimaculatus*), Saral Puntii (*Puntius sarana*), Magur (*Clarias batrachus*),

Tangra (*Mystus vittatus*), and Shingi (*Heteropneustes fossilis*) have all but vanished from the local markets and the waters of village ponds, canals, and other freshwater sources. This decline has far-reaching consequences, not only for the region's biodiversity but also for the livelihoods of the local communities who depend heavily on fishing for their sustenance and economic stability.

The sharp decline in these fish populations is primarily attributed to human-induced environmental degradation. Over the years, increasing agricultural expansion, urbanization, and industrial activities in and around the Sundarbans have led to the excessive use of pesticides and chemical fertilizers. These pollutants have made their way into the aquatic ecosystems, contaminating water sources and disrupting the delicate balance of these habitats. The reproductive cycles of these fish species, which typically peak during the breeding season from April to July, have been severely affected by the deteriorating water quality. Polluted waters hinder their ability to spawn and grow, leading to dwindling numbers in the wild. The destruction of essential breeding grounds, such as marshes and shallow waters, further compounds the problem. Beyond pollution, the physical alteration of habitats has also contributed to the decline. The encroachment of human settlements, unregulated fishing practices, and changes in the hydrological flow due to dam construction and other infrastructural developments have fragmented these fish populations. This habitat fragmentation prevents them from accessing areas necessary for their life cycles, further accelerating their decline.

Since the 1980s, various research initiatives and field observations have documented these trends, raising concerns about the long-term impacts of these losses. The disappearance of indigenous fish not only threatens the region's biodiversity but also poses a serious risk to food security for local populations, as these species once formed an essential part of the diet and culture in the Sundarbans. The economic consequences are also profound, with many fisherfolk facing dwindling catches and reduced income, further exacerbating poverty in an already vulnerable region.

Given the gravity of the situation, it is imperative that both governmental and non-governmental stakeholders take immediate steps to address this issue. Environmental conservation efforts must focus on restoring the natural habitats of these fish species, reducing pollution levels in water bodies, and promoting sustainable fishing practices. Public awareness campaigns and community engagement are crucial to ensure that local populations understand the importance of preserving these ecosystems. By taking decisive action now, we can prevent the extinction of more species and work towards a future where the Sundarbans' biodiversity and the livelihoods it supports can thrive in harmony.



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