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# Roots of Resilience: Preserving Indian Natural Heritage

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# Roots of Resilience: Preserving Indian Natural Heritage

Welcome to the latest edition of the *Progyan Communique*, a platform where science meets sustainability. At Progyan Foundation for Research & Innovation (PFRI), we are dedicated to fostering resilient communities and promoting environmental stewardship through research-driven solutions. As an independent nonprofit based in Kolkata, we strive to address some of the most pressing challenges of our time: climate change, biodiversity loss, sustainable livelihood generation, and green energy transition. Since our inception as the research arm of the South Asian Forum for Environment (SAFE), we have collaborated with global partners to design impactful projects, blending local wisdom with cutting-edge science. Our focus on building adaptive capacity and sustainable solutions continues to drive us forward as we work to improve the lives of vulnerable communities, conserve our natural heritage, and support a greener future for all. We hope this newsletter informs, inspires, and engages you with our ongoing efforts to promote a balance between development and ecological integrity.

Happy reading!

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Roy, AK. (2023). Mangrove forest. Indian Sundarban.

## The Beauty of Budgeting: A Path to Financial Freedom

Abhay Das

**B**udgeting often carries the misconception of being restrictive, but in reality, it is a tool for empowerment, enabling individuals, families, and organizations to control, plan, and optimize their finances. Rather than imposing limits, budgeting offers the freedom to align financial resources with meaningful goals, reduce stress, and cultivate disciplined spending.



Google Image. (2024).

At its essence, budgeting is the art of crafting a financial plan that allocates income and

## Coastal Wetlands: The Crucial Heartbeat of Ecosystems

Asit Kumar Roy

**C**oastal wetlands, often overlooked, are vital ecosystems that bridge the gap between land and sea.

expenditures over a specified timeframe. This process ensures that expenses do not exceed earnings, while setting aside resources for future aspirations. An effective budget not only reflects personal or organizational priorities but also enhances accountability and encourages strategic resource use.

One of the strongest advantages of budgeting is the control it grants. Without a budget, it's easy to lose track of spending and find oneself facing financial challenges. Budgeting heightens awareness of where money flows, allowing individuals and organizations to make intentional decisions. By tracking income and expenses, areas of unnecessary spending can be identified, redirecting funds to support priorities that hold greater significance or impact.

True beauty of budgeting lies in its capacity to connect financial activities to long-term aspirations. Whether aiming to save for a vacation, pay off debt, or invest in future endeavours, budgeting serves as a personal roadmap for achieving financial dreams. This approach enables people to set realistic goals and track progress with confidence, creating a budget that is both disciplined and adaptable, accommodating shifts in priorities while remaining focused on reaching specific targets.

In the non-profit world, where resources are often limited, budgeting is essential for financial sustainability and maximizing social impact. According to research from the National Council of Nonprofits, organizations with structured budgeting processes reported a 30% increase in program efficiency, fostering greater donor trust and supporting long-term stability.

Ultimately, budgeting is more than a financial practice; it is a transformative tool that fosters financial well-being, reduces stress, and aligns people with their values and aspirations. Far from being restrictive, budgeting offers individuals, families, and organizations a pathway to stability, intentionality, and success. Whether managing personal finances or guiding an organization, budgeting opens a world of possibilities by ensuring that resources are directed with purpose and clarity.

Defined comprehensively by the Ramsar Convention, these areas encompass a range of environments, including marshes, mangroves, estuaries, and anthropogenic sites such as paddy fields, fish ponds and salt pans. Their dynamic nature supports diverse floral and faunal community, making them critical for biodiversity. They serve as breeding grounds for birds, fish, and other wildlife, reinforcing the ecological balance that sustains life on both the land and water. The ecological significance of coastal wetlands cannot be overstated. They engage in nutrient cycling, assimilating essential elements from their surroundings and returning them to the ecosystem, which eventually promotes fertility. This cycle supports the formation of nutrient-rich peat soils over time, while also stabilizing sediments to counteract erosion. Moreover, coastal wetlands play a unique role in mitigating the impacts of climate change, with mangroves and salt marshes acting as natural barriers against rising sea levels and recurrent storm surges. The biodiversity found in these areas is astonishing,

providing habitats for a multitude of species, from amphibians to migratory birds, and highlighting their role as biodiversity hotspots.

Economically, coastal wetlands are invaluable. They support millions of livelihoods through commercial fishing, aquaculture, and ecotourism. These ecosystems are not just sources of income; they also provide essential ecosystem goods such as food, salt, and medicinal plants. The beauty of coastal wetlands attracts tourists, contributing to local economies while fostering a sense of stewardship for these precious environments. Similarly, considering the social implications, coastal wetlands serve as natural buffers, absorbing storm surges and protecting coastal communities from erosion. They also replenish freshwater aquifers, enhancing water security in regions where this resource is scarce. Their capacity for carbon sequestration is another crucial aspect, as they capture

significant amounts of carbon, contributing to global climate regulation. The ability of wetlands to purify water by filtering pollutants further underscores their importance in maintaining healthy ecosystems for human habitations.



Roy, A. K. (2016). Degraded mangrove at Bichitrapur. Subarnarekha Estuary, Odisha.

The classification of coastal wetlands under the Ramsar Convention reflects their diversity and ecological complexity. Each type, from coral reefs to intertidal forests, plays a specific role in the broader ecosystem. Understanding and preserving these wetlands is paramount as they offer immense ecological, economic, and social benefits. As we navigate the challenges of climate change and biodiversity loss, recognizing the importance of coastal wetlands is essential for sustaining our planet and securing the livelihoods of those who depend on them.



## Empowering Communities: The Role of Agroforestry in Enhancing Flood Resilience in Majuli Island

Abhijit Sarkar

**M**ajuli, situated in the Brahmaputra River in Assam, India, holds the distinction of being the world's largest river island. However, this unique island is highly

vulnerable to seasonal flooding and severe erosion due to the Brahmaputra River's dynamic and unpredictable course. Intense monsoon rains amplify river levels and sediment deposition, elevating flood risks and accelerating land erosion. As a result, area of Majuli has reduced drastically, shrinking approximately from 1,250 km<sup>2</sup> to around 500 km<sup>2</sup> within a century. This ongoing erosion has led to the displacement of numerous families, deeply affected agricultural productivity, and jeopardized local livelihoods that depend on stable land resources. Despite various government interventions aimed at controlling erosion, inhabitants of Majuli remain exposed to the adverse impacts of flooding and land degradation. Agroforestry has emerged as a promising and sustainable response to these challenges, offering a flood-resilient model of land management that integrates trees with agricultural crops. This integrated approach improves soil fertility, stabilizes the land, reduces erosion, and promotes biodiversity. Trees in agroforestry systems anchor soil with their deep root networks, minimizing erosion and providing vital shade and habitats for various beneficial organisms. By incorporating flood-tolerant tree species and crops, agroforestry reduces the





Google Image. (2024). Water cover of Majuli, Assam, India.

impact of flooding on agriculture, allowing farmers to cultivate resilient crops while diversifying income sources. This diversification is achieved through the production of timber, fruits, and other non-timber forest products, contributing to local food security and providing alternative income streams that strengthen community resilience against environmental shocks.

In Majuli, agroforestry practices often include a blend of fruit orchards, alley cropping, and the cultivation of fast-growing species like bamboo, which effectively stabilize soil and buffer the landscape against erosion. Integrating livestock within these agroforestry systems further enhances soil health by providing natural fertilization and offering fodder resources. Such practices not only improve soil structure but also promote nutrient cycling, ultimately supporting a more resilient agricultural environment. These agroforestry systems offer a viable pathway to enhance agricultural resilience, encourage sustainable land use, and empower the island dependent communities in coping with flood and erosion challenges. With sustained investment in community education, resources, and improved access to markets, agroforestry could become a cornerstone the long-term agricultural sustainability of Majuli, preserving both the ecological integrity and livelihood options for the island people.



## Phytoplankton: The Unsung Heroes in Earth's Oxygen Budget

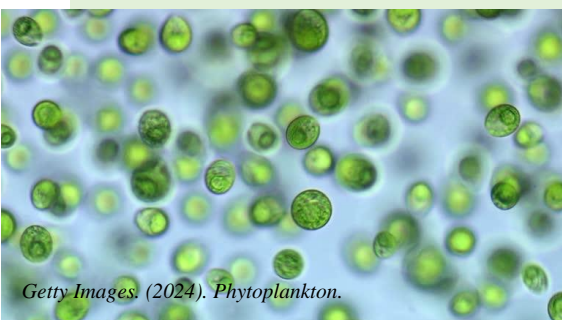
*Bhaskar Deb Bhattacharya*

When we think about oxygen production on Earth, we often picture vast forests, jungles, and plants we encounter in our everyday lives. However, there is a lesser-known yet vital contributor that plays a key role in maintaining the planet's oxygen balance: phytoplankton. Phytoplankton are microscopic, single-celled

organisms that float in the upper layers of oceans, lakes, and rivers. Though small in size, their contribution to Earth's oxygen supply is immense. These tiny creatures perform photosynthesis, a process through which they absorb carbon dioxide and release oxygen, just like terrestrial plants. In fact, phytoplankton are responsible for producing roughly 50% of the oxygen we breathe. This means every second breath we take comes from the ocean.

Phytoplankton use sunlight to convert carbon dioxide and water into glucose, producing oxygen as a byproduct. Because the oceans cover more than 70% of the Earth's surface, the sheer volume of phytoplankton in marine ecosystems allows them to have a monumental impact on the planet's oxygen levels. Without phytoplankton, our atmosphere's oxygen content would be significantly lower, jeopardizing the survival of many terrestrial and aquatic species, including humans. Beyond oxygen production, phytoplankton also play a key role in regulating the Earth's climate. They absorb about 10 gigatons of carbon from the atmosphere annually, helping to reduce the overall carbon footprint. This carbon sequestration process mitigates the impacts of climate change by lowering the concentration of greenhouse gases. Additionally, the carbon absorbed by phytoplankton eventually sinks to the deep ocean when these organisms die, trapping the carbon in the ocean for centuries. This process, known as the "biological pump," is one of nature's most efficient methods of storing carbon, helping to balance the Earth's carbon cycle.

Despite their importance, phytoplankton populations face several threats due to climate change and human activities. Rising sea surface temperatures, ocean acidification, and pollution are all detrimental to the growth and survival of these organisms. Warmer waters slow the rate of photosynthesis, while



Getty Images. (2024). Phytoplankton.

acidified waters hinder their ability to build protective shells, which are crucial for some species of phytoplankton. Moreover, nutrient pollution from agricultural runoff creates harmful algal blooms that deplete oxygen levels in water bodies, creating "dead zones" where marine life struggles to survive. These phenomena disrupt the delicate balance of marine ecosystems and threaten the overall oxygen supply. The health of phytoplankton populations is not just an environmental issue;



## Colonialism and unsustainability- How British imperialism disrupted ecological, social, and economic harmony in the Dooars

*Chandreyi Sengupta*

The implications of British colonization across the world have been widely discussed in both public and academic forums for a long time, sparking extensive debate in the process. Nevertheless, one aspect that has remained comparatively less discussed is the noteworthy influence of British policies and activities on the ecology of its colonies in North America, Asia, and Africa. Widespread deforestation and soil degradation caused by the

it's a matter of planetary survival. As the primary producers of oxygen and regulators of carbon, these microscopic organisms are crucial in maintaining a liveable atmosphere. Protecting phytoplankton from environmental stressors is essential to sustaining Earth's natural systems, including its oxygen budget.

To safeguard phytoplankton and the vital services they provide, it is important to take meaningful steps toward reducing carbon emissions, controlling ocean pollution, and protecting marine ecosystems. International policies focused on climate action, as well as local conservation efforts, can help preserve these microscopic heroes and ensure that they continue to support life on Earth. Phytoplankton may be small, but their role in balancing the oxygen load in our environment is immense. By understanding and protecting these vital organisms, we can ensure that Earth's oxygen supply remains steady, enabling all forms of life to thrive.



*Google Image. (2024). Tea garden of Dooars. Northern West Bengal, India.*

introduction of plantation systems, floral species replacement in forests for commercial or recreational purposes leading to transformations in the local ecosystems, and landscape alterations engendered by infrastructural advancement are some relevant examples in this regard. Notably, these long-lasting ecological impacts triggered significant human conflicts over resource utilization in the affected colonies, both with the administration and among communities, many of which continued even after the end of the imperial regime. One such instance is the latent animosity existing between the indigenous Rabha, Mech, as well as the Toto tribes and the immigrated Oraon, Santhal, and Munda tribes residing in the eastern and northeastern parts of India, specifically in the Dooars region of northern West Bengal and western Assam.

The semi-nomadic Rabha, Mech, and Toto tribes had traditionally inhabited the Dooars region of northern West Bengal and western Assam, depending on its lush forest cover for their economic and



cultural sustenance. With hunting, fishing as well as shifting cultivation as their primary means of livelihood, these tribal groups survived within a subsistence economy. After the acquisition of the Dooars by the imperialist incumbents from the king of Bhutan in 1865, hunting interdictions were imposed, which fomented substantial resentment among the indigenous tribes. These grievances were further fuelled when their cherished forests were converted into commercial timber plantations, degrading the regional soil quality considerably. Furthermore, the development

of tea estates at the expense of the forested lands of the Dooars served as the final nail in the coffin for these tribes who were unable to cope with these unsolicited modifications in their natural habitat. The immigration of the Oraon, Santhal, and Munda tribes into these parts for employment as plantation labourers was viewed unfavourably by the Rabha, Mech, and Toto people who were the sons of the soil. The immigrants were considered to be trespassers, supporting the colonialists in the eventual extirpation of their forests. Moreover, encouraged by the British, the immigrants took up sedentary farming in the Doors as it was more profitable than shifting cultivation. Consequently, being unfamiliar with sedentary agriculture, the indigenous tribes became the most vulnerable section of the Dooars economically. Unfortunately, this situation persisted and ultimately, the indigenous tribal populace were forced to take up minimalistic sedentary cultivation for survival. However, this did not elevate their socio-economic status and instead served in intensifying the schism between them and the immigrant groups, leading to the conclusion that British colonial policies and actions permanently disrupted both the socio-economic and ecological sustenance of the Dooars.



## The Diplomatic Colour of Hunger

*Dipayan Dey*

In this planet of plenty, where enough food grains are being produced to feed all, the largest humanitarian organization 'World Food Program' distributes food to millions in hunger due to conflict, climate or some societal constraints. Is hunger, therefore, an inequity that disables access to food? If so, then should the remedial strategy for overcoming this inequity be relief or resilience, or a blend of both? Counter arguments may lead to similar policy dichotomy as in mitigation and adaptation to abate climate impacts, but in no way, it may intend to doubt the necessities of immediate relief to someone starved.

Recent experiences of two super-cyclones in Bay-of-Bengal, Amphun in 2020 and

Yaas in 2021 that inundated some million hectares of farmlands with seawater in east coast of India and southern Bangladesh, have reissued the question. Whether, immediate hunger of million marginal farmers could be relieved equitably? will it deliver a sustainable solution, in the climate milieu? Circumstantially, with seventeen faces of sustainability orchestrating trade-offs and synergies is in itself a challenge. Amidst it, policies drive hunger. The troops carrying cyclone relief were either not required or in excess of supply to the beneficiaries. Even then there were loud hankerings for it. The 'Relief Tourism' created a parallel economy benching the agrarian trade of the local market. Carrying COVID from urban to desolate deltaic islands and spreading plastics all around the coasts while distributing relief materials was a pie on the cake. This is however, a small scenario. The bigger picture is food grains are made to soil in granaries, so that the market demands do not die back. Later distributed in abundance, where it is not needed or becomes an excess.

The farmer's agitation in Indian Punjab for denial of minimum support price with the advent of corporate custodians of agro-practices may not be an inclusive representation for marginal farmers per se, but the other reality is marginal farmers are not even prepared yet to understand the looming economic crisis that has arisen from agricultural subsidies extended out of vested political interests. Food grains supply chains and direct access to market are in hands of few monopolies, minimum support price is occasionally guaranteed but it doesn't suffice the cost of transportation to the market, even then a farmer has to produce more. Hunger stays at lurch with the ultra-poor in this food grain diplomacy. It's truly difficult for commons to understand how a mere political border can debar the hunger of a million south Asian refugees, when the granaries on the other side are overflowing. Is it just because the refugees make a different religious coterie? Or even something better like power

camaraderie in the region. Whatsoever it is, hunger mustn't have colours.

Going by the capability approach of Nobel laureate economists of this region, it is imperative that the material belongings or mental reactions of people only provide limited or partial information about how life is going. This furthers the argument whether helping them in securing their own (traditional) food should supersede the policies of free supply of grains through highly subsidized public distribution system. Rice, a staple food for 3.5 billion in global south is governed by the political ecology of paddy farming, where farming area or selection of species are both in hands of policy planners. Post cyclone Yaas, there has been a dire crisis of salt tolerant rice seeds in West Bengal but hybrid rice grains were profusely available for relief and mitigation. In Arunachal Pradesh of Northeast India, provisioning of free rice has erased the production of several highland local races of non-till dry rice and the areas are converted to commercial Kiwi farming. Obviously, the farm emission has been quadrupled and women farmers, who used to manage the highland local rice farming, are now jobless.

It's true that global Convention on Biological Diversity condemns wet rice cultivation as an emission intensive process and recommends for improved farming practices for abating methane emission but the significance of organic rice farming is kept cowed in its 'Biodiversity and Climate Change' report, 2007.

Unfortunately, the importance of indigenous non-paddy rice is also obliterated in the IPBES-IPCC 2021 workshop report though the workshop aimed to provide an overview of the impact of biodiversity conservation and sustainable use practices on greenhouse gas emissions. The bull of decarbonizing the economy is dozing out more important agenda of food security for which place-based agro-biodiversity conservation is crucial. It is imperative to say that the huge market economy of fertilizers, agro-farming and irrigational paraphernalia largely dictate the emission intensive practices. While UNEP is still banking on Chinese collaboration for drought resistant lab strains of rice like WDR 73 that seemingly doesn't need flooded paddies for growing, the small hilly state of Nagaland in north-eastern India has turned back to its indigenous 'land races' of rice and millet for food security in changing climatic regime. The dilemma is, whether we would try out a new genetic package that has the possibility of off-target effects derived from unanticipated mutations and the unintended risks or fall back on natural pool of species. Optimization of the two is definitely a pragmatic approach but the level of optimization needs to be decided with equity and reciprocity. The regional workshop, organized by FAO in 2018 on "Rice Landscapes and Climate Change" inferred that rice will remain a key driver of growth at least for the next decade and though the productivity has flattened, there is potential to improve sustainability through innovation and best practices incorporating local knowledge. It's still unclear whether local knowledge includes the use of local resilient species too. International Rice Research Institute, is cautiously developing climate resilient rice varieties (<https://www.iri.org/climate-change-ready-rice>) using marker-assisted breeding program to incorporate desirable climate resilient traits into new varieties. However, those are unfortunately out of bound for the marginal farmers owing to gaps in technology cooperation. Moreover, neither there are exhaustive seed banks for sufficing the need for access to priority seeds for the marginal farmers.

Researchers from Oregon State University USA and EMBL's European Bioinformatics Institute UK, with CGIAR's International Rice Research Institute Philippines have recently been engaged in a research program entitled CIBR:BBSRC:PanOryza: Globally coordinated genomes, proteomes, and pathways for wild and cultivated rice varieties. This is a recommendable action but by the time the outcomes get translated for the benefits of marginal farmers, apprehensions of even more critical challenges remain with us. Traditional varieties and their wild relatives constitute an invaluable gene pool in terms of resistance and tolerance to biotic and abiotic stresses, which can be exploited for developing new generation species to sustain adverse climatic changes, but genuine intentions are unavailable. Unless this inequity is addressed and the divide bridged between policy and practice, it would keep claiming lives in the guise of hunger in global south, duping all efforts in cognizance of sustainable development goals.



# The Importance of Horseshoe Crabs in the Indian Sundarban: Conservation and Ecological Significance

Jalad Kumar Gayen

The Rajkakra, more widely recognized as the Horseshoe Crab, is an ancient marine arthropod with significant ecological and evolutionary importance, particularly within the Indian Sundarbans. This region is home to two species: *Carcinoscorpius rotundicauda* (commonly known as the mangrove Horseshoe Crab) and *Tachypleurus gigas* (the Indo-Pacific Horseshoe Crab). These species are found in key locations such as Jharkhali, Thakuran, Herobhanga Lothian, Satjelia, Jambu Island, and Gangasagar, where they contribute to the overall health of coastal ecosystems.

Horseshoe Crabs, often called 'living fossils' due to their evolutionary lineage dating back over 450 million years, play a pivotal role in maintaining the ecological balance of intertidal zones. Their eggs are a vital source of nourishment for various migratory birds, fish, and other wildlife, especially during breeding seasons. The presence and reproductive cycles of Horseshoe Crabs are strongly influenced by tidal patterns, with peak activity often observed during the full-moon and new-moon phases when tidal heights are most extreme. This synchronicity with tidal rhythms ensures the successful deposition of eggs in nutrient-rich intertidal zones, where they can be accessed by predators, contributing to the food web dynamics.

However, the population of Horseshoe Crabs in the Sundarban is declining. Habitat fragmentation, pollution, and increased human activities, such as coastal development and fishing, have resulted in a severe disturbance to their breeding grounds. Furthermore, natural disasters, including cyclonic storms like Aila (2009), Bulbul (2019), and Amphan (2020), have exacerbated habitat degradation, altered the coastal geomorphology and reduced the availability of suitable nesting areas. These events have led to the increasing rarity of Horseshoe Crab sightings, which raises concern for the long-term viability of their populations in this region.

The conservation of Horseshoe Crabs is critical not only for maintaining biodiversity but also because of their biomedical importance. Horseshoe Crabs possess a unique blood compound known as Limulus Amebocyte Lysate (LAL), which is used in the pharmaceutical industry for testing bacterial endotoxins in medical equipment and vaccines. This adds another layer of significance to their conservation, particularly as global demand for LAL increases. Additionally, Horseshoe Crabs exhibit potential for sustainable aquaculture, as their life history traits—such as their hardy nature and adaptation to brackish environments—make them a promising candidate for cultivation under controlled conditions. This could provide both economic benefits and contribute to their conservation.

In the Sundarbans, however, the conservation of Horseshoe Crabs faces several challenges. Habitat loss due to riverbank erosion, mangrove degradation, and rising sea levels is compounded by anthropogenic pressures like fishing, tourism, and deforestation. Moreover, increased sedimentation and water pollution threaten the quality of their spawning habitats. In light of these challenges, the need for dedicated conservation programs has become more urgent. Field studies and conservation initiatives emphasize the importance of protecting key habitats by implementing stricter regulations on coastal development and reducing human interference in critical breeding sites.

One of the significant findings from field studies is the timing of Horseshoe Crab egg-laying, which occurs year-round but peaks between April and July, coinciding with the region's pre-monsoon and monsoon seasons. Adult Horseshoe Crabs in the Sundarbans typically weigh between 400 and 600 grams and display behaviours adapted to both marine and estuarine environments. These characteristics make them resilient but also vulnerable to sudden changes in water salinity, temperature, and



Roy, AK. (2024). A pair of horseshoe crabs in the breeding process. Indian Sundarban.

habitat structure, all of which are increasingly altered by climate change.

Ongoing conservation efforts focus on habitat protection, the creation of marine protected areas, and raising local awareness about the ecological importance of Horseshoe Crabs. Education campaigns target local communities to reduce harmful practices such as egg harvesting and unsustainable fishing methods. Additionally,



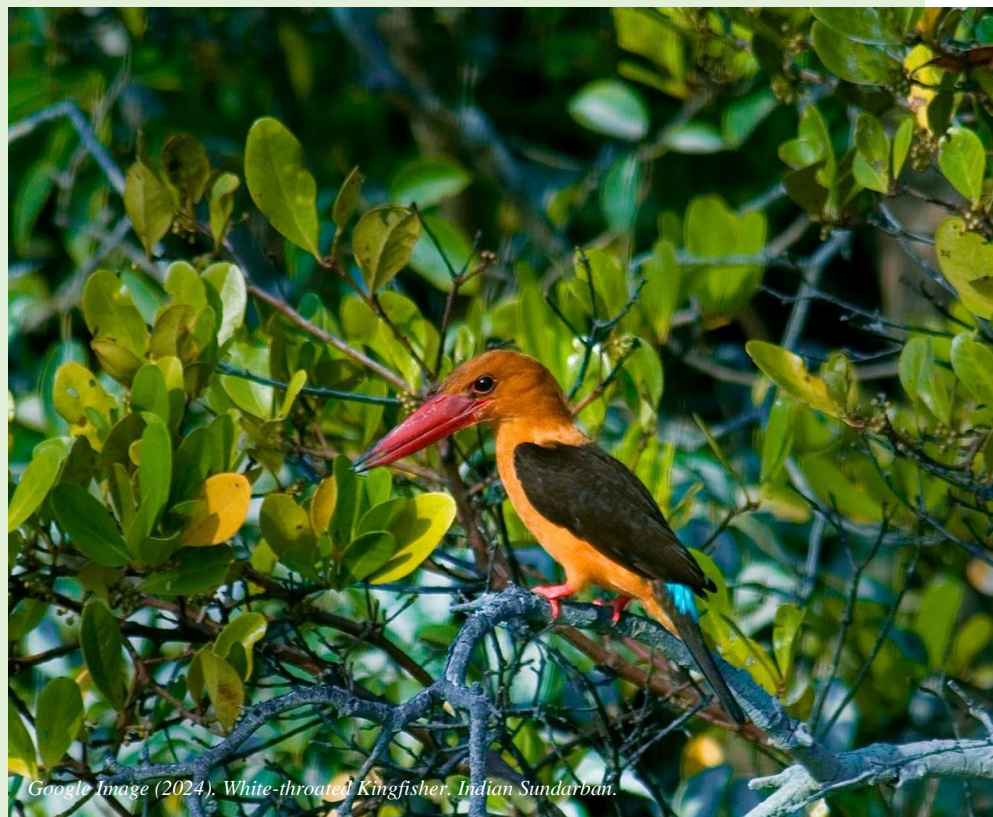
## The Indian Sundarban: An Ecstasy for Kingfishers

*Malancha Dey*

Kingfishers of the Indian Sundarbans represent a vibrant and essential aspect of the rich biodiversity, found within this unique mangrove ecosystem. Nestled along the coast of India and Bangladesh, the Sundarbans is the largest tidal halophytic mangrove forest in the world, boasting a diverse array of flora and fauna. Among the diverse avian species that call this region home, the Kingfishers stand out with their striking colours and remarkable hunting prowess. This article delves into the fascinating world of Indian Kingfishers, exploring their habitat, behaviours, conservation status, and cultural significance within the Sundarbans. If the Sundarbans were a party, kingfishers would be the life of it. These vibrant birds bring a pop of colour and a dash of excitement to the rich tapestry of this unique mangrove forest.

researchers advocate for the use of Geographic Information Systems (GIS) and remote sensing technology to monitor population dynamics and habitat changes over time, which can inform more effective conservation strategies.

In summary, the conservation of the Rajkakra, or Horseshoe Crab, in the Sundarbans is not only essential for maintaining the integrity of coastal ecosystems but also for harnessing their potential in biomedical research and sustainable aquaculture. The continued survival of these species in the face of environmental and anthropogenic challenges requires a multi-faceted approach, integrating habitat protection, scientific research, and community engagement. By preserving this ancient species, we contribute to the broader goal of safeguarding biodiversity and ensuring the resilience of the Sundarbans' complex ecological network.



*Google Image (2024). White-throated Kingfisher. Indian Sundarban.*

Sundarban is hailed as the ultimate paradise for Kingfishers! These small to medium-sized birds are truly a sight to behold, with their large heads, long strong bills, and short legs. Did you know that nine out of twelve species of kingfishers can be found in Sundarban? Whether they are residents or migrants, these magnificent creatures all belong to the family Alcedinidae. Among the kingfisher species found in Sundarban are the ruddy kingfisher (*Halcyon coromanda*) and black-capped kingfisher (*Halcyon pileata*). The ruddy kingfisher, with its vibrant red bill and legs, is a true beauty measuring about 25 cm long. It is a passage migrant to the mangrove forests of Sundarbans, but in recent years, it has been observed that this species has made Sundarbans its home from May to the end of August. These stunning birds prefer the tall trees in the mangroves, often spotted on *Avicennia alba*, locally known as Baine. On the other hand,



the black-capped kingfisher, standing at 28 centimetre long, is easily recognizable by its black cap, purple-blue wings, and coral red bill. With its striking appearance and distinctive call of "ki-ki-ki-ki-ki," this kingfisher is a true gem of the coastal waters of mangroves. They may be easily disturbed, but they perch conspicuously and dive to catch fish, as well as feed on large insects. Both of these kingfisher species are truly fascinating to observe in their natural habitat. From their vibrant colours to their unique behaviours, they never fail to captivate birders and nature enthusiasts alike. So, if you ever find yourself in Sundarban, keep an eye out for these majestic kingfishers and witness the beauty of nature at its finest during their breeding season in summer. A cozy tunnel nest in an earth bank, housing a clutch of 4-5 beautiful round white eggs would be a lucrative price fetching picture.



Google Image, (2023). Blue-eared Kingfishers. Indian Sundarban

The brown-winged (*Pelargopsis amauroptera*) and stork-billed (*Pelargopsis capensis*) kingfishers, both large and impressive at 35 cm in length, are the stars of the show. The brown-winged kingfisher, found along the eastern coasts of the Bay of Bengal, is a sight to behold with its vibrant red or black bill and striking red legs. These beauties call the subtropical or tropical mangrove forests their home

and are marked as a Near-threatened species by the IUCN Red Data List. Now, let's talk about the stork-billed kingfisher, a tree kingfisher that can be found throughout Southeast Asia, from India to Indonesia. With its green back, blue wings, and bright red bill and legs, this kingfisher is a true showstopper. Their flight may be laboured, but it's direct and purposeful. And let's not forget their unique call - a low and far-reaching peer-por-por that echoes through the trees. Both the brown-winged and stork-billed kingfishers are masters of stealth while hunting for food, perching quietly and blending into their surroundings despite their size. These regal birds are not to be underestimated, as they fiercely defend their territory from eagles and other predators. So next time you're near a river bank or a well-wooded habitat, keep an eye out for these magnificent creatures - you won't be disappointed! These incredible species are expert hunters, preying on crabs, fish, frogs, and even rodents and young birds in the case of the stork-billed kingfisher.

Let's dive into the fascinating world of the Common Kingfisher (*Alcedo atthis*) - a magnificent bird measuring 17 cm in length and weighing around 30-34 g. With a wingspan of 30 inches, they are truly a sight to behold. Click this: their underparts are a vibrant orange, complemented by a white bib. Their wings shimmer in shades of bluish green, while their tail boasts a brilliant blue hue. A blue head with white markings on either side adds to their striking appearance. Their short legs are a lovely shade of orange, contrasting beautifully with their colourful plumage. These stunning creatures call the Sundarban National Park home, preferring to reside near streams, slow-flowing rivers, ponds, and lakes. Their diet consists of aquatic insects, small fish, and prawns, which they skilfully hunt during the morning and evening hours. Come springtime, the males woo the females with fish in their beaks, leading to the laying of 6-7 eggs. During the 20-day incubation period, both parents diligently care for the eggs, which are placed on a bed of fish bones and disgorged pellets. The fledging period lasts from 23-27 days, during which the young ones are nurtured by their attentive parents. These fledglings sport hues ranging from blue to pale red, adding to the beauty of this remarkable species.

The White-throated Kingfisher (*Halcyon smyrnensis*) is an absolutely stunning and captivating bird that brings vibrancy and thrill to the environments it calls home. With its strikingly large bill and legs that are a vibrant shade of red, this bird is truly a sight to behold. The flight of the stork-billed kingfisher may seem laboured and flapping, but it is also direct and purposeful. Both male and female stork-billed kingfishers are equally impressive, and their noisy calls can be heard from afar, adding to the excitement of encountering these magnificent creatures. They live in a variety of well-wooded habitats near lakes, rivers, or coasts, and are known to be territorial, fearlessly chasing away eagles and other large predators. Adult stork-billed kingfishers are skilled nest builders, digging their homes in river banks, decaying trees, or tree termite nests. Despite their size, these birds are often inconspicuous as they quietly perch while hunting for crabs, fish, frogs, and even rodents and young birds in the case of stork-billed kingfishers. The White-throated Kingfisher, also known as the White-breasted Kingfisher or Smyrna Kingfisher, is a tree kingfisher that can be found throughout South East Asia. This majestic bird

boasts a bright blue back, wings, and tail, with chestnut-coloured head, shoulders, flanks, and lower belly, and a white throat and breast. Its large red bill and legs add to its striking appearance. When the White-throated Kingfisher takes flight, its rapid and direct movements are a sight to behold, with large white patches visible on its blue and black wings. While males and females may look alike, juveniles have a slightly duller appearance compared to the adults. Overall, encountering these magnificent birds is an exhilarating experience that is sure to leave you in awe of the beauty of nature. This incredible species can be found in a variety of habitats, from open plains with trees and perches to the stunning Sundarbans mangroves. They are skilled hunters, preying on large crustaceans, insects, earthworms, rodents, snakes, fish, and frogs. During breeding season, these birds are particularly vocal and active. They start breeding as soon as the Monsoons arrive, creating their nests in earth banks. The nest-building process is fascinating to watch, with both birds working together to create a cozy home for their eggs. A typical clutch contains 4-7 round white eggs, which hatch in just 20-22 days. The chicks then fledge in a speedy 19 days. Witnessing the life cycle of these amazing birds is truly a sight to behold!

The magnificent blue-eared kingfisher (*Alcedo meninting*) can be spotted throughout the stunning landscapes of the Indian subcontinent and Southeast Asia. This striking bird boasts a darker crown and rufous underparts, with adult males sporting an alluring dark bill while females flaunt a reddish lower mandible. Standing at 16 centimetres

long, this kingfisher is easily recognized by its vibrant blue ear coverts, intense cobalt-blue upperparts, and rich rufous underparts. Juvenile blue-eared kingfishers showcase rufous ear-coverts and subtle mottling on their throat and upper body, which fades away as they mature into adulthood. Young birds also sport a reddish bill with whitish tips, adding to their charm. These enchanting creatures prefer to reside near pools or streams in dense evergreen forests and mangroves, where they can be seen perched on branches overlooking shaded streams before gracefully diving below to capture their prey. During the breeding season, which typically occurs from May to June, these majestic birds construct their nests in meter-long tunnels along the banks of forest streams. Here, they lay about five to seven white, near-spherical eggs, continuing the cycle of life in the most picturesque of settings. The blue-eared kingfisher truly is a sight to behold, adding a touch of magic to the enchanting landscapes.

*Some key conservation strategies for Kingfishers in the Indian Sundarbans:*

- i. Monitoring Programs: Long-term monitoring programs, such as the Sundarbans Biological Observatory Time Series (SBOTS) program, play a crucial role in tracking changes in the Sundarbans ecosystem and freshwater flow.*
- ii. Pollution Management: Specific pollution prevention, control, and remediation practices are essential for the Sundarbans mangrove wetlands. This includes the installation of effluent treatment plants, development of waste disposal mechanisms, and monitoring of industrial activities.*
- iii. Involving Stakeholders: It is imperative to involve all stakeholders, including fishermen, in decision-making processes to ensure effective conservation efforts.*
- iv. Rotational Opening of Forest Areas: Opening Forest areas to users on a rotational basis can lead to better decision-making and sustainable resource management.*
- v. Including Fishers in Development Processes: Integrating fishers into mainstream development processes is crucial for making informed decisions that benefit both the environment and local communities.*
- vi. By following these strategies, we can work towards the preservation of Kingfishers and the overall health of the Indian Sundarbans ecosystem. Let's join forces to protect these magnificent birds and their habitat for generations to come.*

The magnificent pied kingfisher (*Ceryle rudis leucomelanurus*), also known as the Lesser Pied Kingfisher, Indian Pied Kingfisher, or Small Pied Kingfisher, is a vibrant and lively medium-sized water kingfisher measuring about 25 cm in length. This stunning bird can be found across Africa and Asia, showcasing its striking black and white plumage, regal crest, and unique habit of hovering over crystal-clear lakes and rivers before diving in for a delicious fish feast. Males of this species boast a distinctive double band across



their chest, while females sport a single gorget that is often split in the middle. These social birds are typically seen in pairs or small family groups, and when perched, they display charming head bobs and tail flicks. Their sharp chirruk chirruk calls can be heard frequently as they go about their daily activities. Pied kingfishers are known for their impressive hunting skills, primarily feeding on fish but also enjoying crustaceans and large aquatic insects like dragonfly larvae. They have a unique hunting technique of hovering over the water to spot their prey before diving straight down, bill-first, to make a catch. When not on the hunt, these birds showcase their swift and direct flight, reaching speeds of up to 50 km/h. Breeding season for these remarkable creatures occurs from February to April, with nests being excavated in vertical mud banks about five feet above the water's surface. The nest tunnels are four to five feet deep, leading to a cosy chamber where the usual clutch of three to six white eggs is laid. It's not uncommon for several birds to nest in close

proximity, adding to the lively and bustling atmosphere of these fascinating creatures. The magnificent collared kingfisher (*Todiramphus chloris humii*), also known as the white-collared kingfisher or mangrove kingfisher, is a medium-sized tree kingfisher that will leave you in awe. With a wide range spanning from the Red Sea across southern Asia to Polynesia, this stunning bird is a sight to behold. Measuring between 22 to 29 cm in length and weighing 51 to 90 g, the collared kingfisher showcases a beautiful array of colours ranging from blue to green above, with white or buff underparts. The distinctive white collar around its neck is what gives this bird its name, making it truly stand out in the avian world. Some races of the collared kingfisher sport a white or buff stripe over the eye, while others boast a white spot between the eye and bill. A black stripe through the eye adds to its striking appearance. The large bill, black with a pale-yellow base to the lower mandible, is a feature that adds to its charm. Females tend to be greener than males, adding a touch of elegance to their appearance. Immature birds may be duller than adults, with dark scaly markings on the neck. Their loud, harsh, and metallic call is a sound you won't soon forget, repeated several times to make its presence known. Found most commonly in coastal areas, especially in mangrove swamps, the collared kingfisher has a diverse diet. Small crabs are a favourite food in coastal regions, but they also enjoy insects, worms, snails, shrimps, frogs, lizards, small fish, and sometimes even other small birds. When it comes to nesting, these birds are resourceful. They make their homes in tree holes, burrows they excavate themselves in rotten trees, termite mounds, or earth banks. They may even occupy old woodpecker holes. The female bird lays two to seven rounded whitish eggs directly on the floor of the burrow, without using any nest material. Both parents share the responsibility of incubating the eggs and feeding the chicks. After about 44 days, the young birds bravely leave the nest. And guess what? Two broods are often raised in a single year! How amazing is that!



## Reviving Indigenous Rice Varieties in India: A Sustainable Solution to Modern Agricultural Challenges and Food Security

Muktaram Sardar

With the increasing population in India, the demand for rice, a staple food for millions, has risen substantially. To meet this growing demand, modern agricultural practices have introduced high-yielding varieties (HYVs) of rice, often replacing indigenous rice varieties that were traditionally cultivated. These high-yielding varieties are heavily reliant on the use of chemical fertilizers and pesticides, largely promoted by multinational agribusinesses. While these methods have boosted productivity, they come at a cost: soil degradation, environmental harm, and potential health risks to consumers due to the accumulation of chemical residues in rice.

Traditionally, rice cultivation in Bengal followed the 'paddy-cum-fish' culture, an integrated approach where rice paddies would also support fish farming, benefiting the ecosystem. However, this practice has been largely replaced by the intensive cultivation of HYV paddy, where farmers now procure seeds from external markets rather than relying on local seed stocks. The use of low-quality seeds, such as Nibor rice, has led to a decline in paddy quality and yield, negatively impacting the financial stability of

small-scale farmers. Traditional farming practices involving the use of cows and buffaloes for land preparation have also been displaced by mechanized systems, further increasing reliance on external inputs, including synthetic fertilizers and pesticides. The overuse of chemical fertilizers and pesticides has caused long-term degradation of soil health, reduced its fertility and resulted in crops that are not only chemically-laden but also nutritionally inferior. This widespread use of chemicals has raised public health concerns, as these substances accumulate in the food chain, contributing to chronic illnesses among consumers.

In response to these challenges, the PFRI (Forest Research Institute) has actively collaborated with local farmers to reintroduce and scale up the cultivation of indigenous rice varieties. Currently, PFRI is cultivating approximately 50 varieties of traditional rice on experimental fields. These indigenous varieties, which can be grown with minimal external inputs, offer significant advantages over HYVs. For example, they do not require chemical fertilizers or purchased seeds, as farmers can produce seeds on their own, reducing dependence on external markets. Moreover, indigenous varieties often require less processing and are more resilient to local environmental conditions,

making them a more sustainable option for long-term cultivation. One of the challenges with growing indigenous rice varieties is the height of the plants, which can grow tall and become prone to lodging (falling over). However, these varieties offer superior nutritional value compared to many HYVs. For instance, traditional rice varieties have higher starch content, contributing to health benefits. In Bengal, dishes like panta bhat (fermented rice), pitha, and puli made from this rice are highly valued, especially during the winter season, as they are considered not only nutritious but also an important part of the regional culinary tradition.



*Paul, U. (2024). Indigenous paddy cultivation. Indian Sundarban.*

In contrast, while HYVs may be easier to fry and cook quickly, they tend to lack the nutritional density found in indigenous varieties. Additionally, the watery consistency of high-yielding rice when cooked is often seen as inferior in terms of texture and taste. Indigenous rice, though requiring a longer cooking time, is prized for its flavour and health benefits. The cultivation of indigenous rice varieties offers a promising alternative to high-yielding varieties, especially in light of growing concerns about food security, environmental sustainability, and human health. By promoting traditional farming practices and reducing reliance on chemical inputs, the reintroduction of these native varieties could play a critical role in ensuring a more sustainable and healthy future for rice production in India.



# A Comparative Analysis of Ancient and Contemporary Indian Environments: Perspectives from Literature and Art

Shreya Ghosh

India's rich historical tapestry is woven with its diverse natural environments, celebrated and immortalized in ancient texts, art, and cultural traditions. This journey from ancient to modern India offers valuable insights, not only into the ecological transformations that have unfolded over centuries but also into the evolving perceptions and cultural values tied to the natural world. Examining these connections through the lens of literature and visual arts helps us understand how human-nature relationships have shifted, adapted, and, in some ways, fractured over time.

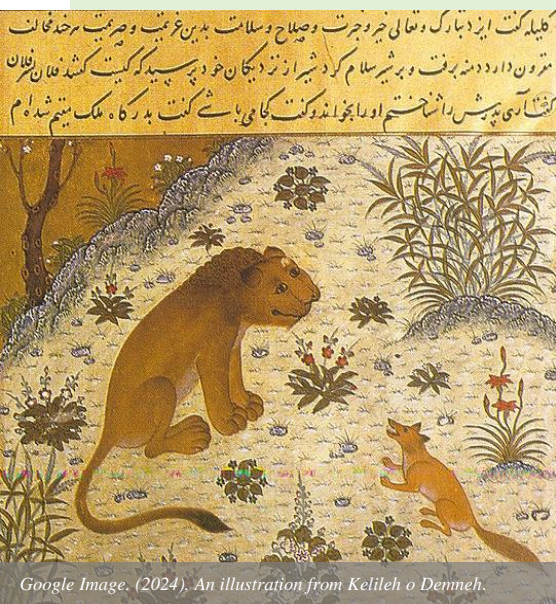
In ancient Indian literature, the environment is portrayed as a divine entity, integral to human existence. Texts such as the Vedas and epics like the Mahabharata and Ramayana depict nature with reverence and harmony, highlighting a world where forests, rivers, and wildlife were revered and protected. The sacredness of rivers like the Ganga is celebrated, with natural landscapes depicted not only as beautiful but as sanctuaries of spiritual significance. The Ajanta and Ellora caves capture this unity, with murals illustrating serene landscapes, abundant flora, and fauna seamlessly woven into religious and philosophical themes.



Dey, M. (2023). Khajuraho. Madhya Pradesh, India.

Modern India presents a different ecological narrative, shaped by rapid industrialization, urbanization, and population growth. Today, art and literature reflect pressing issues of pollution, deforestation, and climate change, with a growing focus on the consequences of these transformations. Metropolitan regions like Delhi and Mumbai have witnessed alarming declines in air and water quality, illustrating the direct impacts of environmental degradation on human health and biodiversity. Artists and writers have taken on advocacy roles, addressing ecological decay and emphasizing the importance of conservation. The contrast between the natural harmony celebrated in ancient art and literature and the conflict-driven themes of modern works reflects the urgent need to reassess our relationship with the environment.

Ancient Indian texts like the Panchatantra and Mughal miniature paintings celebrate the biodiversity of India, depicting the interconnectedness of species and the importance of ecological balance. These works emphasize not only the variety of life forms but the moral and spiritual lessons they embody. In contrast, modern reports, such as the State of India's Birds 2020, lament the steady decline in bird populations, highlighting habitat destruction and pollution as significant drivers of biodiversity loss. Contemporary art, such as *The Suffering Earth* by Subodh Gupta, uses industrial waste and natural elements to represent the struggle for balance amid environmental degradation.



Google Image. (2024). An illustration from Kelileh o Demneh.

In ancient literature, nature was sacred and essential to human well-being, a theme that recurs in texts like the Mahabharata. The epic integrates natural elements as revered characters, celebrating forests and rivers as living entities. Ajanta Cave Paintings also reflect this reverent relationship, with landscapes that evoke harmony. In contrast, modern literature like *The God of Small Things* by Arundhati Roy examines the strain between humans and nature, highlighting the exploitation of resources and the repercussions on ecological and social systems. Similarly, *Environmental Catastrophe* by Gigi Scaria captures the conflict between human encroachment and the natural world, calling for a re-evaluation of humanity's role as stewards of the earth.

Art from ancient India frequently symbolizes tranquility



## Strategies for Conserving the Mangrove Ecosystem

*Soumik Sarkar*

**M**angroves, vital coastal ecosystems, are essential to environmental, economic, and social well-being. Acting as natural barriers, they shield coastal communities from climatic events, sequester significant amounts of carbon, and support a diverse range of wildlife. Despite these benefits, mangroves are increasingly threatened by urbanization, deforestation, pollution, and climate change. Addressing

and balance with nature, as illustrated by the murals of the Ajanta Caves. These works capture daily life, forests, and rivers in an environment of peace. Contemporary art often illustrates environmental conflict, underscoring the struggle to protect nature from degradation. *The Last Stand* by Sushmita Dey and *The Wasteland* by Ranjani Shettar depict the encroachment and waste challenging natural spaces. Both artists call attention to the pressing need for ecological preservation. Themes of unity and respect for nature are prevalent in ancient works, such as the Rigveda, which reveres natural elements like rivers and mountains as sacred. In modern literature, however, there is often a tone of nostalgia and loss. *The Hungry Tide* by Amitav Ghosh, set in the fragile ecosystem of the Sundarbans, poignantly portrays the ecological and cultural losses incurred by climate change and human impact. Ghosh's novel highlights the Sundarbans' unique biodiversity and the human communities dependent on it, capturing the urgency of preserving such ecosystems.

This contrast between ancient reverence and modern exploitation in Indian literature and art is a poignant reminder of the environmental shifts we face today. Reflecting on ancient values and insights encourages us to confront current challenges and work toward a sustainable future. By revisiting these traditional views on nature, we can foster a renewed respect and call to action for environmental conservation. Together, we can help preserve India's diverse ecosystems, ensuring that the natural beauty once celebrated in texts and paintings endures for future generations.

these challenges requires a comprehensive strategy involving multiple stakeholders and varied approaches. Effective conservation begins with community engagement and education. Local communities, who often rely on mangroves for fishing and firewood, play a crucial role in conservation success. By involving community members in conservation initiatives, a sense of ownership and responsibility is fostered. Programs that educate residents about the ecological, medicinal, and economic value of mangroves can inspire a commitment to preserving these ecosystems. Workshops, school programs, and awareness campaigns are instrumental in building this community-based approach. Participatory management further strengthens conservation by incorporating local knowledge into strategies, with community-led projects focused on establishing reserves, rehabilitating degraded areas, and monitoring mangrove health.

Sustainable resource management is another cornerstone of effective conservation. Regulating the harvesting of resources such as fish, shellfish, and wood prevents overexploitation, maintaining a healthy ecological balance. Practices like rotational harvesting and designated zones safeguard mangroves while allowing communities to sustainably benefit from them. Encouraging alternative livelihoods, such as sustainable aquaculture, eco-tourism, and handicraft





Roy, AK. (2024). *Bruguiera gymnorhiza* (L.). Indian Sundarban.

production, reduces pressure on mangroves, offering economic stability that does not compromise the ecosystem. Policy frameworks and economic incentives are also critical to mangrove conservation. Government and NGO support in the form of economic incentives can significantly advance conservation efforts. Initiatives like Payment for Ecosystem Services (PES) recognize and reward communities that maintain healthy mangrove ecosystems. This financial support underscores the importance of conservation, benefiting both the ecosystem and the communities that protect it.

In response to climate change, mangroves are an irreplaceable ally in mitigation and adaptation. Their dense roots store carbon and protect shorelines from rising sea levels and extreme weather. Conservation strategies must assess mangrove areas' vulnerability to climate impacts, incorporating resilience measures to sustain these invaluable ecosystems.

Preserving mangroves is essential for biodiversity, coastal protection, and climate resilience. A holistic approach that combines community involvement, sustainable practices, supportive policies, and climate adaptation can secure the future of these ecosystems. By recognizing mangroves' value and working collaboratively, we can preserve them for future generations, ensuring their continued ecological and economic benefits.



## East Kolkata Wetland, The kidney of The City of Joy

Uma Paul

The East Kolkata Wetlands (EKW) are a vital ecological and economic resource located on the eastern periphery of Kolkata, between the Salt Lake and Rajarhat townships. Spanning approximately 12,500 hectares, the EKW represent one of the world's largest sewage-fed wetland systems and were designated a Ramsar Site in 2002 in recognition of their unique ecological importance. Often referred to as the 'kidneys of Kolkata', these wetlands play an essential role in filtering and purifying the city's wastewater,

much like the function of kidneys in the human body. Every day, this intricate natural system processes close to 1,000 million liters of sewage, utilizing sunlight, microbial activity, and aquatic plants to break down pollutants. This biological filtration not only treats the water but also enables its reuse in fish farming and agriculture, exemplifying nature-based wastewater management.



Google Earth Image. (2024). Parts of East Kolkata wetlands. Kolkata, India.

In addition to wastewater treatment, the EKW regulate Kolkata's water dynamics, absorbing excess rainwater during floods, mitigating the city's biochemical oxygen demand (BOD) levels, and contributing to groundwater recharge. These wetland functions are essential for sustaining Kolkata's environmental health, much as kidneys are essential to human physiology. This

'kidney' function underpins Kolkata's resilience to both flooding and pollution, providing crucial ecological services that would otherwise necessitate costly artificial infrastructure. The EKW sustain the environment while supporting thousands of livelihoods through fish farming, agriculture, and associated industries. Economically, the wetlands serve as a major hub for aquaculture and agriculture, producing over 13,000 tons of fish annually and

irrigating local agriculture with nutrient-rich water. These resources provide affordable food supplies, thereby contributing significantly to Kolkata's food security. Additionally, the wetlands are a source of income for thousands of economically vulnerable individuals, offering employment in fish farming, agriculture, and small-scale industries. Ecologically, the EKW support an impressive diversity of flora and fauna, hosting over 100 plant species, 40 fish species, and a variety of bird species, including migratory birds. This biodiversity makes the EKW a hotspot for conservation, underscoring their importance for ecological stability and resilience. Despite their critical ecological, economic, and social value, the EKW face serious threats from urbanization, illegal landfills, and encroachment, which endanger their delicate ecological balance. These pressures highlight the urgent need to protect the wetlands for Kolkata's long-term environmental stability and socio-economic well-being.



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