International Seminar

on

“Protecting Wetlands and its Impact in Biodiversity Conservation”

26th June, 2025

Organized by

Post Graduate Department of Botany, Darjeeling Government College

Sponsored by

East Kolkata Wetlands Management Authority (EKWMA)

Venue

Prof. Lalita Rai Ahmed Seminar Hall

Darjeeling Government College

Government of West Bengal
Office of the Principal
Darjeeling Government College
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Memo No. BOT/INT. SEM/01(25) *Date :* 25/06/2025

Message from the Desk of the Officer-in-Charge

I am delighted to welcome you all to the International Seminar on "**Protecting Wetlands and its Impact on Biodiversity Conservation**" being organised by the PG Department of Botany, Darjeeling Government College, Darjeeling, and sponsored by East Kolkata Wetlands Management Authority.

Wetlands are among the most productive ecosystems on Earth, providing essential services and habitats for numerous species of plants and animals. They also play a vital role in maintaining the balance of our environment by acting as natural water filters, absorbing pollutants, and mitigating the effects of climate change. Unfortunately, wetlands are among the most threatened ecosystems worldwide.

The theme of this seminar is highly relevant and timely, as it addresses the urgent need to protect and conserve wetlands for the sake of biodiversity and our planet's well-being. This event will bring together researchers, practitioners, policymakers, and students from various disciplines to share their knowledge, experiences, and insights on wetland conservation, restoration, and management.

I am confident that the seminar will provide a platform for valuable discussions, leading to innovative solutions and strategies for the protection and sustainable use of wetlands. As the patron of this event, I encourage all participants to actively engage in the proceedings, learn from each other, and contribute to the global effort to safeguard wetlands and their associated biodiversity.

On behalf of Darjeeling Government College, I extend my heartfelt gratitude to East Kolkata Wetlands Management Authority for their generous support in making this seminar possible. I also thank the PG Department of Botany for their hard work and dedication in organising this event.

I wish you all a productive and enriching seminar experience. Let us join hands to protect and conserve our precious wetlands for the benefit of future generations.

Date: 25/06/2025
Place: Darjeeling

Yours sincerely,

Officer-in-Charge
Darjeeling Government College
Darjeeling - 734101

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MESSAGE

It is a matter of immense pleasure that the Post Graduate Department of Botany, Darjeeling Government College, Darjeeling, West Bengal is organizing one day International Seminar on "Protecting Wetlands and its Impact in Biodiversity Conservation", sponsored by East Kolkata Wetlands Management Authority (EKWMA) on 26th June 2025.

I am sure that this Seminar would provide intellectual debate and opportunities for the participants to study the multifaceted aspects of Ecosystem and will provide a platform for exchange of ideas among all stakeholders on the issue pertaining to management of Biodiversity and developing sustainable environment.

I hope the discussion on various aspects on the theme of the Seminar will provide important insights, innovative solutions and proof beneficial to all the stakeholders. I am confident that the proceeding volume of the book of abstracts will serve as an important tool to aid policymakers and environmentalist alike.

I further extend my best wishes and warm greetings to the Organizer, faculty members, Guest and all participants of the seminar who have put in great efforts to organize such an academic event and hope that it achieves the desired success in its endeavor.

Date: 25/06/2025
Place: Darjeeling

Coordinator, IQAC
Darjeeling Govt. College

Coordinator
IQAC
Darjeeling Government College
Darjeeling

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Ref. No: BOT/INT.SEM/01(25) **Date:** 25.06.2025

Message from the desk of the Head of the Department

It is my great pleasure to welcome you all to the International Seminar on "**Protecting Wetlands and its Impact in Biodiversity Conservation" organised by the UG & PG Department of Botany, Darjeeling** Govt. College, on 26th June 2025. This esteemed event is sponsored by the East Kolkata Wetlands Management Authority, whose support we gratefully acknowledge.

As we convene here, we are reminded of the critical importance of wetlands in maintaining the fragile balance of our ecosystem. Wetlands are not only vital habitats for a diverse array of flora and fauna but also play a crucial role in supporting biodiversity, mitigating climate change, and ensuring the well-being of human communities as well as the entire global ecosystem. The theme of this seminar is particularly relevant in the current context, as wetlands continue to face numerous threats due to human activities, climate change, and other anthropogenic pressures. We must come together to share our knowledge, experiences, and best practices in protecting and conserving these vital ecosystems. Over the course of this seminar, we will have the opportunity to engage with renowned experts and researchers from around the world, who will share their insights on the latest research, policies, and practices in wetland conservation. We will also deliberate on the impact of wetland degradation on biodiversity and explore ways to mitigate these effects.

I would like to express my sincere gratitude to the East Kolkata Wetlands Management Authority for their generous sponsorship, which has made this event possible. I also appreciate the tireless efforts of my colleagues in the Department of Botany, Darjeeling Govt. College, who worked diligently to organise this seminar.

I warmly welcome you to this seminar, a unique opportunity for knowledge sharing, collaboration, and networking among experts and stakeholders dedicated to conserving wetlands and the rich biodiversity and ecological services they provide. I am confident that our collective efforts will yield valuable insights and lasting impacts in this critical field.

Date: 25/06/2025
Place: Darjeeling

Sincerely,

Head
UG & PG Department of Botany
Darjeeling Govt. College
Darjeeling- 734101

International Seminar

on

"Protecting Wetlands and its Impact in Biodiversity Conservation"

26th June, 2025

Abstract Volume

Organized by

Post Graduate Department of Botany, Darjeeling Government College

Sponsored by

East Kolkata Wetlands Management Authority (EKWMA)

Ecological Conservation of *Tylototriton verrucosus* with wetlands protection in Darjeeling

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Abstract

The Himalayan newt (*Tylototriton verrucosus*), which is a rare also threatened amphibian species, inhabits select high-altitude wetlands across the Eastern Himalayas, including the Darjeeling region. This species is the only representative of the order Caudata in the Indian sub-continent. In Darjeeling district, West Bengal, India, *Tylototriton verrucosus* is particularly found in regions like Senchal Wildlife Sanctuary and surrounding moist forest areas with wetland characteristics. Amphibians do face growing threats such as habitat loss and pollution and climate change yet still play a very important ecological role as bio-indicators. Their natural habitats that exist in Darjeeling have been greatly impacted through rapid urbanization along with wetland degradation plus unsustainable land use practices. This poster shows *Tylototriton* is ecologically important, says its survival faces major threats, and says we urgently must conserve it via wetland protection, community awareness, pollution control, and scientific monitoring. Darjeeling's fragile montane ecosystems will benefit when this unique species survives.

Keywords: Himalayan newt, wetlands, conservation.

Mangrove Horseshoe Crab (*Tachypleus gigas*): Ancient Guardian of Coastal Wetlands and Medical Marvel

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Abstract

The Mangrove Horseshoe Crab (Tachypleus gigas) is an ancient marine arthropod whose evolutionary lineage dates back over 450 million years, earning it the title of a "living fossil." This resilient species plays a crucial ecological role in maintaining the health of coastal wetland ecosystems, especially mangroves, by aerating sediments and serving as an essential food source for migratory birds and other wildlife. Despite its resilience, *T. gigas* faces growing threats from habitat destruction, pollution, and overharvesting.

Beyond its ecological significance, the Mangrove Horseshoe Crab is globally renowned for its unique blue blood, which contains Limulus Amebocyte Lysate (LAL). This substance is vital for the biomedical industry, as it is used to detect bacterial endotoxins in vaccines and medical devices, ensuring patient safety worldwide. Sustainable conservation of this species is therefore critical not only for wetland biodiversity but also for human health advancements.

This poster highlights the dual role of Tachypleus gigas as a keystone species and a medical asset, underlining the urgent need for integrated conservation strategies. Protecting this ancient guardian safeguards our coastal wetlands and secures an irreplaceable natural resource for the global medical community.

Keywords: Mangrove Horseshoe Crab, *Tachypleus gigas*, wetlands, conservation, Limulus Amebocyte Lysate (LAL), biomedical importance.

Study of Microbial Community Structure in Coastal Wetland Sediments

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Abstract

Coastal wetlands (CW) represent transitional zones between land and sea, characterized by unique ecological features and vital roles in global biogeochemical cycles, carbon sequestration, and habitat provision. Microorganisms residing in CW sediments are fundamental to nutrient and material cycling within these ecosystems. However, CW are highly dynamic and increasingly impacted by anthropogenic activities and climate change, leading to significant ecological imbalance. A comprehensive understanding of the microbial communities specifically their composition, functions, and ecological capabilities is critical for restoring and enhancing wetland performance. Microbial communities within these environments are key drivers of nutrient cycling, organic matter decomposition, and ecosystem resilience. The intricate interactions between environmental gradients like salinity, tidal influence, organic content, and microbial community structure are highlighted in the present study that explores the microbial diversity in coastal wetlands. Using metagenomic analysis and high-throughput sequencing, the study found a diverse and rich collection of bacteria, archaea, and fungi, many of which are unique to specific microhabitats within the wetland. The findings underscore the ecological significance of microbial populations in maintaining wetland functionality and suggest that shifts in climate and anthropogenic pressures could profoundly alter microbial community dynamics. Understanding microbial diversity in these vulnerable ecosystems is essential for predicting responses to environmental change and for informing conservation and restoration strategies.

Keywords: Coastal wetlands, Biogeochemical cycles, Microorganisms, Nutrient cycling,

ABOVE THE TREELINE: UNDERSTANDING HIGH ALTITUDE WETLANDS IN A CHANGING CLIMATE

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Abstract

Wetlands; an intermediate between land and aquatic ecosystems are often referred to as "Kidneys of the earth". High altitude wetlands (HAWs), are often glacier or snow fed water bodies, formed above 3000m above sea level. Their geographical extent makes these ecosystems particularly sensitive to climate change; recognised amongst most vulnerable ecosystems. HAWs are indispensable for regulating hydrological cycles, supporting river ecosystems, and providing critical habitats for many endangered plant and animal species. The rhythmic freezing and thawing of glaciers replenish these wetlands, enabling them to function as vital natural water storage basins. These wetlands hold some of the highest carbon stocks in the biosphere, making them vital global carbon sinks. In high-altitude wetlands, soil carbon dynamics are primarily governed by abiotic factors like temperature, moisture, and microbial activity. Climate-driven changes in temperature and precipitation are key determinants of organic carbon storage. Microbial communities also play a fundamental role in nutrient cycling and biogeochemical processes, including the transformation of carbon, nitrogen, and phosphorus. Their activity regulates soil fertility, greenhouse gas emissions, and organic matter decomposition, making them key drivers of ecosystem functioning in these cold, nutrient limited environments. This study highlights the importance of long-term monitoring of high-altitude wetlands to understand microbial ecology, endemic species interactions and hydrological changes under a changing climate. It also emphasizes the need to understand anthropogenic pressure and to preserve traditional knowledge and promote community-based conservation to sustain these fragile ecosystems.

Wetlands: Vital Ecosystems for Biodiversity and Climate Resilience

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Abstract

Wetlands are transitional ecosystems between terrestrial and aquatic environments, characterized by saturated soils and distinct vegetation adapted to waterlogged conditions. Found across all climatic zones, wetlands include marshes, swamps, bogs, fens, mangroves, and peatlands, each with unique hydrological and ecological characteristics. These ecosystems play a vital role in maintaining environmental balance by providing essential services such as water purification, flood control, groundwater recharge, shoreline stabilization, and carbon sequestration. Wetlands serve as crucial habitats for a wide variety of flora and fauna, including numerous endangered and endemic species, thereby contributing significantly to global biodiversity.

In addition to their ecological functions, wetlands support millions of people worldwide by providing resources such as fish, fuelwood, fodder, and medicinal plants, and by sustaining livelihoods through agriculture, fishing, and ecotourism. Despite their importance, wetlands are among the most threatened ecosystems globally due to human-induced pressures like land conversion, urbanization, pollution, invasive species, and climate change. The degradation of wetlands leads to the loss of ecosystem services and increased vulnerability to natural disasters.

Conservation and sustainable management of wetlands are imperative to ensuring ecosystem resilience and supporting climate change mitigation and adaptation. International frameworks such as the Ramsar Convention on Wetlands have played a significant role in recognizing and protecting wetlands of international importance. However, there remains a critical need for more integrated policies, community involvement, scientific research, and restoration efforts at local, national, and global levels. This topic underscores the multifunctional value of wetlands and calls for immediate action to safeguard these ecosystems. Promoting awareness, enhancing governance, and implementing evidence-based conservation strategies are key to preserving wetlands for current and future generations.

Keywords: Wetlands, Ecosystem services, Ramsar Convention, Ecosystem resilience, Wetland restoration

Physiochemical properties of High-altitude natural water bodies of Eastern Himalayas

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Abstract

High-altitude lakes of the Eastern Himalayas, spanning regions of Nepal, Arunachal Pradesh, and Manipur, are ecologically significant yet understudied freshwater ecosystems. These lakes namely Rupa, Rara, Begnas, Tilitsho, P.T. Tso, Sella vary widely in their physical, chemical, and biological characteristics due to differences in elevation, geological setting, and anthropogenic impacts. Rara and Tilitsho lakes show oligotrophic conditions characterized by high transparency and low nutrient concentrations, whereas Loktak Lake depicts relatively higher ion and nutrient concentrations under regional influences. Plankton and aquatic macrophyte communities are principal bioindicators of health in the ecosystem, demonstrating seasonal and altitudinal variation. Plankton communities are effective indicators of a water body's trophic status due to their rapid response to environmental conditions and their distinctive biological traits besides their dynamics are essential in pollution monitoring and ecosystem diagnostics. Aquatic macrophytes, though largely limited to shallow zones, significantly influence ecosystem aspects. They contribute to eutrophication, modify physicochemical properties, and are both drivers and indicators of changing water conditions. Thus, measuring macrophyte biomass along with water quality parameters is a robust method for evaluating ecosystem health. These high altitude natural water bodies and wetlands play a pivotal role in biogeochemical cycling, climate regulation, and serve as natural archives of past environmental and climatic changes, making them crucial indicators of climate change. This review consolidates existing knowledge and highlights key areas requiring future investigation to support conservation and sustainable management of these fragile aquatic ecosystems. This review aims to compare and analyze key limnological parameters such as water temperature, pH, dissolved oxygen, nutrient levels, and plankton diversity across selected lakes towards understanding their ecological status and conservation needs.

Keywords: Plankton, macrophyte, bioindicators, ecosystem, sustainable management

Unveiling Microbial Mysteries of Himalayan Wetlands: A Metagenomics Perspective

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Abstract

The Himalayas, with their diverse ecological gradients, harbour unique wetland systems that function as ecological hotspots for microbial diversity and biogeochemical cycling. This review-based study employs high-throughput metagenomic sequencing and advanced bioinformatics to unravel the microbial communities and functional potential across distinct Himalayan habitats including glacier-fed wetlands (Changme Khang & Changme Khangpu), geothermal wetlands (Reshi, Chumathang), freshwater riverine sediments (Brahmaputra), and high-altitude lakes (Pangong Lake, Dal Lake, Samiti Lake). These wetlands, despite harsh environmental constraints, sustain highly adapted microbial consortia contributing to nutrient turnover, stress response, and ecosystem resilience. In the Pranmati watershed wetland (Uttarakhand); 10,38,077 high-quality reads revealed 12,136 OTUs, with rarefaction curves reaching a plateau, indicating sufficient sequencing depth. Seasonal variation influenced community structure significantly Proteobacteria dominated in summer while Cyanobacteria prevailed in winter. Alpha diversity analysis indicated significantly higher Simpson diversity (p = 0.011), while beta diversity (UniFrac, PCoA) revealed clear seasonal clustering. Across all wetlands studied, key phyla included Proteobacteria, Bacteroidetes, Firmicutes, Actinobacteria, and Verrucomicrobia, with environment-specific dominance. Functional profiling highlighted genes involved in carbon and nitrogen cycling, metal resistance, and antibiotic resistance particularly in Brahmaputra riverine sediments and saline wetland systems of Ladakh. The Changthang wetland soils revealed cold-adapted, halophilic taxa, while Samiti Lake wetlands indicated high glycoside hydrolase diversity, supporting active carbon metabolism. This integrative metagenomic exploration of Himalayan wetlands reveals their ecological richness, functional versatility, and their crucial role as reservoirs of microbial innovation. These findings provide a foundational understanding for Himalayan wetland conservation, climate adaptation strategies, and future biotechnological applications involving extremophilic enzymes and sustainable bioremediation.

Keywords: High-altitude, microbial diversity, Verrucomicrobia, extremophiles, biogeochemical cycling

From Marsh to Meadow: Wetland Restoration and Biodiversity Revival

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Abstract

Wetlands, once dismissed as wastelands, are now recognised for their critical role in supporting biodiversity, regulating water cycles, and storing carbon. However, decades of drainage, pollution, encroachment, and infrastructure development have severely degraded these ecosystems. The loss of wetland habitats has led to a sharp decline in native plant and animal populations, disrupting ecological balance. This paper aims to explore how degraded wetlands can be successfully brought back to life through restoration efforts. Attempt has been made to highlight key methods such as rewetting drained lands, removing invasive species, and reintroducing native vegetation to restore natural functions. It will draw on examples from India, particularly from North Bengal, to show how restoration has helped in the return of migratory birds, aquatic life, and wetland-dependent species. The major focus has also been shown to the social and environmental benefits of wetland revival, including improved water quality, flood control, and livelihoods for local communities. With growing awareness and community participation, wetland restoration offers hope for reversing biodiversity loss and building climate resilience. Thus, there is an turgent need to scale up restoration practices to reconnect nature, people, and policy through the lens of wetlands.

Keywords: Wetland restoration, Biodiversity conservation, Habitat recovery, Climate resilience, Ecosystem services

Role of Aquatic Pteridophytes In Wetland Phytoremediation -An Overview

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Abstract

Wetlands are essential ecosystems that naturally filter pollutants and phytoremediation is a technique that uses plants to remove or neutralize contaminants and can greatly increase the efficacy of wetlands. Aquatic pteridophytes have great promise for applications involving wetland phytoremediation. It examines the vital function that aquatic pteridophytes play in boosting wetlands' potential for phytoremediation. Fast growth rates, large biomass production, broad root systems (for certain species), and an exceptional resistance to a variety of pollutants, including heavy metals (e.g., arsenic, lead, and cadmium), excess nutrients (nitrogen and phosphorus), and organic toxins, are some of their important characteristics. Certain processes include rhizo-filtration (adsorption or absorption by roots), phytoextraction (uptake and accumulation of pollutants in plant tissues), phyto-stabilization (immobilization of contaminants in the soil/sediment), and phytodegradation (metabolic breakdown of organic pollutants within plant tissues). Species like *Azolla pinnata*, *Salvinia minima*, and Salvi known for their phytoremediation capabilities. These plants can be used in constructed wetlands or other aquatic systems to remove contaminants from wastewater and other polluted water source. From contaminated water, aquatic pteridophytes can extract a variety of pollutants, such as organic molecules, nutrients (such as phosphate and nitrogen), and heavy metals (such as arsenic, cadmium, lead, copper, and nickel). On account of their quick development and capacity to easily absorb pollutants from the water's surface, floating species like *Azolla* and Salvinia can be very effective. They can be utilized to improve the water quality in artificial wetlands, wastewater treatment facilities, and other aquatic habitats. Nitrogen fixing fern like *Azolla pinnata* and *Salviana minima* are prominent for their ability to remove heavy metals and nutrients.

INDIA'S ENDEMIC PLANTS: KEY TO WETLAND CONSERVATION, RESTORATION AND PHYSIOLOGY

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Abstract

Wetlands are natural transition zones where water and land meet to create rich, life-supporting environments, marked by waterlogged soils, specialized plants, and diverse wildlife. Acting as Earth's natural sponges and filters, they regulate water flow, purify ecosystems, and provide a crucial buffer between human activity and the natural world. Wetlands are some of the most valuable ecosystems on Earth. They help clean our water, protect us from floods, store carbon, and support a rich variety of life. But in India, many wetlands are under serious threat due to pollution, rapid development, and changes in water availability. As we work to conserve and restore these ecosystems, plants play a much bigger role than we often realize. It looks at how certain plant species—and their unique survival traits—can help bring degraded wetlands back to life. Many wetland plants have special physiological abilities: they can survive in waterlogged soils, tolerate salt, absorb excess nutrients, and even help improve soil health. In places like Delhi's Yamuna Biodiversity Park, salt-tolerant grasses were used to restore highly alkaline soils, turning barren land into a thriving green habitat. Other native Indian plants like Typha, Cyperus, and Phragmites have been used in similar ways to clean water, stabilize soil, and support wildlife. By understanding how these plants function, we can make smarter choices when restoring wetlands—choosing the right species for the right conditions and planning for long-term resilience. Blending ecological knowledge with plant science gives us a powerful, nature-based solution for protecting India's wetlands and the many benefits they offer.

Impact of Flood Hazard in the Indian Wetland Region of Sunderban in West Bengal

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Abstract

The Wetlands region of Sundarban area is vulnerable to climate-driven hazards, including flood and cyclone causing the loss of land and associated natural resources of riparian households, which threatens the livelihood, health and food security of these vulnerable communities. Flood is one of the most devastating natural calamities with environmental and socio-economic impacts. The main objective of this study was to examine the capability of geographic information system (GIS) in coupling with analytic hierarchy process (AHP) model for flood susceptibility mapping. The result revealed that distance from river, rainfall and land use land cover have the great role for flood occurring in the study area with selected factor weight value. The validation result showed that prediction accuracy was 0.8142 which may consider for validating the model that applied in present study. Indian Sundarbans is highly susceptible to tropical cyclones and resultant impact such as storm surge- induced floods, embankment breaching and saline water intrusion. It affects life and livelihood in severe ways. Mitigation and policy measures are therefore very important, based on information gathered at the grassroots level. Hence, this study is designed to across inter- village variation in cyclone vulnerability, considering physical vulnerability, and mitigation capacity. This study also highlights livelihood challenges faced by coastal dwellers. The findings from present study will be helpful for planner in flood mitigation strategies as a part of flood preparedness and will appear as a source for further research in the study area.

Keywords: Sunderban, Coastal, Floods, Cyclone, Vulnerable.

Endemic and endangered species found in Ramsar site of North East India and its conservation strategies.

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Abstract

Wetlands, an extremely abundant dynamic natural ecosystems, provide additional ecosystem services such as carbon sequestration, different nutrient cycling, groundwater recharge and the prevention of flooding and water logging. The Ramsar Convention is the intergovernmental treaty adopted on 2nd February 1971 in Ramsar, Iran that provides the framework for the conservation and wise use of wetland and their resources. North East India is Known for India's ecological and cultural legacy surrounded by international borders of Bangladesh, Bhutan, China, and Myanmar. Six Ramsar sites namely Pala wetland (Mizoram), Rudrasagar lake (Tripura), Khecheopalri wetland (Sikkim), Deepor Beel (Assam), Loktak lake (Manipur), and Namdapha National Park (Arunachal Pradesh) while Nagaland and Meghalaya, do not have any Ramsar sites provide great habitat, water holes, and corridors for a wide variety of threatened and endangered animals. However, the entire region harbours rich endemically endangered flora (Siroi Lily, Pinus merkusi, *Abies delavavi*, orchids, *Cymbidiums*, *Vanda*, *Cattaleya*, *Hookeriana*, *Farmeri*, *Dendrobium amoenum*) and fauna (Manipur Brow Antlered Deer, Hog Deer, Dhole, Red Jasper Barb, Keeled Box Turtle, Greater Adjutant, Asian Elephant). Species become endemically endangered due to their limited geographic range combined with threats like habitat destruction, climate change, invasive species, and human activities. Their small populations and narrow ecological requirements make them highly susceptible to extinction when their habitat is disturbed. Strategies like Addressing the Drivers of Wetland Loss and Degradation, Effectively Conserving and Managing the Ramsar Site Network, wisely using all Wetlands and Enhancing Implementation should be taken into consideration to make flora and fauna endemically endangered.

Key words: Ramsar Sites, North East India, Endemically Endangered species, Conservation

Safeguarding India's Wetlands: A Holistic Approach to Conservation and Management

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Abstract

Wetlands are vital ecological assets that provide essential ecosystem services such as water filtration, carbon sequestration, flood control and biodiversity support. In India, wetlands range from high-altitude Himalayan lakes to coastal mangroves, forming a complex and diverse network that supports both ecological balance and socio-economic development. Despite their significance, Indian wetlands are increasingly threatened by unplanned urbanization, agricultural encroachment, industrial pollution, and climate change. This paper explores the multifaceted pressures impacting wetland ecosystems and emphasizes their critical role in maintaining ecological balance. It examines the ecological functions of wetlands as breeding grounds and ecological corridors for migrating species. Integrating traditional knowledge systems and promoting stakeholder-driven conservation models and effective policy implementation are proposed as key recommendations. This study underscores that sustainable wetland management is not only an environmental necessity but also a pathway to achieving long-term ecological and social resilience.

Keywords: Biodiversity, conservation, ecological significance, wetlands

Wetland of Terai and Duars region and their conservation

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Abstract

A wetland is semi aquatic ecosystem whose ground covers are flooded or saturated in water, either permanently for epochs or at intervals. Wetlands form a transitional one between waterbodies and drylands and are differ from other terrestrial or aquatic ecosystem due to their vegetation's roots having adapted to oxygen poor water-logged soil. Wetland conservation is aimed at protecting and preserving areas of land including marshes, swamps, bogs and fens that are covered by water periodically or perpetually due to an intimidatory remark from both natural and anthropogenic hazard. Wetland covers at least 6% of the earth and have become a focal issue for conservation due to the ecosystem service they provide. The Terai and Duars savanna and grassland is a narrow lowland ecoregion at the base of the Himalayas about 25km wide and the continuation of the Indo-Gangetic plain in India Nepal and Bhutan. It is colloquially called Terai in the Gangetic basin east to Nepal then Duars in West Bengal , Bhutan and Assam east to Brahmaputra River. To increase awareness about the use of wetlands, a multi-pronged approached is needed including public education campaigns community engagement and promoting g sustainable practices. Wetland conservation is crucial because wetlands provide essential ecological and economic benefits, including water purification, flood control, habitat for diverse species, and carbon sequestration. They also play a vital role in maintaining water supply, supporting livelihoods, and mitigating the impacts of climate change. So, with the help of project presentations, we are trying to make people conscious about the importance of wetlands.

Key word – Wetland, Terai Dooars savanna and grasslands, Indo Gangetic plain basin.

Wetlands at Risk: Safeguarding Nature's Biodiversity Hotspots

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Abstract

Wetlands are among the most vital and productive ecosystems on Earth, often referred to as biodiversity hotspots due to their role in supporting a vast array of flora and fauna, including endemic, migratory, and endangered species. Despite their ecological significance, wetlands are increasingly threatened by rapid urbanisation, unregulated land-use changes, pollution, climate change, and unsustainable exploitation of resources. The draining and conversion of wetlands for agriculture and infrastructure have led to substantial habitat loss, while industrial effluents and eutrophication degrade water quality and disrupt ecological processes. Climate-induced variations in rainfall and rising temperatures further intensify these threats. This paper aims to explore the complex pressures faced by wetlands and underscore their critical function in maintaining ecological balance. The paper will, further, examine how wetlands serve as breeding grounds, migratory stopovers, and core habitats essential for diverse life forms, while also offering vital ecosystem services such as flood control, groundwater recharge, and carbon sequestration. Case studies of wetland degradation and successful restoration initiatives will be presented to highlight both the risks and the potential for recovery. This paper will also advocate for integrative conservation strategies, policy support, and community engagement to ensure the resilience and sustainability of wetland ecosystems. Protecting wetlands, therefore, is not merely a conservation imperative but a strategic investment in preserving biodiversity, ecosystem health, and human well-being.

Wetlands-Nature’s lifeline-Use wisely, Protect Strongly

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ABSTRACT

Wetlands are areas where water covers soil or is present near the surface permanently or seasonally. They are known as Nature's Lifeline. Wetlands perform important ecological, hydrological and socio-economic functions. They serve as heaven for biodiversity, supporting diverse flora and fauna that rely on this habitat. Wetlands act as natural filters, purifying water by trapping pollutants and sediments. They help control floods by absorbing excess rainwater. Wetlands also provide crucial support to communities through fishing, farming [paddy field] and resource-based activities. The most important role is to help mitigate the impact of climate change by acting as carbon sink and temperature regulator. We, humans have benefitted from wetlands, not just for resources such as foods, water and materials but also through opportunities like ecotourism and cultural practices. However, these benefits often come at a cost. Anthropogenic pressures such as unsustainable agriculture, urbanization, industrial pollution, over exploitation of resources are leading to widespread wetland degradation, loss and alteration. The consequences of these losses are severe including increasing flooding, reduced water quality, biodiversity decline and diminished livelihoods opportunities for communities reliant or wetland resources. To safeguard wetlands through protected area designation and restore degraded sites. Developing and enforcing strong policies and legal frameworks at local, national and international levels to prevent wetland destruction and promote sustainable use. Raising public awareness about wetland importance through impactful slogans, social media campaigns, informative sign boards near wetlands and organizing eco-camps and awareness drives. By integrating these strategies, we can mitigate the loss of these invaluable ecosystems and secure their services for present and future generations.

Arbuscular mycorrhizal fungi: Significant but underappreciated supporter of wetland ecosystem

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ABSTRACT

Arbuscular mycorrhizal fungi (AMF) are vital symbiotic organisms that form mutualistic associations with the roots of most terrestrial plants, including many species found in wetland ecosystems. Although their roles in upland habitats are well-documented, the significance of AMF in wetlands remains underexplored and often undervalued. This study highlights the ecological importance of AMF in supporting wetland plant health, ecosystem functionality, and resilience. Dominant AMF genera such as *Rhizophagus*, *Funneliformis*, *Gigaspora, Glomus* exhibits the ability to survive and function in saturated, low-oxygen environments, contributing to nutrient acquisition, while also improving water use efficiency and tolerance to abiotic stresses such as salinity, heavy metals, and flooding. AMF also play a critical role in soil stabilization, organic matter decomposition, and the modulation of microbial communities, influencing broader biogeochemical cycles. Their interactions with human- influenced factors such as land use change, pollution, and climate variability further emphasizes the need for a deeper understanding of their function in wetland ecosystems. Despite these benefits, AMF are rarely incorporated into wetland management, restoration, or conservation strategies.

This study calls for increased recognition of AMF as ecological allies in wetlands. It highlights the need for further research into their diversity, mechanisms of action under wetland-specific stresses, and potential applications in restoration ecology. It also focuses on the necessity of studies in laboratory condition for identification and characterization of wetland-specific AMF taxa. Utilizing the symbiotic potential of AMF could greatly enhance wetland sustainability, improve plant resilience, and contribute to both biodiversity and human well-being.

KEYWORDS: Arbuscular mycorrhizal fungi; biogeochemical cycle; ecosystem; wetland

Effect of Pollution on Wetlands in Darjeeling: A Local Perspective on Global Concerns

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Abstract:

Wetlands, often referred to as the "kidneys of the ecosystem," play a crucial role in maintaining ecological balance by supporting biodiversity, regulating water flow, and filtering pollutants. In hilly regions like Darjeeling, wetlands such as Senchal Lake, Jorpokhri, and seasonal marshes serve as vital habitats for migratory birds, amphibians, and aquatic flora. However, these ecosystems are increasingly under threat due to escalating anthropogenic pressures.

This study explores the growing impact of pollution on wetlands in the Darjeeling district, with a focus on key pollution sources such as urban runoff, unregulated tourism, agricultural effluents, and developmental activities. The consequences include degradation of water quality, reduction in aquatic biodiversity, disruption of bird migratory patterns, and the proliferation of invasive species. Senchal Lake, a crucial water reservoir and wetland ecosystem, is examined as a case study to highlight the tangible impacts of pollution and changing land use patterns.

The poster presentation aims to not only depict the current threats but also to propose actionable conservation strategies, including sustainable tourism, improved waste management, and community participation. Emphasis is also laid on the alignment of local conservation efforts with global Sustainable Development Goals (SDGs), particularly SDG 6 (Clean Water and Sanitation) and SDG 13 (Climate Action). This localized assessment underlines the urgent need for awareness, policy intervention, and academic engagement in protecting Darjeeling's wetlands.

Keywords: Wetland conservation, Darjeeling, Pollution impact, Senchal Lake, Biodiversity loss

East Kolkata Wetlands: Coserving Nature within a Cityscape.

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ABSTRACT

The East Kolkata Wetlands (EKW), a Ramsar site of international importance, is a unique urban ecosystem that blends ecological resilience with socio-economic sustainability. Spanning over 12,500 hectares, the wetlands serve as a natural sewage treatment system for Kolkata by utilizing domestic wastewater in fish farming and agriculture. This traditional practice of waste-fed aquaculture not only supports sustainable livelihoods for nearly 150,000 people but also offers critical ecological services like water purification, carbon sequestration, and flood control. EKWis home to a wide array of flora and fauna, including over 100 plant species, 52 endemic fish species, and diverse microbial populations. The wetlands also support rich avifauna, including migratory birds like the Asian Openbill Stork, Purple Swamphen, and Kingfishers, and reptiles such as Bengal Monitor and Indian Cobra. These biodiversity elements underscore the area's value as a natural habitat and breeding ground. Despite its ecological wealth, EKW faces numerous threats including illegal encroachment, unregulated construction, industrial pollution, and the spread of invasive species. Effective conservation strategies are essential to protect this fragile ecosystem. These include strict enforcement of land use regulations, segregation of industrial waste from domestic sewage, and community-based management practices like sustainable fish farming and organic agriculture. Restoration efforts such as removal of invasive species, planting of native vegetation, and creation of buffer zones can mitigate further degradation. Public awareness campaigns, scientific monitoring, and eco-tourism initiatives can further enhance conservation outcomes. Strong legal frameworks, adequate funding, and inter-agency coordination are vital to secure the long-term sustainability of EKW. The East Kolkata Wetlands exemplify a living model of how urban development and ecological preservation can coexist when guided by sustainable principles and inclusive governance.

East Kolkata Wetlands (Conservation and Management) Act, 2006: A Review

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ABSTRACT

The East Kolkata Wetlands (Conservation and Management) Act, 2006, is a landmark legislation enacted by the Government of West Bengal to ensure the protection, sustainable management, and ecological preservation of the East Kolkata Wetlands (EKW), a unique and ecologically significant area spanning over 12,500 hectares. Recognized under the Ramsar Convention as a wetland of international importance, the EKW performs critical ecological functions, including wastewater recycling, biodiversity support, flood control, and acting as a carbon sink. The Act was introduced to counteract increasing threats from urban expansion, land encroachment, and pollution. Key provisions of the Act include the prohibition of land-use changes within the wetland area, restrictions on industrial and construction activities, and the establishment of the East Kolkata Wetlands Management Authority (EKWMA). The EKWMA is tasked with formulating and enforcing conservation strategies, regulating human activities and promoting sustainable livelihoods among local communities who depend on the wetland's natural resources. The Act also emphasizes the integration of scientific research, public awareness, and stakeholder participation in conservation efforts.

Through a balance of ecological protection and community involvement, the Act aims to safeguard the EKW's unique socio-ecological system. However, challenges remain in terms of effecting implementation, enforcement, and balancing development needs with environmental conservation. Overall, the Act is a vital legal instrument for maintaining the ecological integrity of one of the world's most remarkable wetland ecosystems.

Key words: Wetlands, Ramsar site, Ramsar Convention, Conservation Acts, Biodiversity

Ecological Dynamics and Conservation Challenges of Umiam Lake (Barapani), Meghalaya: A Case Study of Northeast India's First Reservoir Storage Hydroelectric Project

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Abstract

Umiam Lake, locally known as Barapani, is a prominent man-made reservoir situated in the Ri-Bhoi district of Meghalaya, Northeast India. Established in the 1960s as part of the Umiam-Umtru Hydroelectric Project—the first of its kind in the region—the lake spans a significant area and supports a hydroelectric capacity of 60 MW. Beyond its engineering significance, Umiam Lake functions as an ecologically dynamic freshwater system, supporting rich aquatic and terrestrial biodiversity, including endemic macrophytes, over 100 bird species, amphibians, and diverse fish populations. The lake also holds deep cultural resonance, rooted in Khasi folklore, and serves as a hub for tourism and recreation, offering activities such as boating, kayaking, and birdwatching. The geographical and climatic setting of Barapani, characterized by high rainfall, lateritic soils, and a humid subtropical climate, shapes the lake's hydrological profile, with pH levels ranging from slightly acidic to neutral. However, the region now faces escalating environmental pressures due to deforestation, soil erosion, unregulated tourism, pollution, and the broader impacts of climate change. These threats contribute to habitat degradation, declining water quality, and biodiversity loss. Efforts to mitigate these impacts include afforestation, waste management, promotion of eco-tourism practices, and implementation of the Integrated Watershed Management Programme (IWMP). This study underscores the need for sustained, community-inclusive conservation strategies to preserve Umiam Lake's ecological integrity while balancing socio-economic development. As a multifaceted landscape, Umiam serves as a critical case study in integrated wetland management in the face of growing anthropogenic and climatic stressors.

Microbiome shifts in wetlands: Impacts on biodiversity and the role of bioaugmentation in restoration

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Abstract

Wetlands are essential ecosystems that support a wide range of plants and animals. However, they are experiencing major changes in their microbiomes due to human activities and climate stressors. These shifts are leading to significant loss of biodiversity. This paper explores the reasons behind these microbial changes and their ecological impacts. Nutrient pollution from agricultural and industrial runoff causes eutrophication. This process favours dominant microbes like cyanobacteria, which lower microbial diversity and deplete oxygen, harming aquatic species. Climate change affects hydrology and temperature, allowing heat-tolerant or methane-producing microbes to thrive. This disrupts nutrient cycling and lowers habitat quality for plants and animals. Habitat destruction and invasive species further standardize microbiomes, reducing the resilience of ecosystems. These microbial changes hinder nutrient recycling, destabilize food webs, and threaten key species, such as amphibians that rely on specific microbes. This leads to declines in plant, invertebrate, and bird populations. Evidence from wetlands like the Everglades and European peatlands shows that reduced microbial diversity is linked to wetland biodiversity loss. To address these issues, this study suggests introducing beneficial microbes from outside sources to restore microbial balance, improve nutrient cycling, and help native species. Other solutions include controlling pollution, restoring wetlands, and monitoring microbes using modern sequencing technologies. By combining bioaugmentation with these strategies, conservation efforts can improve microbiome health, reduce biodiversity loss, and increase wetland resilience. This research highlights the important connection between microbial dynamics and ecosystem biodiversity, emphasizing the need for innovative microbial restoration to protect wetland ecosystems and their diverse inhabitants.

Keyword: Wetlands, Eutrophication, Microbes, Ecosystem biodiversity.

Embarkment-driven wetland habitat loss: Impacts on biodiversity and restoration strategies

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Abstract

Wetland habitat loss from embankment construction along their edges is a major cause of biodiversity decline. It disrupts ecosystem functions and species interactions. This paper looks at the ecological effects of embankments built for flood control, agriculture, or urban development. These structures change wetland water flow, reduce habitat area, and break up ecosystems. Embankments limit natural water movement, leading to drying out or permanent flooding. This harms soil quality and plant life that wetland species depend on. These changes make habitats less suitable for amphibians, birds, fish, aquatic mammals and invertebrates. Fragmentation also isolates populations, which restricts migration, gene flow, and access to resources. The resulting habitat loss destabilizes food webs and lowers species diversity. This has broader effects on ecosystem services like water purification and carbon storage. Evidence from areas like the Mississippi Delta and Asian coastal wetlands shows significant declines in biodiversity linked to habitat damage caused by embankments. Proposed solutions include restoring natural water flow through controlled embankment openings, creating buffer zones, and planting native vegetation to improve habitat connectivity. By tackling the effects of embankments and focusing on integrated restoration, conservation efforts can help reduce wetland habitat loss, protect biodiversity, and maintain the ecological health and resilience of these important ecosystems.

Keyword: Wetland loss, Embarkment, Biodiversity, Hydrology, Fragmentation.