Swamped with Potential: Wetlands for Mitigation and Adaptation

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World Wetlands Day is celebrated on 2 February every year and underscores the need to save and restore wetlands and raise awareness about their crucial role. Wetlands are some of the planet's most powerful yet underappreciated ecosystems. These ecosystems where water saturates the land, including mangroves, peat lands, marshes, swamps, and coral reefs, provide a wealth of benefits. They act as habitats for diverse plants and animals, protect shores from waves, reduce the impacts of floods, and even support local livelihoods.

Such ecosystem services of wetlands, especially coastal wetlands, are valued at USD 194,000 per hectare annually, emphasising their immense ecological and economic importance. Another remarkable role of wetlands is their ability to absorb and store millions of tons of carbon, making them vital allies in the fight against climate change. Globally, wetlands store about 20% of the organic carbon of the planet, despite covering only 1% of the Earth's surface.

However, wetlands face persistent threats from both climate change and human activities. Rising sea levels jeopardise habitats and freshwater supplies. Cities such as Mumbai, Haldia, and Visakhapatnam already face significant impacts. Projections from CSTEP's sea level rise scenario study indicate that if global carbon emissions continue to rise, Indian coasts might experience a sea level rise of over 75 cm by the end of the century, leading to flooding, salinisation, habitat loss, and displacement. Urbanisation, industrialisation, and agricultural activities exacerbate the degradation of wetlands. Mangroves, for instance, suffer from disrupted hydrological connectivity due to coastal development and mismanaged upstream water flows. Let's take a closer look at the dual potential of wetlands and their current status in India.

Wetlands in India

India has a total of 15.3 million hectares of wetland area. Owing to the varied geographical and climatic diversity, the country is endowed with a rich variety of wetlands, including high-altitude lakes in the Himalayas, flood planes in the Ganges, marshes and swamps in the Terai region at the border of India and Nepal, saline flats of Indian deserts, and extensive coastal wetlands such as mangroves and coral reefs along the long coastline of India. Wetlands can range from small village ponds of less than an acre to huge lagoons such as Chilika in Odisha spanning thousands of kilometres.

India has made strides in wetland mapping and conservation through national and international efforts, these efforts must be scaled up and enhanced to fully unlock their potential. The Ramsar Convention, adopted on 2 February 1971, promotes wetland conservation and sustainable use. As of 2025, India has the largest network of Ramsar sites (85 in total) in South Asia, covering a total area of 13,26,677 hectares, making it one of the leading nations in wetland conservation. Policies at both the national and state levels have been introduced to strengthen wetland conservation efforts and ensure the protection of these vital ecosystems.

The National Wetland Inventory of India provides periodic assessments of the country's wetlands using remote sensing and GIS mapping, offering valuable insights for conservation and policy planning. This initiative has significantly improved wetland documentation and awareness. However, despite these efforts, wetlands remain underrepresented in national climate policies, and their vast carbon sequestration potential is yet to be fully integrated into India's greenhouse gas inventory. Only mangroves (included in the Forest Survey of India's

reports) and coral reefs (surveyed every decade) receive consistent attention. Although some regional studies continue to highlight the immense value of wetlands, a more integrated approach is needed for maximising the conservation and management potential.

Adaptive capacity against climate disasters

Among the many functions of these wetlands, their capacity to help communities adapt to climate-related shocks stands out, particularly in coastal regions where the stakes are high. Coastal wetlands such as mangroves and salt marshes act as natural buffers against rising seas and extreme weather. These ecosystems adapt to sea level rise, aridity, and salinity through vertical accretion and inland migration. By trapping and slowly releasing floodwaters, snowmelt, and rainwater, they reduce the severity of flooding and erosion. For example, mangroves significantly reduced the impact of the 2004 tsunami by absorbing the wave energy and minimising coastal damage.

In addition to reducing the impacts of climate disasters, wetlands accelerate recovery following such an event. For instance, after the 1999 cyclone in Odisha, rice paddies protected by mangroves recovered their food production more quickly than croplands without such buffers.

Mitigation potential

While the adaptive capacity of wetlands helps communities cope with and recover from climate disasters, their mitigation potential lies in their ability to absorb and store carbon.

Coastal ecosystems absorb and store carbon at significantly higher rates than terrestrial forests. Mangroves can store up to 10 times more carbon than mature tropical forests, emphasising their role in climate change mitigation. However, mangroves in India, covering approximately 0.5 million hectares, store an estimated 125 tons of carbon per hectare, which is significantly lower than the global average of approximately 800 tons per hectare, according to the Forest Survey of India. Although differences in species composition may explain part of this discrepancy, the significantly lower rates underscore the urgent need for enhanced management and restoration efforts to boost carbon storage potential.

Further, India’s wetlands are under-represented in national inventories, with limited carbon sequestration estimates available. Regional studies show significant variation in carbon storage potential, ranging from 13.8 to 548 tons per hectare, highlighting the need for systematic assessments and periodic data collection.

Conclusion

Wetlands play a dual role in climate change mitigation and adaptation, offering significant potential for carbon sequestration while providing vital ecosystem services that help communities adapt to climate impacts like rising seas. However, their vast potential remains untapped owing to gaps in inventory and management. To protect these ecosystems and enhance resilience, science-backed policies that integrate traditional knowledge with modern technology are essential. Wetlands are not just environmental assets—they are critical to India's future resilience, and by acting now, we can safeguard these vital ecosystems for a sustainable, climate-resilient future.

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