



MUMBAI'S MANGROVES AT A CROSSROADS

Development, Climate Risk, and the Ecological Cost of Coastal Roads

Mumbai's identity is inseparable from its coastline. The city's growth, economy, and culture have unfolded along the edge of the Arabian Sea, even as this geography exposes it to rising climate risks. Sea-level rise, extreme monsoon rainfall, tidal flooding, and storm surges are no longer future threats but present challenges (IPCC, 2023). In this context, decisions about coastal infrastructure carry consequences that extend far beyond mobility and economic efficiency. The recent decision of the Bombay High Court permitting the removal of over 45,000 mangrove trees for the Versova - Bhayander Coastal Road has placed Mumbai at the center of a critical national debate. While the project is framed as a necessary development intervention, scientists, environmental planners, and civil society groups warn that the ecological costs may significantly undermine the city's long-term climate resilience.

The Coastal Road Proposal

The Versova-Bhayander Coastal Road is a proposed 26-kilometre corridor along Mumbai's western coastline, intended to improve north-south connectivity across the Mumbai Metropolitan Region. The Brihanmumbai Municipal Corporation (BMC) argues that the project will reduce travel time, ease traffic congestion, and enhance economic connectivity. After reviewing statutory environmental clearances and mitigation measures, the Bombay High Court approved the diversion of mangrove forest land along the project alignment. This approval allows for the felling of approximately 45,000 mangrove trees, subject to conditions such as compensatory afforestation, long-term ecological monitoring, and periodic compliance reporting. Although legally sanctioned, the decision raises fundamental scientific and policy questions about how coastal cities should balance infrastructure development with climate adaptation.



Why Mangroves Matter

Mangroves are among the most ecologically valuable coastal ecosystems on Earth. A substantial body of scientific research shows that mangroves act as natural buffers against storm surges and cyclones, reduce coastal erosion by stabilizing sediments, and significantly lower flood impacts during extreme weather events (*Alongi, 2008; Das & Vincent, 2009*).

Mangroves also serve as critical nursery habitats for fish and invertebrates, supporting coastal fisheries and livelihoods, while storing large quantities of carbon in their biomass and soils. This 'blue carbon' function makes mangroves highly effective nature-based solutions for climate mitigation (*Donato et al., 2011*).

In Mumbai, mangroves function as natural infrastructure. They regulate tidal flows, absorb excess rainwater, and support drainage in low-lying areas. Past flood events, particularly the catastrophic floods of 2005, have demonstrated how the loss of wetlands and mangroves can intensify urban flooding and disruption (*MCGM disaster assessments*).

Compensatory Afforestation: An Incomplete Solution

A central justification for permitting mangrove diversion lies in compensatory afforestation commitments. Authorities have pledged to plant several times the number of mangroves removed, often in districts outside Mumbai.

Ecological science, however, cautions against treating compensatory plantations as equivalent substitutes for natural mangrove systems. Mangroves are highly site-specific ecosystems that depend on precise tidal inundation, salinity gradients, sediment supply, and hydrological connectivity (*Friess et al., 2019*). Plantations established outside natural creek systems frequently show low survival rates and limited ecological functionality. Even where plantations succeed, it can take decades for young mangroves to provide levels of coastal protection comparable to mature forests. Studies on restoration outcomes consistently show that recreated mangrove habitats rarely match the ecological performance of natural systems in the short to medium term (*Lewis, 2005*).

Development Versus Resilience: A False Choice

The debate surrounding Mumbai's coastal road is often framed as a trade-off between development and environmental protection. Increasingly, global research challenges this framing.

Cities across the world are recognizing that degrading natural ecosystems leads to higher long-term economic costs by increasing disaster risk and climate vulnerability. Nature-based solutions are now central to urban adaptation strategies, complementing engineered infrastructure rather than competing with it (*World Bank, 2021*).

In Mumbai's context, urban planners and climate researchers question whether car-centric coastal roads align with sustainable development goals, particularly when public transport expansion, wetland conservation, and integrated coastal zone management could deliver broader and more resilient outcomes.

Legal Safeguards and Implementation Gaps

The Bombay High Court imposed several safeguards, including a three-to-one compensatory plantation requirement, ten years of ecological monitoring, and annual reporting on survival and compliance. On paper, these measures represent an effort to balance development with environmental protection.

However, India's experience with compensatory afforestation has shown mixed results. Reviews by environmental agencies and researchers point to challenges such as inadequate site selection, weak enforcement, limited transparency, and insufficient long-term monitoring (*CAG reports; MoEFCC reviews*). Without independent scientific oversight and public accountability, safeguards risk becoming procedural rather than protective.

Broader Implications

The implications of this decision extend beyond Mumbai. Coastal cities across India and the Global South face similar pressures as urban expansion intersects with climate vulnerability. Key questions emerge: How should policymakers weigh short-term infrastructure gains against long-term climate risks? Can compensatory plantations replace site-specific ecosystems? Who bears the social and economic costs when ecological degradation amplifies flooding, heat stress, and public health risks? As climate change accelerates, these questions will increasingly shape urban governance and environmental jurisprudence.

A Moment for Reflection

The removal of 45,000 mangroves is not merely a local planning issue; it reflects how societies value ecological systems under development pressure. Scientific consensus is clear: nature is not an obstacle to progress but a foundation for resilient cities.

For Mumbai, the choices made today will shape its ability to withstand future climate extremes. Ensuring that infrastructure development is informed by ecological science, climate risk assessment, and ethical governance is essential.

At the Progyan Foundation for Research and Innovation, we believe that informed public dialogue grounded in science and policy analysis is critical for sustainable futures. Mumbai's mangroves stand as a living test of whether cities choose short-term convenience or long-term resilience.

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AT THE TURN OF THE YEAR: *Preparing the Sundarban for What Lies Ahead*

The initial months of 2026 were dedicated to structured field review, monitoring, and planning across intervention sites in the Sundarban. This early-year phase is critical for aligning livelihood activities with ecological conditions and strengthening preparedness for the upcoming production cycles.

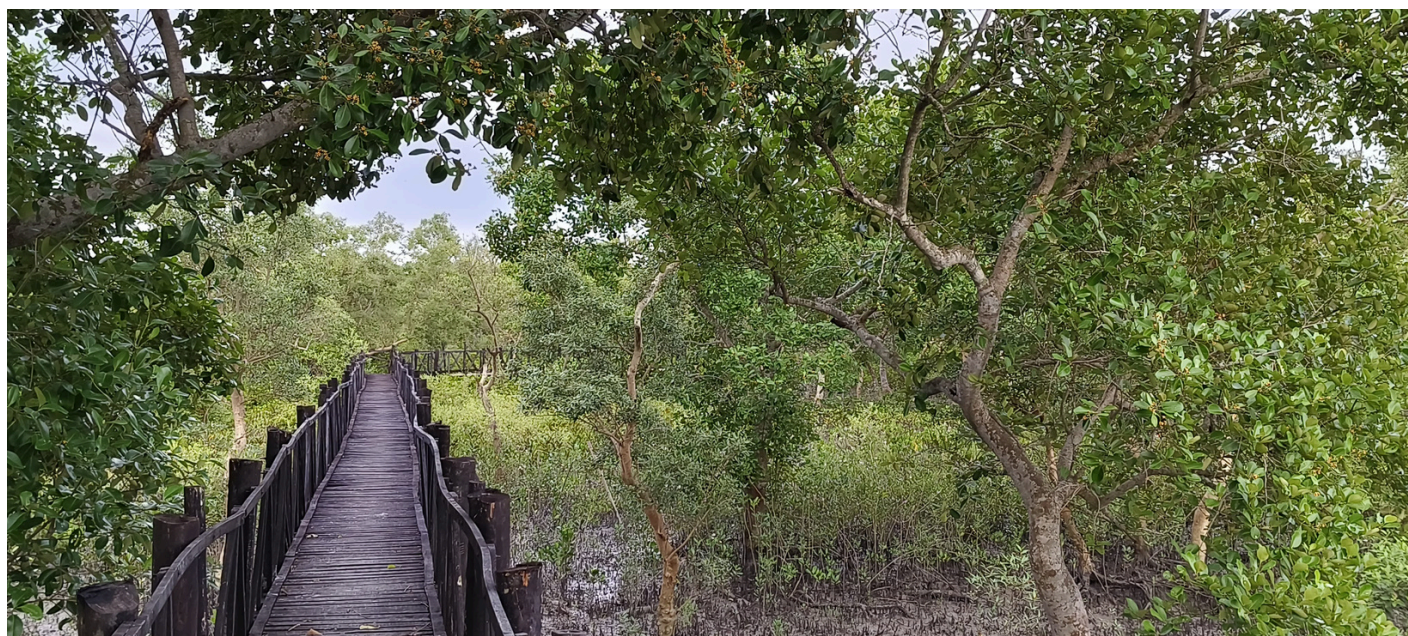
During this period, priority was given to planning freshwater aquaculture activities. Field teams focused on reviewing pond conditions, water quality parameters, and input requirements to ensure readiness for the next production cycle. Early-stage planning is particularly important in the Sundarbans, where climatic variability and salinity fluctuations significantly influence aquaculture outcomes. Standard practices such as pond drying, soil treatment, and phased water filling were assessed, and feeding schedules were structured across an eight-month cycle in line with fish growth stages. Brackish water aquaculture systems were assessed for seasonal suitability to determine the appropriate time for initiation.

Medicinal gardens were closely monitored at the beginning of the year, generating important performance data. High survival rates were observed for Tulsi (over 95%), Joba (around 98%), and Aloe vera (above 99%). Aparajita showed stable establishment with survival close to 85%, while Kalmegh cultivation was nearing the end of its production cycle. These observations are guiding species selection and plantation planning for the next phase.

Float farming initiatives continued to show encouraging results. Tomato cultivation was approaching completion, while onion and chilli crops demonstrated healthy growth and are expected to reach harvest stages in the coming months. Regular monitoring highlighted the importance of continuous water management, especially in areas with dry soil conditions.

Following the seasonal rice harvest, the traditional parboiling process was initiated, reflecting the continued practice of indigenous knowledge systems that support food security and post-harvest management in the region.

Soil and water quality assessments conducted during this period indicated pH values largely within the range of 5.7 to 6.7, suitable for agricultural and aquaculture activities. Overall, the early part of 2026 served as a foundation for evidence-based planning, adaptive field management, and community-centered approaches in the Sundarban.



WORKSHOP:

Advances in Agroforestry and Carbon Finance in Begusarai

On **January 05, 2026**, the *Progyan Foundation for Research and Innovation (PFRI)* hosted a sensitization workshop at Begusarai, Bihar.

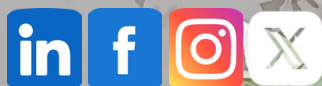
The final workshop targeted awareness-building for farmers on agroforestry practices and carbon finance opportunities. Approximately 35 participants from 18 blocks across Begusarai attended, reflecting strong local interest in sustainable land-use strategies.

Facilitators thoroughly addressed farmers' queries on agroforestry implementation, carbon credit mechanisms, and associated benefits. Key outcomes included consensus on next steps, such as pilot project enrollment and follow-up training sessions to support scalable adoption.

This initiative aligns with broader efforts in community-based conservation and climate adaptation in eastern India.



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