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Biodiversity conservation and protection of ecologically sensitive regions in India: Policy, governance and contemporary challenges

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Abstract
India, a megadiverse nation hosting four global biodiversity hotspots, stands at a critical juncture between rapid economic development and the imperative to conserve its fragile ecological heritage. This comprehensive research report evaluates the current state of biodiversity conservation and the protection of Ecologically Sensitive Regions (ESRs) in India, with a specific focus on the legislative frameworks, judicial interventions, and socio-political conflicts defining the sector in the years 2024-2025. The analysis covers the evolution of Ecologically Sensitive Zones (ESZs) under the Environment (Protection) Act, 1986, contrasting the methodologies of the Gadgil and Kasturirangan committees regarding the Western Ghats and the subsequent policy paralysis. It examines the implementation challenges of the Biological Diversity Act, 2002, particularly in light of the 2023 Amendments and the 2024 Rules, which have sparked debate over access and benefit-sharing (ABS) and traditional knowledge protection. Detailed case studies—including the land subsidence crisis in Joshimath, the conflict over buffer zones in Kerala, the ecological risks of the Great Nicobar Development Project, and hydropower expansion in the Eastern Himalayas—illustrate the tension between infrastructure growth and environmental stability. The report synthesizes data from government notifications, Supreme Court and National Green Tribunal (NGT) judgments, and scientific assessments to provide a nuanced understanding of India's environmental governance trajectory.

Keywords: Ecologically sensitive zones (ESZ), western ghats, biological diversity act 2002, national green tribunal, biodiversity hotspots, joshimath subsidence, great nicobar project, access and benefit sharing (ABS), environmental jurisprudence

Introduction

The Ecological Mandate and Global Context

India's geographical expanse, ranging from the icy heights of the Himalayas to the tropical rainforests of the Western Ghats and the island ecosystems of the Andaman and Nicobar, constitutes a biological treasure trove of global significance. Despite occupying only 2.4% of the world's land area, India accounts for 7-8% of all recorded species, including over 45,000 species of plants and 91,000 species of animals [1]. This biological richness is not merely a statistical anomaly but the life-support system for over a billion people, providing critical ecosystem services such as hydrological regulation, soil fertility, and carbon sequestration.

The protection of this heritage is enshrined in the nation's constitutional framework. Article 48A directs the State to protect and improve the environment and safeguard forests and wildlife, while Article 51A(g) imposes a fundamental duty on every citizen to protect and improve the natural environment [3]. However, the translation of these high constitutional ideals into ground-level conservation has been fraught with structural complexities and conflicting priorities. The concept of "Ecologically Sensitive Areas" (ESAs) or "Ecologically Sensitive Zones" (ESZs) has emerged as the primary policy tool to manage the interface between human activity and wilderness [4]. These zones are intended to act as shock absorbers for protected areas, transitioning from areas of high protection to areas of lower protection, yet their delineation has become a source of profound legal and social conflict.

The Crisis of Balance: Development vs. Conservation

The period from 2023 to 2025 has been particularly tumultuous for Indian environmental governance, marked by a series of ecological disasters and contentious policy shifts. The catastrophic land subsidence in Joshimath [5], which displaced thousands and cracked the foundations of a historic town, served as a grim reminder of the geological limits of the Himalayas. Simultaneously, the approval of mega-infrastructure projects, such as the Great Nicobar Island Holistic Development Plan, has raised questions about the sanctity of "pristine" ecosystems [6].

Furthermore, the legislative overhaul of the Biological Diversity Act in 2023, followed by the notification of new rules in 2024, signals a definitive shift in the country's approach to bio-resources [7]. The narrative has increasingly moved towards "sustainable utilization" and "ease of doing business," a trajectory that critics argue often prioritizes utilization over sustainability. This shift is occurring against the backdrop of India's commitment to international frameworks, including the Convention on Biological Diversity (CBD) and the Kunming-Montreal Global Biodiversity Framework, creating a complex dualism in policy—international commitments to conservation versus domestic imperatives for rapid industrialization.

This report seeks to dissect these complex dynamics through a multi-dimensional lens. It begins by establishing the legal foundations of conservation in India, moves to the specific mechanisms of ESZs and the criteria for their identification, analyzes the status of the four biodiversity hotspots, and finally delves into specific case studies that serve as barometers for the health of India's environmental jurisprudence. By synthesizing legal texts, scientific reports, and administrative data, this document aims to provide a definitive account of the state of India's ecologically sensitive regions.

Theoretical and Scientific Foundations of Ecological Sensitivity

The concept of "ecological sensitivity" in Indian policy is not arbitrary; it is rooted in specific scientific criteria developed to identify areas that are vital for the long-term maintenance of biodiversity and ecosystem services.

1. The Pronab Sen Committee (2000): Defining the Parameters

The foundational document for identifying Ecologically Sensitive Areas (ESAs) in India is the report of the Committee chaired by Dr. Pronab Sen in 2000. Constituted by the Ministry of Environment and Forests (MoEF) to bring scientific rigor to the designation process, the committee moved beyond the "Protected Area" centric approach—which focuses on charismatic megafauna within fenced boundaries—to a broader landscape and ecosystem approach [8].

The Committee defined ecological sensitivity as the imminent possibility of either permanent and irreparable loss of extant life forms from the world or significant damage to the natural processes of evolution and speciation [9]. To operationalize this definition, the committee identified a set of primary and auxiliary criteria.

Primary Criteria:

The committee established that the presence of even one of the following primary attributes is sufficient to designate an area as ecologically sensitive. These criteria reflect a nuanced understanding of biological value and geological fragility:

1. **Endemism:** Areas containing species found nowhere else on earth, making them irreplaceable.
2. **Rarity:** Habitats of species with low population numbers or restricted ranges.
3. **Endangered Species:** Critical habitats for species facing a high risk of extinction.
4. **Centres of Evolution:** Areas significant for the origin of domesticated species (agrobiodiversity).
5. **Wildlife Corridors:** Linear habitats that allow connectivity between fragmented populations, essential for genetic diversity [9].
6. **Specialized Ecosystems:** Unique habitats like mangroves, coral reefs, or shola forests.
7. **Special Breeding Sites:** Critical areas for reproduction, such as sea turtle nesting beaches.
8. **Areas with Intrinsically Low Resilience:** Ecosystems that cannot recover easily from disturbance, such as alpine meadows or deserts.
9. **Sacred Groves:** Community-protected forest fragments rich in biodiversity.
10. **Frontier Forests:** Large, intact natural forest ecosystems.
11. **Uninhabited Islands:** Pristine island ecosystems (e.g., parts of Andaman & Nicobar).
12. **Steep Slopes:** Areas prone to erosion and landslides (Geomorphological based).
13. **Origins of Rivers:** Vital catchments that sustain hydrological flows [10].

Despite the comprehensive nature of these criteria, the Pronab Sen Committee report was largely shelved in terms of national implementation. While it provided the intellectual framework, the actual notification of ESZs became a litigious process driven more by judicial compulsion than administrative will, often ignoring these scientific parameters in favor of arbitrary distances (e.g., the 10km rule).

2. The Function of Eco-Sensitive Zones

In the regulatory context, Eco-Sensitive Zones (ESZs) are notified under the Environment (Protection) Act, 1986. They are designed to act as "shock absorbers" or transition zones around Protected Areas (National Parks and Wildlife Sanctuaries). The goal is not to hermetically seal these areas but to regulate activities that could have deleterious effects on the core protected area. The guidelines emphasize that the width of the ESZ and the nature of regulations should be site-specific, but in the absence of state proposals, the judiciary has often had to intervene to enforce minimum standards [4].

3. The Legal and Institutional Framework for Conservation

The protection of ecologically sensitive regions in India is governed by a triad of legislations: the Wildlife (Protection) Act, 1972 (WPA), the Forest (Conservation) Act, 1980 (FCA), and the Environment (Protection) Act, 1986 (EPA). These are complemented by the Biological Diversity Act, 2002 (BDA), which focuses on the sovereign rights over biological resources and the equitable sharing of benefits.

3.1 The Environment (Protection) Act, 1986: The Umbrella Legislation

The EPA, 1986 serves as the statutory bedrock for declaring Ecologically Sensitive Zones. Unlike the WPA or FCA, which have specific focuses, the EPA provides the Central Government with broad powers to take "all such measures that it deems necessary" to protect and improve the quality of the environment.

- **Section 3** [2] **(v):** This specific section empowers the Central Government to restrict areas in which any industries, operations, or processes shall not be carried out or shall be carried out subject to certain safeguards [11]. This is the enabling provision for all ESZ notifications.

- **Section 5 (Power to give directions):** This provision grants the Central Government extraordinary power to issue directions for the closure, prohibition, or regulation of any industry, operation, or process. This power extends to stopping the supply of electricity or water. While often delegated to state authorities, the central invocation of Section 5 remains the ultimate instrument for enforcing ESZ regulations against recalcitrant states or industries [12].

The genesis of ESZ as a policy tool lies in the "Wildlife Conservation Strategy-2002" adopted by the Indian Board for Wildlife (now National Board for Wildlife - NBWL). It envisaged that lands falling within 10 km of the boundaries of National Parks and Sanctuaries should be notified as eco-fragile zones under the EPA [8]. However, the EPA itself does not use the term "Eco-Sensitive Zone," illustrating how administrative policy has evolved to fill gaps in statutory definitions.

3.2 The Biological Diversity Act, 2002 and the 2023 Amendment

The Biological Diversity Act (BDA) was enacted to implement the Convention on Biological Diversity (CBD) and its objectives: conservation, sustainable use, and fair and equitable sharing of benefits arising from genetic resources. It established a decentralized three-tier structure:

1. **National Biodiversity Authority (NBA):** The apex body regulating access to biological resources for foreign entities and advising the central government.

   State Biodiversity Boards (SBBs): State-level bodies that advise state governments and regulate access for Indian citizens for commercial utilization.

2. **Biodiversity Management Committees (BMCs):** Local-level bodies (at Panchayat/Municipality level) responsible for promoting conservation, sustainable use, and documenting local biodiversity in People's Biodiversity Registers (PBRs) [13].

The Divya Pharmacy Judgment (2018): A Judicial Landmark

A watershed moment in Indian biodiversity jurisprudence was the Divya Pharmacy vs. Union of India judgment by the Uttarakhand High Court. The case involved Divya Pharmacy (a unit of Patanjali Ayurved), which challenged the authority of the Uttarakhand State Biodiversity Board to demand a "Fair and Equitable Benefit Sharing" (FEBS) fee. The company argued that as an Indian entity, it was not liable to pay this fee under the strict reading of the Act.

The High Court, in a progressive ruling, interpreted the law purposively. It held that the BDA is a beneficial legislation intended to support local communities and that the distinction between foreign and Indian entities should not be used to deny benefits to the custodians of traditional knowledge. The court ruled that Indian entities are indeed liable to pay FEBS fees to the SBB when commercially utilizing biological resources [15]. This judgment was seen as a victory for the "bio-cultural jurisprudence" of India, reinforcing the rights of indigenous communities.

The Biological Diversity (Amendment) Act, 2023: The Policy Pivot

In August 2023, Parliament passed significant amendments to the BDA, which have drawn sharp criticism from conservationists and legal experts for potentially undoing the gains of the Divya Pharmacy judgment.

- **Decriminalization:** The Amendment decriminalizes offences under the Act. Violations that previously attracted imprisonment are now punishable only by penalties adjudicated by a Joint Secretary-level officer. While this is framed as promoting "ease of doing business," critics argue it dilutes the deterrence against bio-piracy and illegal extraction [18].

- **AYUSH Exemption:** A highly controversial provision exempts registered AYUSH (Ayurveda, Yoga, Unani, Siddha, Homeopathy) practitioners and holders of "codified traditional knowledge" from the requirement of prior intimation to SBBs for accessing biological resources [14].

- **Implication:** This effectively removes a massive sector of the bio-economy from the ABS (Access and Benefit Sharing) regime. Large corporations could potentially bypass benefit-sharing by employing AYUSH practitioners or claiming their products are based on "codified" texts, thereby depriving local BMCs of critical revenue [20].

- **Rules 2024:** The Ministry notified the Biological Diversity Rules, 2024 on October 22, 2024, to operationalize these amendments, solidifying the streamlined access regime and raising concerns about the commodification of bio-resources without adequate community compensation [7].

The Judiciary as Environmental Guardian: Supreme Court and NGT

In the face of executive lethargy and legislative dilution, the Indian judiciary has often stepped in as the primary guardian of the environment.

1. The National Green Tribunal (NGT)

Established under the National Green Tribunal Act, 2010, the NGT is a specialized body equipped with the necessary expertise to handle multi-disciplinary environmental disputes [22].

- **Jurisdiction and Power:** The Tribunal enforces legal rights relating to the environment and provides relief and compensation for damages. Its orders are binding and enforceable as a decree of a civil court. It is not bound by the Code of Civil Procedure but by principles of natural justice [23].

- **Role in Biodiversity:** The NGT has been pivotal in enforcing the BDA. In Chandra Bhal Singh vs. Union of India, the NGT directed the expedited formation of BMCs and the preparation of PBRs across all states, addressing a decade of non-compliance. It noted that "states cannot be allowed to plead incompetence or inability," forcing a massive administrative mobilization to document biodiversity [24].

- **Recent Interventions (2024):** The NGT has actively monitored the Joshimath crisis, reprimanding the Uttarakhand government for negligence in submitting action plans and demanding accountability for the structural safety of hill towns [26].

2. The Supreme Court's "Continuing Mandamus"

The Supreme Court has maintained a "continuing mandamus" on environmental issues, most notably through the T.N. Godavarman and Goa Foundation cases.

- **The 10 Km Default Rule:** In Goa Foundation vs. Union of India (2006), the SC directed that a 10 km zone around all National Parks and Sanctuaries be treated as an ESZ by default until site-specific notifications were issued. This forced states to act, although the subsequent process has been slow [8].

- **The 2022 Order:** On June 3, 2022, the SC mandated a minimum 1 km ESZ for all protected areas, a decision that triggered widespread protests in Kerala and led to a subsequent modification in 2023 to accommodate ongoing state proposals [29].

The Western Ghats Conundrum: A Policy Stalemate

The Western Ghats, a UNESCO World Heritage Site and one of the world's eight "hottest hotspots" of biological diversity, represents the most significant and intractable ESZ conflict in India. The region covers approximately 160,000 sq. km across six states: Gujarat, Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu [32]. It is the water tower of peninsular India, originating major rivers like the Godavari, Krishna, and Kaveri.

1. Gadgil vs. Kasturirangan: A Clash of Visions

The conflict centers on two high-level committee reports that offered diverging visions for the region's future.

The Gadgil Committee (WGEEP) - 2011:

Headed by ecologist Madhav Gadgil, the Western Ghats Ecology Expert Panel (WGEEP) adopted a strong conservationist stance.

- **Methodology:** It utilized a grid-based approach overlaying biodiversity data and emphasized decentralized governance through Gram Sabhas.
- **Recommendation:** It designated the entire Western Ghats as an Ecologically Sensitive Area (ESA), graded into three levels (ESZ-1, ESZ-2, ESZ-3). ESZ-1, covering high-priority areas, would see a complete ban on mining, large dams, and polluting industries.
- **Governance:** It proposed a statutory "Western Ghats Ecology Authority" (WGEA) to oversee the region, stripping some powers from state bureaucracies [33].

The Kasturirangan Committee (HLWG) - 2013

Faced with fierce opposition from states and mining lobbies, the MoEF constituted a High-Level Working Group (HLWG) under Dr. K. Kasturirangan.

- **Methodology:** The HLWG used remote sensing to distinguish between "Natural Landscapes" (forests) and "Cultural Landscapes" (agriculture/settlements).
- **Recommendation:** It recommended protecting only the "Natural Landscape," which constituted about 37% (approx. 60,000 sq. km) of the Western Ghats. The remaining 63% was opened for development.
- **Restrictions:** While it retained the ban on mining and thermal power in the 37% ESA, it allowed hydropower projects subject to strict clearance and did not recommend a new statutory authority [33].

2. The Endless Draft Notifications (2014–2025)

Despite the Kasturirangan report being "accepted in principle" by the Central Government, its implementation has been paralyzed by state opposition for over a decade. The MoEFCC has issued multiple draft notifications, but none have been finalized.

- **Current Status (2024-2025):** The MoEFCC re-published the draft notification on July 31, 2024, identifying an area of 56,825 sq. km as ESA [37]. This draft reiterated the ban on mining, thermal plants, and large townships (>50 hectares) in the ESA.

State Rejections

- **Karnataka:** On September 26, 2024, the Karnataka Cabinet formally rejected the Kasturirangan report and the 6th draft notification. The state argues that the notification adversely affects the livelihoods of people in the Malnad region and hinders necessary infrastructure [37].
- **Goa:** In January 2025, the Goa government proposed the exclusion of 24 villages from the ESA list, reducing the number of notified villages from 108 to 84, citing "active environmental clearances" and habitation [38].
- **Kerala:** The state continues to demand the exclusion of human habitations and agricultural lands from the ESA boundaries. It relies on ground-truthing surveys to prove that areas marked as "forest" by satellite are actually plantations [38].

As of early 2025, a final consensus remains elusive. The public consultation period for the July 2024 draft ended in September 2024, but the political deadlock implies that the Western Ghats remain vulnerable to unregulated exploitation in the interregnum [40].

The Buffer Zone Crisis in Kerala

While the Western Ghats ESA issue covers a vast landscape, a more localized but equally intense conflict has erupted in Kerala regarding buffer zones around specific Protected Areas (PAs).

1. The Supreme Court's 1 Km Mandate (2022)

In June 2022, the Supreme Court directed that every national park and wildlife sanctuary must have an ESZ of at least 1 km from its demarcated boundary [41]. For Kerala, this order was politically explosive. The state has a unique demographic profile where high-density settlements (average 860 persons/sq. km) often directly border forest boundaries. Farmers in the "high ranges" feared displacement and restrictions on agriculture, housing, and livestock rearing [30].

2. The "Zero ESZ" Proposals and Legal Maneuvering

The Kerala government, under immense pressure from settler farmer lobbies and the Catholic church (which holds influence in the high ranges), adopted a stance of "Zero ESZ" in inhabited areas.

- **State Rationale:** Kerala argued that the 10 km or even 1 km buffer is impractical. In 2020-2021, the state submitted proposals for various PAs, marking the ESZ as zero in urban/populated fringes to protect "human habitation" [42].
- **Legal Relief (2023-2024):** In a significant modification (April 2023), the Supreme Court clarified that the 1 km direction would not apply where draft or final notifications had already been issued by the MoEFCC, or where the state had pending proposals. This provided temporary relief, allowing the state to pursue its "Zero ESZ" proposals [31].
- **Current Status (2025):** The MoEFCC and the Expert Committee on ESZ continue to review these proposals. For instance, the 52nd Expert Committee meeting considered "Zero to X km" variations. In February 2025, the State Environmental Impact Assessment Authority (SEIAA) of Kerala continued to process clearances for construction projects (like the Housing Board project in Kochi) that fall within these contentious zones, subject to strict conditions [44]. The state is also utilizing the Coastal Regulation Zone (CRZ) notification of 2019 to manage areas where PAs abut the coast (like Mangalavanam) [46].

Himalayan Fragility and Urban Disasters: The Case of Joshimath

The Himalayas, the youngest and most geologically active mountain range in the world, are facing an existential crisis driven by unscientific infrastructure development.

1. The Joshimath Subsidence Crisis

In January 2023, large cracks appeared in over 800 houses in Joshimath, a strategic and religious town in the Chamoli district of Uttarakhand. The land subsidence accelerated rapidly, with the ground sinking by several centimeters in a matter of days, leading to the evacuation of thousands [5].=

2. **Causes: A Convergence of Geological and Anthropogenic Factors**

- **Geological Fragility:** Joshimath is situated on the debris of an ancient landslide, located near the Main Central Thrust (MCT), a highly seismically active zone. The soil has low bearing capacity [49].

- **Anthropogenic Triggers**
- **Drainage:** The absence of a sewerage system led to wastewater percolating into the loose soil, reducing its shear strength and causing internal erosion [50].

- **Tapovan-Vishnugad Hydropower Project:** Local residents and experts have long pointed to the tunnel boring for the NTPC hydropower project. It is alleged that the tunnel boring machine punctured an aquifer in 2009, draining the water table and causing the land above to settle due to the loss of pore pressure [50].

- **Over-construction:** The construction of multi-story hotels and roads (part of the Char Dham project) exceeded the carrying capacity of the morainic soil [50].

3. **Scientific Findings (2023-2024)**

Reports from technical agencies confirmed the severity of the crisis.

- **Satellite Data:** Analysis using InSAR (Interferometric Synthetic Aperture Radar) showed deformation velocities of up to -89 mm/year in the 2022-2023 period. The subsidence was most acute in the central and north-western parts of the town [51].

- **Official Assessments:** Investigations by the National Geophysical Research Institute (NGRI) and Geological Survey of India (GSI) in 2024 linked the subsidence to "uncontrolled anthropogenic activities," urbanization, and the blocking of natural drainages (nalas) by construction [51].

4. **Governance Response and NGT Action (2024)**

- The response from the state government was initially slow and opaque. The ISRO report showing rapid subsidence was briefly released and then withdrawn, allegedly to prevent panic.

- **NGT Intervention:** The National Green Tribunal took suo motu cognizance of the disaster. In July 2024, the NGT reprimanded the Uttarakhand government for filing a "deficient" action plan. The Tribunal noted that demolition notices for unsafe buildings were issued, but their status was undisclosed, and no clear rehabilitation plan was in place. It demanded a comprehensive study on the "carrying capacity" of all hill stations in the state [26].

- **Funding:** In May 2025, the Central Government approved a ₹1,700 crore disaster relief package for rehabilitation, but for many residents, the loss of their ancestral homes is permanent [26].

Biodiversity Hotspots: Status and Trends 2024

India hosts four global biodiversity hotspots. Each faces unique pressures in the current decade.

1. **The Himalayas**

- **Range:** Covers the entire Indian Himalayan Region (IHR).

- **Biodiversity:** Includes iconic species like the Snow Leopard, Red Panda, and Himalayan Musk Deer.

- **Threats:** Climate change is the primary accelerant. Rapid glacial melt is altering hydrological flows, increasing the risk of Glacial Lake Outburst Floods (GLOFs). Unplanned urbanization (e.g., Joshimath, Shimla) and the proliferation of hydroelectric projects (HEPs) are destabilizing slopes [54].

- **2024 Developments:** The region has seen an increase in human-wildlife conflict. However, positive steps include citizen science initiatives like the "City Nature Challenge 2024," which documented biodiversity in Darjeeling and Sikkim, engaging local youth in conservation [56].

2. **Indo-Burma**

- **Range:** North-Eastern India (excluding Assam plains), Andaman Islands (partially).

- **Significance:** High endemism in freshwater turtles and primates (e.g., Hoolock Gibbon). It is one of the most threatened hotspots due to high population density and resource extraction [32].

- **New Discoveries:** In 2024, new species like *Phtheirospermum* (Orobanchaceae) were discovered in Mizoram, underscoring the region's unexplored richness [58].

3. **Western Ghats**

- **Range:** West coast of India.

- **Significance:** Older than the Himalayas; high endemism in amphibians (73% endemic) and reptiles (65% endemic). It is the center of origin for many cultivated plants like pepper and cardamom [32].

- **Status:** As detailed in Section 5, the legal protection of this hotspot is in limbo, leaving it vulnerable to fragmentation by linear infrastructure (roads, railways) and plantation agriculture.

4. **Sundaland**

- **Range:** Nicobar Islands (Great Nicobar).

- **Significance:** Home to the Nicobar Megapode, Nicobar Tree Shrew, and pristine marine biodiversity (coral reefs).

- **Crisis:** The proposed trans-shipment port and township in Great Nicobar threatens to destroy some of the last pristine rainforests in this hotspot [6].

Table 1: Comparative Analysis of Key Biodiversity Hotspots in India (Status 2025)

Biodiversity Hotspot	Key States/Regions	Flagship Endemic Species	Primary Threats (2024-25)	Conservation Status
Western Ghats	Kerala, Karnataka, Goa, Maharashtra, TN	Lion-tailed Macaque, Nilgiri Tahr, Purple Frog	Mining, Quarrying, Monoculture Plantations, Linear Infrastructure	Critical: Final ESA notification pending since 2011. High human-wildlife conflict.
Himalayas	J&K, Himachal, Uttarakhand, Sikkim, Arunachal	Snow Leopard, Red Panda, Himalayan Monal	Climate Change (Glacial melt), Hydropower Dams, Unplanned Urbanization	Vulnerable: frequent landslides (Joshimath type) and shifting treelines.
Indo-Burma	North-East India (Mizoram, Manipur, Nagaland)	Hoolock Gibbon, Eld's Deer, freshwater turtles	Shifting Cultivation (Jhum), Illegal Wildlife Trade, Oil Palm cultivation	Threatened: High forest cover loss; conflict between development and tribal rights.
Sundaland	Nicobar Islands (Great Nicobar)	Nicobar Megapode, Nicobar Tree Shrew, Giant Robber Crab	Mega-infrastructure (Trans-shipment port), Tsunami risk, Invasive species	High Risk: Great Nicobar Project involves diverting 130 sq. km of primary forest.

The North-Eastern Frontier: Hydropower vs. Ecology

The Indo-Burma hotspot in Arunachal Pradesh is the theatre of a high-stakes conflict between India's renewable energy targets (hydropower) and biodiversity conservation.

1. Etalin Hydropower Project (3097 MW)

Located in the biodiversity-rich Dibang Valley, this is one of India's largest proposed dams.

- **Biodiversity Concern:** The project area is a unique habitat where tigers are found at unusually high altitudes. It is also home to clouded leopards and over 300 bird species. The project involves the diversion of over 1,150 hectares of unclassed state forests (USF), which are essentially community forests managed by the Idu Mishmi tribe [59].

- **The WII Controversy:** The Wildlife Institute of India (WII) conducted a biodiversity assessment in 2020 which was heavily criticized by independent scientists for "underplaying" the impact. Reviewers noted that the study period (5 months) was grossly insufficient to document the biodiversity of such a complex landscape and failed to account for the cumulative impact of multiple dams in the basin [60].

- **Status 2025:** Despite sustained protests, the project's environmental clearance process advanced in mid-2025. The Expert Appraisal Committee (EAC) recommended environmental clearance, prioritizing the 3097 MW capacity over the ecological objections, reigniting the "development vs. conservation" debate [60].

2. Subansiri Lower Hydroelectric Project (2000 MW)

- **The Elephant Corridor Issue:** Located on the Assam-Arunachal border, this project sits immediately upstream of forests that form a critical elephant corridor. The WII warned in early 2024 that "hydro-peaking" (the sudden release of huge volumes of water to meet peak electricity demand) could "wash away" elephants, particularly calves, attempting to cross the river downstream.

- **Regulatory Failure:** The WII recommended that the National Hydroelectric Power Corporation (NHPC) restrain from hydro-peaking until a multi-seasonal hydrological study was conducted. However, NHPC reportedly objected to this, and the project began power generation in late 2025 without resolving the corridor issue [62]. This represents a clear instance where operational imperatives overrode scientific warnings.

3. A Ray of Hope: Arunachal's "People's Plan" (2024)

In stark contrast to these top-down conflicts, the Arunachal Pradesh government launched the "State Biodiversity Strategy and Action Plan (SBSAP): A People's Plan" in 2024.

- **Approach:** Developed with the World Wide Fund for Nature (WWF-India), the plan emphasizes community stewardship, aligning with the "Pakke Declaration" on climate-resilient development.

- **Targets:** The plan outlines 3 goals, 15 targets, and 140 action points. Crucially, it focuses on documentation of traditional knowledge, sustainable harvesting of Non-Timber Forest Products (NTFPs), and "Nature-based Solutions." It represents a paradigm shift from "fencing off" nature to "community-led" conservation, acknowledging that in Arunachal, most forests are owned by communities, not the state [64].

Case Study: The Great Nicobar Development Project

Perhaps the most controversial project in the 2024-2025 period is the ₹72,000 crore holistic development plan for Great Nicobar Island, a project that epitomizes the clash between strategic necessity and ecological preservation.

1. The Project Components

The project, spearheaded by the Andaman and Nicobar Islands Integrated Development Corporation (ANIIDCO), includes four massive components:

1. An International Container Trans-shipment Terminal (ICTT) at Galathea Bay.
2. An International Airport (dual use for military and civil).
3. A 450 MVA Gas and Solar based Power Plant.
4. A Township for 6.5 lakh people (in an island with a current population of ~8,000) [6].

2. Ecological and Social Cost

- **Forest Loss:** The project requires the diversion of 130.75 sq. km of tropical rainforest, much of which is pristine and unfragmented.

- **Endemic Species:** The island is the only home of the Nicobar Megapode (a mound-building bird), the Nicobar Tree Shrew, and the Nicobar Long-tailed Macaque. Galathea Bay, the site of the port, is one of the most important nesting beaches in the Indian Ocean for the giant Leatherback Turtle [6].

- **Indigenous Rights:** The project encroaches upon the tribal reserve of the Shompen (a Particularly Vulnerable Tribal Group - PVTG) who live in voluntary isolation,

and the Nicobarese, who were displaced by the 2004 tsunami. Critics argue the project violates the Protection of Aboriginal Tribes (PAT) Regulation.

3. Legal Challenges and Transparency Issues

The environmental clearance (EC) granted in late 2022 has been challenged in the NGT and the Calcutta High Court.

- **Sealed Covers:** In 2024, the MoEFCC submitted the report of a High-Powered Committee (HPC)—constituted to review the concerns—in a "sealed cover" to the NGT. Petitioners have challenged this, arguing that environmental governance requires public transparency. The MoEFCC claims the project has "strategic and defense importance," thereby justifying the opacity [68].

- **EIA Flaws:** Submissions to the NGT have highlighted that the Environmental Impact Assessment (EIA) was conducted rapidly (one season) and failed to account for the seismic risks (the island sits on the Ring of Fire) and the loss of the turtle nesting habitat [69].

Conclusion and Recommendations

1. The State of India's Conservation

India’s biodiversity conservation strategy in 2025 is characterized by a "schizophrenic" policy landscape. On one hand, the judiciary (NGT, Supreme Court) and certain state instruments (like Arunachal's Biodiversity Plan) are pushing for rigorous protection, community rights, and scientific management. On the other, the legislative amendments (BDA 2023) and executive clearances (Great Nicobar, Etalin) prioritize "ease of doing business," strategic infrastructure, and the commercialization of bio-resources.

2. Key Insights

1. **The Failure of "One Size Fits All":** The conflict in Kerala and the Western Ghats demonstrates that rigid, top-down ESZ norms (like the 10km rule) are unimplementable in densely populated democracies. Conservation must be site-specific, participatory, and incentive-based, as suggested by the Gadgil report but rejected for its perceived stringency.

2. **Scientific Integrity Under Siege:** The reliance on rapid, consultant-driven EIAs (Great Nicobar) and the dismissal of warnings from premier institutes (WII on Etalin/Subansiri) erodes trust in the regulatory process. When science is subordinated to political expediency, disasters like Joshimath become inevitable.

3. **The Urban-Ecology Nexus:** The Joshimath disaster is a harbinger of future crises in the Himalayas. If "carrying capacity" remains a theoretical concept rather than a binding planning constraint, the region will face accelerating instability.

3. Recommendations

- **Revive the WGEA Model:** A statutory authority for the Western Ghats, with state and local representation, is essential to break the 13-year deadlock on ESA notification. The current draft notification cycle is a loop of failure.

- **Strengthen BMCs:** Empowering Biodiversity Management Committees with the legal and financial capacity to levy ABS fees—despite the 2023 Amendment's loopholes—is crucial. The NBA must issue strict guidelines to ensure the "codified knowledge" exemption is not abused by corporations.

- **Cumulative Impact Assessments:** For the Himalayas and Northeast, project-specific EIAs are insufficient. Basin-level Cumulative Impact Assessments (CIA) must be mandatory before clearing hydropower projects to understand the aggregate stress on the ecosystem.

- **Transparency:** All reports regarding public safety and ecology (like the ISRO Joshimath report or WII Great Nicobar report) must be in the public domain. Secrecy in environmental governance is antithetical to the principles of the Environment Protection Act.

In conclusion, India’s path to becoming a developed nation ("Viksit Bharat") by 2047 cannot be paved over the ruins of its ecological foundations. The protection of Ecologically Sensitive Regions requires not just laws, but the political will to enforce them against powerful economic interests, ensuring that the "lungs" of the country survive to sustain future generations.

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