



Decade of Conservation: Growth and Governance of Eco-Sensitive zones in India

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Abstract

An evaluation of the growth trends and policy implementation of Eco-Sensitive Zones (ESZs) in India which serve as buffer zones around Protected Areas to minimize human-induced ecological impacts while allowing regulated development is very important. Using a quantitative approach based on secondary data from the Ministry of Environment, Forest and Climate Change (MoEFCC) and related government sources for a period of 10 years (2014-2023), the study analysed the annual and compound growth rates in ESZ coverage and the number of notifications issued. Results indicate a three-phase trajectory: an initial surge in ESZ expansion (2015–2017), a period of stable implementation (2018–2021), and a slowdown in recent years (2022–2023). Despite a high Compound Annual Growth Rate (CAGR) of 49.25%, the gap between projected and actual growth in recent years signals potential policy saturation or administrative delays. Further, though India has made substantial progress in ESZ governance now it is time to shift the focus from quantitative expansion to qualitative improvement- in the level of enforcement, community participation, and ecological functionality to ensure long-term sustainability.

Keywords

Eco-Sensitive Zones (ESZs), environmental governance, protected areas, sustainable development, ecological regulation and conservation policy.

Introduction

Eco-Sensitive Zones (ESZs) are buffer areas demarcated around Protected Areas (PAs) such as National Parks and Wildlife Sanctuaries, designed to minimize the negative impact of human activities on fragile ecosystems. In India, the concept of ESZs was introduced by the Ministry of Environment, Forest and Climate Change (MoEFCC) under the provisions of the Environment (Protection) Act, 1986. These zones aim to regulate certain anthropogenic activities—like mining, construction, and industrialization—without completely prohibiting them, thereby balancing ecological conservation and sustainable development (MoEFCC, 2011). The size and extent of ESZs are determined by a case-by-case basis, depending on the ecological sensitivity of the

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area. Activities in these zones are categorized as prohibited, regulated, or permissible, and the goal is to act as a transition zone between areas of high protection and human habitation **(Kumar et al., 2020)**³.

Internationally, the concept of buffer zones around protected or core ecological areas is widely practiced, though it may go by different names such as ecological corridors, transition zones, or buffer zones under the UNESCO Man and the Biosphere (MAB) Programme. According to **UNESCO (2001)**⁴, buffer zones are essential for reducing the risk of biodiversity loss, promoting ecological connectivity, and integrating conservation into broader land-use planning.

For example,

- The European Union employs the Natura 2000 network, which includes Special Areas of Conservation (SACs) and their surrounding buffer zones to protect habitats under the EU Habitats Directive (European Commission, 1992).
- The United States, through its National Environmental Policy Act (NEPA), incorporates buffer zone principles around protected public lands and wetlands, often enforced through local zoning laws **(Beatley, 2000)**⁵.
- Brazil's Forest Code Mandates Legal Reserves and Permanent Preservation Areas, which function similarly to ESZs by restricting deforestation near rivers, steep slopes, and protected zones **(Soares-Filho et al., 2014)**⁶.

These international examples reflect a common understanding that core conservation areas alone are not sufficient; surrounding land use must also be managed carefully to maintain ecological integrity. Eco-sensitive or buffer zones are thus a globally recognized tool in the conservation planning toolkit.

India, one of the world's 17 megadiverse countries, faces the unique challenge of conserving biodiversity while supporting a growing economy and population. In this context, the concept of Eco-Sensitive Zones (ESZs) has emerged as a significant regulatory instrument aimed at creating a buffer between protected ecosystems and areas of intense human activity. Introduced under the Environment (Protection) Act, 1986, and formalized through guidelines by the Ministry of Environment, Forest and Climate Change (MoEFCC) in 2011, ESZs are meant to minimize the impact of urbanization, industrialization, and other anthropogenic pressures on India's National Parks and Wildlife Sanctuaries **(MoEFCC, 2011)**⁷. The primary objective of ESZs is to act as transitional spaces that allow low-impact activities while discouraging environmentally harmful development. These zones vary in width and restrictions depending on the ecological sensitivity of the area. According to MoEFCC, activities in ESZs are categorized into prohibited, regulated, and permissible to ensure a balance

³ Kumar, R., Sharma, N., & Singh, A. (2020). Eco-Sensitive Zones: A Policy Tool for Conservation of Biodiversity in India. *Indian Forester*, 146(2), 187–193.

⁴ UNESCO (2001). *Man and the Biosphere Programme: Operational Guidelines for Biosphere Reserves*. UNESCO, Paris.

⁵ Beatley, T. (2000). Preserving Biodiversity: Challenges for Planners. *Journal of the American Planning Association*, 66(1), 5–20.

⁶ Soares-Filho, B., et al. (2014). Cracking Brazil's Forest Code. *Science*, 344(6182), 363–364.

⁷ MoEFCC (2011). *Guidelines for Declaration of Eco-Sensitive Zones around National Parks and Wildlife Sanctuaries*. Government of India.

between development and conservation. The notification of ESZs gained critical momentum after the Supreme Court of India directed the government in 2012 to expeditiously notify ESZs around all protected areas lacking buffer zones (**Centre for Environmental Law, WWF-India vs. Union of India, 2012**)⁸. This directive served as a catalyst for policy action, resulting in a marked increase in the area covered under ESZs across the country. India's approach to ESZs is particularly significant given the high human population density surrounding many protected areas and the growing environmental risks posed by infrastructure development, mining, tourism, and land-use changes. According to **Kumar et al. (2020)**⁹, ESZs represent a proactive strategy to extend conservation efforts beyond the core zones of protection. Yet, as pointed out by **Chauhan and Verma (2019)**¹⁰, challenges such as lack of community involvement, implementation delays, and ambiguity in land-use restrictions have limited the full potential of ESZs. From 2014 to 2023, India has witnessed a rapid expansion in the notification of ESZs. The notified ESZ area increased from 1,865 sq. km in 2014 to over 68,500 sq. km in 2023, indicating a strong policy push. However, this expansion has not been uniform, with fluctuations in annual growth rates raising questions about policy consistency and implementation bottlenecks.

Statement of the Problem

Eco-Sensitive Zones (ESZs) were introduced in India as a critical policy instrument to protect biodiversity and reduce anthropogenic pressure on Protected Areas through regulated development. Although ESZs have gained momentum through policy directives and judicial interventions, there remains limited empirical assessment of their year-wise expansion, policy consistency, and alignment with conservation goals. A decade after their active implementation, questions persist about the pace, pattern, and governance of ESZ notifications—whether their growth has been strategic and sustainable or fragmented and reactive. Without systematically analysing their annual growth rate, compound growth, and trend consistency, it is difficult to evaluate the effectiveness of ESZs as a long-term conservation strategy. This study seeks to address this gap by examining the quantitative expansion and policy trajectory of ESZs in India from 2014 to 2023.

Objectives

1. To evaluate growth pattern of ESZ in terms of area coverage.
2. To project the trend of ESZ development in the long- run.

Review of literature

Alam (2025)¹¹ explores urban planning strategies suitable for ecologically sensitive zones, with a focus on the Kolkata region. The need for integrating ecological considerations into urban development, especially in regions vulnerable to climate and environmental risks. It emphasizes the use of green infrastructure—such as eco-corridors, bioswales, and sustainable drainage systems—to minimize environmental degradation. The study

⁸ Supreme Court of India (2012). Centre for Environmental Law, WWF-India vs. Union of India, W.P. (C) No. 337/1995.

⁹. *ibid.*

¹⁰ Chauhan, P., & Verma, R. (2019). Policy and Practice of Eco-Sensitive Zones in India: An Analysis. *Journal of Environmental Planning and Management*, 62(10), 1751–1768.

¹¹ Alam, T. (2025). Futuristic urbanism of eco-sensitive zone of India: A case study of Kolkata region. In *Sustainable Climate Action and Water Management* (pp. 303–309). Springer.

also underscores the importance of policy coordination between urban planners and environmental authorities and promotes participatory planning approaches involving local communities. Overall, offers a forward-thinking and practical framework for balancing urban expansion with ecological sustainability in fragile landscapes.

Chhachhiya, D et al. (2025)¹² explores various planning strategies for urban development in ecologically sensitive hilly areas, where balancing environmental protection with infrastructure growth poses significant challenges. It examines existing literature and planning practices to identify key themes such as sustainable land use, risk mitigation (especially landslides and erosion), and community involvement. Also highlights the lack of integrated and context-specific frameworks in current urban planning for hilly terrains. It recommends adopting nature-based solutions and participatory planning approaches to ensure ecological balance and resilient development.

Patil, S. P et al. (2024)¹³ evaluates the Human Development Index (HDI) in the eco-sensitive zones (ESZs) of northern Western Ghats, Maharashtra. Using quantitative data on health, education, and income, the study reveals regional disparities in development. Areas closer to urban centers fare better, while remote villages lag due to limited access to services. The authors highlight the tension between conservation efforts and local development needs. The study effectively uses spatial analysis but could benefit from more qualitative insights. Overall, it offers a valuable perspective on balancing ecological protection and human development in sensitive regions.

Samuel, L. (2022)¹⁴ examines the identification and management of eco-sensitive zones (ESZs) and ecologically fragile lands (EFLs) in Kerala. It highlights how unclear boundaries, lack of updated data, and weak implementation hinder effective conservation. It discusses both well-recognized and overlooked fragile areas, pointing to legal and administrative shortcomings under state and national policies. Samuel calls for scientific mapping, improved data transparency, and stronger community participation to ensure ecological protection without neglecting local livelihoods. Given relevant contribution to debates on sustainable land use in environmentally sensitive regions.

Krishna et al. (2017)¹⁵ examines the shift in India's conservation policy from exclusionary protected areas to more flexible, regulated zones known as Ecologically Sensitive Zones (ESZs). Using the Western Ghats as a case study, the authors highlight the policy evolution through the recommendations of the Gadgil and Kasturirangan Committees, the challenges in ESZ implementation, and the ongoing tension between conservation and development. The study concludes that while ESZs offer a promising model for inclusive conservation, their success depends on legal clarity, strong governance, and stakeholder participation.

Methodology

¹² Chhachhiya, D., Kumar, A., & Pipralia, S. (2025). Scoping review to understand planning approach for urban development in ecologically sensitive hilly areas. Springer, 2.

¹³ Patil, Snehal P., Jaybhaye, Ravindra G., & Sawkare, Kajal H. (2024). Assessment of human development status in eco-sensitive zone of northern part of Western Ghats, Maharashtra. *Population Geography*, 46(2), 1–10.

¹⁴ Samuel, L. (2022). Eco-sensitive zones and ecologically fragile lands in Kerala: Known and unknown. *Eco. Env. & Cons.*, 28(February Suppl. Issue), S213–S216.

¹⁵ Krishna, V., Kumar, A., Pandey, R., Singh, S. K., & Dwevedi, R. (2017). The evolution of Ecologically Sensitive Zones in India: A case study of the Western Ghats. *Environmental Justice*, 10(4), 123–132.

The study identified to analyse the trends and growth pattern in the declaration of Ecologically Sensitive Zones (ESZs) in India. Hence, the study is both analytical and descriptive in nature. This study covers a period of Ten years (i.e) 2014-2023, it marks a decade of significant policy action and increased momentum in ESZ declarations, driven by Supreme Court directives and government initiatives. Reliable and consistent data also became more available during this time, making it ideal for trend analysis. Required secondary data were collected from Ministry of Environment, Forest and climate change (MoEFCC), India State of Forest Reports (ISFR) and Supreme Court reports on ESZs. So, Year-wise data (2014–2023) on Total area (in sq. km) of Protected Areas covered under ESZs and Number of ESZ notifications issued per year were collected.

Data Analysis Techniques

Annual Growth Rate (AGR) and Compound Annual Growth Rate (CAGR) were used to find out the growth pattern of ESZs. Trend analysis is used to observe how the total area under Ecologically Sensitive Zones (ESZs) and the number of notifications issued have changed year by year from 2014 to 2023 and to project up to the year 2034.

Results and Discussion

Table 1 Progress of Eco- Sensitive Zones (ESZs) around Protected Areas of India

Year	Protected Areas (In Sq. km.)	ESZ Notification
2014	1865.14	17
2015	3411.72	33
2016	14618.78	171
2017	30632.78	277
2018	32940.30	293
2019	48845.42	373
2020	59498.30	423
2021	66580.21	457
2022	67204.59	475
2023	68532.80	475

Source: Ministry of Environment, Forest and Climate Change, Government of India

The above table presents the year-wise expansion of ESZ coverage in terms of area (in sq. km) and the number of official notifications issued by the government. In 2014, the ESZ coverage was relatively low, with only 1,865.14 sq. km notified and 17 ESZ notifications issued. A significant surge began in 2015, with both the area and the number of notifications increasing rapidly. The most notable growth occurred between 2016 and 2017, where the notified area jumped from 14,618.78 sq. km to 30,632.78 sq. km, and the number of notifications increased from 171 to 277. This period reflects a strong institutional and legal push, likely influenced by judicial directions and national policy mandates. From 2018 to 2021, the expansion continued at a steady pace, indicating a phase of consistent and systematic implementation. By 2021, the ESZ area reached 66,580.21 sq. km, with 457 notifications issued. However, in the years 2022 and 2023, while the total number of notifications plateaued at 475, the increase in ESZ area was minimal—only about 1,300 sq. km over two years. This slowdown suggests

a possible saturation point in ESZ declarations, either due to completion of coverage around most Protected Areas or administrative and legal delays. Overall, the data reflects a decade of substantial growth in ESZ coverage, with a recent trend indicating the need to shift focus from expansion to effective implementation and governance.

Table 2 Growth and Trend of Eco- Sensitive Zones (ESZs) around Protected Areas of India

Year	AGR %
2014	-
2015	82.92
2016	328.49
2017	109.54
2018	7.53
2019	48.28
2020	21.81
2021	11.90
2022	0.94
2023	1.98
CAGR	49.25% per year

Source: Computed Data

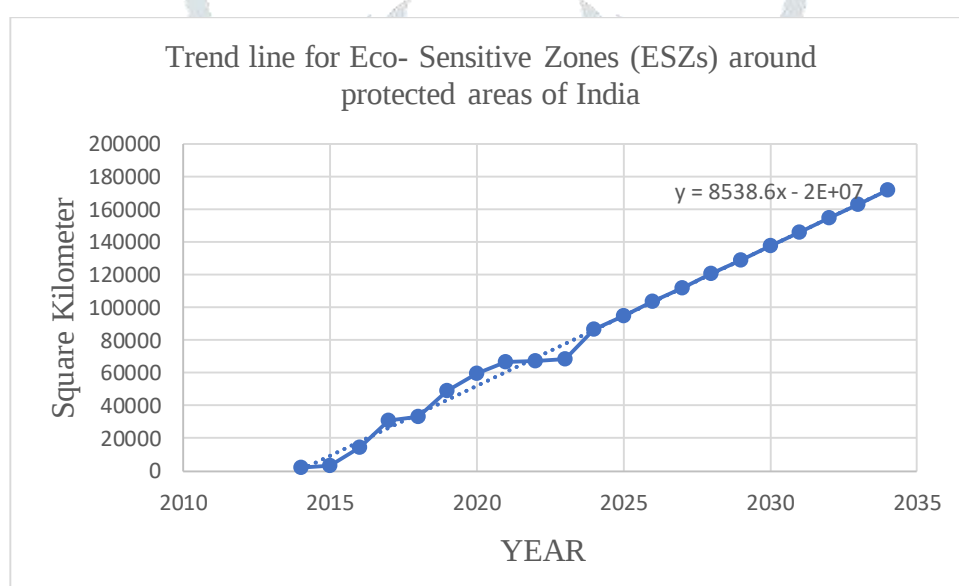
Table 3 Trend of Eco- Sensitive Zones (ESZs) around Protected Areas of India (2014-2034)

Year	Trend value (sq.km)
2014	1865.14
2015	3411.72
2016	14618.8
2017	30632.8
2018	32940.3
2019	48845.4
2020	59498.3
2021	66580.2
2022	67204.6
2023	68532.8
2024	86375.3
2025	94913.9
2026	103452.5
2027	111991.1
2028	120529.7

2029	129068.3
2030	137606.9
2031	146145.5
2032	154684.1
2033	163222.7
2034	171761.3

Source: Computed Data

Chart 1 Trend line for Eco- Sensitive Zones (ESZs) around Protected Areas of India



The analysis of Eco-Sensitive Zone (ESZ) area coverage in India from 2014 to 2023 reveals a three-phase growth pattern. The initial phase (2014–2017) witnessed a sharp increase in notified ESZ area, with the Annual Growth Rate (AGR) peaking at 328.49% in 2016, reflecting a significant policy thrust. This rapid expansion may be attributed to judicial directions, increased environmental awareness, and strategic policy actions under national programs such as the Smart Cities Mission and Compensatory Afforestation Fund Management and Planning Authority (CAMPA). The second phase (2018–2021) reflects a stabilization of growth. Although the area under ESZs continued to increase, the AGR moderated and began to align more closely with the calculated trend values, indicating a more predictable and systematic approach to ESZ implementation. The final phase (2022–2023) shows a noticeable slowdown, with AGR dropping to less than 2%. Despite the continued rise in trend values, actual growth plateaued, possibly due to the completion of ESZ notifications for most Protected Areas, administrative challenges, or shifts in policy focus. The overall Compound Annual Growth Rate (CAGR) of 49.25% from 2014 to 2023 indicates an average annual increase of nearly half the previous year's coverage — a substantial expansion that highlights India's efforts in biodiversity conservation. The projected trend values for Eco-Sensitive Zone (ESZ) areas from 2024 to 2034 indicate a steady and consistent expansion in ecological coverage. Starting from an estimated 86,375.3 sq. km in 2024, the ESZ area is expected to increase annually by approximately 8,538.6 sq. km, reaching 171,761.3 sq. km by 2034. This nearly 99% growth over the 11-year period reflects a strong linear trend, suggesting sustained efforts in biodiversity conservation and environmental

protection. The consistent expansion of ESZs highlights the government's continued commitment to safeguarding ecologically important areas by creating regulatory buffer zones around protected habitats. This trend also implies stricter land-use controls and increased emphasis on sustainable development practices in sensitive regions, aligning with broader national objectives under the Environment Protection Act and biodiversity policies.

Conclusion

The decade-long progress of ESZs in India illustrates a commendable shift towards integrating environmental safeguards into national land-use planning. The initial momentum post-2015 catalysed large-scale notifications and laid a strong foundation for eco-sensitive governance. However, the recent stagnation in growth highlights the need for a transition from quantity to quality - focusing not just on expanding ESZ boundaries but ensuring their effective implementation, ecological integrity, and integration with local development needs. Projections based on current trends suggest that the total ESZ area could nearly double from approximately 86,375 sq. km in 2024 to 171,761 sq. km by 2034, with an average annual increase of about 8,538.6 sq. km. This steady growth reflects the potential for continued ecological expansion, provided that policy efforts prioritize improving regulatory enforcement, involving local communities, and adopting scientific assessment tools to maintain ecological balance while supporting sustainable development goals.

References

1. Alam, T. (2025). Futuristic urbanism of eco-sensitive zone of India: A case study of Kolkata region. In *Sustainable Climate Action and Water Management* (pp. 303–309). Springer.
2. Beatley, T. (2000). Preserving Biodiversity: Challenges for Planners. *Journal of the American Planning Association*, 66(1), 5–20.
3. Chauhan, P., & Verma, R. (2019). Policy and Practice of Eco-Sensitive Zones in India: An Analysis. *Journal of Environmental Planning and Management*, 62(10), 1751–1768.
4. Chhachhiya, D., Kumar, A., & Pipralia, S. (2025). Scoping review to understand planning approach for urban development in ecologically sensitive hilly areas. Springer, 2.
5. European Commission (1992). Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive).
6. Krishna, V., Kumar, A., Pandey, R., Singh, S. K., & Dwevedi, R. (2017). The evolution of Ecologically Sensitive Zones in India: A case study of the Western Ghats. *Environmental Justice*, 10(4), 123–132.
7. Kumar, R., Sharma, N., & Singh, A. (2020). Eco-Sensitive Zones: A Policy Tool for Conservation of Biodiversity in India. *Indian Forester*, 146(2), 187–193.
8. Kumar, R., Sharma, N., & Singh, A. (2020). Eco-Sensitive Zones: A Policy Tool for Conservation of Biodiversity in India. *Indian Forester*, 146(2), 187–193.
9. MoEFCC (2011). Guidelines for Declaration of Eco-Sensitive Zones around National Parks and Wildlife Sanctuaries. Government of India.
10. Patil, Snehal P., Jaybhaye, Ravindra G., & Sawkare, Kajal H. (2024). Assessment of human development status in eco-sensitive zone of northern part of Western Ghats, Maharashtra. *Population Geography*, 46(2), 1–10

11. Samuel, L. (2022). Eco-sensitive zones and ecologically fragile lands in Kerala: Known and unknown. *Eco. Env. & Cons.*, 28(February Suppl. Issue), S213–S216.
12. Soares-Filho, B., et al. (2014). Cracking Brazil's Forest Code. *Science*, 344(6182), 363–364.
13. Supreme Court of India (2012). Centre for Environmental Law, WWF-India vs. Union of India, W.P. (C) No. 337/1995.
14. UNESCO (2001). *Man, and the Biosphere Programme: Operational Guidelines for Biosphere Reserves*. UNESCO, Paris.

