

Green Bonds as Emerging instruments for Biodiversity finance: Evidence from India

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Abstract

This study examines the effectiveness of green bonds as a mechanism for supporting biodiversity finance in India. Using a quantitative research approach, the analysis is based entirely on secondary data collected from the Securities and Exchange Board of India (SEBI) website, which provides detailed information on all green bond issuances in the country. A secondary data review and systematic data tabulation were used to categorize bonds by project type and to determine their direct or indirect contribution to biodiversity-related initiatives. The findings show that India has issued 29 green bonds to date, collectively mobilizing ₹9,023 crore. Overall, biodiversity-linked green bonds account for ₹1,475 crore, representing approximately 16% of the total capital raised. These results highlight the emerging yet significant role of green bonds in strengthening biodiversity finance in India. This work significantly adds to the corpus of existing knowledge.

Keywords: Biodiversity, Biodiversity Conservation, Biodiversity Finance, Finance, Green Bond.

1. INTRODUCTION

Biodiversity is the quantity, variety, and variability of living things within a particular habitat (Heywood and Watson, 1995). According to Wani (2024), biodiversity is the diversity of living things from all sources, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are a part. This includes diversity within species, between species, and of ecosystem. Food and water supply, climate change mitigation and resilience, human health, and employment in a variety of industries, including forestry, agriculture, and fisheries, are all supported by biodiversity (Opoku, 2019). Biodiversity serves as a source of materials that can be used to make food, medicine, and cosmetics (Davis, 2025). The current human population depends on a number of compounds derived from plants and animals for survival and well-being.

According to Himshikha et al. (2022), human development and encroachment on natural and wild habitat, mining for energy needs, transportation development, and uncontrolled recreation are all contributing factors to the destruction of biodiversity. There is almost no part of the world that is not experiencing ecological disasters due to

the loss of biodiversity (Phondani et al., 2016; Li et al., 2024). Loss of biodiversity results in both the extinction of species and a deterioration in ecosystem functioning (Tariq et al., 2024). The conservation of biodiversity is central to the objectives of sustainable development (Jago et al., 2024). The importance of biological diversity for the stability and sustainability of the earth's ecosystem has been recognized in recent years due to a rise in public awareness (Dudgeon and Strayer, 2025). Although biodiversity is crucial to both ecological and financial stability, its incorporation into sustainable finance has not received enough attention (Naifar, 2025). Intergovernmental initiatives like international treaties, government initiatives like the creation of protected areas, the introduction of tax breaks and subsidies, and biodiversity finance are some possible ways to maintain and restore biodiversity (Flammer et al., 2025).

Biodiversity financing is the subject of scholarly investigation (Hutchinson and Lucey, 2024; Hill et al., 2025; Saba, 2025). Raising, maintaining, and utilizing financial incentives to promote sustainable biodiversity management is known as biodiversity finance (Clark, 2007). Biodiversity finance is the set of public, private and blended financial flows



(grants, budgets, loans, investments, payments for ecosystem services, conservation trust funds, debt-for-nature swaps, etc.) that are directed to conserve, sustainably use, restore, and monitor biodiversity and ecosystems — and the financial instruments and policies designed to mobilize those flows at the scale needed to meet national and global biodiversity targets (Christiansen et al., 2025). The world is \$1.3 trillion short of its headline biodiversity finance targets (BloombergNEF & Natural History Museum, 2025). According to Koshy, J. (2024, November 1), India anticipates spending approximately ₹81,664 crore on conservation and biodiversity between 2025 and 2030 (FY). India spent ₹32,207 crore from 2018 to 2022 (FY), and in order to satisfy the increased finance requirements, money from sources other than regular government spending would be needed.

Some of the biodiversity finance instruments are green bonds, private debt, impact bonds, private equity, public equity, etc. (Christiansen et al., 2025). India is actively exploring green bonds as a mechanism for biodiversity finance, with the government's sovereign green bond framework explicitly listing biodiversity conservation as an eligible project category. (Pandey et al., 2019). India is advancing biodiversity finance through public schemes, private capital, and innovative financial instruments like green bonds (Jain, 2025, May 22). According to the Securities and Exchange Board of India (2017), a green bond or green debt security is "a debt security issued for raising funds subject to the conditions as may be specified by the Board from time to time, to be utilized for project(s) and/or asset(s) falling under certain categories like renewable and sustainable energy, climate change, energy efficiency, clean transportation, biodiversity conservation, etc."

Looking at the growing relevance of green bonds and their emerging use as a mechanism for biodiversity finance, it becomes important to explore how effectively green bonds contribute to biodiversity-related outcomes and to assess the extent of their actual contribution so far. Although green bonds are increasingly recognized as a tool for mobilizing capital toward environmental projects, there is still limited clarity on how much they have specifically supported biodiversity

conservation efforts. A review of existing literature shows that no study was found focusing on this specific subject in the Indian context. However, some studies have examined the role of green bonds in promoting broader sustainable finance and sustainable development (Joshi et al., 2024; Khan et al., 2024), indicating the potential for further investigation into their contribution to biodiversity finance.

2. LITERATURE REVIEW

The variety of life forms, such as plants, animals, and even microorganisms, is referred to as biodiversity. Usually, it is a measure of genetic, species, and ecosystem-level variety. The variety of life forms, such as plants, animals, and even microorganisms, is referred to as biodiversity. According to Phondani et al. (2016), it is usually a measure of variance at the genetic, species, and ecosystem levels. Cereals, grains, fruits, vegetables, meat, milk, and eggs are among the foods that biodiversity gives us (Roos et al., 2016). According to Montgomery (2002) and Marselle et al. (2019), eco-tourism, wildlife, bird watching, gardening, and other activities all have significant aesthetic value. Biodiversity is essential to human health and well-being as well as the development of a global community of life on Earth because it can sustain ecosystem functions, thereby satisfying both material and spiritual human needs (Liu et al., 2021). Scientists can better comprehend how life functions and each species' part in maintaining ecosystems thanks to biodiversity. Through the food chain and food web, all organisms are connected to one another, and each species contributes in some way to the ecosystem (Wan et al., 2024).

Biodiversity is on the way of depletion (Ramya et al., 2015; Himshikha, et al. 2022). Some of the significant drivers of biodiversity loss are global environmental pollution, climate change, world's population, over exploitation of species for human use, and fragmentation and degradation (Pfenning-Butterworth et al., 2024). Raising awareness of the value of biodiversity conservation among both rural and urban populations is imperative (Hawkes et al., 2012; Zhu et al., 2021). The management of human use of biodiversity to maximize sustainable benefits for current and future generations is known as biodiversity conservation. Protection, upkeep,

sustainable use, restoration, and augmentation of biodiversity are all included in conservation of biodiversity (Kasso et al. 2013). Adaptive biodiversity conservation priorities must be developed in light of the notable regional variations in danger levels, response strategies, and governmental capacities (Tanalgo and Hughes, 2019). The utilization of private funds for biodiversity protection and restoration is known as "biodiversity finance" and it is one of the potential solutions to preserve and restore biodiversity (Flammer et al., 2025).

Green bond is an innovative financial mechanism and specialized investment fund dedicated to biodiversity conservation (Saba, 2025). Green bonds serve as a tool for financing biodiversity (Christiansen et al., 2025). In addition to being a financial instrument, green bonds also operate as a catalyst for the wider promotion of environmentally friendly initiatives. According to Ahmed et al. (2024), green bonds are seen as a means of achieving the SDGs. (Huang, 2024) examined the impact of green bonds and ESG investments on sustainable finance studies in seven resource-rich economies—China, Brazil, Russia, Australia, Canada, Saudi Arabia, and South Africa and came to the conclusion that green bonds encourage environmentally conscious economic activity and are crucial in advancing sustainable development. Ahmed et al. (2024) investigated the response of the stock market to the announcement of the issuance of green bonds by US listed businesses and discovered that the announcement resulted in a positively anomalous return on equities. Cheng et al. (2024) investigated how the green bond market affected resource efficiency in 12 actively participating Asian economies and discovered a favorable relationship between resource efficiency and the issuance of green bonds. According to Kokurin et al.'s (2025) analysis of the function of sovereign green bonds in funding environmentally

transformative initiatives, green bonds have become a vital instrument for raising money for initiatives like sustainable agriculture, renewable energy, and habitat preservation. Cheng and Wu (2024) found that green bond issuance promote corporate green transformation and sustainable growth in Chinese A-share listed companies.

3. OBJECTIVE & METHODOLOGY

This study aims to investigate the effectiveness of green bonds in financing biodiversity within the Indian setting. The study's specific objectives are to evaluate green bond issuances' overall contribution to biodiversity finance and to investigate the degree to which they support biodiversity-related initiatives in India. To accomplish the goal, the study employed quantitative research. All of the secondary data used in this study came from the Securities and Exchange Board of India's official website. Comprehensive information about all green bonds issued in India, including issuer details, the year of issuance, and the types of projects that qualify, may be found in the SEBI database. The information pertinent to green bond issuances was gathered and examined using a secondary data review data collection method. For data analysis, standard data tabulation techniques were employed to systematically categorize green bonds based on their project types and identify whether any of them directly or indirectly contribute to biodiversity finance. The tabulated data provides the basis for assessing the role and effectiveness of green bonds in supporting biodiversity-related initiatives in India.

4. DATA ANALYSIS

Table 1 displays a dataset from the SEBI website that includes 27 green bonds issued in India between 2017 and 2025, demonstrating a distinct change in the nation's sustainable finance environment.

Table 1: Summary of Green Bonds issued in India

Year	Issuer	Amount Raised (Crores)	Focus Area	Contribution towards Biodiversity Finance
2017	L&T Infrastructure Finance Company Ltd	667	Solar power projects and other renewable energy initiatives	
2018	Tata Cleantech Capital Limited	180	Renewable energy, energy efficiency, and e-mobility.	
2019	Indian Renewable Energy	275	Renewable energy	

	Development Agency Limited			
2019	Indian Renewable Energy Development Agency Limited	590	Renewable energy projects like solar and wind	
2021	Ghaziabad Nagar Nigam	150	Treat wastewater for industrial reuse, reducing freshwater demand	Indirectly
2021	Yarrow Infrastructure Private Limited	581	Solar power projects,	
2021	Priapus Infrastructure Limited	16	Renewable energy projects	
2021	Rattanindia Solar 2 Private Limited	227	Renewable energy projects	
2021	Malwa Solar Power Generation Private Limited	197	Solar energy projects	
2021	Citra Real Estate Limited	19	Solar power projects	
2021	Sepset Constructions Limited	197	Green/renewable energy projects	
2022	Avaada Solarise Energy Private Limited	499	Solar projects	
2022	Clean Sustainable Energy Private Limited	334	Solar and wind energy projects, Reduction of greenhouse gas (GHG) emissions	
2022	Fermi Solarfarms Private Limited	337	Solar power plants.	
2022	Avaada SataraMH Private Limited	270	Renewable energy projects	
2022	Vikas Telecom Private Limited	495	Renewable energy, Energy efficiency, Sustainable waste management, Clean transportation, Green buildings	
2023	Indore Municipal Corporation	550	Solar power plants	
2023	MINDSPACE BUSINESS PARKS REIT	200	Reduce greenhouse gas emissions, green office spaces	
2024	Ahmedabad Municipal Corporation	200	Sustainable water management and wastewater treatment projects.	Indirectly
2024	Vadodara Municipal Corporation	100	Wastewater Management, Water Conservation	Indirectly
2024	Samunnati Financial Intermediation & Services Private Limited	50	Developing and adopting climate-smart agriculture solutions	Indirectly
2024	Dme Development Limited	775	Projects like avenue/median plantations, animal underpasses, solar lighting, rainwater harvesting, and waste management, aiming to reduce environmental impact	Directly
2025	Larsen & Toubro Limited	500	Reduce greenhouse gas (GHG) emissions and freshwater usage	
2025	KPI Green Energy Limited	670	Solar, wind, and hybrid power plants, reducing CO2 emissions	
2025	Minspace Business Parks REIT	550	Reducing GHG emissions, increasing green-certified spaces,	
2025	Muthoot Capital Services Limited	150	To boost India's EV ecosystem and reduce emissions	
2025	Pimpri Chinchwad Municipal Corporation	200	Harit Setu (Green Bridge), Sustainable Mobility, climate change	Indirectly

Source: SEBI website

Table 1 shows that during the initial years (2017–2019) green bonds remained limited, with only four green bonds primarily focused on renewable energy. Year 2021 saw a significant change as seven issuances signalled a resurgence of the post-pandemic drive for low-carbon infrastructure. With five issuances aimed at solar, wind, and hybrid projects in 2022, the upward trend persisted. In

2024, there was a noticeable thematic diversification with four green bonds that addressed water conservation, wastewater treatment, climate-smart agriculture, ecological restoration, and pollution control—areas that either directly or indirectly support biodiversity conservation. In 2023, there was moderate activity with two issuances. It is crucial to remember that 2025 is still ongoing and that additional bonds related to

biodiversity finance may be issued as the year goes on, possibly increasing the proportion of nature-positive investments, even if the year has already seen six issuances.

5. FINDINGS & CONCLUSION

This study aims to investigate how well green bonds support financing for biodiversity. The analysis reveals that the 29 green bonds issued in India have raised ₹9023 crore in total funding, indicating the increasing significance of green financial instruments in India's environmental and climate strategy. Six of these bonds support financing for biodiversity. One bond, DME Development Limited (2024), mobilizes ₹775 crore and is classified as having a direct impact on biodiversity because it focuses on avenue plants, wildlife underpasses, rainwater collection, and ecological infrastructure. Furthermore, five bonds totaling ₹700 crore (Ghaziabad Nagar Nigam 2021; Ahmedabad Municipal Corporation 2024; Vadodara Municipal Corporation 2024; Samunnati Financial 2024; Pimpri Chinchwad Municipal Corporation 2024) show indirect contributions to biodiversity through wastewater treatment, water conservation, and climate-smart agricultural practices. Approximately 16.00% of the entire capital generated, or ₹1,475 crore, is made up of bonds tied to biodiversity. According to sectoral analysis, biodiversity finance now makes up a small percentage of all green bond capital, while renewable energy continues to dominate, accounting for more than 70% of issuances and funding. Nonetheless, the growing prevalence of topics pertaining to biodiversity in 2024 and the first part of 2025 indicates a slow transition to financing that is focused on ecosystems. On June 5, 2025, SEBI introduced a reinforced ESG Bonds Framework, which further supports this rising trend. A new framework for ESG debt securities, including Green, Social, Sustainability, and Sustainability-Linked Bonds, was introduced by the Securities and Exchange Board of India (SEBI). Environment, Social, and Governance (ESG) Debt Securities are defined as "green debt securities, social bonds, sustainability bonds, sustainability-linked bonds, or any other type of bonds, by whatever name called, that are issued in accordance with such international frameworks as adapted or adjusted to suit Indian requirements that are

specified by the Board from time to time, and any other securities as specified by the Board" (Securities and Exchange Board of India, 2025). Finance for biodiversity may be stimulated by this new structure. Activities related to biodiversity, including ecosystem restoration, watershed preservation, sustainable agriculture, urban greening, and nature-based climate solutions, are recognized under the updated framework as qualifying for sustainable funding. A solid regulatory framework that encourages issuers to investigate biodiversity-focused projects is provided by improved transparency, taxonomy alignment, and impact-reporting requirements. As a result, bond issuances focused on biodiversity are probably going to rise in the next years, expanding the reach of India's green finance ecosystem.

Declaration

All authors declare that they have no conflicts of interest.

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