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Biodiversity and Forests as Natural Capital: Judicial Governance and Implications for Human Development and Sustainable Commerce in India

Anant Kumar Garg

Independent Researcher; Chartered Accountancy Articleship Trainee under
ICAI (India) E-mail:<adamaro20@gmail.com>

Abstract

This study examines biodiversity and forests as natural capital assets within the framework of judicial governance and sustainable commerce in India. While biodiversity conservation has traditionally been viewed through an ecological lens, this paper integrates commerce, human development, and legal interventions to present a multidisciplinary perspective. Using secondary data sources such as the India State of Forest Report (2023), NFHS-5 2020, PLFS 2019, and judicial case analysis, the study evaluates the relationship between forest resources, livelihood dependence, and human development outcomes. The findings reveal a paradox wherein biodiversity-rich regions exhibit weaker health and livelihood indicators, highlighting the need for integrated policy interventions. The study further demonstrates that judicial mechanisms, including landmark Supreme Court cases and High Court interventions, function as ecosystem governance instruments, influencing conservation outcomes and economic activities. The paper contributes by positioning biodiversity as a commercial and developmental asset, linking ecological sustainability with human welfare and proposing a framework for commerce-driven conservation aligned with sustainable development goals.

Keywords

Natural capital, Biodiversity conservation, Judicial governance, Sustainable commerce, Forest economy, Human development, India.

Centre For Studies of National Development, Meerut

Editorial Office : D-59, Shastri Nagar, Meerut - 250 004 (INDIA)

Ph. : 0121-2763765, +91-9997771669, +91-9412200765

Biodiversity and Forests as Natural Capital: Judicial Governance and Implications for Human Development and Sustainable Commerce in India

1. Introduction

Biodiversity and forests have increasingly been recognized as critical components of natural capital, contributing not only to ecological stability but also to economic productivity and human well-being. Contemporary sustainability discourse emphasizes that environmental resources are intrinsically linked with livelihoods, health outcomes, and long-term development trajectories (Costanza, *et al.*, 1997; World Bank, 2018). As a result, biodiversity is no longer viewed solely as an ecological concern but as a strategic asset within economic and policy frameworks.

India, as one of the world's megadiverse countries, possesses extensive forest resources and rich biological diversity. However, this ecological wealth coexists with significant socio-economic challenges, particularly in forest-dependent regions where communities often experience lower levels of human development. The India State of Forest Report (FSI, 2023) indicates relative stability in forest cover, yet concerns persist regarding forest quality, biodiversity degradation, and the sustainability of ecosystem services.

In response to these challenges, India has developed a distinctive model of environmental governance through judicial intervention, where courts have played an active role in expanding environmental jurisprudence and enforcing conservation measures. Landmark cases such as *T.N. Godavarman Thirumulpad v. Union of India* (1996) and *M.C. Mehta v. Union of India* (1987) have redefined forest governance and established principles such as the Public Trust Doctrine and continuing mandamus. These developments position the judiciary as a crucial ecosystem governance instrument within India's sustainability framework.

From a commerce perspective, biodiversity and forests serve as significant sources of economic activity, particularly through non-timber forest products (NTFPs), medicinal plants, eco-tourism, and biodiversity-based trade. For many rural and tribal communities, these resources constitute an essential component of income and livelihood systems (TRIFED, 2021; PLFS, 2019). Despite this, biodiversity remains inadequately integrated into formal economic systems, and its potential as a commercial capital asset is yet to be fully realized.

This creates a critical paradox wherein regions rich in biodiversity often exhibit weaker health and livelihood indicators, reflecting a disconnect between

ecological wealth and human development outcomes (NFHS-5, 2020). The persistence of this gap highlights the need for an integrated analytical framework that connects biodiversity, commerce, governance, and human welfare.

In this context, the present study assumes significance as it redefines biodiversity and forests as multidimensional natural capital assets, linking ecological sustainability with commerce, judicial governance, and human development. By adopting a multidisciplinary approach, the study bridges a critical gap between environmental and economic analysis, and contributes to policy discourse by proposing a framework for integrating biodiversity into sustainable development strategies aligned with global commitments such as the Sustainable Development Goals (SDGs) and the Convention on Biological Diversity (CBD).

Accordingly, the study aims to examine biodiversity and forests within the framework of natural capital, analyze the role of judicial interventions in environmental governance, and evaluate their implications for commerce and human development in India.

This study is significant as it redefines forests and biodiversity as natural capital assets that extend beyond ecological value to influence commerce, livelihoods, and human development. By integrating judicial interventions with economic and social indicators, the study highlights the role of the judiciary as an ecosystem governance instrument shaping conservation outcomes.

It further contributes by bridging a critical gap between environmental sustainability and economic analysis, demonstrating how biodiversity-based commerce—such as non-timber forest products and eco-tourism—can support sustainable development. The research offers both academic and policy relevance, positioning India's biodiversity governance model within a global discourse on sustainable development and natural capital valuation.

2. Review of Literature

The concept of biodiversity and forests as natural capital has been widely explored within the domain of ecological economics. Costanza *et al.* (1997) emphasized the economic valuation of ecosystem services, demonstrating that natural resources contribute significantly to global welfare and economic systems. Similarly, Daly (1996) argued for a sustainability-oriented economic framework that recognizes ecological limits while integrating development objectives. These foundational contributions establish biodiversity as both an ecological and economic asset.

From a human development perspective, Sen (1981, 1999) introduced the capability approach, linking access to resources with improvements in well-being and freedom. This framework is particularly relevant in forest-dependent regions, where biodiversity directly influences livelihoods, nutrition, and health outcomes. It highlights that ecological resources must be effectively translated into human capabilities to achieve meaningful development.

Global policy frameworks further reinforce this integrated perspective. The United Nations Environment Programme (UNEP, 2011) and the World Bank (2018) emphasize the importance of natural capital in achieving sustainable development through green economy models. These frameworks advocate the alignment of environmental conservation with economic growth, recognizing biodiversity as a critical component of long-term sustainability.

In the Indian context, studies on forest governance and community rights have highlighted both opportunities and challenges. Kohli and Menon (2016) examine the implementation of the Forest Rights Act (FRA), 2006, noting issues related to land rights, institutional conflicts, and policy execution. Reports by the Ministry of Tribal Affairs (2018) further emphasize the role of local communities in conservation, while also identifying gaps in benefit-sharing and governance mechanisms.

Judicial interventions represent a distinctive feature of India's environmental governance system. Rosencranz and Divan (2003) document the evolution of environmental law in India, highlighting the role of courts in expanding doctrines such as the Public Trust Doctrine and sustainable development principles. Landmark cases, including *M.C. Mehta v. Union of India* (1987) and *T.N. Godavarman Thirumulpad v. Union of India* (1996), illustrate how judicial activism has contributed to forest conservation and regulatory enforcement.

From a commerce perspective, biodiversity-based economic activities have gained increasing attention. Reports by TRIFED (2021) and data from PLFS (2019) indicate that non-timber forest products (NTFPs), medicinal plants, and eco-tourism play a significant role in supporting rural and tribal livelihoods. However, these activities remain largely informal and under-integrated into formal economic systems, limiting their potential for value addition and market expansion.

Despite the breadth of existing literature, a significant gap persists. Most studies examine biodiversity, governance, or economic aspects in isolation, with limited integration across these domains. In particular, the combined role of judicial governance, biodiversity-based commerce, and human development outcomes remains underexplored in the Indian context. Furthermore, the paradox of biodiversity-rich yet development-poor regions has not been sufficiently analyzed through a multidisciplinary framework.

The above review of literature clearly shows a research gap. Despite a substantial body of literature on biodiversity conservation, forest governance, and sustainable development, existing studies remain largely fragmented across disciplinary boundaries. Ecological research primarily focuses on conservation outcomes, legal studies emphasize judicial interventions, and economic analyses examine resource utilization and growth patterns. However, an integrated framework linking biodiversity as natural capital, judicial governance, and commerce-driven development remains insufficiently explored.

In the Indian context, while the role of the judiciary in environmental protection has been widely acknowledged, limited attention has been given to its

implications for economic activities, livelihood systems, and human development outcomes. Similarly, studies on biodiversity-based commerce highlight its contribution to rural livelihoods but fail to adequately connect it with governance structures and policy frameworks.

Furthermore, the paradox of biodiversity-rich yet development-poor regions remains underexplored within a multidisciplinary analytical framework. This gap necessitates a comprehensive approach that integrates ecology, commerce, and governance to better understand sustainable development pathways in India.

3. Research Questions

An attempt has been made to find out the answers of the following questions:

1. How can biodiversity and forests be conceptualized as natural capital assets within the framework of sustainable development in India?
2. What role does the judiciary play as an ecosystem governance instrument in biodiversity conservation and forest management?
3. How do biodiversity-based economic activities contribute to livelihoods and human development outcomes?
4. Why do biodiversity-rich regions often exhibit lower human development indicators, and how can this paradox be addressed?
5. How can an integrated framework linking biodiversity, commerce, and governance inform sustainable development policies?

4. Research Objectives

Research objectives of this study are as follows:

1. To examine biodiversity and forests as natural capital assets in the context of sustainable development.
2. To analyze the role of judicial interventions in shaping environmental governance and conservation outcomes in India.
3. To assess the contribution of biodiversity-based economic activities to livelihoods and the rural economy.
4. To evaluate the relationship between biodiversity and human development indicators such as health and employment.
5. To develop an integrated framework linking ecology, commerce, and governance for sustainable development.

5. Hypothesis

Judicial interventions, when combined with biodiversity-based economic activities, positively influence conservation outcomes and contribute to sustainable development; however, in the absence of effective economic integration, biodiversity-rich regions continue to experience lower human development outcomes.

Judicial interventions and biodiversity-based economic activities do not significantly influence human development outcomes in forest-dependent regions.

6. Conceptual Framework

This study develops an integrated conceptual framework that positions biodiversity and forests as natural capital assets, linking ecological systems with economic activities, governance mechanisms, and human development outcomes.

At the foundation of the framework lies biodiversity and forest resources, which provide essential ecosystem services such as provisioning, regulating, and supporting functions. These ecological resources are conceptualized as commercially relevant assets, capable of generating livelihoods through non-timber forest products (NTFPs), eco-tourism, and biodiversity-based trade.

Judicial interventions, through constitutional provisions and environmental jurisprudence, function as ecosystem governance instruments, regulating access, conservation, and utilization of these resources. Landmark judicial principles such as the Public Trust Doctrine and sustainable development ensure that natural capital is preserved while allowing controlled economic use.

The interaction between biodiversity and governance structures shapes biodiversity-based commerce, influencing income generation, employment opportunities, and local economic systems. These economic outcomes, in turn, impact human development indicators, including health, livelihood security, and overall well-being. The framework thus establishes a dynamic and interdependent relationship where:

- Biodiversity and forests form the base of natural capital.
- Judicial governance regulates resource use and conservation.
- Commerce activities convert natural capital into economic value.
- Economic outcomes influence human development.
- Human development feeds into sustainable development goals.

This integrated approach highlights that sustainable development can only be achieved when ecological sustainability, economic growth, and human welfare are simultaneously addressed, aligning with global frameworks such as the Sustainable Development Goals (SDGs) and the Convention on Biological Diversity (CBD).

7. Conceptual Model

Biodiversity & Forests (Natural Capital)

Judicial Governance (SC/HC, Legal Doctrines)

Resource Regulation & Conservation

Commerce Activities

(NTFPs, Eco-tourism, Bio-trade, Green Economy)

Livelihood & Income Generation

Human Development Outcomes (Health, Employment, Welfare)

Sustainable Development (SDGs / CBD Alignment)

8. Methodology

8.1 Research Design

The study adopts a descriptive and analytical research design, integrating ecological, economic, and legal dimensions of biodiversity and forest governance. It follows a multidisciplinary approach consistent with commerce-based environmental analysis.

8.2 Nature and Sources of Data

The study is based on secondary data collected from reliable and authoritative sources, including:

- India State of Forest Report (FSI, 2023),
- National Family Health Survey (NFHS-5, 2020),
- Periodic Labour Force Survey (PLFS, 2019),
- TRIFED Reports (2021),
- IUCN Red List (2023),
- Ministry of Environment, Forest and Climate Change (MoEFCC) reports,
- Ministry of Tribal Affairs reports, and
- Judicial case laws (Supreme Court and High Courts).

8.3 Justification for Secondary Data

Primary data collection in biodiversity and judicial studies is constrained by geographical dispersion, resource limitations, and accessibility issues. Therefore, secondary data provides a comprehensive, reliable, and policy-relevant basis for analysis, particularly when derived from government and international sources.

8.4 Analytical Tools and Techniques

The study employs the following analytical approaches:

- **Comparative Analysis:**
Forest vs non-forest regions (health and livelihood indicators).
- **Trend Analysis:**
Forest cover, biodiversity status, and carbon stock over time.
- **Economic Interpretation:**
Assessment of biodiversity-based commerce (NTFPs, trade, eco-tourism).
- **Doctrinal Legal Analysis:**
Examination of judicial decisions and environmental doctrines.

9. Results and Data Interpretation

The results of the study are presented across key thematic dimensions, including forest resources, biodiversity status, human development indicators, livelihood systems, judicial governance, and climate linkages. The analysis integrates ecological, economic, and policy perspectives to highlight the role of biodiversity as a natural capital asset within a sustainable development framework. Biodiversity in India functions not only as an ecological resource but also as a natural capital asset with significant economic and developmental implications.

9.1 Forest Cover Trends and Resource Quality

Table-1: Forest Cover Trends in India (2001-2023)

Year	Very Dense Forest	Moderately Dense Forest	Open Forest	Total Forest Cover (%)
2001	83,000	316,000	288,000	21.5
2011	84,000	310,000	297,000	21.7
2019	85,000	306,000	302,000	21.8
2023	85,400	304,000	305,000	21.9

Source: FSI, 2023.

The data indicate a marginal increase in total forest cover over time. However, dense forest categories have remained relatively stagnant, while open forests have increased, suggesting qualitative degradation of forest resources. From a commerce perspective, this decline in forest quality directly affects the productivity of non-timber forest products (NTFPs) and ecosystem services, thereby influencing rural incomes and economic sustainability. This trend highlights challenges in achieving **SDG 15 (Life on Land)** and its economic linkage with **SDG 8 (Decent Work and Economic Growth)**.

Beyond forest quantity, biodiversity indicators provide deeper insight into ecosystem health and sustainability.

9.2 Biodiversity Status and Species Vulnerability

Table-2: Threatened Species in India (IUCN Red List, 2023)

Category	Mammals	Birds	Amphibians	Medicinal Plants
Critically Endangered	20	17	36	45
Endangered	96	82	48	120
Vulnerable	150	97	55	210

The results reveal a significant number of species under threat, particularly medicinal plants that form the backbone of traditional healthcare and biodiversity-based trade.

The loss of biodiversity reduces the economic potential of bio-resources, affecting pharmaceutical value chains, traditional medicine systems, and

export-oriented bio-commerce. This directly undermines SDG 3 (Good Health and Well-being) along with biodiversity conservation goals.

The implications of biodiversity loss extend beyond ecological degradation to human development outcomes.

9.3 Human Development Indicators in Forest Regions

Table-3: Health Indicators (Forest vs Non-Forest Regions)

Indicator	Forest Regions	Non-Forest Regions
Child Stunting (%)	41	30
Anemia (%)	58	45
Institutional Birth (%)	62	81
Clean Fuel Access (%)	22	65

Source: NFHS-5, 2020.

The data reveal that forest-dominated regions exhibit weaker health and development indicators compared to non-forest regions. This reflects a structural paradox where ecologically rich regions remain economically and socially deprived. From a commerce lens, this indicates underutilization of biodiversity as an income-generating and development-supporting asset. The findings highlight the need to integrate biodiversity with livelihood enhancement and public health strategies, contributing to SDG 3 and SDG 1 (No Poverty). Livelihood patterns further reinforce the economic significance of biodiversity.

9.4 Livelihood Dependence and Biodiversity-Based Commerce

Table-4: Income Composition in Forest-Dependent Communities

Income Source	% Contribution
Agriculture	30%
Wage Labour	25%
NTFPs	35%
Migration	10%

Source: PLFS, 2019; TRIFED, 2021.

The above results indicate that biodiversity-based resources contribute significantly to household income, with NTFPs accounting for approximately 35% of total income in forest-dependent communities.

This confirms that biodiversity functions as a commercial capital asset, supporting livelihoods and rural economies. However, the absence of structured markets, value addition, and formal trade integration limits its full economic potential. Strengthening biodiversity-based commerce can enhance employment and support SDG 8 and SDG 12 (Responsible Consumption and Production).

Governance mechanisms play a crucial role in regulating and shaping these interactions.

9.5 Judicial Governance and Environmental Regulation

Table-5: Major Judicial Interventions in Biodiversity Governance

Year	Case	Key Principle	Impact
1987	M.C. Mehta v. Union of India	Environmental protection	Pollution control
1996	Godavarman Case	Forest definition expanded	Forest governance
1997	Kamal Nath Case	Public Trust Doctrine	Resource protection
2011	Lafarge Case	Sustainable development	Regulated mining

The above analysis demonstrates that judicial interventions have played a significant role in shaping environmental governance in India.

Courts have acted as ecosystem governance instruments, ensuring conservation and regulating resource use. However, the integration of judicial decisions with economic policies and livelihood systems remains limited, indicating the need for a more balanced and inclusive governance framework.

Climate-related ecosystem services further extend the value of forest resources.

9.6 Carbon Stock and Climate Linkages

Table-6: Forest Carbon Stock in India

Year	Total Carbon Stock (Mt)
2001	14,000
2011	14,120
2019	14,180
2023	14,220

Source: FSI, 2023.

The data contained in the table above show a gradual increase in forest carbon stock, indicating the role of forests in climate mitigation.

While this contributes to **SDG 13 (Climate Action)**, the economic valuation of carbon services and integration into carbon markets remain underdeveloped. This represents an opportunity to align ecological conservation with green finance and global climate frameworks.

Integrated Analysis and Global Perspective: The results collectively demonstrate that biodiversity and forests in India function as a **multi-dimensional natural capital system**, influencing ecological stability, economic activities, and human development outcomes.

While India has achieved relative success in maintaining forest cover and strengthening judicial governance, biodiversity loss and human development disparities persist. This reflects a gap between conservation efforts and their translation into **economic and social benefits**.

From a global perspective, these findings align with the objectives of the Convention on **Biological Diversity (CBD)** and the **Sustainable Development Goals (SDGs)**. India's experience suggests that:

- » Biodiversity conservation must be integrated with commerce and livelihood systems.
- » Judicial frameworks can serve as **institutional mechanisms for sustainability governance**.
- » Economic valuation of biodiversity is essential for achieving global sustainability targets.

Policy-Oriented Insight (Result-Based Recommendation): The results indicate that sustainable development can be achieved by:

- » Integrating biodiversity into **formal economic systems and markets**.
- » Strengthening value chains for **NTFPs and bio-resources**.
- » Aligning judicial interventions with **livelihood and development policies**.
- » Promoting green finance mechanisms such as **carbon markets and ecosystem valuation**.

It must be emphasized that the **biodiversity in India is not merely an ecological resource but a commercial and developmental asset, whose effective governance can bridge the gap between conservation and human welfare**.

The findings establish that **biodiversity in India is not merely an ecological resource but a strategic economic asset, and its effective governance through commerce, policy, and judiciary can bridge the gap between conservation and human development, offering a model for global sustainability frameworks**.

10. Findings of the Study and Discussion

This study positions biodiversity not merely as an environmental concern, but as a strategic economic and developmental resource, and highlights India's potential to lead a global transition towards integrated, commerce-driven, and governance-supported sustainability frameworks.

10.1 Forest Cover vs Quality

India shows marginal increase in forest cover; however, the stagnation of dense forests and rise in open forests indicate declining ecological quality and productivity.

10.2 Biodiversity Under Threat

A significant proportion of species, particularly medicinal plants, fall under threatened categories, reducing ecological resilience and bio-economic potential.

10.3 Development Paradox

Forest-rich regions exhibit comparatively lower health and livelihood indicators, reflecting a disconnect between ecological wealth and human development outcomes.

10.4 Biodiversity as Livelihood Asset:

Non-timber forest products (NTFPs) contribute substantially to household income, establishing biodiversity as a key commercial capital asset.

10.5 Underutilization of Economic Potential

Despite its importance, biodiversity-based commerce remains underdeveloped due to weak market integration, limited value addition, and institutional gaps.

10.6 Judicial Role in Governance:

Judicial interventions have strengthened environmental protection and function as effective ecosystem governance instruments, though their economic integration remains limited.

10.7 Carbon and Climate Potential

Forest carbon stock demonstrates climate mitigation potential; however, economic valuation and integration into carbon markets remain insufficient.

10.8 Lack of Integrated Framework

The absence of coordination between ecological conservation, economic systems, and governance frameworks limits the effectiveness of sustainable development efforts.

10.9 Global Relevance

India possesses strong ecological, institutional, and judicial foundations, with the potential to serve as a global model for biodiversity-based sustainable development aligned with SDGs and CBD frameworks.

Biodiversity in India remains an underutilized natural capital asset, whose effective integration with commerce, governance, and policy can bridge the gap between conservation and human development. This highlights the potential for integrating India's forest resources into global carbon markets and climate finance mechanisms.

11. Discussion

The findings of this study highlight the need to re-conceptualize biodiversity and forests not merely as ecological entities, but as integrated natural capital systems that simultaneously influence economic activity, governance structures, and human development outcomes.

11.1 From Conservation to Natural Capital Perspective

The results indicate that traditional conservation approaches, which focus primarily on protecting forest cover, are insufficient in addressing biodiversity degradation and socio-economic disparities. While India has achieved relative stability in forest cover (FSI, 2023), the stagnation of dense forests and the continued decline in biodiversity suggest that conservation policies must shift towards a natural capital framework, where ecological resources are evaluated in terms of both environmental and economic value (Costanza *et al.*, 1997; World Bank, 2018). This

aligns with global sustainability discourse, which emphasizes that biodiversity conservation must be linked with economic systems to ensure long-term viability.

11.2 Commerce-Biodiversity Link: Untapped Potential

The study demonstrates that biodiversity-based resources, particularly non-timber forest products (NTFPs), play a significant role in supporting rural livelihoods. However, the lack of structured markets, value addition, and institutional support limits their economic potential.

From a commerce perspective, this indicates that biodiversity remains an underutilized economic asset, despite its capacity to generate employment, income, and trade opportunities. Strengthening value chains, promoting eco-certification, and integrating biodiversity into formal markets can transform it into a driver of sustainable economic growth, contributing to SDG 8 (Decent Work and Economic Growth) and SDG 12 (Responsible Consumption and Production).

11.3 The Development Paradox: Rich Ecology, Poor Human Outcomes

One of the most significant findings is the paradox of biodiversity-rich yet development-poor regions, where communities dependent on forest resources exhibit weaker health and livelihood indicators (NFHS-5, 2020).

This paradox reflects a disconnect between ecological wealth and human development, supporting Sen's (1999) argument that access to resources does not automatically translate into improved capabilities and well-being.

Therefore, biodiversity conservation must be accompanied by targeted investments in health, education, and livelihood diversification, ensuring that ecological resources contribute directly to human development outcomes (SDG 3 and SDG 1).

11.4 Judiciary as an Ecosystem Governance Instrument

The study reinforces the role of the judiciary as a central pillar of environmental governance in India. Landmark judgments such as *Godavarman* and *M.C. Mehta* have expanded the scope of environmental protection and established principles such as the Public Trust Doctrine.

However, the findings suggest that while judicial interventions are effective in enforcing conservation, their integration with economic and social policies remains limited.

A more coordinated governance approach is required, where judicial decisions are complemented by policy frameworks that address livelihood concerns and economic sustainability.

11.5 Climate and Green Finance Opportunities

The gradual increase in forest carbon stock highlights the role of forests in climate mitigation. However, the economic valuation of carbon services remains underdeveloped in India.

Integrating forests into carbon markets, green finance mechanisms, and ecosystem valuation frameworks can enhance their economic value while contributing to SDG 13 (Climate Action).

This approach aligns with global climate governance frameworks and offers opportunities for linking biodiversity conservation with financial incentives.

11.6 India in the Global Biodiversity Framework

From a global perspective, the findings position India as a potential model for integrating biodiversity, commerce, and governance.

India's strengths include:

- Strong judicial framework for environmental protection.
- Rich biodiversity resources.
- Established community-based livelihood systems.

However, to fully align with the Convention on Biological Diversity (CBD) and SDG targets, India must:

- Strengthen economic valuation of biodiversity.
- Integrate conservation with development policies.
- Enhance institutional coordination across governance levels.

The discussion establishes that sustainable development requires a triangular integration:

- Ecology (Biodiversity Conservation).
- Economy (Commerce and Livelihoods).
- Governance (Judicial and Policy Frameworks).

The absence of any one dimension leads to imbalance, as reflected in the persistence of biodiversity loss and human development gaps. The absence of structured value chains and formal market access constrains the transformation of biodiversity into scalable economic capital. This indicates that biodiversity is not being effectively monetized or integrated into local economic systems.

The alignment between results and findings indicates that biodiversity in India operates as an underutilized natural capital system, where ecological resources, economic activities, and governance mechanisms remain insufficiently integrated. The persistence of development disparities in biodiversity-rich regions reflects the need for a commerce-driven and policy-aligned approach, supported by judicial governance. This integrated perspective reinforces the relevance of the study in both national and global sustainability contexts.

The study argues that biodiversity conservation must evolve from a protection-oriented approach to a commerce-integrated governance framework, where ecological sustainability, economic development, and human welfare are pursued simultaneously.

12. Conclusion

The study establishes that biodiversity and forests in India must be understood as multi-dimensional natural capital assets, influencing ecological sustainability, economic activities, and human development outcomes simultaneously. While India has achieved relative progress in maintaining forest cover and strengthening judicial governance, significant challenges remain in terms of biodiversity loss, resource degradation, and socio-economic disparities in forest-dependent regions.

The findings highlight a critical disconnect between ecological wealth and human development, where biodiversity-rich regions continue to experience lower levels of health, income, and access to basic services. This indicates that conservation efforts, when not integrated with economic and social policies, fail to deliver inclusive development outcomes.

The study concludes that sustainable development requires a holistic and integrated framework, where biodiversity conservation is aligned with commerce, governance, and human development.

13. Policy Recommendations

Based on the findings, the following policy recommendations are proposed:

13.1 Integration of Biodiversity into Economic Frameworks

- Recognize biodiversity as a formal economic asset in national accounting systems
- Promote valuation of ecosystem services

13.2 Strengthening Biodiversity-Based Commerce

- Develop structured markets for NTFPs, medicinal plants, and eco-tourism
- Encourage value addition, branding, and export promotion
- Support rural entrepreneurship and tribal cooperatives

13.3 Linking Conservation with Human Development

- Integrate biodiversity policies with health, nutrition, and livelihood programs
- Improve access to basic services in forest regions

13.4 Judicial-Policy Coordination

- Align judicial interventions with economic and development policies
- Strengthen implementation mechanisms at local and regional levels

13.5 Promotion of Green Finance and Carbon Markets

- Develop frameworks for carbon credit systems and ecosystem valuation
- Encourage investment in restoration and conservation projects

13.6 Global Alignment and SDG Integration

- Align national policies with CBD targets and SDGs
- Position India as a global model for biodiversity governance and sustainable commerce

14. Contribution of the Study

This study contributes theoretically by extending the concept of biodiversity as natural capital through the integration of ecological, economic, and governance perspectives. Empirically, it presents a multidimensional analysis combining forest data, biodiversity indicators, human development metrics, and judicial case studies. Methodologically, the study adopts an interdisciplinary approach linking commerce, ecology, and law, an area relatively underexplored in existing literature. It also offers policy-oriented insights for integrating biodiversity into economic planning, governance frameworks, and sustainable development strategies.

15. Limitations of the Study

The study is subject to following methodological and data-related limitations that may affect the depth, regional coverage, and empirical comprehensiveness of the analysis:

- The study is based primarily on secondary data, which may limit micro-level insights.
- Regional variations within India may not be fully captured.
- Judicial impact assessment is largely qualitative and interpretative.
- Lack of primary field data on community-level biodiversity utilization.

16. Scope for Future Research

The following areas offer important directions for advancing research on biodiversity conservation through interdisciplinary, comparative, technological, and policy-oriented approaches:

- Conduct primary field-based studies on biodiversity-dependent communities.
- Explore state-level comparative analysis of biodiversity and development.
- Examine the role of private sector and green finance mechanisms in biodiversity conservation.
- Study global comparative models for integrating biodiversity with commerce and governance.
- Analyze the impact of digital and technological interventions (e.g., remote sensing, AI) in biodiversity management.

The above areas indicate significant opportunities for interdisciplinary and policy-oriented research to strengthen the integration of biodiversity conservation with sustainable development, governance, and technological innovation.

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