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Community Participation in Biodiversity Preservation: Case studies from Sacred Groves and Forests of Madhya Pradesh

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Abstract: Sacred groves in India represent one of the oldest community-led biodiversity conservation models. These culturally protected forest patches, rooted in religious beliefs and Indian Knowledge Systems (IKS), serve as critical refugia for rare and endemic species. Sacred groves in India embody one of the most enduring examples of community-driven biodiversity preservation, deeply rooted in Indian Knowledge Systems (IKS) and cultural-religious traditions. These community-protected forest patches, preserved through religious taboos, rituals, and collective stewardship, function as vital refugia for rare, endangered, and endemic flora and fauna in increasingly fragmented landscapes. This paper explores the mechanisms of community participation in biodiversity conservation via sacred groves, with a focused analysis on Madhya Pradesh — a state rich in tribal diversity and facing urbanization pressures in cities like Indore and Bhopal. Drawing on secondary data from ecological inventories and peer-reviewed studies, the research demonstrates that sacred groves in Madhya Pradesh support significantly higher species richness (e.g., 109 tree species in 59 surveyed groves), tree density, basal area, and carbon storage (mean 153.8 Mg C/ha, 33.1% higher than surrounding forests) compared to non-protected areas. By examining case studies from Jhabua, Alirajpur, and Nimar regions, the paper highlights how Bhil and other tribal communities' indigenous practices offer cost-effective, culturally resilient models. The findings provide actionable lessons for integrating traditional IKS with modern sustainable urban development frameworks, contributing to SDGs 13 and 15 while addressing climate resilience and green infrastructure needs in rapidly urbanizing Indian cities.

Keywords*: Sacred Groves, Community Participation, Madhya Pradesh, Biodiversity Conservation, Bhil Tribe, Indian Knowledge Systems, Carbon Storage.*

1. Introduction

India hosts one of the highest concentrations of sacred groves (also called sacred forests) globally, estimated between 100,000 and 150,000, though documented figures range from 14,000 to over 100,000 depending on surveys. India's sacred groves represent a unique biocultural heritage where local communities have protected forest patches for centuries based on spiritual beliefs, ancestral reverence, and ecological wisdom embedded in Indian Knowledge Systems (IKS). These groves, varying in size from a few trees to several hectares and known regionally as Dev Khera,

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Saran, Devrai, or Sarna, are dedicated to deities, spirits, or ancestors. They prohibit tree felling, excessive resource extraction, and other disruptive activities through strict cultural taboos and collective community enforcement. This traditional model has proven remarkably effective in conserving biodiversity amid widespread habitat loss, deforestation, and climate change impacts.

Madhya Pradesh (MP), often called the heart of India, holds special significance in this context due to its rich tribal population (particularly Bhil, Bhilala, and Gond communities) and diverse forest ecosystems. The state is estimated to have hundreds of sacred groves, especially in districts like Jhabua, Alirajpur, Nimar, and Chhatarpur. These community-managed sites not only preserve high levels of indigenous flora and fauna but also provide critical ecosystem services such as water recharge, soil conservation, and medicinal plant resources. For instance, in the Nimar region, 59 documented sacred groves harbour 109 tree species and exhibit superior carbon sequestration capacity, directly supporting climate resilience goals.

This paper focuses on Community Participation in Biodiversity Preservation through sacred groves, drawing key lessons from Madhya Pradesh. Rapid urbanization in MP cities like Indore (known for its clean city initiatives) and Bhopal creates increasing pressure on surrounding ecosystems. Sacred groves near urban fringes offer practical models for integrating traditional ecological wisdom with modern smart city planning, green infrastructure, and water-sensitive urban design. By analyzing quantitative data on species diversity, carbon stocks, and community governance, this study underscores how culturally rooted participation can complement formal conservation efforts under frameworks like the National Biodiversity Action Plan and Smart Cities Mission. The research ultimately aims to bridge ancient IKS practices with contemporary sustainable development challenges in India.

2. Literature Review

Sacred groves function as biodiversity hotspots and carbon reservoirs in highly fragmented landscapes. A global meta-analysis (Sullivan et al., 2024) of 35 studies across 17 countries found that sacred forests generally harbour biodiversity levels comparable to or higher than nearby non-sacred forests, with stronger positive effects observed for plant taxa. In India, sacred groves are recognized as effective community-based natural resource management (CBNRM) systems.

Global & National Context:

A 2024 meta-analysis (Sullivan et al.) across 35 studies in 17 countries found sacred forests often match or exceed non-sacred forests in biodiversity, with stronger effects on plants. In India, Bhagwat & Rutte (2006) and Khan et al. (2008) established their significance as biocultural hotspots. Ormsby (2010) highlighted community management in Western Ghats and Meghalaya.

Regional and Thematic Studies:

Central India (Madhya Pradesh):Dar et al. (2022) inventoried 59 sacred groves and recorded 109 tree species (90 genera, 40 families), with mean tree density of 398 individuals/ha and total carbon stock of 153.8 Mg C/ha — 33.1% higher than surrounding state forests.

Western Ghats: Studies on Devakad groves in Kodagu highlight their role as refuges for endemic and medicinal plants, supported by strong village-level community management.In Western Ghats1,214 sacred groves cover ~2,500 ha, supporting diverse flora/fauna.

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Northeast India (Meghalaya):Law Kyntanggroves maintained by Khasi and Jaintia tribes show higher biodiversity than disturbed forests.

Himalaya & Other Regions:Anthwal et al. (2010) documented traditional beliefs in Uttarakhand contributing to biodiversity conservation through sacred groves. Khan et al. (2008) emphasized their global significance as virgin forest patches protected by taboos.

Bhagwat & Rutte (2006) noted the potential of sacred groves for biodiversity management. Recent reviews (2023–2025) highlight threats from urbanization and cultural erosion while stressing integration with formal policies.

Rajora et al. (2019) documented three groves in Jhabua District (Bhil-dominated): Strong protection of rare/endangered species (Ghost tree, Indian Kino) and medicinal plants through deity-linked taboos and collective responsibility.

In Alirajpur District, Ishwar Baba Sacred Grove recorded 144 plant species (57 families, 134 genera), with herbs dominant (50%).

Sainkhediya& Ray (2014) reported 12 sacred groves in Nimar region conserving 15 endangered/RET plants(e.g.Gloriosa superba, Ceropegia hirsuta).

A 2026 study in Chhatarpur District compared sacred groves (Jatashankar, Bhimkund) with degraded forests: Higher Shannon-Wiener diversity ($H' = 3.0–3.2$ vs. 1.8–2.0) and Simpson's Index in groves, showing greater resilience under climate stress.

Thematic Insights: Literature consistently shows cultural norms (taboos, rituals) drive low-cost, effective conservation. Threats include encroachment, cultural erosion, and urbanization (especially near Indore/Bhopal). Hybrid approaches (IKS + modern monitoring) are recommended.

Research Gap

Although numerous studies have documented the ecological importance of sacred groves in different regions of India, limited research has specifically examined the relationship between community participation, Indian Knowledge Systems, and biodiversity conservation in Madhya Pradesh. Moreover, the integration of sacred grove conservation into sustainable urban development and climate resilience planning remains underexplored. This study attempts to bridge this gap by analyzing ecological data alongside community-based conservation practices in selected sacred groves of Madhya Pradesh.

Study Area

The study focuses on sacred groves and community-protected forest patches of Madhya Pradesh, particularly in the districts of Jhabua, Alirajpur, Nimar (Khargone and Barwani regions), and Chhatarpur. These areas are characterized by rich tribal populations, including Bhil, Bhilala, and Gond communities, and diverse dry deciduous forest ecosystems. The selected sacred groves serve as important repositories of biodiversity, traditional ecological knowledge, carbon storage, and community-based conservation practices.

3. Objective and Methodology

1. To examine the role of sacred groves as community-managed systems for biodiversity conservation in Madhya Pradesh.
2. To analyze the participation of tribal and local communities (especially Bhil, Bhilala, and Gond communities) in protecting sacred groves and forest resources.
3. To assess the ecological significance of sacred groves in

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terms of species diversity, carbon sequestration, and ecosystem services.
4. To document traditional ecological knowledge and cultural practices that contribute to biodiversity preservation.
5. To evaluate selected case studies from Jhabua, Alirajpur, Nimar, and other regions of Madhya Pradesh.
6. To identify the major threats faced by sacred groves, including urbanization, cultural erosion, and climate change

Methodology

Secondary data analysis from peer-reviewed sources (2022–2026), government reports, and field inventories.
Quantitative: Species richness, density, carbon stocks.
Qualitative: Thematic analysis of community practices.

Data Sources:

- Peer-reviewed journals (e.g.Biotropica, Journal of Forestry Research, Environmental Conservation).
- Reports from MoEFCC, state forest departments, and NGOs.
- Meta-analyses and case studies from Western Ghats, Northeast, Central India, and Himalaya.
- ResearchGate, Wiley Online Library, and government publications (2020–2025).

Data Analysis:

- Quantitative:Comparative statistics on species richness, tree density, basal area, and carbon stocks.
- Qualitative:Thematic analysis of governance models, taboos, rituals, and community practices.
- Limitations:Regional data variability and reliance on existing inventories.

4. Results and Data Analysis

Table: Key Madhya Pradesh Sacred Groves – Biodiversity and Community Data

Region / District	Grove Details	Key Biodiversity & Ecological Data	Community Participation Practices
Central MP (Nimar & nearby	59 Sacred Groves	109 tree species (90 genera, 40 families); Density: mean 398/ha; Basal area: 24.2 m²/ha; Carbon stock: mean 153.8 Mg C/ha (33.1% higher than state forests).	Bhil & local tribes; religious taboos, collective stewardship
Jhabua District	Three groves (e.g., Khairmal, Kallipura)	Rich in RET species (Ghost tree, Indian Kino, Dalbergia); High medicinal plants.	Bhil tribe: Deity-linked protection, unwritten laws, rituals
Alirajpur District	Ishwar Baba Sacred Grove	144 plant species (57 families, 134 genera); Herbs	Tribal belief-based; collective responsibility

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		dominant (50%)	
Nimar Region	Multiple groves	High RET plants (94 species documented); Keystone ecological value	Traditional taboos, clan-specific sacred species

5. Analysis of Specific Madhya Pradesh Case Studies

Central Madhya Pradesh (59 Groves – Dar et al., 2022), Tree Diversity, Biomass and Carbon Stocks in Sacred Groves of Central India.

This comprehensive inventory in Nimar and surrounding areas recorded 109 tree species. Dominant families: Fabaceae, Combretaceae, Malvaceae, Moraceae. Tree density ranged 75–925 individuals/ha, basal area 2.5–69.2 m²/ha. Total carbon stock (tree + soil 0–30 cm) averaged 153.8 Mg C/ha, significantly higher than surrounding forests. Positive correlations exist with grove age and distance from villages, indicating reduced disturbance enhances conservation. Community participation maintains these benefits through traditional rules, making groves effective carbon reservoirs and biodiversity refugia.

Biodiversity Metrics

- Species Diversity: In Central Indian (MP) sacred groves: 109 tree species (90 genera, 40 families). Dominant families: Fabaceae, Combretaceae. Tree density: 75–925 individuals/ha (mean 398 ± 32). Basal area: 2.5–69.2 m²/ha (mean 24.2 ± 1.9).
- Comparison: Sacred groves often harbour 33.1% higher total carbon stock and 74.7% of regional tree diversity compared to surrounding forests.
- National Scale: Groves cover ~1,000 km² of unexploited land, preserving rare/endemic flora and fauna (e.g., threatened medicinal plants, orchids in Meghalaya).

Carbon Storage and Ecosystem Services; Total Carbon stock (tree + soil 0–30 cm): 44.7–455.4 Mg C/ha (mean 153.8 ± 9.6 Mg C/ha). Positive correlation with tree basal area and distance from villages.

Jhabua District (Bhil-Dominated Groves – Rajora et al., 2019)

Three studied groves show strong ecological-cultural linkage. Bhil tribe (37.7% of MP's tribal population) protects them for deities and ancestors. Rare species like Ghost tree (Ailanthus excelsa) and Indian Kino (Pterocarpus marsupium) thrive due to taboos against felling (only fallen wood allowed). Collective responsibility and rituals sustain groves despite pressures. This model demonstrates in-situ conservation of medicinal plants and keystone species, driven by indigenous knowledge.

Alirajpur District (Ishwar Baba Grove)

In the article Faith and Healing in the sacred groves of madhyapradesh by sahanaghoshAlirajpur district is Documented with144 plant species(herbs 50%, trees ~23%). Serves as a medicinal plant hub. Bhil and Bhilala communities follow unwritten laws rooted in faith. Threats include overexploitation of herbs and youth cultural erosion, yet belief systems provide resilience.

Nimar Region

Sainkhediya& Ray (2014), Studies on the sacred groves of Nimar region, Madhya Pradesh, India, highlight 94 rare/threatened plants. Groves act as gene pools, protected by tribal myths and clan

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associations with specific species of ecological importance.

Madhya Pradesh groves outperform many formal forests in local diversity and carbon storage due to community-driven governance. Cultural buy-in ensures low-cost, sustainable protection. However, urbanization near Indore/Bhopal fringes and generational shifts pose risks. Hybrid models (IKS + GIS monitoring) could scale success.

6. **Discussion: Lessons Learned and Conclusion**

Strengths: Cost-effective, culturally embedded conservation with high ecological returns (e.g., carbon storage, medicinal plants), Culturally embedded, low-cost, high ecological returns. Maintains genetic diversity and ecosystem services (water, soil, medicinal plants).Aligns with IKS and SDGs (13, 15).

Challenges:Urban encroachment near Indore/Bhopal, generational knowledge gaps,cultural dilution, and climate stress, urbanisation, industrialisation, liberalisation, mining activities etc.

Policy Relevance: Integrate sacred groves into National Biodiversity Action Plan, Smart Cities green infrastructure, and Joint Forest Management with stronger legal recognition and community incentives.Strong potential for hybrid models in sustainable urban development.

Indian sacred groves exemplify successful community participation in biodiversity preservation. Data shows they outperform many formal systems in local contexts through cultural stewardship.sacred groves of Madhya Pradesh exemplify effective community participation. Data from Dar et al., Rajoura et al., and others confirm their value. Integrating these with modern policies can advance biodiversity goals.The study further reveals that indigenous knowledge systems and cultural traditions of tribal communities such as the Bhil, Bhilala, and Gond have been instrumental in sustaining these ecosystems over generations.

Religious beliefs, sacred taboos, customary laws, and collective stewardship have created an effective conservation framework that operates at minimal financial cost while ensuring long-term ecological sustainability. Such culturally embedded conservation practices offer valuable lessons for modern biodiversity management and climate resilience strategies.

However, sacred groves are increasingly threatened by urban expansion, land-use change, cultural erosion, and declining intergenerational transmission of traditional knowledge. Without appropriate policy support and community engagement, the ecological and cultural values of these sacred landscapes may gradually diminish. Therefore, there is an urgent need for legal recognition, systematic documentation, community incentives, and integration of sacred groves into biodiversity conservation programs, climate action plans, and sustainable urban development initiatives.

7. Recommendations

1. Statewide mapping and legal recognition.
2. Community incentives and youth education.
3. Integration with Smart Cities and National Biodiversity Plans.
4. Nationwide mapping and legal recognition.
5. Community capacity building.
6. Integration with modern technologies (GIS monitoring).
7. Longitudinal studies on resilience.

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