Assessing Public Attitudes Toward Conservation of Endangered Plant Species in India: A Survey Study

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Abstract:
This study investigates public attitudes toward the conservation of endangered plant species in India—an area historically underexplored in conservation discourse dominated by faunal protection. Utilizing a structured cross-sectional survey, data were collected from 612 respondents across five ecologically and culturally diverse Indian states (Uttarakhand, Kerala, Maharashtra, Assam, and Madhya Pradesh) through stratified random sampling. The study aimed to assess levels of awareness, perceived urgency, willingness to participate, and policy preferences regarding plant conservation, while also identifying socio-demographic determinants of these attitudes. Quantitative analysis using descriptive statistics, chi-square tests, and ANOVA revealed that awareness levels are moderate overall, with education emerging as a key predictor of both awareness and urgency perception. Urban participants displayed higher engagement with digital and monetary forms of support, whereas rural populations favored participatory activities like tree-planting. Key barriers to participation included lack of information, time constraints, and low visibility of conservation campaigns. Respondents showed strong support for policy tools like environmental education, tax incentives, and community seed banks, suggesting a civic readiness to support plant protection if adequately mobilized. The study concludes that a pluralistic, hybrid conservation model—integrating educational reforms, local participation, and institutional support—is vital to make endangered plant conservation inclusive and effective. It also identifies future research needs in longitudinal tracking, behavioral evaluation, and qualitative exploration of socio-cultural drivers. This work contributes empirical evidence for reorienting conservation governance to include public perspectives, particularly in developing-country contexts.

Keywords: endangered plants, public attitudes, conservation India, biodiversity awareness, plant protection, ecological policy.

1. INTRODUCTION

The biodiversity of India, home to over 47,000 plant species, stands as one of the richest in the world, but this biodiversity faces growing threats due to rapid urbanization, deforestation, agricultural expansion, and climate change (Sharma & Thokchom, 2014). Among these diverse species, a significant proportion are classified as endangered, particularly medicinal and endemic plants that are critically vulnerable to habitat loss and overexploitation. India's conservation agenda has historically emphasized charismatic fauna, often sidelining flora in policy and public discourse (Jalli, Aravind & Pandey, 2015). With 28% of Indian plant species considered threatened and many listed under the IUCN Red List, the ecological repercussions of plant extinction ripple through ecosystems and human livelihoods (Gowthami, Sharma & Pandey, 2021).

While legislative and institutional mechanisms such as the Biological Diversity Act (2002), Forest Rights Act (2006), and India's National Biodiversity Authority have been enacted, their implementation remains fragmented. The lack of community engagement and weak public support further hampers conservation initiatives (Karanth, Kramer & Qian, 2008). Conservation science has gradually expanded its focus to include socio-ecological dimensions, particularly public attitudes, which shape both compliance and collaboration in

conservation efforts (Talukdar & Gupta, 2018). In India, especially rural areas adjacent to biodiversity hotspots, attitudes toward plant conservation are influenced by cultural values, economic dependency, and perceived government neglect (Bhat et al., 2012). Public perception studies worldwide have underscored the need to understand laypeople's views toward conservation as a tool for policy formulation, awareness programs, and participatory conservation (Badola, Barthwal & Hussain, 2012). However, India lacks a comprehensive, empirical analysis of how its diverse populace perceives and prioritizes plant species conservation. The growing chasm between conservation science and societal awareness poses a risk to achieving the UN Sustainable Development Goals, especially SDG 15 (Life on Land) (Ridwan et al., 2023). Despite a robust body of ecological literature on threatened plant species, little research has systematically examined the public's awareness, perception, and behavioral inclinations toward conservation in India (Shivanna & Sanjappa, 2021). Previous studies have primarily focused on forest and wildlife conservation, largely ignoring endangered plant species (Varma et al., 2015). The available work on plant conservation attitudes is either fragmented geographically or limited to case studies of isolated regions like Chakrashila or Bhitarkanika (Talukdar & Gupta, 2018; Badola et al., 2012). Even fewer studies integrate a nationwide quantitative survey approach with a socio-demographic lens to explore how factors like education, rural-urban divide, and economic dependency shape conservation attitudes. This disjunction creates a significant gap in understanding public priorities and cognitive perceptions regarding threatened flora—data that is vital for framing inclusive conservation policies and targeted awareness campaigns (Karanth et al., 2008). While studies like those by Jalli et al. (2015) and Sharma & Thokchom (2014) document endangered species and conservation challenges, they do not address public perception or support mechanisms.

Given the disproportionate focus on wildlife compared to plant conservation in India, there is a critical need to assess how the public perceives, values, and supports endangered plant conservation. The lack of widespread public understanding and engagement hampers the success of conservation programs. Without empirical data on public sentiment, conservation efforts risk being top-down, exclusionary, and ultimately unsustainable. This study aims to assess public attitudes toward the conservation of endangered plant species in India through a structured survey-based approach. It seeks to:

1.   Evaluate the level of public awareness regarding endangered plant species.
2.   Analyze public perception toward the urgency and importance of plant conservation.
3.   Identify socio-demographic factors influencing conservation attitudes.
4.   Explore public willingness to support and participate in conservation activities.

By addressing these objectives, the research aims to inform policy design, outreach programs, and conservation strategies that are both participatory and effective.

This study contributes to bridging the research-policy-practice divide in biodiversity conservation by offering empirical insights into the socio-cognitive dimensions of plant protection. As India continues to experience biodiversity erosion, integrating public opinion into conservation science becomes crucial. Findings from this study will aid government agencies, NGOs, and educational institutions in crafting context-specific, community-engaged conservation interventions. Moreover, this work expands the scholarly discourse on biodiversity governance in developing countries, especially in relation to underrepresented flora.

2. LITERATURE REVIEW

This section organizes and critically analyzes prior studies on endangered plant species conservation, with a focus on public perception and socio-cultural factors influencing conservation efforts. Structured thematically to align with our research objectives—awareness levels, stakeholder perceptions, indigenous knowledge, and public support—this review groups existing research under four central themes.

Theme 1: Public Awareness and Perceptions toward Conservation

Understanding public awareness about conservation practices is fundamental to developing effective biodiversity policies. In a notable study, Karanth et al. (2008) evaluated attitudes toward conservation among Indian citizens and conservation professionals. The study highlighted a significant bias in conservation priorities favoring megafauna over flora and found that public understanding of plant endangerment was limited. Similarly, Varma et al. (2015) analyzed public discourse and perceptions on biodiversity in India, underscoring the lack of representation for endangered plant species in national priorities and suggesting that public opinion surveys are vital for reorienting conservation focus.

Kanagavel et al. (2014) went beyond general public opinion and examined differentiated stakeholder responses—ranging from local residents to practitioners—toward conservation in the Western Ghats biodiversity hotspot. Their results revealed how conservation practitioners valued plant species more than lay communities, emphasizing the critical role of public engagement.

Theme 2: Role of Indigenous Knowledge in Conservation

Indigenous knowledge systems play an invaluable role in the conservation of local flora. Ridwan et al. (2023) explored the perceptions of local communities in the Rajouri District of Jammu and Kashmir, demonstrating that indigenous ecological knowledge significantly contributed to the protection of plant biodiversity. Participants identified 92 useful plant species and expressed willingness to conserve them, motivated by their utility in food, medicine, and culture.

Earlier, Shukla and Gardner (2006) studied community-based medicinal plant conservation initiatives in India, arguing that traditional systems like Unani and Ayurveda maintain a nuanced understanding of sustainable use. Their findings suggest that such community-driven conservation models, grounded in local knowledge, can enhance long-term conservation efficacy.

Theme 3: Socio-Cultural and Religious Influences

Cultural and religious values can act as catalysts for conservation efforts. In Tomalin (2004), the concept of "bio-divinity" was analyzed to demonstrate how religious reverence toward sacred groves and deity-associated flora supported conservation. Religious environmentalism, especially in Hindu traditions, was found to imbue a moral obligation toward nature, particularly plants.

Talukdar and Gupta (2018) investigated conservation-oriented traditions in Assam's Chakrashila Wildlife Sanctuary and reported that cultural attachments to specific plants and forest elements contributed positively to public conservation attitudes. Aesthetic and medicinal values were particularly influential in shaping respondents' conservation behaviors.

Theme 4: Conservation Gaps and Policy Constraints

Despite multiple regulatory mechanisms, policy implementation gaps continue to impede effective conservation. Jalli et al. (2015) provided a comprehensive overview of India's plant conservation status, identifying institutional fragmentation and insufficient funding as major barriers. They called for better integration of public perception data into policy-making.

Zehra et al. (2023) analyzed regulatory mechanisms concerning endangered medicinal plants like *Chlorophytum tuberosum*, concluding that public awareness and decentralized seed banks were critical to improving conservation outcomes.

Kothari et al. (1995) offered a macro-perspective, critiquing India's conservation direction as overly bureaucratic and exclusionary. They emphasized the need for participatory conservation involving local populations, a recommendation still echoed in recent studies.

While existing literature has provided valuable insights into biodiversity conservation, significant gaps remain in empirical research focusing on public attitudes specifically toward endangered plant species. Most studies either address wildlife conservation, general biodiversity, or are restricted to localized case studies with limited generalizability. The absence of a large-scale, quantitative assessment of public opinion on plant conservation across diverse Indian demographics hinders the development of inclusive conservation strategies.

This study seeks to bridge this gap by conducting a structured, survey-based investigation into public awareness, perceptions, and willingness to support endangered plant species conservation in India. By incorporating demographic and cultural dimensions, the research aims to generate actionable insights that can inform targeted policy measures and educational campaigns. Addressing this gap is crucial to fostering a conservation culture that encompasses not only fauna but also the less-visible yet ecologically critical flora.

3. RESEARCH METHODOLOGY

This section details the methodological framework adopted to address the literature gap identified in Section 2.2, focusing on assessing public attitudes toward the conservation of endangered plant species in India. The research was designed as a cross-sectional, descriptive study utilizing a structured quantitative survey method to gather data from a diverse cross-section of the Indian population. The design aligned with the study's objective of generating empirical insights into public awareness, perceptions, and participatory inclinations toward endangered flora conservation.

3.1 Research Design

The study adopted a survey-based quantitative research design, suitable for measuring public perceptions and awareness on a large scale and allowing statistical analysis of trends across socio-demographic groups. A structured questionnaire was developed based on validated instruments from previous biodiversity attitude studies, refined through expert review and a small pilot test (n=30). The final instrument comprised 25 closed-ended items divided into five sections:

- Section A: Demographics (age, gender, education, occupation, residence)
- Section B: Awareness about endangered plant species
- Section C: Perceptions of urgency and ecological value
- Section D: Willingness to support conservation activities
- Section E: Preferred modes of engagement and policy expectations

All items were rated on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), which provided ordinal-level data for quantitative analysis.

3.2 Population and Sampling

The target population included adult individuals (age ≥18) residing in both rural and urban parts of five biodiversity-rich Indian states: Uttarakhand, Kerala, Maharashtra, Assam, and Madhya Pradesh. These states were selected to ensure ecological and cultural diversity as well as varying exposure to conservation programs. A stratified random sampling technique was employed to capture responses across key demographic strata (rural/urban, gender, education level). The total sample size achieved was 612 respondents, exceeding the minimum sample size requirement (n=384) calculated using the Yamane formula (95% confidence level, ±5% margin of error).

3.3 Data Source and Instrument Details

Below is a detailed table summarizing the core elements of the data collection process:

Component	Details
Primary Data Source	Structured online and in-person questionnaire survey
Instrument Format	25-item closed-ended questionnaire with Likert-scale and demographic items
Geographic Coverage	Uttarakhand, Kerala, Maharashtra, Assam, Madhya Pradesh
Sampling Strategy	Stratified random sampling
Respondent Eligibility	Indian citizens, aged 18+, able to understand English or Hindi
Number of Respondents	612 total (urban: 326; rural: 286)
Pilot Tested	Yes, on 30 respondents for validation and refinement
Mode of Survey	65% digital (Google Forms), 35% paper-based
Languages Offered	English, Hindi
Ethical Considerations	Informed consent, anonymity ensured, voluntary participation
Data Collection Period	February to March 2025
Survey Administration	Conducted by trained research assistants and local field workers

3.4 Data Analysis Method

To analyze the ordinal-scale survey responses and test for trends across demographic groups, descriptive statistics and Chi-square tests of independence were used. The Chi-square test was chosen as the primary analytical tool due to its appropriateness for assessing associations between categorical variables, such as levels of awareness or support, and demographic factors like education, gender, or urban-rural divide.

The software SPSS Version 27 was used to:

- Generate frequency distributions and cross-tabulations
- Conduct Chi-square tests for each of the four core objectives
- Report statistically significant relationships at $p < 0.05$

In addition, measures of central tendency (mean, median) and dispersion (standard deviation) were calculated for Likert-scale items to evaluate overall trends in perception and awareness.

3.5 Scope and Limitations

The methodological scope was intentionally focused on five Indian states known for their ecological sensitivity and diversity to ensure relevance to the topic. However, the study did not include North-East

frontier regions or Union Territories due to logistical constraints. While every effort was made to include rural respondents, limited internet access in remote areas slightly skewed the digital data collection toward urban participants. Furthermore, the use of self-reported attitudes may not perfectly translate to actual behavior, which remains a general limitation in perception-based research.

This structured methodology was designed to provide statistically reliable and generalizable insights into public attitudes toward endangered plant conservation in India. By aligning the research design with the gap in empirical, population-level data, the study contributes to a more grounded, actionable understanding of the socio-cognitive landscape surrounding plant conservation efforts.

4. RESULTS AND ANALYSIS

The following section presents the empirical findings derived from the survey of 612 respondents across five states. Descriptive statistics provide an overview of demographic characteristics and core attitude measures, while inferential results (χ^2 tests) illuminate relationships between socio-demographic factors and conservation attitudes. All analyses were executed in SPSS 27; p-values below 0.05 are considered statistically significant. Tables are formatted to approximate APA-style SPSS output. Detailed interpretations follow each table.

Table 1: Respondent Demographics (N = 612)

Variable	Category	n	%
Gender	Male	298	48.7
	Female	310	50.7
	Non-binary/Prefer NA	4	0.6
Age Group (years)	18–29	182	29.7
	30–44	249	40.7
	45–59	126	20.6
	60 +	55	9.0
Education Level	Secondary or below	133	21.7
	Undergraduate	268	43.8
	Postgraduate & above	211	34.5
Residence	Urban	326	53.3
	Rural	286	46.7

Interpretation

Table 1 establishes a balanced sample crucial for reliable inference. Gender distribution approximated national parity, minimizing sex-based sampling bias. A youthful to mid-career majority (70.4 % under 45) suggests respondents are economically active and likely decision-makers—an advantage for gauging willingness to contribute to conservation. Education skewed toward undergraduate or higher (78.3 %), indicative of greater exposure to environmental discourse but also cautioning that highly literate voices may be over-represented. Urban respondents comprised 53.3 %, only slightly above India's 2025 urbanization estimate (~51 %), providing reasonable rural–urban balance. These demographic contours underpin subsequent cross-tabulations, ensuring that observed attitude patterns can be plausibly generalized—within study limitations—to India's diverse populace.

Table 2: Awareness of Endangered Plant Species

Awareness Level (Composite Score[1])	Frequency	%
Low (< 2.5)	164	26.8
Moderate (2.5–3.49)	275	44.9
High (≥ 3.5)	173	28.3
Total	612	100

[1]*Mean of six Likert items on knowledge of legal status, Red-List categories, and local examples.*

Interpretation

Approximately 28 % of respondents demonstrated high awareness of endangered flora, while 26.8 % exhibited low awareness. The moderate cluster (44.9 %) indicates a diffuse baseline knowledge: respondents

can often identify general threats but lack specific taxonomic or legal details. This distribution underscores the literature gap flagged earlier—namely, the limited penetration of plant-specific conservation messaging beyond specialist circles. High-awareness respondents correlated with postgraduate education and urban residency (explored further in Tables 5–6), implying that formal education and proximity to information networks bolster knowledge. Yet the sizeable low-awareness segment—even within an above-average literacy sample—signals that nationwide outreach must move beyond passive information channels. Awareness heterogeneity sets the stage for testing whether knowledge deficits translate into lukewarm conservation support or whether intrinsic cultural values compensate for informational gaps.

Table 3: Perceived Urgency of Plant Conservation by State

State	M	SD
Uttarakhand	4.13	0.61
Kerala	4.08	0.67
Maharashtra	3.79	0.74
Assam	3.96	0.69
Madhya Pradesh	3.83	0.72
Overall	3.96	0.70

Likert scale 1–5 (5 = "extremely urgent").

Interpretation

Mean scores exceeded 3.7 in all five states, signifying a general consensus on the criticality of conserving endangered plants. Uttarakhand reported the highest urgency (M = 4.13), plausibly reflecting heightened awareness due to recent media coverage of Himalayan habitat loss. Kerala's similarly high mean aligns with its longstanding social-forestry programs, indicating that institutional foregrounding can raise urgency perception. Maharashtra and Madhya Pradesh trailed modestly, perhaps because dominant conservation narratives there still emphasize megafauna over flora. Standard deviations hovering around 0.70 indicate moderate dispersion, suggesting intra-state heterogeneity that warrants localized policy modulation. The overall mean (3.96) corroborates the premise that, while knowledge details are uneven (Table 2), intuitive recognition of ecological stakes is broadly shared, offering an attitudinal foundation upon which targeted education and engagement strategies can build.

Table 4: Willingness to Participate in Conservation Activities by Residence

Activity Type	Urban n (%)	Rural n (%)	χ^2 (df = 1)	p
Monetary donation (≥ ₹200/year)	172 (52.8)	104 (36.4)	17.12	.000
Volunteer tree-planting events	194 (59.5)	167 (58.4)	0.07	.788
Citizen-science reporting (apps)	141 (43.3)	66 (23.1)	28.55	.000
Advocacy via social media shares	238 (73.0)	123 (43.0)	47.33	.000

Interpretation

Urban respondents were significantly more inclined to offer monetary contributions, engage in app-based citizen science, and disseminate conservation messages online (p < .001 for three of four behaviors). The digital divide likely underpins the stark contrast in citizen-science participation: limited smartphone penetration and patchy connectivity constrain rural engagement. By contrast, no significant difference emerged for hands-on volunteerism (χ^2 = 0.07, p = .788); tree-planting maintains cultural resonance in both settings, exploiting social cohesion rather than technological capital. These findings highlight that intervention design must tailor participation channels—leveraging digital outreach for urban audiences while bolstering on-ground initiatives in rural areas. Furthermore, fiscal willingness clustering in cities suggests fundraising campaigns may initially target urban donors, with parallel in-kind programs cultivating rural stakeholders, thereby synergizing financial and labor resources for plant conservation.

Table 5: Cross-Tabulation of Awareness Level × Education (N = 612)

Education Level	Low n (%)	Moderate n (%)	High n (%)	Row Total
Secondary or below (133)	61 (45.9)	55 (41.4)	17 (12.8)	133
Undergraduate (268)	77 (28.7)	129 (48.1)	62 (23.1)	268

| Postgraduate & above (211) | 26 (12.3) | 91 (43.1) | 94 (44.6) | 211 |
| Column Total | 164 | 275 | 173 | 612 |

$\chi^2(4) = 72.34, p < .001$

Interpretation

Education exerted a pronounced influence on awareness. Nearly 46 % of respondents with only secondary schooling fell in the low-awareness band, compared with 12 % among postgraduates. Conversely, 44.6 % of postgraduates demonstrated high awareness—more than triple the proportion in the secondary cohort. The significant χ^2 statistic confirms that the relationship is unlikely due to chance. These results corroborate global evidence linking formal education to environmental literacy and, by extension, informed conservation attitudes. Importantly, the sizeable moderate-awareness block across all tiers signals that even higher education does not guarantee deep knowledge, suggesting curricular gaps in biodiversity content. Programmatically, outreach efforts might prioritize interactive learning modules for lower-education groups while offering advanced, species-specific information to university audiences to convert moderate awareness into expert advocacy.

Table 6: Perceived Urgency Score by Education (Likert 1–5)

Education Level	M	SD	95 % CI (Lower, Upper)
Secondary or below	3.62	0.72	3.51, 3.73
Undergraduate	3.91	0.68	3.83, 3.99
Postgraduate & above	4.18	0.59	4.10, 4.26
Overall	3.96	0.70	3.90, 4.02

One-way ANOVA: $F(2, 609) = 26.58, p < .001; \eta^2 = 0.08$

Interpretation

Mean urgency scores climbed steadily with education, rising from 3.62 among secondary-educated respondents to 4.18 among postgraduates. The ANOVA confirmed significant between-group variance ($p < .001$), with $\eta^2 = .08$ indicating a medium effect size. Post-hoc (Tukey) comparisons showed all pairwise differences significant at $\alpha = .05$. Higher education likely enhances ecological systems thinking, yielding heightened perception of conservation urgency. Yet even the secondary group averaged above the mid-point, suggesting intrinsic concern independent of scholastic attainment. Translating urgency into concrete support remains the next analytical step; later tables demonstrate whether these higher urgency ratings convert into behavioral willingness. Strategically, messaging for less-educated audiences might link plant conservation to immediate livelihood benefits, while postgraduate campaigns can leverage scientific narratives and policy engagement opportunities.

Table 7: Perceived Barriers to Participation in Plant Conservation

Barrier (Multiple Response)	Frequency	% of Cases (N = 612)
Lack of information/training	317	51.8
Time constraints	264	43.1
Limited financial resources	238	38.9
Belief that plants are government's responsibility	201	32.8
Low visibility of plant conservation campaigns	187	30.6
Lack of local conservation projects	162	26.5

Interpretation

Information deficiency surfaced as the top barrier (51.8 %), echoing earlier findings of modest knowledge levels. Time scarcity (43.1 %) underscores the practical obstacles faced by working-age respondents. Interestingly, financial limitation ranked third, though Table 4 indicates that over half of urbanites still expressed willingness to donate—implying that funding constraints are relative rather than absolute. A substantial 32.8 % deferred responsibility to government, revealing a potential attitudinal hurdle of passive citizenship. Low campaign visibility and absence of local projects complete the leading barriers, highlighting the importance of community-scale initiatives and continuous communication. Collectively, these barriers suggest that multi-modal interventions—information provision, flexible volunteering formats, micro-

donation platforms, and local project incubation—are necessary to convert latent goodwill into sustained engagement.

Table 8: Preferred Policy Instruments for Endangered Plant Protection

Instrument	Rank 1	Rank 2	Rank 3	Weighted Score[1]
School & college environmental modules	178	139	84	896
Tax rebates on eco-donations	141	108	97	736
Community seed-bank initiatives	123	121	109	720
Dedicated TV/radio awareness series	94	127	141	677
Penalties for illegal plant trade	76	97	132	553

[1]Weights: Rank 1 = 3, Rank 2 = 2, Rank 3 = 1.

Interpretation

Educational integration emerged as the top-ranked instrument, attaining a weighted score of 896, affirming respondents' belief in early, curriculum-based interventions. Financial incentives (tax rebates) closely followed, indicating pragmatic recognition that economic levers can mobilize citizen support. Community seed banks also scored highly, reflecting grassroots appetite for tangible, locally controlled conservation mechanisms—a finding that dovetails with indigenous-knowledge literature. Broadcast media campaigns ranked fourth, revealing continued relevance of traditional mass media despite rising digital penetration. Enforcement-oriented penalties trailed, suggesting the public favors proactive over punitive measures, or perhaps doubts enforcement efficacy. Policymakers can leverage this hierarchy to allocate resources: strengthening environmental curricula and fiscal incentives is likely to garner widespread acceptance, while simultaneous community initiatives anchor conservation at neighborhood scale, enhancing legitimacy and sustained participation.

5. DISCUSSION

5.1. Bridging the National-Scale Evidence Gap on Plant Awareness

The survey confirms that public knowledge of endangered flora in India is heterogeneous yet substantive, with nearly three in ten respondents achieving high composite awareness scores. This nationwide snapshot responds directly to the lacuna noted by Karanth et al. (2008) and Varma et al. (2015), whose work revealed that discourse and data on plant conservation were either anecdotal or regionally bounded. By extending coverage to five ecologically distinct states and securing a sample exceeding the Yamane threshold, the present study delivers the first statistically powered estimate of awareness levels across diverse socio-demographic strata. The sizeable "moderate" tier (44.9 %) signals that baseline cognizance exists but lacks depth—echoing Kanagavel et al.'s (2014) observation that non-specialist audiences recognise conservation themes without internalising taxonomic or legal specifics. This middle band constitutes a strategic audience for awareness amplification: informed enough to grasp urgency, yet insufficiently equipped to mobilise.

5.2. Education as a Primary Cognitive Driver

Consistent with global environmental-literacy theory and Shukla and Gardner's (2006) findings on medicinal plants, education emerged as the most potent predictor of both awareness ($\chi^2 = 72.34$, $p < .001$) and perceived urgency ($\eta^2 = 0.08$). The monotonic rise from 3.62 to 4.18 on the urgency scale across educational tiers suggests that formal instruction strengthens systems thinking and risk appraisal. Notably, even secondary-educated respondents averaged above the indifference point, corroborating Tomalin's (2004) argument that cultural and religious values can embed a foundational respect for nature independent of scholastic attainment. Nevertheless, the gulf between secondary and postgraduate awareness underscores curricular deficiencies flagged by Jalli et al. (2015); biodiversity content remains peripheral in most state syllabi. Incorporating endangered-plant modules—ranked as the top policy instrument—would therefore not only resonate with public preference but also address a structural determinant of literacy, potentially transforming the moderate awareness tier into informed stewardship.

5.3. Urban–Rural Divergence in Participation Modalities

Tables 3 and 4 reveal a nuanced participation landscape. Urban respondents displayed significantly higher propensities to donate money, report via apps, and engage in social-media advocacy, aligning with Ridwan et al.'s (2023) observation that technological penetration correlates with conservation involvement. Yet the

absence of an urban–rural gap in tree-planting indicates that culturally resonant, low-tech actions retain universal appeal, supporting Talukdar and Gupta's (2018) findings in Assam. The data thus refute a simplistic urban-centric engagement model and instead recommend a dual strategy: leverage digital platforms for city dwellers while scaling community forestry and seed-bank projects in rural zones. This bifurcation also mitigates inequities created by the digital divide documented by Kanagavel et al. (2014) and anticipates Zehra et al.'s (2023) call for decentralised, locally controlled conservation mechanisms.

5.4. Barriers and Policy Levers: From Information Deficits to Incentive Alignment

Information scarcity (51.8 %) surfaced as the foremost obstacle, reinforcing the literature review's theme that plant conservation messages lack salience in mainstream media (Karanth et al., 2008). Time constraints and perceived financial limitations follow, mirroring Varma et al.'s (2015) critique that conservation competes with livelihood priorities. Yet the high acceptance of tax rebates and school curricula reveals a public appetite for solutions that either lower the opportunity cost of engagement or embed learning early. These preferences validate Jalli et al.'s (2015) recommendation to integrate fiscal incentives with awareness programs and dovetail with Tomalin's (2004) emphasis on values education. Interestingly, enforcement penalties ranked lowest, implying scepticism about state capacity or a normative preference for positive reinforcement—an insight that can guide policymakers away from punitive regimes toward participatory and incentive-based tools.

5.5. Implications for Conservation Governance and Practice

Collectively, the results substantiate the argument that endangered plant conservation will benefit from a pluralistic governance model—combining formal education, fiscal measures, and grassroots initiatives. The high urgency means motivational groundwork is established; what remains is converting sentiment into sustained action. Governments could, for instance, integrate plant-conservation modules into the National Education Policy's experiential-learning thrust, while simultaneously offering small tax credits for certified donations to community seed banks. NGOs might deploy citizen-science apps targeting urban populations familiar with smartphones, whereas rural programs can harness traditional ecological knowledge documented by Ridwan et al. (2023) to curate locally valued nurseries. The finding that one-third of respondents view conservation as a government responsibility cautions against over-reliance on voluntarism; institutional scaffolding—budget allocations, expertise, monitoring—must accompany community endeavors.

5.6. Limitations and Future Research

While the stratified design enhances generalisability, limitations persist. The exclusion of the far-north-eastern states and Union Territories leaves gaps in regions with distinct biocultural profiles. Self-reported attitudes may inflate pro-conservation responses due to social desirability bias, a constraint shared with earlier studies (Talukdar & Gupta, 2018). Future research should triangulate survey data with behavioural metrics—such as actual donation records or participation logs—to gauge attitude–action congruence. Longitudinal designs can track whether educational reforms and fiscal incentives translate into measurable conservation outcomes. Finally, qualitative investigation into why enforcement mechanisms attracted lower support could illuminate public trust dynamics and inform regulatory design.

By producing the first multi-state, statistically robust portrait of public attitudes toward endangered plant species, this study fills the empirical void identified in Section 2.2. It complements locality-specific ethnographic work (e.g., Ridwan et al., 2023) by offering macro-level patterns while retaining demographic nuance. The integration of policy preference data extends prior research focused merely on perception, providing actionable levers for practitioners. Crucially, the findings reposition plants—long overshadowed by charismatic fauna—as a legitimate public concern, thereby rebalancing conservation discourse in line with biodiversity's phylogenetic breadth.

6. CONCLUSION

The present study has provided an empirically grounded exploration of public attitudes toward the conservation of endangered plant species in India, addressing a crucial gap in biodiversity literature and conservation policy design. Through a structured, multi-state survey encompassing a diverse and stratified sample, the research has illuminated the contours of public awareness, perceived urgency, behavioral inclinations, and policy preferences related to plant conservation. Findings confirm that while awareness is uneven and often moderate, there exists a strong undercurrent of perceived urgency across demographic groups, with education emerging as a powerful determinant of both knowledge and concern. This suggests

that investments in educational reforms, particularly those integrating biodiversity modules into mainstream curricula, can yield long-term attitudinal shifts.

One of the key takeaways from the study is the recognition that plant conservation, historically relegated to the periphery of environmental activism and policy discourse, is viewed by the public as a matter of considerable importance—albeit one that is poorly supported by information and participation pathways. The alignment between willingness to engage and preference for educational and incentive-based policy tools points toward a civic environment that is primed for engagement, provided the barriers of access, knowledge, and institutional inertia are addressed. Moreover, the findings reinforce that participation is context-dependent; urban and rural populations differ in their capacities and preferred modes of involvement, necessitating tailored strategies that are geographically and culturally responsive.

Another broader implication lies in the articulation of conservation as a shared responsibility. Although a significant portion of respondents still view endangered flora protection as primarily the government's duty, a notable proportion also express readiness to contribute—through financial, physical, or digital means. This dual expectation highlights the need for hybrid governance models that integrate top-down institutional support with bottom-up citizen action. Policymakers, NGOs, and academic institutions must collaborate to convert latent awareness into sustained commitment, ensuring that conservation frameworks are inclusive, accessible, and outcome-oriented.

The study also brings attention to the need for enhanced visibility of plant-related conservation initiatives. Public outreach has traditionally favored iconic fauna, leaving plant species both literally and metaphorically invisible. Future awareness campaigns must strategically reframe narratives around endangered plants—not only as ecological essentials but as cultural, medicinal, and livelihood-linked assets. Engaging communities through storytelling, school-based conservation projects, and locally relevant seed-bank initiatives can restore visibility and forge emotional and practical bonds with flora.

Given its cross-sectional nature, the study opens multiple avenues for further research. Longitudinal studies could track how awareness and behavior evolve over time in response to policy interventions or ecological crises. Behavioral experiments could measure the effectiveness of incentive structures in real-world settings. Further, deeper qualitative studies exploring how indigenous beliefs, gender roles, or intergenerational dynamics shape conservation behavior could offer context-rich insights to supplement these findings. As India confronts growing ecological stress, integrating public attitudes into conservation science is no longer optional—it is essential for the legitimacy, scalability, and success of biodiversity protection.

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