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FLORISTIC DIVERSITY, ETHNOBOTANICAL IMPORTANCE AND CONSERVATION STATUS OF TRADITIONALLY SIGNIFICANT PLANTS IN THE SACRED LANDSCAPE OF AYODHYA, INDIA: A REVIEW

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ABSTRACT

This review synthesises research on floristic evaluation of traditionally significant plants of Ayodhya to address fragmented knowledge on plant diversity, cultural relevance, and conservation challenges. The review aimed to evaluate floristic diversity and traditional uses, benchmark ethnobotanical documentation methods, identify medicinal and ritualistic applications, compare conservation strategies, and examine sacred groves' roles in biodiversity preservation. Literature was selected based on ethnobotanical, medicinal, cultural, and conservation studies from Ayodhya and comparable Indian regions, employing qualitative and quantitative analyses including ethnobotanical indices. Findings reveal rich species diversity dominated by key botanical families, with extensive documentation of medicinal, ritualistic, and sociocultural uses validated through indices like Use Value and Informant Consensus Factor. Sacred groves emerge as critical biodiversity reservoirs and cultural heritage sites, yet face threats from modernisation and erosion of traditional practices. Conservation assessments highlight habitat loss and overexploitation, underscoring gaps in empirical data and integration of traditional knowledge into formal policies. Methodological inconsistencies and limited comparative analyses constrain robust synthesis, while knowledge transmission is predominantly oral and declining among younger generations. Collectively, these findings underscore the need for standardised, multidisciplinary approaches that integrate ethnobotanical knowledge with conservation and sustainable management frameworks. This synthesis informs strategies to preserve Ayodhya's biological diversity and indigenous knowledge systems amid socio-economic transformations.

Keywords:
Ayodhya; Floristic diversity; Ethnobotany; Traditional knowledge; Sacred plants; Sacred groves; Medicinal plants; Biodiversity conservation; Cultural heritage; Indigenous knowledge; Ethnomedicinal practices; Sustainable management.

1. INTRODUCTION

Research on the floristic evaluation of traditionally significant plants of Ayodhya has emerged as a critical area of inquiry due to its intersection of biodiversity conservation, cultural heritage, and traditional knowledge systems. The study of ethnobotanical practices in India has evolved from early documentation of medicinal plants in ancient texts such as the Valmiki Ramayana to contemporary surveys of sacred groves and tribal knowledge, reflecting a growing recognition of plants' ecological and socio-cultural roles (Karnick & Hocking, 1975) (Kandari *et al.*, 2014). India's rich biodiversity, encompassing over 25 global biodiversity hotspots, supports a vast array of medicinal and culturally important flora, which are integral to local livelihoods and spiritual practices (Kumar et al., 2021). The significance of this research is underscored by the reliance of approximately 80% of the rural population on traditional plant-based medicine and the urgent need to conserve threatened species amid

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habitat loss (Kalita et al., 2024).

Despite extensive ethnobotanical studies across various Indian regions, including Uttar Pradesh, Himachal Pradesh, and Assam, there remains a notable gap in comprehensive floristic evaluations specifically focused on Ayodhya's traditionally significant plants (Chanda & Mukherjee, 2012; Agarwal, 2014; Rawat & Kumar, 2024). Existing literature often addresses either medicinal uses or sacred plant practices in isolation, lacking integrative assessments that encompass both cultural and ecological dimensions (Pandey & Pandey, 2016) (Islam et al., 2024; Sambyal, 2017). Furthermore, modernization and socio-economic changes have led to erosion of indigenous knowledge and unsustainable harvesting, posing risks to both biodiversity and cultural continuity (Kandari et al., 2014) (Sejabaledi, 2024). Contrasting perspectives exist regarding the balance between conservation through traditional taboos and the pressures of development, highlighting the complexity of managing these resources (Rathoure, 2024; Sambyal, 2017). The absence of detailed floristic inventories linked with ethnobotanical significance in Ayodhya limits effective conservation and sustainable utilization strategies (Ojha, 2024; Nair & Mathew, 2024).

The conceptual framework for this review integrates the notions of sacred groves, traditional ecological knowledge, and ethnomedicinal plant use as interrelated constructs that underpin biodiversity conservation and cultural preservation (Patel & Adhvaryu, 2024) (Chakravarty et al., 2024; Rathoure, 2024). Sacred groves serve as ecological refugia maintained through religious and cultural taboos, while traditional knowledge informs sustainable harvesting and medicinal applications (Kandari et al., 2014) (Sejabaledi, 2024).

This framework guides the systematic evaluation of Ayodhya's plant diversity within its socio-cultural context, emphasizing the dynamic interplay between human practices and plant conservation (Kumar et al., 2021; Chakravarty et al., 2024).

The purpose of this systematic review is to document and analyze the floristic composition of traditionally significant plants in Ayodhya, synthesizing ethnobotanical knowledge to address existing gaps in integrated cultural and ecological assessments. This study aims to contribute to the conservation of plant biodiversity and the safeguarding of indigenous knowledge by providing a comprehensive resource that supports sustainable management and policy formulation (Chanda & Mukherjee, 2012; Nair & Mathew, 2024). By aligning floristic data with cultural significance, the review offers valuable insights for researchers, conservationists, and local communities engaged in preserving Ayodhya's botanical heritage (Rawat & Kumar, 2024; Patel & Adhvaryu, 2024).

This review employs a systematic literature survey of peer-reviewed ethnobotanical and floristic studies relevant to Ayodhya and comparable regions, applying qualitative and quantitative analyses to synthesize data on species diversity, uses, and conservation status. Inclusion criteria focus on studies documenting plant species with traditional, medicinal, or sacred importance, while exclusion criteria omit unrelated floristic inventories. The findings are organized thematically to elucidate patterns of plant use, cultural practices, and conservation challenges, providing a structured overview of the current knowledge landscape (Chanda & Mukherjee, 2012; Rawat & Kumar, 2024) (Nair & Mathew, 2024).

2. PURPOSE AND SCOPE OF THE REVIEW

2.1 Statement of Purpose

The objective of this report is to examine the existing research on the "floristic evaluation of traditionally significant plants of Ayodhya" in order to synthesise comprehensive knowledge

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regarding the diversity, cultural relevance, and traditional uses of plant species in this region. This review is important as it aims to consolidate scattered ethnobotanical and floristic data to better understand the role of plants in local cultural, medicinal, and religious practices. Additionally, it seeks to highlight conservation challenges and opportunities linked to these traditionally significant plants. By doing so, the review intends to inform sustainable management strategies and promote the preservation of both biological diversity and indigenous knowledge systems associated with Ayodhya's flora.

2.2 Specific Objectives:

- To evaluate current knowledge on the floristic diversity and traditional significance of plants in Ayodhya.
- Benchmarking of existing ethnobotanical documentation methods applied to culturally important plants in the region.
- Identification and synthesis of medicinal, ritualistic, and socio-cultural uses of Ayodhya's plant species.
- To compare conservation strategies addressing the sustainable use of ethnobotanical plants in Ayodhya and similar regions.
- To deconstruct the role of sacred groves and cultural beliefs in preserving plant biodiversity in Ayodhya.

3. METHODOLOGY OF SELECTION OF LITERATURE

3.1 Transformation of Query

We take your original research question — **"floristic evaluation of traditionally significant plants of Ayodhya"** — and expand it into multiple, more specific search statements. By systematically expanding a broad research question into several targeted queries, we ensure that your literature search is both **comprehensive** (you won't miss niche or jargon-specific studies) and **manageable** (each query returns a set of papers tightly aligned with a particular facet of your topic).

Below were the transformed queries we formed from the original query:

- Floristic evaluation of traditionally significant plants of Ayodhya.
- Comparative ethnobotanical analysis of culturally significant plants in India with a focus on their medicinal and ritualistic uses.
- Ethnobotanical significance and traditional uses of medicinal plants across various regions of India.
- Conservation strategies for ethnobotanical plants significant to cultural practices in Ayodhya.
- Role of sacred groves in conserving ethnobotanical diversity and traditional plant uses in Ayodhya

3.2 Screening Papers

We then run each of your transformed queries with the applied inclusion & exclusion criteria to retrieve a focused set of candidate papers for our ever-expanding database of over 270 million research papers. during this process we found 482 papers

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3.3 Citation Chaining – Identifying additional relevant works

3.3.1 Backward Citation Chaining: For each of your core papers, we examine its reference list to find earlier studies it draws upon. By tracing back through references, we ensure foundational work isn't overlooked.

3.3.2 Forward Citation Chaining: We also identify newer papers that have cited each core paper, tracking how the field has built on those results. This uncovers emerging debates, replication studies, and recent methodological advances. A total of 43 additional papers are found during this process.

3.4 Relevance scoring and sorting

We take our assembled pool of 525 candidate papers (482 from search queries + 43 from citation chaining) and impose a relevance ranking so that the most pertinent studies rise to the top of our final papers table. We found 511 papers that were relevant to the research query. Out of 511 papers, 50 were highly relevant.

4. RESULTS

4.1 Descriptive Summary of the Studies

This section maps the research landscape of the literature on floristic evaluation of traditionally significant plants of Ayodhya, encompassing ethnobotanical, medicinal, cultural, and conservation perspectives across diverse Indian regions, including Ayodhya itself. The studies collectively employ qualitative and quantitative ethnobotanical methods such as interviews, surveys, and indices like Informant Consensus Factor and Use Value to document plant diversity, traditional uses, and conservation status. Geographic foci range from Ayodhya and Uttar Pradesh to Himalayan and southern Indian contexts, reflecting varied cultural and ecological settings. This comparative analysis informs understanding of floristic diversity, cultural significance, conservation challenges, and knowledge transmission relevant to Ayodhya's traditionally significant plants.

Table 4.1: Comparative Analysis

Study	Floristic Diversity Index	Ethnobotanical Use Categories	Conservation Status Assessment	Sacred Grove Influence	Knowledge Transmission Patterns
Karnic & Hocking, 1975	50 medicinal plants from Ramayana texts	Medicinal uses in the Ayurvedic system	Not assessed	Not addressed	Historical textual knowledge transmission
Mishra & Tewari, 2007	57 species, 43 families in Devipatan	Medicinal uses by traditional healers	Not assessed	Not addressed	Traditional healers' knowledge documented
Chanda & Mukherjee, 2012	49 species, 35 families, mostly dicots	17 use categories: medicinal and cultural uses	Some species are sustainable, linked to tribal use	Limited mention of sacred groves	Traditional knowledge is strong among the Paharia tribe
Anand *et al.*, 2013	30 tree species in Sonbhadra	Medicinal uses for common ailments	Not assessed	Not addressed	Local preference influences knowledge
Agarwal, 2014	21 species, 17 families, sacred plants	Religious and medicinal uses in rituals	Conservation via cultural beliefs	Sacred plants linked to biodiversity conservation	Local religious practices support knowledge retention
Kandari *et al.*,	Not quantified; focus on sacred	Medicinal plants in religious	Sacred groves protect	Strong sacred grove	Modernisation threatens knowledge transmission

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2014	groves	contexts	ecosystems but face threats	role in conservation	
Pandey & Pandey, 2016	9 sacred species in the Indo-Gangetic plain	Religious, medicinal, and aesthetic uses	Sacred plants conserved via religious beliefs	Sacred plants linked to deity worship	Ancestral beliefs promote conservation knowledge
Narayan & Singh, 2017	Not quantified; ethnomedicinal plants in the Vindhya	Medicinal uses for various ailments	Threats from deforestation noted	Not addressed	Traditional knowledge is dependent on healers
Sambyal, 2017	Sacred groves in the Himalayas	Conservation through sacred groves	Sacred groves threatened by development	Sacred groves are vital for conservation	Traditional knowledge under threat
Chetri *et al.*, 2020	Not quantified; home garden medicinal plants	Medicinal uses for minor illnesses	Conservation via home gardening	Not addressed	Knowledge preservation through gardens
Sen & Bhakat, 2020	217 species in the West Bengal sacred grove	High floristic diversity	Conservation via sacred grove protection	Sacred groves are critical for biodiversity	Traditional knowledge linked to the grove
Kumar *et al.*, 2021	21 plants analysed for religious and medicinal roles	Religious and medicinal uses are intertwined	Conservation linked to sacred status	Sacred plants aid ecosystem protection	Traditional knowledge at risk from modernization
Kumar et al., 2021	64 species, 40 families, trees dominant	Medicinal uses for diverse diseases	Not assessed	Not addressed	Elderly informants primary knowledge holders
Arya & Kumar, 2022	6 religious plants in the Kumaon region	Folklore-based ritual uses	Not explicitly assessed	Rituals conserve plant use	Changes in usage methods over the decades are noted
Floristic and Ethnobotanical Study of In. 2022	143 species, 53 families in Odisha forest	Medicinal uses and floristic diversity	Rare and threatened species identified	Not addressed	Ethnomedicinal knowledge documented
Recent perspectives on the impact of Ethnobo. 2022	Review of the impact in India	Medicinal and aromatic plant uses	Conservation challenges noted	Not addressed	Indigenous knowledge loss highlighted
Kumar & Singh, 2022	83 species, 28 families, medicinal plants	Medicinal uses for diverse ailments	Not assessed	Not addressed	Indigenous knowledge collected via interviews
Kumar & Singh, 2022	82 species, 35 families, medicinal plants	Medicinal uses for multiple diseases	Conservation emphasized	Not addressed	Traditional knowledge documented and conserved
Diversity and traditional Knowledge of S.2022	Review of medicinal plant diversity in India	Medicinal uses and conservation challenges	Conservation difficulties noted	Not addressed	Need for conservation emphasised

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Chandra, 2023	104 species documented in Hindu rituals	Ritualistic plants use detailed	Not directly assessed	Ritual plants reflect environmental geographic links	Ritual knowledge is widespread but declining
Mehrotra *et al.*, 2023	Not quantified; focus on medicinal aromatic plants	Medicinal and prophylactic uses	Not assessed	Not addressed	Traditional knowledge basis for drug development
Poptani *et al.*, 2023	123 species in the urban arid zone	Ethnomedicinal uses documented	Urban threats to plants noted	Not addressed	Traditional knowledge documented
Máthé & Khan, 2023	Not quantified; traditional medicinal plants overview	Ayurvedic and herbal medicine uses	Conservation challenges noted	Not addressed	Traditional knowledge integrated into modern medicine
Naqvi *et al.*, 2023.	67 species in Nagpur hills	Medicinal uses documented	Not assessed	Not addressed	Traditional knowledge recorded
Vishwakarma *et al.*, 2023	66 species in the Madhya Pradesh forest	Medicinal uses documented	Conservation strategies recommended	Not addressed	Traditional knowledge preservation urged
Rawat & Kumar, 2024	47 species, 27 families, magico-religious plants	Magic, sacred, social ceremonies	Conservation linked to cultural values	Sacred practices support biodiversity	Older informants hold most knowledge
Sahoo & Mudgal, 2024	146 plants documented in tribal Bihar	Medicinal, veterinary, food, and social uses	New uses identified; conservation not detailed	Not addressed	Indigenous knowledge is actively recorded
Ojha, 2024	Not specified; focus on medicinal plants in the sanctuary	Medicinal uses for phytotherapy	Habitat loss threatens plants	Not addressed	Indigenous knowledge documented quantitatively
Kalita *et al.*, 2024	80 species, 45 families in Assam	Medicinal uses for 56 diseases	Conservation needs highlighted	Not addressed	Indigenous knowledge recorded via interviews
Das & Duarah, 2024	33 species, 24 families in the Kaibarta community	Medicinal uses for 14 ailments	Not assessed	Not addressed	High fidelity and use values reported
Nair & Mathew, 2024	141-198 species in sacred groves, 50 families	Medicinal uses quantified by indices	Conservation through sacred grove management	Sacred groves are critical for biodiversity	Indigenous knowledge linked to grove use
Anju & Kumar, 2024	111 species, 42 families in tribal Kerala	Food and medicinal uses documented	Conservation linked to traditional knowledge	Not addressed	Traditional ecological knowledge recorded
Patel & Adhvaryu, 2024	182 species in sacred groves, 76 trees	Ethnomedicinal uses for various ailments	Sacred groves protect rare and threatened species	Sacred groves are vital for conservation	Traditional knowledge recorded from healers
Chakravarty *et al.*, 2024	Not quantified; ethnobotany overview	Uses include food, medicine, and fodder	Conservation needs emphasised	Not addressed	Calls for modern research integration
Duche-Pérez *et al.*, 2024	Review of 70 studies on medicinal plants	Documentation and therapeutic uses	Conservation gaps identified	Not addressed	Knowledge transmission challenges noted

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Shukla, 2024	Historical forest and plant diversity overview	Medicinal and cultural plant uses	Forest mismanagement impacts biodiversity	Not addressed	Historical knowledge emphasised
Sharma et al., 2024	201 medicinal plants in Madhya Pradesh	Medicinal uses with quantitative indices	Conservation importance highlighted	Not addressed	Traditional healing practices are prevalent
Islam *et al.*, 2024	56 sacred plants in the Bangladesh Hindu community	Medicinal and religious uses	Conservation linked to cultural significance	Sacred plants are central to conservation	Knowledge documented amid population decline
Rathoure, 2024	Cultural heritage and biodiversity conservation	Cultural practices for biodiversity	Conservation through cultural heritage	Strong cultural role in biodiversity	Integration of traditional knowledge urged
Ojha & Pandey, 2024	95 species in Sohagi Wildlife Sanctuary	Medicinal uses quantified	Conservation importance stressed	Not addressed	Traditional knowledge preservation emphasised
Chauhan & Jishtu, 2024	40 plants, 22 families, diverse habits	Ethno-ceremonial uses documented	Conservation implied through cultural preservation	Sacred groves and folklore aid conservation	Folklore is recorded to preserve knowledge
Sejabaledi, 2024	Review of indigenous knowledge conservation	Indigenous conservation methods	Sustainable use influenced by taboos	Not addressed	Indigenous knowledge is crucial for conservation
Ralte & Singh, 2024	102 species in the Mizoram tribes	Medicinal uses with quantitative indices	Conservation importance highlighted	Not addressed	Indigenous knowledge is well documented
Ojha *et al.*, 2024	96 species, 42 families in the wetland region	Medicinal uses with quantitative indices	Conservation urged due to knowledge decline	Not addressed	Decline in knowledge transmission noted
Dutta *et al.*, 2024	125 species, 60 genera in Assam	Medicinal uses for multiple ailments	Conservation importance highlighted	Not addressed	Indigenous knowledge documented
Balkrishna *et al.*, 2024	114 species, 76 families in the Ganga watershed	Medicinal uses with quantitative indices	Conservation importance stressed	Not addressed	Traditional knowledge preservation emphasised
Nandal et al., 2024	Historical and modern medicinal plant overview	Ayurvedic and pharmacological uses	Conservation challenges discussed	Not addressed	Integration of traditional and modern knowledge

4.1.1 Floristic Diversity Index:

- Over 30 studies quantified species richness, with counts ranging from 6 to over 200 species, reflecting diverse floristic compositions across regions (Chanda & Mukherjee, 2012; Lata & Paul, 2024; Sen & Bhakat, 2020).
- Many studies highlighted the dominance of certain families, such as Fabaceae, Moraceae, and Asteraceae, in traditional flora (Chanda & Mukherjee, 2012**;** Mall, 2017; Kumar et al., 2021).
- Sacred groves and tribal areas often showed higher species richness and endemism, indicating hotspots of floristic diversity (Nair & Mathew, 2024**; Patel** & Adhvaryu,

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2024**; Sen** & Bhakat, 2020).

4.1.2 Ethnobotanical Use Categories:

- Medicinal uses dominate ethnobotanical documentation, with many studies also emphasizing ritualistic, cultural, and socio-economic uses (Chanda & Mukherjee, 2012; Agarwal, 2014; Chandra, 2023).
- Use categories often include medicinal, ritualistic, magico-religious, and food-related applications, with leaves and whole plants being commonly used parts (Rawat & Kumar, 2024; Kumar & Singh, 2022**; Kalita** et al., 2024).
- Quantitative indices such as Use Value and Informant Consensus Factor are frequently employed to assess plant importance (Kalita et al., 2024; Ojha et al., 2024; Sharma et al., 2024).

4.1.3 Conservation Status Assessment:

- Several studies identified threatened or rare species among culturally significant plants, emphasizing habitat loss and overexploitation as key threats (Lata & Paul, 2024; Narayan & Singh, 2017; Patel & Adhvaryu, 2024).
- Conservation efforts are often linked to sacred groves or cultural practices that protect plant species, though modernization poses challenges (Kandari et al., 2014) (Sambyal, 2017) (Sejabaledi, 2024).
- Reviews highlight gaps in scientific validation and integration of traditional knowledge into formal conservation policies (Duche-Pérez et al., 2024) ("Diversity and Traditional Knowledge of S...", 2022).

4.1.4 Sacred Grove Influence:

- Sacred groves are consistently reported as vital for biodiversity preservation and cultural continuity, serving as refuges for rare and endemic species (Kandari et al., 2014) (Nair & Mathew, 2024) (Patel & Adhvaryu, 2024).
- Studies document sacred groves as centers of traditional knowledge transmission and community-based conservation (Agarwal, 2014; Sen & Bhakat, 2020) (Sambyal, 2017).
- However, threats from development and erosion of cultural practices are noted as risks to sacred grove integrity (Kandari et al., 2014; Sambyal, 2017).

4.1.5 Knowledge Transmission Patterns:

- Traditional knowledge is predominantly held by elders and traditional healers, with evidence of erosion among younger generations in several studies (Rawat & Kumar, 2024**;** Ojha et al., 2024; Islam et al., 2024).
- Oral transmission through rituals, folklore, and community practices remains a key mode of knowledge preservation (Agarwal, 2014; Arya & Kumar, 2022; Patel & Adhvaryu, 2024).
- Modernization, urbanization, and declining cultural adherence are common factors contributing to knowledge loss (Kandari et al., 2014**;** Poptani et al., 2023; Sejabaledi, 2024).

4.2 Critical Analysis and Synthesis

The reviewed literature on the floristic evaluation of traditionally significant plants in

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Ayodhya and comparable regions reveals a rich tapestry of ethnobotanical knowledge intertwined with cultural, medicinal, and conservation dimensions. A prominent theme is the documentation of diverse plant species and their multifaceted uses, highlighting the cultural and medicinal significance embedded in local traditions. However, the body of research exhibits variability in methodological rigour and depth of conservation analysis, with some studies lacking standardised approaches or comprehensive validation of traditional claims. Additionally, while sacred groves and cultural beliefs are recognised as vital for biodiversity conservation, the impact of modernisation and socio-economic changes poses challenges to sustaining these practices. Overall, the synthesis underscores the need for integrative, multidisciplinary research frameworks that balance ethnobotanical documentation with conservation and sustainable management strategies.

Table 4.2: Critical Analysis of Plants

Aspect	Strengths	Weaknesses
Floristic Diversity and Ethnobotanical Documentation	Numerous studies provide extensive inventories of plant species with detailed ethnobotanical uses, such as the documentation of 49 species by the Paharia tribe in Ayodhya hills and 105 species among the Kinnaura tribes, reflecting rich biodiversity and indigenous knowledge systems (Chanda & Mukherjee, 2012; Lata & Paul, 2024). The inclusion of botanical families, local names, and plant parts used enhances the comprehensiveness of these records (Kumar & Singh, 2022), (Kumar & Singh, 2022).	Many studies rely heavily on qualitative data from interviews and surveys without employing standardised quantitative indices consistently, limiting comparability and robustness (Chanda & Mukherjee, 2012; Kalita et al., 2024). Some reports lack detailed taxonomic verification or fail to address seasonal and spatial variability in plant availability (Mall, 2017).
Cultural and Medicinal Significance	The integration of cultural practices, religious beliefs, and medicinal uses is well articulated, with several studies emphasising the role of plants in rituals and traditional healthcare, such as the sacred plants linked to Hindu worship and Ayurvedic medicine (Karnick & Hocking, 1975) (Pandey & Pandey, 2016) (Chandra, 2023). Quantitative ethnobotanical indices like Informant Consensus Factor (ICF) and Use Value (UV) are applied in some recent works to validate medicinal importance (Rawat & Kumar, 2024; Kalita et al., 2024; Ojha et al., 2024).	Despite the cultural richness, there is often insufficient scientific validation of medicinal claims, with limited phytochemical or pharmacological corroboration, which constrains the translation of traditional knowledge into modern therapeutic applications (Duche-Pérez et al., 2024; Nandal et al., 2024). Additionally, some studies do not critically assess the variability in knowledge transmission across generations (Ojha et al., 2024).
Conservation Status and Threats	Several investigations highlight conservation concerns, noting threats from habitat loss, Overexploitation and modernisation, particularly for threatened and endemic species (Lata & Paul, 2024) (Narayan & Singh, 2017) (Patel & Adhvaryu, 2024). The role of sacred groves as in-situ conservation sites is recognised, with detailed accounts of their ecological and cultural importance (Kandari et al., 2014) (Patel & Adhvaryu, 2024) (Sambyal, 2017).	There is a general paucity of empirical data on population dynamics, regeneration status, and the effectiveness of existing conservation measures. Many studies provide descriptive rather than analytical insights into conservation challenges, lacking integration with broader environmental or policy frameworks (Kandari et al., 2014) (Sejabaledi, 2024). The impact of socio-economic changes on traditional conservation practices is underexplored (Kandari et al., 2014).
Role of Sacred Groves and Cultural Beliefs	Sacred groves are consistently identified as critical reservoirs of biodiversity and cultural heritage, with studies documenting their	However, the sustainability of sacred groves is threatened by modernisation, urbanisation, and erosion of traditional

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in Biodiversity Preservation	species richness and the protective role of religious taboos and rituals (Kandari et al., 2014) (Patel & Adhvaryu, 2024; Sen & Bhakat, 2020). The linkage between spiritual beliefs and sustainable resource use is well established, supporting community-based conservation (Rathoure, 2024; Sambyal, 2017).	values, which some studies acknowledge but do not systematically investigate or propose adaptive management strategies (Kandari et al., 2014; Patel & Adhvaryu, 2024). There is also limited exploration of how sacred groves can be integrated into formal conservation policies (Rathoure, 2024).
Methodological Approaches and Data Quality	The use of semi-structured interviews, questionnaires, and participatory surveys enables the collection of rich ethnobotanical data, often involving knowledgeable elders and traditional healers (Chanda & Mukherjee, 2012; Chandra, 2023; Mishra & Tewari, 2007). Some recent studies employ quantitative ethnobotanical indices and statistical analyses to enhance data reliability (Kalita et al., 2024; Sharma et al., 2024).	Methodological inconsistencies are evident across studies, with variable sample sizes, lack of standardised data collection protocols, and insufficient cross-validation of information (Chanda & Mukherjee, 2012) (Kalita et al., 2024). Many studies do not address potential biases in informant selection or data interpretation, which may affect the validity of conclusions (Duche-Pérez et al., 2024).
Comparative Ethnobotanical Practices Across Regions	Comparative insights reveal commonalities in the use of sacred and medicinal plants across culturally rich regions of India, such as similarities in ritualistic plant use in Ayodhya, Kumaon, and Himachal Pradesh (Agarwal, 2014; Arya & Kumar, 2022) (Rawat & Kumar, 2024). This cross-regional perspective enriches understanding of ethnobotanical patterns and conservation implications (Kumar et al., 2021).	Nonetheless, comparative analyses are often superficial, lacking systematic frameworks to evaluate differences and similarities in ethnobotanical knowledge, conservation status, and socio-cultural dynamics across regions (Arya & Kumar, 2022; Rawat & Kumar, 2024). There is a missed opportunity to identify best practices or transferable conservation models.
Integration of Traditional Knowledge with Modern Conservation and Healthcare	Some studies advocate for the integration of ethnobotanical knowledge with modern pharmacology and conservation science, emphasising the potential for sustainable development and drug discovery (Kumar et al., 2021; Mehrotra et al., 2023; Nandal et al., 2024). The recognition of traditional knowledge as a valuable resource for biodiversity conservation is a positive trend (Chakravarty et al., 2024; Duche Duche-Pérez et al., 2024).	Despite these calls, practical frameworks for integration remain underdeveloped, with limited interdisciplinary collaboration or policy engagement documented. Challenges such as intellectual property rights, knowledge erosion, and scientific validation are acknowledged but inadequately addressed (Duche-Pérez et al., 2024; Sejabaledi, 2024). The transmission gap of traditional knowledge to younger generations is a critical concern that is insufficiently explored (Ojha et al., 2024).

4.3 Thematic Review of Literature

The reviewed literature on the floristic evaluation of traditionally significant plants of Ayodhya and related regions reveals several prominent themes. These include extensive documentation of ethnobotanical and medicinal plant diversity, the cultural and religious significance of plants, and the critical role of sacred groves and traditional beliefs in biodiversity conservation. Additionally, conservation challenges and sustainable management of medicinal and sacred plants emerge as key focuses, with an emphasis on preserving indigenous knowledge amidst modernization and environmental threats. Methodological variations across studies highlight both qualitative ethnographic approaches and quantitative analyses, reflecting a progression towards integrative conservation strategies.

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Table 4.3: Thematic Analysis

Theme	Theme Description
Ethnobotanical and Medicinal Plant Diversity Documentation	A major focus across studies is the extensive cataloguing of ethnobotanical and medicinal plant species, their botanical classifications, and traditional uses for treating diverse ailments. This includes quantitative assessments such as Use Value (UV), Informant Consensus Factor (ICF), and Fidelity Level (FL) to evaluate plant significance in various Indian regions, including Ayodhya, Uttar Pradesh, and Himachal Pradesh. Such documentation emphasizes the rich biodiversity and the continuing reliance of local communities on traditional phytomedicine (Chanda & Mukherjee, 2012; Karnick & Hocking, 1975; Chandra, 2023; Lata & Paul, 2024; Kumar & Singh, 2022; Kumar & Singh, 2022; Kalita et al., 2024; Ojha et al., 2024; Dutta et al., 2024; Sharma et al., 2024).
Cultural and Religious Significance of Plants	Plants are deeply embedded in religious rituals, cultural ceremonies, and folklore, serving not only as medicinal resources but also as symbols of spiritual and social identity. Studies reveal the integration of plants into Hindu rituals, local festivals, and indigenous belief systems, highlighting species like Aegle marmelos and Ocimum sanctum as culturally sacred. This theme underscores the symbiosis between cultural heritage and plant use, fostering conservation through traditional reverence (Agarwal, 2014; Pandey & Pandey, 2016; Arya & Kumar, 2022; Chandra, 2023; Rawat & Kumar, 2024; Kumar et al., 2021) (Islam et al., 2024).
Sacred Groves and Traditional Conservation Practices	Sacred groves function as biodiversity hotspots conserved through religious and sociocultural practices, offering protection to rare, endemic, and medicinal plants. These community-managed forest patches reflect indigenous conservation ethics, where taboos and rituals restrict exploitation. However, modernisation and anthropogenic pressures threaten these practices, necessitating integrated management strategies that respect traditional knowledge while addressing ecological sustainability (Kandari et al., 2014) (Nair & Mathew, 2024) (Patel & Adhvaryu, 2024) (Rathoure, 2024) (Sambyal, 2017) (Sen & Bhakat, 2020)
Conservation Challenges and Sustainable Management	The literature highlights threats to traditionally significant plants, including habitat loss, overharvesting, and erosion of indigenous knowledge due to modernization and globalization. Emphasis is placed on sustainable harvesting, propagation methods, afforestation, and community awareness programs aimed at conserving medicinal and culturally important species. Several studies call for policy integration of traditional knowledge into formal conservation frameworks (Lata & Paul, 2024; Ojha, 2024; Narayan & Singh, 2017; "Recent perspectives on impact of Ethnobo...", 2022; "Diversity and Traditional Knowledge of S...", 2022; Sejabaledi, 2024)
Integration of Traditional Knowledge with Modern Scientific Methods	There is a growing trend to combine ethnobotanical knowledge with scientific validation through phytochemical, pharmacological, and quantitative ethnobotanical indices. This approach aids in authenticating traditional uses and promoting the development of new drugs while ensuring cultural preservation. Methodological diversity ranges from qualitative interviews to robust statistical analyses, enhancing the reliability and applicability of findings (Kumar et al., 2021; Ojha, 2024; Chakravarty et al., 2024; Duche-Pérez et al., 2024; Balkrishna et al., 2024; Nandal et al., 2024; Ojha & Pandey, 2024).
Regional and Tribal Ethnobotanical Variations	Studies document geographically and culturally specific plant uses among various tribal and ethnic groups across India, including the Paharia, Kinnaura, Mullu Kuruman, and Kaibarta communities. These variations reflect adaptations to local ecology, cultural practices, and socio-economic

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	contexts, underscoring the importance of region-specific conservation and knowledge preservation efforts (Chanda & Mukherjee, 2012) (Lata & Paul, 2024) (Kalita et al., 2024) (Das & Duarah, 2024) (Anju & Kumar, 2024) (Ralte & Singh, 2024).
Ethnomedicinal Plant Use in Urban and Semi-Urban Contexts	Some research explores the persistence and challenges of medicinal plant use within urbanized and semi-urban areas, where rapid development threatens traditional flora. Documentation in cities like Bhuj and Nagpur reveals continued reliance on ethnomedicinal plants despite environmental pressures, highlighting the need for urban biodiversity conservation and integration of traditional knowledge in city planning (Poptani et al., 2023; Naqvi et al., 2023).
Role of Folklore and Oral Traditions in Knowledge Transmission	Folklore and orally transmitted traditions serve as vital mechanisms for preserving ethnobotanical knowledge, particularly regarding ritualistic and medicinal uses of plants. The studies trace how such knowledge is passed across generations, though noting a decline in transmission to younger populations, which poses risks to cultural continuity and biodiversity conservation (Arya & Kumar, 2022; Das & Duarah, 2024; Ojha et al., 2024)

4.4 Chronological Review of Literature

Research on the floristic evaluation of traditionally significant plants in Ayodhya and related regions has evolved significantly over the past five decades. Early studies primarily focused on documenting medicinal plants mentioned in ancient texts and exploring their traditional uses within cultural and religious contexts. Over time, research expanded to include ethnobotanical surveys of local tribes and communities, emphasizing the medicinal, ritualistic, and conservation aspects of plants. Recent works have integrated quantitative analyses, biodiversity conservation strategies, and the impact of modernization on indigenous knowledge, highlighting the critical role of sacred groves and cultural beliefs in preserving plant diversity.

Table 4.4: Chronological Analysis

Year Range	**Research Direction**	**Description**
1975–2000	Foundational Documentation of Medicinal Plants in Cultural Texts and Early Ethnobotany	Initial research centered on identifying medicinal plants described in ancient epics and Ayurveda, emphasizing their cultural and therapeutic significance. These studies laid the groundwork by enumerating key species with traditional uses and linking them to historical religious practices. The focus was on cataloguing plant species connected to the cultural heritage of regions like Ayodhya and understanding their role in life-saving traditional medicine.
1975–2000	Foundational Documentation of Medicinal Plants in Cultural Texts and Early Ethnobotany	Initial research centered on identifying medicinal plants described in ancient epics and Ayurveda, emphasizing their cultural and therapeutic significance. These studies laid the groundwork by enumerating key species with traditional uses and linking them to historical religious practices. The focus was on cataloguing plant species connected to the cultural heritage of regions like Ayodhya and understanding their role in life-saving traditional medicine.
2007–	Ethnobotanical	This period saw an increase in field-based ethnobotanical

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2014	Surveys and Indigenous Knowledge Documentation	surveys among tribal and rural communities, documenting local knowledge on medicinal and ritualistic plants. Studies also highlighted the cultural importance of sacred plants and groves, emphasizing their role in social and religious practices. Conservation challenges due to habitat loss and modernization began to emerge as critical themes, with calls for preserving indigenous knowledge through systematic documentation.
2016–2020	Integration of Conservation and Ethno-cultural Practices	Research expanded to focus on the conservation of ethnobotanical resources, particularly sacred groves and traditionally protected plants. The linkage between cultural beliefs, religious festivals, and biodiversity protection was analyzed, underscoring sacred plants' role as a conservation tool. Studies documented the diversity of plant species used socio-culturally and explored the sustainable management of these resources amid increasing anthropogenic pressures.
2021–2024	Quantitative Ethnobotany, Biodiversity Assessment, and Modern Challenges	Recent research employs quantitative indices to assess the cultural and medicinal importance of plant species and to evaluate informant consensus on their uses. There is a growing emphasis on documenting diverse regional floras, comparing ethnobotanical practices across cultural landscapes, and addressing threats from urbanization, modernization, and knowledge erosion. Studies integrate ethnomedicinal knowledge with biodiversity conservation, promote sustainable use strategies, and call for scientific validation of traditional claims to support modern healthcare.
2024	Advanced Ethnobotanical Studies and Integration with Pharmacology	The latest studies focus on comprehensive ethnomedicinal documentation coupled with modern analytical tools to understand traditional plant uses deeply. There is an increased interest in linking indigenous knowledge with pharmacological potential and conservation strategies. These works advocate for preserving cultural heritage through sustainable practices and highlight the urgent need to transmit knowledge to future generations amidst rapid socio-environmental changes.

4.5 Agreement and Divergence across Studies

The reviewed literature shows broad consensus on the importance of plants in traditional ethnobotanical practices, religious rituals, and medicinal applications across diverse Indian regions, including Ayodhya. Most studies agree on the key role of sacred groves and cultural beliefs in preserving biodiversity and traditional knowledge. However, divergences arise in the extent of floristic diversity reported, conservation status assessments, and the dynamics of knowledge transmission, often influenced by geographic, cultural, and methodological differences. Some studies emphasize threats to traditional knowledge from modernization, while others highlight ongoing robust practices and community conservation efforts.

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Table 4.5: Analysis of the Potential of Literature

Comparison Criterion	**Studies in Agreement**	**Studies in Divergence**	**Potential Explanations**
Floristic Diversity Index	Multiple studies report rich and varied floristic diversity, with high representation of families such as Fabaceae, Asteraceae, and others in ethnobotanical contexts, including trees, herbs, and shrubs (Chanda & Mukherjee, 2012; Lata & Paul, 2024; Mall, 2017; Dutta et al., 2024). Flora typically includes 40 to over 100 species used traditionally (Agarwal, 2014; Chandra, 2023; Ojha & Pandey, 2024).	Diversity estimates vary Considerably; for example, 49 species in the Ayodhya Hills (Chanda & Mukherjee, 2012), 105 species among the Kinnaura tribes (Lata & Paul, 2024), and up to 217 species in a sacred grove in West Bengal (Sen & Bhakat, 2020). Some recent regional studies report fewer species, reflecting possibly smaller study areas or focus (Islam et al., 2024).	Differences likely arise from geographic focus, survey scope, sampling methods, and ecological variation across study sites. Some focus on specific communities or forest types, explaining variance.
Ethnobotanical Use Categories	There is strong consensus that medicinal and ritualistic uses dominate plant applications, with leaves, roots, flowers, and whole plants commonly used (Chanda & Mukherjee, 2012) (Agarwal, 2014) (Pandey & Pandey, 2016) (Chandra, 2023) (Kumar & Singh, 2022) (Kumar & Singh, 2022) (Islam et al., 2024). Religious significance tied to medicinal value is widely documented, showing overlap between spiritual and health-related uses (Karnick & Hocking, 1975; Kumar et al., 2021) (Mathe & Khan, 2023).	Some papers emphasize additional use categories such as food, fodder, veterinary uses, and household needs alongside medicinal and ritual uses (Sahoo & Mudgal, 2024; Anju & Kumar, 2024). Also, the number of use categories and emphasis on specific ailments vary regionally (Kalita et al., 2024; Das & Duarah, 2024).	Variation arises from cultural diversity, ecological resource availability, and research focus; some studies emphasize medicinal uses, others broader ethnobotanical applications.
Conservation Status Assessment	Many studies highlight threats to medicinal and culturally important plants from habitat loss,	While threat levels are often reported, some studies indicate ongoing successful	Differences may be due to temporal context, local

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	overharvesting, and modernization (Kandari et al., 2014; Lata & Paul, 2024; Narayan & Singh, 2017; Patel & Adhvaryu, 2024; "Recent perspectives on impact of Ethnobo...", 2022; Nandal et al., 2024). Recognition of endangered species and the need for sustainable management is common (Lata & Paul, 2024; Patel & Adhvaryu, 2024) (Vishwakarma et al., 2023).	conservation through sacred groves and cultural practices (Pandey & Pandey, 2016; Rathoure, 2024; Sambyal, 2017). Others report less emphasis on threats or lack a detailed conservation assessment (Ojha, 2024) ("Floristic and Ethnobotanical Study of In...", 2022).	conservation efforts, degree of anthropogenic pressure, and focus on either conservation or documentation in studies.
Sacred Grove Influence	Almost all studies focusing on sacred groves confirm their critical role in biodiversity preservation and maintenance of cultural traditions, often serving as refuges for rare and medicinal plants (Kandari et al., 2014; Nair & Mathew, 2024; Patel & Adhvaryu, 2024; Rathoure, 2024; Sambyal, 2017; Sen & Bhakat, 2020). Sacred groves contribute both ecologically and socio-culturally to plant conservation.	Some divergence exists regarding the current state of sacred groves; while traditionally, sacred groves are well-conserved, Modernization and erosion of cultural values threaten their efficacy (Kandari et al., 2014; Patel & Adhvaryu, 2024; Sambyal, 2017). Some regions report active degradation or loss of groves (Patel & Adhvaryu, 2024).	Variability is explained by differences in regional cultural adherence. modernization impact and local community engagement in grove management and conservation practices.
Knowledge Transmission Patterns	Numerous studies agree that traditional knowledge is mostly orally transmitted, with older generations holding key ethnobotanical wisdom (Chanda & Mukherjee, 2012; Arya & Kumar, 2022; Das & Duarah, 2024; Ojha et al., 2024; Ojha & Pandey, 2024). Sustained cultural practices help preserve this knowledge, especially in tribal and rural communities	Several recent studies report a decline in knowledge transmission due to modernisation, migration, and generational shifts, causing erosion of ethnobotanical knowledge among youth (Kandari et al., 2014) (Ojha et al., 2024) (Poptani et al., 2023).	Differences may be due to demographic changes, educational influences, urbanization levels, and the strength of cultural institutions and rituals maintaining knowledge

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	(Agarwal, 2014; Kumar et al., 2021; Ralte & Singh, 2024).	Conversely, some communities show stable or even revitalized knowledge transfer (Anju & Kumar, 2024; Ralte & Singh, 2024).	continuity.

4.6 THEORETICAL AND PRACTICAL IMPLICATIONS

4.6.1 Theoretical Implications

The synthesis of floristic and ethnobotanical studies from Ayodhya and comparable regions reinforces the integral role of traditional knowledge systems in conserving plant biodiversity, particularly through sacred groves and religious practices. This supports existing ecological theories that cultural beliefs and rituals act as informal conservation mechanisms, preserving both biological and cultural diversity (Kandari et al., 2014; Rawat & Kumar, 2024; Rathoure, 2024).

The documented medicinal and ritualistic uses of plants in Ayodhya align with classical Ayurvedic and ethnomedicinal frameworks, confirming the continuity and relevance of ancient texts such as the Valmiki Ramayana in contemporary ethnobotanical knowledge. This continuity challenges the notion that modernisation uniformly erodes traditional knowledge, instead highlighting selective persistence and adaptation (Karnick & Hocking, 1975) (Kumar et al., 2021) (Nandal et al., 2024).

Quantitative ethnobotanical indices (e.g., Informant Consensus Factor, Use Value) applied in recent studies provide robust methodological frameworks for assessing the cultural significance and conservation priority of plant species. These metrics enhance theoretical understanding of how socio-cultural factors influence plant use patterns and knowledge transmission (Rawat & Kumar, 2024; Kalita et al., 2024; Sharma et al., 2024).

The observed erosion of traditional knowledge among younger generations and the impact of modernisation and religious conversions on sacred groves underscore the dynamic interplay between socio-cultural change and biodiversity conservation. This highlights the need to integrate socio-ecological resilience theories with ethnobotanical research to better understand knowledge retention and loss (Kandari et al., 2014) (Rawat & Kumar, 2024; Ojha et al., 2024).

Comparative analyses across diverse Indian regions reveal both convergence and divergence in ethnobotanical practices, suggesting that while certain plant species hold pan-Indian sacred and medicinal status, local ecological and cultural contexts shape unique usage patterns. This supports theories of cultural ecology emphasising localized adaptation within broader traditional frameworks (Arya & Kumar, 2022) (Rawat & Kumar, 2024; Das & Duarah, 2024).

The integration of ethnobotanical knowledge with modern pharmacological research, as indicated by several studies, advances theoretical models of biocultural conservation and sustainable development, bridging traditional wisdom with scientific validation and drug discovery (Duche-Pérez et al., 2024) (Nandal et al., 2024) (Ojha & Pandey, 2024).

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4.6.2 Practical Implications

The documented importance of sacred groves and culturally significant plants in Ayodhya and similar regions calls for policy frameworks that formally recognize and protect these sites as critical biodiversity hotspots, integrating religious and cultural values into conservation legislation and management plans (Kandari et al., 2014) (Patel & Adhvaryu, 2024) (Rathoure, 2024).

Ethnobotanical documentation efforts provide essential baseline data for sustainable resource management, enabling local communities, forest departments, and policymakers to develop targeted conservation strategies that balance ecological preservation with cultural practices and livelihood needs (Lata & Paul, 2024) (Nair & Mathew, 2024; Sejabaledi, 2024).

The demonstrated medicinal value of traditionally used plants underscores the potential for developing community-based pharmacological enterprises and ecotourism initiatives that promote sustainable harvesting, benefit-sharing, and economic empowerment of indigenous and tribal populations (Ojha, 2024; Anju & Kumar, 2024; Ojha & Pandey, 2024).

Awareness-building programs involving youth, religious leaders, and local practitioners are critical to revitalizing traditional knowledge systems and fostering stewardship of ethnobotanical resources, thereby mitigating knowledge erosion and enhancing intergenerational transmission (Kandari et al., 2014) (Rawat & Kumar, 2024) (Rathoure, 2024).

The application of quantitative ethnobotanical indices in assessing plant use and conservation status can guide prioritisation of species for in situ and ex situ conservation, cultivation, and propagation efforts, ensuring the survival of culturally and medicinally important taxa (Rawat & Kumar, 2024; Kalita et al., 2024) (Sharma et al., 2024).

Collaborative interdisciplinary research combining ethnobotany, ecology, pharmacology, and social sciences is essential to develop culturally sensitive, scientifically sound conservation and sustainable use policies that address both biodiversity loss and cultural heritage preservation (Duche-Pérez et al., 2024; Nandal et al., 2024) (Sejabaledi, 2024).

4.7 LIMITATIONS OF THE LITERATURE

The ethnobotanical literature is constrained by several important limitations that affect the depth, reliability, and broader applicability of research findings. Most studies are geographically restricted and based on small sample populations, which limits the generalization of results across diverse cultural and ecological regions. Inconsistencies in research methodologies and the lack of standardized data collection techniques further hinder comparative analysis among studies. Additionally, many investigations focus primarily on documenting traditional medicinal uses without adequate pharmacological or phytochemical validation, reducing their scientific applicability. The predominance of short-term and cross-sectional studies also limits understanding of temporal changes in plant use and traditional knowledge systems. Another major limitation is the declining transmission of indigenous knowledge to younger generations, which remains insufficiently addressed in the literature. Furthermore, conservation strategies and policy-oriented approaches are often inadequately explored, while excessive emphasis on medicinal aspects tends to overlook the ecological, ritualistic, socio-cultural, and economic importance of plants in traditional communities.

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Table 4.7: Limitations of the Literature

Area of Limitation	Description of Limitation	Papers that have limitations
Geographic Bias	Many studies focus on specific regions or communities, limiting the external validity of findings across the broader Ayodhya region or similar cultural contexts. This geographic concentration restricts generalizability and comparative analysis.	(Chanda & Mukherjee, 2012), (Agarwal, 2014), (Kandari et al., 2014), (Rawat & Kumar, 2024), (Lata & Paul, 2024), (Nair & Mathew, 2024).
Small Sample Sizes	Several studies rely on limited informants or small community samples, which may not capture the full diversity of traditional knowledge. This constraint reduces the robustness and representativeness of ethnobotanical data.	(Agarwal, 2014) (Rawat & Kumar, 2024) (Ojha et al., 2024) (Dutta et al., 2024)
Lack of Standardisation	There is a notable absence of standardized methodologies for data collection and analysis, leading to inconsistencies across studies. This methodological constraint hampers the comparability and synthesis of ethnobotanical findings.	(Chauhan & Jishtu, 2024) (Kandari et al., 2014) (Duche-Pérez et al., 2024)
Insufficient Scientific Validation	Many papers document traditional uses without rigorous pharmacological or phytochemical validation, limiting the integration of ethnobotanical knowledge into modern medicine and conservation policies. This gap affects the practical applicability of findings.	(Kumar et al., 2021) (Duche-Pérez et al., 2024) (Nandal et al., 2024) (Ojha & Pandey, 2024)
Limited Longitudinal Data	The majority of studies are cross-sectional, lacking longitudinal perspectives to assess changes in traditional knowledge transmission or plant use over time. This limits understanding of dynamic cultural and ecological processes.	(Arya & Kumar, 2022) (Rawat & Kumar, 2024) (Ojha et al., 2024)
Threats to Knowledge Transmission	Declining transmission of indigenous knowledge, especially among younger generations, is frequently noted but insufficiently addressed. This erosion threatens the sustainability of ethnobotanical practices and biodiversity conservation.	(Kandari et al., 2014) (Rawat & Kumar, 2024) (Ojha et al., 2024)
Incomplete Conservation Focus	While many studies highlight conservation challenges, few provide comprehensive strategies or legislative frameworks, weakening the potential for effective preservation of culturally significant plants	(Kandari et al., 2014) (Patel & Adhvaryu, 2024) (Sejabaledi, 2024)

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	and sacred groves.	
Overemphasis on Medicinal Uses	The literature predominantly emphasizes medicinal applications, often overlooking other cultural, ritualistic, or ecological roles of plants, which limits a holistic understanding of their significance in traditional contexts.	(Karnick & Hocking, 1975) (Pandey & Pandey, 2016) (Kumar et al., 2021) (Islam et al., 2024)

4.8 Gaps and Future Research Directions

The analysis of existing ethnobotanical literature reveals several critical research gaps and future priorities for the Ayodhya region. Major gaps include the absence of standardized methodologies for ethnobotanical data collection, limited scientific validation of traditional medicinal claims, inadequate ecological assessment of culturally significant plant species, and insufficient understanding of the effects of modernization, urbanization, and anthropogenic activities on sacred groves and indigenous knowledge systems. Furthermore, traditional knowledge remains poorly documented and is increasingly threatened by generational discontinuity. Existing studies also provide limited insight into socio-economic influences, gender-specific knowledge systems, and cross-regional comparative ethnobotanical patterns. Future research should therefore focus on developing standardized quantitative frameworks, conducting phytochemical and pharmacological validation studies, assessing population dynamics and conservation status of important species, promoting community-based conservation programs, integrating sacred groves into formal policy frameworks, and digitally documenting indigenous knowledge. Special emphasis should also be placed on women's roles in ethnobotanical traditions, sustainable livelihood development, and mitigation of human-induced ecological pressures. Addressing these research gaps will strengthen biodiversity conservation, preserve cultural heritage, and enhance the scientific and practical applicability of ethnobotanical knowledge in Ayodhya and similar cultural landscapes.

Table 4.8: Gaps and Future Research Directions

Gap Area	Description	Future Research Directions	Justification	Research Priority
Standardisation of Ethnobotanical Data Collection	Inconsistent Methodologies and a lack of standardised quantitative indices limit the comparability and robustness of ethnobotanical data across studies in Ayodhya and similar regions.	Develop and implement standardized protocols incorporating quantitative indices like Use Value (UV), Informant Consensus Factor (ICF), and Fidelity Level (FL) for ethnobotanical surveys in Ayodhya. Conduct cross-regional	Standardization will enhance data reliability, enable meta-analyses, and facilitate integration of traditional knowledge into conservation and pharmacological research (Chanda & Mukherjee, 2012; Kalita et al., 2024; Duche-Pérez et al.,	High

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		comparative studies using these standards.	2024).	
Scientific Validation of Medicinal Claims	Many ethnobotanical studies document medicinal uses without phytochemical or pharmacological validation, limiting the translation of traditional knowledge into modern therapeutics.	Conduct phytochemical screening, bioactivity assays, and clinical trials on traditionally used plants of Ayodhya to validate medicinal claims. Prioritize species with high use values and cultural significance.	Validation is essential to confirm efficacy and safety, fostering acceptance of traditional remedies in modern healthcare and supporting sustainable use (Duche Pérez et al., 2024; Nandal et al., 2024; Kumar et al., 2021).	High
Conservation Status and Population Dynamics	Limited empirical data exist on population status, regeneration, and threats to traditionally significant plants in Ayodhya, hindering effective conservation planning.	Undertake ecological studies assessing population structure, regeneration rates, and habitat conditions of key ethnobotanical species. Integrate findings with threat analyses to inform conservation strategies.	Understanding species viability and threats is critical for targeted conservation and sustainable management of culturally important flora (Lata & Paul, 2024; Narayan & Singh, 2017) (Patel & Adhvaryu, 2024).	High
Impact of Modernisation of Sacred Groves and Knowledge Transmission	Modernization, urbanization, and socio-economic changes are eroding sacred grove integrity and disrupting traditional knowledge transmission among younger generations.	Investigate socio-cultural dynamics affecting sacred groves and knowledge transmission in Ayodhya. Develop community-based programs involving youth education, cultural revitalization, and participatory conservation.	Addressing these impacts is vital to preserving both Biodiversity and intangible cultural heritage are linked to sacred groves (Kandari et al., 2014; Rawat & Kumar, 2024; Ojha et al., 2024).	High

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Integration of Sacred Groves into Formal Conservation Policies	Sacred groves are recognised for biodiversity conservation but lack formal legal protection and integration into regional conservation frameworks.	Advocate for policy development that legally recognizes sacred groves as protected areas. Promote collaborative governance models involving local communities and government agencies.	Formal integration will strengthen protection, resource allocation, and sustainable management of sacred groves (Kandari et al., 2014; Rathoure, 2024) (Sejabaledi, 2024).	Medium
Cross-Regional Comparative Ethnobotany	Comparative analyses of ethnobotanical practices across culturally rich Indian regions, including Ayodhya, are superficial and lack systematic frameworks.	Design comparative studies using standardised ethnobotanical metrics to evaluate similarities and differences in plant use, conservation status, and cultural practices across regions.	Such comparisons can identify best practices, transferable conservation models, and enrich understanding of cultural-ecological linkages (Agarwal, 2014; Arya & Kumar, 2022; Rawat & Kumar, 2024).	Medium
Documentation and Preservation of Indigenous Knowledge	Traditional Knowledge is predominantly oral and at risk of loss due to a lack of systematic documentation and generational gaps.	Implement comprehensive ethnobotanical documentation projects using digital tools, participatory approaches, and inclusion of diverse community members, especially elders and healers.	Preserving knowledge is crucial for cultural continuity, biodiversity conservation, and potential pharmacological discoveries (Sahoo & Mudgal, 2024; Patel & Adhvaryu, 2024) (Sejabaledi, 2024).	High
Socio-Economic Drivers of	Limited understanding exists of how socio-	Conduct socio-economic assessments to	Insights into socio-economic drivers can	

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Plant Use and Conservation	economic factors influence plant use patterns, harvesting pressures, and conservation attitudes in Ayodhya.	explore livelihoods, market demands, and cultural values affecting ethnobotanical plant use. Develop sustainable livelihood alternatives linked to conservation.	inform community-based conservation and sustainable resource use strategies (Kandari et al., 2014) (Lata & Paul, 2024) (Anju & Kumar, 2024).	Medium
Role of Women in Ethnobotanical Knowledge and Conservation	Women's roles in knowledge transmission and conservation are acknowledged but underexplored in the context of Ayodhya's traditional plant use.	Investigate gender-specific knowledge systems and conservation practices. Design empowerment programs to engage women in biodiversity conservation and knowledge preservation.	Women often hold critical ethnobotanical knowledge and can be key agents in sustaining cultural and biological diversity (Kandari et al., 2014) (Rawat & Kumar, 2024).	Medium
Effects of Anthropogenic Activities on Ethnobotanical Flora	Anthropogenic pressures such as deforestation, habitat fragmentation, and tourism threaten the diversity and availability of culturally significant plants.	Map and monitor anthropogenic impacts on key habitats in Ayodhya. Develop mitigation strategies, including habitat restoration, sustainable harvesting guidelines, and ecotourism management.	Mitigating human-induced threats is essential to maintain plant diversity and associated cultural practices (Kandari et al., 2014; Narayan & Singh, 2017; Ojha et al., 2024).	High

5. OVERALL SYNTHESIS AND CONCLUSION

The collective body of literature on the floristic evaluation of traditionally significant plants in Ayodhya and comparable Indian regions reveals a rich diversity of plant species deeply intertwined with cultural, medicinal, and religious practices. Across these studies, the floristic diversity is extensive, encompassing hundreds of species predominantly from families such as Fabaceae, Moraceae, Asteraceae, and Piperaceae. Sacred groves emerge as critical strongholds for this biodiversity, serving not only as reservoirs of rare and endemic species but also as focal points for community-based conservation driven by religious and cultural beliefs. These groves and sacred plants are integral to local rituals, healthcare, and social ceremonies, highlighting a symbiotic relationship between ecological conservation and cultural heritage.

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Ethnobotanical documentation consistently underscores the predominance of medicinal uses among traditional plant applications, with leaves, whole plants, and flowers commonly employed. Quantitative ethnobotanical indices like use value and informant consensus factor have been increasingly used to validate and quantify the cultural importance and medicinal reliability of various species. However, while traditional knowledge is rich and detailed, there is a notable gap in scientific validation of medicinal claims, limiting the integration of indigenous practices into modern pharmacology and healthcare systems. Furthermore, the transmission of ethnobotanical knowledge is increasingly threatened by modernization, urbanization, and generational shifts, leading to concerns over knowledge erosion and loss of cultural continuity.

Conservation challenges are a recurring theme, with habitat destruction, overexploitation, and socio-economic changes posing significant threats to both plant populations and the associated traditional knowledge systems. Although sacred groves provide effective in situ conservation, their sustainability is jeopardized by developmental pressures and diminished cultural adherence. The literature highlights the need for adaptive management strategies that integrate traditional beliefs with formal conservation policies, promoting sustainable use while safeguarding biodiversity and cultural identity.

Methodologically, studies vary in rigor and standardization, with many relying on qualitative surveys and interviews that limit cross-comparability. There is a growing call for multidisciplinary research frameworks that combine ethnobotanical documentation with ecological assessments, phytochemical validation, and policy integration. Comparative analyses across regions reveal shared ethnobotanical practices but fall short of systematically identifying best practices or transferable conservation models. Overall, the literature advocates for the preservation of both biological diversity and indigenous knowledge through collaborative, scientifically informed, and culturally sensitive approaches that engage local communities, healers, and policymakers alike.

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