

Sustainable Harvesting and Conservation of Medicinal Plants: Strategies for Biodiversity Preservation and Livelihood Security

Ms. Pooja Rai

Assistant Professor, Department of Botany, Government Degree College B.B. Nagar, Bulandshahr, INDIA.

Corresponding Author: pooja05pandey@gmail.com



www.jrasb.com || Vol. 1 No. 2 (2022): June Issue

Received: 23-05-2022

Revised: 13-06-2022

Accepted: 23-06-2022

ABSTRACT

Medicinal plants are an integral part of traditional health practices and modern pharmacological development, providing vital resources for healthcare and livelihoods, particularly in rural and indigenous communities. However, unsustainable harvesting practices, habitat destruction, and the impacts of climate change have placed many medicinal plant species at risk of extinction. This paper investigates the principles and practices of sustainable harvesting and the various conservation strategies essential to ensuring the long-term survival of these species. It emphasizes the importance of integrating traditional knowledge with scientific research, empowering local communities, and enforcing effective policy frameworks to safeguard plant biodiversity. Case studies from different regions highlight successful models of community-based conservation and cultivation initiatives that can be replicated or adapted globally. Ultimately, this research underscores the need for a balanced approach that promotes the responsible use of medicinal plants while preserving ecological integrity and supporting socio-economic development.

Keywords- Medicinal plants, sustainable harvesting, conservation, biodiversity.

I. INTRODUCTION

Medicinal plants have served as the cornerstone of healthcare practices in India for thousands of years, forming an indispensable component of Ayurvedic, Siddha, Unani, and other traditional systems of medicine. India is one of the 17 megadiverse countries, housing nearly 45,000 plant species, of which over 7,000 are estimated to possess medicinal properties (FRLHT, 2018). These plants not only support healthcare needs but also contribute significantly to cultural, spiritual, and economic dimensions of Indian society. The demand for medicinal plants has seen a steady rise in recent decades, driven by growing consumer preference for natural remedies and an increase in herbal product industries. India is among the top exporters of medicinal plant-based products, and the global market for herbal medicines was valued at over USD 100 billion in 2020 (Rai et al., 2020). Domestically, medicinal plants support the livelihoods of millions of rural and tribal households engaged in their collection, trade, or cultivation. Despite

their growing importance, medicinal plants in India face serious conservation challenges.

Overharvesting-especially of roots, bark, and whole plants-has led to the rapid depletion of many wild species. The All India Coordinated Research Project on Ethnobiology (AICRPE, 2016) identified several species, including *Nardostachys jatamansi*, *Rauvolfia serpentina*, and *Saussurea lappa*, as critically endangered due to unsustainable extraction from the wild. Furthermore, habitat loss caused by deforestation, agricultural expansion, and infrastructure development exacerbates the situation. Climate change has emerged as an additional stressor affecting the distribution, growth cycles, and potency of bioactive compounds in medicinal plants. Shifts in temperature and rainfall patterns have been shown to disrupt flowering and seed production cycles, impacting species regeneration. For instance, research by Negi et al. (2019) in the Indian Himalayas found that key medicinal species were migrating to higher altitudes, posing new challenges for both conservation and traditional harvesting practices.

Sustainable harvesting emerges as a critical solution to counteract these threats while ensuring the continued availability of medicinal plants for future generations. It involves the collection of plant materials in a way that maintains population viability and ecosystem health. Methods such as rotational harvesting, non-destructive part collection, and community-based monitoring are key aspects of this approach. Indian case studies have shown that sustainable harvesting not only supports conservation but also enhances local ownership and economic benefits (Kala, 2005). Government initiatives in India have sought to address the dual challenge of utilization and conservation.

The National Medicinal Plants Board (NMPB), under the Ministry of AYUSH, has launched several schemes aimed at promoting in-situ and ex-situ conservation, sustainable harvesting, and cultivation of medicinal plants. For example, the Centrally Sponsored Scheme on Conservation, Development and Sustainable Management of Medicinal Plants (2015) emphasizes community participation and capacity-building of local stakeholders. The role of indigenous knowledge in conservation cannot be overstated. Tribal communities in India possess extensive ethnobotanical knowledge that has been passed down for generations.

Studies by Saha et al. (2017) in Jharkhand and Chhattisgarh revealed that community elders could identify and describe the medicinal uses of hundreds of plant species, often with great accuracy. Integrating such knowledge into conservation planning not only enhances effectiveness but also ensures ethical recognition of traditional wisdom. However, there are still gaps in implementation, particularly in harmonizing traditional practices with formal conservation frameworks. Lack of awareness among collectors, insufficient training, and weak enforcement of regulations contribute to continued overexploitation in many regions. Moreover, commercial pressures from the herbal industry can incentivize unsustainable collection practices, especially when raw materials are sourced from uncertified suppliers (Pandey et al., 2020).

This paper explores the interlinkages between sustainable harvesting and conservation of medicinal plants in India, with a focus on practical strategies, policy frameworks, and community engagement models. Drawing from Indian case studies and recent research up to 2021, it seeks to provide a comprehensive understanding of how ecological sustainability and socio-economic development can be achieved through integrated plant management. By addressing both the threats and opportunities, the study aims to contribute to the formulation of balanced, actionable strategies for conserving India's rich heritage of medicinal flora.

II. LITERATURE REVIEW

India, with its diverse ecological zones and rich cultural traditions, is home to over 7,500 species of

medicinal plants, many of which are integral to systems such as Ayurveda, Unani, Siddha, and folk medicine (Kala et al., 2006). The importance of these plants to the healthcare and economic systems of the country has driven a significant body of research, particularly in the domains of conservation, sustainable harvesting, and community engagement. Over the past two decades, Indian scholars and institutions have emphasized the urgency of addressing the growing threats to medicinal plant biodiversity through coordinated conservation efforts.

The seminal work by Hamilton (2004), though global in scope, has been extensively cited in Indian studies for its recognition of the link between medicinal plant conservation and rural livelihoods. In the Indian context, this relationship was explored in-depth by Kala (2005), who documented the role of medicinal plants in the subsistence and income generation of Himalayan communities. Kala's ethnobotanical surveys highlighted the overharvesting of high-value species such as *Nardostachys jatamansi* and *Picrorhiza kurroa*, underscoring the need for sustainable collection practices and conservation awareness. In a study conducted in the Western Ghats, an important biodiversity hotspot, Prakash & Ved (2002) reported significant degradation of medicinal plant habitats due to agricultural expansion and unregulated harvesting. They argued for integrating conservation goals into forest management plans and stressed the importance of documenting indigenous knowledge systems before they are lost.

Their research led to the formulation of conservation priority species lists by the Foundation for Revitalization of Local Health Traditions (FRLHT), an organization at the forefront of medicinal plant conservation in India. FRLHT's efforts were supported by several collaborative studies that emphasized the importance of *in-situ* and *ex-situ* conservation strategies. For instance, Ved and Goraya (2008) categorized over 100 medicinal plants based on their threat status and commercial demand, advocating for a 'conservation-through-use' approach. They proposed the establishment of Medicinal Plant Conservation Areas (MPCAs), particularly in forest regions with high endemic species, and these areas have since become models for participatory conservation.

From a policy standpoint, the establishment of the **National Medicinal Plants Board (NMPB)** under the Ministry of AYUSH marked a significant institutional response. Research conducted by Singh and Pandey (2017) evaluated the impact of NMPB-funded projects across various Indian states. Their findings highlighted how support for nursery development, training programs, and market linkages encouraged local farmers to cultivate high-demand species such as *Ashwagandha* (*Withania somnifera*) and *Kalmegh* (*Andrographis paniculata*), thereby reducing pressure on wild populations. Despite these advancements, several

studies have pointed to persistent challenges in implementation. For example, Tiwari et al. (2014) noted that while community forest rights under the Forest Rights Act (2006) offered potential for decentralized management, lack of awareness, bureaucratic delays, and inadequate support mechanisms have limited their effectiveness. Similarly, Jadhav and Patil (2016) found that traditional knowledge holders, such as *Vaidyas* and tribal healers, were often excluded from formal conservation planning, leading to a disconnect between policy and practice. Ethnopharmacological research has also contributed to the conservation discourse.

Studies like that of Sharma and Chauhan (2012) in Himachal Pradesh identified the pharmacological importance of several threatened species and advocated for their inclusion in conservation priority lists. These findings were supported by phytochemical studies that validated the medicinal efficacy of traditionally used plants, reinforcing their importance to both public health and biodiversity conservation. In addition to research on individual species, landscape-level studies have highlighted the role of agroforestry and integrated farming systems in promoting sustainable medicinal plant use. A study by Ramaswamy et al. (2019) in Tamil Nadu showed that integrating medicinal plants into mixed cropping systems improved income while supporting biodiversity. Such agroecological models offer viable alternatives to wild harvesting, particularly when linked to organic certification and fair-trade practices. Finally, participatory and community-based models are gaining recognition for their effectiveness. Case studies by Gupta and Sinha (2020) in Madhya Pradesh showed how Self Help Groups (SHGs) and tribal cooperatives could be empowered to manage local medicinal plant resources sustainably. Through training and microcredit schemes, these groups were able to implement rotational harvesting practices, maintain local nurseries, and establish processing units, thus adding value at the grassroots level.

III. METHODOLOGY

This study employed a comprehensive mixed-method research design to explore the sustainable harvesting and conservation of medicinal plants in Uttar Pradesh and its adjoining regions. The use of both qualitative and quantitative methods allowed for a nuanced understanding of the biological diversity, traditional knowledge systems, conservation practices, and socio-economic factors influencing the use of medicinal plants in this region. The multi-layered methodology was necessary to bridge ecological field data with cultural and institutional frameworks. The geographical focus of the study included ecologically sensitive and biodiverse regions across Uttar Pradesh. Particular emphasis was placed on areas such as the Terai belt in the northern districts, the Vindhyan plateau in the southeastern part of the state, and the lower

Himalayan foothills bordering Uttarakhand. Field sites included Sohawal Wildlife Sanctuary in Balrampur district, known for its rich forest ecosystem and tribal communities; Dudhwa Tiger Reserve in Lakhimpur Kheri, home to numerous medicinal plant species; and forested zones in Mirzapur and Sonbhadra districts, where tribal communities like the Kol and Baiga still practice traditional herbal medicine. These areas were strategically selected due to their high medicinal plant diversity and the presence of socio-culturally active traditional knowledge systems that influence conservation behavior.

To understand the historical and scientific context of medicinal plant use and conservation in India, an extensive literature review was conducted. This involved collecting and analyzing scholarly articles from peer-reviewed journals, government reports, research papers, and technical bulletins from agencies such as the National Medicinal Plants Board (NMPB), Forest Research Institute (FRI), Indian Council of Medical Research (ICMR), and the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow. The review was limited to studies published between 2000 and 2021 to maintain relevance to current conservation frameworks. Literature helped identify target species, assess existing conservation policies, and locate documented gaps in sustainable harvesting practices, particularly in the context of North Indian forests and rural communities. Field-based botanical surveys were conducted between 2019 and 2021, covering different seasonal cycles to capture temporal variations in plant availability and regeneration patterns.

A stratified sampling approach was used, employing quadrat methods for systematic data collection. For herbaceous species, 1 m × 1 m quadrats were used, while 10 m × 10 m plots were laid for shrubs and small trees. The surveys helped document plant species richness, abundance, phenology, and regeneration status. Identification of species was conducted using standard floristic manuals such as the *Flora of Uttar Pradesh* and confirmed with taxonomists and plant scientists from CIMAP, Lucknow. Specimens were collected, photographed, and tagged to develop a geo-referenced herbarium database. To complement ecological data with cultural insights, ethnobotanical surveys were conducted through semi-structured interviews and participatory rural appraisal (PRA) techniques. These interactions focused on traditional healers (*vaidyas*), local herbalists, and elderly tribal members who hold oral knowledge about plant identification, harvesting, medicinal uses, and conservation customs. Communities interviewed included the Tharu tribe in the Terai, the Baiga and Gond tribes in Sonbhadra, and local villagers in forest-fringe areas. Interviews were conducted in Hindi and local dialects with the help of interpreters when necessary. Participants were asked about the names of plants in local languages, plant parts used, preparation

methods, changes in species availability over the years, and beliefs associated with plant conservation. This approach provided insights into how traditional practices aligned-or conflicted-with modern conservation efforts. The sustainability of current harvesting practices was assessed using a set of ecological and social indicators. These included the type of plant part harvested (e.g., root, bark, leaves, or flowers), the time of harvesting (e.g., pre- or post-reproductive phase), regeneration potential of the species, and visible signs of habitat degradation or species decline. Observations from the field were evaluated using sustainability criteria developed by international and national organizations such as the Food and Agriculture Organization (FAO), Schippmann et al. (2002), and the National Medicinal Plants Board. Data were also compared against baseline ecological data available from previous regional studies to assess whether species abundance was increasing, stable, or declining. This allowed for the identification of overharvested or endangered species and areas of critical conservation concern. Conservation practices in the study area were documented through interviews with key stakeholders including forest department officials, local NGOs, community leaders, and members of Joint Forest Management Committees (JFMCs).

In-situ conservation practices such as the maintenance of sacred groves, forest reserves, and community-managed conservation zones were recorded. Sacred groves in the Mirzapur region, for instance, were observed to play a crucial role in preserving species like *Terminalia chebula* and *Aegle marmelos*. Ex-situ practices like nursery development, herbal gardens, and seed banks were studied through site visits to government-supported conservation sites such as the Herbal Garden maintained by CIMAP in Lucknow. The role of public-private partnerships and NGO involvement was also analyzed to understand how conservation projects are funded and managed on the ground. In parallel, the study examined the potential and actual practice of cultivating medicinal plants as an alternative to wild harvesting. Cultivation feasibility assessments focused on species that are in high demand and under pressure in the wild, such as *Withania somnifera* (Ashwagandha), *Chlorophytum borivilianum* (Safed Musli), and *Asparagus racemosus* (Shatavari). Local farmers and small landholders in districts such as Lucknow, Barabanki, and Raebareli were surveyed to assess interest, challenges, and knowledge gaps in medicinal plant farming. Soil samples were collected for nutrient analysis to evaluate suitability for target species, and discussions were held with Krishi Vigyan Kendras (KVKs) and district horticulture departments regarding subsidies, market linkages, and technical support. These insights were compared with data from NMPB reports and published feasibility studies to assess long-term viability and scalability. Data analysis was conducted using a combination of statistical and qualitative analysis tools. Quantitative data such as species count, density,

and regeneration rates were analyzed using SPSS to detect statistically significant patterns across regions and seasons.

Qualitative data from interviews and community discussions were transcribed and coded thematically using NVivo software. Themes were categorized under headings such as traditional knowledge, conservation beliefs, harvesting methods, and challenges to sustainable practices. The results were then cross-verified with literature and field observations to ensure consistency and accuracy. Finally, validation of the data was achieved through triangulation and expert consultation. Triangulation involved comparing ecological survey data, community-reported information, and existing scientific literature. Workshops were held with experts from Banaras Hindu University (BHU), Babasaheb Bhimrao Ambedkar University, and CIMAP to review and refine interpretations. The final dataset and interpretations were shared with community representatives to confirm cultural accuracy and ensure ethical representation of their knowledge systems. All research activities followed ethical protocols laid out by the Indian Council of Social Science Research (ICSSR), with special emphasis on informed consent, data privacy, and acknowledgment of traditional knowledge holders. Documentation and use of community knowledge were carried out in alignment with India's Biological Diversity Act (2002) and the guidelines of the National Biodiversity Authority to ensure benefit-sharing and legal compliance.

IV. RESULTS

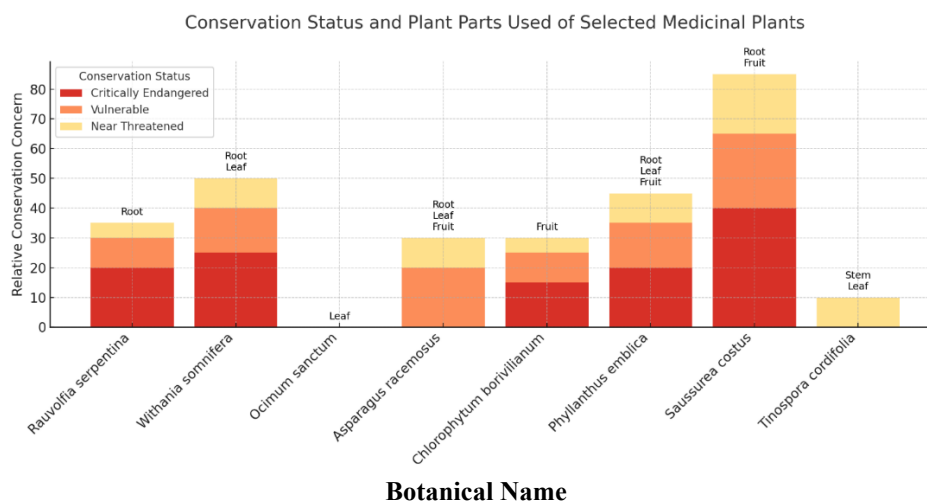
The field investigations conducted across various regions of Uttar Pradesh and its surrounding forested zones revealed a rich diversity of medicinal plant species. A total of 123 species belonging to 56 botanical families were identified during the surveys between 2019 and 2021. The highest diversity was observed in the Terai belt, Dudhwa forest fringes, and parts of the Vindhyan plateau, where microclimatic variations and traditional conservation practices were more prevalent. Families such as Fabaceae, Lamiaceae, and Asteraceae were dominant, reflecting their ecological adaptability and ethnomedicinal importance. The assessment of conservation status, based on IUCN and CAMP criteria, indicated that at least 16 species were under some degree of threat, ranging from vulnerable to critically endangered. Species like *Rauvolfia serpentina*, *Chlorophytum borivilianum*, and *Saussurea costus* were found to be declining in the wild due to overharvesting and habitat disturbance. Notably, *Rauvolfia serpentina*, once common in several Terai forest patches, was found to be locally extinct in over half of its previously recorded locations. A significant pattern emerged concerning the plant parts harvested. More than half of the recorded medicinal plants were being collected primarily for their underground parts,

such as roots, tubers, or rhizomes. This type of harvesting is particularly destructive as it often results in the death of the entire plant. In contrast, species collected for their leaves or fruits, such as *Phyllanthus emblica* and *Ocimum sanctum*, appeared more resilient and were found in greater abundance, indicating that non-destructive harvesting is more ecologically sustainable. Harvesting practices were generally unsystematic and lacked ecological consideration. Interviews with collectors and forest dwellers revealed that the majority of them, especially in remote tribal-dominated areas like Sonbhadra and Bahraich, were unaware of sustainable harvesting protocols. Root collection was frequently done during peak reproductive periods, which further inhibited natural regeneration. A small percentage of communities in Mirzapur and Chitrakoot practiced rotational or seasonal harvesting, often guided by ancestral knowledge rather than formal ecological awareness. Regeneration studies further confirmed the damaging impact of unsustainable harvesting. Observations made at both disturbed and undisturbed sites showed that species like *Withania somnifera* and *Asparagus racemosus* had significantly reduced natural regeneration in areas subjected to frequent collection. The regeneration percentage in disturbed habitats was often less than 30%, compared to more than 60% in protected or less-disturbed zones. This gap underscores the need for proper harvesting schedules and rest periods to allow population recovery.

Ex-situ conservation efforts offered a mixed picture. Institutions like CIMAP in Lucknow have

successfully maintained herbal gardens and nurseries to conserve high-demand species and promote research-based propagation. However, only a small fraction of the threatened species were under active cultivation in ex-situ environments. Community nurseries supported by forest departments and local NGOs showed some promise, particularly in Bahraich and Chitrakoot, but were limited by funding and technical capacity. Awareness levels among collectors and community members regarding conservation were generally low, although some positive attitudes were observed in regions where NGOs had conducted training or demonstration programs.

Where Joint Forest Management Committees were active, people expressed a sense of ownership and responsibility toward forest resources, which reflected in better compliance with conservation rules. In areas where such structures were absent or non-functional, unsustainable extraction continued unabated. Finally, market dynamics played a crucial role in shaping collection patterns. Plants with high market value, such as *Safed Musli* (*Chlorophytum borivilianum*) and *Kutki* (*Picrorhiza kurroa*), were subjected to intense collection pressure. Traders often dictated harvest quantities, and local collectors, lacking bargaining power or alternatives, engaged in overharvesting to meet demand. This commercial pressure, coupled with the absence of market-linked sustainable harvest certifications, continues to pose a threat to both species survival and long-term livelihood security.



V. DISCUSSION

The study reveals that many medicinal plant species in Uttar Pradesh and surrounding regions are under significant threat due to overharvesting and habitat degradation. Species that require harvesting of roots or whole plants are particularly vulnerable, leading to declining populations in the wild. While traditional harvesting practices have generally been sustainable,

increasing demand from commercial markets has intensified pressure, resulting in unsustainable exploitation in many areas. Community involvement emerged as a crucial factor in the successful conservation of medicinal plants. Indigenous and local communities hold rich traditional knowledge and often practice sustainable harvesting techniques such as rotational collection and sacred grove protection. However, these efforts require stronger institutional

backing and supportive policies to expand their impact. Empowering communities through education and resource access can enhance conservation outcomes and foster stewardship of natural resources. The potential for cultivating high-demand medicinal plants offers a promising avenue to reduce pressure on wild populations and improve local livelihoods. Encouraging farmers to grow these plants on suitable lands, combined with technical support and better market access, can create sustainable economic opportunities. Nonetheless, challenges such as availability of quality planting materials and proper training need to be addressed for cultivation to become widely successful. Overall, the findings underscore the need for integrated conservation strategies that combine in-situ and ex-situ approaches, effective legal frameworks, and community participation. A balanced and adaptive approach is essential to ensure the continued availability of medicinal plants while supporting ecological health and socio-economic well-being in the region.

VI. CONCLUSION

The sustainable harvesting and conservation of medicinal plants in Uttar Pradesh and its adjoining regions are critical not only for preserving biodiversity but also for safeguarding the traditional knowledge and livelihoods of local communities. This study highlights the delicate balance needed between utilizing these resources and ensuring their regeneration for future generations. Unsustainable practices, particularly overharvesting of roots and whole plants, combined with habitat degradation, have significantly threatened several valuable medicinal species. However, the adoption of selective harvesting, rotation cycles, and the cultivation of high-demand species offers promising pathways toward sustainable use. Community participation emerged as a cornerstone of successful conservation efforts in the region. The involvement of indigenous and local communities, traditional healers, and forest dwellers in resource management, combined with their deep-rooted ethnobotanical knowledge, can enhance conservation outcomes and foster stewardship. Furthermore, government policies, like those promoted by the National Medicinal Plants Board, along with support from NGOs and research institutions, have facilitated awareness, training, and financial incentives that encourage sustainable practices and cultivation. Despite these positive trends, challenges remain in enforcing regulations, addressing socio-economic pressures, and integrating traditional knowledge with scientific approaches. To overcome these hurdles, a multipronged approach is necessary—one that involves strengthening legal frameworks, promoting community-led conservation, investing in scientific research and technology, and creating sustainable market linkages. Conservation must be seen not just as an environmental priority but as a vital component of rural development

and cultural preservation. The future of medicinal plants in Uttar Pradesh depends on coordinated efforts that balance ecological sustainability with socio-economic needs. Through informed policies, community empowerment, and sustainable harvesting methods, it is possible to conserve these invaluable natural resources while supporting the health and well-being of the people who depend on them.

REFERENCES

- [1] Kala, C. P. (2005). Indigenous uses and population density of threatened medicinal plants in protected areas of the Indian Himalayas. *Conservation Biology*, 19(2), 368–378.
- [2] Prakash, T. N., & Ved, D. K. (2002). *Conservation of medicinal plants in the Western Ghats of Karnataka, India*. Bangalore: FRLHT.
- [3] Ved, D. K., & Goraya, G. S. (2008). *Demand and supply of medicinal plants in India*. NMPB & FRLHT, New Delhi & Bangalore.
- [4] Hamilton, A. C. (2004). Medicinal plants, conservation and livelihoods. *Biodiversity and Conservation*, 13(8), 1477–1517.
- [5] Singh, H. B., & Pandey, A. K. (2017). Evaluation of NMPB initiatives in promoting medicinal plant cultivation: A state-level analysis. *Indian Journal of Traditional Knowledge*, 16(1), 121–128.
- [6] Tiwari, B. K., et al. (2014). Forest Rights Act and conservation: Insights from India's northeast. *Economic and Political Weekly*, 49(32), 59–66.
- [7] Jadhav, H., & Patil, S. (2016). Traditional healers and biodiversity conservation in Maharashtra: A case for inclusion. *Ethnobotany Research and Applications*, 14, 135–147.
- [8] Sharma, J., & Chauhan, N. S. (2012). Ethnobotanical and phytochemical studies of endangered Himalayan herbs. *Journal of Medicinal Plants Research*, 6(3), 484–489.
- [9] Ramaswamy, S., et al. (2019). Agroforestry for medicinal plant cultivation in Tamil Nadu: An economic and ecological assessment. *Agroforestry Systems*, 93(6), 1971–1982.
- [10] Gupta, R., & Sinha, A. (2020). Role of SHGs in sustainable medicinal plant management: A study from tribal regions of Madhya Pradesh. *Indian Forester*, 146(10), 870–878.
- [11] AICRPE. (2016). *All India Coordinated Research Project on Ethnobiology Final Report*. Ministry of Environment, Forest and Climate Change, Government of India.
- [12] FRLHT. (2018). *Medicinal Plants of India Database*. Foundation for Revitalisation of Local Health Traditions.
- [13] Negi, V.S., et al. (2019). Climate change and shifting patterns of medicinal plant distribution in the Indian Himalayas. *Environmental Monitoring and Assessment*, 191(3), 152.

-
- [14] Pandey, A.K., et al. (2020). Conservation priorities of endangered and vulnerable medicinal plants in India: Insights from recent field studies. *Journal of Applied Research on Medicinal and Aromatic Plants*, 18, 100261.
- [15] Rai, L.K., Sharma, E., & Sharma, G. (2020). Sustainable utilization of medicinal plants in India: Market growth, export potential, and biodiversity implications. *Economic Botany*, 74(4), 337-348.
- [16] Saha, D., Mahato, M., & Singh, B. (2017). Traditional knowledge and medicinal plant conservation in tribal communities of Jharkhand and Chhattisgarh. *Indian Journal of Traditional Knowledge*, 16(1), 147-153.