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FOURTH WORLD BOTANY: GUARDIANS OF ECOLOGICAL AND CULTURAL WISDOM IN BRIDGING TRADITIONAL KNOWLEDGE AND ENVIRONMENTAL CONSERVATION

Taranisen Panda, Nirlipta Mishra, Shaik Rahimuddin, Bikram K. Pradhan, and Raj
B. Mohanty

Taranisen Panda*
Ex-Principal, Chandbali College
Chandbali, Bhadrak 756133, Odisha, India
Nirlipta Mishra
Department of Zoology, Chandbali College
Chandbali, Bhadrak 756133, Odisha, India
Shaik Rahimuddin
Department of Zoology, Chandbali College
Chandbali, Bhadrak 756133, Odisha, India
Bikram K. Pradhan
Department of Botany, Chandbali College
Chandbali, Bhadrak 756133, Odisha, India
Raj B. Mohanty
Ex-Reader in Botany, Plot No. 1311/7628, Satya Bihar
Rasulgarh, Bhubaneswar, Odisha, India
*Corresponding author: taranisenpanda@yahoo.co.in

Abstract

This review aims to examine the role of Indigenous botanical knowledge in supporting environmental conservation and cultural sustainability. Fourth World Botany serves as a crucial bridge between traditional knowledge and modern environmental management, reflecting the deep ecological and cultural wisdom of Indigenous communities that has sustained their ecosystems for generations. A comprehensive literature search was conducted across peer-reviewed journals, scientific databases, and relevant sources, screening over 593 references and ultimately including 123 studies that addressed Indigenous knowledge in guiding sustainable land use, agriculture, healthcare, responsible use of natural resources, and environmental management. The study reveals that Indigenous agricultural practices significantly enhance climate resilience, contributing to sustainable food systems. Traditional medicinal knowledge continues to shape modern healthcare, influencing treatments globally. Beyond agriculture and medicine, Indigenous knowledge supports food security, biofencing, handicrafts, and socio-religious rituals, reflecting the rich cultural heritage of these communities. Legal frameworks, such as India's Traditional Knowledge Digital Library, emphasise the importance of protecting these knowledge systems from exploitation, ensuring that Indigenous knowledge contributions to environmental management and cultural practices are safeguarded for future generations.

Key findings highlight the integration of Fourth World Botany into contemporary environmental management as vital for safeguarding Indigenous rights, enhancing biodiversity conservation, and promoting resource sustainability. However, despite its crucial role in addressing global environmental challenges, Indigenous knowledge faces serious threats from globalization, land dispossession, and cultural erosion. This review contributes to understanding how collaborative efforts between Indigenous communities and modern science can foster resilient ecosystems and sustainable practices to address global environmental challenges.

Keywords: *ecological and cultural heritage, Indigenous knowledge systems, natural resources, sustainable development, traditional knowledge digital library*

1. INTRODUCTION

In the latter half of the 20th century, the term Third World was widely used to describe nations that remained unaligned during the Cold War (1947-1991), positioning themselves outside both the capitalist bloc led by the United States and the communist bloc led by the Soviet Union. Coined by French demographer Alfred Sauvy in 1952, it initially referred to politically neutral countries but later evolved into a label for “developing nations” as global attention shifted toward economic development and modernisation (Tomlinson, 2003). In contrast, the concept of the Fourth World emerged to address a different kind of marginalisation—not of nation-states, but of Indigenous peoples and stateless ethnic groups whose existence lies outside the modern globalised economic and political framework. Introduced by Shuswap Chief George Manuel in 1974, the Fourth World refers to Indigenous nations and cultural groups living within or across state boundaries while maintaining distinct cultural identities. These groups face ongoing struggles such as land dispossession, erosion of cultural practices, and political marginalisation (Manuel and Posluns, 1974). Their knowledge systems, developed through centuries of sustainable interaction with their environments, often stand in contrast to dominant narratives of economic progress and modernisation imposed by nation-states and global economies (Dyck, 1989). Within this framework, the concept of “Fourth World Botany” was introduced to highlight the importance of preserving the ecological knowledge of Indigenous peoples. It is defined as the study and preservation of botanical knowledge systems, ecological wisdom, and plant-based cultural practices maintained by Indigenous and stateless communities whose identities, cosmologies, and land-stewardship traditions exist beyond the political, economic, and epistemic frameworks of dominant nation-states (Khasim et al., 2013). Indigenous knowledge, rooted in long-term interaction with ecosystems, forms an invaluable repository of ecological wisdom, practices, and sustainable resource management strategies passed down through generations (Sukula, 2006; Radcliffe et al., 2020; Kusumastuti et al., 2023). This knowledge, often predating colonisation, reflects deep cultural and ecological ties to the land, making it distinct from local knowledge, which is shaped by livelihood and cultural practices rather than being tied to ancestral land (Hill et al., 2020). Both Indigenous and local knowledge systems are characterised by holistic, intergenerational transmission and a deep understanding of the environment, highlighting their crucial

role in environmental stewardship (Gadgil et al., 1993; Benyei et al., 2020; Turner et al., 2022).

Fourth World Botany offers a unique contribution to modern conservation efforts by integrating Traditional Ecological Knowledge (TEK) with scientific research. TEK, often referred to as Indigenous Technical Knowledge or local knowledge, has only gained formal recognition within the Western scientific community in the last five decades (Johnson, 1992; Berkes, 2008; Joa et al., 2018). Since the 1980s, reports like the World Conservation Strategy and Our Common Future have underscored the value of TEK in natural resource management (Johnson, 1998), and the 1991 UNESCO workshop further emphasised its role in sustainable development planning (Berkes, 1993). More recently, TEK has been recognised in global policies, including Article 8(j) of the United Nations Convention on Biological Diversity, which calls for the respect and preservation of Indigenous knowledge in the context of biodiversity conservation (United Nations, 1992). The importance of TEK lies not only in its ecological sensitivity but also in its incorporation into sustainable resource management practices. Indigenous knowledge is deeply embedded in social institutions that govern local communities, guided by customary rules, prohibitions, and sanctions (Osemeobo, 2001; Adom et al., 2016; Sinthumule and Mashau, 2020). Furthermore, it reflects the cosmologies of Indigenous peoples, including their spiritual beliefs and sacred objects, which shape their understanding of the environment and resource use (Melaku Getahun, 2016; Kosoe et al., 2020). TEK is learned through observation, demonstration, and hands-on interaction with nature (Fongod et al., 2014; Joa et al., 2018; Reniko et al., 2018), and has been acknowledged by international organisations such as the World Bank (1998) and the Millennium Ecosystem Assessment Report (2005) for its vital role in biodiversity conservation.

Incorporating TEK into modern conservation and resource management strategies can help achieve global Sustainable Development Goals (SDGs) in a more environmentally friendly manner (Das et al., 2023). Indigenous knowledge is valuable in fields such as sustainable agriculture (Siahaya et al., 2016), disaster risk management (Islam et al., 2018), and climate adaptation, including the use of medicinal plants for healthcare (Shiva, 1996; Posey, 1999; Isaac et al., 2018). However, this knowledge is increasingly at risk due to the pressures of globalisation, climate change, and the disruption of traditional land-use patterns (Shiva, 1993; Ford et al., 2020; Pearson et al., 2023). India, with one of the world's largest Indigenous and tribal populations, is a significant region for the study and preservation of Fourth World Botany. The ethnobotanical traditions of India's tribal communities not only offer a vast reservoir of traditional knowledge but also provide critical perspectives on sustainable resource management. These insights are vital in addressing global environmental challenges such as biodiversity loss and climate change (Shiva, 1993; Khasim et al., 2013). This review explores the role of Indigenous botanical knowledge within the Fourth World Botany framework, highlighting its significance in biodiversity conservation, climate adaptation, and sustainable development. It highlights the socio-political and cultural significance of preserving

Indigenous knowledge and demonstrates how integrating this knowledge into modern conservation strategies is essential for fostering ecological and cultural sustainability.

Theoretical Synthesis and Conceptual Framework

This study presents a conceptual model that views Indigenous Knowledge Systems (IKS) and Traditional Ecological Knowledge (TEK) as dynamic, place-based knowledge frameworks shaping human–environment relationships. The model highlights four interconnected pathways through which IKS and TEK support conservation: (i) ecological stewardship through culturally regulated practices, (ii) cultural continuity that preserves collective identity and resource ethics, (iii) adaptive strategies that enhance community resilience to environmental changes, and (iv) governance traditions that promote rights-based, community-led resource management. These pathways operate within broader socio-political and environmental pressures, illustrating how Indigenous communities serve as custodians of both ecological and cultural wisdom. This theoretical framework forms the basis of the review’s structure and guides the interpretation of its findings.

2. MATERIALS AND METHODS

A systematic review of academic literature on the role of Fourth World Botany was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which include the stages of identification, screening, eligibility, and inclusion of relevant literature (Tricco et al., 2018). This review employed a multi-step, systematic approach to gather, analyse, and synthesise academic literature on Fourth World Botany and Indigenous botanical knowledge in environmental conservation and cultural sustainability. A peer-reviewed literature search was conducted using databases such as Web of Science, Scopus, PubMed, JSTOR, and Google Scholar. The search string used for the study included terms such as “traditional knowledge” OR “indigenous knowledge” OR “local knowledge” OR “local ecological knowledge” OR “indigenous knowledge systems,” “Fourth World Botany,” “tribal botany,” “ethnobotany,” and “biodiversity conservation” OR “nature conservation” OR “environmental conservation” OR “natural resource management” OR “sustainable plant use.” No restrictions were placed on publication year, subject area, or country of publication. Only peer-reviewed, English-language articles with full-text access were included. For articles where full-text access was unavailable, requests were made to authors through platforms like ResearchGate. Duplicate records and unrelated abstracts were removed. Conference papers, dissertations, and materials classified as notes or errata were excluded due to incomplete methodological details or lack of rigorous peer review. A total of 593 records were retrieved, of which 165 duplicates were removed, leaving 428 records for screening. Based on title and abstract screening, 239 articles were excluded. The remaining 189 full-text articles were assessed for eligibility, of which 66 were excluded for the

following reasons: not related to Fourth World Botany (n = 32), non-peer-reviewed (n = 6), not focused on Indigenous knowledge systems (n = 21), or insufficient methodological detail (n = 7). Ultimately, 123 studies were included in the final qualitative synthesis. The complete selection process is illustrated in the PRISMA flow diagram (Figure 1).

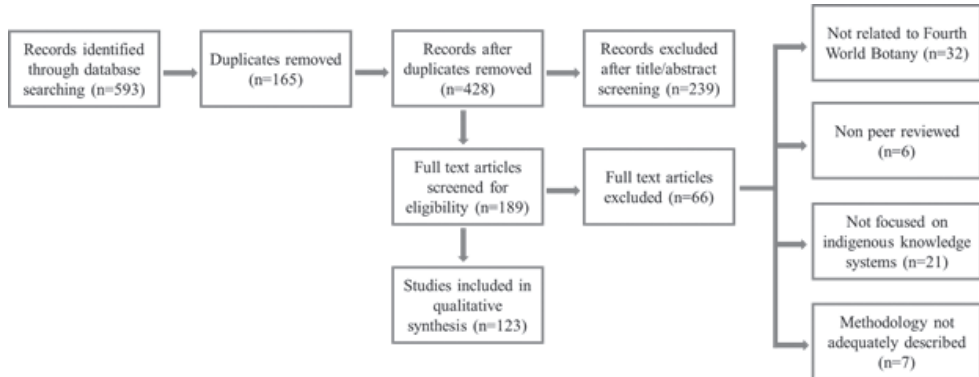


Figure 1. PRISMA workflow depicting study identification, screening, and inclusion for Fourth World Botany

All included articles were examined for recurring concepts and methodological approaches. The studies were categorised into eight themes that consistently emerged across the literature: (i) Indigenous knowledge systems, agroecology, and epistemologies; (ii) ethnomedicine and traditional healing practices; (iii) biodiversity conservation and ecological stewardship; (iv) sustainable resource use and environmental governance; (v) socio-cultural dimensions and community identity; (vi) climate adaptation, resilience, and environmental change; (vii) challenges, threats, and sociopolitical marginalisation; and (viii) integrative approaches and pathways for future sustainability. These themes represent the key domains through which Indigenous botanical knowledge supports ecological resilience, cultural continuity, and sustainable environmental management. A structured summary of the included studies and their thematic distribution is presented in Table 1.

Table 1. Summary of included studies categorised by major themes with key focus areas

Theme	No. of Studies (n = 123)	Key Focus Areas
Theme 1: Indigenous Knowledge Systems, agroecology, and epistemologies	19	Ecological and cultural heritage; Indigenous epistemologies; sustainable agricultural practices; traditional land and resource management.
Theme 2: Ethnomedicine and traditional healing practices	23	Plant-based remedies; healing rituals; ethno-pharmacological knowledge; integration of traditional medicine into modern healthcare systems.

Theme 3: Biodiversity conservation and ecological stewardship	18	Indigenous-led species and habitat conservation; community forest management; sustainable forestry practices.
Theme 4: Sustainable resource use and environmental governance	15	Indigenous environmental governance; resource-use practices; land and customary rights; policy constraints and sociopolitical challenges.
Theme 5: Socio-cultural dimensions and community identity	14	Intergenerational knowledge transfer; protection of traditional knowledge and benefit-sharing frameworks in India; ritual, ceremonial, and cultural significance of plants.
Theme 6: Climate adaptation, resilience, and environmental change	13	Gender roles in knowledge transmission; climate-resilient practices; adaptation strategies; policy and legal frameworks supporting resilience.
Theme 7: Challenges, threats, and sociopolitical marginalisation	11	Erosion of Indigenous Knowledge Systems (IKS); land alienation; sociopolitical marginalisation; need to integrate IKS and scientific knowledge for sustainable solutions.
Theme 8: Integrative approaches and pathways for future sustainability	10	Pathways for sustainable development; leveraging Indigenous practices; collaborative approaches to biodiversity conservation, climate adaptation, and cultural preservation.

3. RESULTS AND DISCUSSION

Indigenous Knowledge Systems (IKS) are intricate frameworks developed over millennia, rooted in the cultural identity and environmental understanding of Indigenous populations (Henri et al., 2021). These systems encompass a wealth of knowledge, traditions, and beliefs that guide communities in managing and preserving their natural resources. Unlike modern practices that often focus on maximum productivity, IKS emphasises sustainability, reciprocity, and ethical relationships with nature, viewing it not as a collection of commodities but as an interconnected system essential for both human and ecological well-being (Berkes, 1993). IKS is predominantly transmitted orally, with knowledge passed down through generations and adapted through direct experience. Its focus on maintaining social, cultural, and ecological stability forms the foundation of traditional societies' relationships with the natural world. Well-established Indigenous knowledge systems such as Ayurveda, Unani, and acupuncture illustrate the longevity and adaptability of these traditions, many of which have been incorporated into contemporary research and practice (Bruchac, 2014; Hoppers, 2021). As localised and experience-driven systems, IKS remains highly relevant to addressing community-specific challenges in agriculture, health, and environmental management. Its adaptability, built through long-term observation and trial-and-error, strengthens community resil-

ience and supports sustainable resource use. These knowledge systems also operate as forms of social capital, fostering community cohesion and reinforcing shared values and practices. A total of 123 publications met the inclusion criteria and were systematically analysed. These studies cover a broad range of topics related to Fourth World Botany, including ethnobotany, Indigenous Knowledge Systems, biodiversity conservation, environmental governance, and climate adaptation. Through qualitative synthesis and thematic coding, the literature was organised into eight main thematic categories that highlight recurring ideas, knowledge domains, and research priorities. The distribution of studies across these themes is presented in Figure 2.

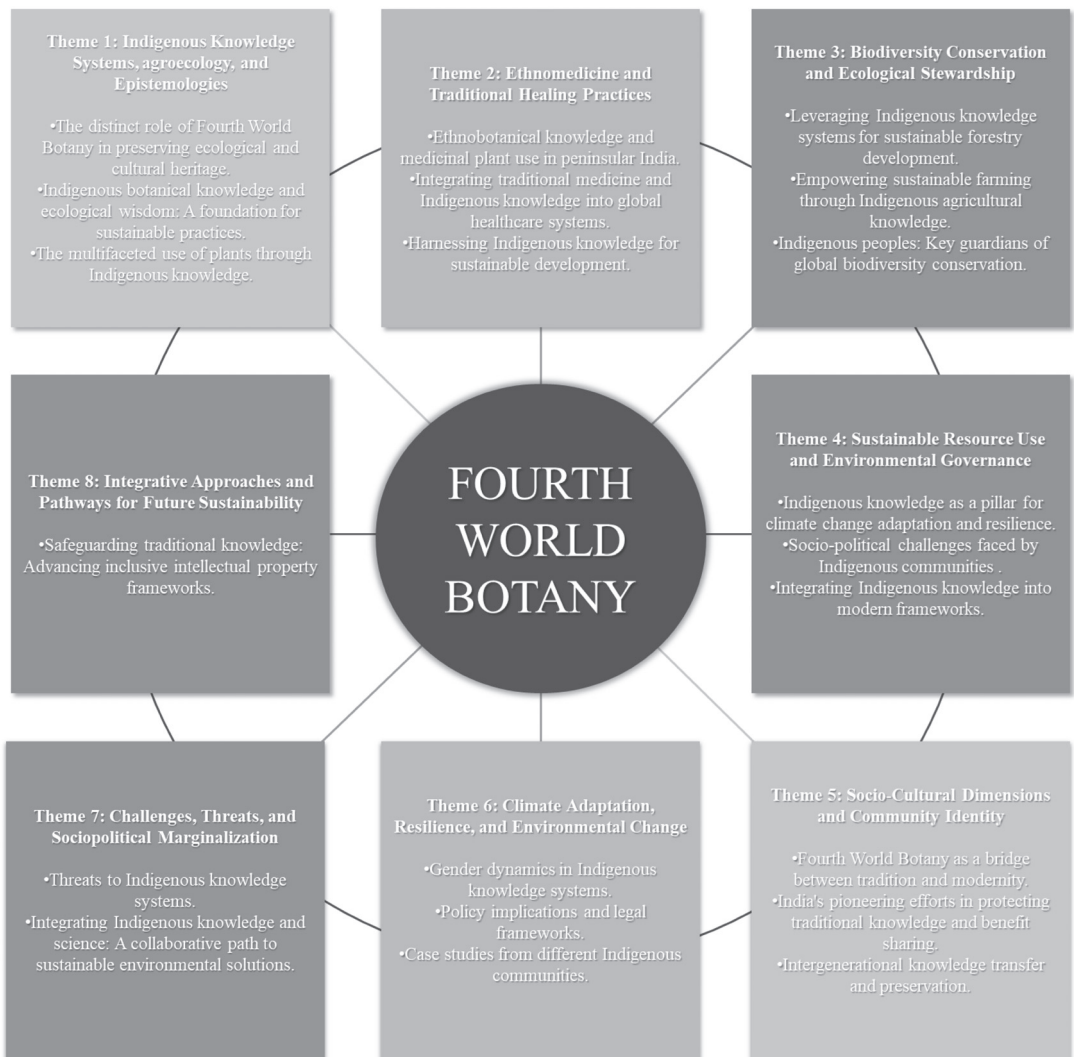


Figure 2. Distribution of subthemes across eight thematic clusters

3.1. Indigenous Knowledge Systems, Agroecology and Epistemologies

3.1.1. The distinct role of Fourth World Botany in preserving ecological and cultural heritage

The unique value of Fourth World Botany lies in its deep-rooted connection to Indigenous Knowledge Systems and the ecological wisdom of stateless, marginalised communities. Unlike conventional ethnobotany, which often documents plant use from a more neutral or academic perspective, Fourth World Botany highlights the struggles, resilience, and sustainable practices of Indigenous peoples who exist outside mainstream nation-states. These communities have cultivated, conserved, and sustainably managed local ecosystems for centuries, often through practices that modern science now recognises as vital for biodiversity conservation and climate resilience (Shiva, 1993; Berkes, 2008). The holistic approach of Fourth World Botany encompasses not just the practical uses of plants, such as for medicine, food, and rituals, but also the cultural, spiritual, and communal relationships between these people and their environment (Posey, 1999). As Indigenous knowledge is passed down through oral traditions, rituals, and sacred spaces like groves, Fourth World Botany preserves this knowledge in the face of threats like land dispossession, climate change, and globalisation (Manuel and Posluns, 1974). This field serves as a bridge between ancient ecological wisdom and modern environmental challenges, offering valuable, often overlooked, solutions for sustainable development, biodiversity protection, and climate adaptation (Shiva, 1996; Khasim et al., 2013).

3.1.2. Indigenous botanical knowledge and ecological wisdom: A foundation for sustainable practices

Indigenous botanical knowledge is a vital component of traditional ecological wisdom, encompassing sustainable agricultural practices, biodiversity conservation, and the use of medicinal plants. Through centuries of interaction with their ecosystems, Indigenous communities have developed a profound understanding of their natural environments, leading to unique approaches to resource management. In India, tribal groups such as the Gonds, Bhils, and Santhals possess extensive knowledge about medicinal plants, food crops, and wild edibles. This knowledge is not only practical but also intricately woven into cultural practices, passed down through generations via oral traditions, rituals, and customs (Warren, 1991; Khasim et al., 2013;). The holistic relationship these communities maintain with their ecosystems enables them to manage resources in ways that preserve ecological balance, often aligning with contemporary conservation principles like agroforestry and permaculture (Gadgil and Berkes, 2009; Berkes, 2012). For example, traditional farming systems often incorporate crop diversity and natural resource recycling, minimising environmental impact while ensuring long-term productivity—principles that mirror those of modern permaculture. Despite the critical role that Indigenous botanical knowledge plays in sustainable development, it remains largely under-documented and marginalised in mainstream environmental discourse

(Posey, 1999). The erosion of this knowledge due to globalisation, land dispossession, and generational changes threatens the survival of these sustainable practices. Documenting and preserving Indigenous wisdom is therefore essential, not only for cultural preservation but also for its contributions to global sustainability. A striking example from this review is the use of sacred groves in India for biodiversity conservation. These sacred natural spaces, often protected by cultural and spiritual traditions that prohibit deforestation and exploitation, represent an ancient form of ecological wisdom. However, they are often overlooked by global conservation efforts, which tend to prioritise scientific, state-led approaches (Shiva, 1993). Integrating these traditional practices into modern conservation strategies could offer a more inclusive and sustainable path forward for biodiversity preservation, blending ancient ecological knowledge with contemporary scientific efforts (Sundararajan and Sahu, 2014).

3.1.3. The multifaceted use of plants through Indigenous knowledge

Indigenous Knowledge Systems have long demonstrated the diverse applications of plants, encompassing medicinal, cultural, and ecological functions. This deep-rooted understanding spans various traditional health systems like Ayurveda, Unani, and Traditional Chinese Medicine (TCM), which emphasise holistic well-being through plant-based remedies (Subbarayappa, 1997; Subhose et al., 2005; Mukherjee, 2001; Marshall, 2020; Nedungadi et al., 2023). Beyond medicine, plants are integral to Indigenous communities for food, biofencing, handicrafts, and socio-religious rituals (Mohanty et al., 2011; Mohanty et al., 2012; Tripathy et al., 2014; Panda et al., 2018; Panda et al., 2021; Sahu and Panda, 2021; Panda et al., 2022; Panda et al., 2023; Panda et al., 2024). For example, the Kani tribe's use of *Trichopus zeylanicus* for anti-fatigue properties led to the development of the drug Jeevani, showcasing how Indigenous wisdom can drive pharmacological advancements (Mashelkar, 2001; George et al., 2016). In the Amazon, Indigenous tribes utilise a vast array of plants for complex medicinal purposes, revealing the untapped potential of such knowledge (Plotkin, 1993). Additionally, this ecological wisdom aids in biodiversity conservation and sustainable land use (Berkes, 2008). Preserving and integrating Indigenous knowledge into modern practices is crucial for both cultural preservation and addressing current environmental and health challenges (Alves and Rosa, 2007).

3.2. Ethnomedicine and Traditional Healing Practices

3.2.1. Ethnobotanical knowledge and medicinal plant use in peninsular India

Peninsular India is a rich repository of ethnobotanical knowledge, shaped by its cultural and floristic diversity. The country is home to nearly 67.8 million tribal people belonging to 227 ethnic groups, residing in about 5,000 forested villages (Pushpangadan, 2002). These tribal communities occupy approximately 18.74% of India's total area, spanning 21 states and union territories (Arora, 1995). According to the 2011 census,

the tribal population stands at 104,281,045, constituting 8.2% of India's total population (Sahoo et al., 2013). Each community has its distinct social and cultural identity, with around 116 dialects and 227 subsidiary dialects spoken by these groups (Khasim et al., 2013). These Indigenous people are not only the custodians of traditional knowledge but also a treasure house of ethnobotanical wisdom, accumulated over generations through observation, experimentation, and oral transmission. This is particularly significant in terms of botanical knowledge regarding the multiple uses of plants in their surroundings. For instance, an All India Coordinated Research Project in Ethnobotany, sponsored by the Ministry of Environment and Forests, Government of India, reported that out of over 15,000 species of higher plants found in India, approximately 9,000 are economically useful. Of these, 7,500 are medicinal, 3,900 are edible, 700 are culturally important, 525 are used for fibre, 400 for fodder, 300 for pesticides and insecticides, 300 for gum, resin, and dye, and 100 for incense and perfume (Anonymous, 1994). Globally, more than 20,000 species of higher plants are used in traditional medicine practices by Indigenous cultures (Ved Prakash, 1998), and over 10,000 wild plant species are reported to be utilised by Indian tribal communities for primary healthcare, food, and other material needs (Pushpangandan and Kumar, 2005). However, much of this invaluable ethnobotanical knowledge remains undocumented and scientifically unverified. Furthermore, this knowledge is rapidly fading due to urban migration, a lack of interest among the younger generation in traditional practices, increasing dependence on modern medicine, and the extinction of some tribes. Additionally, deforestation and biodiversity loss exacerbate the problem. Given this scenario, it is imperative to conduct extensive surveys, documentation, and scientific evaluation of Indigenous knowledge to develop new modern drugs and validate the efficacy of traditional practices. Efforts in this direction began three decades ago with the screening of medicinal plants at the Central Drug Research Institute in Lucknow and other national institutes. Approximately 700 plant samples have exhibited a wide range of biological activities, including antifertility, cardiovascular, spasmolytic, anticancer, antimalarial, hypoglycaemic, and antiviral effects, out of about 4,000 samples screened. Some promising leads have already been developed into drugs, while others are currently undergoing clinical evaluation (Ved Prakash, 1996).

3.2.2. Integrating traditional medicine and Indigenous knowledge into global healthcare systems

Alternative medicines are widely used by about 60% of the global population, serving rural populations in developing countries and individuals in developed nations where modern medicine is dominant (Ballabh and Chaurasia, 2007). As the largest producer of medicinal plants, India has around 250,000 registered Ayurvedic practitioners compared to 700,000 in modern medicine. While approximately 20,000 medicinal plants have been recorded in India, only 7,000–7,500 are actively used by traditional healers to treat various diseases. These plants are incorporated into different traditional medicinal

systems, with Ayurveda using 2,000 plants, Siddha 1,300, Unani 1,000, Homeopathy 800, Tibetan 500, Modern medicine 200, and folk medicine 4,500 (Pandey et al., 2013). India has about 25,000 effective plant-based formulations, and over 1.5 million practitioners utilise these traditional systems for healthcare. Despite their widespread use and cultural significance, the commercialisation of medicinal plants, often without recognition of intellectual property rights, poses a threat to Indigenous communities who have relied on this knowledge for centuries. These communities, rich in traditional medicinal wisdom, face exploitation as their knowledge is commodified, leading to cultural erosion. While plants like *Terminalia arjuna* for heart ailments and *Azadirachta indica* (Neem) for antibacterial uses are vital to these practices, the bioprospecting of such plants often excludes benefit-sharing, leaving Indigenous peoples vulnerable to exploitation (Samy et al., 1998; Kamboj, 2000; Ballabh and Chaurasia, 2007; Pandey et al., 2013).

3.2.3. *Harnessing Indigenous knowledge for sustainable development*

Indigenous communities, comprising about 5% of the global population but representing nearly 15% of the world's poor, hold vast repositories of traditional knowledge essential for sustainable development (International Fund for Agricultural Development, 2019). For centuries, these communities have established ways of living in harmony with the environment through living sustainably (Bansal et al., 2022). They are characterised by unique cultures, values, and beliefs, prioritising kin-based structures over market-oriented approaches (Altman, 2001), with a strong focus on community orientation, resource sharing, and cooperation (Schaper, 1999). In the face of globalisation and urbanisation, Indigenous peoples play a crucial role in preserving cultural identities and managing ecosystems sustainably (Rock et al., 2009; Lawhon and Murphy, 2012). Their active involvement is critical to achieving all 17 Sustainable Development Goals (SDGs), as the 2030 Agenda emphasises the importance of integrating diverse knowledge systems, including both Indigenous and scientific knowledge, to address global challenges (Magni, 2017; Talan and Sharma, 2019). Through generational knowledge transfer, Indigenous communities have adapted their sustainable practices to meet developmental challenges (Mehta et al., 2010). This deep connection with nature positions them as key actors in addressing climate change, managing natural resources, and promoting food systems that ensure healthy nutrition for all (Thiede and Gray, 2020; Yap and Watene, 2019). In India, which has over 700 Scheduled Tribes (STs), traditional practices like the farming techniques of Kerala's Kuttanad region—recognised as a Globally Important Agricultural Heritage System (GIAHS) by the FAO—offer sustainable solutions for agriculture and biodiversity conservation (CEE, 2015). However, India's vulnerability to climate change, exacerbated by socio-economic disparities and institutional inefficiencies, calls for a coordinated approach that integrates Indigenous knowledge into national strategies (Beg et al., 2002). Aligning these practices with SDGs, particularly SDG 2 (Zero Hunger), SDG 6 (Clean Water), and SDG 15 (Life

on Land), could significantly advance India's climate action and sustainability efforts while improving the socio-economic conditions of tribal communities (Priyadarshini and Abhilash, 2019; Jakes, 2024).

3.3. Biodiversity Conservation and Ecological Stewardship

3.3.1. Leveraging Indigenous knowledge systems for sustainable forestry development

Indigenous knowledge systems have played a crucial role in regreening disturbed hill-sides for over 30 years, often utilising the planting of both native and carefully selected exotic tree species that thrive in local environments. This practice significantly contributes to maintaining ecological balance in various regions. One of the most vital applications of Indigenous knowledge lies in its medicinal practices, which not only safeguard community health but also support efforts in hunger eradication and poverty reduction. Furthermore, Indigenous knowledge is integral to sustainable practices in ecotourism, offering development perspectives that differ from conventional approaches (Cunningham, 2010). Given that local communities often inhabit vulnerable ecosystems, their knowledge is essential for understanding and responding to the challenges posed by climate change. In Asia, for instance, Indigenous peoples possess deep insights into climate threats such as typhoons, monsoons, flooding, rising sea levels, and freshwater salinisation, having experienced the impacts of these natural phenomena for generations (Nyong et al., 2007). Similarly, Indigenous populations in the Americas and the Caribbean hold valuable knowledge regarding the effects of glacier melting, hurricanes, rising sea levels, and shifting rainfall patterns (Kronik and Verner, 2010). Recognising and integrating these traditional practices into broader environmental policies can foster resilience and promote sustainable development.

3.3.2. Empowering sustainable farming through Indigenous Agricultural Knowledge

Indigenous Agricultural Knowledge (IAK) has long played a vital role in fostering sustainable agricultural practices, providing farmers with the ability to adapt to diverse environmental conditions without reliance on synthetic inputs. For generations, Indigenous communities have utilised techniques like intercropping, crop rotation, terracing, and agroforestry, which promote soil fertility through biological processes rather than chemical fertilisers and pesticides (Tella, 2007; Maru et al., 2019). These practices minimise environmental degradation, reduce greenhouse gas emissions, and contribute to long-term sustainability (Arunrat et al., 2022). For instance, the Khasi and Garo tribes in India have perfected mixed cropping in hilly terrains, ensuring soil stability and fertility (Bharati et al., 2014). However, modern agricultural policies often encourage monocultures and chemical-based farming, threatening the survival of these ecologically sound techniques. This shift, driven by the introduction of hybrid seeds and chemical inputs, not only erodes Indigenous knowledge but also leads to biodiversity loss and undermines food sovereignty (Shiva, 1996; Mishra et al., 2018; Yeleliere et al.,

2023). Therefore, integrating Indigenous knowledge into modern agriculture is crucial for building resilience to climate change and ensuring sustainable food systems.

3.3.3. Indigenous peoples: Key guardians of global biodiversity conservation

The importance of Traditional Ecological Knowledge (TEK) in biodiversity conservation is not confined to a specific region or continent; it is widespread and reported across many parts of the world, including the Pacific Northwest (Charnley et al., 2007), Europe (Hernandez-Morcillo et al., 2014), Canada (Houde, 2007), China (Jiao et al., 2012), India (Das et al., 2023), Ecuador (Becker and Ghimire, 2003), the Philippines (Camacho et al., 2016), and Africa (Sinthumule, 2023). Indigenous Peoples and local communities (IPLCs) are integral to global biodiversity conservation, managing territories that contain approximately 80% of the world's remaining biodiversity and intersect with nearly 40% of protected areas and ecologically intact landscapes (Anonymous, 2024). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) 2019 global assessment reported that 35% of formally protected areas and 35% of all remaining terrestrial regions with minimal human intervention are traditionally owned, managed, or used by Indigenous peoples (IPBES, 2019). Their traditional knowledge and land-use practices, such as controlled burning, agroforestry, and water management, help maintain ecological balance and enhance resilience against environmental challenges like climate change (Berkes, 2009; Bharati et al., 2019). For instance, sacred groves in India, managed by Indigenous groups such as the Bhils and Garos, act as biodiversity hotspots, preserving rare and endangered species (Gadgil et al., 1993). Moreover, areas managed by IPLCs show slower rates of biodiversity loss compared to other regions, emphasising their effectiveness as environmental stewards (Garnett et al., 2018; Fa et al., 2020). However, despite their contributions, IPLCs face marginalisation, resource extraction pressures, and inadequate recognition in global conservation policies (Díaz et al., 2019; Hill et al., 2020; McElwee et al., 2020). For transformative change, it is essential to ensure the formal recognition of IPLC territorial rights and equitable involvement in biodiversity governance (Forest Peoples Programme et al., 2020). Although Indigenous communities are vital to biodiversity conservation, they are disproportionately affected by climate change impacts such as shifting rainfall patterns, deforestation, and biodiversity loss. Moreover, global conservation policies frequently exclude their participation, leading to conflicts over land rights and further marginalisation (Wyllie de Echeverria and Thornton, 2019).

3.4. Sustainable Resource Use and Environmental Governance

3.4.1. Indigenous knowledge as a pillar for climate change adaptation and resilience

Indigenous knowledge (IK) is increasingly recognised as essential for climate change adaptation, providing sustainable, adaptive strategies refined over centuries. Rooted in a deep, place-based understanding of the environment, Indigenous peoples' knowledge systems are derived from generations of observation and interaction with nature, offer-

ing insights that enhance ecosystem resilience and biodiversity conservation (Parrotta and Agnoletti, 2012; IPCC, 2019). These communities rely on traditional practices such as agroforestry, rotational farming, and water management to mitigate climate impacts, sequester carbon, and reduce emissions (Green and Raygorodetsky, 2010; Johnston, 2012). Indigenous knowledge also plays a crucial role in disaster preparedness, with practices like weather prediction, crop rotation, and food storage helping communities anticipate and adapt to climate extremes (Jiri et al., 2015; Apraku et al., 2018). For instance, the use of IK in agriculture has led to climate-smart practices like intercropping and the cultivation of resilient crop varieties, enhancing food security in uncertain climates (Sukula, 2006; Kusumastuti et al., 2023). Beyond agriculture, Indigenous knowledge extends to sectors like water management, hunting, and traditional medicine, all of which contribute to climate resilience (Clements et al., 2011). Despite its value, Indigenous communities remain among the most vulnerable to climate change, facing heightened risks from altered rainfall patterns, deforestation, and biodiversity loss (Leal Filho et al., 2021). Integrating Indigenous knowledge into global climate strategies is crucial for fostering more equitable, resilient, and sustainable climate solutions, benefiting both Indigenous and non-Indigenous populations (Chen and Cheng, 2020).

3.4.2. Socio-political challenges faced by Indigenous communities

Indigenous communities around the world face a myriad of socio-political challenges that stem from historical injustices, marginalisation, and ongoing discrimination. Many of these groups struggle for recognition of their rights to land, culture, and self-determination, often encountering legal and bureaucratic barriers when seeking to assert these rights (Anaya, 2004). Economic disadvantages are compounded by inadequate access to education, healthcare, and employment opportunities, leading to persistent cycles of poverty. Additionally, Indigenous populations frequently face cultural assimilation pressures, which threaten their languages, traditions, and social structures. Political representation remains a significant issue, as Indigenous voices are often excluded from decision-making processes that directly impact their lives and territories (Higgins, 2019). The fight for environmental justice is also critical, as many Indigenous lands are threatened by exploitation and development projects, further exacerbating their socio-political struggles (McGregor et al., 2020).

3.4.3. Integrating Indigenous knowledge into modern frameworks

Integrating Indigenous botanical knowledge into modern scientific research and policy frameworks is essential for addressing contemporary global environmental challenges. When combined with scientific approaches, Indigenous knowledge systems can provide innovative solutions for biodiversity conservation, sustainable agriculture, and climate resilience (Berkes, 2008). Several initiatives, such as community-based conserva-

tion projects and participatory resource management, have demonstrated promise in aligning Indigenous practices with modern sustainability goals. For example, programs that empower Indigenous communities to manage their resources, like the Community Conserved Areas initiative in India, exemplify the effective blending of traditional knowledge with contemporary conservation strategies (Shahabuddin and Rao, 2010). However, any integration must respect Indigenous communities' autonomy, intellectual property rights, and cultural integrity. Engaging these communities through participatory approaches is critical to ensuring their voices are heard and their knowledge is valued. This respect fosters collaboration and leads to more effective conservation outcomes.

3.5. Socio-Cultural Dimensions and Community Identity

3.5.1. Fourth world botany as a bridge between tradition and modernity

Ultimately, Fourth World Botany serves as a critical bridge between traditional knowledge systems and contemporary environmental challenges. This term refers to the botanical knowledge held by Indigenous communities, emphasising their unique relationship with the land and plants in the context of cultural, ecological, and economic sustainability. By highlighting the resilience and adaptability of Indigenous practices, Fourth World Botany underscores the importance of incorporating these perspectives into global efforts to combat climate change, promote biodiversity conservation, and achieve sustainable development. Indigenous communities, often overlooked in the global discourse on conservation, hold valuable insights that can inform and enhance modern scientific and policy frameworks (Shiva, 1996; Khasim et al., 2013). For example, traditional agroecological practices have been shown to enhance soil fertility and resilience against climate impacts, contributing to food security while preserving biodiversity. Integrating these traditional knowledge systems into contemporary practices not only enriches our understanding of ecological processes but also fosters a more holistic approach to environmental management. By recognising the value of Fourth World Botany, we can build bridges between Indigenous wisdom and modern scientific inquiry, ultimately leading to more effective and equitable solutions for our planet's pressing challenges. In conclusion, embracing Fourth World Botany as a bridge between tradition and modernity is essential for fostering sustainable practices that honour both the wisdom of Indigenous communities and the imperatives of contemporary environmental science.

3.5.2. India's pioneering efforts in protecting traditional knowledge and benefit sharing

India holds the distinction of being the first country in the world to experiment with a benefit-sharing model under Article 8(j) of the Convention on Biological Diversity (CBD), recognising the rights to resources and intellectual property (IPR) of traditional communities. This model ensures that benefits derived from the use of knowledge de-

veloped, preserved, and maintained by these communities over generations are shared equitably (Anand, 1998; Mashelkar, 2001). In 2001, the Council of Scientific and Industrial Research (CSIR) and the Ministry of AYUSH, Government of India, developed the Traditional Knowledge Digital Library (TKDL), a pioneering digital repository aimed at protecting India's traditional knowledge, especially concerning medicinal plants and formulations used in Indian systems of medicine. The primary objective of TKDL is to prevent biopiracy and unethical patents by documenting this ancient knowledge electronically and classifying it according to the international patent classification system. This initiative helps safeguard India's vast traditional heritage from being exploited by global corporations. Additionally, the National Institute of Science Communication and Information Resources (NISCAIR), under CSIR, has been publishing the Indian Journal of Traditional Knowledge since 2003, covering various aspects of traditional knowledge. Another prominent publication, *Ethnobotany*, released since 1989 by the Society of Ethnobotanists, shares research findings on ethnobotanical topics. The study of traditional knowledge, particularly ethnobotany and the traditional healthcare system practiced in India since ancient times, gained momentum with the pioneering work of Dr. A. K. Janaki Ammal in 1956 (Jain and Jain, 2015). Since then, this subject has gained popularity, with hundreds of researchers from educational and scientific institutions now engaged in studying this rich heritage. However, the vast world of traditional knowledge in India, particularly in healthcare, requires more extensive surveys, documentation, and preservation. Without proactive measures, this invaluable knowledge risks being lost due to modernisation, cultural erosion, and the rapid disappearance of Indigenous practices both in India and globally.

3.5.3. Intergenerational knowledge transfer and preservation

Intergenerational Knowledge Transfer and Preservation play a vital role in maintaining the continuity and evolution of Indigenous ecological wisdom. In many Indigenous communities, knowledge about plants, agriculture, and medicinal practices is traditionally passed down orally through storytelling, rituals, and hands-on demonstrations, often beginning in early childhood. This transfer process ensures that younger generations not only learn the practical uses of plants but also understand their cultural and spiritual significance. However, modern pressures such as urbanisation, cultural assimilation, and loss of traditional lands threaten this process, leading to the erosion of centuries-old knowledge systems. Preserving these methods of knowledge transfer is critical for sustaining biodiversity and maintaining cultural identity. Community-led education programs and documentation efforts have emerged as important strategies to bridge the gap between traditional knowledge systems and modern education, ensuring that Indigenous wisdom endures despite rapid socio-economic changes (Turner and Clifton, 2009; Berkes, 2012; Gomez-Baggethun and Reyes-Garcia, 2013; McCarter et al., 2014).

3.6. Climate Adaptation, Resilience, and Environmental Change

3.6.1. Custodians of wisdom: Women and gender dynamics in Indigenous knowledge systems

In many Indigenous communities, women hold crucial roles as knowledge keepers, particularly in the areas of medicinal plants, food preparation, and agriculture. Their contributions are central to the preservation and application of traditional ecological knowledge. Women are often the primary custodians of plant-based wisdom, especially in food production, healthcare, and the use of medicinal plants. Through daily subsistence activities—such as gathering wild plants, cultivating crops, and preparing herbal remedies—women serve as key transmitters of botanical and ecological wisdom. This gendered knowledge is frequently passed down through matrilineal systems, where mothers and grandmothers teach younger generations how to sustainably use natural resources. Despite their central role, women's contributions to Indigenous knowledge are often underrepresented in formal conservation and development discussions. Empowering women within these communities and acknowledging their expertise is critical for sustaining biodiversity and ensuring the continuation of ecological practices that support both cultural heritage and environmental resilience (Howard, 2003; Turner and Turner, 2008; Agarwal, 2010).

3.6.2. Policy implications and legal frameworks

The legal frameworks and policy implications surrounding Indigenous knowledge are critical for protecting the intellectual property and cultural heritage of Indigenous communities while fostering biodiversity conservation. International agreements such as the Nagoya Protocol and the Convention on Biological Diversity (CBD) stress the importance of fair and equitable benefit-sharing from the use of genetic resources, ensuring that Indigenous peoples are appropriately compensated for their traditional knowledge. A notable national example is India's Traditional Knowledge Digital Library (TKDL), which safeguards Indigenous medicinal knowledge by preventing biopiracy and unethical corporate exploitation. The Biological Diversity Act of 2002 further strengthens this protection by regulating access to biological resources and ensuring benefit-sharing with local communities. While India leads with such pioneering efforts, many other nations face challenges in implementing similar frameworks due to enforcement gaps, underrepresentation of Indigenous peoples in decision-making, and difficulties in balancing intellectual property rights with the open access necessary for scientific research. Adopting comprehensive legal measures like those in India could guide other countries in preserving Indigenous wisdom while promoting innovation and biodiversity (CBD, 1992; Posey and Dutfield, 1996; Biological Diversity Act, 2002; Young, 2015).

3.6.3. Case studies from different Indigenous communities

Case studies from various Indigenous communities offer valuable insights into their unique cultures, challenges, and resilience. These studies often explore traditional knowl-

edge systems, environmental stewardship, and social structures that have sustained these communities for generations. For instance, research into the Sámi people of Scandinavia highlights their adaptive reindeer herding practices, now increasingly threatened by climate change. Similarly, studies of the Maori in New Zealand emphasise their efforts to reclaim language and cultural identity through educational and legal reforms, which are interconnected with their environmental stewardship. In North America, Native American tribes frequently address land rights issues, environmental justice, and the preservation of sacred sites. In the Amazon rainforest, the Kayapo people employ traditional land management practices, such as agroforestry and controlled burning, to maintain biodiversity and sustain their livelihoods while protecting their ecosystems. The Maasai in East Africa practice rotational grazing, which preserves the savannah ecosystem and promotes diverse plant growth. In India, the Dongria Kondh community uses agricultural methods aligned with cultural beliefs to conserve indigenous rice varieties and forest ecosystems. Collectively, these case studies highlight the adaptability and resilience of Indigenous knowledge systems, showing how traditional practices effectively address contemporary environmental challenges, enhance biodiversity, support sustainable development, and preserve cultural heritage and autonomy. By documenting and sharing these examples, we can better appreciate the significance of Indigenous ecological wisdom in the global context of conservation and climate change (Posey, 1985; Nepstad et al., 2006; LaDuke, 1999; Forbes, 2009; Smith, 2012; Horstkotte et al., 2017; Oduor, 2020; Behera, 2021; Dandapat, 2021).

3.7. Challenges, Threats, and Sociopolitical Marginalisation

3.7.1. Threats to Indigenous knowledge systems

Indigenous botanical knowledge faces several significant threats, including land dispossession, environmental degradation, and the impacts of globalisation. The rapid expansion of industries, infrastructure projects, and commercial agriculture has displaced Indigenous communities from their ancestral lands, severing their connection to the ecosystems that are vital to their knowledge systems (Maffi, 2001). Additionally, globalisation has contributed to cultural homogenisation, undermining the transmission of traditional knowledge across generations. As younger individuals gravitate toward urbanisation and modern lifestyles, they become increasingly disconnected from their Indigenous roots, jeopardising the intergenerational transfer of vital knowledge (Huntington, 2000; Wyllie de Echeverria and Thornton, 2019).

The imposition of external legal frameworks governing land and resource use further undermines Indigenous governance systems. Often, Indigenous knowledge is unrecognised by formal institutions, leaving these communities vulnerable to exploitation and the erasure of their cultural heritage (Turner, 2005). This lack of recognition can lead to the appropriation of Indigenous knowledge by external entities without equitable benefit-sharing, exacerbating the marginalisation of these communities (Ramos and Zizumbo-Villarreal, 2017).

3.7.2. Need for integrating Indigenous knowledge and science: A collaborative path to sustainable environmental solutions

Although Indigenous knowledge systems face numerous sociopolitical threats, meaningful integration with scientific research can counter marginalisation and restore epistemic authority to Indigenous communities. Research partnerships between Indigenous knowledge and science are crucial for addressing complex environmental challenges and enhancing decision-making processes. Ecological science, though grounded in systematic, evidence-based approaches, often lacks the deep temporal and spatial understanding that Indigenous and local knowledge systems offer. Indigenous knowledge, developed through generations of interaction with the environment, can fill gaps in scientific data and generate new insights into climate patterns, biodiversity, and sustainable resource management (Berkes et al., 2000). While scientific methods are often restricted by specific study sites and technological tools, Indigenous knowledge spans generations, providing detailed and holistic perspectives on ecosystem dynamics (Stevenson, 1996). One of the major advantages of integrating Indigenous knowledge is its ability to reduce inherent biases in scientific research, which may arise from governmental policies, funding priorities, or the values of researchers (Boakes et al., 2010). In contrast, Indigenous knowledge is shaped by sustained and intimate engagement with local environments, offering a complementary view that enriches scientific understanding (Roebuck and Phifer, 1999). Collaborative research with Indigenous communities not only makes research more locally relevant and ethically sound but also promotes more equitable and inclusive decision-making processes (Agrawal, 1995; Turner et al., 2022; Kaushik et al., 2023; Teixidor-Toneu et al., 2023). These partnerships can also help resolve conflicts over resource management by integrating the traditional wisdom of local communities with scientific frameworks (Danielsen et al., 2010). In practice, Indigenous knowledge offers valuable contributions to conservation and sustainability efforts. For instance, long-term Indigenous monitoring of species like the Porcupine caribou herd in northern Canada has provided critical data that scientific studies may overlook, thereby improving conservation strategies (Gagnon et al., 2020). Additionally, the adaptive and flexible nature of Indigenous practices offers solutions for ecosystem-based adaptation to climate change and globalisation (Congretel and Pinton, 2020). In conclusion, integrating Indigenous knowledge with scientific research leads to a more comprehensive, inclusive, and effective approach to addressing the complex environmental challenges of the modern world.

3.8. Integrative Approaches and Pathways for Future Sustainability

3.8.1. Safeguarding traditional knowledge: Advancing inclusive intellectual property frameworks

Traditional Knowledge (TK) refers to the cultural, ecological, and medicinal wisdom passed down through generations within Indigenous and local communities. Historically, this knowledge has been vulnerable to misappropriation, particularly within intel-

lectual property (IP) systems that prioritise individual ownership, novelty, and codified documentation. The World Intellectual Property Organisation (WIPO) Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC), established in 2000, was a critical response to the challenges posed by economic globalisation, aiming to address IP concerns surrounding genetic resources, Indigenous knowledge, and traditional cultural expressions. While existing IP frameworks have been explored as possible avenues for protecting TK, Indigenous knowledge holders have consistently called for legally binding instruments that genuinely reflect and respect their rights and values. The 2007 UN Declaration on the Rights of Indigenous Peoples (UNDRIP) reinforces this by affirming Indigenous peoples' rights to maintain, control, and protect their cultural heritage and intellectual property (UN, 2007). However, current legal systems often fall short, as they tend to exclude intangible heritage—such as oral traditions, folklore, traditional medicine, and ecological knowledge—from formal protection, leaving such knowledge susceptible to exploitation and biopiracy. A major breakthrough came in May 2024 with the adoption of the WIPO Treaty on Intellectual Property, Genetic Resources, and Associated Traditional Knowledge, which requires patent applicants to disclose the origin of genetic resources and associated TK. While not retroactive, this treaty provides a vital framework to ensure transparency, fair benefit-sharing, and the active participation of Indigenous peoples in IP governance. For biodiversity-rich nations like India, the treaty reinforces national efforts and enhances their global standing in protecting TK. This evolving international framework marks a pivotal step towards recognising TK not just as cultural heritage but as intellectual property deserving of robust legal protection (Handique and Dubey, 2022; WIPO, 2024).

3.9. Novel Integrative Contributions of Fourth World Botany

This review provides three unique and original contributions to the emerging field of Fourth World Botany. First, it introduces a new integrative perspective by understanding Fourth World Botany as a biocultural governance system rather than solely as an ethnobotanical or cultural study. This approach demonstrates that Indigenous stewardship practices, including ritual ecologies, lineage-based resource management, traditional ecological indicators, and rotational harvesting, work together as a dynamic regulatory system that actively influences ecosystem resilience and biodiversity outcomes. This conceptualisation shifts the focus of the field from simple documentation to an operational ecological and policy-relevant science. Second, the review provides a clear policy framework for integrating Traditional Ecological Knowledge (TEK) into contemporary environmental governance. This includes systematically applying Free, Prior, and Informed Consent (FPIC), Access and Benefit-Sharing (ABS), TEK data sovereignty protocols, and Indigenous-led monitoring structures. By explaining how Indigenous governance mechanisms can be embedded within institutions for biodiversity conservation, climate adaptation, and environmental impact assessments, the review

provides a practical model for mainstreaming TEK into policy. Third, the review identifies the most urgent threats to Indigenous knowledge systems, including biopiracy, inadequate legal protections, the erosion of intergenerational knowledge transfer, externally imposed conservation models, and the marginalisation of Indigenous authority in decision-making. In response, it emphasises priority actions like strengthening community-based conservation, supporting Indigenous-controlled knowledge repositories, ensuring legally enforceable protections for TEK, investing in long-term co-production research methods, and establishing national standards for ethical documentation and fair benefit-sharing. These pioneering contributions position Fourth World Botany as a rigorously scientific and policy-relevant field that demonstrates how Indigenous biocultural systems can enhance sustainability governance, climate adaptation, and ecosystem resilience across multiple levels.

4. CONCLUSION

Fourth World Botany exemplifies the profound interplay between ecological stewardship and cultural heritage. As guardians of rich botanical traditions, Indigenous communities offer insights honed over generations, providing sustainable solutions to modern environmental challenges. Integrating this knowledge into conservation strategies not only enhances biodiversity and resilience to climate change but also preserves the cultural heritage of these communities. A collaborative approach that combines scientific understanding with traditional ecological practices leads to more holistic and effective environmental management frameworks. Traditional agriculture, medicine, and resource management practices offer sustainable alternatives that promote resilience and adaptability in the face of environmental shifts. However, these systems are increasingly threatened by factors such as globalisation, land dispossession, and the erosion of cultural identities. To safeguard Indigenous knowledge, it is crucial to protect it through legal frameworks and benefit-sharing models that empower local communities. Efforts like India's Traditional Knowledge Digital Library and community-based conservation initiatives highlight the potential for collaboration between Indigenous practices and modern science. As we confront pressing global challenges, the lessons within Fourth World Botany urge us to rethink our relationship with nature. By valuing and integrating Indigenous perspectives, we can foster a more equitable and just world, where the wisdom of Indigenous communities plays a vital role in ecological stewardship and cultural vitality. Championing Fourth World Botany not only honours the guardians of this knowledge but also paves the way for a more sustainable future for all humanity and the planet we share. In conclusion, Fourth World Botany stands as a testament to the enduring connection between ecological wisdom and cultural identity. Protecting and revitalising these knowledge systems is essential not only for Indigenous peoples' rights but also for our planet's health. Valuing this wisdom will pave the way for a more resilient and sustainable future, where Indigenous communities play a crucial role in addressing global environmental challenges.

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BOTANIKA ČETVRTOG SVIJETA: ČUVARI EKOLOŠKE I KULTURNE MUDROSTI U POVEZIVANJU TRADICIONALNOG ZNANJA I ZAŠTITE OKOLIŠA

Taranisen Panda, Nirlipta Mishra, Shaik Rahimuddin, Bikram K. Pradhan, and Raj B. Mohanty

Sažetak

Ovaj pregledni rad ima za cilj ispitati ulogu botaničkog znanja autohtonih naroda u očuvanju okoliša i kulturne održivosti. Koncept botanike Četvrtoga svijeta predstavlja važnu poveznicu između tradicionalnog znanja i suvremenog upravljanja okolišem te odražava duboku ekološku i kulturnu mudrost autohtonih zajednica koje su tijekom generacija održavale svoje ekosustave. Napravljen je opsežan pregled literature u recenziranim časopisima, znanstvenim bazama podataka i drugim relevantnim izvorima, pri čemu su analizirane više od 593 reference, a u konačnici su uključena 123 istraživanja koja se bave ulogom znanja autohtonih naroda u usmjeravanju održivog korištenja zemlje, poljoprivrede, zdravstvene skrbi, odgovornog upravljanja prirodnim resursima i okolišem. Rezultati pokazuju da poljoprivredne prakse autohtonih naroda značajno povećavaju otpornost na klimatske promjene te doprinose razvoju održivih sustava prehrane. Tradicionalni pristupi u liječenju i dalje oblikuju suvremenu zdravstvenu skrb te utječu na terapijske pristupe na globalnoj razini. Osim u poljoprivredi i medicini, znanja autohtonih zajednica pridonose sigurnosti lanca opskrbe hranom, uporabi prirodnih ograda (eng. biofencing), izradi rukotvorina te društveno-religijskim ritualima, što odražava bogatu kulturnu baštinu tih zajednica. Pravni okviri, poput indijske Digitalne knjižnice tradicionalnog znanja (eng. Traditional Knowledge Digital Library), naglašavaju važnost zaštite ovih sustava znanja od eksploatacije te osiguravaju očuvanje njihove uloge u upravljanju okolišem i kulturnim praksama za buduće generacije. Ključni nalazi upućuju na to da je uključivanje botanike Četvrtoga svijeta u suvremene pristupe upravljanju okolišem od presudne važnosti za zaštitu prava autohtonih naroda, očuvanje bioraznolikosti i održivo upravljanje resursima. Unatoč tome, znanja autohtonih naroda suočavaju se s ozbiljnim prijetnjama uslijed globalizacije, izvlaštenja zemljišta i erozije kulture. Ovaj rad pridonosi razumijevanju načina na koje suradnja između autohtonih zajednica i suvremene znanosti može pomoći razvoju otpornijih ekosustava i održivih praksi kako bi se pomogli riješiti globalni ekološki izazovi. .

Ključne riječi: *Digitalna knjižnica tradicionalnog znanja, ekološka i kulturna baština, održivi razvoj, prirodni resursi, sustavi znanja autohtonih naroda*

BOTANIK DER VIERTEN WELT: HÜTER ÖKOLOGISCHER UND KULTURELLER WEISHEIT – EINE BRÜCKE ZWISCHEN TRADITIONELLEM WISSEN UND UMWELTSCHUTZ

Taranisen Panda, Nirlipta Mishra, Shaik Rahimuddin, Bikram K. Pradhan, and Raj B. Mohanty

Zusammenfassung

Diese Übersichtsarbeit zielt darauf ab, die Rolle des indigenen botanischen Wissens bei der Förderung des Umweltschutzes und der kulturellen Nachhaltigkeit zu untersuchen. Die Botanik der Vierten Welt dient als wichtige Brücke zwischen traditionellem Wissen und modernem Umweltmanagement und spiegelt die tiefgreifende ökologische und kulturelle Weisheit indigener Gemeinschaften wider, die ihre Ökosysteme seit Generationen erhält. Es wurde eine umfassende Literaturrecherche in Fachzeitschriften, wissenschaftlichen Datenbanken und relevanten Quellen durchgeführt, bei der über 593 Referenzen gesichtet und schließlich

123 Studien einbezogen wurden, die sich mit indigenem Wissen als Leitfaden für nachhaltige Landnutzung, Landwirtschaft, Gesundheitsversorgung, verantwortungsvollen Umgang mit natürlichen Ressourcen und Umweltmanagement befassen. Die Studie zeigt, dass indigene landwirtschaftliche Praktiken die Klimaresilienz erheblich verbessern und zu nachhaltigen Ernährungssystemen beitragen. Traditionelles medizinisches Wissen prägt weiterhin das moderne Gesundheitswesen und beeinflusst Behandlungen weltweit. Über Landwirtschaft und Medizin hinaus unterstützt indigenes Wissen die Ernährungssicherheit, den Bau von Biozäunen, das Kunsthandwerk und sozio-religiöse Rituale und spiegelt das reiche kulturelle Erbe dieser Gemeinschaften wider. Rechiliche Rahmenwerke, wie Indiens „Traditional Knowledge Digital Library“, betonen die Bedeutung des Schutzes dieser Wissenssysteme vor Ausbeutung und stellen sicher, dass die Beiträge des indigenen Wissens zum Umweltmanagement und zu kulturellen Praktiken für zukünftige Generationen bewahrt werden. Wichtige Erkenntnisse heben die Integration der Botanik der Vierten Welt in das zeitgenössische Umweltmanagement als entscheidend für den Schutz indigener Rechte, die Erhaltung der biologischen Vielfalt und die Förderung der Ressourcennachhaltigkeit hervor. Trotz seiner entscheidenden Rolle bei der Bewältigung globaler Umweltprobleme ist indigenes Wissen jedoch ernsthaften Bedrohungen durch Globalisierung, Landenteignung und kulturelle Erosion ausgesetzt. Diese Übersichtsarbeit trägt zum Verständnis bei, wie gemeinsame Anstrengungen indigener Gemeinschaften und der modernen Wissenschaft widerstandsfähige Ökosysteme und nachhaltige Praktiken fördern können, um globale Umweltprobleme anzugehen.

Schlüsselwörter: ökologisches und kulturelles Erbe, indigene Wissenssysteme, natürliche Ressourcen, nachhaltige Entwicklung, digitale Bibliothek für traditionelles Wissen