

Eco-literacy Among Tribal Communities in India: Its Contemporary Relevance

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Abstract

This paper reviews eco-literacy among tribal communities in India and analyses its contemporary relevance. Drawing on the conceptualizations of eco-literacy proposed by Capra and Orr, the study interprets Traditional Ecological Knowledge (TEK) integrated in Indigenous Environmental Knowledge (IEK) systems of Scheduled Tribes as a sophisticated, practice-based form of environmental understanding. Using a Systematic Literature Review, the paper synthesizes empirical and conceptual studies on the depth, transmission, and current status of tribal eco-literacy. Findings reveal that tribal communities possess moderate to profound ecological competence rooted in close interaction with local ecosystems; however, this knowledge system is increasingly threatened by forest detachment, modernization, and intergenerational discontinuity. The review highlights the contemporary relevance of TEK for climate change adaptation and Sustainable Development Goals (SDGs). It proposes curricular infusion, community-linked pedagogies, and teacher competency development grounded in indigenous knowledge systems. The study concludes that strengthening community governance mechanisms, including provisions under the Forest Rights Act (2006), is essential for sustaining India's ecological knowledge heritage.

Keywords: Eco-literacy, Tribal Communities, TEK, IEK, Climate Change, Sustainability

Introduction

The global community faces many ecological challenges that demand a fundamental change in how humanity approaches environment. This necessity is addressed by the term "eco-literacy," a concept introduced by David W. Orr and popularized by Fritjof Capra. Capra defined eco-literacy as an educational framework aimed at integrating ecological principles to guide humanity in creating a

sustainable society (Capra, 1999). For nations like India, which possess immense cultural diversity and biodiversity, an exploration of the environmental understanding held by indigenous populations offers a vital route to systemic solutions for sustainability.

India is home to approximately 705 ethnic groups formally recognized as Scheduled Tribes (STs), most of whom inhabit forest ecosystems (Christopher et al., 2023). These communities are frequently acknowledged as the primary guardians of biodiversity, a role stemming from their deep historical and cultural dependence on their natural surroundings (Joshi, 2021). The practical, functional ecological comprehension of these groups is formally designated as Indigenous Environmental Knowledge (IEK) or Traditional Ecological Knowledge (TEK) (Berkes, 2017). TEK is understood as a collective body of practice, belief, and knowledge accumulated over time, continually refined through adaptive processes and passed through generations, detailing the relationships between living beings and their environment (Berkes, 2017).

This knowledge system represents an advanced form of ecological literacy, as its foundational principles are continuously tested and validated through everyday subsistence activities. The economic security of tribal households is linked to forest resources, as a substantial proportion of forest-dependent communities rely on forests for fuel wood, fodder, subsistence needs, and income from Non-Timber Forest Products (Dash et al., 2016). This profound dependence on forests contributes significantly to the development of tribal eco-literacy, as the identification of medicinal plants, wild edible species, and seasonal ecological cycles forms an essential part of everyday survival and resource management practices (Chakraborty et al., 2017). Despite its value, the integrity of this knowledge system is increasingly jeopardized by processes of modernization, economic marginalization, and complex policy initiatives. This systematic review aims to chart the current scholarly discussion surrounding tribal eco-literacy in India. This paper contends that tribal eco-literacy, as manifested in TEK, is an invaluable, yet deteriorating, national asset crucial for establishing resilience against climate change and achieving India's long-term sustainability objectives.

Objectives

1. To analyse the major factors contributing to the erosion of tribal eco-literacy.
2. To examine the contemporary relevance of tribal eco-literacy in relation to climate resilience and Sustainable Development Goals.

Review of Literature

Research on ecological literacy among different tribal communities in India shows that their environmental knowledge varies from group to group, so it is not correct to make one general assumption about all Indigenous communities (Majumdar & Chatterjee, 2022). Research undertaken in eastern India, covering communities like the Lodha, Santhal, and Oraon, documented a result, with scores ranging from minimal to exceptionally high levels of eco-literacy (Majumdar & Chatterjee, 2022). These findings highlight the critical need for localized, community-specific research instead of relying on uniform definitions of "tribal knowledge."

A consistent determinant identified in multiple studies is the degree of reliance on, and direct interaction with, the natural environment. The disruption of traditional social–ecological systems and separation from forest-based livelihoods threaten the continuity of traditional ecological knowledge and ecological understanding among Indigenous communities (Tran et al., 2024). This underscores that the physical connection and practical necessity—the constant use of knowledge for sustaining life—are indispensable for maintaining ecological understanding. For example, among the heavily forest-dependent Oraon community, only a handful of households were observed to be completely independent of natural resources, confirming that a deep socio-ecological bond is fundamental to their way of life (Majumdar & Chatterjee, 2022).

A major compounding issue is the profound intergenerational failure in knowledge transmission. Studies have shown that older individuals often possess greater traditional ecological knowledge than younger generations, indicating an intergenerational decline in ecological knowledge and nature-based experience (Okui et al., 2021). This decline is observed in younger participants; for instance, young Lodha respondents registered a relatively low mean score (39.60) (Majumdar & Chatterjee, 2022). This age-related gradient suggests that exposure to modern education or economic changes frequently replaces traditional ecological knowledge rather than enhancing it. Shifts in occupation, food practices, and lifestyles reduce dependence on traditional ecological knowledge systems, contributing to the gradual erosion of such knowledge and negatively affecting both community well-being and ecosystem sustainability (Aswani et al., 2018).

Traditional Ecological Knowledge constitutes a comprehensive, empirically validated form of wisdom relevant across diverse sectors, including agriculture, forestry, health care, and craft production (Karunamay et al., 2024). This knowledge is especially crucial in the health sector, as all traditional Indian medical systems—including Ayurveda, Siddha, Yoga, Unani, and Folk Medicine—rely entirely on the extensive and varied biodiversity knowledge preserved by tribal groups (Karunamay et al., 2024).

Documented evidence of applied resource knowledge is substantial. Studies from South India have documented extensive traditional ecological knowledge related to medicinal, edible, and culturally significant plant species among indigenous and rural communities (Sivasankari et al., 2014). Plants used in rituals, ceremonies, and social practices demonstrate that traditional ecological knowledge functions not only as practical environmental knowledge but also as a cultural and social institution embedded within community life (Berkes, 2018). Traditional ecological knowledge plays a crucial role in maintaining the relationship between human well-being and ecosystem sustainability, emphasizing that conservation strategies must integrate cultural values alongside biological protection (Díaz et al., 2018).

Furthermore, indigenous methods for resource management often demonstrate high levels of ecological sophistication. The Oraon tribe, for instance, protects biodiversity through the maintenance of sacred groves and employs traditional techniques like building small check dams and rainwater harvesting for sustainable water management (Karunamay et al., 2024).

The fundamental method for transferring and sustaining this ecological literacy is cultural transmission. Indigenous Knowledge Systems (IKS) depend heavily on oral methods, including rituals, songs, and storytelling, to transmit skills, information, values, and attitudes to succeeding generations (Karunamay et al., 2024). This intergenerational learning model rooted in the community aligns TEK intrinsically with the goals of Education for Sustainable Development (ESD) (Karunamay et al., 2024).

Methodology

This research utilized a Systematic Literature Review (SRL) framework to analyse and synthesize the existing body of scholarly literature and secondary data. As the study's goal was to review the current academic dialogue rather than generate new primary data, the SRL approach provided a robust, clear, and replicable method for mapping the established knowledge base regarding tribal eco-literacy in India.

To ensure authenticity, scholarly sources were diligently searched, including technical reports from recognized bodies, published academic texts, and peer-reviewed journal articles. The search terms were strategically combined, using phrases such as "eco-literacy," "Traditional Ecological Knowledge," "Indigenous Knowledge Systems," "tribal communities India," "climate change adaptation," and "sustainable development." The scope of the search was global, but strictly focused on material pertaining to the Indian context.

The gathered literature was subjected to a qualitative analysis using thematic synthesis. The findings were conceptually categorized into three main areas: foundational definitions (eco-literacy/TEK), empirical evidence (transmission, levels, and erosion), and policy implications (governance and SDGs). This structuring facilitated the identification of consistent themes, implementation challenges, and clear causal relationships, such as the direct link between economic independence and the erosion of traditional knowledge.

Result and Discussion

Erosion of Tribal Eco-Literacy

Tribal eco-literacy in India is gradually declining due to multiple interconnected socio-economic, cultural, and environmental factors. As traditional communities become less reliant on local resources and begin to adopt modern lifestyles, ecological knowledge is being lost (Pilgrim et al., 2008).

One of the most significant causes of TEK erosion is the declining dependence of tribal communities on forests and natural resources (Gomez-Baggethun & Reyes-Garcia, 2013). Traditionally, tribal livelihoods were deeply connected with forests through activities such as gathering non-timber forest products, medicinal plant collection, hunting, shifting cultivation, and water conservation practices. This close interaction enabled tribal communities to develop ecological understanding regarding biodiversity, seasonal cycles, medicinal flora, and sustainable resource management.

Economic transformation and occupational shifts have further accelerated the decline of eco-literacy. Processes such as industrialization, urbanization, market integration, and environmental degradation are contributing to the erosion of traditional ecological knowledge (Gomez-Baggethun et

al., 2013). Younger generations are increasingly detached from traditional agricultural and forest-based activities, limiting opportunities for experiential learning. Studies have consistently shown that older generations possess richer ecological knowledge compared to younger members of tribal communities, reflecting a serious intergenerational gap in knowledge transmission (Reyes-Garcia et al., 2013).

Modern education systems also contribute to this erosion when they fail to recognize indigenous knowledge systems. Formal schooling often prioritizes standardized and westernized forms of knowledge while neglecting local ecological practices, oral traditions, and community wisdom (McCarter & Gavin, 2011). Consequently, younger tribal students may perceive traditional knowledge as outdated or less valuable compared to modern scientific and technological knowledge. This weakens the continuity of indigenous ecological traditions.

Environmental degradation and climate change also threaten the survival of TEK systems. Deforestation, biodiversity loss, irregular rainfall patterns, soil degradation, and resource depletion alter the ecological conditions on which tribal communities have historically depended, making traditional ecological practices increasingly difficult to sustain (IPBES, 2019; Whyte, 2013).

The erosion of tribal eco-literacy has serious implications not only for tribal communities but also for environmental sustainability. The decline of TEK weakens biodiversity conservation, sustainable resource management, climate adaptation practices, and community resilience. Therefore, preserving tribal eco-literacy requires integrated efforts involving culturally responsive education, protection of forest rights, community participation in governance, and recognition of indigenous knowledge systems as valuable components of sustainable development.

TEK and the Challenge of Climate Adaptation

Traditional Ecological Knowledge (TEK) plays an important role in helping tribal communities adapt to climate change. Tribal people closely observe nature and environmental changes in their surroundings. Because of their long-term interaction with forests, rivers, soil, and weather patterns, they possess detailed knowledge about local ecosystems.

Studies show that many tribal farmers are highly aware of climate change and its effects. They have noticed changes such as irregular rainfall, rising temperatures, droughts, and declining water availability. This environmental understanding helps them develop local adaptation strategies based on experience and observation (IPCC, 2022; Nyong et al., 2007). Traditional knowledge systems are flexible and continuously adapt to changing environmental conditions. Tribal communities use various indigenous practices such as rainwater harvesting, crop diversification, forest conservation, sacred grove protection, and sustainable resource use to reduce environmental risks and improve resilience (Kuhnlein, 2009; Malhotra et al., 2001; Nyong et al., 2007).

TEK is especially valuable because it provides location-specific solutions that are practical and environmentally sustainable. Unlike generalized scientific models, indigenous knowledge is directly connected to local ecological conditions and everyday community life (Berkes, 2012; IPCC, 2022). Therefore, integrating TEK with modern scientific approaches can strengthen climate adaptation strategies.

Alignment with Sustainable Development Goals (SDGs)

The specialized knowledge held by India's tribal communities provides unique perspectives for resolving global issues, making their involvement indispensable for meeting national and international development targets. The comprehensive nature of TEK means it is directly relevant to numerous UN Sustainable Development Goals:

- **SDG 4 (Quality Education):** Folk education and oral traditions serve as crucial means of knowledge transfer, contributing to quality education for sustainable development.
- **SDG 6 (Clean Water & Sanitation):** Tribal practices, such as sacred water conservation and indigenous rainwater harvesting, support sustainable water resource utilization.
- **SDG 13 (Climate Action):** TEK supplies local strategies for climate mitigation and adaptation.
- **SDG 15 (Life on Land):** Contributions include the conservation of biodiversity through the protection of medicinal plants and sacred groves.

Policy Interface and Governance Challenges

Today, discussions about tribal eco-literacy mainly focus on how traditional tribal knowledge can work together with modern government systems. One important law in this area is the Forest Rights Act (FRA) of 2006 (Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006)

. This law was created to recognize the historical rights of tribal and forest-dwelling communities. It also gives them responsibility for protecting forests, using resources sustainably, and maintaining ecological balance. In simple terms, the Act supports community-based forest management and local self-governance.

However, the implementation of the Forest Rights Act has not been fully successful everywhere. Tribal lands still face threats from deforestation, mining projects, urbanization, and other development activities. A major challenge is that modern conservation policies often do not fully value tribal ways of understanding nature (Lee, 2018).

Conservation efforts may fail if policies only use tribal knowledge for scientific purposes while neglecting the traditional systems that actually protect and preserve natural resources, such as sacred groves and customary practices. Therefore, policies should recognize Traditional Ecological Knowledge (TEK) as a complete and holistic system of environmental management rather than just a source of information. Tribal communities and TEK holders should be directly involved in decision-making and forest governance through community-led and adaptive management systems.

Conclusion

This study shows that tribal communities in India have rich ecological knowledge gained through their close relationship with nature over many generations. Their Traditional Ecological Knowledge (TEK) helps in protecting biodiversity, managing natural resources sustainably, and adapting to climate change. Tribal people use many local practices, such as forest conservation, rainwater harvesting, and protection of sacred groves, which support environmental sustainability.

However, this valuable knowledge is gradually declining because of modernization, changing lifestyles, environmental degradation, and reduced connection of younger generations with forests and traditional practices. Therefore, there is an urgent need to preserve and promote tribal eco-literacy through education, community participation, and supportive government policies. Integrating indigenous knowledge with modern scientific approaches can help create more practical and sustainable solutions for present environmental challenges and contribute to a more environmentally responsible future.

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