

Enduring Wisdom: Traditional Sustainable Livelihood Practices of Indian Tribes

Trwała mądrość: Tradycyjne zrównoważone naturalne praktyki plemion w Indiach

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Abstract

Traditional Ecological Knowledge (TEK) and Indian Knowledge Systems (IKS) of the indigenous tribes of India represent valuable learning opportunities that lead to sustainable livelihood practices encompassing ecological, cultural, and spiritual aspects. TEK and IKS are grounded in place-based memories and observations acquired over centuries. These systems include sacred grove protection, rotational farming, and community-oriented resource management approaches and examples from the Khasi, Gond, Korku, Apatani, and Santhal tribes that outline practices that help conserve biodiversity, food security and climate resilience and have similar multiple United Nations Sustainable Development Goals (SDGs): Zero Hunger; Good Health and Well-being; and Life on Land. Despite their benefits, TEK and IKS are susceptible to modernisation, land alienation, and marginalisation, which threaten their continued existence. This study emphasises the significance of policy support, documentation, and the integration of indigenous knowledge with modern scientific solutions for achieving sustainable development. Recognising and empowering the tribal communities of India to account for their traditional knowledge about their relationship with the environment is crucial for addressing global environmental problems while also ensuring cultural preservation and ecological balance for future generations.

Key words: biodiversity conservation, Indian Knowledge System (IKS), indigenous tribes, sustainable development, Traditional Ecological Knowledge (TEK)

Streszczenie

Tradycyjna Wiedza Ekologiczna (TEK) i Indyjskie Systemy Wiedzy (IKS) rdzennych plemion w Indiach stanowią cenne źródła edukacyjne, które prowadzą do zrównoważonych praktyk utrzymania, obejmujących aspekty ekologiczne, kulturowe i duchowe. TEK i IKS opierają się na pamięci i obserwacjach związanych z miejscem, gromadzonych przez wieki. Systemy te obejmują ochronę świętych gajów, rolnictwo rotacyjne oraz zorientowane na społeczność metody zarządzania zasobami. Przykłady z plemion Khasi, Gond, Korku, Apatani i Santhal przedstawiają praktyki pomagające zachować bioróżnorodność, bezpieczeństwo żywnościowe i odporność na zmiany klimatu, a także mają wiele podobnych praktyk do Celów Zrównoważonego Rozwoju ONZ, w szczególności: Zero Głodu; Dobre Zdrowie i Dobrobyt; oraz Życie na Łądzie. Pomimo korzyści, TEK i IKS są podatne na modernizację, alienację ziemi i marginalizację, które zagrażają ich dalszemu istnieniu. Niniejsze badanie podkreśla znaczenie wsparcia politycznego, dokumentacji i integracji wiedzy rdzennej z nowoczesnymi rozwiązaniami naukowymi dla osiągnięcia zrównoważonego rozwoju. Uznanie i umożliwienie społecznościom plemiennym w Indiach rozliczenia się z ich tradycyjnej wiedzy na temat ich relacji ze środowiskiem jest kluczowe dla rozwiązania globalnych problemów środowiskowych, a także dla zapewnienia ochrony dziedzictwa kulturowego i równowagi ekologicznej dla przyszłych pokoleń.

Slowa kluczowe: ochrona różnorodności biologicznej, Indyjski System Wiedzy (IKS), plemiona rdzenne, zrównoważony rozwój, Tradycyjna Wiedza Ekologiczna (TEK)

Introduction

Traditional Ecological Knowledge (TEK) refers to a broad, place-based body of knowledge, practices, and beliefs gained through continuous, intergenerational engagement with a community's natural environment by Indigenous and local communities. While TEK represents a complex and nuanced understanding of ecological processes, resource management, and environmental interactions, it must be understood in the specific cultural, spiritual, and historical context of the community or group of people, using the knowledge system (Leaf, 2022). TEK is dynamic and adaptable (Wright, 2020) and should be seen as a knowledge system that harmonizes ecological knowledge with social values, spiritual beliefs, and traditional practices to establish sustainable relationships between communities and their ecosystems, rather than a static compilation of observations or pseudo-scientific knowledge. TEK is seen as connected and a holistic epistemology that could lead to environmental and social sustainability and responsible stewardship, despite the ecological, cultural, and spiritual dimensions being distinct, and interconnected. Importantly, TEK reflects a worldview in which humans are part of nature, rather than separate and dominant to the world around them. This understanding shapes adopted practices and observances of ongoing ecological balance, resilience, and biodiversity conservation. TEK exemplifies ways of knowing that inform decision-making while entrenching ethical considerations and relational dimensions around ecological change, and differs from a mainstream formal Western scientific thought that rarely acknowledge that ethical- dimension (Casi et al. 2021). TEK establishes a knowledge umbrella that includes records of local species, abundance, and relationships among local ecosystems, defining ecology using similar observation-based knowledge like those found in TEK. In addition, TEK is intrinsically dynamic, always adjusting to environmental changes and socio-cultural changes, yet TEK is grounded in principles of reciprocity and respect for the environment. This dynamism has allowed Indigenous and local communities to navigate various issues, such as climate variability, resource scarcities, and pressures on their land from external sources . TEK mixes empirical knowledge with values and practices emphasizing harmony with nature in order to provide lessons for current days of environmental management and sustainability practices, especially in our changing world faced with global challenges such as climate change and biodiversity loss. TEK is an important source of ecological knowledge and a culturally-grounded approach for building resilience and coexistence with the natural world.

The Indian Knowledge System (IKS) of indigenous tribes in India encompasses a vast repository of traditional practices, ecological wisdom, and cultural values that have been passed down through generations(Ministry of Human Resource Development, Government of India, 2020). These systems, which have their roots in a thorough understanding of the environment, provide insightful information on ecological balance, resource management, and sustainable living.(Gadgil & Guha, 1995). By integrating tribal knowledge with modern sustainability efforts, we can address contemporary environmental challenges effectively (Akhil Bhartiya Shiksha Samagam 2023).

The Indian Knowledge System (IKS) of indigenous tribes is closely intertwined with Traditional Ecological Knowledge (TEK), as both embody holistic, place-based understandings of the environment rooted in centuries of observation and practice (Berkes, 2013). IKS encompasses the cultural, spiritual, and ecological wisdom of Indian tribes. In the Indian context, IKS aligns with TEK by focusing on biodiversity preservation, seasonal forecasting, and community-driven resource governance (R. K. Singh et al., 2010). TEK encompasses the cumulative knowledge, practices, and beliefs developed by indigenous communities through generations of interaction with their environment. TEK contributes to biodiversity conservation, sustainable resource management, and ecosystem resilience. Various case studies from multiple tribal communities across India illustrate how indigenous practices, such as rotational farming, sacred groves, and community-based resource management, enhance ecological balance and foster sustainable development (Ramakrishnan, 1996). These practices are pivotal in fostering biodiversity conservation, enhancing food security, and facilitating sustainable development.

Indian Knowledge System of Indian tribes and sustainability

Traditional ecological knowledge, especially that of tribal communities such as the Khasi of Northeast India, offers valuable insights for modern sustainability discourse. Through the case study of the Mawphlang Sacred Forest illustrates how indigenous belief systems have preserved biodiversity and ecological integrity for centuries without formal enforcement mechanisms. The Khasi's veneration of nature, their communal resource management, and taboos that align with ecological cycles are highlighted as effective and culturally embedded practices of sustainability. such traditional knowledge systems are still alive and adaptable, and integrating them with modern scientific approaches could offer viable pathways for sustainable development, especially in the face of climate change and environmental degradation(Kakoty, 2017).The Gond and Korku tribes, residing in the Pachmarhi Biosphere Reserve (PBR) not only harvest plants following customary norms and seasonal patterns but also engage in farming, maintain home gardens, and perform rituals tied to agriculture and natural conservation. TEK, deeply embedded in the community's cultural and spiritual practices, offers valuable insights for sustainable resource management and biodiversity conservation (Kala, 2022).

Traditional Ecological Knowledge (TEK), deeply rooted in the cultural practices of indigenous groups, aligns closely with twelve of the United Nations' Sustainable Development Goals (SDGs). These include SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), SDG 5 (Gender Equality), SDG 6 (Clean Water and Sanitation), SDG 9 (Industry, Innovation, and Infrastructure), SDG 10 (Reduced Inequalities), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), SDG 14 (Life Below Water), SDG 15 (Life on Land), SDG 16 (Peace, Justice and Strong Institutions), and SDG 17 (Partnerships for the Goals). TEK encompasses indigenous systems such as traditional farming, water management, and the preservation of sacred groves – each reflecting sustainable, community-driven approaches to resource use. These practices promote biodiversity conservation, equitable resource distribution, and sustainable agriculture while integrating ecological, cultural, and spiritual values. By offering low-impact, eco-friendly alternatives to modern development models, TEK provides holistic solutions to global sustainability challenges, highlighting the critical role of indigenous knowledge in achieving the SDGs (Das et al., 2021).

The traditional knowledge of the Khasi, Adi and Monpa, tribes in northeast India supports sustainable development and conservation of biocultural diversity. Grassroots efforts such as biodiversity contests, recipe competitions, and the creation of Village Traditional Knowledge Banks (VTKBs) and Community Knowledge Gardens (CKGs) help in preserving and promoting indigenous knowledge systems. However, there is need for policy support, documentation, intellectual property protection through Prior Informed Consent (PIC), and integration with formal science to convert TK into viable micro-enterprises, ensuring both ecological and economic sustainability (R. K. Singh et al., 2010).

Through ethnobotanical surveys that focus on nutritional and therapeutic value in the context of climate resilience and food security, the Mullu Kuruman tribe's long-standing relationship with their use of wild and underutilized plants for food, medicine, and cultural practices has been examined (Anju & Kumar, 2024). The study promotes the inclusion of indigenous knowledge in biodiversity conservation and climate adaptation programs by highlighting sustainable harvesting methods, cultural respect for certain species, and the conservation implications of traditional knowledge. The study also highlights the difficulties in putting the Forest Rights Act (FRA) into practice as well as the underutilization of non-timber forest products (NTFPs) as a result of infrastructure and regulatory constraints. In order to assist environmental sustainability and improve tribal lives, it also urges more acknowledgement, recording, and support of indigenous activities (Anju & Kumar, 2024). The knowledge, customs, and inventions of indigenous groups that have been developed over centuries regarding the sustainable management and use of natural ecosystems for purposes like forestry, agriculture, fisheries, healthcare, and crafts are all included in the TEK of tribal communities in North East India, a region rich in biodiversity and cultural diversity. The importance of TEK in biodiversity conservation, especially through livelihood-supporting and ecologically balanced activities like holy groves and agroforestry systems like areca nut and betel leaf agriculture. The application of therapeutic animals and plants in conventional medicine, highlighting their significance for rural areas. Although there is a wealth of documentation on TEK, its preservation is threatened by its fast modernization, which calls for its incorporation into contemporary conservation policies and more study to guarantee sustainable practices and equitable benefits (Tynsong et al., 2020).

The significance of Traditional Ecological Knowledge (TEK) and community-based natural resource management in Northeast India, focusing on the Apatani landscape in Arunachal Pradesh and the Demazong Buddhist landscape in Sikkim, underscores the critical role of indigenous knowledge, cultural traditions, and spiritual beliefs in biodiversity conservation and sustainable resource use. The Apatani are noted for their integrated farming systems and social institutions, while the Demazong region blends Buddhist spiritual practices with ecological stewardship (Rai, 2007). TEK is recognised globally as complementary to scientific knowledge, with relevance in ethnoecology, population ecology, and forest management. Despite its value, TEK is diminishing due to modernization, and its integration into conservation efforts is limited by a lack of understanding in scientific communities (Mekonen, 2017).

A few plant species from various families used by the Bhotiya community for treating ailments have been documented, emphasizing their ethnobotanical knowledge and reliance on medicinal plants due to limited access to modern healthcare. Sacred pastures, groves, and forests – protected by religious and cultural traditions – serve as key reservoirs of medicinal plants and biodiversity and are sustainably managed by local organizations. However, the study notes significant loss of traditional knowledge among younger generations, along with the impacts of overexploitation and climate change on high-value medicinal species. It recommends promoting the cultivation of medicinal plants and integrating traditional knowledge into conservation efforts to ensure sustainable resource use and the preservation of biocultural heritage in the region (Negi et al., 2017).

The Apatani tribe in Ziro valley practices sustainable wet rice and fish cultivation, maintains bamboo and pine plantations, and protects species like the orange-bellied Himalayan squirrel through the Dapo system, which enforces penalties for overexploitation. The Galo tribe manages Mithun (*Bos frontalis*) rearing through the Lura system, a fenced forest area that supports sustainable livestock management and conserves forest resources by regulating activities like hunting and timber extraction. The Adi tribe conserves biodiversity through cultural practices, including totemism, taboos during festivals, and magico-religious beliefs that protect specific plants and

animals. These practices highlight the tribes' rich traditional ecological knowledge, though modernization threatens cultural heritage, necessitating documentation and integration with modern conservation strategies for sustainable development (Chaudhry et al., 2011). The ethnomedicinal plants used by North Indian tribal communities in states like Himachal Pradesh, Uttarakhand, Rajasthan, Jammu and Kashmir, Uttar Pradesh, and Ladakh aids in reducing kidney stone formation and manage urological diseases such as urinary infections, kidney stones, and renal disorders. The rich indigenous knowledge of these tribes emphasises the potential of these plants for developing novel urological treatments (Balkrishna et al., 2024). The ethnomedicinal survey of the Paliyar tribe in Kadamalaikundu, Theni District, Tamil Nadu highlighted the tribe's reliance on medicinal plants for primary healthcare and veterinary purposes, but noted threats to this knowledge due to forest destruction, lifestyle changes, and declining interest among younger generations. It emphasised the need for conservation, documentation, and integration of this knowledge into modern healthcare systems, supported by initiatives like the WHO Global Centre for Traditional Medicine and India's Ministry of AYUSH. The findings underscore the Paliyar tribe's rich ethnobotanical heritage and the urgency to preserve it for future pharmacological and conservation efforts (Divya et al., 2024).

Tribal communities in India conserve the environment through traditional knowledge, beliefs, and practices, their deep connection with nature, and viewing elements like forests, rivers, and mountains as sacred and integral to their survival. Practices such as totemism, taboos, and the maintenance of sacred groves play a crucial role in biodiversity conservation, protecting various plant and animal species. For instance, totemic beliefs among tribes like the Oraons and Birhors prevent the destruction of specific flora and fauna, while sacred groves, such as those managed by the Khasi and Meetei, serve as biodiversity hotspots and water reservoirs. However, there is a need to revive and support these indigenous practices to ensure sustainable environmental management amidst modern challenges (Bain, 2017).

Sustainable agricultural and livelihood practices

The Chuktia Bhunjia Tribe of Odisha integrates ecological understanding with cultural and spiritual practices to sustain agriculture. Their traditional farming methods – such as intercropping, agroforestry, and crop rotation – are deeply rooted in local knowledge and have evolved over generations through hands-on experience and ritual transmission. These sustainable practices not only maintain biodiversity and soil health but also serve as effective strategies for climate change adaptation. The study emphasises the value of indigenous knowledge systems in promoting resilient and sustainable food production, offering lessons for broader environmental and agricultural policies (Sabar & Midya, 2022).

The socioeconomic and environmental challenges faced by the Kattunayakan tribe – a Particularly Vulnerable Tribal Group (PVTG) in Wayanad, Kerala – have been explored, highlighting issues such as landlessness, low education levels, and increasing human-wildlife conflict affecting agriculture and livestock. The study notes the decline of traditional knowledge and forest-based livelihoods amidst environmental degradation and social change, with alarmingly low average annual income from agriculture and livestock. To enhance sustainability, the study recommends distributing non-sellable degraded land, promoting cultivation of crops unpalatable to wildlife, improving education in local languages, supporting cooperative livestock ventures, and offering training in value-added forest products. The research emphasizes the need for urgent, integrated policy interventions in agriculture, forestry, and social sectors tailored to tribal needs (Ramakrishnan et al., 2024). A case study conducted in Udaipur's Salumber and Lasadiya blocks, the study centres on the Meena and Gameti tribes and emphasises the central role of women in sustainable agriculture. Implemented by Prayatna Samiti with support from Finnish partners, the project trained tribal women in cultivating minor millets and vegetables using Good Agricultural Practices (GAP), organic manure, and greenhouse nurseries. It resulted in the formation of Self-Help Groups (SHGS), Biodiversity Management Committees, and seed banks, boosting food production, nutrition, and self-reliance. Case studies illustrate the revival of traditional crops like foxtail millet and the use of nutrition gardens to diversify diets and income. Despite climate and resource challenges, the project's bottom-up, community-driven approach proved effective for sustainable rural development, with a strong emphasis on women's empowerment and indigenous resilience (Chhabra & Sinha, 2020).

A study on How The traditional food knowledge and practices of Adi women contribute to sustainability and community resilience in Northeast India found that remote villages utilise more diverse and culturally embedded biocultural resources than transitional ones, indicating a strong link between tradition and ecosystem conservation. Adi women use agronomic and cultural methods like mixed cropping, seed dispersal, and taboo-based hunting restrictions, often rooted in spiritual beliefs. These practices not only secure food and health but also conserve biodiversity. The study calls for policy frameworks that recognise and integrate this indigenous knowledge to help meet several Sustainable Development Goals (SDGS), particularly those related to hunger, health, poverty, and life on land (R. K. Singh et al., 2020).

The traditional practices of India's tribal communities – especially those in Odisha – embody the principles of sustainability through deep-rooted ecological and cultural harmony. The paper highlights how Indigenous

Knowledge Systems (IKS), including organic farming, reverence for sacred groves, and community-led forest conservation like *Thenga Pali*, support both environmental and social sustainability. The Kandha tribe's belief in *Mother Earth* as a deity and their rejection of chemical farming showcase their sustainable ethos. However, there is a need to mainstream indigenous practices into policy and education, documenting traditional knowledge digitally, and strengthening community-based governance systems. Overall, it can be argued that indigenous practices are not only environmentally viable but also culturally resilient frameworks for sustainable development (Sahoo, 2024). Indian tribal festivals and performances serve as potent mediums for climate sustainability and ecological consciousness. The ecological significance of festivals like *Sarhul*, *Baha*, and *Kunde Habba*, highlighting how rituals, such as sacred grove worship, sustainable agricultural timelines, and collective ecological rituals, foster environmental stewardship, biodiversity conservation, and community resilience. The integration of biocultural expressions into broader sustainability efforts can enhance environmental justice and climate resilience (Mondal & Pandey, 2024).

Santhali's ecological worldviews and knowledge systems

The Santhal community, a marginalised tribal group in India, possesses unique indigenous practices that contribute to sustainable development. These include festivals (e.g., Karam, Soharai), traditional medicine, cultivation systems, food preservation techniques, and social structures like joint families and dowry systems. These practices are conducive to environmental, economic, and social sustainability. The research indicates the importance of documenting and preserving indigenous knowledge, which is rapidly being lost due to modernisation. Indigenous knowledge is a precious resource in risk management, biodiversity conservation, and encouraging sustainable development. It recommends the creation of databases to store and disseminate this knowledge, ensuring its integration into development planning. The Santhal community's practices demonstrate the potential of indigenous knowledge to address global challenges, making it essential for environmental protection, cultural preservation, and achieving sustainable development goals (C. Singh et al., 2021). The Santhal community perceives and engages with their environment through a unique ethnoscience worldview deeply embedded in cultural beliefs and practices. Santhals classify environmental elements into living and non-living, and further distinguish between natural and constructed aspects, all of which carry spiritual and cultural significance. Their traditional ecological knowledge – expressed through rituals, folk classifications, and resource management – reveals a sustainable, ecocentric worldview. The generational differences in environmental perception and awareness of environmental change, with elders possessing deeper traditional knowledge and stronger connections to conservation practices (Majumdar & Chatterjee, 2021). Santhals have historically constructed and asserted their indigeneity through oral traditions, written archives, religious movements, and script invention. The invention of the ol' chiki script by Raghunath Murmu and the dissemination of literature in Santali have played a crucial role in strengthening community identity and resisting marginalisation. The Santals' engagement with their environment, myths, and rituals forms a living knowledge system that counters dispossession and asserts cultural agency in modern India (Carrin, 2022).

Integration with Sustainable Development Goals (SDGS)

The indigenous knowledge systems can significantly contribute to achieving the Sustainable Development Goals (SDGS). Indigenous peoples, despite facing marginalisation and environmental threats, possess a deep ecological understanding rooted in centuries of coexistence with nature. This knowledge supports sustainable practices in agriculture, resource management, climate adaptation, and disaster risk reduction. The central role of women and elders, and the threats posed by formal education systems that often disregard indigenous perspectives. Integrating indigenous and scientific knowledge through participatory approaches can ensure land rights, justice, and inclusive policy-making. Indigenous peoples can act as active agents of sustainable development and knowledge preservation within the agenda 2030 framework (Magni, 2017).

The profound impact of globalisation on the traditional livelihoods of Scheduled Tribes in India highlights how tribal communities, once reliant on forest-based subsistence and shifting cultivation, have been increasingly marginalised due to land alienation, displacement, and state control over natural resources. The influx of non-tribal actors, expansion of industry, and neoliberal economic policies have led to socio-economic exclusion, cultural erosion, and forced migration. Despite governmental efforts through five-year plans and various welfare schemes, these interventions have largely failed to address the root causes of tribal distress (Rao & Manasa, 2019).

The indigenous knowledge in climate adaptation, environmental conservation, and sustainable development has centuries of ecological knowledge, including traditional agriculture, forest and water management, medicine, and disaster risk reduction. They are based on a holistic world view that emphasises balance, reciprocity, and deep respect for nature. The case studies from the Andes to the Amazon demonstrate how indigenous methods enhance

biodiversity, soil fertility, carbon sequestration, and resilience to climate shocks. Integrating indigenous perspectives into climate policy through equitable partnerships can honour traditional knowledge, self-determination, and environmental justice (Karn, 2024).

India's tribal communities can contribute significantly to India's attainment of the Sustainable Development Goals (SDGs), through traditional practices, deeply rooted in biocultural diversity, that offer low-cost, ecologically sound strategies for sustainable agriculture, water management, biodiversity conservation, and climate change adaptation. There are correlations between various tribal practices with specific SDG targets, with their value in food security, health, education, and resource conservation. There is a need for stronger policy recognition, better data integration, and enhanced support for Tribal Research Institutes (TRIS) to document and mainstream indigenous knowledge. Empowering tribal communities and preserving their ecological wisdom is essential for a climate-resilient and inclusive sustainable development framework in India (Priyadarshini & Abhilash, 2019).

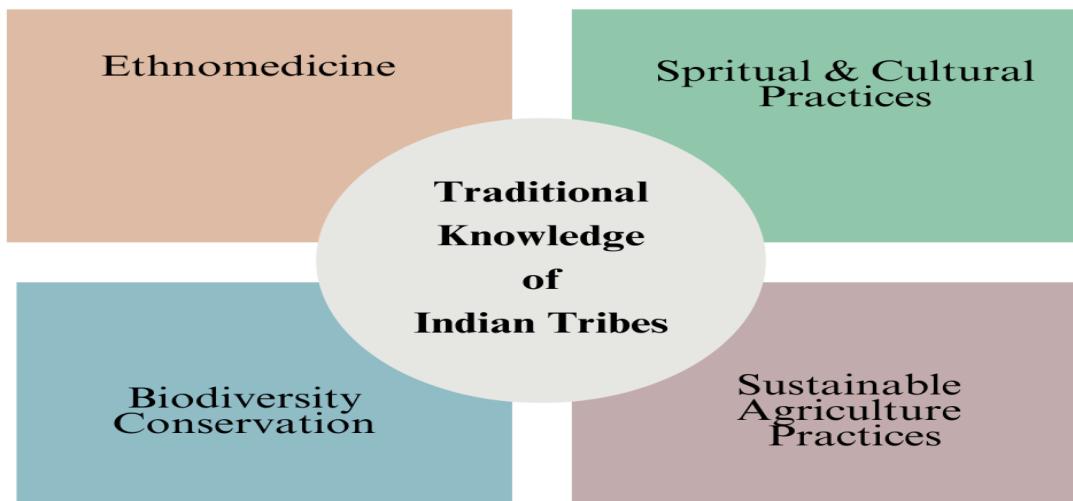


Figure 1. Traditional Knowledge of Indian Tribes, source: Author's contribution

Table 1. Indian tribes, Traditional Ecological Knowledge and SDGs alignment

Indian Tribe	Traditional Ecological Knowledge (TEK)	SDG Aligned With	References
Gond /Korku (Madhya Pradesh)	Plant species in the Pachmarhi Biosphere Reserve (PBR) are used as food and medicine, where harvesting is considered sustainable and combined with useful ethnobotanical knowledge. As discussed, agriculture, livestock rearing, and harvesting forest produce constitute some primary activities with the region gleaned from hunter-gatherer and historical knowledge of sustainable uses of plants of the area.	SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), SDG 15 (Life on Land)	(Kala, 2022)
Thengal Kachari (Assam)	Sustainable management of the bari system of farming, incorporating traditional agricultural practices by women to enhance soil fertility and biodiversity.	SDG 2 (Zero Hunger), SDG 5 (Gender Equality), SDG 15 (Life on Land)	(Barooah & Pathak, 2009)

Indian Tribe	Traditional Ecological Knowledge (TEK)	SDG Aligned With	References
Soligas (Karnataka)	Forest conservation, agricultural systems, and land use patterns, including sacred groves management, supporting biodiversity and resource sustainability.	SDG 13 (Climate Action), SDG 15 (Life on Land)	(Madegowda, 2009)
Lepcha (Sikkim)	Ethnobotanical plant use and bird conservation practices in the Dzongu valley, promoting biodiversity conservation and sustainable resource management.	SDG 15 (Life on Land)	(Pradhan & Badola, 2008)
Khasi (Meghalaya)	Sacred grove, traditional water harvesting, and sustainable agriculture practices like shifting cultivation.	SDG 6 (Clean Water and Sanitation), SDG 13 (Climate Action), SDG 15 (Life on Land)	(Tiwari et al., 2010)
Apatani (Arunachal Pradesh)	Paddy-cum-fish cultivation, an indigenous hill farming system that integrates agriculture and aquaculture for sustainable food production.	SDG 2 (Zero Hunger), SDG 15 (Life on Land)	(Rai, 2005)
Biate (Assam)	Zootherapeutic use of animals for medicinal purposes, contributing to traditional healthcare and sustainable resource use.	SDG 3 (Good Health and Well-being)	(Betlu, 2013)
Tagin (Arunachal Pradesh)	Traditional healthcare practices using local plants and resources, supporting community health and sustainable use of bioresources.	SDG 3 (Good Health and Well-being)	(Goswami et al., 2009)
Oraon (Jharkhand)	Revival of indigenous foods like millet flour to improve nutrition and health, countering the shift to processed foods.	SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being)	(Tirkey, 2019)

Conclusion

Learning from the Vedic perspective on environmental sustainability is worthwhile since it instils profound, intrinsic respect for nature, considering all aspects of the environment – earth, water, air, fire, and space – not simply as material for exploitation but as sacred, integral aspects of human lives. Indian tribes' Traditional Ecological Knowledge (TEK) and Indian Knowledge Systems (IKS) are rich in concepts of living in harmony with nature and protecting biodiversity. Based on ecological knowledge, resource conservation, and cultural beliefs, these systems present a proven method to combat global environmental issues. Integrating tribal knowledge with modern-day sustainability and conservation practices will allow India to maintain ecological balance and achieve sustainable development. The interaction between TEK and the environment reflects the importance of conserving both indigenous knowledge and its dependent ecosystems. One should recognise the contributions of tribal communities to nature conservation through their traditional practices and assist them with specific policies and community-based programs. Appreciating and adopting these practices not only recognises the past of India's indigenous people but also ensures a harmonious coexistence between mankind and the planet.

While IKS and TEK serve many purposes, they are also facing challenges of marginalisation and erosion through modernisation, and IKS and TEK are often not recognised in policy instruments. To overcome marginalised recognition of indigenous systems of knowledge with their potential to address environmental sustainability, governments and other institutions will have to make efforts to recognise, weave, integrate, and incorporate indigenous knowledge into the design and implementation of environmental programs, such as afforestation programs and climate adaptation policies. Once tribal systems of knowledge are legally recognised, organisations could organise interactions between tribal communities and scientists to help develop opportunities to integrate traditional knowledge into modern knowledge systems. The final aspect relevant to governance and to ensuring the longevity of tribal systems of knowledge in India is to ensure land rights and cultural autonomy to make sure communities can be guardians of their knowledge systems and can live sustainably. In essence, India must integrate TEK into different policy sectors to enact policies needed for it to sustain and address environmental challenges. We must learn from history and follow a balanced approach towards Nature and the environment.

References

1. AKHIL BHARTIYA SHIKSHA SAMAGAM, 2023, *In Thematic Session 15 Indian Knowledge Systems*, https://www.education.gov.in/sites/upload_files/mhrd/files/nep/ABSS_Report_Session_15.pdf.
2. ANJU T., KUMAR A., 2024, Traditional ecological knowledge and medicinal plant diversity usage among the Mullu Kuruman tribes of Wayanad district of Kerala, India and its implications for biodiversity conservation in the face of climate change, *Trees Forests and People*, 16: 100595.
3. BAIN W.K., 2017, Conservation of environment through traditional knowledge and wisdom with special reference to beliefs and practices in tribal India: an overview, *Heritage: Journal of Multidisciplinary Studies in Archaeology*, 5.
4. BALKRISHNA A., SHARMA H., NAG S., SRIVASTAVA D., SHARMA N., 2024, Ethnomedicinal plants used by the North Indian tribes in the management of urological diseases, *The Journal of Phytopharmacology*, 13(5): 391–401.
5. BAROOAH M., PATHAK A., 2009, Indigenous knowledge and practices of Thengal Kachari women in sustainable management of bari system of farming, *Indian Journal of Traditional Knowledge*, 1: 35–40.
6. BERKES F., 2013, Religious traditions and biodiversity, *Encyclopedia of Biodiversity*, ed. Levin A., Academic Press: 380–388.
7. BETLU A.L.S., 2013, Indigenous knowledge of zootherapeutic use among the Biate tribe of Dima Hasao District, Assam, Northeastern India, *Journal of Ethnobiology and Ethnomedicine*, 9(1).
8. CARRIN M., 2022, Santal indigenous knowledge, cultural heritage, and the politics of representation, *Modern Asian Studies*, 56(5): 1438–1463.
9. CASI C., GUTTORM H.E., VIRTANEN P.K., 2021, *Traditional ecological knowledge*, Helsinki University Press: 181–194.
10. CHAUDHRY P., DOLLO M., BAGRA K., YAKANG B., 2011, Traditional biodiversity conservation and natural resource management system of some tribes of Arunachal Pradesh, India, *Interdisciplinary Environmental Review*, 12(4): 338.
11. CHHABRA D., SINHA S., 2020, Improving food security through sustainable agricultural practices and strengthening local biodiversity management - A case study of Indigenous practices from India, *International Journal of Advanced Research*, 8(5): 209–219.
12. DAS A., GUJRE N., DEVI R.J., MITRA S., 2021, A review on traditional ecological knowledge and its role in natural resources management: North East India, a cultural paradise, *Environmental Management*, 72(1): 113–134.
13. DIVYA C., PAUL M., LATA C., MANIKANDAN G., RAMASUBBU R., 2024, Ethnomedicinal survey of the Paliyar tribe: a case study of Kadamalaikundu, Theni District, *International Journal of Anthropology and Ethnology*, 8(1).
14. GADGIL M., GUHA R., 1995, *Ecology and equity: The use and abuse of nature in contemporary India*, Routledge.
15. GOSWAMI P., SOKI D., JAISHI A., DAS M., SARMA H.N., 2009, Traditional healthcare practices among the Tagin tribe of Arunachal Pradesh, *Indian Journal of Traditional Knowledge*, 1: 127–130.
16. KAKOTY S., 2017, Ecology, sustainability and traditional wisdom, *Journal of Cleaner Production*, 172: 3215–3224.
17. KALA C.P., 2022, Traditional ecological knowledge of tribal communities and sustainability of nature and natural resources in Pachmarhi Biosphere Reserve in India, *International Journal of Ecology*, 2022: 1–13.
18. KARN R.N., 2024, Traditional knowledge for sustainable practices: Indigenous tribal people's cognizance of climate change, *International Journal of Scientific Research in Engineering and Management (IJSREM)*, 8(5): 1–18.
19. LEAF J.R., 2022, What is Traditional Ecological Knowledge and why does it matter?, *Frontiers in Ecology and the Environment*, 20(1): 3.
20. MAGNI G., 2017, Indigenous knowledge and implications for the sustainable development agenda, *European Journal of Education*, 52(4): 437–447.
21. MAJUMDAR K., CHATTERJEE D., 2021, The cultural dimension of environment: Ethnoscience study on Santhal community in eastern India, *International Journal of Anthropology and Ethnology*, 5(1), <https://doi.org/10.1186/s41257-021-00057-2>.
22. MEKONEN S., 2017, Roles of traditional ecological knowledge for biodiversity conservation, In Madda Walabu University, *Journal of Natural Sciences Research*, 7(15): 21–22, <https://core.ac.uk/download/pdf/234657468.pdf>.
23. MINISTRY OF HUMAN RESOURCE DEVELOPMENT, GOVERNMENT OF INDIA, 2020, *National Education Policy 2020*, https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf.
24. MONDAL A., PANDEY M.S., 2024, Indigenous festivals and climate sustainability in India: A case study of cultural practices and performances, *Rupkatha Journal on Interdisciplinary Studies in Humanities*, 16(1): 1–13, <https://doi.org/10.21659/rupkatha.v16n1.03>.

25. NEGI V.S., PATHAK R., SEKAR K.C., RAWAL R., BHATT I., NANDI S., DHYANI P., 2017, Traditional knowledge and biodiversity conservation: a case study from Byans Valley in Kailash Sacred Landscape, India, *Journal of Environmental Planning and Management*, 61(10): 1722–1743, <https://doi.org/10.1080/09640568.2017.1371006>.
26. PRADHAN B.K., BADOLA H.K., 2008, Ethnomedicinal plant use by Lepcha tribe of Dzongu valley, bordering Khangchendzonga Biosphere Reserve, in North Sikkim, India, *Journal of Ethnobiology and Ethnomedicine*, 4(1), <https://doi.org/10.1186/1746-4269-4-22>.
27. PRIYADARSHINI P., ABHILASH P.C., 2019, Promoting tribal communities and indigenous knowledge as potential solutions for the sustainable development of India, *Environmental Development*, 32: 100459, <https://doi.org/10.1016/j.envdev.2019.100459>.
28. RAI S.C., 2005, Apatani paddy-cum fish cultivation: An indigenous hill farming system of North East India, *Indian Journal of Traditional Knowledge*, <https://www.semanticscholar.org/paper/Apatani-paddy-cum-fish-cultivation%3A-An-indigenous-Rai/09afcd1d1c4d3ec3e7f2e89c46efd2f7a25ca5c7b>.
29. RAI S.C., 2007, Traditional ecological knowledge and community-based natural resource management in northeast India, *Journal of Mountain Science*, 4(3): 248–258, <https://doi.org/10.1007/s11629-007-0248-4>.
30. RAMAKRISHNAN P.S., 1996, Conserving the sacred: Ecological and social implications of sacred groves in Northeast India, *UNESCO-MAB Proceedings*, 16: 155–167.
31. RAMAKRISHNAN R., RAJENDRAKUMAR S., KOTHURKAR N.K., 2024, Regional sustainability of the Kattuna-yakan tribe in Kerala, India through the enhancement of agricultural, livestock, and livelihood options, *Agricultural Systems*, 217: 103929, <https://doi.org/10.1016/j.agsy.2024.103929>.
32. RAO V.S., MANASA B.S., 2019, The plight of tribal livelihood in the context of globalisation, *Geographical Analysis*, 8(2): 70–75, <https://doi.org/10.53989/bu.ga.v8i2.4>.
33. SABAR B., MIDYA D.K., 2022, Intersecting knowledge with landscape: Indigenous agriculture, sustainable food production and response to climate change – a case study of Chuktia Bhunja Tribe of Odisha, India, *Journal of Asian and African Studies*, 59(1): 123–141, <https://doi.org/10.1177/00219096221099634>.
34. SAHOO P., 2024, Practices of indigenous people are leading towards sustainability, *International Journal for Multidisciplinary Research (IJFMR)*, 6(1): 1–7, <https://www.ijfmr.com/>.
35. SINGH C., MAHATO S., GOPE L., 2021, Identification indigenous knowledge for sustainable development – A study on Santhal community, *EPRA International Journal of Multidisciplinary Research (IJMR)*, 7(1), <https://doi.org/10.36713/epra2013>.
36. SINGH R.K., KUMAR A., SINGH A., SINGHAL P., 2020, Evidence that cultural food practices of Adi women in Arunachal Pradesh, India, improve social-ecological resilience: insights for Sustainable Development Goals, *Ecological Processes*, 9(1), <https://doi.org/10.1186/s13717-020-00232-x>.
37. SINGH R.K., PRETTY J., PILGRIM S., 2010, Traditional knowledge and biocultural diversity: learning from tribal communities for sustainable development in northeast India, *Journal of Environmental Planning and Management*, 53(4): 511–533, <https://doi.org/10.1080/09640561003722343>.
38. TIRKEY A., 2019, *Reviving foods, preserving culture: My journey as an Indigenous food entrepreneur – Terralingua*, *Terralingua*, <https://terralingua.org/stories/reviving-foods-preserving-culture-my-journey-as-an-indigenous-food-entrepreneur/>.
39. TIWARI B., TYNSONG H., LYNSTER M., 2010, Forest management practices of the tribal people of Meghalaya, northeast India, *Journal of Tropical Forest Science*, 22(3): 329–342.
40. TYNSONG H., DKHAR M., TIWARI B., 2020, Review: Traditional ecological knowledge of tribal communities of North East India, *Biodiversitas Journal of Biological Diversity*, 21(7), <https://doi.org/10.13057/biodiv/d210743>.
41. WRIGHT R., 2020, Traditional ecological knowledge: Learning from Indigenous practices for environmental sustainability, *Journal for the Study of Religion, Nature and Culture*, 14(2): 304–306, <https://doi.org/10.1558/jsrnc.39475>.