

Indian Knowledge Systems and Environmental Sustainability: Traditional Wisdom for Modern Ecological Challenges

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Abstract

Indian Knowledge Systems (IKS), evolved through centuries of observation, experimentation, and philosophical inquiry, provide profound conceptual and practical resources for tackling contemporary environmental crises, including climate change, rapid biodiversity decline, water stress, and ecologically unsustainable agricultural practices. Drawing upon foundational principles such as *ṛta* (the cosmic order and harmony), *dharma* (ethical duty and righteous conduct), *ahimsā* (non-violence), and *aparigraha* (non-acquisitiveness), this paper explores how traditional Indian thought conceptualizes the intricate web of relationships between humans and the natural world.

The study highlights the application of these insights in real-world conservation practices, including the protection of sacred groves, indigenous water harvesting and management systems, regenerative farming methods that work in harmony with local ecosystems, and decentralized community-led forest stewardship. At the heart of IKS lies a worldview that emphasizes interconnectedness, cyclical renewal, and mindful restraint in consumption—values that can enrich and complement modern scientific knowledge and technological innovations in the pursuit of genuine sustainability.

Historical movements such as the Chipko Andolan and the Bishnoi community's long-standing environmental traditions demonstrate the enduring power of these knowledge systems in mobilizing collective action for ecological protection. The paper argues for a deeper synthesis of indigenous wisdom with contemporary sustainability science, advocating its meaningful integration into environmental education, policy formulation, and participatory governance structures. Such an approach can help foster solutions that are not only effective but also culturally resonant and ethically grounded within the Indian context.

By re-engaging with these rich traditions, societies can develop more resilient pathways toward ecological balance and long-term environmental health.

Keywords: Indian Knowledge Systems, Traditional Ecological Knowledge, Environmental Sustainability, Sacred Groves, Agroecology, Traditional Water Harvesting, Ecological Ethics, Biodiversity Conservation.

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I. Introduction

Environmental sustainability is one of the greatest challenges of the 21st Century. The ecological bases of human life are under threat due to climate change, biodiversity loss, water scarcity, soil degradation, deforestation, pollution and unsustainable consumption patterns. The crises of ecological problems (technical problems) have been addressed with powerful scientific analysis tools and technologies developed in the modern world. They are also a lack of values, lifestyles, governance and human relations with nature. For this reason, many scholars and international organisations today consider local, Indigenous and traditional knowledge systems to be important sources for the alleviation of environmental challenges (Berkes, 2018; IPBES, 2019; UNESCO, 2025).

Indian Knowledge Systems offer a valuable paradigm to rethink sustainability. The Indian Knowledge Systems, or Bharatiya Jnana Parampara, are the philosophical, agricultural, ecological, medical, artistic, ethical and community-based traditions that had developed over centuries, which were interwoven with the local environment. These systems are not just about the Sanskrit books or the elite knowledge, but are also about folk practices, tribal knowledge, oral traditions, sacred geography, water harvesting, agroecology, forest conservation, animal protection, seasonal calendars, Ayurveda, Yoga, local institutions and everyday ethical practices. The National Education Policy 2020 and the guidelines of University Grants Commission have highlighted the

importance of bringing the Indian Knowledge Systems into the education in meaningful and interdisciplinary manner (Ministry of Human Resource Development, 2020; University Grants Commission, 2023).

The applicability of IKS to environmental sustainability is that IKS has a holistic worldview. Many Indian traditions see human beings as a part of the ecological and cosmic order rather than simply nature's resource for extraction. The concepts of dharma, ahimsa, aparigraha, yajna, rta, prakriti and loka-sangraha promote responsibility, restraint, reciprocity and balance. Solutions found in traditional practices like sacred groves, rain water harvesting, mixed farming, cow-based agriculture, herbal medicine, community forest management and respecting rivers and trees illustrate how cultural values can contribute to ecological behaviour. The chapter looks at the potential contribution of Indian Knowledge Systems to the current concept of environmental sustainability. It maintains that traditional knowledge cannot be romanticized and needs to be critically incorporated with scientific, policy and community engagement.

II. Indian Knowledge Systems and the Ecological Worldview

The principle of interconnectedness is a key to Indian Knowledge Systems. People, animals, plants, rivers, mountains, soil, air and cosmic forces are frequently considered as elements of an order of living. This is an alternative perspective from purely extractive models of development that do not consider the interconnections between human development and ecological wellbeing. In most Indian traditions, nature is not merely an object, but a living entity, with moral, spiritual and practical significance. It can be seen in the worship of river Ganga and Yamuna, peepal, banyan, neem, tulsi, cow, snake, elephant and monkeys etc. and in forests, hills, lakes, sacred groves etc.

Veda's concept of rta is the concept of cosmic order, harmony and balance. Later ethical and philosophical traditions had similar concepts through their notion of duty, responsibility, right conduct and social-ecological order in the form of dharma. The environmental meaning of dharma is that of individuals/ communities' obligations to live without damaging the foundation of life. Ahimsa, the principle of non-violence, extends the range of moral concern beyond human to animal and other living beings. The term ahimsa has been adopted by Jain, Buddhist, Hindu and Gandhian traditions to encourage restraint, compassion and non-injury (Chapple, 1993).

Aparigraha (non-possessiveness) is another important concept. There is a strong connection between overconsumption, unlimited accumulation, and modern ecological crises. Aparigraha is the practice of moderation, and helps to diminish the desire to take what one does not need. Likewise, santosha, or contentment, conflicts with consumerism by proposing that happiness isn't just a matter of growth of material things. These ethical concepts are not a climate change solution, but rather they offer a way of tackling the cultural underpinnings of unsustainable behavior. Sustainability is not just about renewable energy, pollution control, and all that, it's about a change of human desire, consumption and responsibility.

IKS also fosters a cyclical understanding of time and nature. Seasons, agricultural rhythms, festivals, monsoons, lunar calendars, and ritual cycles are all ways that tie humans to ecological cycles. Traditional calendars were used to assist traditional farming activities such as sowing and harvesting, fasting, water usage and community activities. This way of living according to the rhythm contributed to the adaptation of the communities to seasonal change. Modern industrial systems, on the other hand, tend to set one-size-fits-all production and consumption regimes irrespective of ecological constraints. IKS urges us all to think about the place, season, climate, soil, water and biodiversity of our surroundings to live sustainably.

III. TEK and Biodiversity Conservation

Traditional Ecological Knowledge, defined as knowledge, practices, beliefs and innovations that communities have acquired over time as a result of their relationship with the ecosystem (Berkes, 2018). In India, these skills exist in the form of knowledge among the farmers, pastoralists, fisher folk, healers, artisans, and tribal communities. It encompasses the understanding of medicinal plants, seeds, animal characteristics, soil description, rainfall indicators, forest regeneration, pest control, grazing habits, and food storage. Often Indigenous knowledge is based on local observation, cultural rules and community management, and Gadgil, Berkes, and Folke (1993) suggested that this could provide an important contribution to the process of biodiversity conservation.

The sacred grove is one of the most powerful instances of traditional conservation in India. Sacred groves are areas of forest that are safeguarded by local people due to their religious association with deities, ancestors, spirits and/or ritual practices. Taboo or custom or community regulation may limit tree cutting, animal hunting, or disturbance of the grove. Gadgil and Vartak (1975) have recorded sacred groves as a significant instance of culturally protected biodiversity in India. Some of the subsequent research also indicated that sacred groves can save for conservation of rare species, old-growth trees, medicinal plants, water resource and microhabitats (Malhotra et al., 2001).

The meaning of sacred groves is one of the linkages between belief and conservation. Today, nature protection is often a legal matter and is regulated by the state, while sacred groves demonstrate how cultural values can generate conservation behaviour in the community level. A community might preserve a grove not for

scientific biodiversity language, it is sacred, ancestral or morally significant. From a sustainability point of view this is crucial: ecological rules are best integrated in local meaning. Today, however, sacred groves are at risk due to urbanisation, land conversion, commercialisation and a decay in community institutions. Their revival thus needs cultural respect and contemporary conservation planning.

There is another example in the ecological ethics of the Bishnoi people of Rajasthan. The Bishnoi religion is recognized for its conservation efforts of khejri trees and animals like black buck and chinkara. Amrita Devi Bishnoi and the community's resistance to tree felling in the eighteenth century remains an important symbol of the commitment to the environment. There are several historical details which differ from one account to another, but the essence of the Bishnoi tradition is that religious ethics, community law and ecological protection come together (Jain, 2011). It is not just science, it is a moral question and a collective discipline as well, as is demonstrated in this example.

IV. Water Politics: Balancing Nature and People

India is facing one of the worst ecological problems of water scarcity. Water sustainability is a major policy issue due to water depletion, polluted rivers, irregular monsoons, flooding, droughts and inequitable access to drinking water. Traditional Indian water systems are useful in learning from them, as these systems were often designed to suit the local geography, precipitation, soil conditions and community requirements. The decentralised water systems are developed in various ecological regions like stepwells, tanks, johad, baolis, ahar, kunds, pynes, bamboo drip irrigation, zing, surangam and temple tanks.

Agarwal and Narain (1997) described the diversity and extinction of traditional water harvesting systems in India and explained how water knowledge was weakened in the hands of the communities due to the colonial administration, centralised engineering and the neglect of local institutions. The significance of these systems is in the physical structure, and also in the social organisation that surrounds them. Community labour, local rules, religious endowment, caste based/seasonal occupations and cleaning were important factors in maintaining many tanks, ponds, and stepwells. Water was not only a good, it was a way of life.

The importance of traditional water harvesting in the era of climate uncertainty. In some settings, large dams and centralised water supply systems play a key role, but they are not sufficient to address the local water stress. Decentralised systems can recharge groundwater, decrease run-off, help agriculture, enhance drought resilience and increase community involvement. Johads, for instance, in Rajasthan, and tank systems in the south India demonstrate how small-scale water structures can be incorporated to local ecology. These systems are very consistent with the current concepts of watershed management, rain water harvesting, nature-based solutions and adaptation to climate change.

But it is not possible to simply replicate the traditional water systems if they are to be adapted. These systems are affected by population pressure, pollution, change of ownership, urbanisation and climate variability. IKS' lesson is not to eschew modern hydrology, but to use water wisdom coupled with scientific mapping, water quality testing, legal protection, and participative governance. Technical knowledge and community commitment are needed to manage water sustainably.

V. Agriculture, Food Systems, and Agroecological Knowledge

One of the most prominent sectors where Indian Knowledge Systems play a significant role towards sustainability is agriculture. Conventional Indian farming had features like mixed cropping, rotation of crops, selection of seeds, utilization of organic manure, integration of animals, agroforestry, seasonal calendars, local varieties of seeds, and water efficient farming. These practices were not universal in India, but varied in accordance with geography, soil, rainfall, caste, tribe and local ecology. They had something in common—adaptability to place.

In many ways, modern industrial agriculture has grown production but, at the same time, it has created ecological challenges like degradation, depletion of groundwater, pollution, loss of seed diversity and vulnerability of farmers. The use of traditional agroecological practices can be a solution to these problems, enhance diversity, resilience and local self-reliance. Mixed cropping helps in minimizing risks as failure of one crop does not mean loss of the entire crop. Local varieties of seeds may be more resistant to local pests, drought, salinity and/or variability in rainfall. Soil health is maintained by using organic manure or composting. There are functions of agroforestry for biodiversity, shade, fodder, fuel and carbon storage.

Food and health are also linked with seasoning, ethics and ecology in the context of IKS. In Ayurveda, food items are categorized based on their characteristics, season, digestion and body type. These categories are to be taken with a pinch of salt; they are not to be equated with current nutrition science, but do promote mindful eating, seasonality in food, moderation and awareness of the relationship between body and environment (Frawley, 1997). Traditional food systems also help bolster local biodiversity, such as millets, pulses, leafy greens, wild foods, fermented foods and local grains. The renewed interest in millets in India is a testament to the understanding

that traditional crops can play a role in food and nutrition security, climate change resilience and dryland farming sustainability.

The Food and Agriculture Organization (FAO, 2024) defines Globally Important Agricultural Heritage Systems as living agricultural systems developed by communities, biodiversity, cultural practices, landscapes and sustainable livelihoods. This is aligned with the claim that traditional agriculture is not backward per se. Can be used for adaptive knowledge for future food security. The task is to balance traditional knowledge and science with modern soil science, climatic information, farmer rights, fair markets, and technology.

VI. Forestry and the Conservation of Nature and Environment

Indian environmental history teaches us that often communities have opposed destructive uses of forest. One of the most prominent examples of the Chipko movement is in the Himalayan region. It was a pro-test action of local communities, particularly women, against commercial logging and forest policies that posed risks of livelihoods and ecological stability. Guha (1989) situated Chipko in the context of the longer history of peasant resistance to forest control during the colonial and post-colonial era. The movement demonstrated that forests are not just production of timber but also provide fuel, fodder, water, soil protection, cultural identity and survival.

What makes Chipko special is its blend of eco-concerns, livelihood demands, Gandhian principles of non-violence, and local involvement. It challenged development models which looked down on local communities and saw mountain forests as a commercial resource. The role of the women was particularly important because women were often responsible for gathering fuelwood, fodder and water. Thus, their ecological knowledge was based on the day-to-day work and survival. As illustrated in this example, sustainability needs to incorporate gender justice and livelihood security.

There are also Adivasi and forest dependent communities that have traditional forest knowledge. These communities may have detailed knowledge about the use of plants, animal life, soil, fire, rainfall and forest regeneration. But such understanding has often been sidelined by state policy and commercial interest, as well as conservation models that have excluded local people. A sustainable solution should consider community rights and also be protective of the ecosystems from overuse. This calls for careful governance, as not all practices are sustainable locally, and not all state actions are necessarily harmful. Participative conservation (science and community working together) is the best strategy.

Indian Knowledge Systems thus help in sustainable forestry, as they demonstrate that protecting forests is cultural, moral, economic and political. Forest protection is not possible if communities are disempowered from the landscapes that they rely on. Meanwhile, community traditions need to respond to emerging challenges of population growth, market extraction, invasive species and climate change. Collaborative and respectful relationships between local communities, ecologists, policy makers and civil society will be the key to the future of conserving forests.

VII. The Principles of Ethics for Sustainable Modernity

Ethical, not technological, may be the most significant work that IKS has done to support environmental sustainability. In modern environmental policy, carbon, biodiversity, waste and resource efficiency are frequently among the primary pillars. These are essential but change in attitude towards prosperity is also needed for sustainability. There are a number of ideas in Indian ethical traditions that can contribute to this change.

The principle of 'ahimsa' can promote 'non-injury' of living beings. In ecological terms, the practice of ahimsa can help promote animal welfare, vegetarian ethics, less violence towards ecosystems and compassionate development. It does not say that everyone must live the same way, but it asks if it is avoidable human choice that is causing harm? The idea of aparigraha is to reject unlimited consumption and accumulation. Aparigraha is an essential critique of excess in a consumerist, wasteful, fast fashion and planned obsolescence world. It states that it doesn't seem like there's any way to be sustainable without some self-restraint.

Yajna can also be understood in the ecological sense. Traditionally, yajna means sacrifice or offering, but in the broader philosophical sense it means reciprocity or responsibility. Human beings take from nature – air, water, food, soil, sun, biodiversity and we have to give back to it through care, control, protection. The Bhagavad Gita relates action, sacrifice, nature and social order, which can be interpreted as an ethic of interdependence (Easwaran, 2007). Loka-sangraha translates to welfare of the world and asks for action for the welfare of the collective, instead of only the individual.

Gandhian thought is a prominent modern statement of Indian ecological ethics. Gandhi condemned industrial civilization, which he termed as "Greed, Violence and multiplying of wants. Some of his ideas are still pertinent in sustainable consumption, such as consumption restraints, simplicity, swadeshi, non-violence, and trusteeship (Gandhi, 1938/2008). Gandhi's now-famous concept that there is enough for the need but not for the greed resonates with an omnipresent sustainability truth: ecological crisis is the result of a hunger for more than can be given.

VIII. IKS and Modern Ecological Challenges

To address modern ecological issues, both scientific innovations and cultural transformation are necessary. Renewable energy, climate-resilient infrastructure and the reduction of emissions, early warning systems and international cooperation are needed to combat climate change. There is a need for protected areas and habitat restoration, legal regulation and ecological research to halt biodiversity loss. Water scarcity requires efficient water irrigation, wastewater treatment, rain water harvesting and aquifer governance. IKS can help address these challenges by providing local adaptation knowledge, ethical motivation and community-based practices.

Traditional knowledge can assist communities to read local environmental changes signals, choose resilient crops, handle water and diversify livelihoods and respond to disasters as part of their climate adaptation strategies. UNESCO has identified local knowledge as a resource that can support climate observation, adaptation, mitigation, disaster risk reduction, biodiversity and water governance (UNESCO, 2025). Traditional knowledge is not correct or complete in all cases, but rather local experience is a source of data and strategies that should not be neglected.

IKS is relevant to the conservation of biodiversity in sacred groves, taboo systems, traditional medicine, conservation of seeds, conservation of animals, and in landscape-based cultural practices. It helps with water sustainability in the roles of rainwater harvesting, tanks, stepwells, water laws and traditions of the watershed and community water-maintenance. It contributes to sustainable consumption via a philosophy of moderation, a philosophy of repair, a philosophy of reuse, a philosophy of seasonal living, a local food philosophy and a simple living philosophy. It provides stories, rituals, festivals, ethics, and examples from the local area, all of which can communicate the meaning of sustainability in an emotional way for EE.

The integration of IKS with modern sustainability should be in a “knowledge dialogue” manner. Traditional knowledge is not a superstition but neither is it simply accepted without questioning. Water quality, biodiversity effects, soil health, climate resilience, and public health can be evaluated through scientific methods. Community knowledge can offer historical memory, local acceptance, place specific practices and ethical commitment. They can create more realistic sustainability plans when they work together.

IX. Education and Policy for the Future of IKS-based Sustainability

Education is one of the most important environment-oriented fields in which the link between IKS can be established. The National Education Policy 2020 aims to promote the integrated education of different disciplines and to value and strengthen Indian knowledge systems (Ministry of Human Resource Development, 2020). UGC guidelines also promote the inclusion of IKS in higher education curricula (2023) (University Grants Commission). This is a chance to educate sustainability not just as environmental science, but also as a cultural ethic, community practice, history, literature, agriculture, health, and policy.

Sustainable education in the framework of an IKS curriculum can be connected with sacred groves, traditional water systems, agroecology, ayurveda and seasonal living, environmental ethics in the Indian philosophy, tribal ecological knowledge, the environmental movements of India and the field work. Students were able to visit ponds, farms, forests, sacred groves, waste management and community conservation projects. They were able to compare the old methods with the scientific data of the modern days. This education will create and help students realize that sustainability is not a foreign concept but is also embedded in their local life and Indian Civilization.

IKS can also be used as a policy tool to promote decentralized harvesting of water, community seed banks, local biodiversity registers, sacred grove protection, agroecology by farmers and participatory forest management, and the recognition of traditional healers and knowledge holders. But policy is also needed to safeguard communities from being victimized. Conventional knowledge can be easily commercialised. There must be a respect for culture, consent of the community, benefit sharing, and intellectual property rights. Sustainability should not be another mode of extraction – a process in which local knowledge is appropriated without acknowledging community rights.

X. Critical Reflections and Limitations

Any discussion of IKS and sustainability must be taken out of the fanciful realm. Not all traditional practices are sustainable, inclusive, and scientifically sound. Certain practices might have been developed at different levels of population, ecological settings, or social organizations. Some may perpetuate caste, gender or tribal discrimination. Some of the ones may be eco-friendly, but not necessarily socially just. So IKS needs to be approached on a critical rather than an idealised basis.

One problem is the risk of standardisation of Indian practices. India is not a single ecological and cultural unit. The knowledge of the communities of the Himalayas is different from the coastal fisher folk, the pastoral communities in the desert, the forest-dwelling Adivasis, the wetland farmers and craft communities of the city. IKS needs to be plural, regional, multilingual and dynamic, however. Sanskrit texts are significant, but not a

complete repository of Indian knowledge. There also needs to be consideration of oral traditions, Adivasi worldviews, knowledge of local crafts and women's knowledge.

There is also a need to be evidence based for integration. The use of traditional water structures, herbal practices, crop varieties and conservation customs should be carefully documented, studied and adapted. Some may be very effective and others may require modification. The problem of industrial pollution, climate change, plastic waste, nuclear pollution, etc. are modern environmental issues which cannot be addressed using traditional knowledge. They demand sophisticated science, regulation, international cooperation and technology change. IKS is complementary, as it brings with it values, local knowledge, community legitimacy and adaptive practices.

XI. Conclusion

Indian Knowledge Systems have vast resources on environmental sustainability. They are good at dealing with the whole picture, being in control of themselves, getting involved in the community, respecting biodiversity, and adapting to their surroundings. The term dharma gives a moral framework in which to develop ecological responsibility: ahimsa, aparigraha, yajna, prakriti and loka-sangraha also are critical concepts. Practical Sustainable practices, like sacred groves, traditional water harvesting, agroecology, seed diversity, animal protection, seasonal living and community forest movements, reflect sustainable practices in the Indian context. Modern world requires more than technological solutions. It requires new ideas regarding prosperity, consumption, development and human responsibility. By bringing ecological action back to ethics, culture, education, and community, IKS can help. However, it needs to be evidence-based, inclusive and critical. It is important to not use traditional knowledge as a relic of the past, but to put it in conversation with contemporary science and democratic principles. In a responsible manner, Indian Knowledge Systems can play a significant role in addressing the contemporary ecological problems and create a more sustainable future.

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