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Indigenous Knowledge and Modern Technologies for the Environmental Sustainability

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Abstract
Climate change has emerged as one of the most challenging global issues of the twenty-first century, posing significant threats to ecosystems, water resources, food security, biodiversity, and human well-being. While contemporary scientific research has developed numerous technological approaches to address climate-related issues, Indigenous and local communities have long practiced sustainable resource management strategies.
This study explores the role of Indigenous Traditional Knowledge (ITK) in enhancing climate resilience and promoting sustainable environmental management. The study examines the effectiveness of community-based water conservation systems, agroforestry, mixed cropping, traditional agricultural practices.
The study further investigates the potential for integrating Indigenous Traditional Knowledge with modern scientific and technological innovations, including Geographic Information Systems (GIS), remote sensing, geospatial technologies, and Artificial Intelligence (AI).
The study concludes that fostering collaboration between Indigenous communities, policymakers, and scientific institutions is essential for building resilient and sustainable societies capable of addressing future environmental challenges.

***Keywords*: Climate Change, Indigenous Traditional Knowledge (ITK), Climate Adaptation, Climate Resilience, Sustainable Development, Artificial Intelligence.

I. INTRODUCTION

Climate change is one of the biggest challenges which the world is facing today. Rising temperatures, erratic rainfall, decline in biodiversity and continuous conservation of natural resources have affected both human life and ecosystems. Scientific research and development of new technologies are essential to address these challenges. But along with this, the views of local and Indigenous communities need to be understood.

Indigenous and local communities around the world have been living in balance with nature for centuries. Based on their experiences and long-term observations of the environment, they have developed effective ways to conserve forests, water sources, agriculture, and biodiversity. This knowledge is called Indigenous Traditional Knowledge (ITK). This knowledge is deeply connected with local conditions, natural resources, and the lifestyle of the community.

In recent years, it has been observed that in areas managed by Indigenous communities, the conservation of biodiversity and natural resources remains relatively better. Despite this, this knowledge is still not given sufficient importance in policies related to climate change and environmental management.

This study explores how indigenous traditional knowledge can help to mitigate the impacts of climate change, protect biodiversity, and promote the sustainable use of natural resources. It also discusses how combining traditional knowledge with modern science and new technologies can develop more effective and sustainable climate solutions. The purpose of the study is to show that the knowledge of local communities and scientific innovation together can play a crucial role in building a safer, greener, and sustainable future.

A. Research Problem Statement

Although numerous studies and real-life examples prove that Indigenous and traditional knowledge (ITK) can play a significant role in addressing the challenges of climate change, it still has not received adequate space in government climate policies. Today, most climate plans are based on new technologies, large engineering projects, and strategies to reduce carbon emissions. These measures are important, but they are often expensive and cannot work according to the local needs of each region.

In contrast, ITK-based practices are based on the experiences of multiple generations and an understanding of local conditions. Therefore, these methods are simple, cost-effective, and more suitable for the local environment. These knowledge systems help in the conservation of natural resources, adaptation to the impacts of climate change, and enhancing the capacities of communities.

In such a situation, an important question arises as to how local and traditional knowledge can be effectively integrated into climate actions, while also ensuring that the rights, culture, and contributions of Indigenous communities are fully respected. This requires better cooperation and dialogue between policymakers, scientists, and local communities.

If traditional knowledge is combined with modern science and technology, strategies to tackle climate change can become more effective, inclusive, and sustainable. This approach can make a significant contribution to building a green, safe, and more resilient society in the future.

B. Objectives of the Study

This study focuses on four main objectives.

(1) It attempts to understand how Indigenous Traditional Knowledge (ITK) contributes to environmental conservation, ecosystem management, and coping with the impacts of climate change.

(2) It focuses on the examples and case studies from different parts of the world to understand how traditional practices are used in various social and environmental contexts.

(3) The study examines how modern technologies, such as artificial intelligence (AI), satellite-based monitoring, and digital tools, can help in making the traditional knowledge more effective. Its aim is not to replace traditional knowledge, but to strengthen and make it useful.

(4) This research analyses current climate and environmental policies to determine how much importance is given to indigenous knowledge and the participation of local communities, and in which areas improvement is needed.

In conclusion, our study presents practical recommendations through which indigenous and traditional knowledge can be effectively integrated into national and international climate policies. It also emphasizes on ensuring that the communities possessing traditional knowledge become active participants in the process of developing and implementing climate solutions. Thus, the combination of traditional knowledge and modern science can help in developing more sustainable and effective climate solutions.

C. Research Methodology

Our study is based on the various research papers, reports, policy documents, and regional studies published between 1995 and 2024. For information, studies from academic journals, reports of international institutions, and various non-governmental organizations (NGOs) working in the fields of environment and community development have been used.

To understand the role of indigenous traditional knowledge (ITK) in coping with climate change, several case studies from different countries and ecological zones were analysed. Through these examples, an effort was made to understand how traditional practices are used in different environmental and social conditions and how they help local communities to deal with the climate challenges.

The study also compares ITK-based methods with modern climate solutions. This comparison considers important aspects such as environmental impact, cost, community participation, and the feasibility of implementing these measures on a large scale.

By integrating information obtained from various fields such as environmental studies, sustainable development, anthropology, and policy research, our research presents a comprehensive perspective. It helps in understanding how traditional knowledge can significantly contribute to climate change adaptation, the conservation of natural resources, and the promotion of environmental sustainability.

II. LITERATURE REVIEW

Many researchers have stated that Indigenous communities and modern science have their own ways of understanding nature. Although the approaches of both may be different, they are also complementary to each other. According to “Agrawal” [3], traditional knowledge and scientific knowledge together can provide a better understanding of the environment, as both highlight different aspects.

“Gadgil and Guha” [4] have shown through examples from Indian history that Indigenous communities have long been conserving forests and natural resources. This conservation work has been happening since the time when governments had not even established national parks and protected areas.

“Berkes” [7] introduced the concept of 'Sacred Ecology.' According to him, in many communities, religious and cultural beliefs related to nature motivate people to protect natural resources. This is the reason why they use forests, rivers, and other resources responsibly.

In an important study conducted by UNESCO and UNU, “Nakashima and his colleagues” [5] found that Indigenous communities have very precise knowledge related to the local climate and environment. They can estimate changes in the climate by observing the timing of plant flowering, signs of the weather, and natural changes. Many times, this information even matches with modern meteorological data.

Traditional systems have also proven useful in the field of carbon conservation. “Nair” [10] reported that traditional agroforestry systems can store large amounts of carbon. Similarly, “Bhatt and Singh” [17] found in their study that Indigenous agricultural areas of Central India store a significant amount of carbon per hectare annually, which helps in mitigating climate change.

Nevertheless, the study by "S. Kumar and A. Tiwari" [12] revealed that very few conservation programs in India incorporate Indigenous and traditional knowledge. This difference highlights the need to give greater importance to ITK in environmental conservation and climate policies and to incorporate it effectively.

III. IMPORTANCE OF ITK IN CLIMATE ACTION

ITK contributes to climate action in three interconnected ways: reducing greenhouse gas emissions through land stewardship; building resilience to climate variability through generations of localised observation; and maintaining the biodiversity that keeps ecosystems functional and adaptable.

A. ITK as a Climate Mitigation Tool

Indigenous communities are the world's most experienced carbon managers. Around 57% of the Amazon Basin sits within territories governed by indigenous peoples, storing an estimated 150 to 200 billion tonnes of carbon — more than a decade of total global emissions. In India, forests managed with Indigenous communities under ITK principles sequester around 52 million tonnes of CO2 each year [4]. Figure 1 below illustrates how ITK-managed ecosystems compare on carbon sequestration rates.

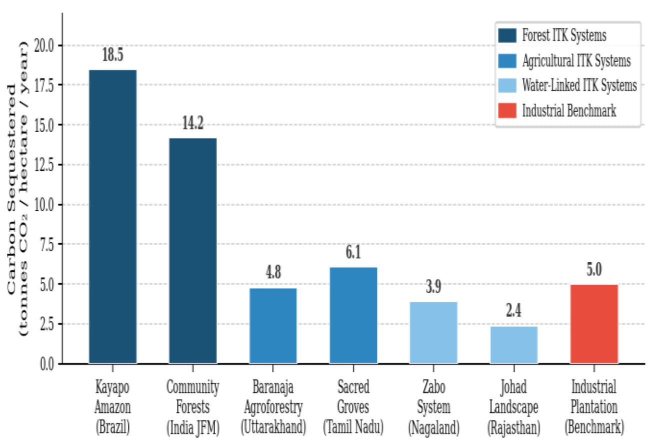


Fig. 1. Carbon Sequestration Rates Across ITK-Managed Ecosystems vs. Industrial Plantation Benchmark

B. ITK as a Climate Adaptation Tool

Long before weather apps or meteorological stations, indigenous communities were reading the climate through the world around them. Himalayan communities track Rhododendron arboretum flowering to predict monsoon timing. Pastoral communities across the Sahel observe bird behaviour, plant responses, and star positions to anticipate drought weeks before instruments detect it [5].

C. ITK and Biodiversity

Sacred groves — Dev Vans in Uttarakhand, Sarnas in Jharkhand, Kovils in Tamil Nadu — are among the oldest conservation areas on Earth, predating national parks by centuries. There are an estimated 100,000 to 150,000 such groves across India alone. Researchers consistently find more plant species inside a sacred grove than in an adjacent government-managed forest of the same size [12]. As Figure 3 (see Section VI) illustrates, indigenous-managed territories hold a disproportionate share of global biodiversity.

IV. ITK AND THE GREEN PLANET: FORESTS, FARMS, AND SEEDS

A. Forests and Sacred Grove Governance

The Bishnoi community of Rajasthan has protected the Khejri tree (Prosopis cineraria) for centuries based on the practical knowledge that these trees fix nitrogen in desert soils. Modern soil science confirms they were right: fields beside Khejri trees yield 15 to 23% more than fields without them [7]. This is ITK at its most direct — a community protecting an ecosystem service it understood intuitively long before science gave it a name.

B. Traditional Farming Systems

A baranaja field in Uttarakhand grows twelve crops together — millets, lentils, beans, vegetables — sharing the same soil. If one crop fails, others thrive. No synthetic fertiliser is needed because the plants feed each other. Similarly, the jhum shifting cultivation of northeast India, when practised at its traditional 10 to 15 year pace, allows forests to regenerate, soils to recover, and biodiversity to return [13].

C. Seeds and Medicinal Plant Knowledge

In villages across Telangana, women farmers maintain living seed libraries. The Deccan Development Society documented over 80 traditional sorghum varieties in Zaheerabad area alone [12] — carrying drought tolerance and heat resilience traits that plant breeders now try to recover through expensive laboratory work. Traditional home gardens in Kerala's Wayanad district contain 186 medicinal plant species within a single half-hectare plot — a density matching primary rainforest.

V. ITK AND THE BLUE PLANET: WATER, WETLANDS, AND SEAS

A. Water Harvesting the Traditional Way

Before canals and dams, communities in Rajasthan built johads — small earthen ponds that catch monsoon rain and slowly sink it into the ground. When Tarun Bharat Sangh began reviving johads in over 650 villages in Alwar district from 1985, groundwater tables rose by three to six metres over a decade. Five rivers that had run dry began flowing year-round again [6]. All of this was achieved using earth, community labour, and centuries-old knowledge of where to put a pond.

Other traditional water systems tell similar stories. The kuls channels of Lahaul-Spiti carry glacial meltwater to terraced farms. The ahar-pyne networks of Bihar distribute monsoon water across paddy fields. The surangam wells of coastal Kerala extract fresh groundwater horizontally — no pump needed, no salt intrusion possible [13].

B. Wetlands and Marine Stewardship

The ChilikaMatsyajeeviMahasangh enforces seasonal no-take zones and spawning area protections that have kept fish diversity alive in Asia's largest coastal lagoon [14]. In New Zealand, the Maorirahui designates ocean areas off-limits for recovery periods. Independent studies record fish population recoveries of 35 to 55% within three to five years [14] — matching results of formally established marine reserves, achieved through cultural authority alone.

C. Rivers as Living Entities

In 2017, New Zealand granted the Whanganui River legal personhood following Maori advocacy — a governance model now taken seriously in Colombia, Ecuador, and Bangladesh [16]. In India, movements to grant legal rights to the Ganga and Yamuna draw on this same indigenous ecological thinking: the understanding that healthy rivers need governance as whole systems, not sectoral permits.

VI. CASE STUDIES FROM INDIA AND THE WORLD

Dimension	ITK Approaches	Modern/Scientific Approaches
Knowledge Base	Lived experience passed through generations; oral traditions and direct observation of nature	Quantitative data collected through instruments, satellites, and controlled laboratory experiments
Agriculture	Mixed cropping, moon-guided sowing calendars, community seed saving, twelve-crop baranaja systems	Precision farming tools, genetically engineered crops, chemical fertilizers, aerial drone surveillance
Water Mgmt.	Johad ponds, kuls channels, zabo terrace collection, underground surangam wells	Large reservoir dams, drip irrigation networks, seawater desalination, IoT-enabled monitoring
Biodiversity	Spiritually protected sacred groves, village-managed forests, women-run seed libraries	State-managed national parks, institutional gene banks, bioengineering programs
Carbon Mgmt.	Low-intensity seasonal burning, community-protected mangroves, spiritually-guarded peatlands	Carbon trading markets, engineered carbon capture, large-scale plantation forestry
Community Role	Community is at the centre; decisions flow from shared responsibility and local authority	Communities are often passive recipients of externally designed government programs
Cost	Very affordable; built from local materials, skills, and collective effort	Expensive; demands significant capital, engineering infrastructure, and specialist expertise

TABLE I
COMPARATIVE ANALYSIS: ITK VS. MODERN TECHNOLOGICAL APPROACHES

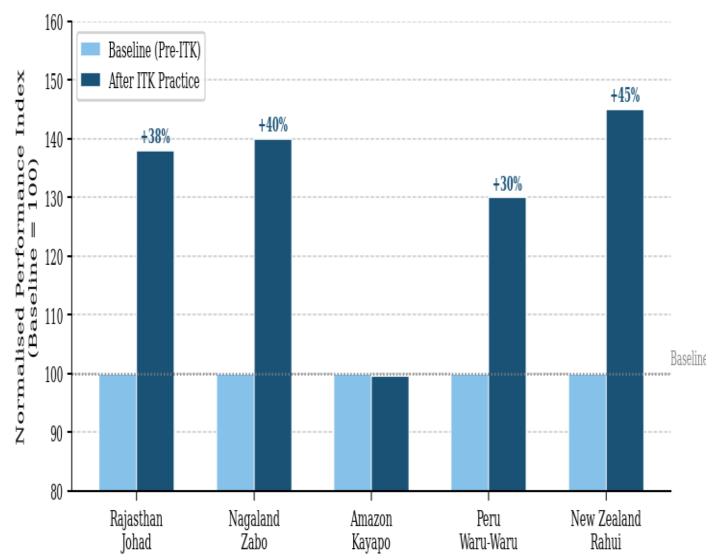
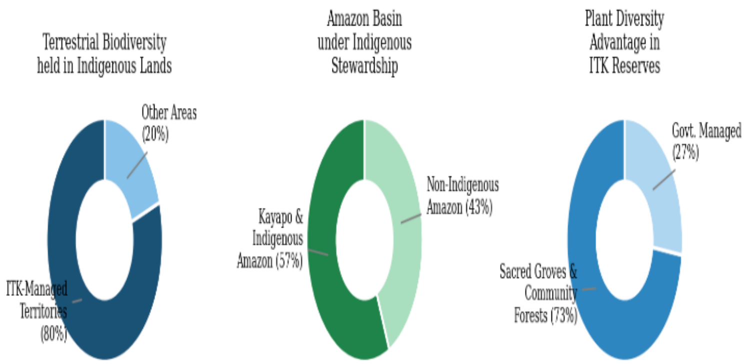


Fig.2. Before-and-After Ecological Performance Index Across Five Global ITK Case Studies

As Figure 2 shows, all five major ITK case studies demonstrate significant ecological improvement above the pre-intervention baseline. The four narratives below bring these numbers to life.



A. Rajasthan, India — Bringing Dead Rivers Back to Life

When Rajendra Singh arrived in Alwar district in 1985, he found villages running out of water and rivers that had stopped flowing. Working alongside communities using traditional johad knowledge and labour, Tarun Bharat Sangh helped build more than 8,600 water structures across 650 villages. The results changed everything: groundwater rose three to six metres, five rivers ran year-round again, and agricultural yields climbed by 28 to 40% [6].

B. Nagaland, India — A System That Feeds the Soil

The Angami Naga people's Zabo system keeps hilltop forests intact because the community understands their roots hold the water in place. Rainfall flows through livestock enclosures — picking up organic nutrients — then into stepped paddy terraces below. The result is a closed loop: the forest feeds the water, the water feeds the animals, the animals feed the fields. Villages using Zabo produce about 40% more paddy and also protect habitat for the endangered Blyth's Tragopan pheasant [5].

C. Amazon, Brazil — Protecting a Forest the Size of Portugal

The Kayapo govern 10.6 million hectares of Amazonian rainforest through a deeply embedded territorial knowledge system. NASA satellite data (2019–2023) shows annual forest loss below 0.5% in Kayapo territories versus more than 5% in surrounding non-indigenous areas [3]. Their deliberate planting of apete — islands of forest in open grassland — creates wildlife corridors and regulates local temperatures.

D. Andes, Peru — Engineering Warmth at 3,800 Metres

The Quechua waru-waru raised field system places water channels between elevated planting beds. During the day the water absorbs sunlight; at night it releases warmth into the surrounding air, raising temperatures by up to 2°C and keeping frost away from crops. When researchers helped rehabilitate over 3,000 hectares, frost-related crop losses dropped by 30% [2].

VII. WHEN TECHNOLOGY MEETS TRADITIONAL KNOWLEDGE

A. Satellites Confirming What Communities Already Know

When researchers ran LiDAR satellite scans in the Western Ghats, the areas with the highest above-ground biomass corresponded almost exactly to sacred grove boundaries that local communities had identified without any instruments [9]. Technology, in this case, is not adding knowledge — it is validating what was already there. Google Earth Engine analysis comparing Kayapo territories with adjacent unprotected land confirms the same pattern.

TABLE II
GLOBAL CASE STUDIES: ITK-BASED ENVIRONMENTAL MANAGEMENT PRACTICES

Fig.3. Indigenous Stewardship — Biodiversity, Amazon, and Sacred Grove Coverage

B. AI Learning from Traditional Calendars

Region	ITK Practice	Ecological Benefit	Ecosystem	Documented Outcome
Rajasthan, India	Johad rainwater ponds	Underground water recharge; drought resilience	Dry/Semi-arid	Water table rose 6 m; five rivers restored
Nagaland, India	Zabo hillside water terraces	Flood control; organic nutrient recycling	Terraced Hills	Paddy yield +40% vs non-Zabo villages
Uttarakhand, India	Baranaja twelve-seed farming	Richer soil, diverse crops, zero chemical inputs	Mountain farms	Zero synthetic fertiliser; climate-resilient yields
Amazon, Brazil	Kayapo forest stewardship	Forest intact; massive carbon locked in ecosystem	Rainforest	<0.5% forest loss vs >5% in adjacent areas
Andes, Peru	Waru-waru raised field farming	Night frost reduced by thermal water channels	High altitude	Frost-related crop losses cut by 30%
New Zealand	Maori rahui fishing bans	Fish populations recover; reef ecosystems heal	Coastal/ Marine	Fish stock +35-55% within 3-5 years
Bangladesh	Baira floating gardens	Crops grown on water; food security preserved	Floodplain	Over 50,000 families fed annually
Ethiopia	Diguet soil bunds	Topsoil held; rains absorbed not lost to runoff	Highland farms	Soil erosion reduced by ~60%

India's Traditional Knowledge Digital Library (TKDL) encodes thousands of years of traditional medicinal plant knowledge. Machine learning tools identified 15 traditional herbal preparations effective against climate-sensitive diseases including dengue and drug-resistant malaria [12]. AI models trained on indigenous seasonal calendars improve planting date predictions for smallholder farmers by 12 to 18% compared to conventional weather forecasts alone.

C. Communities as Environmental Monitors

The MeriMaati platform in Uttarakhand equips village-level monitors with smartphones and trains them to combine traditional landscape reading with basic scientific field survey skills. When this community data is fused with satellite imagery, emergency response times in participating watersheds have been cut by an estimated 30% [13].

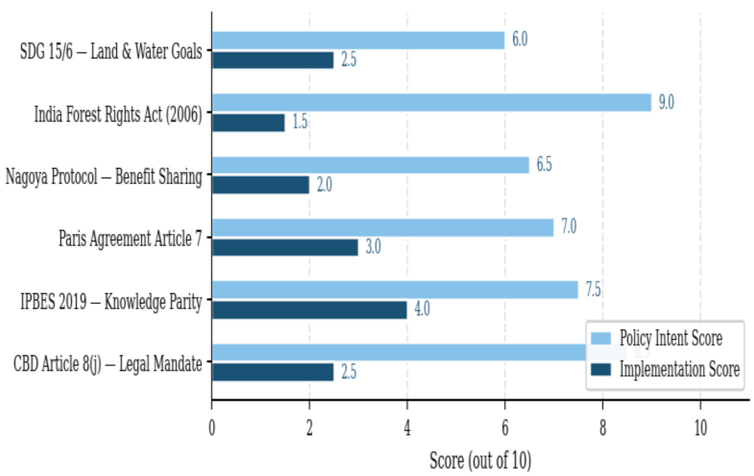


Fig.4. Comparative Radar Chart: ITK vs. Modern Technology Across Key Sustainability Dimensions

VIII. WHAT STANDS IN THE WAY

A. The Problem of Not Being Taken Seriously

Perhaps the most frustrating barrier ITK faces is simply not being believed. Formal institutions tend to trust numbers from instruments more than knowledge from people, even when that people-based knowledge is older, more locally accurate, and more practically applicable. Sillitoe [11] describes this as a form of epistemic injustice: judging one kind of knowledge by the rules of another that was never designed to evaluate it.

B. Taking the Practice Without the People

A common mistake in ITK adoption is borrowing the technique while ignoring the community that makes it work. Sacred grove protection functions not just because trees are left alone, but because the community believes those trees are spiritually protected and social consequences follow if anyone breaks that rule [8]. When outside programs bring no cultural authority and no community governance, the grove tends to disappear quietly within a generation.

C. When Knowledge Has No One Left to Carry It

Every year, India loses three to five indigenous languages. With each language goes a vocabulary for describing the natural world that cannot be recovered. The IPBES assessment (2019) concluded that in some regions, the speed of ITK loss is now outpacing even biodiversity loss itself [2]. Once an elder who knows how to read a particular landscape is gone, that knowledge is gone.

D. When Climate Change Disrupts the Knowledge Itself

Climate change is disrupting the ecological cues that ITK depends on. If a Himalayan community has always sown seeds when a particular flower blooms, and that flower now blooms three weeks earlier due to warming — the knowledge does not automatically update [5]. Supporting communities to update their knowledge in dialogue with scientific monitoring is part of what genuine co-production looks like.

IX. POLICIES, PROMISES, AND THE GAP BETWEEN THEM

TABLE III
POLICY FRAMEWORKS AND THEIR RELEVANCE TO ITK INTEGRATION

Policy / Framework	How It Relates to ITK	Where It Falls Short
CBD Article 8(j), 1992	Requires all member countries to protect indigenous ecological knowledge and share its benefits fairly	Most countries have signed but do little in practice to enforce it
Paris Agreement, 2015	Article 7 recognises that indigenous peoples hold knowledge vital to climate adaptation plans	Fewer than 30% of national climate plans include meaningful ITK commitments
Nagoya Protocol, 2010	Sets rules for how companies can access and share benefits from traditional knowledge	Biopiracy still happens because penalties are weak and rarely applied
IPBES Assessment, 2019	Officially treats indigenous knowledge as equally valid evidence alongside scientific research	Translating this into actual monitoring systems is still very much a work in progress
India Forest Rights Act, 2006	Gives Indigenous communities legal rights to govern forests through traditional systems	By 2023, fewer than 3% of valid community claims had been officially recognised
SDG 15 and SDG 6	Goals protecting life on land and clean water closely mirror what ITK communities have always done	ITK is not mentioned in any official SDG measurement indicators

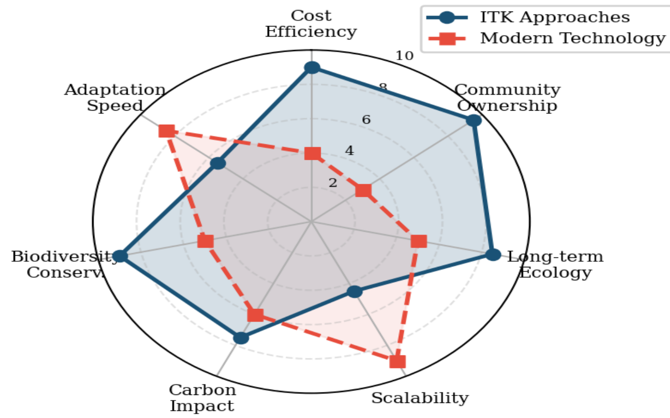


Fig.5. Policy Intent vs. Actual Implementation Scores for ITK-Related Climate Governance Frameworks

Figure 5 makes the implementation gap painfully visible. Across every major framework, the gap between stated policy intent and on-the-ground reality remains wide. India's Forest Rights Act scores highest on intent but lowest on implementation [4].

A. International Commitments

Article 8(j) of the Convention on Biological Diversity has required member governments since 1992 to protect indigenous knowledge and ensure communities benefit from its use. Article 7 of the Paris Agreement acknowledges the role of indigenous knowledge in adaptation planning [15]. But fewer than 30% of countries' updated national climate plans include any substantive commitment to ITK, and enforcement against biopiracy remains largely dormant [15].

B. India's Legal Framework

India's Forest Rights Act of 2006 legally recognises the right of Indigenous communities to govern forests through traditional institutions [4]. In practice, a 2023 audit found fewer than 3% of eligible community claims had been fully processed. Tens of millions of hectares that could be under community-governed, ITK-based conservation remain in legal limbo.

X. WHAT NEEDS TO HAPPEN NEXT

A. Policy and Institutional Recommendations

Several things need to change if ITK is to move from the margins to the centre of climate action. Governments should establish National ITK-Climate Advisory Councils with formal roles in shaping national climate plans and directing adaptation funding. ITK impact assessments should become mandatory for infrastructure projects in ecologically sensitive areas. At least 10% of national climate adaptation budgets should go directly to community-led ITK programmes [16]. The Forest Rights Act must be implemented fully — these forest lands are one of India's most underutilised climate assets.

B. Technology and Research Recommendations

Biocultural mapping platforms should be built with community data sovereignty from the start — communities control who sees the data and how it is used [9]. ITK-derived ecological indicators should be incorporated into national environmental monitoring frameworks. Research funding bodies should require that studies on ITK be co-led by indigenous knowledge institutions, not just conducted on indigenous communities [17].

C. Future Research Directions

Priority research directions include: (1) long-term standardised measurements of carbon stored in ITK-managed sacred groves and agroforestry; (2) modelled effectiveness of ITK water management systems under projected 2050 and 2100 climate scenarios; (3) a global ITK vulnerability index combining language endangerment, ecosystem change, and climate exposure data; (4) AI tools to help communities track how their own ecological indicators are shifting; and (5) policy implementation evaluations tracking measurable ecological outcomes after Forest Rights Act titling.

Fig. 6. ITK Co-Production Framework: Pathways from Knowledge to Climate Outcomes

Figure 6 presents the co-production framework this paper advocates — a model in which ITK holders and modern scientists work as equal partners, with their combined knowledge feeding upward into policy and downward into measurable Green and Blue Planet outcomes.

XI. CONCLUSION

This paper has tried to make the case in the language that policy institutions understand: with data, case studies, comparison tables, charts, and citations. The evidence is consistent. Where communities are given authority and resources to manage their own ecosystems using their own knowledge, the results — in carbon sequestration, water security, biodiversity, and food resilience — are measurable, significant, and durable.

Getting ITK into the mainstream of climate governance is not a technical problem. The tools exist. The knowledge exists. The legal frameworks largely exist. What is missing is political will, honest funding, and the institutional humility to recognise that some of the world's best climate science has been running quietly in communities that never called it science at all. A truly Green and Blue Planet will be built not just in research labs and policy conferences, but in the fields, forests, rivers, and fishing grounds of the people who have cared for them longest.

REFERENCES

[1] IPCC, "Climate Change 2023: Synthesis Report," Intergovernmental Panel on Climate Change, Geneva, Switzerland, 2023.

[2] T. Roe et al., "Indigenous and local knowledge in biodiversity assessment," IPBES Global Assessment Report, Bonn, Germany, 2019.

[3] A. Agrawal, "Indigenous and scientific knowledge: Some critical comments," Indigenous Knowledge and Development Monitor, vol. 3, no. 3, pp. 3-6, 1995.

[4] S. Gadgil and R. Guha, Ecology and Equity: The Use and Abuse of Nature in Contemporary India. London: Routledge, 1995.

[5] J. Nakashima et al., Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation. Paris: UNESCO/UNU, 2012.

[6] R. Rajagopalan, Water Harvesting Traditions and the Village Ecosystem. New Delhi: Centre for Science and Environment, 2014.

[7] A. Berkes, Sacred Ecology: Traditional Ecological Knowledge and Resource Management. Philadelphia: Taylor & Francis, 1999.

[8] UNEP, "Bridging the gap: Indigenous and community conserved areas in the CBD," UNEP-WCMC, Cambridge, 2008.

[9] M. Tengo et al., "Connecting diverse knowledge systems for enhanced ecosystem governance," Ambio, vol. 43, no. 5, pp. 579-591, 2014.

[10] P. K. Nair, "Carbon sequestration studies in agroforestry systems: A reality-check," Agroforestry Systems, vol. 86, no. 2, pp. 243-253, 2012.

[11] R. Sillitoe, "The development of indigenous knowledge: A new applied anthropology," Current Anthropology, vol. 39, no. 2, pp. 223-252, 1998.

[12] S. Kumar and A. Tewari, "Traditional ecological knowledge and biodiversity conservation in the

Himalayas," Journal of Ethnobiology and Ethnomedicine, vol. 17, no. 1, pp. 1-14, 2021.

[13] B. B. Jana et al., "Traditional water harvesting systems of India: A review," Indian Journal of Traditional Knowledge, vol. 18, no. 3, pp. 510-521, 2019.

[14] CBD Secretariat, Local Biodiversity Outlooks 2: Indigenous Peoples and Local Communities. Montreal, Canada, 2020.

[15] UNFCCC, "Paris Agreement," United Nations Framework Convention on Climate Change, Paris, 2015.

[16] T. Tsosie, "Indigenous people and environmental justice: The impact of climate change," University of Colorado Law Review, vol. 78, pp. 1625-1677, 2007.

[17] G. Bhatt and K. P. Singh, "Agroforestry practices linked to traditional knowledge in central India: Carbon and livelihood co-benefits," Ecological Engineering, vol. 150, 105855, 2020