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Sacred Earth: Indigenous Wisdom and Ecological Justice

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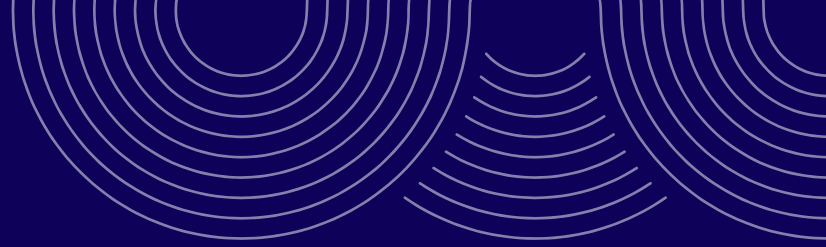


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Editor's Choice

SHRI MILAN KANTI MANDAL: Conserving Tigers and Mangroves in the Sundarban

Ms. Anolita Singho, Communication Officer(PFRI)

Abstract

Shri Milan Kanti Mandal, I.F.S. (West Bengal cadre), is a forest officer whose work synthesizes field biology, landscape management and community-centred conservation. Trained in zoology and experienced across diverse Indian landscapes, his recent leadership of restoration, protection and livelihood programmes in the Sundarban Biosphere Reserve (SBR) exemplifies an integrated approach to conserving a highly specialized mangrove–tiger ecosystem. The following account reframes his professional trajectory, management strategies, and policy recommendations in a concentrated, scientific style drawing on Shri Milan Kanti Mandal’s field observations and project outcomes.

Professional trajectory and field foundations

Shri Milan Kanti Mandal’s early postings (mid-1990s) in Baikunthapur exposed him to complex forest mosaics, high biodiversity and entrenched wildlife crime. These formative years characterized by frequent anti-poaching operations and enforcement, shaped his pragmatic conservation outlook: ecological protection must be coupled with social and legal measures. Subsequent long-term field deployment in Buxa Tiger Reserve provided hands-on training in census methodology and habitat management, reinforced by formal instruction at the Wildlife Institute of India.

Over his career he has occupied administrative roles across West Bengal (Divisional Forest Officer posts, urban/industrial forestry), contributing to species documentation (including a regional record of the Indian grey wolf during his tenure as DFO at Paschim Bardhaman, Durgapur) and institutional capacity-building.

The Sundarban as a distinct conservation landscape

The Sundarban presents ecological and socio-economic conditions unlike any other tiger habitat. The Indian SBR is part of a transboundary mangrove complex that supports dense tidal networks, high plant diversity (700+ vascular species reported), and an estimated 4.5 million people along the delta. Salient ecological features include restricted tiger movement in dense mangroves, an atypical prey base dominated by spotted deer and wild pigs, and acute exposure to climate stressors (sea-level rise and cyclonic events). These attributes create unique management imperatives: habitat restoration, prey base maintenance, and mitigation of human livelihood dependence are central to tiger conservation here.



Image: Shri Milan Kanti Mandal, I.F.S.

Restoration, protection and programme design

Under Shri Milan Kanti Mandal's oversight, the Forest Department executed large-scale mangrove restoration and protection initiatives. These efforts combined high planting targets with structured protection protocols and social monitoring mechanisms. Key elements included:

- High-volume planting targets implemented across notified and non-notified lands, with phased achievement of multi-crore sapling goals.
- Emphasis on sapling survival and post-planting protection (regular patrolling, bank maintenance, and net repairs) rather than tokenistic planting.
- Deployment of a three-layer patrol architecture for spatially distributed oversight and a citizen-facing smartphone application enabling geotagged reporting of damage or malpractice.
- Leveraging national employment schemes (MGNREGA) to provide livelihoods particularly for women during plantation and protection phases, with direct wage transfers for transparency.

This model integrates ecological restoration with socio-economic safeguards, thereby reducing immediate pressures on core habitats while building local ownership of conservation outcomes.



Image: Shri Milan Kanti Mandal, I.F.S

Community engagement and alternative livelihoods

He frames the Forest Department's role as facilitative: enabling forest-friendly livelihoods and formalizing erstwhile informal resource uses. Notable interventions include formation of honey cooperatives (shifting honey collection from hazardous, illegal extraction to managed apiaries), promotion of mud-crab farming, and establishment of roadside beekeeping and other micro-enterprises. Institutional pathways, Joint Forest Management Committees (JFMCs), women's self-help groups, and revenue-sharing mechanisms (for example, sharing a portion of tourism gate fees) are used to align local incentives with conservation objectives.

These measures aim to reduce human forays into core areas and to provide resilient income alternatives following environmental shocks.

Human-tiger conflict: drivers and mitigation principles

Shri Milan Kanti Mandal's operational experience indicates that conflict in the Sundarban is predominantly driven by socio-economic necessity and habitat overlap rather than unprovoked predation. Seasonal and post-disaster poverty compel individuals to enter banned core zones for fishing, crab collection or honey gathering, putting them in close proximity to tigers adapted to short-range ambush in tidal channels. Environmental degradation (salinity intrusion, cyclone damage) reduces usable habitat and prey availability, increasing encounter rates. Consequently, effective mitigation requires a threefold strategy:

- **Preventive measures:** strict core-area enforcement, spatial zoning and community-based surveillance.
- **Livelihood alternatives:** market-linked interventions and wage-based restoration employment to reduce illegal forest dependence.
- **Post-event support:** rapid compensation and social safety nets for affected families to prevent repeat forest entry driven by desperation.



Image: Shri Milan Kanti Mandal, I.F.S

Policy prescriptions and operational recommendations

Drawing on field lessons, he proposes targeted policy actions to strengthen tiger conservation at landscape scale:

- **Relocation of settlements from core areas**, where feasible and ethically conducted, to restore inviolate habitat patches and reduce chronic human–wildlife interfaces.
- **Specialized, multidisciplinary tiger task forces** for rapid response, anti-poaching enforcement and cross-district coordination.
- **Regulation of tourism** with strict zonal rules permitting controlled visitation in buffer zones while prohibiting tourist activity in core areas to minimize disturbance and risk.

These recommendations are complementary: relocation and strict zoning protect habitat integrity, task forces enhance enforcement capacity, and regulated tourism provides a sustainable revenue stream without compromising core sanctuaries.



Image: Shri Milan Kanti Mandal, I.F.S

Reflections and guidance for practitioners

Shri Milan Kanti Mandal’s cumulative experience underscores several practical principles for young conservationists and managers: priorities field exposure; integrate scientific methods (census techniques, habitat monitoring) with community engagement; adopt appropriate technologies (e-patrols, UAVs, GPS and social monitoring apps) as force multipliers; and maintain administrative resolve tempered by humility and stakeholder trust-building. He emphasizes that conserving the tiger in the Sundarban is synonymous with conserving an entire deltaic ecology mangrove, prey species and the socio-ecological processes that support local communities.

Conclusion

Shri Milan Kanti Mandal’s work in the Sundarban demonstrates that effective conservation in extreme and socially complex landscapes rests on integrated action: scientifically informed restoration, robust protection systems, livelihood substitution, and participatory governance. The Sundarban’s singular ecological characteristics demand bespoke management responses; his operational model centered on protection, plantation and people’s participation offers a replicable paradigm for conserving other fragile, human-linked habitats.



DIGITAL ILLITERACY IN ACCESS-BENEFIT SHARING FOR RURAL WOMEN: **Myth or Mandate**

Dr. Dipayan Dey, Director (PFRI)



Image: Communication Department (PFRI)

Access and Benefit Sharing (ABS) for women actually means ensuring women, who are often the crucial knowledge holders and conservers of biodiversity, receive fair access to nature resources including genetic diversity and as well share equitably in the monetary/non-monetary benefits of nature services from their use, a goal often hindered by gender inequality, requiring mainstreaming gender in ABS policies like the Nagoya Protocol to recognize their vital role and secure their rights. ABS Matters for Women because women traditionally hold vast knowledge of plants and ecosystems, crucial for conserving biodiversity, yet their contributions are often overlooked. Gender inequity can lead to unfair distribution of benefits, even when women are primary providers of resources and knowledge. In this regard, the digital divide is a crucial bottleneck in empowering rural women for access and benefit sharing of nature's goods and services. By focusing on women's roles and ensuring their meaningful participation, ABS systems can become truly equitable, aligning with the goals of biodiversity conservation and sustainable development, provided the digital divide is bated equitably, as well.

Digital illiteracy of women in the global south refers to significant gaps in women's access, skills, and opportunities in technology, stemming from digital exclusion and misalignment with socioeconomic factors, incubating lower literacy, lack of basic amenities and infrastructure, cultural norms, and safety concerns, leading to exclusion from economic and social benefits, but efforts focus on digital literacy training, STEM education, affordable access, and targeted programs to empower women as digital creators and leaders. The key aspects of the digital divide are identifiable in five fingertip factors, like

- **Access & Affordability:** Lower smartphone ownership, internet penetration, especially in rural areas, and cost barriers.
- **Digital Literacy & Skills:** Women often lack basic digital skills (using apps, finding info) and advanced skills (coding), hindering career growth.
- **Socio-Cultural Barriers:** Gender biases in education, stereotypes in STEM fields, and patriarchal norms limiting women's tech engagement.
- **Safety & Online Harassment:** Fear of cyberbullying, stalking, privacy breaches, and non-consensual image sharing deter internet use.
- **Economic Exclusion:** Reduced access to digital finance, e-commerce, and tech jobs, limiting economic empowerment.

Statistical enumerations and review of researches highlight the gap, further widening the urban-rural divide, since globally, women are less likely to use the internet than men, with larger gaps in low-income countries, whereas in global south, rural women have significantly lower internet access (e.g., 25% vs. 49% for men) and smartphone ownership.

Men are significantly more likely to possess advanced ICT skills like programming, which is being nourished by the same social ethos that women don't need this in their daily scores, as it once denied formal education of girls in rural global south, especially in the Asian ecoregion. This divide needs to be immediately bridged and for this a similar five-finger tips would necessarily include

- **Skills Training:** Offering digital literacy, reskilling, and STEM education.
- **Infrastructure:** Expanding affordable connectivity, especially in underserved areas.
- **Policy & Awareness:** Developing gender-specific digital inclusion strategies and promoting female role models.
- **Safety Initiatives:** Creating safer online spaces to encourage participation.
- **Challenging Stereotypes:** Encouraging girls in early education to pursue math/science and STEM fields.

By addressing these multifaceted barriers, efforts aim to ensure women can fully participate in the digital economy and society, fostering both gender equality and digital transformation.

However, there is a twist in the story. Opening gateways to the digital world for women can recoil back with a thud on the society, wherein even the urbanite women and the elite can be baffled, unless they are equipotentiality in general and digital educated. Information flow must have genuine purpose, ethical approach and unfabricated content. Simply saying that it should not be disinforming people, especially women.

Five weeks prior to declaring COVID -19 a pandemic, speaking at the Munich Security Conference on February 15, 2020 WHO Director-General Tedros Adhanom described the bigger challenge that the world was already facing. "We're not just fighting an epidemic; we're fighting an infodemic", he said about of tsunami of information that people globally were exposed to.

He implied fake news as the amalgamation of information, misinformation, disinformation, mal-information that formed a cocktail of toxicity and posed greater threat to public health and wellbeing. "Fake news spreads faster and more easily than this virus; the Corona Virus, and is just as dangerous", he pointed out. The global pandemic of fake information is spreading rapidly through social media platforms and other outlets. Be it the times of global danger such as COVID-19 or other times of lesser significance, fake information has been identified as a major cause of global unrest and worry. World leaders identify the challenge of addressing the issue and have listed its solution as a priority to safeguard sanity of the world.

In India the issue has many- fold effect. The mainstream media already terms the source of the fake spread from "Whatsapp University" implying the information is disseminated through WhatsApp without any substance, evidence or verification. Indeed, much before the COVID -19 pandemic that held the world to stand still, Indians have used false, purported, biased, innocent, faith-based, unscientific information to rule their lives. The spurt of social media in the last decade amplified its impact beyond imagination. There have been evidences of war, terrorist attacks, communal tensions, health disasters, accidents, stampedes, violence, gender-based crimes, human trafficking etc through the rapid spread of fake news in the country of 1.3 billion people. Although there are strict cyber and criminal laws that forbids creating, sharing, forwarding and editing of real information that can have adverse impact on social harmony, Indians have had little understanding towards the infodemic thus bringing little regard for law. The reason usually is found to be simple; sheer entitlement, little knowledge, inherent biases, societal inequality, little means to verify and innocent behavior.



Image: Communication Department (PERJ)

The fall out is all the more dangerous, social evils such as lynching of human beings, acid attacks, domestic violence, rape, extortion, suicide have been mainstreamed. They do not make part of the sensational news any longer, rather such news are justified with “ifs and buts”, bringing unrest and anarchy in the organized news sector. The most dangerous consequence of the widely and unabated spread of fake news in times of COVID-19 is the several remedial measures doing the rounds based on hearsay, old beliefs, dependence on quacks and mistrust among masses that pose greater threat to the spread of the disease.

Just after COVID-19 was declared a public health emergency of international concern, WHO's risk communication team launched their new information platform called WHO Information Network for Epidemics (EPI-WIN), with the aim of using a series of amplifiers to share tailored information with specific target groups. In India, the impact of fake news so huge that on March 31, 2020 the Supreme court of India asked the central government to curb fake news on corona virus and set up portal within 24 hours for real time info as it was creating panic among people. Still the pandemonium continues unabated causing more harm to the well-being of the nation than the disease itself.

Indeed, every outbreak of disease or societal disorder is accompanied by a kind of tsunami of information that intends to safeguard one's interest at the cost of others. That information is backed by selfish interest, business necessity, misinformation, rumors, etc since the middle ages. The impact now is a million times more with social media amplifying and going faster and further, like the viruses that travels with people faster and further. This is the new challenge caused by the travel time of information and that needs to be fixed by debunking fake news with correct information traveling faster to be able to mitigate the impact. The challenge is not only to make sure that people are informed; it is also about making sure if people are informed to act appropriately, much ahead of fake news reaching them.



Another recent myth is building up with similar disinformation that Bats are the real culprit of Nipah virus outbreak. People are either killing bats or stopping to buy fruits for the kids. As if all fruits are Bat-infected and can spread Nipah infection. This is the difference between precaution and panic. Its true that Bat saliva is one of the vehicles of contamination of Nipah virus but this is a myth that bats only cause it and killing bats can stop its spread. If this happens ruthlessly, there will be no chiropterophily. Now, therefore, it is important to know that Pollination by bats is called chiropterophily, derived from Chiroptera, the scientific order for bats, referring to the transfer of pollen by these nocturnal mammals, crucial for many tropical plants like bananas, mangoes, and agave. Over 500 plant species rely on bats, making them vital pollinators for ecosystems and food sources like tequila (from agave) and various fruits, whereas flowers pollinated by bats often have strong scents, produce abundant nectar, and are sturdy enough to support the bats.

To conclude, we must endorse the fact that while digital literacy is significantly important for women empowerment in Access and Benefit sharing, knowledge and awareness building remains crucial for its effective usage. This is more important because, in this digital era women's land rights and access to resources are often unsecured, despite their vital roles are being denied, since the land data is all digitized and accessible only in the digital portals that the women can't access. Policy Gaps disable ABS systems that need to be inclusive, giving women a voice in policy and benefit-sharing decisions, whereas incorporating gender considerations into all levels of ABS regimes is crucial for achieving equity.

ELDERS AS KNOWLEDGE KEEPERS: Medicinal Plant-Based Traditional Ecological Knowledge in Rural Bengal

Mr. Somnath Samanta, Research Assistant (PFRI)



Image: Somnath Samanta, Research Assistant (PFRI)

Abstract

Traditional Ecological Knowledge (TEK) plays a vital role in sustaining community health and biodiversity through intergenerational learning. This study explores the transmission of medicinal plant knowledge in Udaynarayanpur, a rural block in Howrah district, West Bengal. Elders pass down knowledge of locally used plants such as Kalmegh (*Andrographis paniculata*), Lotapata (*Clerodendrum infortunatum*), Akand (*Calotropis gigantea*), and Tulsi (*Ocimum sanctum*) through observation and oral instruction. These practices support household healthcare, promote sustainable plant use, and strengthen cultural identity. However, modernization and declining engagement with traditional practices threaten the continuity of TEK. The study highlights the need to preserve and integrate TEK to enhance ecological resilience and cultural sustainability.

Introduction

TEK is the intergenerational transmission of ecological knowledge and practices through lived experience and oral traditions, enabling communities to understand ecosystems, manage resources sustainably, and maintain reciprocal relationships with nature. Guided by elders, this knowledge preserves cultural values and ecological ethics, emphasizing cooperation with the natural world rather than its exploitation, and sustaining practices such as selective harvesting, controlled burning, silviculture, and soil–water conservation based on long-term ecological observation (*Gagnon & Berteaux, 2008*).

Case Study

Udaynarayanpur is a rural community development block in Howrah district of West Bengal, India. With agriculture as the main occupation and a strong village-based lifestyle, traditional ecological knowledge and plant-based remedies continue to play a significant role in household healthcare practices (Guchhait, 2012). The study area is part of the Udaynarayanpur block. Udaynarayanpur is a Community Development Block located in the Howrah district of West Bengal, India. It forms part of the Howrah Sadar subdivision and is primarily rural in character. Our study area located from 22°43 01' N, 22°36'54" N to 87°58'30" E, 87°58'06" E. The block covers an area of approximately 113.45 square kilometers and comprises several gram panchayats.

Context of Traditional Knowledge Transfer

In Udaynarayanpur, local elders - especially grandparents - actively pass down knowledge about medicinal plants to younger members of the community. This knowledge is shared through observation, household practice, and oral instruction rather than written documentation, making it an important example of intergenerational learning in everyday life (Sharma & Sharma, 2025).

Key Medicinal Plants in Local Use

Residents of Udaynarayanpur commonly use several medicinal plants that are easily found in home gardens, field edges, and nearby fallow lands. Informal surveys and local observations (consistent with broader ethnobotanical findings in Howrah and neighbouring districts) reveal that:

(a) Kalmegh (*Andrographis paniculata*)

Local elders teach that Kalmegh is a bitter herb used to manage fever, liver complaints, common cold, and digestive discomfort. Children learn how to identify the plant, when to harvest it (*often before flowering for maximum potency*), and how to prepare a safe dose (*usually leaf extract with warm water*). (Figure: 1)



Figure: 1 (*Andrographis paniculata*)

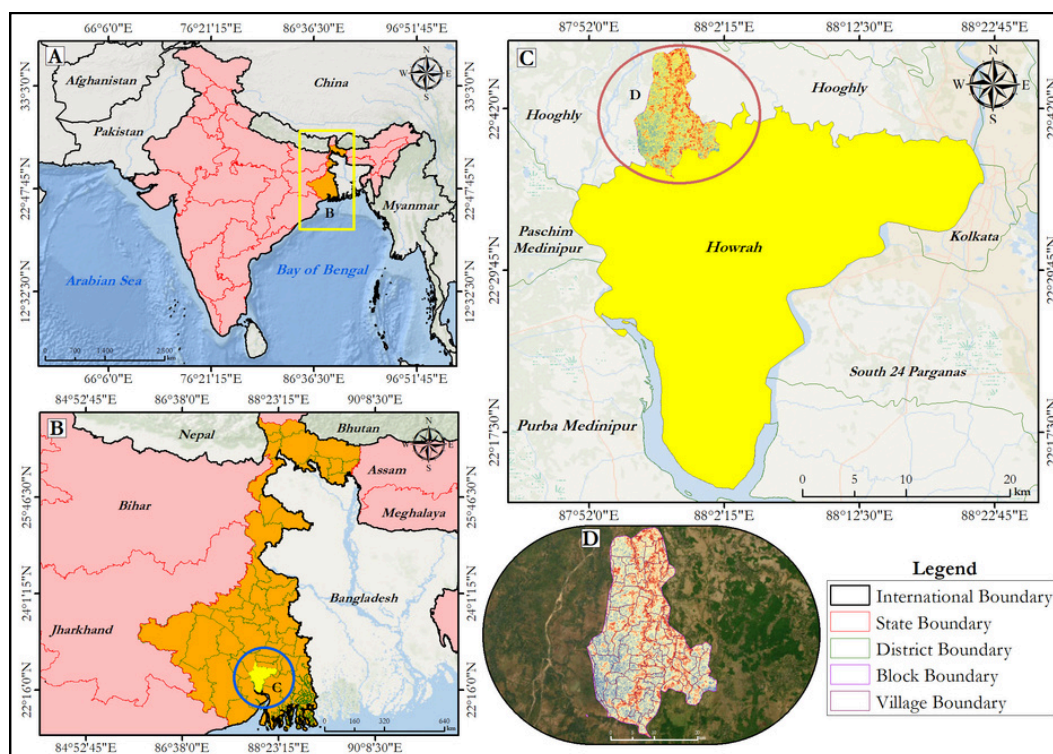


Figure: Location map of the study area.

(b) Lotapata (*Clerodendrum infortunatum*)

Known locally as Lotapata, this plant is recognized for cough relief, chest congestion, and reducing inflammation. Grandparents demonstrate how to correctly identify the leaf shape and smell, prepare a leaf paste or decoction, and caution against incorrect look-alikes that may be harmful. (Figure: 2)

(c) Milkweeds (*Calotropis gigantea*)

In rural and semi-rural areas of West Bengal, the Akand flower (*Calotropis gigantea*) forms an important part of TEK. Elders pass down knowledge of the plant's medicinal, religious, and ecological uses across generations. The Akand flower and other parts of the plant are used in folk medicine, in a limited and controlled manner, to relieve pain, treat skin conditions, and reduce inflammation. The flower is also offered during Shiva worship, linking spiritual beliefs with environmental care. (Figure: 3)

(d) Tulsi (*Ocimum sanctum*)

Tulsi holds both medicinal and cultural value in households. Children in Udaynarayanpur are taught to care for the Tulsi plant (never uprooting it), use its leaves to ease colds and sore throat symptoms, and incorporate the plant in daily routines. Tulsi's growing presence in home gardens also connects ecological stewardship with spiritual practices. (Figure: 4)



Mechanisms of Knowledge Transfer

In this community, knowledge transfer occurs in everyday interactions:

- Observation of plant growth and seasonal cycles
- Hands-on participation in harvesting and preparing remedies
- Storytelling and advice from grandparents and elders
- Reinforcing respect for nature through cultural storytelling and beliefs

These practices strengthen both ecological awareness and family bonds, ensuring that younger generations value biodiversity.

Importance and Outcomes

The intergenerational transfer of ecological knowledge in Udaynarayanpur has several benefits:

- Preservation of traditional healthcare practices that can treat common ailments safely at home
- Conservation of local plant biodiversity through sustainable harvesting and care
- Strengthened cultural identity connected with ecological knowledge
- Reduced dependence on modern medicine for minor illnesses

Challenges

Despite these strengths, knowledge transfers face challenges such as modernization, reduced time spent in nature by younger generations, and limited documentation of oral knowledge (Gagnon & Berteaux, 2008). Studies from Howrah and neighbouring Bengal districts show that traditional medicinal plant knowledge remains significant but is gradually declining without active preservation efforts (Whyte, 2017). Traditional Ecological Knowledge (TEK) represents a cumulative, place-based knowledge system that embodies long-term human–environment interactions and adaptive ecosystem management (Chaitanya et al., 2025). Its relevance is increasingly recognized in addressing environmental challenges such as climate variability, biodiversity loss, and landscape degradation in regions like West Bengal. However, processes of land commodification, infrastructural expansion, and extractive development have disrupted Indigenous and local socio-ecological systems, leading to the marginalization and erosion of TEK (Sharma & Sharma, 2025). From an ecojustice perspective, the integration of TEK into contemporary environmental governance is critical, as it reinforces ecological resilience, sustainable resource management, and the recognition of historically marginalized knowledge systems.

Conclusion

In Udaynarayanpur, the practice of passing down medicinal plant knowledge, especially with Kalmegh, Lotapata, and Tulsi, serves as a living example of how ecological understanding and cultural values are shared across generations. It highlights the importance of both community-based learning and biodiversity conservation in rural West Bengal (Konar et al., 2022).

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SCIENCE OF *Sustainability*



ROOTS:

Recognizing Ownership and Operationalizing Tribal Stewardship through Forest Rights and Indigenous Knowledge Systems in Jharkhand and Odisha

Dr. Malancha Dey, Director (PFRI)

Abstract

The Forest Rights Act (FRA) of 2006 represents a paradigm shift in India's conservation discourse, yet implementation gaps persist in recognizing Traditional Ecological Knowledge (TEK) as central to forest governance. This article explores the synthesis of TEK and legal frameworks under the Forest Rights Act (2006) within the tribal landscapes of Jharkhand and Odisha. By examining the intersection of ecological justice and inclusive conservation, the study highlights how indigenous stewardship models rooted in the socio-ecological equity of the Munda, Santhal, and Kondh tribes, offer a robust template for participatory governance. We argue that integrating ancestral wisdom with formal conservation science is essential for achieving climate resilience and sustainable forest management.

Introduction:

The Paradigm of Ecological Justice

Indigenous communities constitute approximately 26% and 23% of Jharkhand and Odisha's populations respectively, maintaining intricate relationships with forest ecosystems spanning millennia (*Ministry of Tribal Affairs, 2023*). Despite constitutional protections under the Fifth Schedule and the landmark FRA 2006, tribal communities continue experiencing systematic marginalization from forest governance (*Kashwan, 2017*).



Image: Dr. Malancha Dey, Director (PFRI)

The intersection of ecological justice and TEK offers transformative potential for reimagining conservation frameworks that honour both biodiversity preservation and human rights (*Tengö et al., 2014*). This article synthesizes empirical evidence demonstrating how operationalizing tribal knowledge systems can achieve inclusive conservation while addressing the dual crises of biodiversity loss and social inequity.

Traditional Ecological Knowledge as Scientific Practice and Foundation of Sustainable Resource Management

Phenological Indicators and Climate Adaptation

Indigenous tribes in Odisha utilize phenological cues such as the flowering of the Sal (*Shorea robusta*) tree to predict rainfall patterns and time their agricultural cycles. This approach provides high-resolution data that formal meteorological models often lack (Rath & Parija, 2021).

Sacred Groves: Micro-Refugia of Biodiversity

The Sarnas of Jharkhand and Jaheras of Odisha are community-protected sacred groves. Scientifically, these act as micro-refugia for endemic species and critical carbon sinks. The Santhal and Ho tribes enforce strict extraction taboos within these zones, effectively maintaining high-density biodiversity clusters that outperform state-managed protected areas (Das & Ront, 2023).

Sustainable Resource Management

TEK encompasses cumulative knowledge, practices, and beliefs regarding ecosystem relationships, transmitted intergenerationally through cultural transmission (Berkes, 2018). In Jharkhand's Santhal Parganas and Odisha's Mayurbhanj districts, tribal communities including Santhal, Ho, Munda, and Kondh demonstrate a sophisticated understanding of forest phenology, medicinal plant properties, and sustainable harvesting protocols (Devi et al., 2020).

Research by Mahapatra and Tewari (2005) documented over 150 non-timber forest products (NTFPs) utilized by Odisha tribes, with harvest timing calibrated to regeneration cycles, preventing resource depletion.

Comparative studies reveal TEK-based management achieves biodiversity outcomes comparable to state-protected areas while simultaneously supporting local livelihoods (Porter-Bolland et al., 2012). In Jharkhand's Saranda Forest, Ho tribal communities employ rotational harvesting of *Shorea robusta* leaves for plate-making, maintaining forest cover at 78% compared to 64% in adjacent non-community managed areas (Kumar & Nongkynrib, 2021). This empirical evidence challenges colonial-era exclusionary conservation models, demonstrating that indigenous presence does not inherently threaten forest integrity.



Image: Dr. Malancho Dey, Director (PFRI)

Forest Rights Act (FRA) 2006: Legislative Framework and Implementation Challenges

The FRA 2006 recognizes both individual and community forest rights, including critical Community Forest Resource (CFR) rights enabling autonomous governance (*Springate-Baginski et al., 2013*). However, implementation remains severely constrained. As of 2022, Jharkhand had recognized only 12% of potential CFR claims, while Odisha achieved 31%, substantially below the estimated eligible communities (*Community Forest Rights-Learning and Advocacy, 2022*). Bureaucratic resistance, incomplete awareness among tribal communities, and competing forest department jurisdictions create systemic barriers (*Lele & Menon, 2014*).

- Odisha's Institutional Progress: Odisha has demonstrated significant leadership in CFR recognition, particularly among the Kondh and Santhal communities. The state's "Mo Jungle Jami" scheme exemplifies a shift toward decentralized governance (*Sabu et al., 2024*).
- Jharkhand's Socio-Political Landscape: Despite the strong Khuntkatti (ancestral land holding) traditions among the Mundas, the implementation of FRA in Jharkhand faces hurdles due to industrial mining interests and administrative delays (*Kumar et al., 2021*).

Critically, even where rights are recognized, integration of TEK into formal management plans remains minimal. Standard forest working plans typically disregard indigenous classification systems, harvest calendars, and spiritual-ecological interconnections central to tribal stewardship (*Rai & Bava, 2013*). This epistemic exclusion undermines both conservation efficacy and tribal agency, perpetuating knowledge hierarchies that privilege Western scientific frameworks over indigenous expertise.

Participatory Governance and Community Stewardship Models

Successful participatory governance requires institutional arrangements enabling genuine power-sharing rather than mere consultation (*Agrawal & Gibson, 1999*). The Gram Sabha, constitutionally empowered as the primary decision-making body under FRA, offers institutional architecture for collaborative forest management when effectively operationalized (*Bose, 2010*). In Odisha's Nayagarh district, Gram Sabhas exercising CFR rights reduced forest fire incidence by 67% through community-designed fire management protocols integrating traditional fire-break systems with contemporary early warning mechanisms (*Vasundhara, 2018*).

Co-management frameworks that systematically incorporate TEK demonstrate enhanced adaptive capacity facing climate variability. Research in Jharkhand's Gumla district documented tribal communities' predictive knowledge regarding rainfall patterns based on indigenous phenological indicators, enabling anticipatory water resource management that reduced drought vulnerability by 43% compared to non-participatory villages (*Singh et al., 2019*). These findings underscore that indigenous knowledge systems constitute sophisticated adaptive management tools deserving formal recognition in climate resilience planning.



Image: Dr. Malanba Dey, Director (PFRI)

Socio-Ecological Equity and Justice Dimensions

Forest rights discourse fundamentally concerns distributive, procedural, and recognition justice (Schroeder *et al.*, 2008). Tribal communities in Jharkhand and Odisha experience compounded marginalization through historical dispossession, contemporary development-induced displacement, and systematic exclusion from decision-making processes affecting their territories (Guba, 2000). Operationalizing forest rights represents not merely conservation strategy but essential redress for historical injustices.

Recent scholarship demonstrates that secure tenure rights correlate strongly with improved well-being outcomes including nutritional security, educational attainment, and women's empowerment (Robinson *et al.*, 2018). In Odisha's Keonjhar district, communities with recognized CFR rights exhibited 34% higher household income, 28% improved food security, and 52% greater women's participation in village governance compared to communities without recognized rights (Oxfam India, 2020). These outcomes illustrate the inseparability of social equity and ecological sustainability.

Challenges to Inclusive Conservation

The intersection of indigenous rights and ecological justice is currently threatened by several vectors:

- **Industrial Encroachment:** The 'Mineral Belt' across Jharkhand and Odisha often sees the diversion of forest land for mining, bypassing the mandate for Free, Prior, and Informed Consent (FPIC).
- **Epistemic Injustice:** The systematic devaluation of tribal knowledge by formal forestry departments leads to a 'top-down' approach that alienates local stewards (Nayaram & Pattnaik, 2022).
- **Market Fluctuations:** Vulnerability in the NTFP supply chain often forces tribal communities into unsustainable extraction practices to meet immediate livelihood needs.

Conclusion and Recommendations

Advancing inclusive conservation in Jharkhand and Odisha requires systemic integration of tribal knowledge systems into forest governance through three critical pathways.

- First, accelerating CFR recognition with proactive identification and rights settlement, moving beyond demand-driven approaches that disadvantage marginalized communities.
- Second, developing hybrid knowledge frameworks that position TEK as co-equal with scientific forestry, requiring curriculum reforms in forest management education and revised working plan guidelines.
- Third, strengthening Gram Sabha institutional capacity through legal literacy, financial resources, and technical support while safeguarding decision-making autonomy.

The convergence of forest rights implementation and TEK recognition offers an unprecedented opportunity for transformative conservation that centers indigenous communities as primary stewards rather than peripheral stakeholders. Evidence from Jharkhand and Odisha demonstrates that when tribal knowledge systems guide resource management, both ecological and social outcomes improve. Realizing these potential demands not only incremental reforms but a fundamental reimagining of conservation paradigms toward epistemic pluralism, participatory governance, and ecological justice.

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Image: Dr. Malancho Dey, Director (PERI)

PROTECTING SOCIO-ECOLOGICAL JUSTICE: Integrating Indigenous Knowledge Systems into Conservation Policy *(Focus Area: Policy gaps in socio-ecological justice)*

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Image: Communication Department (PFRI)

Throughout the world, ecosystems described as ecologically critical, such as forests, wetlands, and grasslands are often landscapes that Indigenous Peoples and Local Communities (IPLCs) have actively managed for generations. These communities have not simply lived alongside nature, but also developed systems of land use, governance, and conservation, shaping these ecologies. Yet, mainstream environmental policies have mostly treated these systems as peripheral, and often, incompatible with modern conservation. This has resulted in a persistent gap between ecological effectiveness and social justice (Sangha, 2025).

Traditional ecological knowledge functions as a form of governance, regulating land and resource usage in significant biodiversity hotspots globally. It is grounded in prolonged familiarity with specific landscapes, built through practice rather than documentation, and maintained through social norms rather than external enforcement (Sinthumule, 2023).

These ways of managing land emerged in response to constraints such as unpredictable rainfall, fragile soils, seasonal scarcity, and long recovery periods. They are dynamic, evolving as conditions change, and guided by collective experience.

The functioning of indigenous governance systems becomes clearer when viewed through concrete examples. Maasai pastoralists in East Africa move livestock across grazing grounds in ways that prevent overuse and allow grasslands to recover. Aboriginal communities in Australia have historically used controlled burning to manage fuel loads and sustain diverse habitats. Yanomami communities in the Amazon rely on detailed knowledge of river behaviour to guide settlement and subsistence, reducing exposure to floods and resource loss. In India, the Apatani tribe of Arunachal Pradesh has long cultivated rice using a carefully maintained network of water channels that follow the natural contours of the land. The system distributes water evenly across terraces, limits erosion, and maintains soil fertility under intense monsoon conditions. In the sal forests of Chhattisgarh, Gond communities cultivate millets alongside forest species, allowing land to rest and regenerate after harvest. Santhal and Munda communities of Jharkhand practice rotational cultivation, leaving plots fallow for extended periods to restore soil health and align farming cycles with wildlife movement. In each case, ecological outcomes are shaped by long-standing social practices rather than external regulation (Coughlan *et al.*, 2023; Dhanjal & Sharma, 2024; Olekao & Sangeda, 2018; Singh, 2023).

Difficulties arise when development and conservation policies intervene without recognising these arrangements. Modern environmental policy makers often prioritise standardised solutions and technical models, using administrative control to impose uniform technologies and rigid restrictions that disrupt existing balances. For instance, in the Apatani plateau, externally introduced irrigation infrastructure altered water flows, leading to erosion and uneven distribution that local farmers had warned against. In central India, forest laws have criminalised intercropping and forest-based livelihoods that previously supported regeneration. In Jharkhand, rotational fields have been labelled as wastelands by formal land classification systems, making them vulnerable to plantations that exhaust soils and reduce resilience. Similarly, exclusionary protected areas have displaced pastoralists, suppressed indigenous fire practices, or opened customary lands to mining and commercial agriculture in several critical ecological zones globally (*Coughlan et al., 2023; Dhanjal & Sharma, 2024; Olekao & Sangeda, 2018; Singh, 2023*).

In modern policy-making, the decision-making authority is usually concentrated in distant institutions, while local knowledge is treated as anecdotal or advisory. Climate adaptation and mitigation programmes often emphasise finance and technology, while positioning IPLCs as beneficiaries rather than decision-makers. Even when indigenous practices are acknowledged, they are rarely allowed to influence policy design or determine outcomes. Although consultation with IPLCs has become increasingly important in modern policy-making, it is often procedural, offering limited influence over decisions that directly affect their livelihoods and landscapes.

This disconnect creates a structural imbalance whereby those with the deepest understanding of a landscape are expected to comply with rules designed without their holistic participation. Furthermore, indigenous women, despite their central roles in farming, seed conservation, and water management, are routinely side-lined from policy dialogues. Institutional fragmentation further worsens the problem. Responsibilities for land, forests, water, agriculture, and development are divided across agencies, while indigenous concerns cut across all of them. Moreover, legal provisions recognising local governance frequently exist theoretically but are weakly implemented, and often, overridden by competing economic priorities. Consequently, policy continues to draw ecological value from IPLC-managed landscapes without securing the institutions that sustain them.

This pattern reflects a deeper failure to treat socio-ecological justice as a foundational requirement of environmental governance rather than a secondary concern. When policies ignore customary tenure, undermine community institutions, or reduce participation to mere formality, they reproduce the very inequalities that have historically driven ecological degradation. Conservation efforts built on insecure rights and weak accountability remain fragile, prone to conflict, and difficult to sustain over time. Addressing these shortcomings requires policy frameworks that recognise shared authority and long-term stewardship. Securing collective land and resource rights, recognising indigenous institutions as legitimate governing bodies, and enabling community-led monitoring and management are central to this shift. It is also essential to stop extractive engagement with traditional knowledge, where specific practices are promoted in isolation while decision-making authority remains external.

In such cases, knowledge is treated as a technical input, separated from the social institutions, norms, and rights that enable it to function. This approach not only weakens the effectiveness of conservation interventions but also exposes communities to loss of control over how their knowledge is interpreted and applied.

Environmental governance that embeds social justice is more equitable and effective than the one that does not, because it aligns conservation objectives with the lived realities of those who have sustained ecosystems over generations. Without such alignment, policies aiming to protect landscapes will continue to be performative while eroding the social foundations that allow them to endure.



Image: Communication Department (PFRI)

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ROOTS OF RESISTANCE:

How Indigenous Wisdom Battles Climate Chaos and Corporate Greed

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Across the globe, indigenous peoples - comprising less than 5% of the world's population yet stewarding 80% of remaining biodiversity - embody the frontlines of climate resistance, their ancestral wisdom clashing against corporate plunder. In the Amazon, Yanomami guardians repel illegal gold mining that poisons rivers with mercury, preserving carbon-rich rainforests vital for global climate regulation. Australian Aboriginal fire management practices, refined over 60,000 years, mitigate megafires intensified by fossil fuel-driven warming, while Sami reindeer herders in the Arctic combat oil extraction threatening permafrost thaw. These 'roots of resistance' reveal indigenous epistemologies - holistic, relational, and adaptive - not as relics, but as dynamic strategies outpacing technocratic fixes from polluter-funded agendas.

In India, where climate vulnerabilities amplify under rapid industrialization, indigenous communities amplify this global narrative, battling corporate greed through community-led conservation amid policy flux. Sundarban fishers and honey collectors, drawing on Bhugri dialect folklore for cyclone prediction, restore mangroves against shrimp monocultures backed by agribusiness giants, safeguarding 4 million livelihoods from salinization. In Maharashtra's Western Ghats, Warli and Katkari tribes enforce sacred groves (devrais) to halt bauxite mining by multinationals, preserving agroforestry mosaics that enhance soil carbon and resilience to droughts.



Image: Communication Department (PFRI)

Bihar's Adivasi farmers in the Kosi floodplains revive millet-based systems and tanka water harvesting, resisting biofuel plantations that displace commons. These efforts underscore indigenous wisdom's role in India's Nationally Determined Contributions (NDCs), advocating for Forest Rights Act enforcement against greenwashing by extractive industries.

This paper delves into how these roots of resistance - scientifically validated through biodiversity indices and resilience metrics - challenge neoliberal paradigms, urging a paradigm shift toward decolonized climate governance that centers indigenous sovereignty.

Climate change adaptations on global perspective

Fire and Landscape Management

Strategic fire practices by indigenous groups transform destructive wildfires into regenerative tools, reducing fuel loads and enhancing biodiversity. Australian Aboriginal patch burning involves cool, low-intensity fires set in mosaic patterns during cooler seasons, which prevent megafires, promote regrowth of food plants like yams and grasses, and maintain cultural landscapes tied to Bed-time stories. In the Peruvian Amazon, ancestral fire brigades - community fire-watchers using smoke signals and river patrols - now integrate drones for real-time mapping of fire hotspots, enabling rapid containment of slash-and-burn incursions by loggers while preserving nutrient cycles in terra preta soils.

Diversified Farming and Agroecology

Agroecological systems blend crops, trees, and livestock to mimic natural ecosystems, boosting resilience against erratic weather. Mayan K'iche' in Guatemala's highlands layer maize with beans, squash, and fruit trees in milpa agroforestry, using phenological observations of constellations and insects to time plantings, which retains soil moisture, suppresses weeds, and yields diverse harvests even in prolonged dry spells (Rossetti, 2025). Sikkim's Lepcha track floral blooming and migratory birds as phenological cues to sow climate-smart finger millets and large cardamom in shifting cultivation plots, interspersing nitrogen-fixing legumes that restore terrace soils depleted by monsoonal leaching.



Image: Communication Department (PFR)

Water and Seed Resilience

Holistic water harvesting and seed sovereignty ensure food security amid hydrological shifts, drawing on linguistic and ecological memory. Nagaland's Angami Naga employ Zabo - a gravity-fed system channeling rainwater from hill catchments into forest-fed ponds for fish, then irrigating paddy fields and livestock troughs - filtering sediments naturally and providing buffer stocks during deficits. Canadian Inuit maintain community seed banks in permafrost-inspired cold caches for qinuq (Arctic berries) and heritage grains, paralleling Sundarbans models where fisherfolk curate salt-tolerant amur varieties and mangrove propagules in raised bunds, reviving flood-adapted agrobiodiversity lost to industrial shrimp farming.

Climate change adaptations on Indian perspective

Indigenous strategies, honed over millennia, leverage biophysical cues like wind patterns, animal behaviors, and soil moisture alongside agrobiodiversity to deliver adaptation superior to monocultures, achieving 20-50% greater yield stability under climate stress through diversified, low-input systems that enhance soil health and genetic resilience.

Coastal Deltas

In the Sundarban and Odisha deltas, communities cultivate 54 indigenous rice landraces tolerant to 9 mS/cm salinity and cyclones (Aich & Dey, 2022), reviving lost germplasm via community seed banks that boosted post-cyclone resilience by 40% in pilot projects by enabling farmer-led seed selection and exchange. Koraput's Paraja tribes deploy floating gardens (dhiman) - bamboo rafts with nutrient-rich silt and vegetables like ash gourd - that yield 2-3 tons/ha amid annual floods, transforming inundation into productive assets while preserving soil microbes.

Arid Zones

Rajasthan and Gujarat's Bhil and Rabari pastoralists harvest rainwater in khadins - earthen check dams creating fertile wetlands - and maintain millet banks of bajra and jowar with 30-40% higher drought tolerance, slashing crop failure by 35% through opportune sowing guided by peacock calls and thunder. Gujarat's Bhungroo innovates solar desalination pipes channeling underground freshwater to irrigate 5-10 ha per farmer (*Santra et al., 2021*), hybridizing TEK with tech to reclaim salinized coasts from shrimp farms.

Himalayas

Ladakh and Uttarakhand's Changpa nomads integrate seabuckthorn agroforestry hedges (*Sanwal et al., 2018*) that fix 10-15 tons CO₂/ha/year, bind slopes against erosion, and stabilize glacial lakes prone to outburst floods while providing vitamin-rich berries. Bhotia highlanders monitor glacial lake outburst risks via TEK indicators like ice crack echoes and boulder shifts, enabling timely evacuations and puga rituals that reinforce community vigilance.

Northeast Forests

Arunachal and Meghalaya's Adi wet-rice terraces with bamboo sluices retain 20-30% more soil moisture (*Blackburn, 2008*), preventing landslides in steep slopes amid intensified monsoons. Khasi sacred groves (law kyntang) conserve 200+ medicinal species as microclimate buffers (*Laskar, 2024*), absorbing 15-25% of temperature rises through canopy shade and humidity. Apatani's integrated fish-rice paddies in Ziro valley yield 4-5 tons/ha of protein-rich food via paddy-stocked with snow trout, recycling nutrients in a closed-loop system.

Policy Alignment

These practices advance Kunming-Montreal Global Biodiversity Framework Targets 10 (genetic diversity protection) and 13 (indigenous leadership), exemplified by PM JANMAN's scaling of Particularly Vulnerable Tribal Group (PVTG) models through community reserves and seed systems for national climate resilience

Resistance to Extractives

Indigenous communities worldwide have orchestrated fierce, organized resistance against extractive industries, securing landmark victories that safeguard ecosystems and affirm territorial sovereignty. These triumphs - through courts, referendums, and blockades - expose corporate greed's vulnerabilities, blending legal strategy with cultural resurgence to halt deforestation, pollution, and land grabs.

Territorial Defense

In Ecuador's Amazon, Waorani hunters and gatherers halted oil auctions across 500,000 acres (200,000 ha) via a 2019 Provincial Court ruling (*Wiebe, 2021*), invalidating the government's sham 2012 'consultation' that violated free, prior, and informed consent (FPIC) under ILO Convention 169. Led by Nemonte Nenquimo of CONCONAWEP, their lawsuit set precedent for 16 oil blocks spanning 7 million acres, blocking auctions and inspiring allied nations despite government appeals. In Colombia, U'wa people expelled Occidental Petroleum after a 1997-2001 campaign of spiritual blockades, hunger strikes, and international pressure, forcing the firm to abandon a \$1 billion Andes-30 oil project threatening sacred watersheds; today, U'wa territories remain fossil-free, preserving jaguar habitats.

Referendums and Blockades

Guatemala's Maya Q'eqchi' rejected Fenix nickel mines in 2009 with a 98% referendum vote in Barrio La Laguna, despite death-squat violence by Hudbay Minerals contractors; community patrols and global solidarity compelled Guatemala's Constitutional Court to suspend operations in 2011, protecting Lake Izabal's fisheries. Ecuador's 2023 Yasuní referendum saw 59% of voters (5.5 million ballots) endorse closing oil wells in Yasuní-ITT, halting Petroecuador's extraction in 200,000 ha of biodiversity hotspot home to uncontacted Waorani, slashing projected emissions by 247 million tons CO₂-equivalent through 2030s (*Lehnen, 2024*).

Sundarbans Parallels

Villagers in the Sundarbans leverage gram sansads - village-level assemblies under West Bengal's Panchayati Raj system - to resist biotic pressures such as illegal overfishing, poisoning by 'company mahajans,' and shrimp farming mafias that have encroached on traditional lands. These committees, empowered through frameworks like the Forest Rights Act (FRA) 2006, organize community patrolling of sensitive habitats, including horseshoe crab spawning grounds along Odisha-adjacent coasts, where seasonal bans and awareness efforts have helped stabilize declining populations amid threats from destructive fishing.

India's Indigenous Shields: Battling Climate Crisis and Extractive Onslaught

In the scorched sands of Rajasthan's Thar Desert, Bhil women shift through ancient seed banks, reviving millet varieties that endure 45°C heatwaves and erratic monsoons, while in Chhattisgarh's dense sal forests, Gond Adivasis blockade coal trucks to protect sacred groves from mining scars (*Borde, 2017*).

Across India's vulnerable frontiers - from Himalayan glaciers to coastal deltas - over 104 million Indigenous peoples, constituting 8.6% of the population, confront compounded threats: climate extremes like 20-30% rainfall variability and 1-2 mm annual sea-level rise, alongside extractive industries ravaging 25% of their territories. These communities, stewards of 15% of global forest cover, fuse traditional ecological knowledge (TEK) with resilient advocacy, offering scalable models for national survival.

Synthesizing Roots of Resistance

Indigenous wisdom emerges not merely as survival tactics but as sophisticated blueprints for planetary resilience, outperforming industrialized paradigms in biodiversity stewardship, emissions reduction, and adaptive capacity. Comprising less than 5% of humanity yet safeguarding 80% of terrestrial biodiversity, these communities demonstrate through fire mosaics, seed banks, and sacred groves that relational ecologies - grounded in reciprocity - yield 20-50% superior stability against climate shocks compared to monocultures.

Global victories like Waorani court triumphs and Yasuní referendums, paralleled by Sundarbans gram sansads enforcing FRA claims, mandate embedding free prior informed consent (FPIC) in NDCs and Kunming-Montreal Targets 10/13. India's PM JANMAN scaling PVTG models exemplifies this shift, integrating TEK metrics - biodiversity indices, carbon sequestration via seabuckthorn (10-15 tCO₂/ha) - into policy for equitable governance.

Decolonized climate action demands amplifying indigenous sovereignty: funding community reserves over corporate offsets, enforcing Panchayat Extension to Scheduled Areas (PESA) against bauxite grabs, and hybridizing drones with ancestral fire brigades. These roots of resistance - scientifically validated, culturally potent - chart the urgent paradigm shift from plunder to partnership, ensuring ecosystems and equity endure.



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BRIDGING CUSTOMARY AND CODISED LAW: **The Efficacy and Limitations of Community Protocols in Access and Benefit-Sharing Regimes**

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Image: Communication Department (PFRI)

Abstract

This article examines the role of Biocultural Community Protocols (BCPs) as pivotal instruments within Access and Benefit-Sharing (ABS) frameworks, designed to operationalize Indigenous and local community rights. While BCPs are theorized as “translation tools” between customary law and state/international systems, empirical evidence reveals a significant implementation gap.

Through case studies from India, Peru, and Madagascar, this analysis demonstrates that BCPs' effectiveness in ensuring ecological justice and preventing biopiracy is contingent upon genuine community ownership, robust legal recognition, and the circumvention of structural power asymmetries. While BCPs hold transformative potential, they are currently insufficient alone to guarantee equitable ABS outcomes.

Introduction

The Nagoya Protocol to the Convention on Biological Diversity (CBD) establishes the global Access and Benefit-Sharing (ABS) framework, which aims to ensure that genetic resources and associated traditional knowledge (TK) are accessed with Prior Informed Consent (PIC) and that resulting benefits are shared fairly and equitably. A persistent critique, however, is that ABS frameworks have yielded only “patchy effectiveness” in curbing biopiracy, with monetary benefits often exaggerated and unrealized (*Pratbapan et al., 2018; Wynberg, 2023*). A central challenge is the integration of Indigenous customary laws, which are dynamic, oral, and context-specific, into rigid statutory ABS processes. In response, the Biocultural Community Protocol (BCP), a community-developed document that articulates customary laws, governance structures, and terms for engagement with external users, have emerged as an instrument to articulate customary norms and conditions for access and benefit-sharing (*Halewood et al., 2021*).

BCPs as Bridging Mechanisms

BCPs are formalized documents wherein communities codify their biocultural heritage, customary laws, and procedures for engaging with external actors. Their primary function is bridging: they translate community-based governance into a legible form for state authorities, researchers, and corporations (Jonas et al., 2010). The Nagoya Protocol explicitly encourages such protocols, requiring parties to “take into consideration” Indigenous customary law and community protocols (Article 12) (Robinson & Forsyth, 2016). Theoretically, BCPs operationalize legal pluralism, embedding Indigenous authority within ABS transactions and moving beyond token recognition towards enforceable rights (Arjumend, 2018).

Case Studies in Efficacy and Transformation

The Potato Park, Peru: Biocultural Territorial Governance

The Parque de la Papa (Potato Park) in Cuzco is a paradigmatic example of a BCP underpinning a biocultural territory. The protocol enabled six Quechua communities to collectively govern over 1,362 native potato varieties, facilitating the repatriation of hundreds of landraces from the International Potato Center (Angé, 2018; Graddy, 2013). Ecological benefits are profound: the protocol sustains in-situ agrobiodiversity conservation, integrates landscape management rooted in Andean cosmovisión, and enhances climate resilience through adaptive cultivation of diverse varieties (Sayre et al., 2017). Here, the BCP functions as a governance blueprint, linking ecological integrity directly to community-defined rules and sacred values, rather than narrow ABS commodification.

The Raika of Rajasthan, India: Asserting Stewardship and Rights

The Raika pastoralists of Rajasthan developed a BCP to assert their role as creators and guardians of livestock breeds like the Marwari camel. The protocol documents their sustainable grazing practices and frames pastoralism as conservation, directly countering state narratives of degradation (Köhler-Rollefson & Rathore, 2021). Strategically, the Raika used this codified stance to claim grazing rights within restricted wildlife sanctuaries like Kumbhalgarh and to position themselves as legitimate rights-holders in national and CBD forums. This case illustrates BCPs as political tools for legitimizing customary land and resource use within contested legal landscapes.

The Kani–Jeevani Case, India: A Cautionary Tale of Flawed ABS

Contrasting with the above, the oft-cited Kani–Jeevani benefit-sharing agreement in Kerala exemplifies the failure of ABS in the absence of a robust, community-led protocol. The deal, centered on the drug Jeevani developed from Kani TK, was negotiated ex-post without genuine PIC or clear community representation (Anuradha, 2000; Schüklenk & Kleinsmidt, 2006). Benefits were framed as charitable compensation rather than enforceable rights, leading to internal disputes and minimal, poorly governed monetary flows (Sagrelins, 2012). The case underscores that without a protocol to assert authority and conditions ex-ante, communities remain vulnerable to top-down, inequitable arrangements.



Persistent Challenges and Structural Limitations

Despite promising cases, widespread implementation faces significant hurdles:

Top-Down Development and Co-optation

BCP processes are often externally driven by NGOs or donors aligned with project timelines, which can distort objectives toward narrow ABS compliance rather than holistic biocultural values (*Rakotondrabe & Girard, 2021; Parks, 2018*). In Madagascar, BCPs were sometimes reduced to ABS project components, underplaying sacred protocols and customary law, the very “biocultural” core they are meant to protect (*Rakotondrabe & Girard, 2021*).

Weak Legal Recognition and Enforceability

A critical barrier is the minimal legal weight granted to BCPs by states. The Nagoya Protocol’s language-“take into consideration... as appropriate” grants states wide discretion, often allowing domestic law to override customary norms (*Arjument & Koutouki, 2020*). Consequently, BCPs frequently remain “soft law” tools with limited enforceability against non-compliant corporations or state agencies.

Internal Community Heterogeneity

The assumption of a monolithic “community” is problematic. Differences in power, gender, age, and interpretation of custom can lead to elite capture of BCP processes, skewing benefits and undermining internal legitimacy (*Girard et al., 2022*). Effective bridging requires inclusive, lengthy facilitation, a resource-intensive endeavor rarely sustained by short-term funding (*Girard et al., 2022*).

The Digital Biopiracy Loophole

Emerging challenges like Digital Sequence Information (DSI) exacerbate BCP limitations. Cases from India and Namibia show companies bypassing physical resource ABS obligations through digital genomic data “digital biopiracy”, a domain where most BCPs and national laws offer little protection (*Vincent, 2024; Bond & Scott, 2020*).

Towards Meaningful Ecological Justice

The evidence suggests BCPs are necessary but insufficient for achieving ecological justice in ABS. They provide a vital platform for communities to articulate sovereignty and conditions, as seen in Peru and Rajasthan. However, their transformative potential is mediated by political will and structural inequities. For BCPs to move from symbolic to substantive, three shifts are critical:

- **Legal Hardening:** Domestic ABS legislation must formally recognize and enforce community protocols as binding components of PIC and MAT (Mutually Agreed Terms).
- **Process Integrity:** BCP development must be community-led, adequately resourced, and focused on comprehensive biocultural rights, not just ABS transactions.
- **Systemic Integration:** BCP principles must be embedded in broader data governance, including DSI, through mechanisms like the CARE (Collective Benefit, Authority to Control, Responsibility, Ethics) principles for Indigenous data (*Carroll et al., 2020*).

Conclusion

BCPs represent a significant innovation for translating Indigenous wisdom and customary law into the realm of biodiversity governance. They can enhance agency, document stewardship, and provide a foundation for more equitable negotiations. Yet, as the case studies reveal, their ability to secure ecological justice is consistently undermined by power asymmetries, weak enforcement, and co-optation. Therefore, while BCPs are a promising tool within the “Sacred Earth” paradigm, their success is inextricably linked to broader struggles for Indigenous land rights, data sovereignty, and the fundamental redesign of ABS systems towards simplicity, enforceability, and equity (*Laird et al., 2020*). Without this, the risk remains that BCPs merely document biocultural heritage without securing the authority to protect it.

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Image: Communication Department (PERI)

SACRED EARTH, SHARED STEWARDSHIP:

Women Leaders in Indigenous Biodiversity Conservation

Ms. Anolita Singho, Communication Officer (PFRI)

Across Indigenous and local communities, women have long been central to the daily work of conserving biodiversity. Their leadership does not typically appear through formal titles or official institutions, but through sustained responsibility for land, water, forests, and living species. Women regulate access to common resources, maintain seed diversity, restore degraded ecosystems, and respond to ecological change through practices shaped by long-term engagement with specific landscapes. These roles are closely tied to food security, water management, and household economies, placing women at the heart of ecological governance. Yet, despite this centrality, their leadership remains largely informal and continues to be marginalized within dominant conservation and policy frameworks.

Evidence from diverse ecological contexts suggests that biodiversity conservation is most effective when knowledge, authority, and accountability remain embedded within everyday governance practices. Women's leadership often operates through customary norms, collective decision-making, and practical regulation of shared resources rather than through externally imposed conservation structures. The cases below illustrate how such leadership shapes conservation outcomes across forest, agricultural, and coastal ecosystems.

Community Forest Protection and Regeneration

In the Nayagarh district of Odisha, women-led forest protection groups have been instrumental in reversing forest degradation. Organized through village collectives, women undertake regular patrols, regulate extraction, and enforce locally negotiated rules. These practices rely on social accountability and shared norms rather than state enforcement. Over time, sustained stewardship has resulted in visible forest regeneration and strengthened community control over forest resources, eventually contributing to the recognition of Community Forest Resource rights under India's Forest Rights Act (*Agarwal, 2009*).

Comparable forms of governance are evident beyond South Asia. In the Itombwe Mountains of the Democratic Republic of Congo, Indigenous women have mobilized reforestation efforts on customary lands affected by conflict and resource pressure. Drawing on traditional ecological knowledge, women guide species selection and planting practices suited to local ecological conditions. These initiatives not only restore ecologically significant landscapes but also reinforce long-term stewardship grounded in customary authority rather than external conservation mandates (*Sinthumule, 2023*).

Seed Stewardship and Agrobiodiversity Conservation

Women's leadership is particularly visible in the conservation of agrobiodiversity, where seed selection, preservation, and exchange are critical to ecological resilience. In the Andean highlands of Bolivia, Quechua women have led initiatives that combine the restoration of native *Polylepis* forests with the maintenance of diverse crop varieties adapted to high-altitude environments. Rather than separating conservation from livelihood concerns, these practices integrate forest regeneration with food systems, ensuring that biodiversity conservation strengthens local subsistence and cultural continuity (Wynberg & Laird, 2022).

Similar patterns emerge in climate-vulnerable regions of eastern India. In the Sundarban, women farmers and forest users draw on detailed knowledge of salinity, soil conditions, and seasonal variability to conserve seeds and adapt cropping strategies. Their practices support both biodiversity and food security in a landscape shaped by environmental uncertainty and livelihood risk, demonstrating how ecological knowledge embedded in everyday practice contributes to adaptive conservation (Singh, 2023).



Image: Communication Department (PERI)

Coastal and Fisheries Governance

In coastal ecosystems, women's leadership often becomes visible where resources are under pressure and formal governance is weak. In small-scale fisheries in Mexico, women fishers have taken on roles in monitoring, rule-setting, and enforcement, challenging assumptions that fisheries governance is inherently male-dominated. Their involvement has strengthened compliance and improved stewardship, particularly in contexts where state regulation is limited or ineffective (Agarwal, 2009).

Parallel dynamics can be observed in India's mangrove and delta regions. In the Sundarban, women participate in mangrove protection, fisheries-related decision-making, and resource monitoring. These activities support ecosystem recovery in a fragile environment while reinforcing collective responsibility for shared resources. Here, women's leadership directly links ecological protection with the social systems that sustain it.

Institutional Constraints and Governance Gaps

Despite clear evidence of their contributions, women's leadership in biodiversity conservation remains structurally constrained. Conservation policies frequently frame women as participants or beneficiaries rather than as decision-makers with authority over ecological governance. Formal institutions often prioritize technical expertise and centralized management, sidelining customary systems through which women exercise leadership.

Even within participatory conservation models, women's involvement is often limited to representation without substantive decision-making power. This disconnect undermines conservation outcomes by weakening the social legitimacy and accountability that underpin effective stewardship. Across regions, research indicates that biodiversity governance is more resilient when women's authority is recognized within community institutions, rather than appended to externally designed conservation frameworks (Sinthumule, 2023; Wynberg & Laird, 2022).

Ecological Governance and Enduring Stewardship

Women's leadership in biodiversity conservation points to a broader insight central to ecological justice: conservation is ultimately a question of governance. It depends not only on ecological interventions, but on who holds authority, whose knowledge informs decisions, and which relationships with land and resources are sustained over time.

Across forests, farms, and coasts, women's leadership has consistently aligned biodiversity protection with livelihood security, cultural continuity, and long-term stewardship. Recognizing this leadership requires moving beyond symbolic inclusion toward institutional arrangements that respect customary governance and collective rights. Within the framework of Sacred Earth: Indigenous Wisdom and Ecological Justice, women's leadership affirms that ecological sustainability and social equity are not parallel objectives, but interdependent foundations of enduring conservation.

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VOX POPULI



ICONOGRAPHIES OF PRECARITY: Mangrove Art and the Ethics of Survival in a Cyclonic Delta

Mr. Rajib Das, Research Assistant (PFRI)

In the Sundarban of South 24 Parganas in West Bengal, India, art does not imitate nature. Instead, it negotiates with it. Among mangrove creeks and silted embankments, patachitra, the traditional scroll painting of Bengal, emerges as a living ecological text. These scrolls are unfurled not merely for aesthetic contemplation but for survival. In this amphibious delta, where land and water perpetually renegotiate their boundaries, patachitra functions as a mnemonic device through which communities remember how to live with uncertainty, risk, and restraint.

The patachitra of Sundarban differs markedly from its inland counterparts. These scrolls elongate like tidal rivers, their frames fluid rather than rigid, echoing the unstable geomorphology of the delta. Mangroves dominate the visual field, painted with exaggerated, interlacing roots that clutch the earth in silent resistance. These roots are not artistic excess but ecological commentary. They speak of sediment accretion, shoreline stabilisation, and the unseen labour by which mangroves dissipate cyclonic energy. Boats glide narrow and unembellished through sinuous channels, reflecting hydrodynamic adaptation to shallow and unpredictable waters. Tigers appear neither monstrous nor benign. They occupy liminal spaces as guardians of ecological thresholds rather than mere predators.

At the centre of many scrolls stands the figure of Banabibi, anchoring art, belief, and ecology within a single ethical framework. She is often painted at the edge of the forest, one hand raised in protection, the other in restraint. These visual narratives are traditionally animated through performance, as the patua sings while gradually unrolling the scroll. The song invokes Banabibi not as distant divinity but as an arbiter of balance. A widely sung verse continues to resonate across forest villages:

“জয় বনবিবি
জয়,
দুখে সুখে রাখো
লয়।
জঙ্গলে যাই দয়া
ক’রে,
প্রাণ বাঁচাও মা
দয়া ধরে।”

*(Victory to
Bonbibi, victory
be yours;
In sorrow and in
joy, hold us close.
As we enter the
forest with folded
hands,
Protect our lives,
O Mother of
mercy.)*



Image: Communication Department (PFRI)



Image: Communication Department (CFRI)

The scroll and the song function together as a pedagogical system. They instruct without didacticism, embedding ecological caution within rhythm, colour, and narrative. To overharvest is to invite calamity; to disrespect the forest is to transgress a moral order older than formal law. From a scientific perspective, patachitra operates as an informal mechanism of environmental governance. It shapes risk perception, regulates access to forest resources, and mediates human–wildlife coexistence within one of the world’s most hazardous ecosystems.

What characterizes the patachitra of the Sundarban is its temporal depth. Each scroll becomes an archive of cumulative observation, bearing witness to cyclones survived, embankments breached, and tides misjudged. Climate change has intensified its relevance. As sea level rise, salinity intrusion, and erosion accelerate, contemporary scrolls quietly absorb these transformations. Images of broken homes, shrinking islands, and migrating livelihoods increasingly find place within the painted narrative. Art thus becomes both witness and warning.

In the Sundarban, conservation is not proclaimed; it is performed. Patachitra does not articulate sustainability as policy; it preserves it as memory. Where scientific models quantify resilience, these painted tides sustain its cultural grammar. To read a scroll is to understand that survival here is neither conquest nor control, but an art of listening to the roots beneath the mud and to a delta that endures by remembering its limits.

TRADITIONAL CONSERVATION PRACTICES AND SACRED NATURAL SITES:

A General View Supporting the Indian Context

Mr. Sujay Bhattacharjee, Research Assistant (PFRI)

Introduction:

Traditional conservation practices are indigenous and community-based methods developed over generations to sustainably manage natural resources. These practices are deeply embedded in local cultures, belief systems, and customary laws. Among them, sacred natural sites (SNSs), such as sacred groves, sacred forests, rivers, hills, and water bodies play a crucial role in biodiversity conservation and ecological balance (*Singh & Rana, 2016*).

Sacred natural sites are areas of land or water having special spiritual significance to communities. These sites are protected through religious beliefs, taboos, and customary restrictions rather than formal legal mechanisms. Human interference, such as tree felling, hunting, or resource extraction, is often strictly prohibited, ensuring long-term ecological protection.

Traditional Conservation Practices:

Traditional societies employ several conservation practices, including:

- **Protection through taboos and rituals:** Cultural restrictions prevent overexploitation of resources.
- **Seasonal resource use:** Harvesting is regulated according to ecological cycles.
- **Community-managed landscapes:** Collective responsibility ensures sustainable use.
- **Sacred species protection:** Certain plants and animals are revered and not harmed.

These practices contribute to maintaining soil fertility, water availability, and habitat stability.

Sacred Natural Sites in India:

India is home to over 990 Protected Conservation Areas (PCAs), including 106 national parks, 564 wildlife sanctuaries, 99 conservation reserves, and 218 community reserves. Certain plants and animals are traditionally worshipped and protected. Trees like Peepal, Banyan, Neem, and Tulsi, and animals such as cows, snakes, and certain birds, are considered sacred, contributing to species conservation.

Cultural conservation areas also exist, especially within Hindu communities (*Wadhwa, 2023*). Some examples of sacred natural sites are given below:

- **Sacred Groves of the Western Ghats:** Found in Kerala, Karnataka, Tamil Nadu, and Maharashtra; these groves are protected by local communities due to religious beliefs.
- **Devari/Devarakadu (Maharashtra & Karnataka):** Community-protected forest patches dedicated to local deities. These sites preserve native flora and fauna and play a vital role in groundwater recharge.
- **Law Kyntang and Law Lyngdoh (Meghalaya) :** Sacred forests protected by Khasi and Jaintia tribes.
- **Orans of Rajasthan:** Sacred forests maintained by the Bishnoi and other desert communities.
- **Sarna Sacred Groves (Jharkhand, Chhattisgarh, Odisha)**
- **Pushkar Lake (Rajasthan):** A sacred water body protected due to religious significance.

Sacred Natural Sites in the World:

Some sacred natural sites around the world are affiliated with UNESCO. Examples include:

- **Kaya Forests (Kenya):** Sacred forests of the Mijikenda people, protected through customary laws and rituals.
- **Osun–Osogbo Sacred Grove (Nigeria):** A World Heritage Site preserved for religious beliefs and cultural traditions.
- **Crater Lake (Oregon, USA):** A site preserved through Indigenous American history and the traditions of the Klamath people.

Ecological Significance:

Sacred natural sites often serve as:

- Biodiversity hotspots, conserving rare, endemic, and medicinal species.
- Gene banks, preserving native flora and fauna.
- Climate regulators, supporting carbon sequestration and microclimatic balance.
- Watershed protectors, ensuring groundwater recharge and streamflow.

Many sacred groves represent the last remnants of primary forests in heavily modified landscapes.

Cultural and Social Importance:

Beyond ecological functions, sacred natural sites reinforce:

- Cultural identity and spiritual values
- Indigenous knowledge systems
- Social cohesion and community governance
- Intergenerational transmission of environmental ethics

Threats to Sacred Natural Sites:

Despite their importance, sacred natural sites face increasing threats such as urbanization and infrastructure development, decline of traditional belief systems, commercial exploitation of resources, and weak integration with formal conservation policies.

Conflicts in Sacred Natural Sites:

Sacred natural sites, such as groves, mountains, and rivers are conserved by Indigenous communities. However, these communities face conflicts arising from development pressures, resource extraction, religious shifts, and conservation policies. Conflicts mainly stem from economic interests and modern governance systems. Common threats include mining, tourism, privatization, urbanization, and encroachment by other faith groups (*Ossai, 2025*).

For example, mining operations threaten sites such as Oak Flat in Arizona; the Q'eqchi' Maya territories at Semuc Champey in Guatemala; and sacred landscapes in Nigeria's Igboland and Ghana affected by religious expansion (*Roba, 2021*).

In India, several recent events highlight these challenges. In Shivamogga, Karnataka, environmentalists and heritage activists have objected to the Sharavathi pumped storage project, citing potential damage to ecological balance and sacred cultural sites. Memoranda were submitted demanding comprehensive impact assessments and protection for culturally significant landscapes (*TOI, 2025*). In Jharkhand, Adivasi groups formed human chains and symbolic protests against construction projects encroaching on sacred groves, framing their resistance as a defense of cultural survival (*Minji, 2025*).

The Aravalli controversy further underscores this issue. The Aravalli hills host numerous sacred groves, including 89 identified natural and hill-deity sites linked with rituals and traditions. These sites have traditionally been protected by local communities, but recent Supreme Court verdicts have raised concerns over weakened protections.

Role in Modern Conservation:

Integrating traditional conservation practices with scientific management can enhance sustainable development. Recognizing sacred natural sites within formal conservation frameworks and empowering local communities are essential for long-term environmental sustainability.

Why This Is Important for Conservation:

These conflicts highlight that conservation is not only scientific or ecological - it is also about justice, identity, and rights. Protecting sacred places often means defending Indigenous knowledge systems and long-standing relationships with nature against extractive pressures.



Image: Communication Department (PFRI)

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EMPOWERING WOMEN THROUGH FINANCE: Strengthening Biodiversity Conservation Outcomes

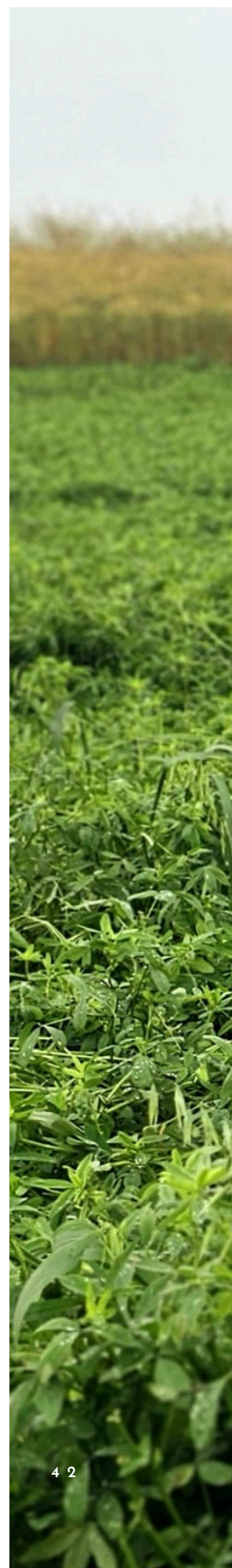
Mrs. Arpita Chakraborty, Finance Officer (PFRI)

The role of women in safeguarding nature and biodiversity is deeply rooted in their responsibilities. Women's leadership is increasingly recognized as a critical driver of effective biodiversity conservation. Across communities, particularly in rural and Indigenous contexts, women are often the primary custodians of land, forests, seeds, and water systems. They are positioned as crucial players in conservation and possess a distinct ecological perspective, thanks to their daily interactions with natural resources. But only when financial institutions provide women access, opportunities, and decision-making authority can they reach their full potential as leaders. Putting money at the centre of the conversation shows how financial inclusion directly improves biodiversity results while also strengthening gender equality.

Financial inclusion-access to affordable financial services, including credit, savings, insurance, and payments-transforms women's ability to lead and engage significantly in conservation efforts. Traditionally, women have faced systemic obstacles such as the lack of collateral, restricted land ownership, and exclusion from official banking systems. These obstacles limit their capacity to engage in sustainable practices or assume leadership positions in conservation initiatives. When women have access to financial resources, they are better able to adopt biodiversity-friendly technologies, broaden their livelihoods, and influence local natural resource governance.

Credit and microfinance organizations have been essential in assisting women to establish environmentally sustainable businesses. Women benefiting from microloans frequently invest in pursuits like organic agriculture, medicinal herb farming, beekeeping, and sustainable crafts, all of which aid in biodiversity conservation while providing financial returns. Access to funding allows women to engage in and lead community-oriented conservation groups, as financial autonomy enhances their influence in decision-making processes. Research from different areas indicates that when women possess financial independence, environmental impacts, like enhanced forest regeneration and decreased overharvesting, generally get better.

Green finance and climate funds offer further avenues for advancing women-led environmental action. Through gender-responsive climate financing, conservation initiatives spearheaded by women, such as community forest management, mangrove restoration, and nature-based tourism, can receive targeted support. Directing financial resources to women's groups enables governments and development agencies to enhance the reach and impact of local female-led environmental stewardship initiatives. Savings groups and cooperatives also serve as powerful mechanisms for empowerment. Women's savings and loan groups provide not only financial security but also a foundation for collective action. By pooling resources, these groups support biodiversity projects, invest in nature-based enterprises, and strengthen women's leadership skills. Over time, such networks often gain influence within community governance, enabling women to advocate for sustainable resource management and equitable benefit-sharing.





Payment for Ecosystem Services (PES) schemes and biodiversity credits offer emerging financial mechanisms that can further empower women. Ensuring women's direct participation and benefits from these schemes strengthens their role as protectors of forests, watersheds, and wildlife habitats. When women receive financial incentives for conserving ecosystems, they gain both economic security and greater authority in household and community decisions.

Ultimately, advancing women's leadership in biodiversity conservation demands that gender equality be embedded within financial systems, environmental policies, and climate finance frameworks. Expanding women's access to financial resources unlocks their potential as innovators, decision-makers, and stewards of the environment. Financial inclusion thus becomes more than an economic strategy-it is a critical pathway for strengthening biodiversity conservation and achieving sustainable development.

THREADS OF EARTH AND SKY: Folk Art as Guardians of the Green

Ms. Shreya Ghosh, Admin Officer (PFRI)

In the sun-dappled lanes of Raghurajpur, Odisha, where every mud wall blooms with murals of deities and beasts, young Aruna Chitrakar dipped her brush into a pot of lampblack. At thirteen, she had already etched her first Pattachitra, a scroll of Lord Jagannath's tales on cloths primed with tamarind paste, chalk, and gum. The village, declared Odisha's first heritage crafts village in 2000, after INTACH's meticulous study, pulsed with this ancient rhythm. Pattachitra, born around the 5th century BC from the Chitrakar clan's devotion to Puri's Jagannath cult, filled every home-turned-studio. No single soul "introduced" it; elders whispered it flowed from temple rituals, evolving through family lineages where styles varied like monsoon clouds, bold lines from one house, delicate fills from the next.

Aruna's grandmother, Maa Sita, recounted the rise of Raghurajpur's fame over evening pakhala. Once a quiet hamlet amid coconut groves, 15 km from Puri, it drew the world in the late 20th century. Travelers sought its scrolls depicting Krishna's rasleela, Ram's exile, or Bali Yatra fairs myths unfurled in vivid vignettes. National awards and global galleries amplified its call; by 2026, tourists thronged its two streets, buying framed miniatures adapted from yard-long pats. Yet fame's root lay deeper: oral traditions. Chitrakars chanted palm-leaf engravings and Gotipua dance verses, embedding Jagannath's lore into children's bones. Colors came from earth itself: red from laterite stones, yellow from haritala ore, blue from indigo skies, green from mango leaves, white from conch shells. Even today, though poster paints tempt for speed, masters like Aruna's kin shun synthetics, grinding naturals to honor the soil.



Image: Communication Department (PFRI)

One dusk, as cyclones brewed fiercer from warming Bay of Bengal mangroves, Maa Sita unrolled a sacred pat: the Thia Badha style, where Krishna tames the serpent Kaliya in the Yamuna. 'See how the river bends, child? It teaches santulan balance. Pollute it, and Kaliya rises.' Aruna listened, the story's moral seeping in: nature as divine kin, not conquest. Raghurajpur's art wove spiritual ecologies: forests as Vishnu's cradle, rivers as Ganga's veins. Scrolls warned of Kalki's final avatar, purging earth's abuse, mirroring oral epics sung during Chhau masks or Dangia dances. These weren't mere tales; they were covenants. Families invoked Mahaprasad blessings before paints, fasting for pure motifs, their craft a vrata to earth's bounty.

Beyond the village, threats loomed. Plastic choked Chilika Lake; shrimp farms devoured wetlands sacred to Lakshmi. Aruna, now 22, saw elders' fears manifest: migratory birds thinned, like strokes fading on old pats. Inspired by a fading mural of Varuna devouring forests, she rallied the Chitrakars. "Our brushes must fight," she declared at the annual patachitra mela. They revived Kalighat influences once borrowed from Bengal pilgrims crafting new scrolls: one showed Jagannath astride a tiger amid shrinking mangroves, captioned in Odia script with forgotten panchali verses: "Cut the green vein, bleed the god's heart."

Word spread via oral chains. Gotipua boys, acrobats-in-training, performed pat-inspired dances at Puri's beaches, chanting stewardship hymns. Palm-leaf gurus etched warnings: "He who fells the sacred grove invites Indra's wrath." Spiritual ecologies bound it jaladevata rituals where paints from river clays honored water spirits. Aruna's innovation: eco-Pattachitra workshops. Visitors learned grinding kumkum from tulsi roots while hearing tales of Bali kings who planted for monsoons. Sales funded mangrove saplings; each scroll bore a QR code linking myths to conservation science cyclone-resilient coasts echoing Krishna's calm.

Raghurajpur's metamorphosis rippled outward. In Bhadrak's betel farms, farmers etched palm engravings of Yamuna cleansings, reviving go-char rotations. Bhil tribes in nearby forests adopted motifs, their warli-like lines merging with pattachitra curves for anti-deforestation murals. Oral traditions amplified: bards wove pat stories into paika ballads, sung at gram sabhas. Spiritual ecology peaked during Rath Yatra 2025, when Chitrakars paraded a mega-scroll 10 meters of Ganga's descent pledging zero-plastic vows. Authorities noted: bird counts rebounded 20%; betel yields stabilized sans chemicals.

Yet challenges persisted. Youth lured by cities diluted lineages; synthetic lures tempted. Aruna countered with collectives, training 50 apprentices in natural pigments, blending Thia Badha's flat fills with modern frames. A pivotal pat depicted Prithvi earth goddess shackled by smokestacks, her plea in verse: "My children unchain with root and reed." Exhibited in Delhi's 2026 heritage expo, it sparked policy: Odisha's folk art grants tied to green pledges.

As monsoons broke gently that year, Aruna stood amid replanted groves, brush in hand. Raghurajpur's art proved folk forms as living sentinels visual prayers, sung lore, sacred bonds steering humanity from ruin. Pattachitra wasn't decoration; it was dharma in dye, oral wisdom etched eternal, spiritual ecologies where deities dwelled in dirt and dew. In this weave, Odisha's greens thrived, a testament: when art guards the wild, the wild returns the grace.



Image: Dr. Malanika Devi, Director, (PFR)

NEWS

Hamlet



GEODESIC SAUCER-BALL MARKETS: Outwitting Geopolitics with Local Resilience

Dr. Dipayan Dey, Director (PFRI)

With the complete collapse of the Global Plastic Treaty, its now time to withdraw our dependency on the geopolitical black-magic, awaiting global uncanny climate negotiations and build a local geodesic economic paradigm or the ‘Saucer-Ball Market Model’, which is actually a geodesic dome-design approach in building a local resilient economic framework for sustainability and inclusive growth. I talked about this model in detail in my book ‘Sustainable and Traditional Environmental Conservation in Asia’ (<https://lnkd.in/d8FKXEiK>). For sure, this paradigm building would need the knowledge of the ‘Science of Indigenous Sustainability’.

Geodesic markets can be so powerful that they would outwit rapacious 21st-century business tycoons by virtually downsizing of the market with locally-led environmental and societal governance. These markets will be operating on a network topology almost identical to the geodesic dome structures and remain self-sustainable even in the greatest global recession. These new geodesic markets would enable the consecration of large concentrations of financial information and consumer data by spiralling and folding, which are currently used as commodities and as well adaptively integrate both natural and physical goods and services as capital into fractally smaller and smaller bits, micro-intermediating it all institutionally, like an instantaneous transnational (trans-community) market led by local traders. We would be cheering these new markets, as they’re not going to make us so damned about money heist. This market will operate, finally, under the control of local economics, instead of the confiscatory ‘policies’ of aristocrats or nation-states.

Nation-states will eventually be as ceremonial as modern-day constitutional monarchs. Like the way physics and philosophy got out from under theology at the end of the mediaeval dark ages, and the church was denied as a vehicle of revelation, economics too will no longer be the handmaiden of geopolitics in a geodesic market.



Image: Ms. Anshu Singha, Communication Department (PFRI)

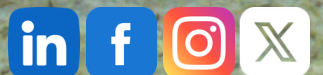


Image: Shri Milan Kanti Mandal, I.F.S



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