# Environment & Climate in Odisha: Living on the Front Line

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B sector-primer Environment

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> "*Tribal and forest-dependent communities protect about a third of Odisha's forest estate. The people the state has historically treated as the problem are, in fact, among its most effective conservation infrastructure.*" — Y. Giri Rao, Executive Director, Vasundhara

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In Kodalpalli village in Nayagarh district, women have patrolled their forest every day for forty years. In Kalahandi's Jamguda, 75 households have been collecting mahua, siali leaves, mushrooms, tubers, and bamboo from the same forest for generations — maintaining it, in the process, more effectively than the Forest Department managed it during the decades of formal control. In Bhitarkanika, coastal communities who live inside the mangrove ecosystem have co-existed with saltwater crocodiles and fishing cycles for centuries in a way that external conservation managers, arriving with management plans written in Bhubaneswar, consistently fail to replicate.

Odisha's environmental story is a story about knowledge — about who has it, who gets to use it, and what happens when the people with the deepest ecological knowledge of a place are simultaneously treated as the people most dangerous to it.

The state sits in an extraordinary geographic position. The Chilika Lake — Asia's largest brackish-water lagoon, a Ramsar Convention site and a UNESCO heritage zone — supports 150,000 fishers and harbours one of South Asia's most diverse wetland

ecosystems. Bhitarkanika, the second-largest mangrove ecosystem in India, is a nesting ground for four species of marine turtle and hosts populations of saltwater crocodiles and Irrawaddy dolphins. The Eastern Ghats — running through Koraput, Rayagada, Kandhamal, and Gajapati — are one of India's biodiversity hotspots, home to endemic species and vast community-managed forest areas. Odisha's forest cover is 33% of its land area — among India's highest.

And yet this natural wealth is under severe and accelerating pressure. Mining, industrial development, aquaculture expansion, unsustainable fishing, and the intensifying impacts of climate change — more frequent cyclones, erratic monsoons, coastal flooding, and forest fire — are transforming ecosystems faster than any conservation programme is restoring them.

This Primer examines what the evidence says about environmental conservation in complex social-ecological systems like Odisha's, what the most effective civil society organisations in this space actually do, and where the opportunities for NGO intervention are highest.

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# Part One: The Environmental Landscape — Assets, Pressures, and Who Bears the Cost

## Chilika Lake: Asia's Largest Brackish Lagoon

Chilika stretches across the districts of Puri, Khordha, and Ganjam — a brackish-water ecosystem of approximately 1,100 square kilometres that is India's first Ramsar Convention site (1981) and a wintering ground for over a million migratory birds annually. It supports 150,000 fishing households directly and millions more through the food supply chain.

For thirty years, Chilika was in ecological crisis. Declining salinity from freshwater sediment inflow, explosive growth of invasive water hyacinth, illegal aquaculture gherries (enclosures that blocked water circulation and destroyed seagrass beds), and

over-fishing had collapsed fishery productivity dramatically by the 1990s. The Chilika Development Authority, established in 1992, reversed this through a combination of ecological interventions — channel excavation, de-weeding, removal of over 152 square kilometres of illegal gherries — combined with community-based fishery management.

The recovery is documented and significant. Bird populations, fish diversity, and Irrawaddy dolphin numbers have all increased since the CDA's establishment. Olive Ridley sea turtles, designated a vulnerable species, resumed daytime nesting on Odisha beaches in 2020 for the first time since 2013. The Chilika story is one of India's genuine environmental success stories — and its central mechanism was the combination of government institutional commitment and community engagement, not either alone.

What it did not fully solve: the livelihoods of the 150,000 fishing households whose access to the lake is constantly threatened by competing interests — commercial fishing, tourism, aquaculture, and the conservation measures themselves. A 2024 analysis of Chilika's sustainable tourism and governance model found that fishing communities have been forced to engage in dolphin-based tourism and juvenile fish-catching as coping mechanisms when conservation restrictions constrain their primary livelihood. Conservation that does not integrate livelihoods produces resentment, and resentment produces poaching.

## Bhitarkanika: Mangroves, Crocodiles, and Coastal Livelihoods

Bhitarkanika in Kendrapara district is the second-largest mangrove ecosystem in India. It provides storm surge protection for coastal villages in one of India's most cyclone-exposed coastlines; carbon sequestration at significant scale; and nursery grounds for the marine species that support coastal fisheries across Odisha and beyond.

The mangroves are under pressure from shrimp aquaculture, timber extraction, and industrial development. Between climate change impacts — rising sea levels,

increased cyclone intensity, salinity intrusion — and economic development pressures, Bhitarkanika faces a trajectory of degradation without sustained conservation intervention.

Community-based mangrove conservation — involving fishing communities in planting, monitoring, and protecting mangrove areas — has produced documented restoration outcomes in Bhitarkanika and at Chilika's outer channel. The World Bank–supported coastal resilience programme found that when communities led their own biodiversity interventions including mangrove planting and conservation, and when alternative income sources (coir rope-making, eco-tourism) reduced dependence on extractive activities, both mangrove restoration and community livelihoods improved simultaneously.

## The Eastern Ghats: Forest, Biodiversity, and Community Rights

The Eastern Ghats forest system — spanning Odisha's southern and western districts — is the last significant forest landscape of the peninsula. It contains habitats for tigers, elephants, leopards, and countless endemic species. It is also the landscape in which Odisha's tribal communities have lived, farmed, collected, and conserved for generations.

As the previous Primer on Social Justice documents in detail, tribal communities protect roughly a third of Odisha's forest estate through community-based institutions — thengapalli patrols, customary harvesting rules, sacred grove protection. The formal conservation system — national parks, wildlife sanctuaries, tiger reserves — has historically treated these communities as threats to conservation rather than as its most effective practitioners.

The evidence on this is unambiguous. Communities that hold legally recognised tenure rights over their forests — through the Forest Rights Act — both conserve those forests more effectively and manage them more sustainably than the Forest

Department manages equivalent areas under centralised control. The Kalahandi Gram Sabha Mahasangha's community forest management, which generated ₹15 crore in kendu leaf revenues in 2023–24 while maintaining forest cover, is a documented example of what community tenure produces when supported adequately.

## Climate Vulnerability: Odisha on the Front Line

Odisha is among India's most climate-vulnerable states. The combination of a long, low-lying coastline exposed to Bay of Bengal cyclones; a densely settled flood plain in the Mahanadi delta; extreme weather-dependent agriculture in tribal districts with low irrigation coverage; and a tribal population whose livelihoods are directly tied to forests, rivers, and coastal ecosystems creates a multi-dimensional climate risk.

Cyclone Fani in 2019 — the most powerful cyclone to hit India in twenty years — killed 89 people in Odisha (dramatically fewer than equivalent-strength historical cyclones, owing to Odisha's now-internationally-regarded disaster preparedness system) but caused massive ecological damage. The cyclone-proof mangroves that protected Bhitarkanika communities were shredded. Agricultural seasons were disrupted across coastal districts. The OSDMA model, while effective at saving lives, does not yet have equivalent capacity for ecosystem recovery or climate adaptation at the community level.

In tribal districts, climate change is disrupting traditional agricultural calendars and forest product availability. The millets that have been staple food and climate-resilient crops for tribal communities for centuries are sensitive to timing disruptions in monsoon onset. Mahua — one of the most important NTFP species for tribal livelihoods and nutrition — flowers at a season that is shifting with warming temperatures. Spring fires, which communities traditionally used to manage forest undergrowth, are becoming more destructive as drier conditions extend the fire season.

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# Part Two: What the Global Evidence Says

## Community-Based Natural Resource Management: What Works

The global evidence on community-based natural resource management (CBNRM) is among the most robust in conservation science. Across Africa, Latin America, and South Asia, the pattern is consistent: communities with legally recognised rights over natural resources and institutional capacity to exercise those rights conserve those resources more sustainably than either pure government management or pure open access.

A landmark meta-analysis of 130 studies found that community forests across the tropics had significantly lower deforestation rates than government-managed forests — while also producing higher livelihoods outcomes for community members. The mechanism is straightforward: communities with rights have both the authority to exclude outsiders and the incentive to conserve for their own long-term benefit.

The conditions for CBNRM to succeed are well-documented: clearly defined resource boundaries; rules of access and exclusion that community members understand and enforce; proportional sanctions for rule violations; low-cost dispute resolution mechanisms; recognised rights to organise; and some degree of institutional nesting with larger governance systems. The design principles, developed by Nobel laureate Elinor Ostrom, have been empirically validated across hundreds of cases.

For Odisha, the Forest Rights Act provides the legal foundation. What communities additionally need is: the institutional capacity to exercise CFR governance (gram sabha training, record-keeping, boundary demarcation); market access for sustainably harvested forest products; and the protection of their rights from encroachment — by mining companies, the Forest Department, or commercial interests — that requires legal support and advocacy.

## Nature-Based Solutions: The Evidence for Mangroves

The evidence on mangroves as storm surge protection is among the most quantified in nature-based solutions research. Studies across Southeast Asia, India, and Bangladesh consistently show that mangrove belts of sufficient width and health reduce coastal flooding from cyclones and storm surges significantly — equivalent to expensive engineered seawalls in many contexts, at a fraction of the cost and with co-benefits for fisheries, carbon storage, and biodiversity.

A key finding relevant to Odisha: mangrove restoration that involves local communities in planting and monitoring has dramatically higher survival rates than restoration undertaken by external contractors. Community-planted mangroves that people protect because they understand the benefits to their own fisheries and coastline survive. Contractor-planted mangroves that no one has a stake in maintaining frequently do not.

## Climate Adaptation: Agricultural Resilience

The evidence on climate-resilient agriculture in rain-fed tropical systems — the context for most of Odisha's tribal agriculture — points consistently toward diversification, reduced external input dependence, and strengthening of traditional ecological knowledge as the foundations of resilience. Monoculture farming is more productive in optimal conditions and more catastrophically vulnerable to climate disruption than diversified, traditional farming systems.

For Odisha's tribal communities, this means that the agricultural approaches they have historically practised — millet-based polycultures, forest-integrated farming, traditional seed conservation — are, with targeted support, the most climate-resilient option available. This is not nostalgia for a pre-modern past. It is an evidence-based assessment of which farming systems survive increasingly erratic monsoons, extended dry spells, and the disruption of traditional seasonal calendars.

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# Part Three: Five Organisations Doing This Exceptionally Well

## 1. Vasundhara (Odisha)

Vasundhara deserves dual mention — having appeared in the Social Justice Primer for their FRA work — because their community conservation work is inseparable from their rights work. They understand that you cannot conserve a forest sustainably without the community that lives in it having legal rights over it. Their support for 12,000 villages across 15 districts in FRA claims has simultaneously secured livelihoods and produced conservation outcomes.

The Kodalpalli thengapalli example is illustrative: forty years of community-led forest patrolling, formalised and strengthened by CFR title recognition. The legal recognition did not create conservation — it protected it.

**Transferable lesson:** Rights and conservation are the same work in Odisha's forest landscape. An NGO that frames its work as either conservation or livelihoods has not understood the evidence.

## 2. Chilika Development Authority Community Partnership Model

The CDA is a government agency, not an NGO — but its community engagement model over thirty years is one of the most documented environmental governance case studies in India. Their work engaging local fishers as dolphin conservation watchers, bird monitors, and turtle protection volunteers; their co-management approach to illegal gherrie removal; and their integration of community hall construction and livelihood infrastructure into conservation programming — all represent the evidence-based practice of conservation with, not against, communities.

**Transferable lesson:** Environmental NGOs that model themselves on the CDA's approach — treating fishing communities as co-managers rather than threats — produce better conservation outcomes and more sustainable community relationships

than those that treat conservation and livelihoods as competing priorities.

## 3. ATREE (Ashoka Trust for Research in Ecology and the Environment)

ATREE works across India on biodiversity conservation, ecosystem services, and the rights of forest-dependent communities. Their research and practice in the Eastern Ghats region is directly relevant to Odisha — they have documented the conservation value of community forest management in comparable forest landscapes and produced the evidence that conservation science needs to advocate effectively for community tenure rights.

Their approach to community-based biodiversity monitoring — training community members as citizen scientists to document forest health, wildlife sightings, and ecosystem change — produces locally relevant data that formal monitoring systems miss, while building community awareness and stewardship.

**Transferable lesson:** Citizen science — training community members to monitor their own ecosystems — is both a conservation intervention and a legal empowerment tool. Communities with documented evidence of their forest's biodiversity have stronger grounds for resisting diversion for mining or development.

## 4. IUCN — Natural Resource Management Approaches

IUCN's frameworks for community conserved areas (CCAs) — territories and areas where indigenous and local communities self-initiate and manage conservation — have been applied globally in contexts directly comparable to Odisha's tribal forest landscape. Their documentation of CCAs across India, including in tribal Odisha, provides both the conceptual framework and the practical case studies for what community-led conservation can achieve.

The sacred grove systems of Odisha's tribal communities — areas protected because of spiritual significance, maintained for generations before any formal conservation system existed — are among the most biodiverse patches in Odisha's landscape and

among the most threatened, as traditional belief systems weaken and formal protection does not fill the gap.

**Transferable lesson:** Sacred groves are both conservation and cultural heritage assets. NGOs that help communities formalise protection for sacred grove areas — potentially through CFR recognition — are protecting biodiversity while also strengthening cultural identity.

### 5. Practical Action (South Asia)

Practical Action works on climate adaptation with marginalised communities — specifically on practical, community-level technological and agricultural solutions that strengthen resilience without requiring communities to abandon their existing livelihoods and land use patterns.

Their work on climate-smart agriculture — seed banks, drought-tolerant crop varieties, rainwater harvesting, integrated pest management — is directly applicable to Odisha's rain-fed tribal agriculture. Their model of working with existing community knowledge rather than replacing it with external technical packages is the evidence-based approach.

**Transferable lesson:** Climate adaptation is not about getting communities to adopt external technologies. It is about supporting communities to strengthen the resilience that already exists in their traditional systems, while adding specific technical support in areas where traditional systems face genuinely novel challenges (altered rainfall patterns, new pest species, market integration pressures).

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## Part Four: The Odisha Adaptation

### What Transfers Directly

**Community forest management with CFR rights** is already embedded in Odisha's legal and policy landscape through the FRA and Mo Jungle Jami Yojana. The global CBNRM evidence and the Odisha-specific experience from Kalahandi and Nayagarh

align: communities with rights conserve better. The NGO role is in rights facilitation, governance capacity building, and market linkage for sustainable forest products.

**Community-led mangrove restoration** — the model demonstrated at Chilika and Bhitarkanika where community engagement produced better survival rates than contractor-planted restoration — transfers directly. The social infrastructure (fishing community organisations, women's SHGs) exists; the ecological need is acute; the technical knowledge for coastal restoration is available.

**Citizen science and biodiversity monitoring** — training community members to document ecosystem health — transfers directly in forest-adjacent tribal communities where ecological knowledge is deep and the motivation to document and protect is strong, particularly where documentation serves as evidence for CFR claims or conservation advocacy.

## What Requires Significant Adaptation

**Climate adaptation messaging** for tribal communities whose traditional agricultural knowledge is already sophisticated requires adaptation from the standard agricultural extension approach. Telling a farmer who has managed a traditional millet polyculture for three generations about "climate-smart agriculture" without engaging their existing knowledge will produce resistance, not adoption. Effective climate adaptation support starts from community knowledge and adds targeted technical support where it is genuinely missing.

**Eco-tourism as a livelihood alternative** for coastal and forest-adjacent communities requires extremely careful design. The evidence on eco-tourism as a conservation finance mechanism is mixed — many community eco-tourism projects produce income for intermediaries (tourist operators, lodges) while delivering little benefit to the communities they nominally serve. Designs that keep tourism revenue within the community, with community members as guides, service providers, and decision-makers over visitor numbers and rules, are the ones with positive evidence.

### What Must Be Built

**An early warning and community-level climate adaptation system** for Odisha's most vulnerable tribal communities — specifically, a system that translates district-level climate forecasts into block and village-level advisories that can inform agricultural decisions, forest product harvesting timing, and disaster preparedness — does not yet exist in a functional form. Odisha has world-class cyclone early warning; it does not have equivalent agricultural climate advisory for tribal farming systems.

**Systematic documentation of traditional ecological knowledge** — the accumulated knowledge about species, seasonal patterns, ecological relationships, and natural hazard indicators held within tribal communities — is disappearing with elder generations and has not been systematically recorded. This knowledge is both conservation-relevant (it contains information about baseline ecological conditions that scientific monitoring lacks) and culturally irreplaceable. NGOs with ethnobotanical and anthropological capacity can play a specific role here.

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## Part Five: Government Scheme Mapping

**Forest Rights Act 2006 / Mo Jungle Jami Yojana (Odisha):** CFR recognition — the foundational legal mechanism for community forest conservation. NGO role: claims facilitation, gram sabha capacity building (see Social Justice Primer for full detail).

**Compensatory Afforestation Fund (CAMPA):** Funds forest restoration activities. NGO role: advocate for community-led restoration using CAMPA funds; monitor contractor-planted restoration quality.

**National WASH and Jal Jeevan Mission:** Water security is environmental security — groundwater depletion and watershed degradation in tribal districts directly affect water availability. NGO role: community-level watershed conservation linkage; groundwater recharge monitoring.

**Odisha Disaster Risk Management Authority (OSDMA):** Disaster preparedness programming. NGO role: community-level climate awareness and local early warning system support; post-disaster ecosystem recovery advocacy.

**MGNREGS with Natural Resource Management Convergence:** MGNREGS can fund water harvesting, plantation, land development, and soil conservation works. In PESA areas, gram sabhas control worksite selection. NGO role: ensuring MGNREGS natural resource management works are community-designed and ecologically sound.

**National Mission for Green India:** Afforestation and forest quality improvement. NGO role: supporting community participation in planning and implementation; monitoring ecological outcomes.

**Odisha Millet Mission:** While primarily agricultural, millets are inherently environmental — drought-tolerant, low water-demanding, soil-building. NGO role: linking millet promotion to climate resilience framing.

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# Part Six: Further Reading

**Community Conservation:**

- *Community Forest Rights and Governance: Evidence from Odisha* — Vasundhara / Rights and Resources Initiative: Documents the potential and challenges of CFR implementation in Odisha with field evidence.
- *Governing the Commons* — Elinor Ostrom (1990): The foundational text on community-based natural resource management. The design principles remain the most empirically validated framework for community conservation governance.

**Chilika and Coastal Systems:**

- *Sustainable Tourism, Livelihood and Coastal Governance: Chilika Lake* — ScienceDirect (2024): The most current analysis of livelihood and conservation tensions in Chilika's governance.

- *Nature Offers Solutions to Climate Risks* — World Bank / ReliefWeb (2021): Documents community-led mangrove conservation and livelihood diversification in Odisha's coastal communities.

**Climate Adaptation:**

- *Climate-Smart Agriculture for Food Security* — FAO: Comprehensive evidence base on climate-resilient agricultural practices in smallholder rain-fed systems comparable to Odisha's tribal agriculture.

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## A Final Note: Conservation and Justice Are the Same Work

Odisha's environmental crisis and its social justice crisis are not separate problems. The communities most exposed to environmental degradation — tribal forest-dwellers, coastal fishing families, rain-fed smallholders — are also the communities with the least political power to shape the decisions that drive that degradation.

Mining proceeds because tribal communities cannot stop it. Mangroves are cleared because fishing communities are not recognised as rights-holders. Forests degrade because communities are treated as encroachers rather than stewards.

The evidence from Odisha and globally is consistent: when communities have legally recognised rights and the institutional capacity to exercise those rights, they conserve their environments more effectively than any external agency. The most important environmental work that NGOs can do in Odisha is not planting trees. It is securing rights, building institutional capacity, and ensuring that the communities who know this land best have the authority and the legal protection to manage it.

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**Related Knowledge Commons:**

- Practice Note: Community Forest Rights — From Title to Conservation
- Practice Note: Mangrove Restoration — Community-Led Models
- Practice Note: Climate-Resilient Agriculture for Tribal Farmers
- Org Spotlight: Vasundhara — Conservation as Rights Work
- Org Spotlight: Chilika Development Authority — Co-Management Model
- Sector Primer: Social Justice & Tribal Welfare (Sector 03) — FRA and community rights
- Sector Primer: Agriculture & Markets (Sector 09) — Millets and ecological farming

**Schemes Referenced:** FRA 2006 · Mo Jungle Jami Yojana · CAMPA · Jal Jeevan Mission · OSDMA · MGNREGS · National Mission for Green India · Odisha Millet Mission

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