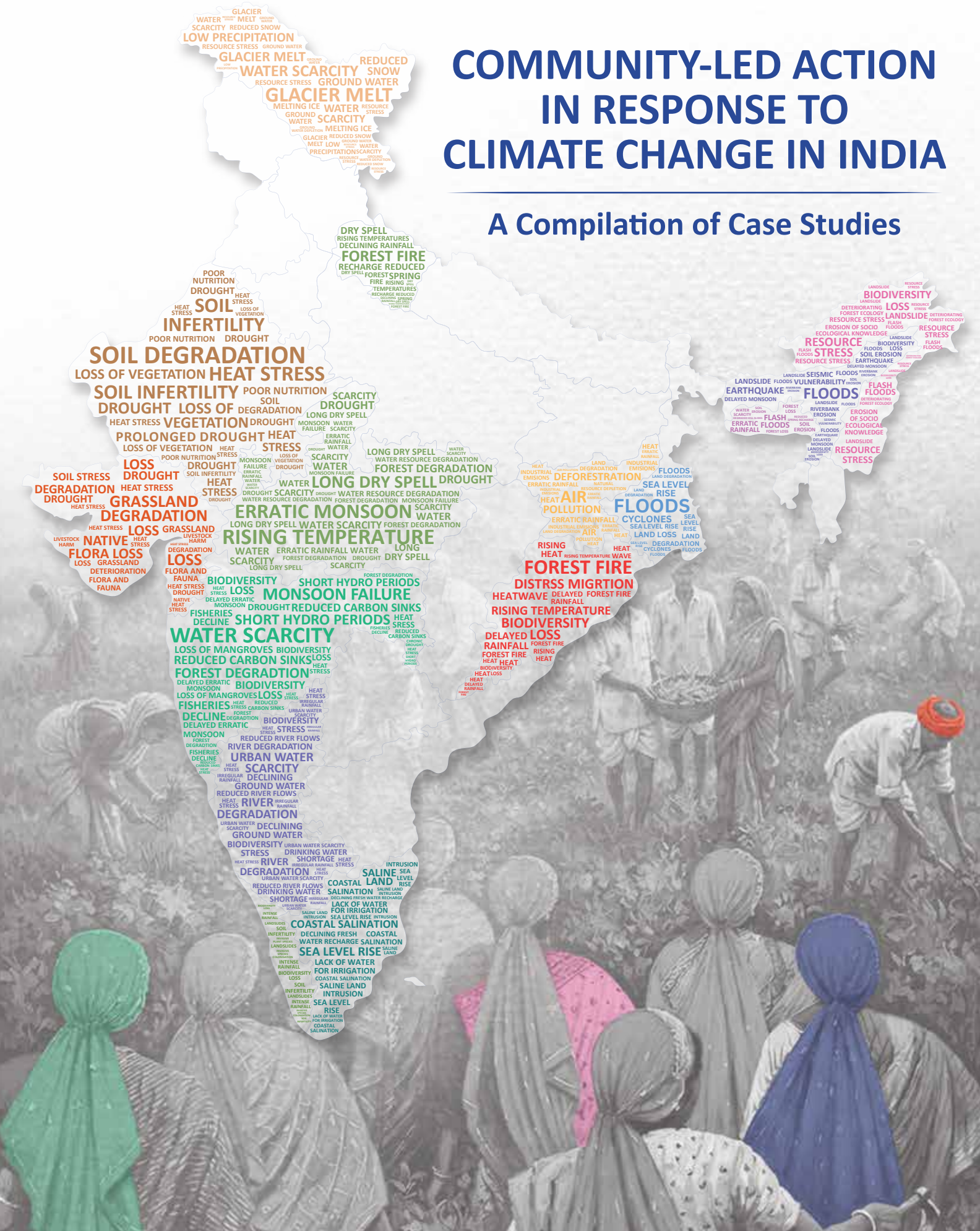


## A Compilation of Case Studies



## INDEX

- Context Note .....1
- Case study Index table .....3
- Climate challenge/  
Community-led action Map .....4
- Case studies .....5
- Synthesis Note .....45



## CONTEXT NOTE

### Locating Climate Action within Community Histories and Collective Futures

Across different parts of India—whether in grasslands, deltas, cities, or forest villages—communities have experienced climate change as a part of their daily lives, not as something far away or abstract. Climate change today is no longer an abstract future threat. It is deeply felt in the daily rhythms of disrupted farming cycles, drying springs, failing monsoons, intensifying heatwaves, and shrinking forests. While scientific models attempt to quantify these impacts, more emphasis needs to go towards capturing the lived experience of those on the frontlines of ecological distress.

This compilation of case studies seeks to centre those experiences by foregrounding stories of communities who are not just victims of climate adversity but active agents shaping adaptive and regenerative futures.

### Understanding ‘Community’ in a Climate Context

It is important here to pause and clarify our understanding of a foundational concept: the term “community”. In our approach here, a “community” refers to a group of people—formally or informally organized—who share a common geography and a lived history of environmental risks and climate-induced disruptions. These can range from cohesive tribal groups to amorphous regional collectives.

This fluidity in what constitutes a community also reveals the diverse social fabrics within which climate action takes place. The responses documented in these case studies range from the tightly coordinated networks of tribal women to distributed, inter-generational efforts. What unites them is not the form of organisation, but a shared commitment to reclaim, protect, and sustain the ecosystems that sustain them.

In many instances, this shared commitment emerged not through a planned articulation of “climate resilience” but through the slow, place-based struggle for dignity, survival, and justice. These struggle-led actions have taken the form of robust buffers against the very climate threats, now recognised in scientific discourse.

### Who leads, and what makes it Community-Led?

One of the central questions guiding our curation was: what constitutes a truly community-led initiative? We understand that many efforts begin with the involvement of an external catalyst—a researcher, a civil society actor, or a concerned citizen collective. However, we do not define the presence of an external trigger as evidence of a top-down initiative. What distinguishes community-led action, in our view, is the process that follows: whether the idea is debated, reshaped, and fully owned by the people it is meant to serve and implemented in a sustained manner and over a period also inspiring others to join in. What mattered was whether the community shaped the initiative’s design, execution, and evolution.

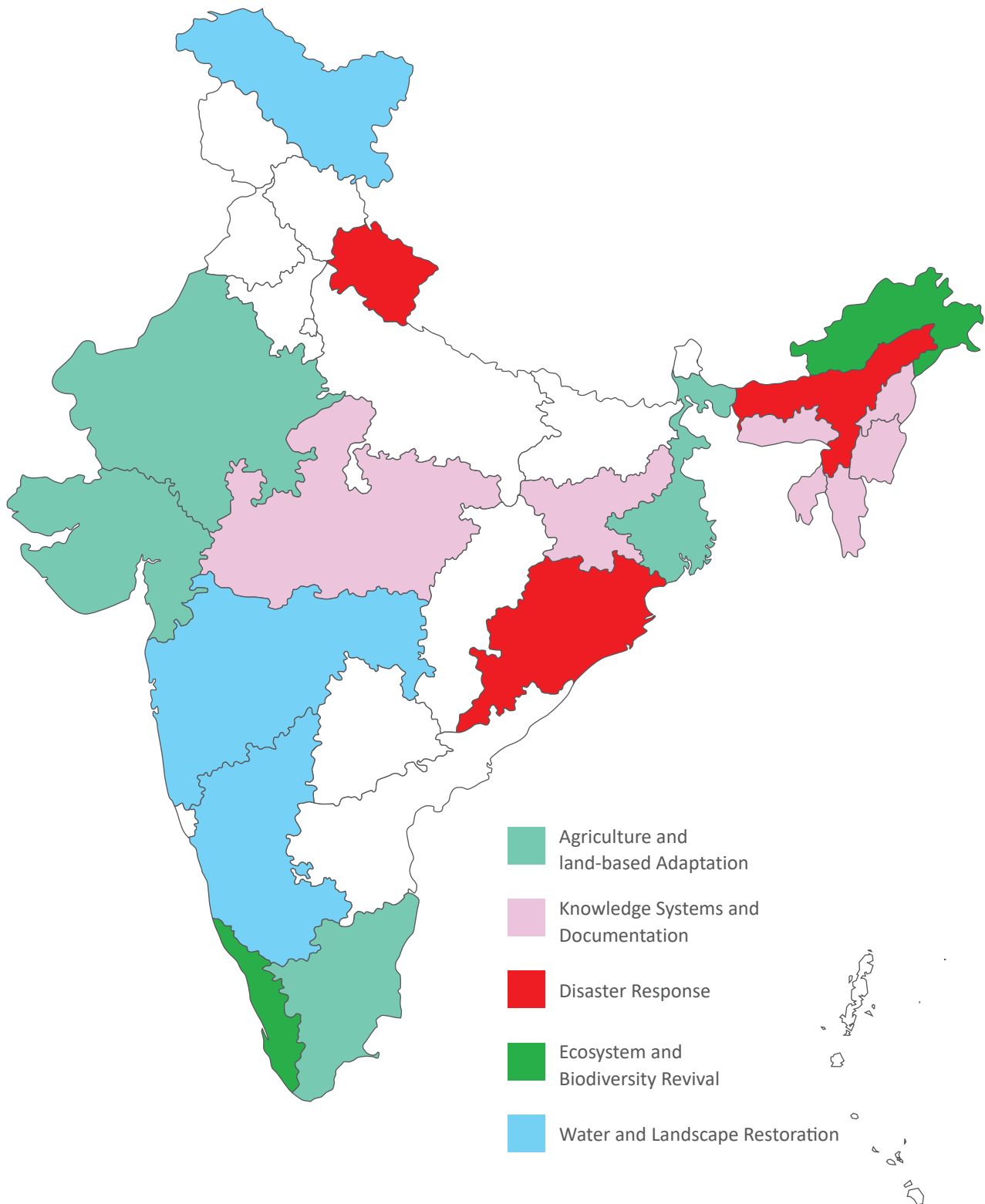
This compendium is a documentation of collective community spirit and science—of people who, bound by shared adversities and aspirations, forged pathways of resilience through their own labour, relationships, and wisdom. It discusses the climate context in which these communities are situated and how they are affected by the climate changes. It spotlights their actions in response, future challenges and key learnings that support community-led actions.

That said, we are also mindful of the limitations we encountered in this exercise. To avoid replicating popular narratives already covered widely in the media, we relied on under-reported cases documented in secondary sources. Much as we hoped to, we were unable to visit these communities ourselves. The voices we present are mediated through articles, interviews, and grey literature—and this, too, shapes how the stories unfold.

We recognise that the field of community-led climate action is evolving. Much remains to be understood—especially about the nuanced interplay of vulnerability, identity, and resilience. But if there is one thing these case studies affirm, it is that transformative change is already underway— in the everyday acts of people protecting the places they call home.



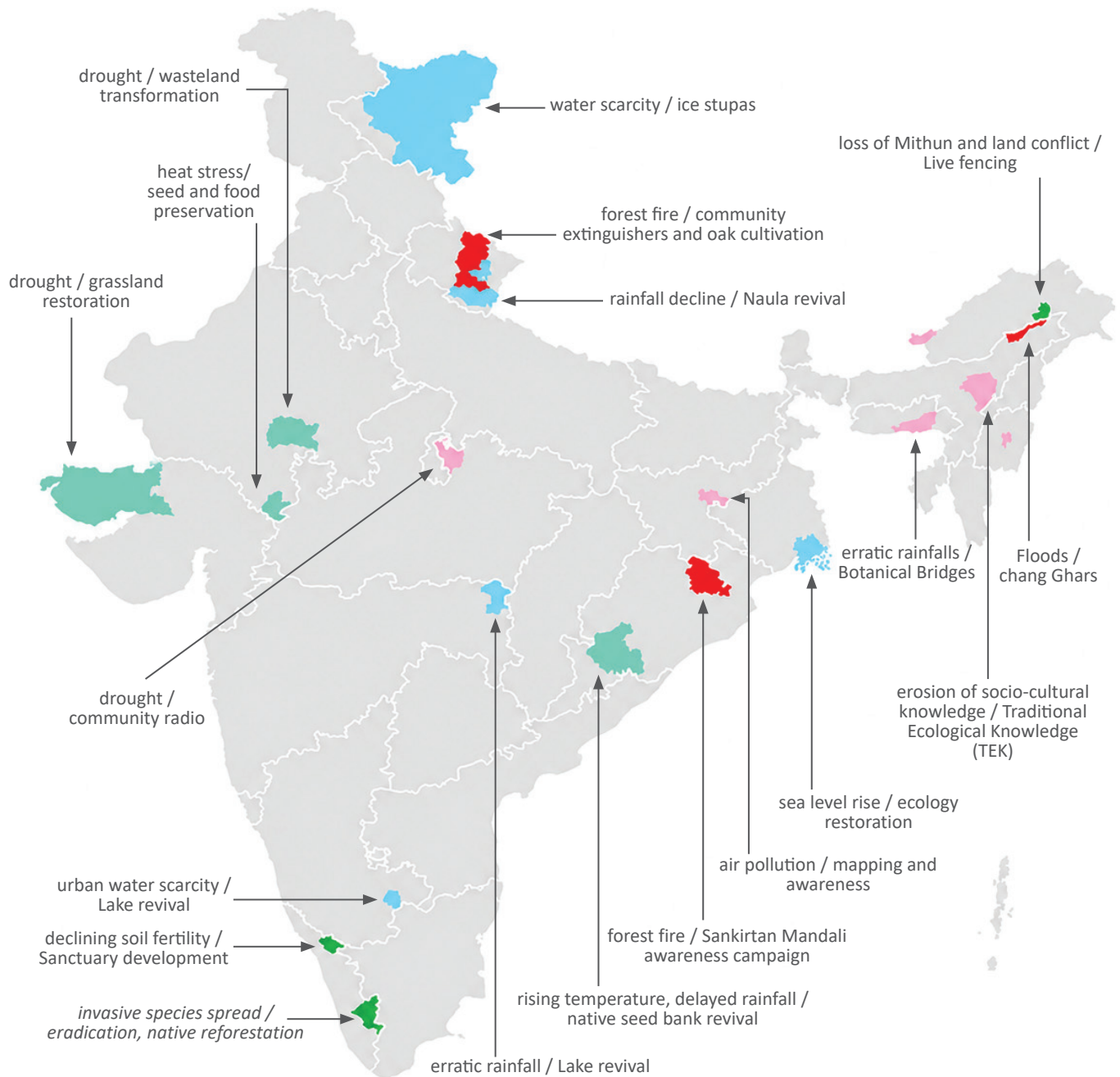
# CLIMATE RESPONSE ACROSS INDIA



| Case Title                                                                                                      | State             | Climate Response                                                                                                                                                                                                                                         | Climate challenge                                                                 |
|-----------------------------------------------------------------------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Going Back to Seeds: Community Preservation and Preparedness against Seed Acculturation and Climate Adversities | Rajasthan         | <br><b>Agriculture and Land-based adaptation:</b> Dryland farming, Sustainable Agriculture, Soil Regeneration, Seed Sovereignty, Organic Farming, Wasteland Restoration | prolonged drought, soil degradation, heat stress                                  |
| Turning the Tide: Local Adaptation Story in the Disappearing Islands of the Sundarbans                          | West Bengal       |                                                                                                                                                                                                                                                          | sea-level rise, floods, degradation of land and water resources                   |
| Reviving Banni: Pastoral Rights, Grassland Restoration and Climate Resilience in Kutch                          | Gujarat           |                                                                                                                                                                                                                                                          | grassland degradation, prolonged droughts, loss of native flora                   |
| Millet, Mountains, and Memory: Climate Adaptation by Dongria Kondhs of Niyamgiri                                | Odisha            |                                                                                                                                                                                                                                                          | rising temperatures, delayed rainfall, biodiversity loss                          |
| Soil Salvation: Traditional Solutions to Combat Salinity                                                        | Tamil Nadu        |                                                                                                                                                                                                                                                          | coastal salinity intrusion due to sea-level rise, declining freshwater recharge   |
| Communal Restoration: Village Collectivization for Wasteland Transformation and Resource Management             | Rajasthan         |                                                                                                                                                                                                                                                          | land degradation, soil infertility, loss of vegetation due to drought             |
| Ice Stupas: One concept, Many forms of a Ladakhi architectural innovation                                       | Ladakh            | <br><b>Water and Landscape restoration :</b> Water Scarcity, Floods, Coastal Salinization, Community Infrastructure, Watershed Development                              | glacier melt, water scarcity due to reduced snow and precipitation                |
| Reviving Gondia's Lakes: Fisher folk's Stewardship and Climate Resilience in Rural Maharashtra                  | Maharashtra       |                                                                                                                                                                                                                                                          | delayed/erratic monsoon, shortened hydro periods, rising temperature              |
| Revival of Jakkur Lake in Bengaluru: A Community Mosaic for Urban Climate Resilience                            | Karnataka         |                                                                                                                                                                                                                                                          | urban water scarcity, declining groundwater levels, irregular rainfall            |
| Springs of Resilience: Community-led Revival of Traditional Water Resources                                     | Uttarakhand       |                                                                                                                                                                                                                                                          | declining rainfall, reduced spring recharge, drought-like conditions              |
| Rooted in Resilience: Women Reviving the Rainforest Ecosystem in Kerala                                         | Kerala            | <br><b>Ecosystem and Biodiversity Revival :</b> Forests, Biodiversity Habitat, and Ecosystem services                                                                 | declining soil fertility, biodiversity loss, landslides due to intense rainfall   |
| People of Forest: Tribal Adaptation and Restoration of Forest                                                   | Kerala            |                                                                                                                                                                                                                                                          | biodiversity loss, slow-onset climate shifts affecting forest ecology             |
| Building Defense: Living Fences for Cattle Protection and Forest Conflict                                       | Arunachal Pradesh |                                                                                                                                                                                                                                                          | biodiversity loss, ecosystem fragmentation, forest conflict under resource stress |
| Cultural revival protects forests: Sankirtan Mahila Mandali                                                     | Odisha            | <br><b>Disaster Response:</b> Monitoring, Awareness, and Eco-Architecture                                                                                             | forest fire risk, heatwaves, loss of traditional fire-resilience practices        |
| Building houses and Resilience: tribal architecture and design for floods and earthquake                        | Assam             |                                                                                                                                                                                                                                                          | floods from erratic monsoon, seismic vulnerability                                |
| Forest Guardians: Women as Frontline Forest fire Fighters                                                       | Uttarakhand       |                                                                                                                                                                                                                                                          | increasing forest fires due to prolonged dry spells, temperature rise             |
| River Memory, Climate Change, and the Making of a People's Archive in Northeast India                           | North-East India  | <br><b>Knowledge Systems and Documentation:</b> TEK (Traditional Ecological Knowledge), Mapping, Assessments, Climate Memory, Indigenous knowledge systems, Media     | erosion of socio-ecological knowledge due to climate and cultural change          |
| Radio Bundelkhand: From Community, for the Community                                                            | Madhya Pradesh    |                                                                                                                                                                                                                                                          | drought, erratic rainfall, frequent monsoon failure                               |
| Beyond the Smoke: Women-led Air Quality Monitoring in the Coal Heartland of Jharkhand                           | Jharkhand         |                                                                                                                                                                                                                                                          | air pollution linked to industrial emissions, deforestation, and heat             |
| Botanical Bridges and Community Wisdom: Climate-Resilient Infrastructure from the Khasi Hills of Meghalaya.     | Meghalaya         |                                                                                                                                                                                                                                                          | erratic rainfall, flash floods, soil erosion                                      |



# CLIMATE CHALLENGE / COMMUNITY-LED ACTION



- Agriculture and land-based Adaptation
- Knowledge Systems and Documentation
- Disaster Response

- Ecosystem and Biodiversity Revival
- Water and Landscape Restoration



# Going back to Seeds: Community Preservation and Preparedness against Seed Acculturation and Climate Adversities

**Case Context:** Amid rising climate stress and eroding agrobiodiversity, tribal women are reviving seed sovereignty and food preservation practices, building climate resilience, reducing market dependence, and restoring traditional knowledge for community sustenance.

**Location:** Banswara, Rajasthan has been one of the most socioeconomically backward districts of India (Ministry of Panchayati Raj / Government of India, 2009). Pushing the crop yields of the district are below national averages (Banswara District / DES, 2010), the erratic weather has disrupted agricultural cycles and further intensified agricultural challenges in this semi-arid topography.

## The Climate Challenge

Rajasthan faces intensifying climate stress due to rising temperatures, erratic rainfall, and prolonged dry spells. Heat stress and dry land vulnerability make farmlands unproductive. This creates a multilayered loss for the communities that experience this climate calamity. Agricultural cycles disrupted by erratic weather lead to loss of livelihood, food scarcity, and health issues because of nutritional deficiencies and loss of agro-cultural knowledge. The water table is also rapidly falling in Rajasthan, due to over-extraction and lack of recharge, deepening the crisis for farming households, especially during the dry months. Soil degeneration is a compounding factor, caused by long-term exposure to high heat and variable monsoons.

## Description of the Affected Community

Banswara is mainly inhabited by the Bhil tribal people, one of the oldest and most renowned for their ecological knowledge. The community mainly practices rain-fed agriculture, cultivating maize, pulses, moong, and wheat. The community has experienced a shrinking produce because of groundwater availability at 400 feet below, with no proper irrigation systems. Because of this, the district is also experiencing male out-migration, leaving behind women to take care of both the farmland and their families. Because of dwindling food supply, the community is also facing significant nutritional challenges, particularly for children and other marginalized sections of the region.

The green revolution that began in the 1960s shifted the focus from native crops to commercially high-yielding varieties of crops. Over the years, the soil and land have gone through degradation because of excessive commercial farming that did not take into account the specific abilities of the soil and the region. Such a drastic shift also had a great impact on the traditional culture of seeds, most of the seeds native to this region are on the verge of extinction. This 'Seed Acculturation', a socio-cultural phenomenon of the adoption of newer and

foreign seeds over indigenous seeds, leads to a cultural erosion in agriculture that perpetuates a disconnect from traditional practices and foodways. The community had also become dependent on the market for seed procurement and food consumption. Irrigation, chemical fertilizers, and pesticides also incur additional costs for the farmers, pushing them into a trap of debt.

These ecological and socio-economic shifts reinforce one another in a **continuous cycle of vulnerability**. Degrading land and declining soil fertility reduce agricultural productivity, weakening household incomes and limiting access to diverse and nutritious food. As farming becomes increasingly unviable, seasonal and long-term migration emerges as a livelihood strategy, with men often moving out in search of work. This, in turn, leaves women to shoulder expanded responsibilities of farming, caregiving, and household management while navigating diminishing natural resources. Thus these challenges become **interconnected consequences of ecological degradation**, each compounding the other.

## Community-led action

In response, Women have been reviving the traditional systems of preservation and agriculture. Local women have followed the practice of '**sun-drying vegetables**' for generations as a way to reduce food waste, and now they are also utilizing this practice in times of food crisis. When nothing is left in the fields after March, food preservation allows them to feed their families as they dry up from the plentiful winter crops. They slice the fresh and locally grown vegetables like okra, cluster beans, spinach, fenugreek, and lay them out in the courtyards and rooftops to dry them under the sun for two to three days. Upon optimum dryness, they are stored in **traditional pots called 'Kabali'** to protect them from moisture and pests. The dry vegetables are then taken out in the months of scarcity. After boiling to soften them, they are cooked with minimal spices and oil. These vegetables retain their nutritional value.

This practice also reduces their market dependence; the families in the village also practice a **bartering system** where they exchange dried greens, beans, or wild produce with each other, thereby keeping the food local and accessible during winters.

The women of Sangela village of Banswara district took up the foresight climate action of Seed Preservation. They have been preserving the traditional varieties of seed lost to commercial crops. Supported by a local NGO, Vaagdhara, the women are leading a **movement of seed sovereignty called 'Beej Swaraj'**. They collect, dry, and store indigenous seeds in pots using traditional methods.

The women in the community are aware of the nutritional value, medicinal properties, and resilience of their local crops. The prevalence of hybrid varieties of crops in the market led to local crops slowly disappearing from their diets and cultivation practices. The community understand that this is a valuable skill that only the women of the community understand, they were taught by their mothers, and they now want to carry this practice forward.

They follow a meticulous **preservation process** where the seeds are selected according to their weight and then filled into a sack that is sealed and kept in a greenhouse for the forthcoming season. Some crops, such as bottle gourd and Ridge gourd are just hung as whole fruits and ripened. For vegetables, seeds from the vegetable are extracted and stored once they ripen. Traditional containers called “kabla” are made using bamboo or other wood for the storage of traditional seeds. These kablās are then coated with a mixture of clay and cow dung. Afterward, these kablās are dried in the sun, and they are used for storing seeds like corn, rice, and wheat. Before storage, neem leaves are spread at the bottom of the kabla, and seeds are placed intermittently, with neem leaves in between. This process is repeated until the kabla is filled to the top. Then, neem leaves are spread on the uppermost layer, followed by covering it with sagwan or coconut leaves, and finally sealing it with a mixture of cow dung and clay before packing.

The women have also started practicing Mixed legumes cropping, Crop diversification and nutrient-sensitive farming. In Aamplipara village, the women are cultivating traditional Millet varieties of Dheemdi and Garmela that are high in potassium and magnesium. They also grow leafy vegetables and fruits for domestic consumption. The farmers do not use chemicals, that allows them to successfully and naturally dry their produce and store it for much longer.

The active discussion forums for traditional knowledge and experience sharing, in the beginning, facilitated by the local NGO, are run by the women now. They frequently meet to share their traditional knowledge and stories from other villages, keeping them inspired.

## Impact

The families, especially women in the region, are now hardly dependent on the markets. It has saved women leaders and their households almost INR 16,000 a year. Many nutrition studies suggest that dehydrated vegetables have high nutritional value. The act of preserving seeds helped them at the time of the COVID-19 crisis, while the big farmers struggled for seed procurement due to limited travel and lockdown; these women’s groups had surplus seeds to sustain themselves in difficult times.

## Major challenges and Learnings

As land holdings and water availability shrink, so do vegetable cultivation and harvest, both of which impact surplus food preservation for the future. Erratic weather and pest attacks further exacerbate the challenges. Dried produce storage has shrunk from up to two years to lasting only a year now. The combination of erratic weather, sudden downpours, high humidity, scorching heat, and increasing pest infestation is making storage harder. The challenges, however, may limit the scope of sustenance in the region and replicability beyond it.

Villages of the Banswara district are inspired by each other. The initiative demonstrates the conditions and principles that enabled the response to emerge, sustain, and remain relevant to the local context. The following learnings highlight key considerations for practitioners, organizations, and institutions seeking to strengthen community-led climate action.

1. Communities should be recognized as knowledge stakeholders. The intervention built on the **community’s existing ecological knowledge** instead of introducing external solutions. Women, in particular, were given the agency to revive, preserve, and exchange indigenous seed varieties and farming practices.
2. When both **the problem and the knowledge to address it originate from the same context**, responses are more likely to be ecologically appropriate, culturally relevant, and aligned with local needs. The intervention responded simultaneously to the region’s climate stress, declining agrobiodiversity, and nutritional vulnerabilities because it was shaped by the lived experiences of the community.
3. While the knowledge to address the challenge already existed within the community, it **required facilitation to be mobilized and shared collectively**.





# Turning the Tide: Local Adaptation story in the Disappearing Islands of the Sundarbans

**Case Context:** The Sundarbans delta, straddling India and Bangladesh, is among the most climate-vulnerable regions in the world. In the Indian part of the delta, particularly in the island of Ghoramara, sea level rise, riverbank erosion, and cyclones have displaced thousands. As homes vanish into the river, residents have begun grassroots efforts to adapt—restoring mangroves, reinforcing embankments, and rebuilding ecological resilience.

**Location:** Ghoramara Island, part of West Bengal's South 24 Parganas district, has lost over half its land area since the 1970s—from 26 square kilometres to just around 7 square kilometres today. Its proximity to the estuary of the Hugli River and Bay of Bengal makes it highly exposed to rising tides and storm surges.

## The Climate Challenge

Climate change has worsened coastal vulnerabilities in the Sundarbans. Sea level in the region is rising at around 3.14 mm per year, higher than the global average, causing accelerated erosion and saline intrusion (Hazra et al., 2002). Recurrent cyclones like Aila (2009), Amphan (2020), and Yaas (2021) have devastated embankments and croplands. Floodwaters contaminate freshwater ponds, while salt-tolerant weeds overrun paddy fields. For Ghoramara's inhabitants, who largely depend on agriculture and fishing, this has meant livelihood losses, chronic displacement, and constant exposure to extreme weather events.

## Description of the Affected Community

The island is home to around 5,000 people, including smallholder farmers, fishers, daily wage workers, and women-headed households. Many are former residents of other disappearing islands like Lohachara, and their settlement on Ghoramara was already shaped by displacement. The erosion has not just affected land and homes—it has also fragmented community structures, kinship networks, and traditional knowledge systems. Families live in makeshift homes along fragile embankments. Women face added burdens of water collection, caregiving, and food insecurity as crop failure becomes more common. Youth migration to urban centres like Kolkata and Port Blair is rising, as uncertainty grows over Ghoramara's future.

The impacts of climate change on Ghoramara extend beyond the loss of land and livelihoods, creating interconnected ecological, economic, and social vulnerabilities. Repeated erosion and livelihood losses compel families to relocate, often leading to displacement into resource-constrained areas and increasing pressure on land, water, and public services. Displacement also fragments social and cultural networks, disrupting community cohesion, local knowledge systems, and traditional ways of living. These intersecting challenges reinforce one another,

with **ecological degradation giving rise to economic insecurity, resource stress, social fragmentation, and cultural loss**. Climate change, therefore, is experienced as a **multidimensional disruption** affecting the community's social, economic, and cultural fabric.

## Community-Led Action

Despite their precarity, local communities have taken proactive steps to defend their shrinking island, to continue staying in their homelands. The exclamation by a local schoolteacher, "It is no longer just about saving the island—it's about holding on to a way of life." (VillageSquare, 2024), captures the resilient spirit and the inspiration behind organically emerged local climate actions. While organizations like SEEDS or WWF have offered technical guidance in some villages, the planning, mobilization, and implementation have fundamentally involved island residents and local committees—not external agencies acting unilaterally. Following are the major initiatives on islands:

- **Riverbank stewardship and waste management:** Residents in Ghoramara's compact six-square-kilometre inhabited zone organized riverbank clean-ups, composted collected plastic to reduce erosion caused by clogged tidal channels, and strengthened shoreline stability (Telegraph India, 2024).
- **Sapling planting for erosion control:** Women's SelfHelp Group collectives planted over 30,000 native mangrove and tamarisk saplings along eroding banks. Supported by bamboo frames and coir mats, this vegetation now protects soil against tidal surges and helps rebuild sediment layers (VillageSquare, 2024).
- **Restoration of freshwater ponds:** Community youth committees desilted and managed over 35 village ponds, ensuring recharge during monsoons, maintaining freshwater for household use, and experimenting with small aquaculture to support income generation.
- **Food system adaptation:** Households embraced salt-tolerant rice varieties and diversified with kitchen gardens, poultry, and pond-fish cultivation—practical adaptations to saline flooding and soil salinity (Down to Earth, 2020).
- **Local early-warning governance:** Ward-level Community Climate Action Committees, including young men and women, now integrate traditional weather-forecasting wisdom with alerts (e.g., mobile or loudspeaker notifications) to coordinate cyclone preparedness and embankment maintenance teams.
- **Distress-Anticipatory Savings:** Women-led savings groups now include climate adaptation funds for minor house repairs and embankment reinforcement.

## Impacts

These grassroots efforts have slowed erosion in certain tracts of the island's northern fringe, where community-planted mangrove belts have taken root. The regenerated patches have seen the return of small fish species and crabs, helping marginal fishers recover partial incomes. Kitchen gardens with saline-tolerant crops such as okra, brinjal, and spinach have improved household nutrition. Educational activities around mangroves and tides have fostered local youth participation. Importantly, these actions have fostered a sense of dignity and collective resilience in a context where institutional support is minimal.

## Major Challenges and Learnings

Despite local efforts, land erosion continues to displace families as climate impacts intensify. Embankments remain vulnerable to cyclones and are expensive to repair. Voluntary participation is difficult to sustain, especially as livelihoods become more fragile. Migration of youth risks a loss of traditional ecological knowledge.

1. The community's success depends on sustained collective effort, despite limited external support. The intervention highlights the importance of adopting a **multi-stakeholder approach to climate adaptation**. By engaging women, men, youth, and community institutions in clearly defined roles, it distributes responsibility across different groups while drawing upon their diverse capacities and experiences.
2. It also shows that the improved access to credit, land tenure clarity, and inclusion in **disaster planning frameworks** can further strengthen grassroots resilience.
3. The intervention demonstrates how **comprehensive and coordinated responses are essential for addressing complex climate challenges**. By combining early warning systems, women's savings groups, food system adaptation, ecosystem restoration, and community preparedness, the different components reinforce one another rather than functioning as isolated activities.





# Reviving Banni: Pastoral Rights, Grassland Restoration, and Climate Resilience in Kutch

**Case Context:** The Banni Grasslands in Kutch, Gujarat, are among Asia's largest tropical grasslands and have long supported the pastoralist Maldhari community. Historically treated as a resource frontier or wildlife zone by state and conservation agencies, Banni's degradation was accelerated by invasive species, overgrazing, and bureaucratic restrictions. While the primary motivation behind the community's mobilization was to secure land rights and reclaim customary governance, these efforts have resulted in enhanced ecological health and climate resilience, especially in the face of rising temperatures, irregular rainfall, and prolonged droughts (Down to Earth, 2021; Ramble Project, 2023).

**Location:** The Banni Grasslands lie on the southern edge of the Rann of Kutch in Gujarat, covering over 2,600 square kilometers. This arid zone, characterized by saline soils, low rainfall, and seasonal wetlands, is home to more than 40,000 Maldharis living in around 48 panchayats. The region has historically served as a grazing commons for buffalo, sheep, goats, and cattle raised by the Maldharis, who are organized along clans and traditional panchayats (Sahapedia, 2020).

## The Climate Challenge

The Banni region is extremely vulnerable to climate variability. Annual rainfall has become highly erratic—dropping from an average of 350 mm to under 200 mm in some years—causing delays in grass regeneration and reducing surface water availability. Heatwaves have intensified over the past two decades, with daytime temperatures crossing 45°C for longer periods, increasing water stress for livestock and people alike. Recurring droughts and encroachment by the invasive *Prosopis juliflora* have further degraded the commons. These shifts have directly impacted the Maldhari way of life, whose seasonal grazing patterns and livestock care depend on climatic rhythms (Ramble Project, 2023; Down to Earth, 2021).

## Description of the Affected Community

The Maldharis—meaning “owners of livestock”—are a semi-nomadic, caste-diverse community of silvipastoralists who have practiced rotational grazing in Banni for centuries. They rely on traditional breeds like the Banni buffalo, prized for high milk yields under arid conditions, and practice sustainable grazing through clan-based coordination and seasonal migration. Their vulnerability is multi-layered: they face extreme weather, invasive species, and erosion of collective tenure. This is compounded by institutional marginalization, limited access to welfare schemes, and a decline in customary governance due to state-led conservation and privatization. Climate change has worsened these vulnerabilities by disrupting pastoral calendars, reducing fodder availability, and increasing livestock disease due

to heat stress and water scarcity. Women, in particular, shoulder the burden of walking longer distances for water, managing fodder, and caring for ailing animals. Moreover, the disruption of traditional grazing routes and the loss of native grasses have broken intergenerational knowledge transfer, weakening the ecological intelligence embedded in daily pastoral practices (Sahapedia, 2020; Ramble Project, 2023).

Pastoralists, livestock, and grasslands are not separate entities but a co-evolved system. As customary grazing systems become disrupted, the health of the grasslands further deteriorates, creating a reinforcing cycle of ecological decline. Climate change therefore impacts an interconnected system in which the well-being of the land, livestock, and pastoral communities is mutually dependent, with changes in one component cascading across the others.

## Description of the Community-Led Action

Community action in Banni began as a struggle for land rights and local governance. In 2007, 47 village **panchayats filed a collective claim** under the Forest Rights Act (FRA), seeking recognition as the rightful custodians of the grassland commons. This collective mobilization was driven by local panchayats and community leaders, many of whom were supported by the Banni Breeders' Association and civil society networks. After years of legal advocacy and community mapping, the claim was approved in 2021, making Banni one of the few landscapes in India where pastoralists secured rights over an entire ecosystem (Down to Earth, 2021).

Building on this victory, Maldhari groups began reviving Traditional Ecological Knowledge (TEK) through rotational grazing, reseedling of native grasses, and management of *Prosopis*-infested plots. The Ramble Project—a collaborative of ecologists, herders, and local youth—helped facilitate **community science initiatives**. Women's collectives initiated mapping of grazing routes, seasonal water points, and grass species. In select villages like Dhordo and Hodko, seed banks for native fodder species were revived and shared through customary networks. Community science training equipped youth with data tools to monitor grassland regeneration, enabling adaptive grazing and early drought response (Ramble Project, 2023). Pastoralists also began negotiating grazing corridors with the forest department and regulating stall feeding to ease pressure on recovering plots. Seasonal festivals and livestock fairs were used to reconnect younger herders with traditional knowledge systems. These grassroots actions—rooted in autonomy and territorial belonging—began shaping a holistic response to climate and ecological distress.

## Impact

The revival of Banni grasslands has yielded a range of social, ecological, and climate-related outcomes. Pastoral collectives, after securing their forest rights under the FRA, have been able to reclaim agency over land use, reducing overgrazing through rotational grazing and collective management. These practices have led to improved pasture quality and vegetation cover, aiding soil moisture retention and carbon sequestration. Ecological monitoring by the Ramble Project and local elders documented the return of over 250 bird species and 40 native grass varieties in managed plots. The restoration efforts have also contributed to improved livestock health, especially during extended dry periods caused by erratic rainfall and rising temperatures. Women's groups have played a central role by reviving TEK, establishing seed banks for native fodder species, and mapping seasonal water sources. These initiatives have enhanced the self-sufficiency of the Maldhari economy and reduced dependence on external fodder during droughts. Community stewardship has also improved social cohesion, intergenerational knowledge exchange, and cultural confidence, further reinforcing resilience in the face of escalating climate threats.

## Major Challenges and Learnings

Despite recent gains, challenges remain. The *Prosopis* invasion still covers over 50% of Banni, and full-scale removal is labor- and cost-intensive. Policy contradictions between forest, grazing, and conservation laws hinder integrated management. Extreme weather events—like heatwaves and delayed monsoons—are expected to worsen, requiring improved early warning systems

and diversified fodder strategies. Institutional recognition of community science and pastoralist leadership remains weak, threatening the long-term viability of grassroots restoration. Younger generations also face pressures to out-migrate due to changing aspirations and diminishing economic returns, risking a rupture in knowledge continuity.

1. The restoration of Banni's grasslands was enabled through **collective action** by pastoral communities rather than individual efforts. Community institutions and shared decision-making strengthened the management of common lands, enabling coordinated restoration, sustainable grazing, and long-term stewardship of the ecosystem.
2. The intervention demonstrates that **ecological restoration is closely linked to community tenure and governance rights**. Recognition of community rights over common landscapes enabled pastoralists to apply their traditional management systems and take collective responsibility for restoring and sustaining the grasslands. Securing rights, therefore, becomes a foundation for long-term ecological resilience.
3. The intervention was rooted in the Maldharis' traditional understanding of grazing cycles, livestock management, native grasses, and landscape stewardship. **Modern scientific tools and technical support complemented this knowledge** rather than replacing or overriding it.

The future of Banni's climate resilience depends on aligning pastoral governance, ecological restoration, and climate adaptation through community-led frameworks.





# Millet, Mountains, and Memory: Climate Adaptation by Dongria Kondhs of Niyamgiri

**Case Context:** The Dongria Kondhs of Odisha have traditionally relied on rainfed hill farming and forest foods for survival. With changing agricultural practices and external interventions, their farming diversity shrank and food security declined. Climate change made things worse, with erratic rains and rising pest attacks. In recent years, the community began restoring their old cropping methods to strengthen local food systems (Mongabay-India, 2018; Vikalp Sangam, 2017).

**Location:** Dongria Kondhs live in the Niyamgiri hill range, which stretches across Rayagada and Kalahandi districts in southern Odisha. Their villages include Hundijali, Kurli, Khemdipadar, Lakhpadar, and Khambesi. These settlements, located in the steep Eastern Ghats forests, fall under protected habitat areas as per the Forest Rights Act, 2006 (Vikalp Sangam, 2017).

## The Climate Challenge

Over the past decade, farmers here have seen temperatures rise and the monsoon become increasingly unpredictable. Earlier, the sowing period started with April rains, but now rainfall often comes late. Some years, sowing gets pushed back by more than a month, affecting germination, especially for paddy. Higher pre-monsoon temperatures have dried out the soil and made it harder to prepare land (Earth Journalism Network, 2018).

At the same time, pests like stem borers and leaf-eating insects have become more common. Elders believe this is due to longer dry spells and fewer natural predators. Hybrid crops, particularly rice, are affected more by these changes. Traditional millets, such as finger millet, foxtail millet, and sorghum, cope better. They need less water, grow well on sloped land, and resist many local pests. These crops also mature at different times, reducing the risk of total loss from sudden dry spells or heavy rain (Mongabay-India, 2018; Vikalp Sangam, 2017).

## Description of the Affected Community

The Dongria Kondhs are one of India's Particularly Vulnerable Tribal Groups (PVTGs), known for their deep spiritual and material relationship with the forests of Niyamgiri. They consider the hills sacred and revere Niyam Raja, the mountain deity who is seen as both protector and provider. Their cultural identity is tightly interwoven with the forest, which sustains their diet, medicine, rituals, and worldview (Padel & Das, 2010). Forest gathering contributes significantly to their nutrition, with tubers, wild greens, bamboo shoots, and mushrooms forming a regular part of meals.

Farming is conducted on hill slopes through shifting cultivation, complemented by rainfed plots closer to settlements. The decline in rainfall and shifts in seasonal patterns have affected not only their crop yields but also the health of forest-based food systems. Women are at the forefront of managing this crisis.

They lead much of the seed revival work—from identifying lost crop varieties to organising seed exchanges and managing crop storage using time-tested methods. In some hamlets, over half the adults became protein-deficient, and malnutrition affected more than 60% of children (Global Issues, 2015). As forest cycles faltered, so did traditional rhythms of farming and gathering, placing cultural and ecological knowledge at risk (Global Issues, 2015).

Soil health, crop diversity, forest health, human nutrition, and community well-being are closely interconnected, with each influencing the resilience of the others. Declining soil moisture and erratic rainfall weaken crop health, reducing the availability of diverse and nutritious foods. This affects human nutrition while also limiting the regeneration of local seed varieties and weakening ecological relationships within the farming landscape. **Climate change therefore the health of the ecosystem as a whole**, where the destabilization of one element creates deteriorating effects across ecological, nutritional, cultural, and social health systems.

## Description of the Community-Led Action

The decision to restore traditional seeds and practices was driven by multiple years of poor harvests, pest outbreaks, and the failure of hybrid crops to cope with local conditions. As access to forest foods declined and nutritional stress increased, women and elders took the lead in reclaiming their agricultural systems. They began by identifying and collecting heirloom seeds that had disappeared from local fields. Village priestesses (*bejuni*) and older women gathered seeds from nearby relatives and hamlets.

The cultural revival of '*Bihan Parab*' became an anchor for these efforts. It is a traditional seed-sowing festival celebrated with prayers, songs, and the ceremonial blessing of seeds offered to Niyam Raja, the mountain deity. The festival reaffirms the bond between community, forest, and farming, making it central to both ecological and cultural continuity for the Dongria Kondhs. During *Bihan Parab*, seeds are wrapped in neem leaves or cow dung for protection, exchanged, and blessed collectively. This renewed practice has helped root the agricultural revival in a shared cultural framework. The movement began in villages like Hundijali, Lakhpadar, and Khambesi, and now reaches over 30 hamlets across the region (Earth Journalism Network, 2018). Women and elders began bringing back their traditional seeds.

This revival started in villages like Hundijali, Lakhpadar, and Khambesi and has now reached over 30 hamlets across the two districts (Earth Journalism Network, 2018).

Farming now includes 30 to 50 crops each season—millets, pulses, maize, oilseeds, and leafy vegetables. These are sown together to save water and control pests. Women manage grain storage using bamboo containers lined with ash and turmeric. These efforts have helped communities return to home-grown food and depend less on subsidised rice (Mongabay-India, 2018).

Villages also use fairs and festivals to exchange seeds and talk about soil, rainfall, and pest issues. Through regular practice and shared responsibility, they keep traditional knowledge alive. For instance, women use **age-old methods like storing seeds in bamboo containers coated with ash and turmeric** to prevent pests and moisture damage. Gathering tubers, yams, and mushrooms alongside farming adds to both food and ecological diversity. One elder said, *“Even when the rains fail, our forest does not”* (Vikalp Sangam, 2017).

## Impact

The seed revival has led to the return of over 50 heirloom varieties of pulses, millets, and vegetables across more than 30 villages. Millets now make up a significant portion of local diets, helping improve nutrition and reduce dependence on subsidised rice. During the 2017–18 droughts, areas that adopted traditional cropping faced minimal crop loss. Cultural festivals like *Bihan Parab* have also been revived, reconnecting farming with rituals and community gatherings. These ceremonies—where seeds are blessed, exchanged, and sown—are once again building social ties and reviving oral traditions. Women-led seed exchanges and shared storage practices have strengthened community bonds and rebuilt ecological confidence in local knowledge systems.

## Major Challenges and Learnings

Alongside climatic uncertainties, the community also faces emerging socio-economic challenges that threaten the continuity of traditional farming systems. Increasing migration and changing aspirations among younger generations are reducing engagement with farming as a livelihood. Commercialization of agriculture and the preference for high-yielding crop varieties continue to displace indigenous crops and associated knowledge systems. These shifts pose long-term challenges to sustaining community-led seed conservation and traditional agroecological practices.

The intervention offers valuable learnings on strengthening community-led climate adaptation in ecologically and culturally sensitive landscapes. It demonstrates that long-term ecological resilience is built by reinforcing the social and cultural systems that sustain it.

1. The revival of indigenous seeds and farming practices was sustained because it built upon **cultural traditions that communities already identified with and valued**.
2. The intervention demonstrates that farming cannot be viewed solely as an individualized activity or an opportunity for commercial growth. In its very essence, **farming is an interdependent communal practice** where knowledge, seeds, labour, and stewardship are collectively shared and sustained. **Strengthening farmer collectives** and building connections between different community groups reinforces this collective fabric, creating the social foundation necessary for ecological resilience, economic security, and the continuity of traditional farming cultures.





# Soil Salvation: Traditional and Modern Solutions to Combat Salinity

**Case Context:** In Kadagam, Tamil Nadu, rising sea levels and groundwater depletion have led to severe soil salinity. Farmers combat this through traditional livestock penning, rainwater harvesting, and climate-resilient crop varieties, reviving degraded lands and restoring agricultural productivity with organic practices.

**Location:** Kadagam Village, Tiruvarur, Tamil Nadu. Kadagam is a coastal agrarian village located in the Tiruvarur district of Tamil Nadu, about 20 km from the Bay of Bengal. Situated within the fertile Cauvery Delta, the region is known for its paddy cultivation and extensive irrigation networks. Its low-lying geography and proximity to the coast make it particularly vulnerable to sea-level rise, saline intrusion, cyclones, and changing rainfall patterns, placing agriculture and freshwater resources under increasing climate stress.

## The Climate Challenge

With sea level rise and climate threats, soil salinity will be a constant matter of adaptation for coastal villages. Sea levels around India's East Coast are rising by 2-4 mm/per year on average, influenced by global warming, glaciers, and ocean warming (ResearchGate, 2020). This exacerbates sea water intrusion; groundwater depletion from drought or overuse pushes saltwater into freshwater aquifers. This is an especially alarming change for low-lying coastal zones.

Tsunami events, such as the 2004 tsunami of Tamil Nadu, are evidence of the widespread damage water-based climate change does to both human and nature (ScienceDirect, 2009). The tsunami flooded coastal farmlands with seawater, significantly increasing soil and groundwater salinity. It, in turn, affects crop viability and yield. The tsunami caused soil EC to rise sharply. The electrical conductivity (EC) is an indicator of soil salinity and its health. If it is more than 4 deciSiemens/meter (dS/m), it would be difficult to grow any crop (Village Square, 2018). Inadequate rains and droughts have been leading to groundwater depletion in many coastal villages in Tamil Nadu.

## Description of the Affected Community

In the village of Kadagam, predominantly smallholder farmers manage around 20-acre lots of clayey soil. Almost half of the households belong to scheduled castes, and practice Agriculture and Livestock management (VillageInfo.in, 2025). The village is only 20 kms from the Bay of Bengal, making the community vulnerable to sea water intrusion, rising sea levels, and poor rainfall leading to lower groundwater recharge. The soil electrical conductivity in parts of Kadagam has reached 7 dS/m, which is well above the safe threshold for cultivation. Hence, most crops fail to germinate or survive, and the nutrient uptake has also been impaired by it (Village Square, 2018).

## Community-led action

To protect their land suffering from high EC, the farmers turned to traditional methods of soil regeneration- Livestock Pen, cultivation of traditional crop varieties, and Rainwater Harvesting.

First, to repair and prepare land for fresh cultivation, the farmers of the village convert their lands into **livestock pens**. It is a traditional method of using livestock to restore soil health. The land is temporarily converted into a goat pen, they rotate the animals across different plots. The manure from the animals adds organic matter and helps in reclaiming the degraded salty land. This practice can be traced back to pastoral traditions. It was revived by some farmers in the village, who then advocated it to other villagers as well.

Second to **Soil preparation**, the farmers have also moved to the plantation of 'Kolinji' that efficiently removes salinity. Farmers grow 'kichili samba', 'seeraga samba' and other traditional **paddy varieties that are suitable for the clayey soil type** of their land and are more resilient to a changing climate.

These sowing decisions are followed by plant and land care strategies. Farmers believe retaining rainwater where it falls can also help tackle salinity. For reference, a farmer has constructed 5 ponds on his 20-acre land. The farmers also **dig trenches** close to the bunds and filled them with leaf litter and pruned tree branches. The bunds are raised on the perimeter of the land and also within the land for delineation according to crops and the level of water needed for irrigation, customizing diverse crop requirements within the same land. These bunds not only prevent surface runoff but also leaching of salts in case neighboring farmers do not practice organic farming.

## Impact

The farmers have reported that now they are growing crops successfully through organic practices. Officials of Krishi Vigyan Kendra have also validated the efforts of the farmers to be successful. The farmer-led interventions have led to noticeable improvements in soil quality. More importantly, in a rapid and adversarial climate change state, this initiative has built agricultural resilience and community confidence. The farmers report feeling more capable and prepared for the droughts and building their crop yield even under difficult conditions (Village Square, 2018) (The News Minute, 2018).

The initiatives of the farmers of Kadagam village are a result of the replicability of the organic land reclamation pioneered by the late Nammalwar, a respected organic farming advocate, that followed the 2004 tsunami- TOFARM (Tamil Nadu Organic Farmers' Movement). After the tsunami filled fields with sea flush and salt, Nammalwar supported farmers in restoring their soil by using biological inputs and traditional crops. NGOs and

farmers restored farmlands using green manures like Dhaincha, reclaiming over 1,600 ha, reviving 385+ traditional paddy varieties, and doubling their yields (FAO, 1997).

The farmers of Kadagam, in this time of crisis, were inspired by the land reclamation initiatives and the success of the 2004 tsunami (The New Indian Express, 2014).

### Major challenges and learnings

This multi-folding initiative is run by the collective labor of farmers. Building structures and maintaining systems requires community coordination and manual labor. The large-scale implementation and maintenance of these efforts requires institutional support and backing, especially for a wider adoption. The success of rainwater management systems relies on timely and adequate monsoons. In case of the Tsunami of 2004, EC rose sharply immediately after, but monsoon rains helped natural leaching to restore the soils to pre-tsunami conditions by 2006 (Japanese Society of Irrigation, Drainage and Rural Engineering, 2010).

1. The case demonstrates how context-specific solutions can evolve from one successful application to benefit many communities, enabling scale through relevance rather than continued external support. Because these practices were **locally relevant, feasible, and built upon familiar agricultural knowledge**, they could be readily adapted by farmers facing similar climatic conditions years later.

2. **Climate adaptation should strengthen collective resilience while protecting individual action.**

Farming operates within a shared ecological landscape, where the actions of one farmer can influence neighbouring fields. At the same time, climate adaptation measures should be designed so that individual farmers are not disadvantaged when neighbouring farms have not yet adopted similar practices. The use of trenches filled with organic matter along field bunds created a protective buffer that reduced the transfer of salinity from adjacent lands. Such approaches recognise farming as both a collective ecological system and an individual livelihood, enabling farmers to build resilience without being entirely dependent on collective adoption.





# Communal Restoration: Village collectivization for wasteland transformation and resource management

**Case Context:** In Kekariya, Rajasthan, rampant deforestation and overgrazing turned community lands into degraded wastelands. Through collective action, villagers formed a Tree Growers Cooperative, restoring 100 acres into thriving commons—reviving biodiversity, groundwater, and livelihoods while ensuring sustainable natural resource governance.

**Location:** Kekariya, Rajasthan, a revenue village, was surrounded by dense forests, until 1980s, teeming with diverse tree species, wildlife and abundant water resources. However, reckless deforestation, overgrazing and increased pressure for agriculture and livestock needs severely impacted the natural resources in the area.

## The Climate change

Overgrazing, unsustainable farming practices, and deforestation across Rajasthan have significantly increased its vulnerability to climate change, stripping off its vegetative cover, destabilizing the soil, and leading to significant wasteland formation and its degradation. Of India's total population, 40% depend on wastelands for livelihood. This population is primarily rural, non-/semi-literate, and from marginalized communities. (JK Policy Institute, 2025)

Wasteland formation further led to livelihood dependence, food shortage, and biodiversity degradation. The Kekariya gorge was home to abundant population of vultures around 20 years ago, with reduced water flows and food availability, the gorge no longer provided a safe habitat, and the vulture population slowly vanished from the region, with hardly any sightings.

## Description of the Affected Community

The community inhabiting Kekariya is mainly agro-pastoralist, with huge dependence on their common lands for water, fodder, and other resources. Over the past five years, the dependence of communities on managed grazing lands has increased, especially for fodder consumption; they are dependent on Common Property Resources (CPRs) for fuel wood and intangible benefits.

The market forces, lack of resource management, and individual greed are responsible for deforestation. The forest cover in the adjoining forest area has also reduced alarmingly with the increasing demand for firewood. Even Dhok, a resilient tree species native to the region, experienced a significant decline in both its distribution and quality as a result of increased human activity. It further accelerated soil erosion and rainwater runoff, depleting the village's water resources, including groundwater levels, as evidenced by reduced water availability in open wells.

## Community-led action

The community of Kekariya came together to form a village institution to restore and govern their common lands in 1996.

They formed the Tree Growers Cooperative Society (TGCS) and acquired a lease for 100 acres of degraded common lands beside the Kekariya gorge. (Village Square, 2023)

The revenue wasteland faced soil erosion and degradation. The community commenced restoration efforts, including **soil and moisture conservation, and revegetation**, to improve forest cover and water availability. Trenches were dug; **native grasses and tree species** were planted; the entire community

took responsibility for their protection and conservation. The community members did the installation of gabions, check-dams to control water flow, contour trenches, and stone bunds to prevent soil erosion. With proper management and strong governance practices, the degraded land was finally revived and converted into grazing land.

**Rules and mechanisms** were put in place to stop unsustainable practices and ensure the protection of the restored land.

The rules governing the management of grazing lands allow villagers to collect only dry twigs that fall from trees for use as firewood. The grazing land is closed for four to five months during the monsoons to allow grass and new regenerating plants to grow. The cutting of branches and grazing of animals are strictly prohibited during this period. In case the rule is broken, the village institution imposes graduated sanctions. The penalty for breaking rules depends on the extent of damage done and the economic background of the offender. The Samiti institutionalized by-laws, such as '*kulhadibandi*' (restriction on carrying axes to the commons) and the ora system (voluntary guard on a rotational basis).

Regular meetings are conducted, fostering open discussions and decision-making that involve the entire community. Moreover, the community's commitment to safeguarding their commons has led to improved infrastructure, including a connected pucca road, an upper primary school, and an Aanganwadi.

## Impact

Over the past years, as a result of the community's concerted actions, the landscape of Kekariya has seen substantial improvements. The 100-acre patch regained its past glory with a lush green cover, flowing streams, and a significant increase in wildlife. This restoration improved surface and groundwater resources. It also enhanced the availability of fodder and fuel for the local communities, consequently enhancing livelihoods in the village by supporting agriculture and livestock production. The restoration of the common land also played a crucial role in conserving native species, thereby enhancing the local ecosystems. Various **species of flora and fauna**, including threatened and vulnerable species such as Vultures, Indian Wolf, Striped Hyena, Alexandrine Parakeet, Black-headed Ibis, and Woolly-necked Stork, **have returned to the area**. At present,

over 50 vultures (in groups as large as 42 vultures) have been recorded in the area (Village Square, 2023). One of the most remarkable outcomes was the revival of dhok trees, both in terms of density and quality, transitioning from stunted shrubs to fully grown trees. At present, over 50 vultures (in groups as large as 42 vultures) have been recorded in the area.

Having demonstrated the significance of collective action and community stewardship of natural resources, the community of Kekariya now actively engages in the management of approximately 350 acres of common land, including 100 acres of revenue wasteland under the TGCS and 250 acres of adjoining forests.

### Major challenges and learnings

Sustainability of the initiative depends on the security of land tenure, and Cooperative models must be inclusive, ensuring participation across caste and socioeconomic.

1. The intervention demonstrates that restoring degraded commons is not solely an ecological exercise but also an institutional one. Its long-term success emerged from community ownership, locally evolved governance systems, and shared responsibility for protecting restored landscapes.

**Land is restored through ecological practices, but it remains restored through institutions.**





# Ice Stupas: One concept, Many forms of a Ladakhi architectural innovation

**Case context:** In climate-stressed Ladakh, melting glaciers and erratic snowfall threaten spring water supply. Villagers in Shara adapted the Ice Stupa—an artificial glacier—to store winter meltwater, restoring pre-sowing irrigation, reviving traditional crops, and integrating sacred water ethics into climate adaptation.

**Location:** Leh, Ladakh, nestled in the Trans-Himalayan belt, is facing severe impacts of climate change. Traditionally known as a cold desert, Ladakh has historically depended on glacial meltwater for its agrarian livelihoods.

## The Climate change

Rising temperatures, erratic snowfall, and rapid glacial retreat have created water scarcity, particularly during the crucial pre-sowing spring months. According to the Indian Himalayan Climate Adaptation Programme (IHCAP), average temperatures in Ladakh have risen by over 1°C in recent decades, with long-term projections indicating a further reduction in glacial mass and snow cover. This jeopardizes both livelihoods and long-standing socio-ecological systems in the region.

## Description of the affected Community

The communities affected most acutely by this change are small, agro-pastoral settlements in Leh district, such as Phyang, Gangles, and Shara villages. These villages consist predominantly of Buddhist families, practicing subsistence farming and depending on timely snowmelt to irrigate fields growing barley, wheat, and vegetables. Demographically, the region has a sparse population, primarily comprising Scheduled Tribes, with a high reliance on traditional knowledge systems and local governance structures such as village councils (Yulpa). Shara village, located about 60 kilometers southeast of Leh, is a cluster of hamlets spread across uneven terrain, making it historically difficult to distribute early spring meltwater equitably. These communities are deeply tied to the rhythm of seasons and vulnerable to even minor disruptions in water availability.

Spring water scarcity delays sowing, reduces yields, and contributes to out-migration, especially of youth seeking work in urban centers. As farming becomes increasingly unviable, traditional knowledge and social systems also begin to erode.

## Community-led action

The “Ice Stupa” initiative is a community-led adaptation effort pioneered by engineer and educationist Sonam Wangchuk in 2014, that quickly evolved into a grassroots, participatory movement. An ice stupa is a man-made glacier, an innovative water-conservation structure designed to freeze and store winter meltwater in **Conical Ice Towers**, which slowly release water during spring as temperatures rise. The first prototype was built in Phyang village, where villagers and monks collaborated to

construct an 18-meter-tall ice stupa that stored approximately 150,000 liters of water. The concept was simple but elegant: divert unused winter streamflow through gravity-fed pipes to sprinkle and freeze water in a shaded cone shape using minimal infrastructure. The stupa’s conical form minimizes surface area exposed to the sun, allowing it to last into late spring.

Monasteries provided land and logistical support, while villagers, including women and youth, contributed labor, planning, and knowledge of local terrain and weather conditions. The Ice Stupa project aligned with existing cultural and ecological values- water as sacred, mountains as spiritual spaces, and this facilitated its acceptance and expansion.

In subsequent years, the movement scaled to multiple villages, with competitions organized between communities to build the tallest or most durable stupas. These “**Ice Stupa Competitions**” became festivals that generated pride and encouraged innovation. Schools, local NGOs like the Students’ Educational and Cultural Movement of Ladakh (SECMOL), and even the Army supported the initiative by offering manpower, organizing awareness events, and funding basic equipment like pipes and valves.

Although the initial prototype was externally conceptualized, the scaling, refinement, and maintenance of ice stupas are now led and **customized by each village**. Local masons, shepherds, and elders adapt techniques based on terrain and seasonal changes, demonstrating strong ownership and innovation.

In Shara, water management is traditionally overseen by village elders and male representatives. However, through the ice stupa project, women, especially members of self-help groups, played a key role in organizing water-sharing schedules and maintaining smaller stupas.

In Shara village (Leh district), local residents began building smaller, **decentralized ice stupas** instead of one large structure. Unlike Phyang or Gangles, which had relatively open land and a single central water source, Shara’s topography is fragmented, with water channels passing through several scattered hamlets. To address this, elders and shepherds suggested placing multiple smaller ice stupas at key junctions along water distribution routes. This ensured equal water access across hamlets, better alignment with small agricultural plots, and lower labor requirements per stupa, allowing more families to participate directly. Local masons also modified the structure’s orientation and shading based on the sun’s path specific to their valley, helping the stupas last longer into spring. They used **stone fencing and willow thatch screens**, traditional techniques used for food preservation, to shade the stupas and reduce melting. These were not part of the original prototype but were added based on indigenous knowledge of microclimatic management. This adaptation resulted in sustained irrigation for spring barley

and early potatoes, helping restore pre-sowing cycles disrupted by climate-induced snowmelt delays. The villagers also revived traditional norms of collective decision-making, like allocating “chu-thal” or water turns.

The restored water supply has helped reintroduce heirloom barley and buckwheat varieties, which require longer growing cycles but offer better nutritional value and climate resilience. The village has begun documenting and exchanging seeds across neighboring communities, reactivating local knowledge networks. The Ice Stupa initiative is deeply intertwined with **Buddhist eco-ethics**, both in symbolism and practical philosophy. This integration has played a significant role in the community’s acceptance, participation, and expansion of the initiative.

## Impact

Prior to the initiative, fields in the upper hamlets of the Shara village received water late, leading to delayed sowing and reduced yields. By placing five mini-stupas along gravity-fed irrigation lines, water availability was extended by 3–4 weeks into early May, allowing the timely sowing of barley and potatoes, staples for the community. (Dialogue Earth, 2025) Farmers reported that land lying fallow for the past few years due to water stress was brought back under cultivation. In particular, two out of five hamlets achieved 100% coverage of irrigated fields in 2023, for the first time in over a decade.

The case of Shara village is one of scalability and replicability. The success of the Ice Stupa project has inspired similar initiatives in high-altitude arid zones such as Zaskar (Ladakh), Spiti (Himachal Pradesh), and even international interest in Switzerland and Chile. The construction of an Ice stupa requires minimal material cost; all materials and labor being sourced locally.

Shara’s mini-stupa program also created seasonal employment for youth trained in water engineering and solar systems through SECMOL and local NGOs. At least 12 young people from the village have since started offering services to build stupas in neighboring villages, creating a micro-economy around traditional water management.

## Major challenges and Learnings

The design works best in areas where winter temperatures fall well below freezing and where gravity-fed water diversion is feasible. Its success is therefore geographically limited, but within that geography, it is highly adaptable. Despite efforts for equal water access, it has also sparked localized conflict, especially around water access and distribution rights. In some locations, particularly in Phyang and Phey villages, downstream farmers have accused upstream villages of “hoarding” water by building ice stupas and diverting winter water for storage.

What upstream villages see as unused water, downstream communities see as essential for soil saturation, spring recharge, or other uses. As more

villages build stupas, coordination over shared glacial streams becomes critical, a gap that wasn’t foreseen in the early stages.

While the Ice Stupa initiative responds to a highly localized climate challenge, its approach offers broader lessons for designing and scaling community-led climate innovations.

1. The Ice Stupa demonstrates that scientific innovations are more likely to be adopted when they are **simple, locally feasible, and do not rely on resource-intensive infrastructure** or continuous external support. By enabling communities to construct, maintain, and adapt the structures themselves, the intervention strengthened local ownership and long-term sustainability.
2. The acceptance and continuity of the intervention were reinforced by its alignment with local values, traditions, and ways of relating to water and the landscape. **Embedding scientific solutions within cultural ethics** fostered trust, community ownership, and greater participation in the initiative.
3. The intervention illustrates that meaningful **scaling requires adapting solutions** to the ecological, geographical, and social context of each community. Variations in the design, height, and placement of Ice Stupas reflected differences in village location, water availability, and local resources, demonstrating that successful replication depends on contextual adaptation rather than uniform implementation.
4. The initiative maintained **community participation through continuous engagement** rather than one-time implementation. Cultural events, public demonstrations, competitions, and local symbolism helped keep the intervention visible, encouraged wider participation, and strengthened community ownership.



# Reviving Gondia's Lakes: Fisher folk's Stewardship and Climate Resilience in Rural Maharashtra

**Case Context:** In eastern Maharashtra's Gondia and Bhandara districts—once Vidarbha's 'Lake District'—fishing communities faced severe lake degradation due to invasive species, harmful practices, and erratic rainfall. In response, over 60 lakes were revived through habitat-based restoration rooted in traditional ecological knowledge, offering a powerful community-led model for climate resilience (Rajankar, 2020; Vikalp Sangam, 2021).

**Location:** The case is situated in the districts of Gondia and Bhandara, in eastern Vidarbha, Maharashtra. These low-lying districts, historically known for their network of rain-fed lakes and wetlands, form part of the Wainganga river basin and receive monsoon-dependent rainfall. The restoration initiatives cover more than 63 lakes across 43 villages in this region (Rajankar, 2020).

## The Climate Challenge

Climate variability in the region has manifested in several ways: delayed or erratic monsoons, rising temperatures, reduced lake hydro periods, and declining water quality. These changes have disrupted fish breeding cycles, increased evapotranspiration, and reduced the abundance of aquatic vegetation. The degraded ecological synchrony between monsoon rains, plant regeneration, and fish migration is central to the crisis. Moreover, elevated temperatures and shorter wet phases have contributed to oxygen stress in shallow lakes and increased the frequency of fish kills (Kale, 2014; Rajankar et al., 2011).

## Description of the Affected Community

The Dhiwar and tribal fishing communities in these villages have historically depended on the lakes for nutrition, economic sustenance, and community life. Declining fish stocks and lake health directly impacted their incomes, food security, and cultural practices. Women, in particular, were affected by reduced opportunities for fish drying, processing, and sales—key to household sustenance. With few alternative livelihoods and increasing climatic stress, these communities chose to take stewardship of the lakes into their own hands (Rajankar, 2020; Down to Earth, 2020).

## Description of the Community Led Action

Since 2009, community-led ecological revival has been spearheaded by fisheries cooperatives with the support of Bhandara Nisarga Va Sanskruti Abhyas Mandal (BNVSAM). The approach is grounded in traditional ecological knowledge (TEK) and combines physical restoration, collective governance, and social inclusion. Key interventions include:

- **Ecological Restoration:** The Dhiwars identified degraded lakes, manually removed invasive weeds such as *Ipomoea*

*fistulosa*, and ploughed lakebeds pre-monsoon to aerate sediment and encourage root systems. Native aquatic plants like *Hydrilla*, *Vallisneria*, and *Nymphoides* were reintroduced in synchrony with rainfall patterns, restoring fish nurseries and oxygen levels (Rajankar, 2020).

- **Revival of Indigenous Fisheries:** Once vegetative cover returned, communities restocked lakes not with exotic species but by encouraging the return of native fish populations, such as *Clarias magur*, through ecological cues and controlled migration from nearby water bodies (Vikalp Sangam, 2021).
- **Codified Resource Use Norms:** Cooperatives created and enforced local bylaws—banning destructive practices like dragnet fishing, prohibiting chemical use, and collectively agreeing not to introduce fast-growing exotic fish. Seasonal fishing bans were reintroduced to protect breeding cycles (The Better India, 2020).
- **Women's Inclusion:** Women actively participated in aquatic planting, fish drying, and lake monitoring. Their roles were institutionalized through inclusion in cooperative decisions and SHG-led microenterprises around fisheries (Vikalp Sangam, 2021).
- **Knowledge Sharing and Documentation:** The revival efforts were supported by knowledge-sharing platforms and local environmental education initiatives that documented seasonal indicators, local species behaviour, and restoration outcomes—ensuring continuity of traditional knowledge across generations (Down to Earth, 2020).

This deeply place-based, iterative, and ecologically literate model continues to thrive by blending traditional practices with responsive, decentralized governance.

## Impact

The initiative restored over 63 lakes across 43 villages through community-led conservation and governance efforts (Rajankar, 2020). Ecological restoration contributed to a twofold to sixfold increase in fish catch in many lakes, alongside the return of native fish species, strengthening both livelihoods and local biodiversity (Vikalp Sangam, 2021). Women's participation in fisheries cooperatives and ecological governance also increased, reinforcing inclusive stewardship of the restored commons. The revival of aquatic vegetation and fish refugia improved the ecological balance of the lakes and enhanced their resilience to rising temperatures and increasing rainfall variability, enabling these freshwater ecosystems to better withstand climate-related stresses (Rajankar et al., 2011).

Community-led lake restoration in Gondia and Bhandara has influenced local discourse on wetland governance, prompting recognition of traditional lakes as ecological

assets (Rajankar, 2020; Down to Earth, 2020). These efforts have inspired replication in nearby districts and reinforced the value of traditional ecological knowledge and women's roles in cooperative governance (Vikalp Sangam, 2021). Local authorities have begun engaging with such models in district planning discussions, reflecting a shift toward inclusive, low-cost climate resilience (The Better India, 2020).

### Major Challenges and Learnings

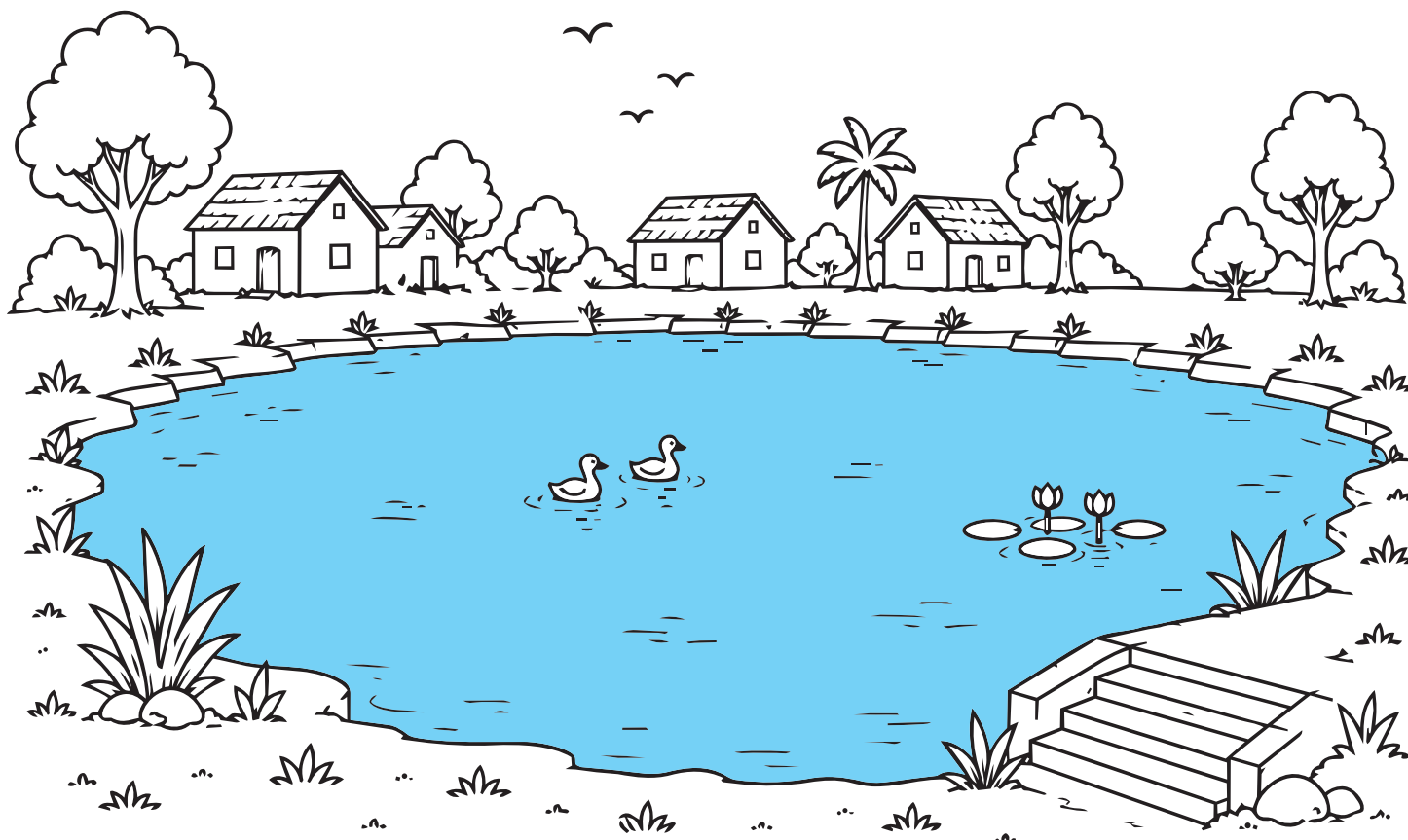
While the initiative has demonstrated significant ecological and livelihood benefits, it also faces important challenges. Manual restoration is labour-intensive and depends on sustained collective effort over long periods. The approach also encounters resistance from commercial interests that favour exotic fish species or mechanized dredging over habitat-based restoration. In addition, maintaining the health of restored ecosystems requires continuous ecological monitoring and sustained financial support.

At the same time, the initiative offers valuable learnings for community-led climate adaptation. It demonstrates that traditional ecological knowledge can provide solutions that

are both ecologically sound and culturally rooted. The active involvement of women strengthens **ecological governance** while improving livelihood outcomes, and **habitat-based restoration** emerges as a more sustainable and cost-effective alternative to heavily engineered approaches.

Community-led lake restoration in Gondia and Bhandara has influenced local discourse on wetland governance, prompting recognition of traditional lakes as ecological assets (Rajankar, 2020; Down to Earth, 2020). These efforts have inspired replication in nearby districts and reinforced the value of traditional ecological knowledge and women's roles in cooperative governance (Vikalp Sangam, 2021). Local authorities have begun engaging with such models in district planning discussions, reflecting a shift toward inclusive, low-cost climate resilience (The Better India, 2020).

1. The model, emphasizing habitat-based restoration, native species, and cooperative governance, is easily replicable in similar wetland regions across India. Its **low-cost, knowledge-intensive approach provides an alternative** to infrastructure-heavy wetland revival schemes. In fact, several other cooperatives in Vidarbha have already replicated this model (Down to Earth, 2020).





# Revival of Jakkur Lake in Bengaluru: A Community Mosaic for Urban Climate Resilience

**Case Context:** Jakkur Lake in north Bengaluru is one of the city's few successfully rejuvenated urban lakes, now functioning as a climate-buffering, people-managed ecosystem. Years of pollution, encroachment, and broken governance had degraded it severely. While the restoration was initially driven by public concern over pollution and ecological loss, it has evolved into a meaningful model for climate adaptation through inclusive, multi-stakeholder action (Citizen Matters, 2022).

**Location:** Located in northern Bengaluru, Karnataka, Jakkur Lake spans 160 acres, including a 55-acre wetland, and falls within a rapidly urbanizing zone. Historically, it served as a key irrigation source for surrounding agricultural lands and supported traditional fishing livelihoods. Over time, the lake evolved into a shared ecological and social space for a mix of urban residents, fisherfolk, civic volunteers, and informal settlers—each with differing, yet interconnected, stakes in its rejuvenation.

## The Climate Challenge

Bengaluru is witnessing a surge in urban heat island effects, water scarcity, and flash floods due to high surface runoff from concretized landscapes. Jakkur's surroundings once saw healthy rainfall absorption through agricultural wetlands. However, the lake's degradation in the 1990s—owing to construction, dumping, and sewage—meant a loss of local microclimate regulation. Climate change has worsened these impacts, with hotter summers and extreme rainfall leading to lake overflows and stagnant sewage zones.

There are different and varied layers of vulnerability observed. Heavy rains overflow the lake into low-lying slum areas, disrupting lives and damaging homes, while office-goers face flooded streets and delayed commutes. Fisherfolk see disrupted breeding cycles and unsafe water quality, while school children report increased heat stress and reduced access to green learning spaces.

## Description of the Affected Community

The Jakkur Lake zone hosts a layered, plural set of users: long-settled fishing families, apartment dwellers, informal workers, domestic workers, school groups, and civic organizations like Jalaposhan and PNLIT. These groups interact with the lake in different ways—fishing, walking, teaching, washing, or observing birds. Informal settlements nearby are most vulnerable to flooding and pollution, as they lack piped water and adequate sanitation. Women and children in these areas bear the brunt of environmental degradation, with exposure to mosquito-borne diseases and contaminated runoff.

Meanwhile, the urban middle class depends on the lake for recreational, and hydrological benefits—such as reduced temperatures, biodiversity, and improved groundwater

recharge. Civic groups seek the lake as a learning and public commons space, while fisherfolk view it as a traditional livelihood. These differentiated vulnerabilities shaped how restoration efforts were framed and understood, especially as climate-linked concerns like flooding, heat, and biodiversity loss gained visibility (India Water Portal, 2021).

## Description of the Community-Led Action

The lake revival began around 2005–06 with concerns over sewage inflow, siltation, and loss of biodiversity. The Bengaluru Development Authority restored the lake's physical structure in 2008. However, it was the local citizens, not the authorities, who catalyzed the ecological transformation. Jalaposhan, a citizen collective, mobilized RWAs, schoolchildren, fisherfolk, and civic volunteers to monitor, clean, and educate around the lake.

A decentralized model of stewardship took root. The constructed **wetland became a natural sewage treatment plant**. Treated water was routed into the lake, improving quality. Fisherfolk reintroduced native fish and stopped harmful aquaculture practices. School students began biodiversity mapping and air-water quality testing. Urban volunteers led composting drives and lake cleanups. Street vendors and walkers participated in public awareness events.

Women's groups played a pivotal role: they conducted plantation drives, coordinated community waste management, and ensured safety around the lake. **Civic campaigns** connected lake health with local experiences of heat and flood. People began to see that cleaning the lake could also cool their neighborhood or reduce flood damage. Lake walks and storytelling events became platforms to explain climate threats in accessible ways. The lake gradually became both an ecological commons and a civic space for dialogue, where climate impacts became visible and locally understood.

Anecdotal evidence and planning assessments indicate that these efforts have made measurable changes in microclimate regulation and public awareness. The presence of floating islands, wetlands, and tree belts has enhanced evapotranspiration and moderated local temperatures. Children and elders now report a noticeable difference in heat comfort along the lake path, especially during summer (Deccan Herald, 2023; Research Matters, 2023)

## Impact

The revival has led to improved water quality, stable water levels, restored wetland functions, and strengthened community engagement. Biodiversity has returned, with over 50 bird species and 30 aquatic plant species recorded. The fishers' cooperative now reports steady yields. The lake cools surrounding areas, helps recharge aquifers, and mitigates flooding impacts. A 2023

Research Matters report and local planning experts indicate that lake-adjacent areas like Jakkur experience 2–3 °C cooler temperatures compared to other parts of Bengaluru, due to the combined effect of restored wetlands, native tree buffers, and green cover (Research Matters, 2023; Deccan Herald, 2023).

Importantly, social impacts are visible. Civic participation in lake maintenance has increased. School engagement has fostered ecological learning. Communities are more aware of the connection between heat, water stress, and lake degradation. This has changed behavior—from water conservation to waste segregation—and sparked replication efforts at Puttenahalli, Kaikondrahalli, and other Bengaluru lakes.

The Jakkur model—community-driven wetland restoration, scientific monitoring, and inclusive governance—can inform efforts across India’s urban water bodies. Success hinges on engaging diverse stakeholders, treating lakes as social commons, and allowing flexibility in design based on community priorities.

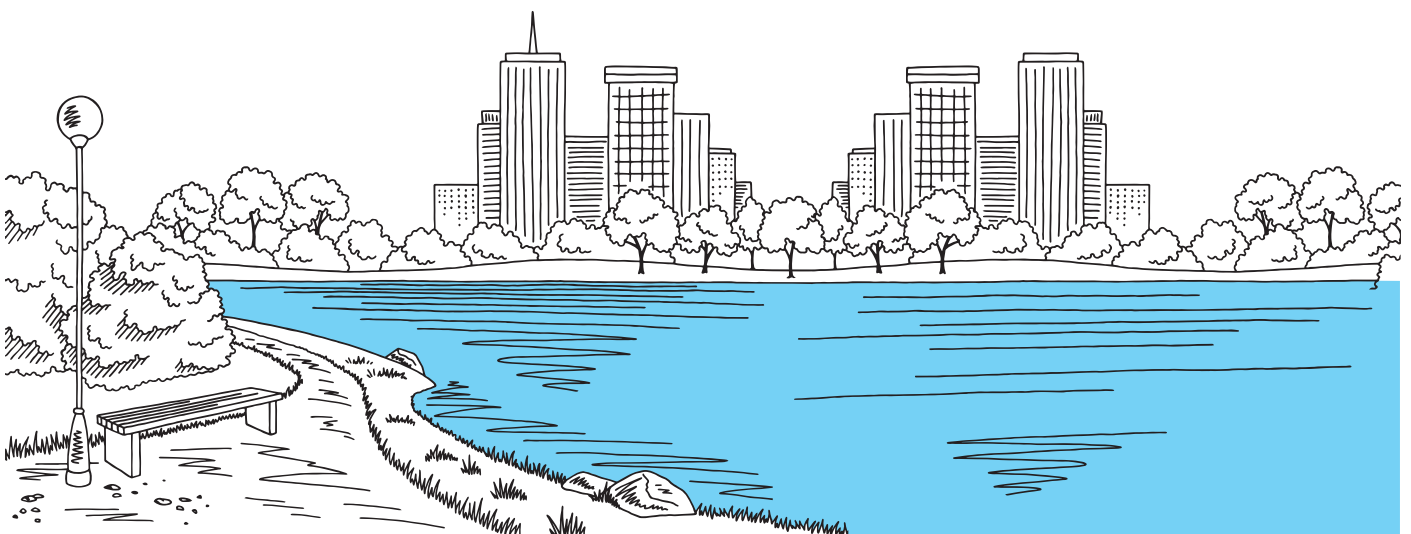
### Major Challenges and Learnings

It was observed that, while the main motivation behind revival may not have been climate resilience, the revival has effectively cooled the microclimate, buffered floods, and improved overall heat comfort for diverse stakeholders. A view from the system level shows that, Lake Governance remains fragmented across multiple city agencies. Encroachment and real estate pressure

threaten the lake’s buffer zones. Coordination between civic groups and officials requires constant negotiation. However, the Jakkur experience shows that inclusive lake management can strengthen urban climate resilience—not just through ecological gains but through civic empowerment, knowledge sharing, and addressing differentiated vulnerability.

Unlike rural cases where people directly experience crop failure or water scarcity, urban climate change is often diffuse and institutionally managed. People don’t necessarily connect flooding, heat, biodiversity loss, sewage, and water scarcity. This intervention succeeds because it makes those connections visible and gives citizens an active role in acting on them.

1. Ecological restoration becomes **embedded in everyday urban life** through walking, recreation, education, and community activities. When ecological spaces also function as civic spaces, communities develop a stronger sense of ownership and responsibility towards their conservation.
2. Climate governance in cities is strengthened through **distributed stewardship**. Rather than relying solely on municipal authorities, the intervention demonstrates how different urban stakeholders can collectively contribute to ecological restoration through clearly defined and complementary roles. Such distributed stewardship builds long-term ownership while reducing dependence on any single institution.





# Springs of Resilience: Community-led Revival of Traditional Water Resources

**Case Context:** In Uttarakhand's Kumaon region, centuries-old stone-built **naulas** (spring-harvesting structures) have dried up due to deforestation, cement repairs, and climate-driven declines in rainfall recharge. Villages are witnessing a resurgence of these community-managed water temples, restoring perennial springs through local action rooted in traditional architecture and spiritual conservation. This revival is a potent blend of cultural revival and nature-based climate adaptation (Vikalp Sangam, 2018).

**Location:** The Naula-revival are observed primarily in Nainital, Almora, and Chamoli districts—part of the Himalayan “water tower” catchment area. Villages like Satkhol, Salna, Nathuakhan, Chanoli, and Chatola are the sites where degraded springs have been revived through community mobilization.

## The Climate Challenge

The Kumaon Himalayas face complex and compounding climate vulnerabilities. Erratic monsoons and declining winter precipitation have led to drying springs and disrupted hydrological cycles (Yes! Magazine, 2023). Warming temperatures have intensified evapotranspiration, and deforestation of native oaks has weakened soil retention, worsening slope instability (CHIRAG, 2022). The loss of water from naulas has heightened drinking water scarcity, reduced agricultural viability, and amplified gendered burdens (India Water Portal, 2012). Beyond the physical impacts, climate change threatens local cosmologies—decoupling ancestral rituals from seasonal rhythms, and eroding community bonds historically maintained through collective water stewardship (Vikalp Sangam, 2018). Climate stress here is ecological, economic, emotional, and existential.

## Description of the Affected Community

Kumaoni villages depend on springs for household needs, farming, and cultural practices. As naulas began to dry, the impacts unfolded across multiple layers. Women took on increased labor—not just fetching water, but managing failing farms and food systems. Youth migrated, leaving behind elderly populations with reduced care networks. Cropping calendars faltered, and traditional ceremonies marking sowing, rain, or harvest waned. Once sacred, naulas became abandoned relics. This disconnection from place-based rituals and ecological rhythms has weakened cultural identity and intergenerational knowledge sharing, compounding the sense of vulnerability.

## Description of the Community-Led Action

Community-led revival of naulas in the Kumaon region has extended well beyond physical repair. Facilitated by local collectives and supported by the Central Himalayan Rural

Action Group (CHIRAG), the process began with **participatory hydrological assessments** and **spring mapping** to identify recharge zones and prioritize vulnerable sites.

A key local figure in this effort is Ratan Singh Bisht, known as the “**last naula builder**” of **Chatola village** in Nainital. As a master of dry-stone masonry, Bisht not only preserved traditional craftsmanship but also **trained village youth**, ensuring that intergenerational knowledge passed into contemporary restoration practices (India Water Portal, 2012).

Guided by such leadership, community members, particularly women, mobilized to restore degraded naulas. Through *shramdaan* (voluntary labor), they built **percolation trenches, check dams, and vegetative buffers** in catchment areas. Traditional masons reconstructed naulas using dry-stone techniques that allow natural water infiltration, avoiding cement that would otherwise disrupt the recharge process.

Women played a central role, leading sapling plantations and reviving cultural traditions such as the *Naula Poojan* ceremony—an annual spring worship ritual that invokes the blessings of the water deity and reaffirms collective stewardship (Vikalp Sangam, 2018). Water User Committees were formalized to manage maintenance funds, oversee equitable water sharing, and ensure ongoing ecological care.

Together, these efforts reactivated not just a water source but a deeply rooted ethic of community resilience, combining spiritual reverence, hydrological wisdom, and decentralized governance.

## Impact

The initiative has revived over 400 springs, significantly improving access to water and reducing the time and physical burden of water collection, particularly for women. In villages such as Bhadyun and Beduli, reliable spring flows have been restored even during the peak summer months, strengthening water security for both domestic use and agriculture. Restoration efforts have also regenerated oak-dominated catchments, improving soil moisture, biodiversity, and the overall health of the watershed. Enhanced water availability has increased the viability of local farming, helping reduce migration pressures by strengthening rural livelihoods. Beyond these ecological and economic gains, the revival of traditional Naulas has also restored their cultural significance, once again serving as important community spaces for social interaction, rituals, and collective life.

Inspired by the success in Satkhol and Chatola, communities in nearby Ramgarh village have revived their naula with similar participatory planning and traditional construction, led by local youth in collaboration with forest councils and village elders.

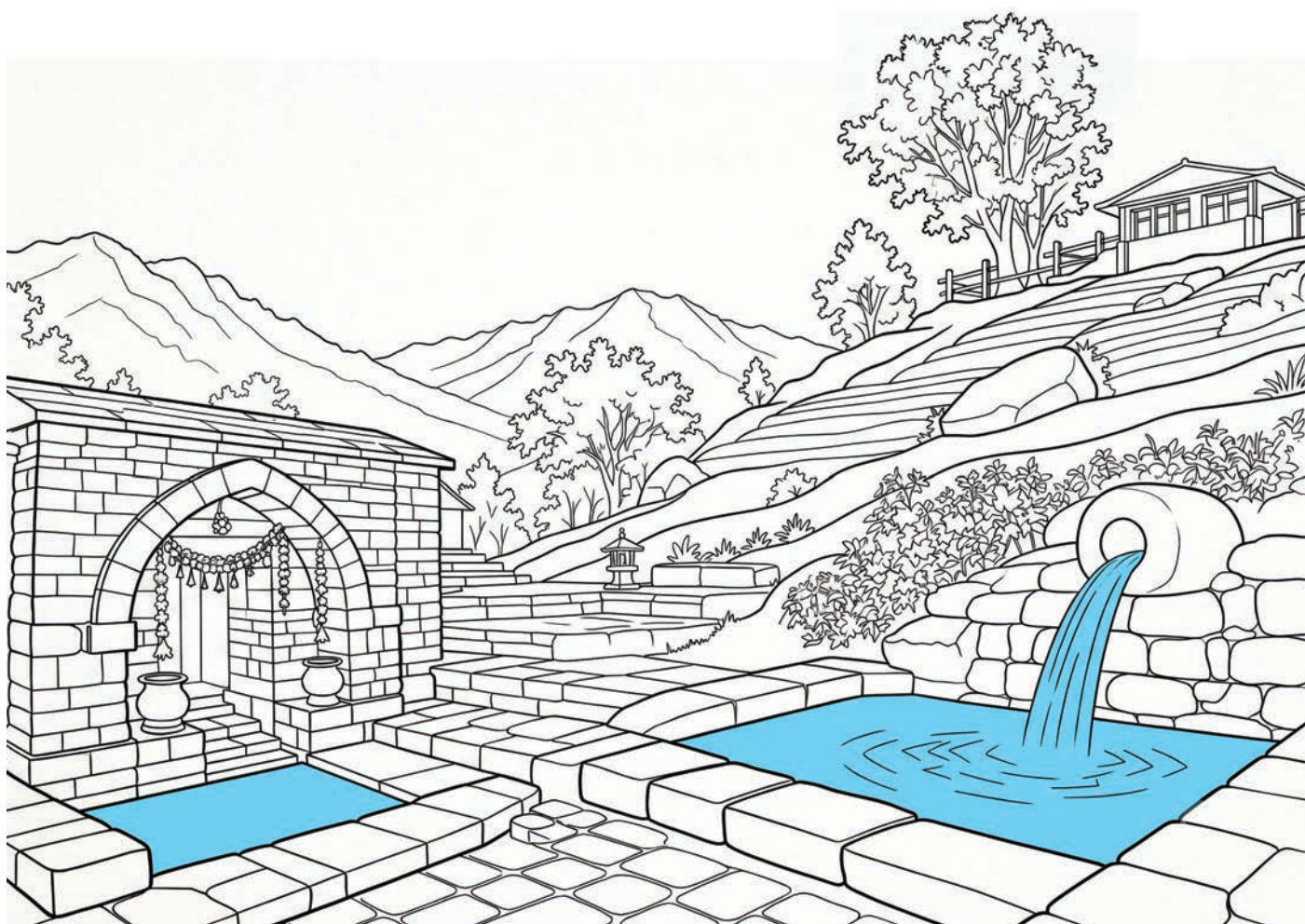
Community-led revival of naulas has influenced Uttarakhand's water governance, with district officials increasingly collaborating with Water User Committees (CHIRAG, 2022). Field successes have informed the State Action Plan on Climate Change, encouraging the adoption of springshed-based recharge models (Yes! Magazine, 2023). These outcomes reflect a growing policy interest in decentralised restoration that honours Traditional Ecological Knowledge (TEK), promotes gender-inclusive governance, and links ecological recovery with heritage preservation (Vikalp Sangam, 2018; India Water Portal, 2012).

### Major Challenges and Learnings

While the initiative has demonstrated significant success in spring restoration, several challenges remain. Securing access to land for recharge interventions continues to be difficult, particularly where private ownership or forest land regulations create constraints. The traditional knowledge required to

restore and construct Naulas is also at risk, as many skilled artisans are aging, highlighting the need to train younger generations to sustain these practices. Although women play a central role in implementing restoration activities, they continue to be underrepresented in leadership and decision-making committees.

1. At the same time, the initiative reinforces an important learning: **combining traditional ecological knowledge with hydrogeological science** leads to more effective spring recharge and strengthens the long-term sustainability of restoration efforts.
2. This decentralized, community-led model has organically expanded across hundreds of villages, with its principles now being emulated in other Himalayan states. Its integration of ecological restoration, **cultural values, and decentralized governance** makes it replicable in similarly vulnerable mountain regions.





# Rooted in Resilience: Women Reviving the Rainforest Ecosystem in Kerala

**Case Context:** Gurukula is a rewilding initiative that has become a botanical sanctuary *with the efforts of local women of Wayanad*, Kerala. Started by a conservationist, it has expanded into a woman-led, comprehensive climate initiative that integrates adaptation, mitigation, and intergenerational knowledge transfer.

**Location:** Wayanad District of Kerala, within the Western Ghats, is an ecologically sensitive mountain range and a global biodiversity hotspot. The region's tropical montane forests regulate monsoons, support endemic species, and sustain local livelihoods. This terrain is marked by high rainfall, rich biodiversity, and cultural interdependence between people and forests.

## The Climate Challenge

The Western Ghats face escalating threats from deforestation, monocultures, infrastructure development, and climate instability. These stressors have led to biodiversity loss, declining soil fertility, erratic rainfall, and increased risk of floods and landslides. Climate models predict more frequent extreme weather events in the region, intensifying risks for both ecosystems and people. (Vikalp Sangam, 2021)

## Description of the Affected Community

The communities surrounding Gurukula comprise mostly Adivasi groups and smallholder farmers who depend on forests for food, medicine, fuelwood, fodder, construction material, and spiritual practices. With limited access to formal markets and infrastructure, their livelihoods rely heavily on ecological stability. Forest degradation due to commercial plantations and infrastructure projects has disrupted this balance, eroding both subsistence and cultural lifeways. Depleted forest cover has also triggered a decline in soil fertility, reduced crop yields, and made hill slopes more prone to landslides.

Women, who traditionally manage water, fuel, and household subsistence, face heightened burdens as climate impacts multiply. Women and children are forced to travel longer distances to fetch water due to the drying up of springs once used for irrigation and drinking water. The erosion of indigenous ecological knowledge has further isolated them from decision-making about the forests they depend on. This is a lived experience of multi-layered climate vulnerability.

## Community Led Action

Started as a forest patch restoration by a conservationist in the 1970s, with community participation and initiative, Gurukula evolved into a Botanical Sanctuary. It is a woman-led model of conservation that **integrates forest ecology, local knowledge, and climate resilience**. Women have played a central role in identifying, collecting, and planting species that stabilise

soil, retain water, and sequester carbon. With techniques like canopy gardening, seed banking, micro-habitat creation, and reviving watershed systems, they have restored a rainforest with an expanse of 70 acres (The Guardian, 2025).

The sanctuary focuses on the propagation and reintroduction of **native rainforest species**—over 2,000 of them—to restore degraded landscapes and support biodiversity. The women of Gurukula refer to it as a 'Hospital' or care centre for endangered species. They develop and use **customised methods of cultivation for the vegetation in need**, advancing Reproductive life strategies adaptation. These interventions are designed to increase vegetation density, reconnect forest patches, and support species migration, essential for ecosystem adaptation in response to rising temperatures and erratic monsoons. These efforts apply to the kind of compost, irrigation techniques, and more elemental needs that these women identify and understand as a mother understands her child.

The forest gardens that mimic natural rainforest layers, are also designed and maintained, helping regulate microclimates and protect against soil erosion. These rewilded areas buffer the impact of cloudbursts and prevent flash floods by slowing down runoff. With growing climate instability, such nature-based solutions offer a replicable blueprint for climate adaptation.

As a creation of indigenous knowledge, Gurukula has become a centre of nature education for local women, disseminating proven restoration expertise and intergenerational learning. **Local women and youth train in ecological restoration practices**, combining observational science with hands-on care. It has also fostered a culture of ecological literacy, linking conservation to dignity, autonomy, and resilience. Women from diverse backgrounds are the primary stewards of the sanctuary, drawing sustenance and livelihood from its care and conservation. This initiative has empowered an ecological legacy deeply rooted in interlinked community and nature agency.

## Impact

Over five decades, the women of Gurukula have restored 70 acres of degraded land into biodiverse forest habitat. It has safeguarded endangered species, recharged groundwater, and revived perennial springs in surrounding areas. These outcomes have reduced local vulnerability to climate extremes, landslides, and water scarcity. (The Guardian, 2025)

Women involved in the sanctuary have gained recognition as ecological experts, seed conservators, and trainers. The initiative has revitalised traditional knowledge systems, empowered grassroots leadership, and improved intergenerational learning. Social cohesion and collective stewardship have strengthened local resilience not only to climate but also to social displacement.

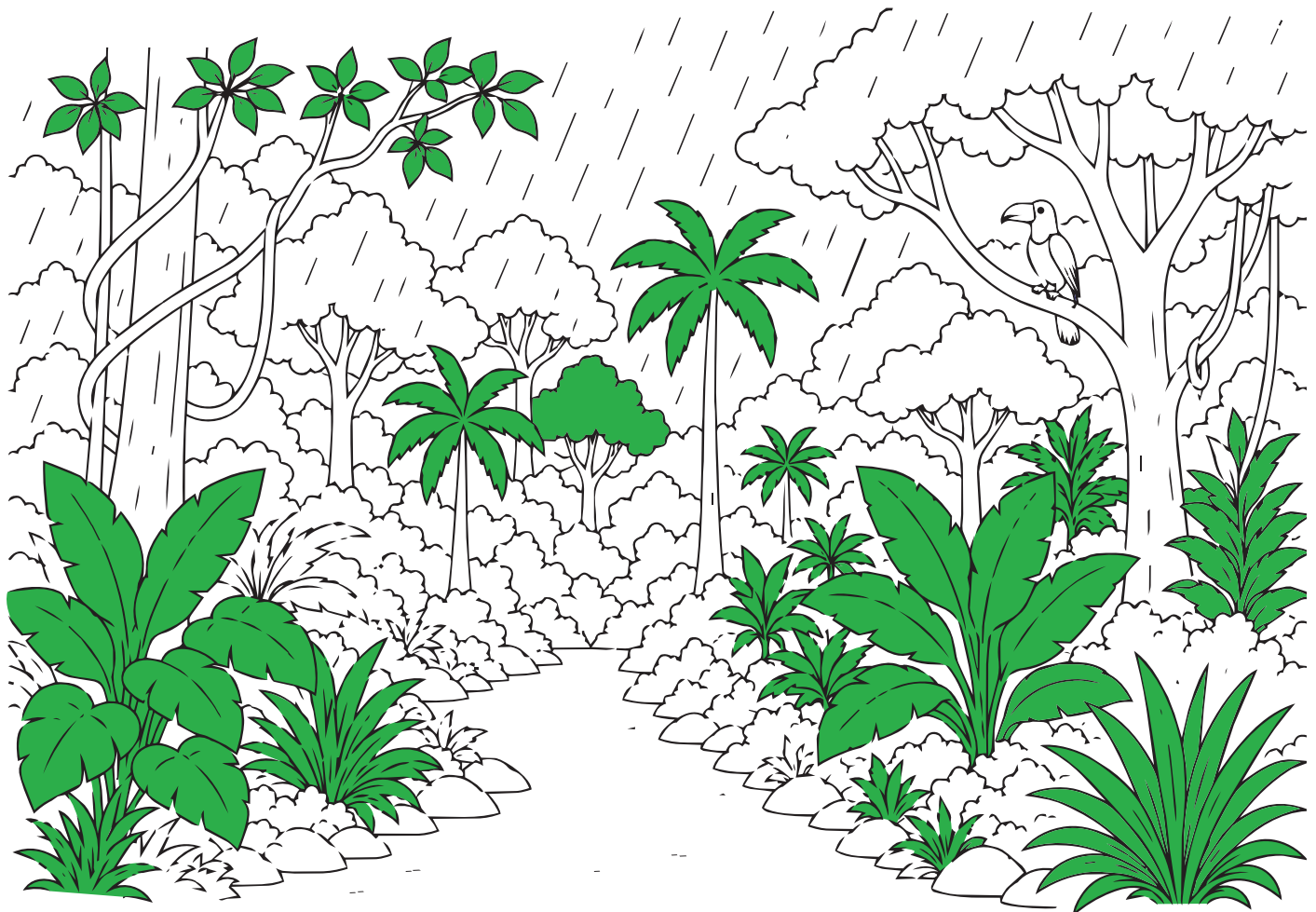
Gurukula is a community-and ecology-centred pathway that connects forest restoration, women's leadership, and biodiversity conservation. It is well-suited for other ecologically fragile and community-dependent landscapes. Its low-tech, place-based methods can be scaled with appropriate training, documentation, and policy backing. It has already inspired similar initiatives across India and influenced forest commons movements like Save the Western Ghats and Vikalp Sangam.

### Major Challenges and Learnings

Key challenges include resisting land-use change driven by tourism, plantations, and infrastructure projects. Institutional recognition of non-formal conservation work remains limited.

However, the sanctuary's work demonstrates that deep, long-term engagement with landscapes—rooted in care, patience, and local agency—can regenerate both ecosystems and social fabrics.

1. **Place-specific ecological knowledge guided every restoration decision.** Rather than applying standard restoration techniques, the community relied on intimate knowledge of native species and local ecological processes.
2. The sanctuary evolved into a centre of ecological learning because the restoration knowledge was **continuously shared with local women and youth.** This ensured that the practices remained living, adaptive, and community-owned rather than dependent on external expertise.
3. The initiative **connected conservation with everyday life by creating opportunities for livelihood,** leadership, and ecological education. As restoration became socially and economically meaningful, long-term community commitment and stewardship naturally evolved.





# People of the Forest: Tribal Adaptation and Restoration of the Forest

**Case context:** Kerala's forests face climate threats from deforestation, erratic rainfall, and invasive species. The Kadar tribe combats this through forest restoration—removing invasives, replanting native species, and reviving traditional practices—protecting biodiversity, forest-based livelihoods, and their cultural connection to the Western Ghats.

**Location:** Pothupara, Kerala, residence of the Kadar community, is a new tribal hamlet formed after a landslide in 2018. It has a cover of 400 sq. km. Some of the invasive species, like *Lantana camara* and *Senna spectabilis*, targeting particularly the Pothupara region of Kerala, were introduced to the region in the 19th century by colonial officials as ornamental plants. Their impenetrable thorns and invasion challenge the native species to break through them and survive. Over the decades, they have suppressed the native plants and changed the soil structure (Ala, 2020).

## The Climate change

Kerala has been experiencing massive climate degradation caused by progressively increasing long-term deforestation, rising temperatures, biological invasions, and unreliable rainfall. These slow-onset changes are weakening Kerala's ecosystems and permanently altering the structure and practices of the jungles and their inhabiting tribes.

Over the decades, the state has witnessed the conversion of forest land into plantations, losing 62% of green cover between 1950 and 2018. The devastating landslides of 2024 were exacerbated by deforestation and climate change, intensified rains, among other climate-harming human interventions. Increased and erratic rainfall intensity also creates a hospitable environment for the spread of invasive species (Down to Earth, 2024; Reuters, 2024; The Hindu, 2024). The 2019 Kerala Forest Survey (KFS) recorded more than 1,000 invasive species in the state's core forests. These invasive species outcompete and harm the native flora and fauna of the forest ecology and the local biodiversity.

Additionally, invasive species limit the foraging space for wildlife, and for the farmers, they threaten the availability of non-timber forest products, impacting local livelihoods.

## Description of the affected Community

The Kadar tribe is a small hyper-endemic tribe; they reside in the Anamalai hills of Kerala and Tamil Nadu. They are one of the 75 Particularly Vulnerable Tribal Groups (PVTG) in India. The majority of the population depends on forest-based activities, and on non-timber forest produce or Minor Forest Produce (MFP). Kaders, literally translating to 'Forest people', are famous for their great adaptability to the climate and changing topography of the forest. They live their lives closely attuned to nature. The tribals received their Community Forest Resource

(CFR) rights under the Forest Rights Act in 2014 (IJRAR / Ala, 2019/2020).

Their economy and lifestyle depend on the forest. They collect products like honey, fruits, and medicinal plants from the forest. Their fishing and hunting practices are affected by the biodiversity imbalance in the region. They largely depend on forest produce, which is threatened by invasive species.

They face a danger of losing their land through deforestation, degrading the environment, and intrusions by individuals into their ancestral territories. Reduction in forest cover due to deforestation, hydroelectric projects, and other anthropogenic activities, as well as restrictions on access to forests, have made it unsustainable for them to depend entirely on forests for livelihood and sustenance. Many work as daily-wage labourers or forest guards to get two square meals a day. The younger generation now grows up away from the settlement, in Model Tribal Schools and hostels around Thrissur and Palakkad.

## Community-led action

The Kaders are renowned as caretakers of the Western Ghats forests all along. They understand the general ecosystem of the area and are thus able to identify any slight changes in their environment owing to the generational expertise and knowledge transfer. As a sustainable community, they have always been open to change and collaboration to protect their forests. They have altered their practices, updated their systems, and lifestyle to put the forest first.

They exhibited consideration for nature's limits and openness to the Western Ghats Hornbill Foundation for the protection of the Hornbill. A small number of Kadar used to take hornbill chicks from nests when times were dire, which was not a problem when hornbills were abundant in the hills. However, by 2001, this became an unknowingly dangerous practice when 54 percent of the natural forest was felled by plantation owners and the state for teak and tea plantations (George, 2001), dwindling hornbill populations, and inducing more scarcity for the Kadar. With the Western Ghats Hornbill Foundation's (WGHF) awareness programmes, this practice of taking hornbill chicks has nearly become non-existent, with only one case reported in the last ten years (Bachan et al. 2013).

The Kadar tribe, in response to the invasive species dominating their forest resources, initiated a pioneering project to **restore natural forests and revitalise the forest ecosystem**. Maintaining their open nature and accessibility, they opened their **knowledge and skills to collaboration with the Kerala Forest Department**. They work along with Kerala Forest Department and local NGOs to eradicate illegitimate species and repopulate indigenous species, a community-led project approved by the nine tribal gram sabhas.

First, the members of the community identify the invasive species and undertake geographical mapping of the large infestations. Their legacy knowledge and innate understanding of the species of the forest make them sharp observers. They mapped 29 invasive species that needed safe eradication without damaging the native species and the neighboring environment. They actively remove these invasive plants, such as *Lantana camara*, *Chromolaena odorata*, *Mimosa diplotricha*, and *Mikania micrantha*.

They apply the cyclical method to maintain and monitor the restored area. They also use the scientific method of encapsulating the aim of ecological restoration as the systematic process of bringing degraded land to a stable, natural state.

The next step, therefore, is to reintroduce the native plant species to the area. The Kadar tribe, supported by a local botanist, developed nursery beds of indigenous species like bamboo, teak, and several herbal plants. These include *Myristica beddomei*, *Canarium strictum*, *Garcinia gummi-gutta*, *Phyllanthus emblica*, *Entada rheedii*, and more. These plants are vital for the community, as they provide forest products that locals rely on. These nurseries play an important role in providing healthy saplings to replace what has been removed by the clearing activities carried out for restoration purposes. The community uses its expertise to guarantee the new plants a protected, safe, and healthy environment to grow in.

**To maintain the success of the initiatives and continued collaborative effort, the tribe also organizes community collaborations with schools and local organizations.** They educate the co-inhabiting community about the need and ways to protect the native species of wildlife. They introduce their experience and inspire a consciousness of environmental protection among children.

The Kadar have **traditional protocols** to ensure the sustainable use of forest resources. Extraction of resources becomes unsustainable and exploitative when it does not ensure regeneration. Every practice of resource collection—be it honey, firewood, resin, or herbs—is designed to allow time for regeneration. When the population of dammar trees declined due to deforestation, they also stopped the over-extraction of resin from black dammar and white dammar trees, by ensuring that no more than one person extracts from a tree.

## Impact

The tribe is an exemplary case of an open, adaptive, and sustainable community that lives with and in tune with its forests. The Kaders have conserved the forest and reclaimed their forest from the ravages of colonial imprints. They have restored the forest health, improving forage availability for self and wildlife.

## Major Challenges and learnings

The initiative is labor and time-intensive. It requires sustained and community efforts. There is also a need for constant maintenance. The risk of regrowth mandates ongoing monitoring and management.

1. The initiative demonstrates how **CFR rights holders utilize traditional knowledge** to protect and regenerate their resources. Local governance is crucial, with Gram Sabhas overseeing the project. The Tribal community, armed with their knowledge of the forests and the rights conferred on them by the constitution through the FRA, 2006, takes care of the natural systems in the most adaptive ways.
2. The MGNREGA scheme also contributed to livelihood enhancement by employing tribal members for the eradication of invasive species and building supporting systems, underscoring the importance of **linkages between climate actions and institutional schemes and communities and institutions**. The collaboration between the tribal group and the forest department led to forest restoration.
3. **Coordination between multiple institutional stakeholders** is integral to knowledge transfer and continued action.
4. **Restoration is sustained through cyclical stewardship rather than one-time ecological interventions**. The process extends beyond invasive species removal to include continuous monitoring, native species regeneration, nursery development, and long-term protection, recognising restoration as an ongoing ecological responsibility.



# Building Defense: Living Fences for Cattle Protection and Forest Conflict

**Case Context:** The Adi tribe built “live fences” using trees and barbed wire to protect the culturally sacred Mithun. This innovation reduced human-animal conflict, curbed deforestation, revived Mithun populations, and promoted eco-friendly grazing through silvopasture.

**Location:** Mirem, Arunachal Pradesh, is a village in East Siang district, located within the biodiverse foothills of the Eastern Himalayas. The region is characterised by dense forests, high rainfall, and rich wildlife, supporting indigenous communities whose livelihoods are closely linked to forests, livestock, and shifting cultivation. Its ecological significance and dependence on natural resources make the landscape particularly sensitive to deforestation, habitat fragmentation, and changing climate patterns.

## The Climate challenge addressed through climate action

The Mithun (*Bos Frontalis*) is a semi-wild bovine. It is a cultural icon that is not just livestock in the forested hills of the eastern Himalaya- it is a sacred animal and a form of local currency. The communities that take care of Mithuns believe that the Earth’s well-being depends on the well-being of these cattle. Rituals, marriages, legal settlements, and all festivals are centered around Mithun.

Deforestation and climate change have led to an increase in human-animal conflict. Shrunken forest covers and expanding commercial agricultural frontiers have decreased grazing lands. From 2001-2023, Arunachal lost 262 sq km of forest (Global Forest Watch, 2025). Mithuns are attacked by dogs and farmers when they stray onto farms. The population of Mithuns in Mirem has dropped drastically from 300 two decades ago to just 50 by 2016. Mithuns have been classified as vulnerable by the International Union for Conservation of Nature, IUCN (BBC Future, 2024) (Hindu Press International, 2024).

The animal also has an ecological role in nurturing the soil health. Their foraging activities aid in the dispersal of seeds of various plants and trees, regenerating forests through their manure. Because of the depleting population of Mithun, the soil health is also rapidly degrading and requires External And artificial Nourishing interventions (PubMed Central, 2021).

## Description of the affected Community

The Adi Tribe is one of the major indigenous communities of Arunachal Pradesh, primarily inhabiting in the districts of Siang and Diabang. Adi means hill or mountain top people; they have lived for generations in harmony with the rugged terrain of the Eastern Himalayas. They believe in animism- all elements of nature, animals, rivers, forests, and stones are alive and sacred.

Mithun plays an important role in the socioeconomic and cultural life of the local tribal population. It serves as a symbol

of pride and local currency (Livestock Research for Rural Development, 2014). It is used in the barter trade in an ethnic society, as a bride price and settling legal disputes. Pressures such as deforestation, commercial agriculture, human-animal conflict, and climate change have threatened the way of life of the Adi tribal community. It has also affected their livelihood and income. Farmers have had to pay as high as 40,000 INR for crop damage when their Mithuns have strayed into another agricultural land because of a lack of grazing opportunities and fencing in the region.

Many farmers from the Adi community have stopped rearing Mithun because of increased conflict and decreased grazing. It has increased migration for work to cities in the community.

## Community-led action

The Adi community are the protectors of the Mithun. To protect the Mithun, the tribes came up with a **very innovative and feasible Fencing system**. The local community began building ‘**live fences**’. It is a sustainable innovation that uses barbed wire. The farmers **fix two living orchid trees together**, reinforce these fences with new trees planted between posts. It prevents the cattle from straying, hence reducing the conflict that arises between farmers and the consequential costs that the farmers have to bear.

The farmers tend to the fences at intervals, clearing out the weeds and checking them for any damage. Heavy rainfall sometimes leads to dangerous currents in the Remi River that can submerge fences. With maintenance, these wires can last up to 10 years or more.

The construction and maintenance of these fences is an easy alternative to the backbreaking labor of hauling logs to the hills for wooden fences, which were not efficient because of their small height that the Mithuns could climb over. The usage of wooden logs was also adding to the deforestation in the forest. Hence, the fences are also helping tackle deforestation. No one is allowed to cut trees after the fences have been put up. If anyone cuts a tree inside the community forest, the community has set up rules to pay a fine of Rs 500, or else they lose welfare facilities that the village council oversees (BBC Future, 2024).

## Impact

Since the live fences, Mithun population has increased from 50 in 2016 to 70 by 2020. The farmers have made a profit of rupees 9,75,000 during this period (BBC Future, 2024). Realizing the benefits, both economic and cultural, of rearing Mithun, many other farmers in the region have started to own Mithuns.

In Nagaland, efficient fencing has helped other livestock thrive. Protection and mindful grazing of Mithun leads to dispersal of seeds and spreading of manure, which boosted plant growth as well as grassland (Morung Express, 2022).

Silvopasture, the practice of grazing livestock among trees and shrubs, restores land and captures CO<sub>2</sub> (Frontiers, 2023). Mithun rearing is also less methane-intensive than cattle farming, further contributing to maintaining the health of ecosystems that are depleting because of climate change (IEA, 2025).

Silvopasture is an easy-to-replicate practice. It has been practiced in the eastern US as well, and reports have shown its significant positive impact on carbon dioxide sequestration (Frontiers, 2023). Establishing fences outside Nagaland and Arunachal Pradesh, from a point of scalability, can cost farmers up to 50,000. This project requires funding from the government, and its scalability depends on other factors such as grazing land and resources.

### Major Challenges and Learnings

The effectiveness of live fencing depends on continuous community maintenance, monitoring, and collective compliance, particularly in a landscape vulnerable to heavy rainfall and flood damage. As grazing lands continue to shrink

due to deforestation and expanding commercial agriculture, fencing alone cannot address the larger issue of habitat loss. The declining interest of younger generations in Mithun rearing, coupled with increasing migration for employment, poses a challenge to the continuity of traditional livestock management knowledge. In the long term, sustained conservation will require not only protecting the species but also ensuring that Mithun-based livelihoods remain economically and culturally viable for future generation

The intervention demonstrates that conservation is strengthened when it responds simultaneously to ecological realities and community livelihoods.

1. The live-fence innovation addressed human-animal conflict using locally **feasible materials and maintenance practices**.
2. The intervention combined ecological innovation with **locally enforced community rules and sanctions**, ensuring that restored landscapes and conservation gains were collectively protected over time.





# Cultural Revival Protects Forests: Sankirtan Mahila Mandali

**Case context:** In Keonjhar, Odisha, women from the Juang tribal community revived the traditional Sankirtan practice—transforming devotional song into a tool for forest conservation. Their awareness campaign significantly reduced forest fires and empowered women as cultural and climate leaders in their community.

**Location:** Angul and Keonjhar districts, are forest-rich districts in northern Odisha, forming part of the state's deciduous forest landscape and mineral belt. The region is home to several indigenous communities who depend on forests for food, livelihoods, and cultural practices. Rising temperatures, prolonged dry seasons, mining pressures, and increasing forest fires have made these ecologically significant landscapes highly vulnerable to climate change and biodiversity loss.

## The Climate challenge

India has recorded an alarming increase in forest fires, both in frequency and intensity, becoming one of the most fire-prone countries in the world. According to the Forest Survey of India (FSI), over 36% of India's forest cover is vulnerable to occasional fires, and nearly 10% is prone to frequent fires. Odisha is the second-worst-hit state by forest fire. The dry leaves of the deciduous forests are vulnerable to soaring temperatures in the state. Additionally, cultural leaf-burning activities lead to uncontrollable wildfires. Fires have already affected more than 4,500 hectares of area in Odisha (The Guardian, 2025).

Forest fires cause multi-layered and difficult-to-reverse damage. It significantly degrades soil and water systems, damages habitats, leading to loss of biodiversity, and adds to carbon emissions.

## Description of the affected Community

In the Murgapahadi village of Keonjhar district, the Juang tribal community's life and livelihood depend on its forest. The Juangs are classified as a primitive tribal group (PTG) by the Government of India (Murgapahadi village, VillageInfo.in, 2025). In this forest-dependent village, the women collect Mahua flowers, tamarind, honey, leaves, flowers, tubers and other forest produce that is consumed by their families and sold in the local markets. Burning leaves is a local practice of gathering. The fire clears the area of insects and snakes, making it safer for women to access the flowers. The burnt residue of leaves is also considered good for the soil by the community. Major fires impact both their earnings and nutrition- they lose forest produce and have to make do with the rice that they get from the government.

The Juang community ancestrally practiced shifting cultivation, food gathering, and hunting. Many have transitioned to settled agriculture. The community has also experienced male migration to cities like Hyderabad for job hunting. While the women of the

village bear the residual load of migration; they manage farms and keep their households running. Forest fire and migration deeply affect the ecological landscape, livelihood, and cultural heritage of the Juang community.

## Community-led action

Women are actively filling a cultural void left by the migrating men of their communities. Men used to exclusively practice and maintain the **Sankirtan Mandalis** - devotional musical groups in their villages. Sankirtan is an integral part of traditional village life. These mandalis, dating back to 15th century traditions of the Bhakti movement, are cultural troupes that perform devotional art involving song and dance, men playing cymbals and drums. This tradition is deeply woven into the religious and social fabric of communities in Odisha. It is deeply respected and revered. Migration declined this cultural space of interaction and dialogue; however, it opened an opportunity for women to reclaim this practice in a society where they are discouraged from even going out, let alone singing and dancing publicly.

The women reclaimed and revived this tradition to preserve their heritage and create a sense of community in a growing state of crisis. They accepted the proposal of the forest department to sing songs about forest conservation and preventing wildfires. The women-led Mandalis of the Keonjhar district sing lyrics in Odia, in the devotional rhythm of Sankirtan- *"Listen listen my dear sisters, brothers, don't set fire to the forest. If the forest survives, we survive...we get a healthy climate."* They sing in **local languages that are easily understood, widely accepted, and thoroughly enjoyed.**

The women actively write and perform songs on conservation in village daily life and other events. This tradition and its response to the environmental hazard have also encouraged young girls and students to join the troupe. Since women are the primary caretakers of the forest, this initiative is educational for both the performers and the audience.

The wide acceptance and cultural relevance of Sankirtan tradition enables and facilitates an easy and deep resonance with forest conservation awareness. The songs have a very strong appeal in the community; villagers believe them, and if they are asked not to do something, they obey.

## Impact

The forest department officials have reported a significant decline in the forest fire incidents in the district since the Sankirtan awareness initiative. There has been a 20-30% drop in fires in some areas. Ghatagaon forest range, where Murgapahadi is located, is among them. Omprakash Jena, a forest guard, credits Pradhan's troupe for the "minimal" forest fires recorded this summer, making up just 26 of the 600 fires that occurred in Keonjhar district (The Guardian, 2025).

This initiative has also created a greater sense of agency and empowerment among women of the community. This initiative has brought women, their relevance, and abilities, to the center stage of cultural and climate concerns.

The case of Murgapahadi has influenced women in adjoining villages and districts. The Forest Department has already enlisted 80 devotional groups for their conservation efforts across just Keonjhar district (The Guardian, 2025). They are now also taking projects from the forest department for other environmental causes. This model of awareness is being replicated for the cause of water conservation. This community-led initiative is based on a locally generated and self-motivated movement and tradition. There are similar traditions that are culturally rooted and accepted by the communities that can be used for climate awareness and action.

### Major challenges and learnings

Forest fire is a larger ecosystem issue that is not caused solely because of leaf burning by the villagers. They are also caused by rising temperatures due to rapid industrialization. The villagers, who face the brunt of this, cannot alone mitigate this problem. However, they have and continue to create influence on community behavior.

1. **Culture itself can function as climate infrastructure.** The intervention demonstrates that **climate communication** becomes more effective when it is embedded within **trusted cultural traditions and community institutions**. The intervention revitalized an existing and deeply respected cultural tradition, allowing climate awareness to emerge through familiar practices that communities already valued and trusted.





# Building houses and Flood Resilience: Tribal Architecture and Design

**Case Context:** In flood-prone Dhemaji, Assam, the Mishing community uses traditional knowledge and bamboo stilt houses (Chang Ghar) to adapt to worsening floods intensified by climate change- building resilience through indigenous architecture and ecological foresight.

**Location:** Dhemaji district in Assam is a flood-prone area, one of the most severely hit in India. In 2022, over 100,000 people in the district were affected by three waves of floods. The district is vulnerable to severe floods because of the abrupt slope of the river Brahmaputra that plunges from an altitude of 3000 meters in Tibet to less than 150 m at Pasighat in Arunachal Pradesh. When entering Assam, it creates tremendous pressure in the immediate floodplains of Dhemaji. There are a total of 26 unpredictable tributaries that pass through the district.

## The Climate change

Assam is among the 12 states in the Indian Himalayan Region, which is most vulnerable to climate change. Climate change projections for Assam indicate an increase in extreme rainfall events by 5-38% and floods by more than 25% by mid-century. Assam has been through a lot of severe floods disasters in the past. Floods have become an annual disaster in Assam over the past 10-15 years, affecting an average of around 930,000 hectares per year (Down To Earth, 2023).

A combination of climate change and the construction of infrastructure such as highways and airports is behind the increasing intensity of floods. These and other construction projects may be sited in flood-risk areas, but have insufficient drainage, with their hard, rather than porous, surfaces increasing run-off. Additionally, the geographical location of Assam brings it in the direct seismic zone. The 1950 Assam earthquake even shifted the riverbed of the Brahmaputra which made flood more frequent.

## Description of the affected Community

The Mishing community lives along the banks of the Brahmaputra River. A community of 700,000 people, they have co-existed with floods for decades now. The traditional knowledge of this community includes reading early warning signs, flood-resilient cropping, and architecture. They are known for practicing shifting cultivation. For centuries, this tribal community has been living close to the river, and they lead their lives in sync with the flow of the Brahmaputra. Many people from the community move away, especially during heavy currents and flood season, from their original habitat to a safer place.

They are forced to take shelter in the elevated community space. They lose their belongings, savings, utensils, and cattle that get washed away. The floods also pose a serious health, water, and sanitation concern for the community (Karuna News, 2024).

## Community-led action

The Mishing community's traditional weather forecasting and flood prediction methods have been passed down through generations. They have been navigating through Assam's frequent floods with their ability to read nature's indicators and prepare for the calamity in accordance with it. They use ants' behavior as a natural indicator for heavy rainfall. Ants are known for their sensitivity to environmental changes, particularly to moisture levels. When the community sees ants moving to higher ground, they interpret it as an act of seeking refuge from rising water levels.

The community uses their traditional knowledge to build **flood resilient houses**, which are called '**Chang Ghar**'. These houses are perched above the ground on bamboo stilts. Based on their predictions, the community keeps raising the height of the stilts above the flood level of last year. For instance, if water was up to five feet last year, this year the community would make stilts as high as 6 feet. The interiors have three shelves at different levels for storage of different kinds of materials, based on how securely one needs to keep them and their resistance to water in case it enters the house. They also have a balcony-like extension outside the well-ventilated house. Stilts provide a space that enables the flow of water beneath the house and thus continues protecting the living area from water incursion.

These houses are built with **locally available materials like bamboo, wood, and cane**. The community members keep the bamboo poles stacked and ready before the monsoons. Bamboo is feasible and the community adapts to it more efficiently than other concrete materials like cement or iron rod. It is lighter so it bends easily and also adapts to the scenario and requirement of the house. It can be cut within the period of three to five years depending on its variety and is an ecofriendly product compared to timber or cement.

The **flexibility and reliability of bamboo** also support the lifestyle practice of the community. The Mishing community lives with the river; they move with the flow of the river. The flexible nature of bamboo allows these houses to be makeshift. They can be easily dismantled and moved in case of a landslide or a change of river course that would influence the movement of the community as well. This can be done in a short time and cost-effectively. However, other concrete materials will be costly to move away from when required and may also change their community lifestyle and traditions of living with the river.

Since Bamboo is quite pliable, the structure can absorb and distribute the energy created by the seismic waves impacting the structure. The erecting technique applied for houses with bamboo involves cross bracing, which adds to the level of resistance that buildings constructed from bamboo demonstrate in an earthquake. In this method, several bamboo

poles are fitted together at different angles in such a way that they provide firm support for the structure that is under development, while at the same time, they can bend or twist without breaking.

Mishings also build **traditional man-made mounds**, known as '*kaso pithiya*'. They are used to solve the problem of waterlogging. These mounds are generally built in the shape of a semicircle, like the shell of a turtle rising above the floodwater. During a flood, land that is temporarily immersed in water can become waterlogged, which is when the soil becomes completely saturated with water that is unable to drain away. Building houses on top of kaso pithiya avoids floodwater weakening foundations, as they are raised above the water and will not get waterlogged. It also solves the problem of dirt and silt that is left behind when floods recede. Many communities even build these "highlands" to protect wildlife, as animals can take refuge on the soil mounds that rise above the water level during floods. The mounds are typically shaped like a semicircle and are designed to resemble a turtle's shell as they rise above the floodwaters. By creating these elevated platforms, people can protect their homes, livestock, and essential belongings from being inundated by floodwaters.

## Impact

Chang Ghar is disaster-resilient and does not get submerged during severe flood situations and it can be dismantled during soil erosion or riverbank erosion crises. It protects the community's life and storage.

The Assam government is already trying to adopt the Chang Ghar design in all Mishing-dominated areas. This concept is now replicated and scaled up by other communities and families who are living in severe flood-prone areas along the river basin.

Some cultural taboos or norms, however, play a deterring role in its replicability, because some communities do not want to implement a housing technique that is so strongly associated with a different group. The Mishings are recognised as a Scheduled Tribe under the Indian constitution, indicating a history of socio-economic marginalisation. More privileged communities can be resistant to adopting practices from those they have historically looked down upon.

Pradhan Mantri Awaas Yojna has incorporated Chang ghar as a component under the scheme, and plans to scale in the flood-prone regions of Assam.

## Major challenges and Learnings

The houses may not get inundated, but the bamboo may still suffer damage depending on the force of the water. Many people, for this reason, have adapted to concrete pillars using iron rods and cement. It is also an improvisation and adaptation to the design. However, it is not feasible because of the extra cost it incurs that many economically vulnerable can't do. The poor can't afford it.

1. The community does not reproduce its traditional practices unchanged. Instead, it **continually modifies** housing design, stilt heights, storage systems, and settlement patterns based on changing flood levels, demonstrating that traditional ecological knowledge remains effective because it evolves with environmental change.
2. The intervention relies on materials such as bamboo that are **locally available, affordable, repairable, and familiar** to the community. Such context-appropriate solutions reduce dependence on external resources while allowing communities to independently maintain and adapt their infrastructure.
3. The flood-resilient houses **support the Mishing way of living** with the river, seasonal mobility, and cultural practices. Because the intervention accommodates existing livelihoods and traditions, it is naturally sustained and passed across generations.
4. The integration of Chang Ghar under the Pradhan Mantri Awaas Yojana demonstrates how **public institutions can strengthen community-led adaptation by recognizing and scaling locally proven practices**. These, if, implemented widely can also provide support to the economically weaker sections of the society who may not be able to effectively build and use this climate-challenge solution.





# Forest Guardians: Women as Frontline Forest Firefighters



**Case context:** Facing rising forest fires in Uttarakhand, women's groups mobilized to douse flames and restore ecosystems through oak reforestation, offering a low-cost, community-led model of ecological stewardship and climate resilience.

**Location:** Almora, Rudrapur, Uttarakhand is a semi-arid landscape, marked by prolonged dry spells and degrading soil, is increasingly vulnerable to forest fires intensified by climate change and erratic rainfall patterns. Cultivation of pine, introduced by the British as a commercial crop, has proven to be extremely detrimental to the ecosystem of the region. Its needles are coated with inflammable wax, creating an unsuitable ground for other native species. In the current extreme heat conditions, pine exacerbates the vulnerability of Uttarakhand to wildfires.

## The Climate Challenge

India has experienced an alarming increase in forest fires, both in frequency and intensity, making it one of the most fire-prone countries in the world. According to the Forest Survey of India (FSI), over 36% of India's forest cover is vulnerable to occasional fires, and nearly 10% is prone to frequent fires (Forest Survey of India, 2021). Every forest vegetation presents challenges that are unique to its nature and people.

In June 2004, Uttarakhand experienced an all-time low rainfall, receiving just about 21 mm of rainfall, which is 75% below normal. The region has also witnessed extreme heat waves with temperatures soaring between 40 and 44°C. Such climatic

conditions make Uttarakhand extremely vulnerable to forest fires. These wildfires, both deliberate and accidental, are caused by an acute lack of awareness; over 95% of the five fires are man-made in Uttarakhand (Forest Research Institute / FSI, 2019/2024). The sheer volume of cases reported in the last decade has alarmingly increased in Uttarakhand. The prolonged dry spell from February to June, locally referred to as fire months, is particularly difficult.

Wildfires are a cause of climate change and consequently change the climate.

## Description of the Affected Community

Forest fires cause damage to forest produce, biodiversity, and environmental systems. Communities living in Uttarakhand, especially women, interact with these forest resources on an essential basis in their lives. With burning forests, several springs have been drying up lately, increasing the burden on women to walk further distances to fetch water. The community has experienced financial losses due to the loss of timber, and the forest department experiences revenue loss because of fires. In Almora and Chamoli, van panchayats have reported up to 60% decline in NTFP collection due to recurring summer fires. (CarbonCopy, 2024) There has been a decline in apple orchards, with rising temperatures. Both flora and fauna are losing their habitat (India Today, 2024).

## Community-led action

In April 2021, a group of Self-organised women across Kumaon and Gharwal districts, in the villages of Sitlakhet, Dhanachuli and Chamoli, mobilized during the peak fire season. These groups known with different names such as, *'Jungle ke Dost'* in Sitlakhet, took the self-driven initiative of detecting and dousing forest fires.

Women use **basic tools to extinguish fires**. As soon as there is information, from their village networks, about the forest fire, these groups gather and proceed towards the location of the disaster. They make lines and extinguish the fires with tree branches. Many times, they cross the forest fire lines to douse fires that spread from tree to tree. They consider themselves to be the guardians of the forest and assume the responsibility of taking care of it today, so that it can provide for generations tomorrow.

These women **fill the big gap of manpower required for forest care**, especially in cases of wildfires in the forest department. This community initiative and motivation are a great asset to the forest department. Officials have been actively collaborating and engaging with these community forest fighters. The Mahila Mangal Dal of Bheeri village also formally submitted a written proposal to the forest department to take immediate legal action against the individuals guilty of deliberately igniting forest fires.

Women inspire each other across villages and districts of Uttarakhand. Mahila Mangal dal convenes regular meetings to track their progress and encourage others to protect the forests.

Over the last decade, with support of local NGO's and the government, the community has been **actively replacing Pine with Oak**. It has an unparalleled water storage, creating reservoirs that sustain the oak and other crops around it. The Oak reforestation initiative mitigates both forest fires and resolves soil degradation, addressing the larger biodiversity and ecosystem damage.

## Impact

There has been a reduction in fires, the ground reports indicate a faster local response that is very efficient. This initiative empowers women who were limited to their domestic lives; they have now gained recognition as ecological stewards.

The government hires about 4,800 fire watchers seasonally across Uttarakhand, half of them are women in areas like Nainital and Almora district (Uttarakhand Forest Department, 2025).

Women are inspired by neighboring villages making it a movement of women protecting forests. That is an organic replication of this low-cost initiative through local inspiration.

## Major challenges and Learnings

Extinguishing forest fires is a risky voluntary initiative. Women extinguishing fires with tree branches face extreme danger with a lack of proper gear. There is little to no compensation or formal status granted to these voluntary activists.

The intervention, however, demonstrates that climate action is strengthened when it emerges from strong community ownership and is embedded within existing social institutions and ecological relationships.

1. The intervention combined emergency fire response with the long-term replacement of fire-prone pine forests by native oak species. **Responding simultaneously to the disaster and its ecological drivers** strengthened the sustainability and long-term impact of the initiative. Addressing immediate risks alongside long-term ecological restoration strengthens intervention outcomes.
2. The women did not function as substitutes for government agencies but as community partners who complemented the Forest Department's efforts. This **collaborative model** increased the effectiveness of both community action and institutional response.
3. By recognizing local knowledge and **creating formal roles** for existing community leaders, institutional support enhances both the legitimacy and long-term sustainability of the initiative.



# River Memory, Climate Change, and the Making of a People's Archive in Northeast India

**Case Context:** As Northeast India faces intensifying climate variability—especially erratic rainfall and flooding—river-dependent communities are increasingly disconnected from traditional water knowledge and seasonal cues. In this context, documenting lived experiences of rivers has emerged as a climate-adaptive act, preserving memory and traditional ecological knowledge (TEK) to inform future action. The 'Digital River Archive', a people's initiative, seeks to build a repository of oral histories, folklore, and environmental transformations from the region's riverscapes.

**Location:** The Digital River Archive spans the northeastern states of Assam, Arunachal Pradesh, Manipur, Meghalaya, and Nagaland. These regions are deeply riverine, shaped by major river systems like the Brahmaputra and Barak and their tributaries.

## The Climate Challenge

Northeast India is among the most climate-vulnerable regions in the country, facing a surge in hydrological volatility. The Brahmaputra and Barak river systems now experience erratic rainfall, shifting monsoon onset, unseasonal dry spells, and devastating floods, all of which are intensifying with climate change (Northeast Climate Research Centre, 2023). Glacial melt from Himalayan tributaries compounds the flood risk, while landslides triggered by intense rainfall events bury fields, displace homes, and block waterways. Siltation patterns are increasingly unpredictable, making fertile river islands vanish or shift location entirely. Seasonal signs that once guided sowing, fishing, and navigation no longer align with expected timings. These changes are not only ecological but cultural—disrupting deeply held practices like boat festivals, water rituals, fishing bans, and land inheritance customs. Communities living in floodplains and along riverbanks—already grappling with marginalization—now find their traditional knowledge systems eroded by rapid, unrecorded climate shifts. The urgency to preserve, reinterpret, and share river memory as a form of climate knowledge thus became a necessary, adaptive act.

## Description of the Affected Community

The affected "community" is not a single, cohesive group, but a diverse, amorphous network of river-dependent populations across the northeastern states. These include tribal groups like the Karbi, Garo, Dimas, and Khasi; Bengali-origin riverine settlers; indigenous fisherfolk, boatmen, jhum cultivators, and forest gatherers. What unites them is their deep reliance on rivers for livelihood, ritual, identity, and mobility.

Despite their geographic dispersion and cultural differences, these communities share common experiences of climate stress—submerging land, shifting fish patterns, and

disappearing river channels. Yet, they also share a rich, fast-disappearing knowledge system passed down through songs, oral maps, and ecological rituals. The river archive project has brought these groups together through schools, local artists, teachers, boatmen's collectives, and elders to create a shared digital commons that can serve as both memory and early-warning system in an era of changing climate.

## Community-Led Action

The Digital River Archive, conceptualised by a group of young researchers and practitioners from the Northeast, is built on deep-rooted **community partnerships and intergenerational knowledge sharing**. The initiative began with village storytelling circles, where elders recounted memories of river floods, droughts, fish cycles, and boat routes. Local artists and youth volunteers helped record these oral histories using mobile phones and community cameras.

Rather than extracting data for scientific use, the archive was designed for and by the community. Contributors came from diverse contexts: a Khasi elder documenting rituals held during upstream flooding; a schoolgirl in Dibrugarh mapping her grandmother's water songs; and a Karbi farmer recounting how the river "spoke" before a flood. Fisherfolk shared stories of lost estuaries, while jhum farmers narrated how soil moisture changed with the disappearance of tributaries. These narratives were collated digitally, translated, and categorised thematically (ritual, flood memory, plant lore, river disputes) to make them accessible and interlinked.

Importantly, the archive helped reclaim river narratives from purely technocratic lenses—centering lived experiences and opening room for folk interpretation of climate shifts. For many, participating in the archive became a way to assert river belonging, preserve cultural continuity, and create climate awareness across generations. Students from riverine schools were involved in scanning boat licenses, drawing river maps, and even composing songs around disappearing fish species. This participatory process gave legitimacy to community knowledge, sparking local initiatives around riverbank repair, seed preservation, and seasonal calendar revival.

By documenting oral histories, forgotten practices, and place-based knowledge, the archive becomes more than a digital repository—it is a living map of how communities once lived in deep rhythm with their rivers. These testimonies include ecological observations, seasonal patterns, food habits, flood coping techniques, and riverine rituals that could prove invaluable as India navigates a future shaped by climate unpredictability. In a region highly vulnerable to glacial melt, floods, and erosion, such an archive serves as both a cultural memory and a practical climate adaptation tool. From ancestral recipes that used flood-resilient crops to oral accounts of

pre-dam fisheries and forest-based livelihoods, this people's biography of rivers may well inform tomorrow's climate-resilient lifestyles and policy frameworks

## Impact

The Digital River Archive now holds hundreds of entries, including songs, folk narratives, historical records, and oral maps of climate impacts. It has restored dignity to traditional river knowledge and enabled communities to frame their own climate narratives. In several districts, teachers use the archive in schools to explain seasonal changes and local ecosystems. Elders who once felt excluded from formal processes now feel heard, as their stories shape digital river atlases. In Assam, school children used archive materials to map pre-flood safe zones based on elders' memories. In Meghalaya, archive conversations led to the revival of a river deity festival that hadn't been observed in 15 years. These are not mere cultural acts—they are adaptive responses that reconnect memory, ecology, and climate action.

## Major Challenges and Learnings

Limited digital access and slow internet in remote villages initially hindered real-time uploading of content. Translating oral knowledge into digital form required culturally sensitive methods to avoid oversimplification. A key learning is that "community" is not always spatial—it can be relational, built

through shared memory, risk, and storytelling. The project also faced the challenge of balancing personal river memory with scientific framing, and ensuring inclusivity across gender, caste, and language groups.

Despite these hurdles, the archive thrives as a collective counter-narrative to dominant, top-down climate discourse, with the support of following practices.

1. The initiative created opportunities for elders and younger generations to collectively document river histories, environmental change, and lived experiences. This **intergenerational exchange ensured that traditional knowledge was interpreted and carried forward** by those who will continue to experience and respond to future climate challenges.
2. **Integrating knowledge into daily practice strengthened its relevance, ownership, and long-term retention within the community.** Knowledge was embedded within everyday life through observation, documentation, storytelling, and community engagement, making learning an active and lived process rather than an external transfer of information.
3. **Investing in community researchers builds locally relevant climate knowledge and action.** The intervention highlights the value of training and supporting young community researchers who possess a deep understanding of their social, cultural, and ecological contexts.





# Radio Bundelkhand: From Community, for the Community

**Case Context:** In drought-prone Bundelkhand, where erratic monsoons and water scarcity threaten rural livelihoods, community-run Radio Bundelkhand empowers locals with climate information, traditional knowledge, and access to schemes, building resilience through hyper-local, participatory communication.

**Location:** The Bundelkhand region, spanning parts of Madhya Pradesh and Uttar Pradesh, is one of India's most drought-prone and ecologically fragile zones. Over the last two decades, the region has witnessed increasing aridity, erratic monsoons, groundwater depletion, and declining agricultural productivity. The area is highly dependent on monsoon-fed farming and has seen distress migration, crop failures, and ecosystem degradation as recurring features.

## The Climate change addressed

Madhya Pradesh faces increasing climate variability with rising temperatures, erratic rainfall, frequent droughts, and water scarcity impacting agriculture and rural livelihoods. According to reports by the National Institute of Disaster Management (NIDM) and the Indian Council for Agricultural Research (ICAR), Bundelkhand has faced a rainfall deficit of 40–60% in multiple years between 2002 and 2020. With rising temperatures and overextraction of groundwater, local communities, especially small and marginal farmers, struggle with both water and food security.

## Description of the Affected Community

The communities most affected are rural households engaged in subsistence agriculture, animal husbandry, and forest-based livelihoods. These include Scheduled Castes (especially women), landless labourers, and tribal families in and around Orchha, Jhansi, and Tikamgarh. The region has a high rate of illiteracy, seasonal migration, and compounding social vulnerability. Women and youth are often excluded from formal information networks. Local dialects like Bundeli are widely spoken, but mainstream media rarely use these, further marginalizing access to climate-related knowledge and government schemes.

## Community initiative

Radio Bundelkhand was launched in 2008 to tap into community knowledge and motivation to navigate through their climate challenges. It was conceived as a tool to bridge the communication gap between policy and people by Development Alternatives (DA). The radio began by training a few youths from the Orchha area to record and broadcast local news, traditional songs, and stories related to farming, health, and the environment. Over the years of operation and evolving phases, Radio Bundelkhand gradually and deliberately shifted toward full community ownership.

**Phase 1:** NGO-led capacity building (2008–2012). DA provided infrastructure, technical training, and editorial support. The initial radio team consisted of local youth, mostly women, trained in journalism, audio editing, and field interviews. At this stage, DA managed content curation and funding while fostering local participation.

**Phase 2:** Co-creation and community governance (2013–2016). As listenership grew and community trust deepened, content production became collaborative. Villagers began suggesting topics, sharing stories, and becoming field reporters. A Community Advisory Board was formed with elders, women's group leaders, and teachers, who provided monthly feedback and helped mediate issues of local relevance. Women from self-help groups (SHGs) demanded regular airtime for issues like forest rights, water access, and menstrual health. Their leadership in content development redefined programming priorities. Regular programs focus on Sustainable farming and soil health, Water harvesting and drought-resilient crops, Women's health, migration, and labour rights, Government schemes (PM-KUSUM, MGNREGA, Jal Shakti Abhiyan), and Indigenous knowledge systems for weather prediction and seed saving.

**Phase 3:** Full local management (2017–present). In 2017, Radio Bundelkhand formally transitioned to being run and managed by a local community trust, with editorial autonomy, local hiring, and decentralized decision-making. Today, the team comprises 10–12 people, including Field correspondents (all from local villages), A female station manager, technical operators trained by DA but now independent, and a rotating panel of community contributors.

The NGO continues to provide back-end mentorship and funding linkages, but the day-to-day operations are fully local. Equipment maintenance, editorial direction, outreach, and partnerships are decided by the local team.

The station operates at 90.4 FM and broadcasts within a 15–20 km radius, reaching around 200 villages across the region. Programming is done in Bundeli, the local dialect, with an emphasis on interactive formats like phone-ins, community discussions, and folk storytelling to engage listeners directly.

In listener sessions, villagers discussed climate stressors on farming, heard relatable Bundeli dramas

featuring characters like “Bairu Bhauji” and “Devar Lal Singh,” and learned locally contextual adaptation practices.

Under the effort of Narrow broadcasting, a dedicated team of Community Radio Reporters (CRRs), primarily village residents, including women and youth from marginalized groups, visits village listener groups twice per week. These groups usually consist of farmers, women, adolescent girls, and elders, often clustered at anganwadis, schools, or SHG meeting spaces.

During sessions, programming is aired using mobile transmitters, followed by facilitated discussions and feedback collection, shaping future content and topics. Many women and elderly listeners in Bundelkhand don't own radios or smartphones. Narrowcasting ensures equitable access, especially to those often excluded from mainstream media consumption.

## Impact

The impact of Radio Bundelkhand has been wide-ranging and deeply felt. Farmers in over 50 villages have shifted to drought-tolerant millets and adopted micro-irrigation after listening to episodes on soil health and seed banks. Rainwater harvesting techniques and kitchen gardens have also seen uptake. The station partnered with local water user associations to demystify the Jal Shakti Abhiyan and revived community ponds through collective action after a dedicated radio series.

Radio Bundelkhand gave rural women a platform to speak publicly in their dialect. Several female radio reporters have become local leaders and trainers.

Listeners report improved awareness of health, hygiene, domestic violence, and rights-based entitlements.

## Major challenges and Learnings

Without sustained grant support or ad revenue, many community radios struggle with financial sustainability. Rural

internet and electricity access remain a challenge for back-end operations and digital archiving. However, the community has responded to the challenge with field visits and 'narrow broadcasting'.

Radio Bundelkhand serves as a template for participatory media in ecologically fragile regions. Community radios can address climate change in hyper-local ways, with external incubation support that is rooted in community ownership and autonomy. The model has already inspired similar efforts in Rajasthan (Radio Mewat), Chhattisgarh, and Jharkhand.

The intervention offers important learnings on how externally facilitated initiatives can evolve into sustainable, community-owned systems.

- 1. Community ownership is built through intentional scaffolding towards sustainability.** The initiative demonstrates that sustainable community-led action requires a deliberate process of transferring ownership. Through phased capacity building, community members were first trained, then engaged in advisory and decision-making roles, while the institutional resources and support systems required for long-term functioning were established alongside them. This intentional scaffolding enabled the initiative to gradually shift from being externally facilitated to being locally owned and led, strengthening its sustainability beyond the period of direct intervention.





# Beyond the Smoke: Women-led Air Quality Monitoring in the Coal Heartland of Jharkhand



**Case Context:** Communities in Jharkhand's coal-mining belts—especially Bokaro and Dhanbad—face extreme air pollution from coal dust, thermal plants, and open-cast mining. Though they contribute little to climate change, these communities endure its worst consequences, including more frequent

heatwaves. Rising heat in Jharkhand interacts with fine particulate matter (PM<sub>2.5</sub>), worsening health risks and turning coal pollution into a growing climate challenge (Outlook Planet Desk, 2025).

**Location:** The case spans ten panchayats across Bokaro and Dhanbad districts, including mining-adjacent areas near Jharia's coal fires and the Bokaro Thermal Power Station. These locations include villages and rural stretches directly affected by open-cast coal mining and persistent black dust in everyday spaces like schools and health centers (Hariram et al., 2022).

## The Climate Challenge

The link between air pollution and climate stress is becoming more visible in Jharkhand. With around 590 heatwave days recorded since 1990—and most of them after 2000—the region faces rising temperatures that intensify the impact of air pollution (Outlook Planet Desk, 2025). Extreme heat increases ground-level ozone and allows coal dust to remain airborne longer, making PM 2.5 exposure worse. Sulfur dioxide, black carbon, and heavy metals from coal operations become more hazardous under heat stress, affecting women and children the most (Wikipedia, 2023).

## Description of the Affected Community

The rural panchayats near Dhanbad and Bokaro house subsistence farmers and informal workers, many of whom live just metres from mining zones. These communities rely on wood-burning stoves and own few vehicles, keeping their carbon footprints minimal. Yet they live in regions where coal extracted for distant power stations severely impacts their health. Health centers report chronic respiratory illnesses among children and elders. In some parts of Jharia, up to 90% of the population is affected by breathing difficulties (The Telegraph, 2024). Local women have long noticed black soot on windows, bedding, and water vessels—markers of a deepening environmental crisis they did not create (Kashmir Times, 2025).

## Description of the Community-Led Action

In 2024, a group of trained women volunteers called Paryavaran Sakhis began monitoring air pollution across 10 panchayats. These women, including community leaders like Sushma Devi from Parjoria and Rekha Devi from Bokaro, used portable sensors to track particulate matter, sulfur dioxide, and carbon monoxide at 26 locations. They selected common community spaces such as anganwadis, public wells, clinics, schools, and markets where daily exposure to pollution was highest.

**Training and equipment were provided** by Think-Do tanks like ASAR and Deshaj Abhikram. The women learned to use handheld devices and apps to collect data, and documented pollution levels during key community activity hours like morning school starts and evening market times. They recorded

peak exposure periods, shared pollution maps in village meetings, and discussed mitigation options like planting trees and avoiding high-pollution hours.

What makes this initiative stand out is the way women combined scientific data collection with **grassroots awareness** (Vikalp Sangam, 2024). They held informal gatherings, used storytelling, and engaged in conversations at water collection points and village meetings to explain what pollution meant—not in abstract numbers but in terms of coughing children, dusty food, and absent workers (Kashmir Times, 2025). They linked air pollution to everyday realities like increased medicine costs and reduced workdays. Children learned about air quality in schools through charts and participatory games developed by these women leaders (ASAR, 2024).

The women also created cultural touchpoints—using local songs and plays during gatherings—to educate villagers about pollution (Vikalp Sangam, 2024). Sushma Devi narrated stories of “chulha ka dhua” (smoke from stoves) and “koyla ki hawa” (coal-laden air) to make invisible threats more relatable (The Telegraph, 2024). Their grassroots messaging helped people recognize air pollution as a shared problem and sparked greater demand for action. Their leadership led to institutional attention.

On World Environment Day, the women presented their findings to local officials. As a result, district representatives visited pollution hotspots and promised fixed monitors and plantation drives around key facilities (Vikalp Sangam, 2024). More importantly, the women shifted the narrative—air pollution was no longer a technical issue but a matter of justice, voiced and visualized by the very people it affected most.

## Impact

The women-led initiative successfully identified 26 high-risk air pollution hotspots across two districts. As a result, local awareness has increased, with communities adjusting routines to reduce exposure during peak hours. The program prompted engagement from district authorities and NGOs, sparking discussion on real-time monitoring and green buffers. The biggest impact lies in the transformation of public discourse, as women turned silent suffering into informed advocacy.

## Major Challenges and Learnings

The use of community monitors requires official validation to influence formal environmental policy. Delays from mining and energy departments pose barriers to timely redress. Long-term impact depends on sustained community participation and external partnerships.

The intervention demonstrates that environmental monitoring becomes more impactful when scientific evidence is generated, interpreted, and communicated by the communities experiencing the problem.

1. By combining **citizen science with local leadership and culturally relevant communication**, the initiative transformed air pollution from an invisible environmental issue into a shared community concern and a basis for collective action. The trust built through women’s leadership and their ability to connect scientific findings with local experience is reshaping how environmental issues are understood and addressed.



# Botanical Bridges and Community Wisdom: Climate-Resilient Infrastructure from the Khasi Hills of Meghalaya

**Case Context:** The Living Root Bridges of Meghalaya are enduring examples of nature-based infrastructure and community-led climate adaptation. Crafted by the Khasi and Jaintia tribes of Meghalaya, these bridges are grown by training the aerial roots of the *Ficus elastica* or a common found species of Rubber tree across rivers and gorges. In the face of rising climate challenges such as flash floods, soil erosion, and biodiversity loss, these living structures showcase how indigenous ecological knowledge fosters long-term resilience and sustainability (Mongabay, 2024).

**Location:** The East and West Khasi Hills of Meghalaya lie within the Indo-Burma Himalayan Biodiversity Hotspot. Nongriat village in the East Khasi Hills is especially known for its iconic living root bridges. With extreme rainfall and fragile terrain, the region exemplifies how communities adapt to environmental vulnerability through ecosystem-based innovations.

## The Climate Challenge

This region experiences some of the highest annual rainfall levels in the world. Conventional infrastructure like concrete bridges often fail under these conditions due to erosion, flash flooding, and soil instability. In contrast, living root bridges strengthen over time, require no carbon-intensive inputs, and are fully integrated with the local forest ecosystem. As climate variability increases, these regenerative structures demonstrate how indigenous knowledge systems can offer climate-adaptive, low-emission alternatives (CS Monitor, 2022).

## Description of the Affected Community

The Khasi and Jaintia communities are agrarian and forest-dependent, living in remote hill villages with limited access to conventional infrastructure. Heavy monsoons isolate these communities, disrupting access to markets, schools, and health services. Women, often responsible for caregiving and water collection, are disproportionately affected by these disruptions. The community's reliance on forest-based mobility routes makes the living root bridges essential to daily survival and wellbeing. Beyond functionality, the bridges embody cultural identity, sacred values, and ecological ethics maintained through customary governance and collective decision-making (Mongabay, 2024).

## Description of the Community Led Action

The cultivation of living root bridges is deeply embedded in Traditional Ecological Knowledge (TEK). Elders mentor youth in selecting suitable *Ficus elastica* trees, guiding root growth with bamboo scaffolds, and maintaining root tension and alignment—techniques refined over centuries. This bioengineering process reflects a sophisticated understanding

of forest ecology, hydrology, and plant physiology.

In Nongriat and neighbouring villages, these practices are sustained through intergenerational learning. Community members collaborate across age and gender, not only to construct and maintain bridges but also to reinforce adjacent trails, regulate tourism, and preserve the forest canopy. Women participate actively in these efforts, contributing to bridge upkeep, forest conservation, and the hospitality economy that surrounds eco-tourism.

While individuals like Morningstar Khongthaw have helped raise awareness, the broader effort and success has been deeply communal. The Living Bridge Foundation, initiated in partnership with village elders, facilitates documentation through oral histories, mapping, and visual archives. These are now being introduced in local schools to embed TEK into formal education.

Additionally, the Technical University of Munich (TUM) has collaborated with local communities to document the architectural and ecological properties of the bridges. Their research has helped amplify global recognition of this unique botanical infrastructure and demonstrate its role in sustainable development and climate adaptation (TUM, 2023).

## Impact

The initiative has strengthened both ecological resilience and community well-being through the preservation and restoration of living root bridges. Today, over **100 functional living root bridges** continue to serve communities across the Khasi Hills, providing climate-resilient infrastructure that has been revitalized through community-led restoration efforts. The intervention has enhanced mobility while creating livelihood opportunities through eco-tourism, with women benefiting from increased income and playing a greater role in the preservation of cultural heritage. The bridges have also gained international recognition through UNESCO nomination efforts and collaborations with academic institutions, drawing attention to their ecological and cultural significance. At the same time, traditional ecological knowledge associated with constructing and maintaining the bridges is being preserved through intergenerational learning and systematic documentation, ensuring its continuity for future generations.

## Major Challenges and Learnings

The community faced several challenges, including the declining transmission of traditional ecological knowledge (TEK) due to youth outmigration, environmental degradation driven by tourism pressures, and the impacts of climate change on root growth rates and forest cover. Key learnings from the initiative highlight that indigenous systems can adapt and thrive when supported through proper documentation and recognition;



the inclusion of women strengthens both ecological and social resilience; and meaningful partnerships between local communities and research institutions can play a crucial role in protecting and elevating traditional knowledge.

Though rooted in Meghalaya's unique ecology, the living root bridge model exemplifies principles of ecosystem-aligned infrastructure, regenerative design, and community stewardship. The intervention offers valuable learnings on how traditional ecological practices can be sustained across generations.

1. The continued construction and maintenance of living root bridges is anchored in the community's **cultural identity and sense of stewardship**. The knowledge is passed across

generations through observation, participation, and practice, allowing each generation to inherit the skill, identity and pride associated with it.

2. The living root bridges have remained relevant because they **respond directly to the geographical and climatic realities of the region**. Beyond their cultural significance, they provide safe, durable, and climate-resilient connectivity across rivers and streams, making them an integral part of everyday life. When community-led practices consistently address local needs and demonstrate tangible benefits, they are more likely to be valued, sustained, and adapted over time.



# Synthesis Note

Across the case studies compiled in this collection, spanning diverse climate challenges, geographies, ecosystems, and approaches, a consistent pattern emerges. While each initiative responds to a unique ecological and social context, the conditions that enabled these responses to emerge and sustain themselves remain remarkably similar, representing the foundational building blocks of community-led climate action: **CENTRALITY OF COMMUNITY AGENCY.**

Across interventions, communities were primary holders of ecological knowledge, the interpreters of local climate realities, implementers of the knowledge into action, and their acceptance for its sustenance. and the designers of contextually relevant responses. Whether the intervention originated within the community or was facilitated by external actors, its long-term sustainability depended on whether communities retained the agency to shape, adapt, implement, and ultimately own the response. These components of Agency, in this context, emerged as reflective checks:

- Does the knowledge originate from the community?
- Can the community interpret and apply its own knowledge?
- Can the community translate this knowledge into action based on its own needs, priorities, and ecological context?
- Can the community accept, adapt, reshape, or even reject externally facilitated interventions?
- Does the intervention resonate with the community's social, cultural, and ecological realities?

A second recurring thread is the indispensable role of women in community-led climate action. Across rural and urban contexts alike, women emerged as custodians of ecological, socio-cultural knowledge, leaders of collective action, the backbone of everyday labour that sustains adaptation efforts. Their contributions extended beyond implementation to preserving cultural practices, strengthening community institutions, and enabling the continuity of knowledge across generations.

The case studies also reinforce that climate action is, fundamentally, collective action. Resilient responses were built through the participation of entire communities - elders, youth, women, men, children, traditional practitioners, and local institutions - each contributing distinct knowledge, responsibilities, and capacities.

An important insight emerging from this compilation concerns the role of external actors. While the initiatives have been documented as community-led, very few evolved in complete isolation from external support. Civil society organisations, researchers, government institutions, and practitioners often played catalytic roles by convening communities, facilitating dialogue, mobilising resources, documenting knowledge, strengthening capacities, or providing technical support. Their

contribution, however, was most effective when it enabled community leadership. Rather than prescribing solutions, successful facilitation created the conditions for communities to recognise, organise, strengthen, and translate their own knowledge into locally meaningful climate action. These case studies, therefore, invite an important reflection on ***'how the external actors should intervene? how can they do so in ways that strengthen, rather than substitute, community agency?'***

Across these interventions, knowledge repeatedly emerged as the foundation upon which climate action was built. Manifested through local innovations, restoration practices, governance systems, cultural traditions, and collective movements, this knowledge is today described through multiple but overlapping terms, including Traditional Ecological Knowledge (TEK), Indigenous Knowledge Systems (IKS), Traditional Knowledge (TK), etc.

This compilation of case studies consistently demonstrates that such knowledge remains a living, evolving system of understanding that continues to guide community responses to ecological change. This recognition makes it imperative to ask not only how traditional ecological knowledge can be documented, but ***how it can be generated, shared, stewarded and applied.*** Strengthening these processes is central to ensuring that such knowledge continues to inform community-led climate action across generations.

## 1. Recognising communities as authors preserves the integrity of traditional ecological knowledge.

Communities are authors and continual contributors of the vast traditional knowledge that these actions emerge from. Acknowledging community authorship ensures that knowledge remains rooted in its original context, reduces the risk of dilution or misrepresentation, and recognizes the intellectual contributions of those who have developed and sustained it over generations.

## 2. Language shapes how traditional ecological knowledge is understood and accessed.

Language is more than a medium of communication; it carries cultural meanings, histories, and ecological understanding accumulated over generations. Local terminologies often encode observations of seasons, landscapes, species, and climatic variations, making knowledge more meaningful and relatable to the communities that practice it. Strengthening climate knowledge therefore also requires strengthening the languages through which it is expressed and understood.

## 3. The mode of knowledge transmission shapes its continuity and application.

Traditional ecological knowledge is sustained through multiple pathways, including intergenerational learning,

community institutions, schools, experiential training, and collective practice. The choice of medium influences how knowledge is transmitted and how effectively it is retained, adapted, and applied in changing climatic contexts.

#### **4. Intergenerational and interdisciplinary groups strengthen knowledge systems.**

The case studies demonstrate the value of bringing together elders, youth, practitioners, and researchers within shared learning spaces. Such groups enable traditional ecological knowledge to be exchanged alongside contemporary skills, documentation methods, and research approaches. This reciprocal learning preserves existing knowledge and enables it to evolve while remaining grounded in local contexts.

#### **5. Knowledge requires thoughtful convening to become collective action.**

Knowledge existing within communities does not automatically translate into shared practice. Individuals, institutions, or community organisations that convene people play a critical role in creating spaces for dialogue, documentation, validation, and exchange. By bringing together diverse knowledge holders and providing the resources needed for collaboration, they strengthen both the accessibility and practical application of traditional ecological knowledge.

#### **6. Formal institutions should support the ethical stewardship and dissemination of traditional ecological knowledge.**

Colleges, universities, research institutions, and training centres have an important role in documenting, validating, and disseminating traditional ecological knowledge. Such engagement, however, should be undertaken with communities as equal knowledge partners, ensuring that knowledge remains grounded in its cultural and ecological context, community authorship is acknowledged, and ethical practices guide its use and wider dissemination. Formal institutions can strengthen the reach and continuity of traditional ecological knowledge by creating platforms for learning, research, and exchange while safeguarding its integrity.

It is this relationship between **knowledge, agency, action, and acceptance** that repeatedly appears to sustain community-led climate initiatives. What repeatedly emerges across these case studies is that community-led climate action is sustained through a continuous relationship between knowledge, its translation into action, the freedom to adapt interventions to local contexts, and the community's long-term ownership and stewardship of those interventions- making it **Community-led Climate Actions**.

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