



## POPULAR SCIENCE ARTICLE

## Indigenous Agricultural Knowledge Systems and Community Based Natural Resource Governance

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### Abstract

Indigenous agricultural knowledge systems in India represent deeply interwoven relationships between communities and nature, shaped through centuries of observation, cultural belief and ecological stewardship. Practices such as Jhum cultivation, the Apatani rice-fish system and the Zabo water-harvesting method demonstrate sophisticated ecological engineering grounded in sustainability, biodiversity conservation and community cooperation. These systems integrate seed diversity, agroforestry, sacred grove protection and customary governance led by village councils and women knowledge custodians. Amid climate change and development pressures, indigenous communities continue adapting through resilient crops, soil enrichment, watershed care and youth engagement. Their governance systems emphasise collective rights, shared responsibility and spiritual ethics, offering powerful models for sustainable resource management. Preserving these knowledge systems requires recognition of community rights, participatory planning and respectful partnerships that value traditional wisdom as essential to ecological and social resilience.

**Keywords:** Indigeneity, Agroecology, Biodiversity, Governance, Sustainability

### Introduction

Across the diverse landscapes of India, tribal communities have spent centuries shaping knowledge systems that blend food production with cultural identity. Their survival is tied to hills, rivers and forests, which are not treated as commodities but as sacred living companions. These communities believe that nature provides generously as long as human show gratitude and restraint.

Every farming decision, whether selecting a crop or choosing a site for cultivation, is guided by stories passed through generations. Learning does not occur through written manuals but through observing stars, listening to the wind or noticing the behaviour of birds. This quiet, continuous learning has helped indigenous peoples thrive in some of the most ecologically fragile areas on earth. Scholars acknowledge these systems as strong examples of sustainable living based on harmony and balance with nature, rather than exploitation for profit (Heyd, 2000).

Indigenous agricultural practices like Jhum cultivation in the North East, the Apatani paddy and fish method in Arunachal Pradesh and the Zabo system in Nagaland show how communities work closely with the land without disturbing its

natural rhythm. They do not impose agriculture on nature but gently weave themselves into the environment.

Customary governance systems led by village councils, elders and ritual authorities protect community rights over natural resources. These forms of governance are powered by collective responsibility, social trust and a belief that the Earth is a shared heritage.

Climate change, external development pressures and the lure of modern lifestyles are testing the strength of these traditions. Yet, indigenous communities continue to adapt, innovate and hold on to the wisdom gifted by their ancestors.

### Traditional Cultivation Systems

#### Jhum cultivation or shifting agriculture

In the lush hills of North Eastern India, the practice of Jhum is much more than agriculture. It is a way of understanding when the Earth needs to rest and when she is ready to give again. Families clear a small plot of forest land, usually through a respectful ritual that asks for nature's permission. Biomass is burnt in a controlled manner, the ash adding nutrients to the soil. Jhum fields are always diverse. On one plot, a farmer may grow millets, maize, chillies, beans, pumpkins and leafy vegetables. This diversity

secures nutrition and protects crops from pests without chemicals.

After one or two harvests, the land is allowed to heal. Forests return, wild fruits grow and the soil regains its strength. Jhum involves ancestral timing and keen observation of natural signs. Elders know exactly when the first thunder of spring signals the sowing season. Jhum provides food security, medicinal herbs, fodder and even ritual plants essential for cultural identity. Research confirms that when practised traditionally with long fallow periods, Jhum supports high biodiversity and soil regeneration.

Communities work together from land preparation to harvesting. There is laughter, song and sharing of meals. Jhum connects every household to the land and to each other. It is a form of cooperation that strengthens both ecology and community values.

### **Apatani paddy and fish cultivation**

Deep in the Ziro Valley of Arunachal Pradesh, the Apatani community has created a beautiful system that integrates rice farming with fish rearing. Terraces are levelled with incredible precision so that water flows smoothly through each plot. Channels are jointly maintained, reflecting unity and shared responsibility.

Fish in the fields feed on aquatic insects, helping control pests naturally. Their droppings enrich the soil. Weeds pulled from the fields are composted, creating a closed loop of nutrient recycling. Households benefit from both rice and fish, improving diet quality and income earnings. This creativity in farming has emerged from generations of practice in a valley with limited land area but excellent indigenous engineering (Baruah, 2018).

The Apatani system showcases a remarkable example of how science and culture coexist seamlessly in traditional knowledge.

### **Zabo water harvesting and landscape harmony**

The Chakhesang people of Nagaland practice Zabo, a community-based water harvesting method developed in areas where direct irrigation is difficult. Rainwater from the forested top slopes collects in community made reservoirs. Before reaching paddy terraces, the water moves through cattle sheds where manure enriches it, creating natural fertiliser.

This cycle revives soil fertility, prevents soil erosion and ensures that every household receives water during the dry season. The Zabo system reflects how knowledge of animals, forests, soil and water are woven together into one landscape. It also highlights how community coordination is essential to manage shared

resources (Amenla, 2021).

These systems show thoughtful adaptation to ecosystem limitations. They respect natural cycles and ensure that both people and nature thrive together.

## **Indigenous Biodiversity Conservation**

### **Seed diversity and wild edible wealth**

Tribal farmers conserve seeds like treasured family members. Each seed holds stories of past harvests, festivals and survival through difficult seasons. Women are the seed custodians. They know which millet can withstand drought, which rice variety stores better for winter and which bean grows well in newly opened Jhum land.

Wild edibles collected from forests provide nutrition that modern markets cannot always offer. The knowledge of where edible leaves grow after rains or which mushrooms are safe is preserved through everyday practice (FAO, 2022). Sustainable harvesting guided by seasonal taboos ensures nature continues to provide.

### **Agroforestry and living green landscapes**

Agroforestry is not a modern invention in tribal communities. Home gardens often resemble small forests of their own, filled with fruit trees, medicinal herbs, bamboo, spices and seasonal vegetables. Such landscapes reduce the need to disturb distant forests. Birds, insects and soil organisms thrive here, supporting the cycle of life.

These systems enhance resilience when climate stress reduces regular crop yields. Food diversity becomes a protective shield in uncertain times.

### **Sacred groves and spiritual guardianship**

Many tribal communities protect small forest patches known as sacred groves. These are spaces where spirits are believed to reside and ancestors are honoured. One cannot simply cut a tree or hunt without rituals and permission. This deep spiritual respect has preserved rare species, water springs and old growth trees that scientific conservation often struggles to protect.

Nature is not separate from culture in these communities. The forest is a temple and protection arises from faith as much as from necessity.

## **Community Governance Systems**

Traditional governance is based on fairness, collective wellbeing and shared responsibilities. Instead of ownership by individuals, land and resources belong to the entire community and must be preserved for future generations

### **Village councils and customary rules**

Village councils form the heart of decision

making. Elders act not as authority figures but as guides who hold wisdom from experience. They plan when Jhum lands are to be opened, how much forest can be used, who gets water first in dry times and how disputes are resolved.

Breaking community rules is not only punished with fines but also seen as shameful behaviour that harms relationships. People follow rules because they believe in protecting the community's dignity.

### **Collective forest ownership and protection**

Community controlled forests in Nagaland and Meghalaya show successful protection because the forest is valued as a shared blessing. Grazing rules, rotational harvesting and seasonal restrictions prevent misuse. The Forest Rights Act in India has brought legal recognition to some of these traditions, though more support is still needed.

### **Women as custodians of knowledge and care**

Although men handle some formal roles, women's knowledge guides daily ecological decisions. They maintain kitchen gardens, manage household nutrition and hold authority over seed choices. Their wisdom ensures that no family goes hungry even during difficult months.

Women contribute silence and strength to governance, often shaping the community without needing an official title.

### **Adaptation to Climate Stress**

Climate change is a direct threat in tribal areas. Rainfall patterns have become unpredictable. Landslides, crop failures and forest fires occur more often. Despite these challenges, indigenous communities show remarkable adaptation.

### **Reviving resilient crops and enriching soil health**

Millet, sorghum and root crops that can survive heat and low water are being revived. Farmers reduce soil loss using mulching, composting and agroforestry. Natural indicators such as flowering of certain trees continue to guide planting decisions (IPCC, 2023).

### **Water security through social unity**

Traditional water channels and springs are restored. Young volunteers join community patrols to protect watersheds. Forest cover near streams receives special care because people realise that without trees, water cannot exist.

### **Keeping knowledge alive through youth engagement**

Schools and research organisations document farming calendars, rituals and ecological indicators. Children learn to value both textbooks and the stories of their elders. Pride in

identity becomes a strong motivation to continue indigenous farming.

### **Rights, consent and partnership**

Communities increasingly demand participation in development decisions. Free prior and informed consent is a basic right that protects cultural heritage and avoids ecological damage. The strongest voice for sustainability often comes from those who have lived with Nature the longest.

### **Discussion**

Indigenous agricultural systems demonstrate that sustainable living is possible when humans value nature as a partner. These systems promote biodiversity, soil health and food security, while ensuring fairness and shared wellbeing.

However, population pressure, youth migration, development projects and market dominance threaten traditional governance and land use. Coexistence of scientific knowledge with indigenous wisdom, along with stronger community rights, can help sustain these systems.

Participatory land use planning, local food promotion and revival of fallow management are necessary steps to ensure future resilience.

### **Conclusion**

Agriculture in tribal India is rooted in trust, cooperation and gratitude toward nature. Jhum supports diversity and strong community bonds. The Apatani system improves nutrition and soil health through integrated land and water use. The Zabo method protects both upland forests and paddy fields. These systems offer guidance for environmentally responsible farming.

Village councils and sacred traditions ensure that lands and forests remain protected. Women nurture seeds and culture. Even under climate change, tribal communities continue adapting with confidence in their inherited knowledge.

Indigenous agricultural knowledge is not a fading tradition. It is a living guide toward a sustainable and just future for both nature and humanity.

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