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Community forest management and indigenous conservation practices: A study of the Karbi tribal communities in the Jamuna watershed, Assam (India)

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Abstract

In North-East India the forest covers are the ecological and cultural foundation of various tribal communities. In the Jamuna watershed of Assam (India), the Karbi tribes have traditionally maintained a close relationship with forest landscapes through various traditional conservational methods. This study investigates the role of community forest management (CFM) and indigenous conservational practices in sustaining forest resources in four Karbi villages located in the upstream hilly zones of the Jamuna watershed. Primary data were obtained from 120 households using structured interviews, focus group discussions and field observations, with key informant inputs from local leaders and forest officials. Quantitative data were analyzed through descriptive statistics using MS Excel, while qualitative narratives were thematically coded. Results reveal that 87% of respondents actively participate in community forest protection, 73% people depends on forest products for daily livelihoods in the upstream zones of the watershed. Traditional methods such as sacred groves, rotational shifting cultivation with fallow forest restoration and community restrictions on timber extraction, one time community fishing in a year and prohibition of catching juvenile fishes contribute significantly to forest and species resilience. However, challenges persist in the form of population pressure, market-driven extraction and weakening customary norms with time. The study concludes that integrating indigenous forest knowledge with formal Community Forest Management (CFM) policy mechanisms can help in ensuring ecological sustainability and management of the Jamuna watershed for the future generations; with recommendations of strengthening community institutions through participatory efforts, training and financial incentives.

Keywords: Community forestry management, Karbi tribe, Jamuna watershed.

Introduction

Forests are among the most significant ecological assets supporting human survival, biodiversity and climate regulation (FAO, 2020). They provide fuel wood, food, regulate water flows, soil fertility and also hold cultural values for millions of forest-dependent people across the world (Agrawal & Chhatre, 2011) ^[2]. In tropical regions, especially South and Southeast Asia, the relationship between indigenous communities and forests extends beyond resource use; it encompasses economic benefits, deep spiritual and social connections (Chakraborty *et al.*, 2021) ^[11]. However, in the last 25 years, deforestation and resource degradation have accelerated due to population growth, agricultural expansion and market-driven timber extraction (Kumar *et al.*, 2020 ^[19]; Acharya *et al.*, 2018). In recent scenario, community-based approaches have been increasingly promoted as alternatives to maintain the remaining forest and their restoration (Adedotun *et al.*, 2023) ^[25].

Community Forest Management (CFM) has emerged as a participatory mechanism that integrates local communities and traditional knowledge in the sustainable use of forest resources (Baynes *et al.*, 2015) ^[6]. The model is based on the principle that people living adjacent to forests are the most capable guardians of their ecological environment (Gilmour, 2016). In India, the evolution of CFM has been closely linked to Joint Forest Management (JFM) programs initiated in the early 1990s under the Ministry of Environment, Forest and Climate Change (MoEFCC). These programs have sought to integrate local participation in forest protection, afforestation and biodiversity conservation (Kumar *et al.*, 2019) ^[20].

Yet, despite institutional innovations, implementation outcomes remain uneven across regions due to socio-cultural diversity, administrative limitations, negligence and the erosion of traditional governance systems (Singh & Das, 2021) ^[28].

Community and Forest Linkages in Northeast India

The hilly and plateau regions of Northeast India are predominantly inhabited by various tribal groups, whose subsistence and identity are inseparable from the natural forest ecosystems (Saikia, 2018) ^[27]. Among these tribal groups, the Karbi people of Assam are known for their distinct forest management traditions and clan-based authority (Teron & Borthakur, 2017) ^[29]. Their indigenous system managed by village heads, regulates forest access through community consensus, seasonal restrictions and sacred forest protection (Terang, 2019) these traditional norms emphasize reciprocity with nature and collective responsibility of the people rather than economic maximization.

The Jamuna River, flowing through the eastern portion of Karbi Anglong and parts of Hojai district, represents a dynamic socio-ecological landscape. The upper catchment is characterized by dense forests, shifting cultivation (*jhum*) plots in the hills and small clusters of settlement. The Karbi people inhabiting these uplands have long practiced community forestry combining rotational cultivation (*Jhumming*), sacred grove protection and controlled harvesting of non-timber forest products (NTFPs) such as bamboo, honey, wild fruits, wild edible vegetables and medicinal plants (Teron & Goswami, 2022) ^[30]. In the past two decades, increased demographic pressure and declining fallow periods in *Jhum* cultivation have led to degradation and shrinkage of community forest lands and it results instability inside the watershed (Das & Dutta, 2020) ^[14].

Rationale of the Study: Several studies have examined JFM and participatory forestry in India, but there is limited understanding of how indigenous Karbi people practices ecological sustainability in the context of watershed-based forest management (Lalramnghinglova, 2021) ^[21]. Most available works focus on policy-level evaluations rather than community level dynamics. Understanding the local ways of organizing forest governance, manage conflicts and adapt socio-economic transitions is important for framing inclusive forest policies in the tribal dominant places (Agrawal, 2014 ^[1]; Menzies, 2018) ^[22]. The Jamuna watershed of Assam, being ecologically fragile and socio-culturally unique, provides an ideal site to explore such inter-linkages between people and forest covers.

This study aims to assess the contribution of community forest management and traditional Karbi style conservation practices in maintaining forest ecosystems in the upstream hilly region of the Jamuna watershed. It focuses on identifying the major practices, evaluating their effectiveness and examining the challenges faced by local communities in sustaining these traditional systems under the changing environmental conditions.

Research Questions and Objectives

The study is guided by the following key questions:

1. What are the traditional and community-based approaches employed by the Karbi tribes to manage forest resources in the Jamuna watershed?
2. How effective are these approaches in sustaining forest cover and biodiversity?
3. What socio-economic and institutional challenges hinder effective community forest management?

The main objective of this work is to document indigenous and community driven forest conservation methods in the upstream of Jamuna watershed of Assam.

Materials and Methods

Study Area: The study was conducted in the upstream hilly catchment of the Jamuna watershed of Assam, Jamuna is a tributary of the Kopili River; Jamuna flows through East Karbi Anglong and Hojai districts, Assam, India. The Jamuna watershed lies between 25°41'N-26°27'N latitude and 92°44' E to 93°40' E longitude (Fig.1), with a total area of about 3900 sq. km and maximum portion of it lies in the East Karbi Anglong district (Borah & Deka, 2019 ^[9]; 2020 ^[10]; Nasrin & Barman, 2025) ^[23]. The elevation of the watershed ranges from 150 to 900 meters above mean sea level. The terrain is undulating, dissected by seasonal streams and hill slopes dominated by tropical moist deciduous and semi-evergreen forests. Annual rainfall averages 2,000-2,500 mm, mainly concentrated between May and September, while temperatures vary from 10°C in winter to 34°C in summer (Assam Remote Sensing Centre, 2023).

The upstream zone of the watershed is sparsely populated, inhabited mainly by Karbi tribal communities with Kuki, Dimasa and other less populated tribes residing in small hamlets surrounded by forest patches, *jhum* fields and bamboo groves. Forests in this region are classified as Reserved Forests, Village Community Forests and Unclassified State Forests under the Assam Forest Department. The majority of local people depend on customary systems to manage forest resources, through traditional councils known as *Rong Anei* or village committees, which helps in regulating forest use and settlement expansion.

Sampling Design

Four Karbi villages were purposively selected from the upper Jamuna watershed based on their dependence on forest resources and presence of community-managed forests. The selected villages are- Rongchelot, Amlakhi, Saijang and Dillai (near Manja of Karbi Anglong) represent variations in settlement size, forest and accessibility. Each selected village comprised 25 to 40 households. A representative sample of 120 households was selected proportionally from the four villages. Within each village, households were chosen through simple random sampling to ensure inclusiveness of all gender, age and occupation. With that 12 key informants were identified purposively, including village headmen, members of the community forest committee, women's group representatives and officials from the local forest range office.

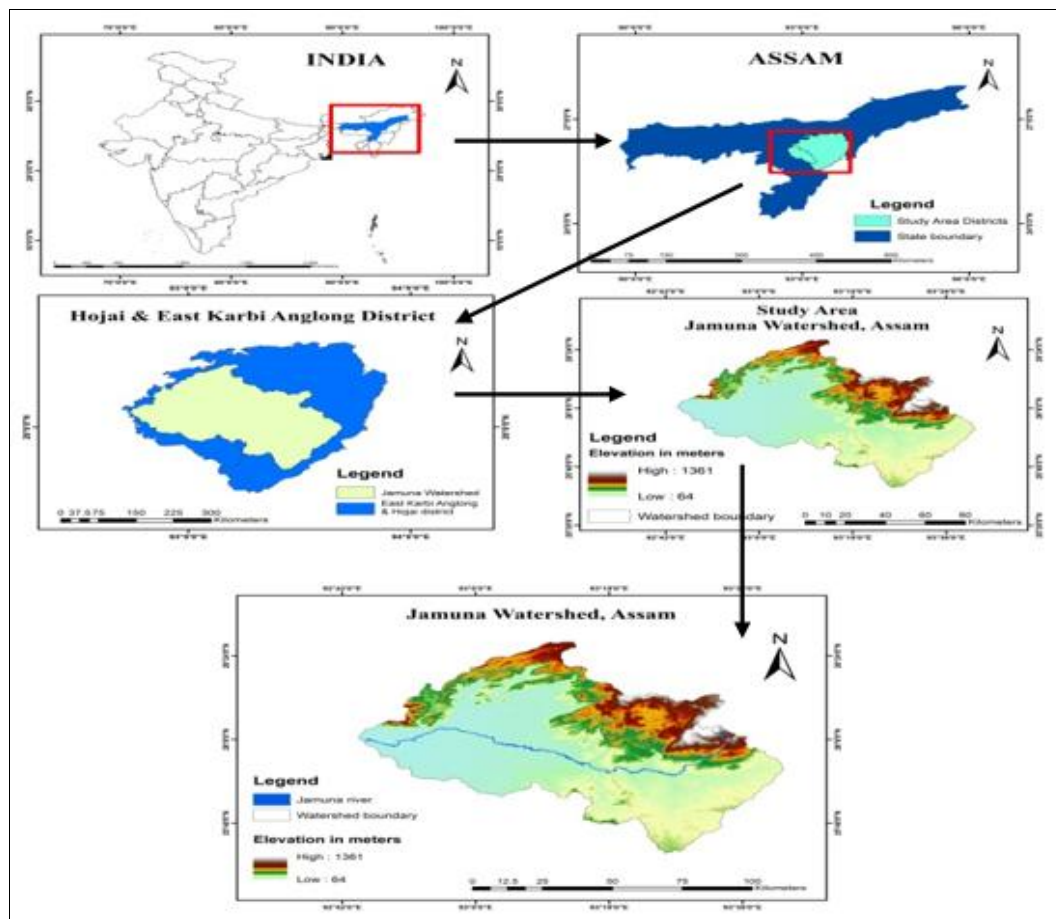


Fig 1: Study area map

Data Collection

The study is done with a mixed method research design, combining quantitative household surveys and qualitative participatory approaches.

1. **Household Questionnaire Survey:** A structured questionnaire was prepared and collected data in 2024, covering demographic characteristics, livelihood dependence on forests, awareness of conservation rules, participation in community forestry and perceptions of forest condition.
2. **Focus Group Discussions (FGDs):** Two FGDs were conducted in each village (one with elders and one with youth and women's groups) to understand collective forest governance, customary laws and emerging challenges.
3. **Key Informant Interviews:** Semi-structured interviews with local leaders and forest officers explored institutional linkages between traditional systems and formal forest management.
4. **Field Observation and Transect Walks:** Field visits and transects walks through forest patches, *jhum* fallows and sacred groves were used to know the land-use practices, vegetation regeneration and evidence of forest degradation.
5. **Secondary Data:** Toposheets and satellite data are from SOI and USGS Earth explorer.

Data Analysis: Quantitative data were coded and analyzed using MS Excel. Descriptive statistics were computed to interpret patterns of forest use and participation in community activities. Qualitative data from interviews and FGDs were thematically analyzed and categorized into key

themes like indigenous management practices, ecological perception, challenges and strategies.

Ethical Considerations

Informed consent was obtained from all participants before data collection. The study respected local customs and ensured confidentiality of respondents. Findings were shared with village committees for validation and feedback.

Results

Socio-Demographic Characteristics of Respondents

The survey covered 120 households across four Karbi villages, named - Rongchelot (30 households), Amlakhi (28), Saijang (32) and Dillai (30). Out of the 120 respondents, 67% were men and 33% were women; the majority (58%) belonged to the 30-49 year age group, while 28% were 20-29 years age group and 14% were above 50 years of age.

Their education levels varied across villages; 42% had completed primary school, 33% secondary school and 8% tertiary education, while 17% were illiterate. Agriculture remained the principal occupation (61%), followed by forest-based activities such as bamboo crafts, forest product collection and non-timber product gathering (24%). Only 15% of respondents reported salaried employment. Average household size was 5.6 persons and the mean landholding was 1.4 hectares, combining *jhum* and settled agriculture plots.

Dependence on Forest Resources

Nearly all respondents (98%) indicated direct dependence on forest products for fuelwood, fodder, and household

materials. Around 73% reported collecting NTFPs such as bamboo, wild vegetables, honey, and medicinal herbs for both subsistence and local trade. Forests also served as cultural and spiritual spaces, especially the (sacred groves)

where rituals of seasonal festivals (*Chojun* and *Rongker*) are performed.

Major Community Forest Activities in the Jamuna Watershed

Table 1: Showing the major forest-based activities identified during the field survey.

Forest-related Activity	% of Households Involved	Remarks
Fuel wood collection	74%	Mainly women
Bamboo cutting and craft	58%	Seasonal livelihood
Honey collection	26%	Managed by men's groups
Medicinal herb collection	41%	Mainly older women
Sacred grove protection (<i>bongthar</i>)	52%	Collective activity
Agroforestry/Tree planting	27%	Practiced near homesteads

Community Forest Management Practices

The Karbi villages in the upper Jamuna basin follow customary systems of forest use and conservation; their three main practices were identified as:

- 1. Village Community Forest Regulation:** Each village maintains a demarcated forest area managed collectively under the village council (*Rong Anei*). Cutting of large timber, hunting of wildlife, or clearing for new cultivation is prohibited without community permission. Around 74% of respondents affirmed the existence of such collective rules, while 11% said enforcement had weakened over time.
- 2. Sacred Groves:** Every villagers in the hills has to maintain the protected forest area, a small forest patch is preserved for ritual purposes. Entry is restricted during sacred periods and extraction is strictly forbidden. Elders reported that trees in these groves are over a century old.
- 3. Shifting Cultivation with Fallow Regeneration:** Traditionally, *jhum* cycles lasted 10 to 12 years, allowing forests to regenerate. Currently, due to population pressure, fallow periods have reduced to 3 to 6 years. However, 68% of respondents reported deliberate replanting of bamboo and native species on abandoned plots to restore fertility.

- 4. Customary Sanctions and Incentives:** Villages impose fines for illegal tree cutting or forest burning, often in the form of livestock or grain contributions. Conversely, community members who volunteer in fire control or replanting drives receive symbolic rewards during village festivals.

Perceived Effectiveness of Management Approaches

The villagers were asked about the effectiveness of current community forest practices, in conserving local forest. Respondents associated success with visible forest re-growth, reduced soil erosion and increased wildlife sightings (especially wild elephants, monkeys and hornbills etc). The distribution of responses regarding perceived effectiveness:

- Very effective - 34%
- Moderately effective - 45%
- Less effective - 14%
- Not effective - 7%

Challenges Faced by the Community

Despite community control, several challenges threaten the sustainability of local forest systems (Table 2).

Table 2: showing major Challenges Reported by Respondents

Challenge	Percentage of Respondents	Description
Population pressure and shrinking <i>jhum</i> cycle	63%	Shorter fallow periods cause soil degradation
Illegal timber extraction and firewood trade	52%	Driven by outside traders and urban demand
Erosion of traditional authority	47%	Youth less interested in age old customary rules
Human-wildlife conflicts	23%	Crop damaged by wild animals
Limited government support/funding	29%	Lack of recognition for community forests

Qualitative narratives revealed that the decline of customary forest rules coincides with the growing market forces and weak enforcement of traditional sanctions. Elders also lamented the lack of youth engagement in community meetings and rituals.

Community Strategies and Innovations

To address these challenges, the villages have introduced several adaptive measures with assistance from local NGOs and forest extension staff:

- 1. Re-establishment of Forest Committees:** Each village has formed or revived a *Community Forest Management Committee* composed of elders, women and youth representatives.

- 2. Agroforestry and Home Gardens:** Households increasingly plant multipurpose trees such as *Michelia champaca*, *Areca catechu* and *Bambusa balcooa* in their homesteads.

- 3. Women's Role:** Women's groups have begun processing wild fruits and medicinal herbs into value-added products like pickles, jelly and balms for alternative incomes.

Overall, 87% of respondents supported continued collective management, expressing pride in ancestral forest traditions. As one elder from Amlakhi stated, "The forest is like our ancestor's home; if we lose it, we lose ourselves."

Quantitative Indicators of Forest Condition

Based on the field observation and participatory counting, villagers perceived an overall 10 to 12% improvement in forest density over the past decade. Regenerated fallows

now exhibit secondary growth dominated by *Schima wallichii*, *Albizia procera* and bamboo species etc and small wildlife populations have reportedly increased.

Table 3: Perceived indicators of forest health based on community perception (in last 10 Years)

Indicator	Percentage Reporting Improvement	Remarks
Forest canopy density	60%	Natural regeneration and protection
Wildlife sightings	65%	Return of small animals and birds
Soil moisture and water availability	50%	Due to tree cover near streams
NTFP availability	55%	Sustainable harvesting practices

The data shows that the persistence of indigenous management practices like sacred grove protection, fallow land restoration and collective monitoring has maintained ecological balance within the upper Jamuna watershed.

Discussion

Community-Based Forest Management and Indigenous Systems:

The results demonstrate that community forest management (CFM) in the upper Jamuna watershed is deeply rooted in indigenous Karbi ecological ethics. The strong participation rate (almost 80%) and high perception of effectiveness (almost 60-70%) shows the enduring relevance of traditional systems that integrate livelihood needs with ecological care. These findings align with studies by Agrawal (2014) ^[1] and Baynes *et al.* (2015) ^[6], who observed that CFM success depends not only on institutional arrangements but also on local cultural norms, reciprocity and social cohesion. The Karbi people of upstream practices protecting *bongthar* (sacred groves) resonates with conservation models reported from other tribal regions of Northeast India, for example the Khasi *Law Kyntang* in Meghalaya and the *Umang Lai* forests of Manipur, where biodiversity is preserved through ritual taboos and religious associations (Tiwari *et al.*, 2010 ^[31]; Upadhya & Barik, 2021) ^[32]. These sacred forests serve as refugia for rare species and form micro-watersheds that sustain perennial springs (Khumbongmayum *et al.*, 2006) ^[17]. In the upstream zones of Jamuna watershed, sacred groves not only conserve biodiversity but also reinforce a restraint against overexploitation, which is often missing from formal forestry programs (Teron & Goswami, 2022) ^[30].

The Karbi people approach to rotational shifting cultivation (*jhum*) reflects adaptive landscape management rather than environmental degradation. When fallow periods are adequate, *jhum* promotes nutrient cycling and secondary succession (Ramakrishnan, 2007) ^[34]. The population pressure and shrinking fallow cycles now threaten this sustainability. Similar concerns have been raised across Northeast India where demographic changes and land scarcity have shortened the regenerative period of shifting cultivation, leading to soil erosion and vegetation loss (Choudhury *et al.*, 2020) ^[13].

Community Participation and Livelihood Linkages

The integration of livelihood benefits like bamboo crafts, forest edibles collection and medicinal herb gathering, with forest protection shows the socio-ecological resilience of the Karbi community. Such livelihood-forest linkages are central to participatory conservation (Ao *et al.*, 2019 ^[4]; Kumar *et al.*, 2020) ^[19]. The challenges like economic marginalization and weak market access is also there.

Respondents noted that while community protection restricts unsustainable extraction, it also limits potential earnings without alternative livelihood support. As Singh and Das (2021) ^[28] argue, community forestry in India often suffers when economic incentives do not match the conservation restrictions. To counter this, the villages of the upstream of Jamuna watershed have introduced micro-level initiatives, like women-led herbal processing and community-based measures of forest protection (Kongkeaw *et al.*, 2019 ^[18]; Pokharel *et al.*, 2007) ^[24].

Institutional and Governance Dimensions

Traditional Karbi governance under the *Rong Amei* remains the central mechanism of forest regulation. Yet, respondents noted declining youth participation and reduced respect for customary authority. The erosion of traditional governance is not unique to the Jamuna watershed; similar patterns have been documented among Naga and Mizo tribes, where the shift from collective to individualized land management undermines communal decision-making (Lalramnghinglova, 2021) ^[21]. Strengthening these indigenous institutions through formal recognition and integration into decentralized forest governance is very important.

The findings reveal that community forestry succeeds when tenure rights, local leadership and benefit-sharing mechanisms are clearly defined. This supports Baynes *et al.*'s (2015) ^[6] observation that clarity of ownership and decision-making autonomy determine the success of CFM initiatives. The results also aligns with Berkes (2004) ^[7], who emphasized that sustainable community management arises when local users feel both custodial and beneficiary rights over forest resources.

In India, the Forest Rights Act (FRA) of 2006 provides legal backing for community forest resource (CFR) ownership, yet its implementation in Assam remains partial and inconsistent (Ugupta *et al.*, 2018) ^[33]. Recognizing Karbi and other community forests under FRA provisions could provide institutional legitimacy, improve access to government support and reduce external encroachment.

Ecological Implications

Quantitative perceptions of forest improvement such as increased canopy density and enhanced NTFP availability etc suggest that the participatory and indigenous approaches have contributed to ecological stability. The regeneration of native tree species and improved soil moisture conditions observed in the study align with ecological outcomes documented in Nepal's community-managed forests (Gautam, 2009) ^[15] and Tanzania's participatory forestry programs (Blomley *et al.*, 2008) ^[8].

The protection of *bongthar* and community reforestation of fallow plots serve as localized climate adaptation strategies,

enhancing carbon sequestration and water regulation. As reported by Giam (2017) ^[16], conserving small forest patches in community-managed systems contributes significantly to maintaining regional biodiversity and ecosystem services. Thus, even without large-scale afforestation projects, the Karbi CFM model demonstrates how grassroots conservation can sustain both cultural and ecological resilience (Chirwa & Phiri, 2025) ^[12].

Conclusion

This study highlights the crucial role of community forest management and indigenous conservation systems in sustaining the forest ecosystems of the Jamuna watershed in Assam. The Karbi people's practices rooted in traditional values, they believe in animism; where they believe that every living things or natural elements have a distinct spiritual essence. Therefore they maintain sacred groves and rotational land use for Jhum cultivation etc measures they take to protect the nature. They demonstrate how community institutions can maintain ecological balance while meeting livelihood needs. The results reveal that despite growing demographic and economic pressures, local participation and traditional ethics have helped retain forest cover and biodiversity. However, some challenges persist in the form of reduced fallow cycles, illegal logging and weakening customary governance. By embedding traditional Karbi ecological wisdom into formal forest management policies, the Jamuna watershed can serve as a model of people-centered conservation for other tribal landscapes in North-East India. As the findings indicates that empowering communities not only protects forests but also strengthens cultural identity, resilience and sustainable livelihoods.

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