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National-scale Assessment of Community Forestry and NTFPs in India: A Synthesis of Spatial Patterns, Livelihood Dependence, and Governance Pathways

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Abstract

Purpose of Review Community forestry (CF) and non-timber forest products (NTFP) are central to rural livelihoods and decentralized forest governance in India; however, national-scale evidence of their scope and impact is lacking. The present study provides the first empirical and countrywide synthesis of the dynamics of CF and NTFP using data covering over 640,000 villages and proposes a new index, namely the community forestry utilization index, a composite state-level indicator based on three normalized components – availability of community forests, availability of NTFP, and household forest dependency – to enable the intensity of CF to be compared across different Indian states.

Recent Findings The analysis revealed pronounced regional disparities and generally low engagement nationwide: only 11.6% of the villages reported access to community-managed forests, barely 3% participated in commercial extraction of NTFP, and less than 0.3% of the households depended primarily on NTFP as a source of income. High values of the proposed index in four states in India – 92 in Nagaland, 70 in Mizoram, 68 in Odisha, and 57 in Chhattisgarh (rounded off values) – indicate strong CF supported by customary tenure and favourable policies, whereas very low values of 29 in Madhya Pradesh and 9 in Kerala show weak CF. Given that all these six states report fairly high densities of forest cover, the cover thus does not necessarily translate into robust community participation or livelihood integration.

Summary Strengthening of CF and NTFP faces three persistent challenges: slow recognition of the community rights to resources, structural inefficiencies in the market for NTFP, and weak institutional capacity to translate legal entitlements into livelihoods. Overcoming these challenges requires accelerated implementation of community rights, empowering local governments, investing in local value chains, and aligning CF with biodiversity and measures to mitigate the adverse effects of climate change—and the proposed index is ideal for monitoring nationwide efforts, benchmarking, and drawing up targeted policies for research in community forestry.

Keywords Common-pool resources · Ecosystem services · Landscape ecology · Resource governance · Socio-ecological systems

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Introduction

Community forests (CFs) are widely recognized as central to strengthening community management and promoting environmentally sustainable local development [1]. At their core, CFs embody collective stewardship, enabling local residents to manage and utilize forest resources while conserving biodiversity, maintaining ecosystem integrity, and supporting livelihoods [2]. Yet, assessing the effectiveness of community forestry (CF) poses a challenge given the limited research linking CFs to measurable socio-economic and ecological outcomes and the absence of standard indicators of effective governance [3, 4]. Although community forest management has long been promoted as a means to align conservation with economic development and resource rights, evidence reveals persistent trade-offs, including inequitable distribution of benefits and local ecological degradation [5]. These conflicts underscore the need for continued research and policy support, especially for small-scale timber producers and rural households reliant on forests for subsistence and income [6]. A substantial body of literature shows that forests are not only ecological assets but also critical components of livelihood systems, providing goods and ecosystem services that sustain human well-being [7–13]. This dependence is particularly acute in the Global South, where forest–people interactions shape settlement patterns and resource geographies. An estimated 1.2 billion people living in or near forests rely on natural resources to meet basic needs [11, 13].

Ecological research in CF highlights the interplay between forest health, governance, and local livelihoods. Community-based management often enhances forest conditions, biodiversity, and ecosystem resilience when local institutions actively engage in stewardship and monitoring [14, 15]. Yet socio-political dimensions such as gender, caste, and political ecology remain underexplored, limiting our understanding of how social hierarchies affect access and decision-making and how marginalized groups often end up being disadvantaged [1, 16]. Addressing these consequences is essential for inclusive and equitable forest governance. Furthermore, the restoration of forest landscape has emerged as a multifunctional strategy, providing carbon sequestration, biodiversity conservation, and livelihood benefits to indigenous peoples and local communities. A global study of 314 forest commons across 15 tropical countries identified five forest clusters with varying trade-offs among carbon storage, species richness, and livelihoods [17]. Formal community management and local participation in rule-making consistently led to positive outcomes, underscoring the importance of context-specific governance in achieving sustainable restoration beyond simple tree-planting initiatives [18, 19]. Community forests and non-timber forest products (NTFP) further contribute to mitigation and adaptation with respect to climate change, illustrating the value of integrating ecological, social, and governance perspectives. In India, NTFP are vital for rural livelihoods, yet the ecological sustainability of such products is poorly understood. Evidence suggests that unsustainable harvesting, combined with other disturbances, can impair species regeneration and ecosystem balance [20]. Comprehensive research is needed to ensure that NTFP-based livelihoods are aligned with biodiversity conservation and long-term health of the ecosystem.

India ranks tenth globally in terms of forest area [21], with nearly 22% of its population dependent on forests [22]. Since the 1980 s, India has implemented multiple community-based forest management models, such as joint forest management (JFM), social forestry, and village forest committees, reflecting diverse institutional and ecological contexts [23].

A major turning point was a piece of legislation, namely the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (Forest Rights Act, FRA), which legalized the customary rights of forest-dwelling communities to land and resources and integrated local governance into a much broader national framework for natural resource management [24]. Central to this legislation is the framework of community rights to forest resources, which granted communities a statutory authority to conserve, manage, and sustainably use forests under their customary care [25, 26]. These evolving institutional arrangements are reshaping forest governance and redistributing rights, access, and responsibilities across landscapes. They also call for ongoing evaluation of how community-centred approaches balance ecological sustainability with social justice in India's forested regions.

Conceptual Framework

The present study conceptualizes CF and NTFP within a geographical, or spatial, perspective that emphasizes spatial heterogeneity, multi-scalar interactions, and institutional mediation. The framework draws on three complementary traditions: common property theory, which explains how collective action shapes shared resource management [27]; the sustainable livelihoods approach, which highlights the role of natural resources in household resilience and income diversification [8, 28]; and forest governance scholarship, which examines how institutions, both formal and informal, mediate access, rights, and benefit-sharing [29]. Together, these traditions provide an integrated lens for analysing the presence of CF, the use of NTFP, and the extent to which household income depends on them.

First, resource geography captures the spatial distribution of community-managed forests. The presence of CF varies

with ecological endowments, forest cover, and the history of land-use [14, 18], leading to spatial heterogeneity in management opportunities and benefit flows. Second, access to NTFP and their use depend on both ecological productivity and socio-economic conditions. Although forests offer diverse provisioning services, communities' ability to utilize or commercialize NTFP is shaped by forest type, market linkages, and cultural practices [30, 31]. This interaction creates regional clusters of forest dependence, with some states and ecological zones showing greater community participation than others [32]. Third, livelihood dependence situates CF and NTFP within household economies. For tribal and marginalized groups, forest resources underpin food security, income diversification, and adaptive capacity [7, 8]. However, this reliance depends on secure access rights and the effectiveness of local institutions in regulating use and resolving conflicts [33].

Finally, institutional mediation forms the governance layer through which access, rights, and benefits are organized. National frameworks such as the Forest Rights Act (2006) provide a legal foundation for secure tenure and collective management, whereas local governments in the form of such village-level institutions as village assembly ('gram sabhas') operationalize participatory governance on the ground [34, 35]. However, weak institutional capacity, insecure tenure, and poor market integration often limit the potential of CF and NTFP, reinforcing regional disparities [36]. By integrating these dimensions, the framework positions CF outcomes as emerging from the interaction between resource endowments, livelihood needs, and multiscalar governance systems. This perspective highlights that CF and NTFP are not inherently sustainable but depend on spatial, institutional, and socio-economic contexts and therefore calls for region-specific strategies that align ecological sustainability with equitable livelihood benefits.

Community forestry has long been promoted as a model of decentralized resource management, valued for its potential to conserve biodiversity while enhancing community well-being through equitable access and benefit-sharing [1, 2]. Similarly, the extraction of NTFP is framed as a livelihood strategy that supports rural economies while maintaining ecological integrity. Yet, empirical evidence reveals a more complex reality. In practice, the effectiveness of CF is frequently limited by weak governance, capture by the elite, social exclusion, and ambiguous tenure rights [37, 38]. Likewise, although NTFP support household economies, their contribution is often modest, seasonal, and vulnerable to market fluctuations. Ecological challenges persist as well: intensive or unregulated extraction of roots, bark, or reproductive parts of plants can hinder regeneration and threaten biodiversity [31, 39]. The tendency to highlight success stories – often from well-supported pilot projects – while overlooking failures or unintended outcomes such as resource degradation and social conflict further distorts policy narratives [40]. Such selective portrayals risk creating unrealistic expectations and policy inefficiencies [41].

The present study addresses these concerns by examining CF outcomes in India through three interconnected indicators: the presence of community-managed forests, the availability and use of NTFP, and the extent of dependence on forest resources at the level of households. Together, these indicators offer a multidimensional framework for assessing ecological integrity, economic viability, and social equity in forest-dependent livelihoods [8, 30, 42]. However, although CF and NTFPs are central to rural livelihoods, most existing research remains localized and case-specific, limiting broader generalization. National-scale analyses are scarce, especially those integrating livelihood dependence, geographical distribution of resources, and governance dimensions. To fill this gap, the present study used the data from Mission Antyodaya—a comprehensive national survey of the indicators of rural development. To our knowledge, this is the first such national-level analysis of the dynamics of CF and NTFP in India using a large dataset that offers new empirical insights into the spatial patterns of access, use, and governance.

The research aims to move beyond generalizations to develop a nuanced understanding of how CF and NTFP shape the dynamics of forests and livelihoods in India. Specifically, the research seeks to (1) identify the enabling and constraining factors for sustainable CF; (2) inform targeted interventions such as income diversification, tenure security, and value-chain development; and (3) situate local practices within the broader goals related to biodiversity conservation and climate action [18, 43, 44]. In doing so, the study contributes to both scholarship and policy by offering grounded, inclusive, and regionally responsive insights for balancing ecological sustainability with the livelihood needs of forest-dependent communities.

Methodology

The present study draws on the voluminous data gathered as part of a national mission, namely Mission Antyodaya, a nationwide initiative by the Government of India that assesses socio-economic and infrastructural conditions in rural areas. Covering 641,357 villages across all the states and union territories of India, the data provide a comprehensive overview of household characteristics, infrastructure, and access to natural resources [45]. Within this framework, 'commercial extraction' refers to the harvesting of NTFP for sale and cash income, and not so much for mere subsistence. Villages were classified as engaged in commercial extraction

when households reported selling NTFPs in local, regional, or state-supported markets ranging from small-scale weekly trade to organized collection through cooperatives or procurement agencies.

In this context, informal market activity needs to be differentiated from formal market activity: informal trade involves small volumes of locally consumed products, such as wild mushrooms and medicinal herbs (roots of *Rauvolfia serpentina* and flowers of mahua (*Madhuca longifolia*) for example), that are exchanged through unregulated markets. Formal trade, by contrast, is carried out through regulated channels such as procurement centres, cooperatives, or licensed buyers, and the commodities include leaves of 'tendu' (*Diospyros melanoxylon*) for rolling bidis (coarse Indian cigarettes), seeds of 'sal' (*Shorea robusta*) for extracting oil, and scrapings from stems of plants encrusted with the 'lac' insect (*Kerria lacca*) for resin production. Because the Mission Antyodaya survey primarily recorded institutionalized activities, informal transactions were underrepresented, which is why 'commercial extraction' should be viewed as a conservative indicator, which captures the formal segment of the NTFP economy, while keeping in mind that informal markets are crucial to subsistence and supplementary incomes.

Selection of Indicators

From this extensive database, three key indicators of CF were identified, namely CFA, NTFPA, and HFD: CFA (community forest availability) represents the proportion of villages with forest lands collectively accessed or managed by communities; NTFPA (non-timber forest products availability), the proportion of villages reporting access to such NTFP as bamboo, tendu leaves, mahua flowers, and honey; and HFD (household forest dependency), the proportion of villages in which more than 50% of the households depended on forests for income or subsistence. The threshold of 50% is consistent with established practice in research on sustainable livelihoods and forest dependency and is recognized as a critical level of dependency [7, 8].

Index Construction and Normalization

Each indicator was first expressed as a percentage at the level of a state or union territory and then normalized using the Min–Max method:

$$I_{ij} = \frac{X_{ij} - minX_{ij}}{maxX_{ij} - minX_{ij}}$$

where, X_{ij} represents the actual value of the i^{th} indicator for the j^{th} state and min X_{ij} and max X_{ij} are the minimum and maximum values of i^{th} indicator observed across all states and union territories. The process of normalization scaled all the indicators to values between 0 and 1, ensuring comparability. The three resulting indexes corresponding to the above three indicators were CFAI, NTFPAI, and HFDI. For easier interpretation of the values of each index, the states or union territories were categorized into four classes on the basis of their index values: very high (>0.75), high (0.50–0.74), medium (0.25–0.49), and low (<0.25).

Composite Index

An overall measure, the CF utilization index (CFUI), was constructed as follows:

$$CFUI_j = \frac{\sum_{i=1}^{n} I_{ij}}{\sum_{i=1}^{n} i} \times 100$$

where, CFUIj is the composite index for the j^{th} state, Iij is the normalized value of the i^{th} indicator, and n is the number of indicators (in this case, 3). Equal weights were applied to all indicators. This approach avoids subjective bias, ensures transparency, and is consistent with best practices in constructing composite indexes in the absence of any empirical evidence for differential weighting [46].

Selection of States for In-Depth Analysis

To complement the national-level analysis, ten states were selected for closer study using a multi-criteria scoring matrix comprising five indicators covering ecological, socio-economic, cultural, and policy dimensions; the score for each varied from 1 (low) to 5 (high), thereby giving a maximum score of 50.The five indicators were as follows: (1) forest cover, (2) implementation of the rights to JFM and to community forest resource (CFR), (3) tribal population, (4) presence and number of biodiversity hotspots, and (5) evidence of traditional forest management systems. This transparent scoring system ensured that the selected states reflected ecological diversity and institutional variation in CF.

Data Quality, Handling, and Validation

Although Mission Antyodaya offered a comprehensive coverage, responses from some villages were either inconsistent or missing entirely. For state-level analysis, the percentages

were derived only from valid responses. Where the reporting gaps exceeded 10% – as was the case with a few states in north-eastern and central India – the results were cross-validated with secondary sources such as the appropriate data sets from the Forest Survey of India [47] and National Sample Survey Office. This triangulation made the results more reliable, lowered the risk of bias from data inconsistencies, and ensured that the indices reflected ground realities.

Visualization and Communication

The values of the indexes were mapped and analysed using ArcGIS (ArcMap ver. 10.8.1). Heat maps, bar charts, and percentage-based charts were employed to highlight spatial heterogeneity, simplify interpretation, and support evidence-based policymaking [48, 49].

Ethical Considerations

This research relied exclusively on publicly available secondary data released by the Government of India through Mission Antyodaya collected under statutory procedures and designed for public dissemination. Also, no information was accessed that could lead to the identification of any individual. The study adhered to the ethical standards for using secondary data, ensuring transparency and responsible reporting, and appropriate acknowledgement of data sources.

Results

Index 1: Community Forest Availability

The National Forest Policy (1988) envisions bringing at least a third of India's total land area under forest or tree cover [50]. Currently, the country's forest cover stands at 0.7 million square kilometres, accounting for approximately 22% of its geographical area. These forests sustain the livelihoods of millions, supporting approximately 17% of the global human population and 18% of the world's livestock [51]. In this context, CF serves as a vital strategy to bridge the gap between existing forest cover and policy targets while enhancing rural livelihoods and promoting sustainable and participatory forest management.

The index of community forest availability showed marked disparities between different Indian states (Fig. 1). Community forestry was the most prevalent in the North-East, particularly in Mizoram, Meghalaya, and Manipur—in these states, more than two-thirds of villages engage in collective forest management, reflecting entrenched customary tenure systems and strong local governance institutions. Nagaland and Arunachal Pradesh also showed high values of the index, underscoring the region's long-standing tradition of community-based forest governance. By contrast, a majority of states, 19 out of 28, showed low values of the index (0–20, indicative of continued dominance by state-controlled regimes and limited uptake of participatory approaches). Moderate values of the index suggest active JFM programmes and institutional support in the form of emerging community reserves. The disparities highlight the influence of socio-cultural traditions, legal frameworks (including autonomous district councils), and terrain-specific contexts on outcomes and emphasize the need for enabling policies, institutional strengthening, and effective implementation of the Forest Rights Act (2006) to expand CF in states showing low values of the index.

Index 2: Household Participation in Commercial Extraction of NTFP

As with community forest availability, the proportion of households engaged in extracting non-timber forest products on commercial basis varied a great deal across states (Fig. 2).

Nagaland housed the greatest proportion of such villages – and therefore the highest value of the index –because nearly all villages in the state participate in NTFP-based livelihoods, a reflection of strong customary rights, active local markets, and a forest-dependent rural economy. The next tier of states recording high values of the index were marked by dense forests, tribal populations, and institutional mechanisms such as cooperatives and state schemes that assured a minimum support-price for some food grains or other commodities. Yet another category comprised states showing substantial but uneven engagement, with active value chains whose outcomes vary according to policy enforcement, rights recognition, and market access. In the North-East, the proportion of villages was constrained by the challenging terrain and inconsistent institutional support. The lowest values of the index were recorded in the north and the west—in states with limited forest cover, smaller forest-dependent populations, and weak commercial networks.

Index 3: Households Primarily Dependent on NTFP Collection and Sales

The percentage of households earning most of their income by selling non-timber forest products showed a highly skewed distribution (Fig. 3), with only three states recording very high values of the index (91–100); however, their

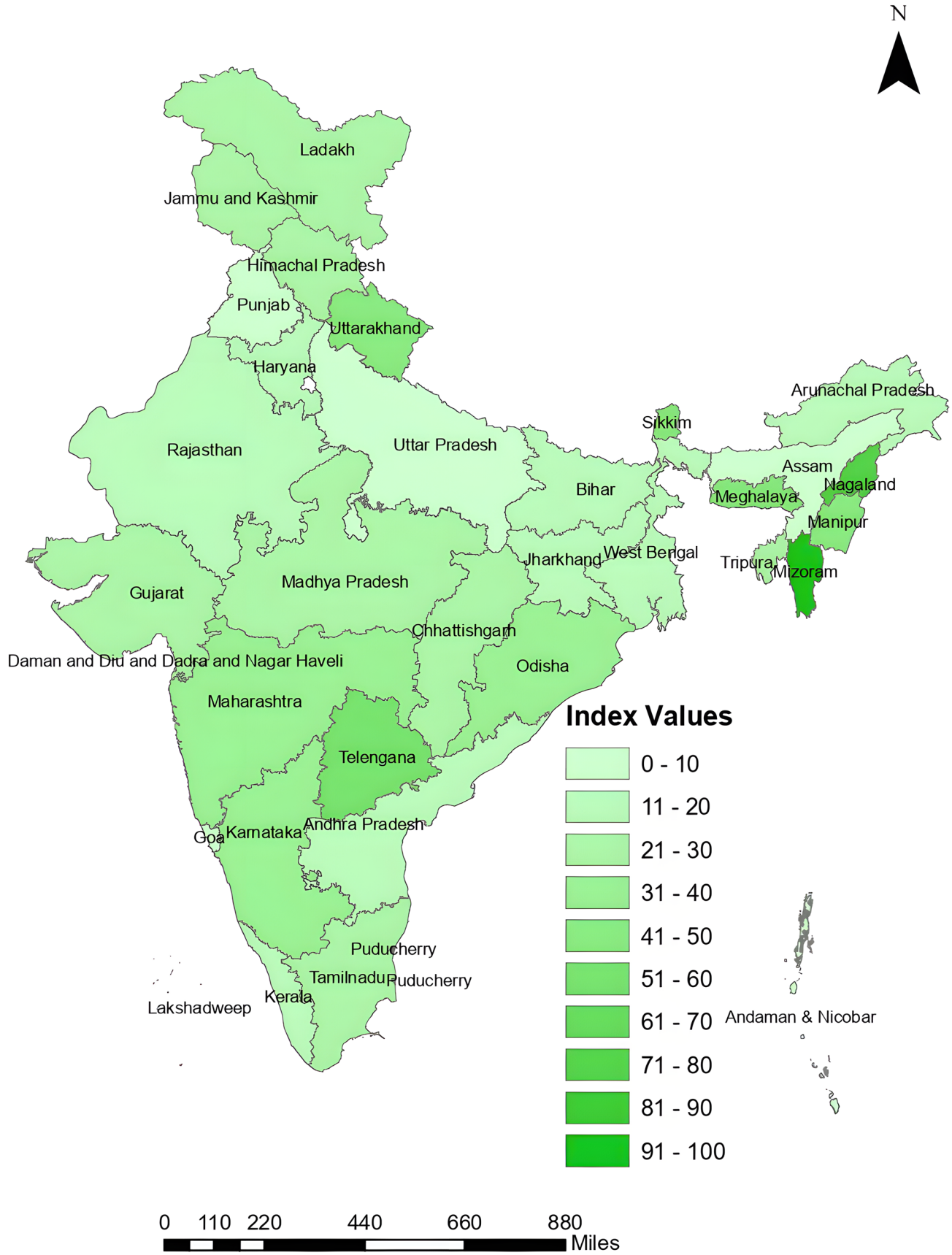

Fig. 1 Proportion of villages that have community-managed forests, by states and union territories in India

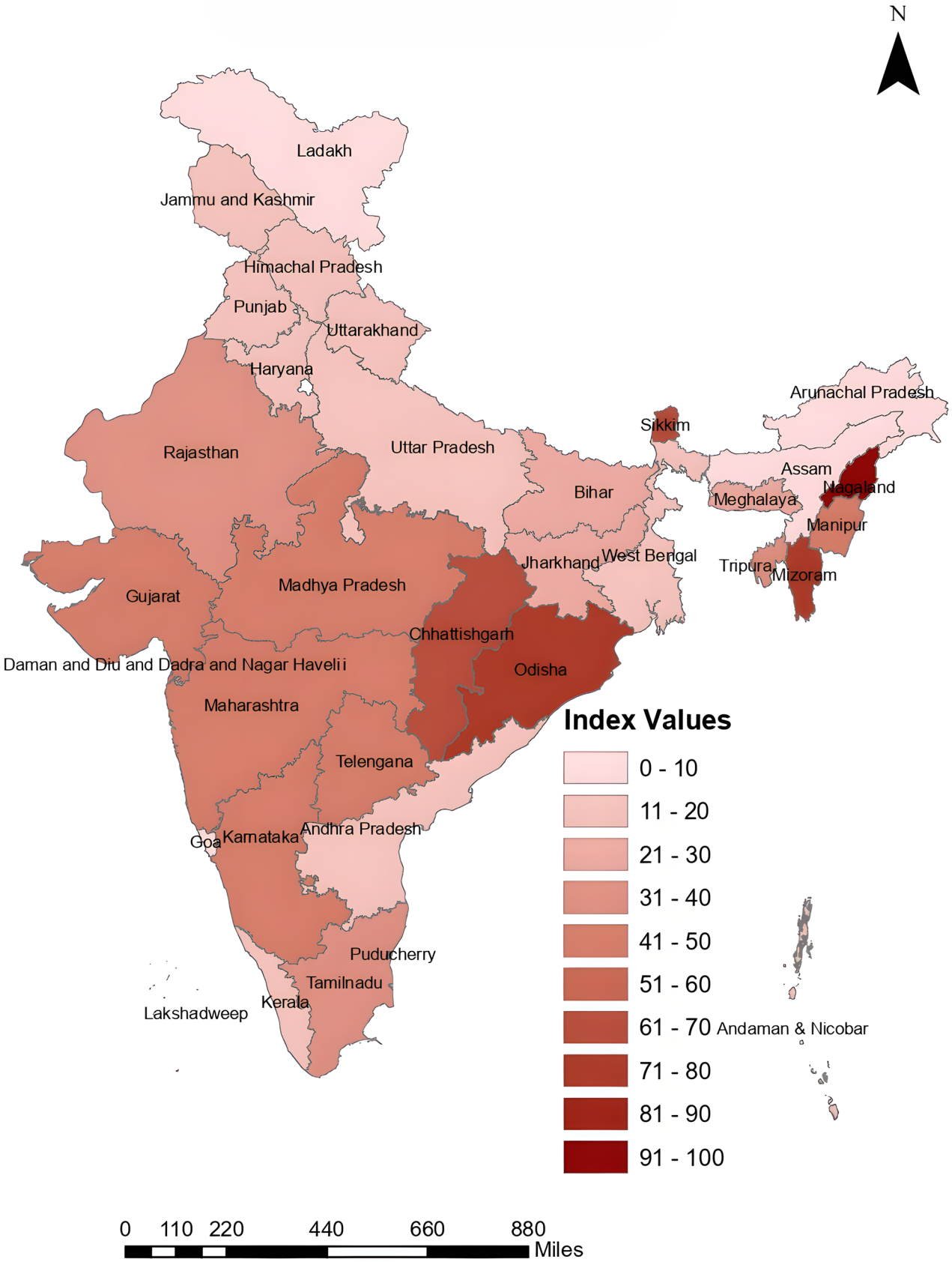

Fig. 2 Proportion of households extracting non-timber forest products on commercial basis, by states and union territories in India

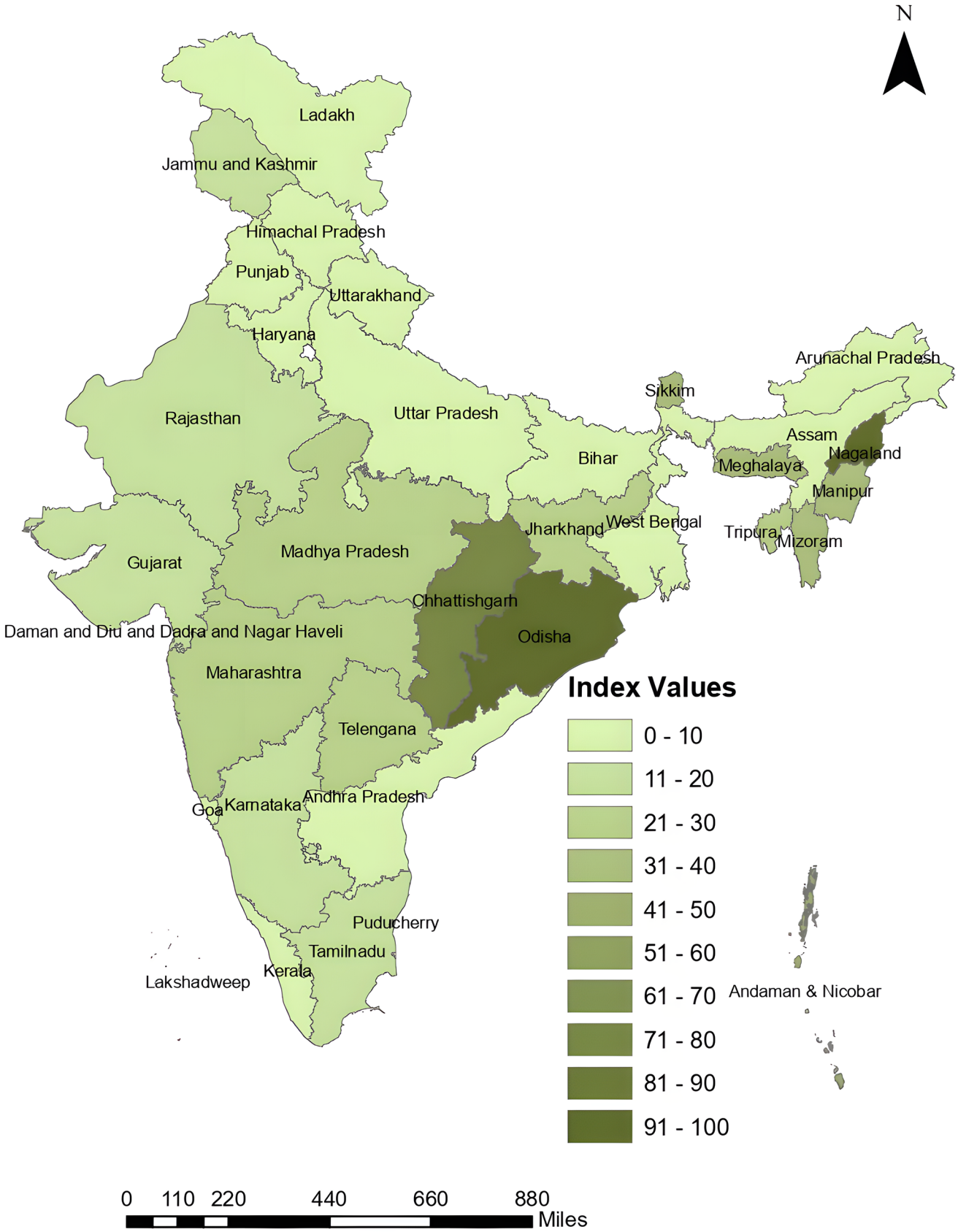

Fig. 3 Percentage of households earning most of their income (more than 50% of the total income) by selling non-timber forest products, by states and union territories in India

livelihood pathways differ markedly, as follows. Odisha relies on formal institutional support, such as the minimum-support-price schemes and state-run federations underpinning trade in sal leaves, siali fibre (from *Bauhinia vahlii*, a giant woody climber), and bamboo; Chhattisgarh demonstrates a federated model with extensive coverage of forest produce under its Minor Forest Produce Federation, anchored by trade in tendu leaves; and Nagaland, in contrast, exhibits localized, custom-based dependence, emphasizing such commodities as broom grass, medicinal plants, and edible insects.

States in the mid-range (61–90) show more heterogeneous patterns. In these states, household dependence on NTFP takes the form of subsistence and trading, facilitated by forest corporations, JFM systems, or local procurement networks. The rest of India showed low values of the index, reflecting limited forest cover, diversified rural economies, and weaker institutional frameworks. At the national scale, just over 627,000 households (0.26% of rural households; Census 2011 baseline) derive more than half their income from NTFP, although such households are highly concentrated among tribal communities and among those living in zones that form the fringes of forests in states showing high value of the index.

Table 1 shows the values of each of the three indexes (CFAI, NTFPAI, HFDI) and the composite score (CFUI) across 34 units comprising Indian states and union territories (marked by an asterisk in the table) in descending order of the composite score and thus highlighting the wide disparities. The north-eastern states such as Mizoram, Nagaland, and Manipur and the eastern state of Odisha consistently recorded high values of all the indexes, reflecting a strong and balanced overall performance. Lakshadweep, comprising a group of islands in the Arabian Sea, recorded zero values of all the indexes, and Goa, Haryana, and Punjab recorded comparatively low scores, suggesting limited performance or possible data constraints. Several other states showed uneven progress across different dimensions. A discernible regional pattern also emerges, with the north-eastern states generally outperforming others and smaller union territories and the northern plains showing low values. Overall, the findings point to pronounced disparities in terms of the four indices.

Table 1 Values of three indexes and of a composite index based on them, by States and union territories in India (CFAI, community forest availability index; NTFPAI, non-timber forest products availability index, HFDI, household forest dependency index, and CFUI, community forestry utilization index)

State or union territory (*)	CFAI	NTFPAI	HFDI	CFUI
Nagaland	77.36	100.00	99.14	92.17
Mizoram	100.00	79.79	32.04	70.61
Odisha	32.13	73.97	100.00	68.70
Chhattisgarh	29.80	62.86	78.70	57.12
Sikkim	41.60	60.97	33.36	45.31
Manipur	47.36	45.00	37.12	43.16
Telangana	54.47	43.80	21.36	39.87
Meghalaya	46.45	27.05	33.62	35.71
Karnataka	30.95	48.48	19.65	33.03
Maharashtra	32.15	41.38	22.04	31.86
Madhya Pradesh	20.56	43.99	23.25	29.27
Gujarat	29.17	44.29	11.86	28.44
Tamil Nadu	27.12	38.93	16.47	27.51
Tripura	22.98	34.69	22.57	26.75
Uttarakhand	41.35	19.41	8.05	22.94
Rajasthan	16.37	33.60	18.27	22.75
Jharkhand	17.11	28.06	20.27	21.81
Andaman and Nicobar Islands*	8.81	11.37	42.51	20.90
Dadra, Nagar Haveli, and Daman and Diu*	40.62	20.51	0.00	20.37
Jammu and Kashmir	27.48	17.48	13.52	19.49
Himachal Pradesh	29.26	16.48	6.59	17.44
Bihar	11.70	21.35	9.03	14.03
Andhra Pradesh	16.92	15.73	8.68	13.77
Arunachal Pradesh	13.49	8.76	9.63	10.62
West Bengal	11.94	13.78	4.73	10.15
Ladakh*	25.25	3.96	0.00	9.74
Puducherry*	11.66	15.05	0.86	9.19
Kerala	13.33	12.46	1.13	8.97
Uttar Pradesh	8.41	11.33	4.11	7.95
Haryana	11.34	10.01	1.38	7.58
Punjab	4.29	12.13	2.43	6.28
Assam	5.36	8.13	4.66	6.05
Goa	8.51	0.00	0.00	2.84
Lakshadweep*	0.00	0.00	0.00	0.00

Status of Community Forest Coverage and NTFP Engagement in Rural India

Figure 4 shows the proportion of villages or households at the all-India level. Only 11.6% of the villages operate under a CF framework (Fig. 4a), which highlights the limited coverage and uneven institutional penetration of CF across rural India. Similarly, only 2.97% of the villages extract NTFP commercially (Fig. 4b), reflecting gross underutilization of forest resources and weak integration into broader market systems. Finally, the proportion of households that derive more than 50% of their income by selling NTFP is only 0.26% (Fig. 4c), emphasizing the marginal contribution of these resources to household-level livelihoods on the national scale. Taken together, these data illustrate a fragmented landscape of CF and NTFP, with formal governance and market-oriented forest use concentrated in a small subset of the states. Although forest-based livelihoods are frequently highlighted in policy discourse, empirical evidence suggests that their role for most rural households remains modest. This gap between ecological potential, institutional

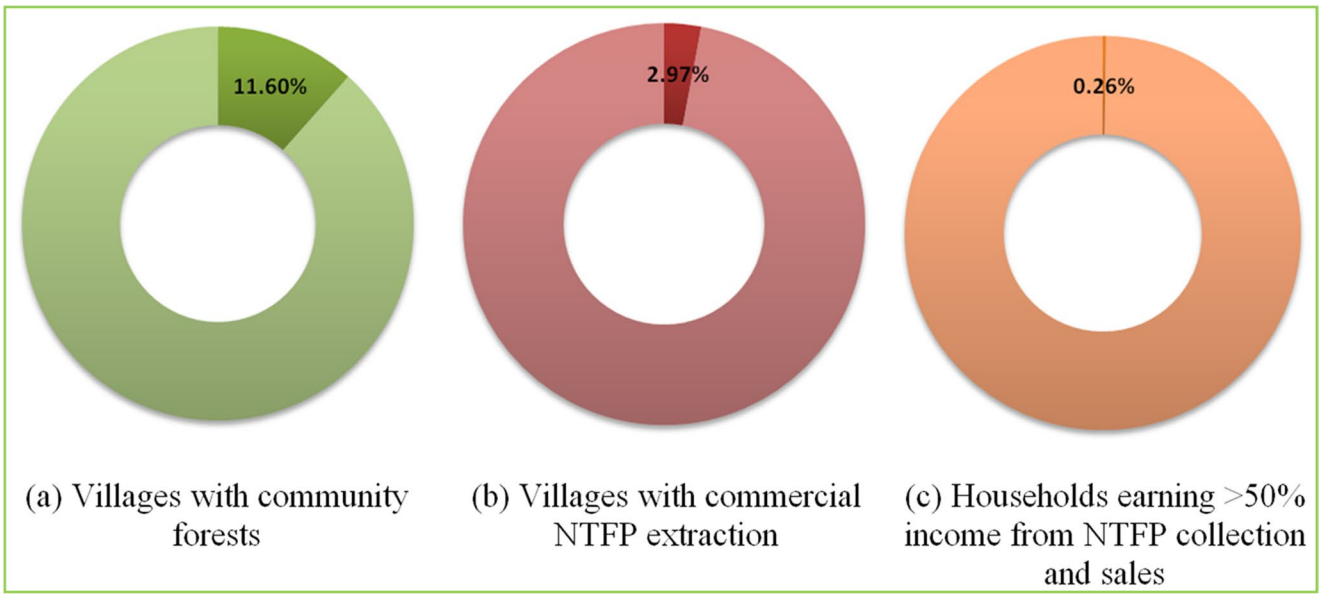

Fig. 4 Proportion of villages or of households across India showing (**a**) presence of community forests, (**b**) practice of commercial extraction of non-timber forest products (NTFP), and (**c**) contribution of income from NTFP exceeding 50% of the total household income

coverage, and livelihood outcomes underscores the need for regionally differentiated policies that can enhance community participation, strengthen market linkages, and promote sustainable use of forest resources.

Community Forestry Landscape in Ten Representative Indian States

Based on the scoring matrix and key selection criteria, ten states were shortlisted to capture the ecological, cultural, and governance diversity relevant to CF and livelihoods in India (Table 2). Collectively, these ten states provide a representative and diverse platform for analysing CF and its linkages to rural livelihoods across India.

Among the ten selected states, Meghalaya ranked first in terms of the percentage of villages with community forests (Fig. 5). The figure highlights regional variation in the extent of adoption of community-based forest management. The north-eastern and Himalayan states, such as Meghalaya and Uttarakhand, exhibit the highest prevalence, reflecting strong customary governance systems, tribal land tenure practices (e.g., Law Kyntang and Law Lyngdoh in Meghalaya [47, 56], and institutionalized forest management frameworks such as the 'van panchayats' (local-level forest councils) in Uttarakhand [49]). States with moderate prevalence benefit from JFM programmes, recognition of the rights to CFR, and tribal welfare initiatives [53, 54]. In contrast, states showing lower adoption reflect the influence of the differences in policy implementation, community participation, forest cover, and local socio-economic or tenure systems [52–54, 60, 61]. These patterns underscore several cross-cutting themes. High-adoption states illustrate how strong sociocultural traditions, supportive policies, and institutional mechanisms can enable widespread community forest management. Conversely, low-adoption states point to the need for context-specific interventions to strengthen governance, recognize community rights, and foster local engagement. Overall, Fig. 5 highlights the critical interplay between sociocultural, institutional, and ecological factors in shaping CF, offering important guidance for policy frameworks that aim to enhance both livelihoods and conservation outcomes.

The proportion of villages engaged in commercial extraction of NTFP across the ten states is shown in Fig. 6. High-engagement states benefit from rich forest resources, strong tribal presence, and institutional mechanisms that support organized collection and marketing. Moderate-engagement states indicate structured community involvement in value chains for products such as tendu leaves, mahua flowers, and honey [57–59]. The lower proportions reflect a combination of ecological constraints, subsistence-oriented forest use, traditional governance systems, and limited infrastructure and access to markets [47, 52, 60–62]. These patterns offer key cross-cutting insights. High-engagement regions may benefit most from continued support for sustainable harvesting, organized value chains, and policy mechanisms that enhance market integration. In contrast, low-engagement states present opportunities to strengthen the commercialization of NTFP through infrastructure development, institutional support, and targeted capacity building, enabling forest-based livelihoods to complement other income sources. Overall, Fig. 6 highlights the importance of context-specific strategies

Table 2 Ten Indian States chosen for more detailed study and reasons for the choice

State	Reasons for selection
Assam	Contributes perspectives from the North-East, emphasizing rich biodiversity, tribal forest use, and shifting cultivation, highlighting both ecological and sociocultural dimensions of forest dependence [53]
Chhattisgarh	Selected for its extensive forest cover, significant tribal population, and active recognition of the rights to community forest resource (CFR), including leadership in implementation within tiger reserves [54, 55]
Jharkhand	Stands out for its forest-based livelihood dependency, long-standing joint forest management, and potential for recognizing CFR [54]
Kerala	Within the Western Ghats biodiversity hotspot, showcases decentralized governance and participatory eco-development initiatives that balance conservation with livelihoods [56]
Madhya Pradesh	With substantial forested areas and proactive CFR implementation, represents a strong institutional example, having one of the largest areas eligible for claims related to CFR [54]
Maharashtra	Included for its diverse livelihood patterns and notable progress in distributing the titles to CFR, supported by active civil-society engagement and progressive reforms in granting secure forest tenures [55]
Meghalaya	Exemplifies community-controlled forests and sacred groves (Law Kyntang), traditionally protected by councils of Khasi, Jaintia, and Garo tribes, reflecting strong customary tenure and biodiversity conservation [48, 57]
Odisha	Combines high dependence on non-timber forest products (NTFP), a large tribal population, and strong implementation of the Forest Rights Act, making the state a national leader in NTFP-based livelihoods and recognition of the rights to CFR [58]
Rajasthan	Despite its limited forest cover, was included for innovative community-based initiatives in arid ecosystems, particularly around 'Orans' (sacred groves or community-conserved forests, often dedicated to local deities, saints, or ancestral spirits) [58, 59]
Uttarakhand	Illustrates the traditional 'van panchayat' system (of forest councils at the village level) in the Himalayas, one of India's oldest models of community governance of forests promoting sustainable use and equity [59]

to foster sustainable NTFP economies as a cornerstone of CF and rural development in India.

The proportion of villages in the ten selected Indian states in which households derived more than 50% of their income by selling NTFPs is shown in Fig. 7. The proportions are a proxy for the extent to which livelihoods depend on forest resources. The data reveal a clear regional pattern: eastern and central states exhibit relatively high dependence whereas states in the north, west, and south show low reliance. The high-dependence states reflect strong tribal populations, extensive forest cover, and policies that support commercialization of NTFP; for instance, NTFP contribute 20%–50% of tribal household incomes in Odisha's Koraput, Bolangir, and Kalahandi districts [63, 64] and about 65% of rural households in Chhattisgarh are engaged in collecting NTFP [65, 66]. Moderate-dependence states reflect localized reliance and active customary forest management [62, 67] whereas low-dependence states enjoy more diversified income sources and smaller forest holdings or face institutional constraints that limit market integration [47, 55, 68, 69]. These patterns suggest cross-cutting themes: high-dependence regions may benefit most from interventions promoting sustainable harvesting, improved access to markets, and policy support to secure both livelihoods and forest conservation. Low-dependence states present opportunities to strengthen NTFP value chains through organization, value addition, and market linkages, potentially supplementing household incomes without disrupting existing livelihood strategies. Overall, Fig. 7 underscores the uneven yet significant role of NTFP in rural economies and highlights the need for context-specific approaches that reflect local ecological, social, and institutional conditions.

Discussion

Community Forest Access: Institutional and Structural Constraints

Although CF is widely promoted as a win–win model for ecological sustainability and rural livelihoods, evidence from the present study reveals its limited reach on the ground. As Fig. 4a shows, only 11.6% of the villages showed some form of a CF framework and 88.4% remained outside it. This disparity underscores the gap between policy ambitions and field realities. The limited spread of CF initiatives stems not so much from ecological scarcity as from institutional and structural barriers. First, the uneven implementation of the Forest Rights Act (2006) has left many potential claimants unaware of their entitlements or delayed its implementation because of protracted verification processes. In states such as Odisha, in which the rights to CF are operationalized more effectively, village institutions enjoy greater autonomy; by contrast, in Jharkhand and Madhya Pradesh, progress remains fragmented owing to administrative inertia and even resistance [70, 71]. Second, overlapping bureaucratic jurisdictions among the departments of revenue, tribal welfare, and forest create regulatory ambiguities that reinforce centralized control by forest authorities. This overlap limits the communities' ability to

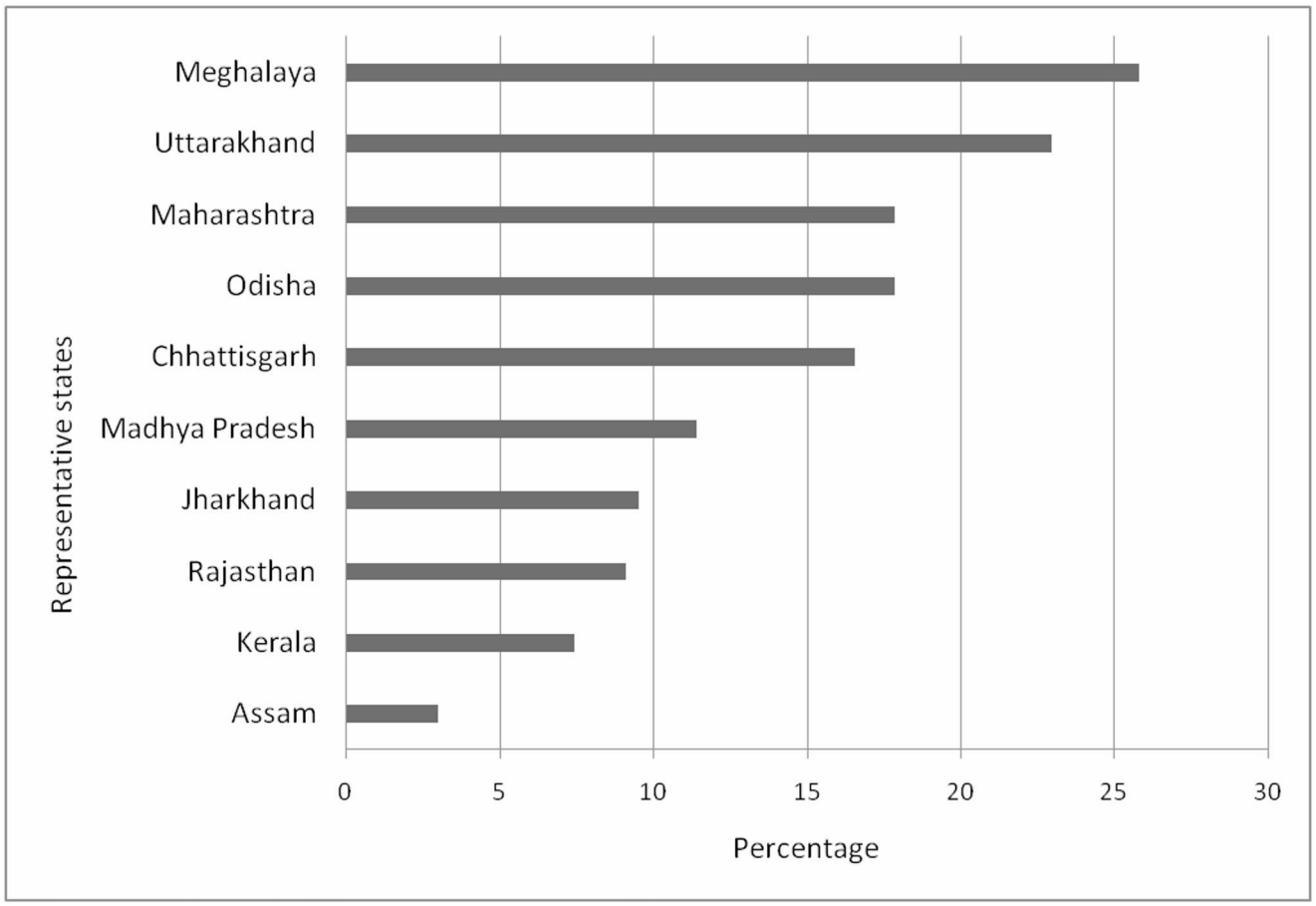

Fig. 5 Percentage of villages with community forests across ten representative states in India

make independent decisions, even when their rights are clear and appropriate committee structures are in place. Third, weak or exclusionary local institutions –including forest rights committees and JFM groups – often restrict participation of marginalized groups. Women, landless households, and 'dalit' or tribal subgroups frequently face social barriers to participating in decision-making or to availing themselves of the benefits from resource use [72, 73]. Ecological pressures further compound these challenges. Forest degradation, fragmentation, and human–wildlife conflict in high-use areas reduce the availability of usable forest resources, limiting livelihood gains even where CF institutions exist [74]. Overall, these findings indicate that the uneven spatial access to CF is driven less by forest distribution and more by the institutional ecology of governance. Wherever empowered village councils, transparent claim processes, and cross-departmental coordination are in place, CF tends to be more inclusive and effective: in their absence, CF frameworks risk existing only in name, with little impact on access or livelihood.

Non-Timber Forest Products in Rural Economies: Potential Versus Market Realities

Despite the ecological abundance and cultural importance of NTFP, their contribution to household income at the national level remains limited. As Fig. 4b shows, very few villages extract NTFP on commercial basis, and only a small proportion of households rely heavily on these resources for their income. This finding highlights the gap between potential and actual livelihood benefits. Although honey and species such as tendu, mahua, and sal are important for subsistence, their commercialization faces persistent structural constraints. First, monopolistic state procurement regimes – for example, state trading of tendu leaves in Madhya Pradesh and Chhattisgarh – limit the bargaining power of communities and lower household incomes [60]. Second, weak market linkages and intermediary dominance mean most NTFP are sold raw or unprocessed at low farm-gate prices, with traders capturing much of the value. Third, inadequate value-addition infrastructure, such as processing

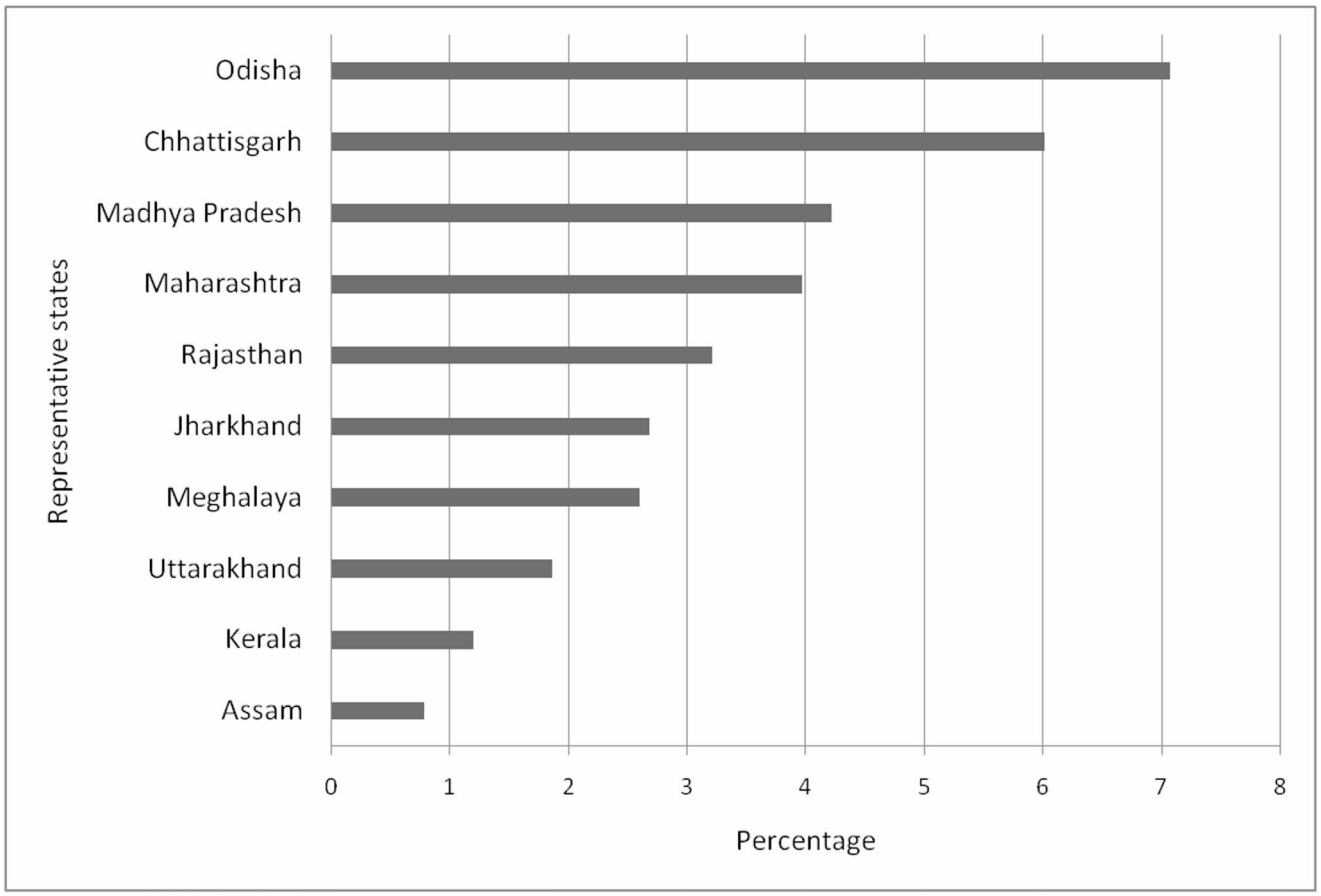

Fig. 6 Percentage of villages engaged in commercial extraction of non-timber forest products (NTFP) across ten representative states in India

units for mahua or honey collection centres, prevents access to higher-value markets [75].

These challenges point to a broader institutional disconnect. Although NTFP are highlighted in policies related forestry, tribal development, and rural livelihood, their integration into rural economies remains modest owing to fragmented institutional responsibilities, underfunded cooperatives, and regulatory uncertainties surrounding access to forests and trade [68]. For instance, the minimum-support-price scheme for NTFP in central India has often failed in augmenting household incomes because of limited awareness, weak procurement networks, and delayed payments. Overall, these findings suggest that the modest economic role of NTFP is not so much due to ecological scarcity as due to policy and institutional bottlenecks. Unlocking the full potential of NTFP requires targeted reforms, including strengthening cooperative procurement systems, expanding local value-addition facilities, and simplifying regulatory frameworks to ensure that the benefits from NTFP accrue to forest-dependent communities instead of to the intermediaries.

Diversified Livelihoods To Reduce Dependence on NTFP and To Increase Resilience of Communities

Non-timber forest products are recognized as important components of sustainable forest management, supporting livelihoods while promoting ecological balance. Since the Brundtland Report, they have been promoted as a way to reconcile conservation with the economic, social, and cultural needs of forest-dependent communities [76, 77]. Yet, analyses at the level of households indicate that, despite ecological availability, NTFP contribute only minimally to rural livelihoods. This limited reliance on NTFP reflects greater diversity in the sources of income, as households increasingly combine farming, paid labour, migration, and other off-farm activities to augment their income and to lower their vulnerability. Although such diversification enhances resilience, it simultaneously diminishes the relative economic contribution of NTFP. Empirical studies show that access to off-farm and non-farm opportunities further reduces dependence on forests, with NTFP serving primarily as sources of supplementary income [78, 79]. Moreover,

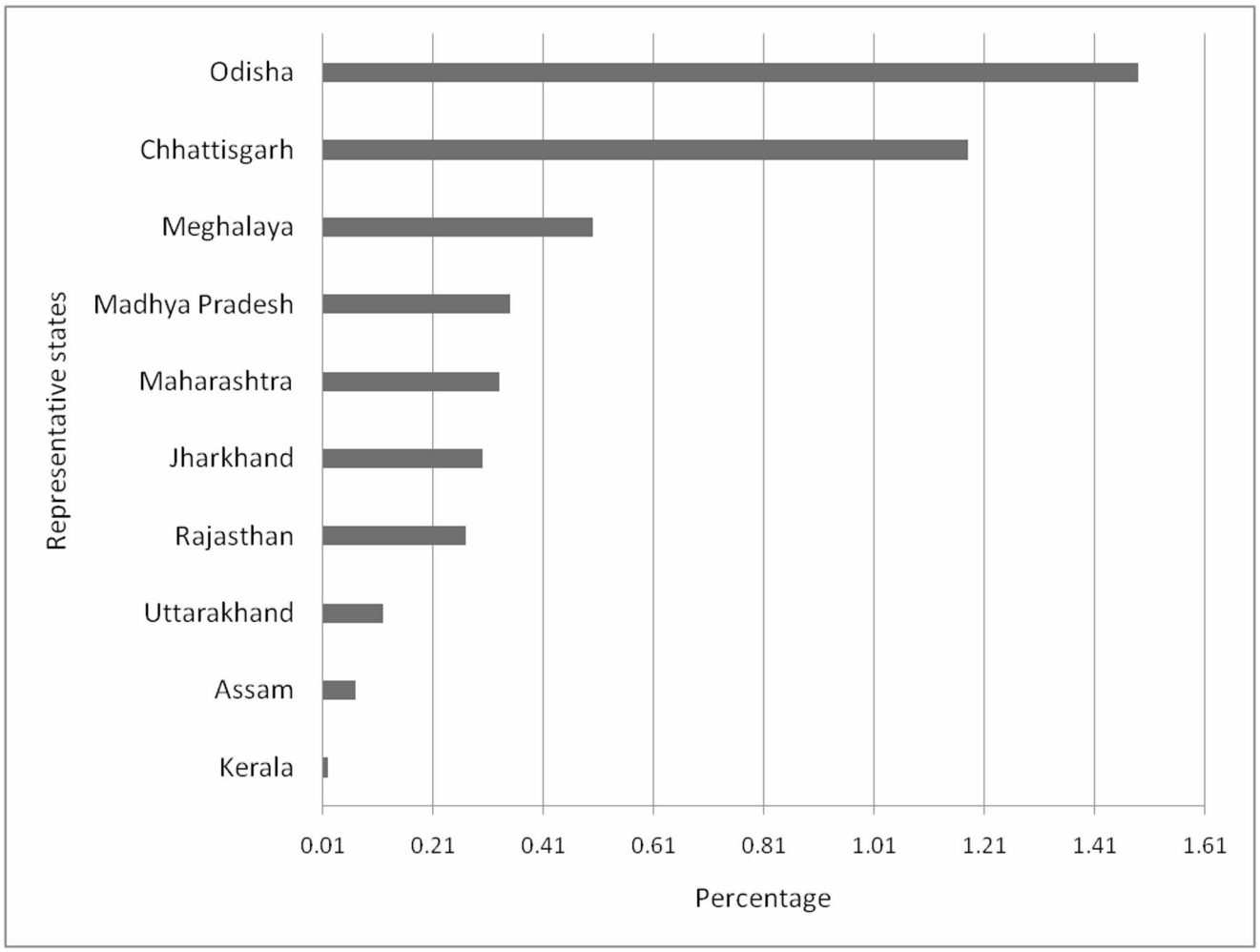

Fig. 7 Percentage of households in villages where over 50% of annual income is derived from collection and sale of non-timber forest products, across ten representative states in India

despite frequent claims, there is little empirical evidence that NTFP alone create poverty traps; most suggested links are conceptual rather than context-specific and should be treated cautiously. Systematic reviews (2019–2024) confirm that differences in livelihood portfolios largely explain the variations across states in the extent of dependence on forests. Taken together, these findings suggest that diversified livelihoods strengthen economic stability while reducing the relative importance of NTFP [80].

Socio-economic and Ecological Challenges To Using NTFP

The use of non-timber forest products is often linked to a range of negative – and sometimes unexpected – socio-economic and ecological consequences. Overexploitation, driven by the potential for significant income, inadequate resource management, and weak community leadership, is a widespread concern [81, 82]. In Indonesia, for example, Menggala et al. (2019) [81] observed that practices such as harvesting bark by cutting down entire trees, intensive extraction, and slash-and-burn techniques contributed to deforestation and posed serious threats to biodiversity. Unequal access to NTFP further widens social and economic inequities [83]. Socio-economic disparities also influence how the benefits of NTFPs are distributed: Nkem et al. [84] found that local communities often receive only a fraction of the value of the commodities they harvest: wholesalers and retailers capture most of the profits. Kimengsi et al. [85] highlighted that dependency on NTFP is influenced by demographic and socio-economic factors including age, gender, economic status, education, and family structure, and further emphasized the role of education, family size, landholding, and proximity to forests in determining the income from NTFP [86]. To address these challenges, strategies such as promoting gender equity, providing training

in sustainable harvesting, and implementing environmentally friendly regulations have been recommended to reduce unsustainable dependency on NTFP [87].

Trade-offs in and Constraints To NTFP-Based Livelihoods

Although non-timber forest products can provide supplementary income and support rural livelihoods, their use involves significant trade-offs and constraints. Overharvesting, limited access to markets, and weak institutional support often restrict the economic benefits that households can derive from NTFP [88]. Intensive extraction practices may also degrade forest ecosystems, threatening biodiversity and long-term availability of resources [39]. Moreover, access to NTFP is frequently uneven, with wealthier or better-connected households capturing disproportionate benefits, widening social and economic inequalities [85]. Seasonal fluctuations, labour demands, and dependence on ecological conditions further constrain the reliability of NTFP as a source of livelihood. Consequently, although NTFP contribute to diversified livelihood strategies, realizing their full potential requires careful management, equitable access, and supportive policies that balance ecological sustainability with socio-economic gains.

Conclusions

The present study provides the first nationwide empirical assessment of community forestry (CF) and non-timber forest products (NTFP) in India, highlighting persistent gaps between policy intent and lived realities. Three key insights emerge. First, access to community forests remains limited, with seriously tardy progress in many states in recognizing the rights to community forest resource (CFR). Second, dependence on NTFP as a livelihood base is modest: only 0.26% of forest-dependent households derive more than half their income from them, indicating underutilized potential. Third, outcomes are shaped by sharp spatial and institutional disparities: proactive engagement of tribal communities and enabling policies in Odisha and Chhattisgarh contrast with underutilization in Kerala and Assam. These findings reveal the gap between progressive frameworks, such as the Forest Rights Act (2006) and joint forest management, and their uneven translation into access, equity, and livelihood benefits. In the short term (1–3 years), policy efforts should prioritize faster recognition of CFR and tenure security by streamlining claim processes and removing bureaucratic hurdles; strengthening village councils through capacity building and inclusive governance; improving links to the markets for NTFP through fair minimum support prices, aggregation, and convergence with rural livelihood schemes; and bridging the gaps in infrastructure and finance through expanded credit and investment in storage, processing, and transport.

Over the longer term (4–10 years), deeper transformation requires embedding CF and NTFP into broader economic and ecological strategies. This includes developing community-led value chains via state-level NTFP federations, institutionalizing participatory governance by integrating community representation into forest planning and biodiversity programmes, and aligning CF and NTFP livelihoods with national priorities on tribal development, resilience to the adverse effects of climate change, and biodiversity commitments under the UN SDGs (sustainable development goals) and NDCs (nationally determined commitments). Sustained capacity building and innovation through regional training hubs under the Indian Council of Forestry Education and Research can support sustainable harvesting, enterprise management, and digital access to markets. Ultimately, India's forests must be seen not only as ecological assets but also as socio-ecological systems vital to the dignity and resilience of forest-dependent communities. Translating these insights into action requires stronger coordination among the union Ministry of Tribal Affairs and the Ministry of Environment, Forest, and Climate Change, state forest departments, institutions of local governance such as village councils and 'panchayat raj', and civil society to bridge the gap between legal entitlements and everyday realities. These actions will enable CF to evolve from a mere legal framework into a cornerstone of inclusive and sustainable rural development.

Key references

- Hazari S, Kalita M, Lahiri B. The value of Non-Timber Forest Products (NTFPs) in promoting India's rural livelihoods. *Indones J For Res*. 2023;10(2):221–37.

  This paper underscores the economic and livelihood significance of NTFPs in rural India. It provides empirical evidence on how NTFPs contribute to household income and resilience, offering critical insights for sustainable forest management and rural development policies.

- Bohnett E, Lamichhane S, Liu YT, Yabiku S, Dahal DS, Mammo S, et al. The implications of community forest income on social and environmental sustainability. *Sustainability*. 2023;15(8):6603. https://doi.org/10.3390/su15086603.

This paper examines how income derived from community forests influences both social equity and environmental outcomes. It highlights the dual role of community forestry in supporting livelihoods while contributing to sustainability, making it highly relevant for policy and practice.

- Hajjar R, Oldekop JA, Cronkleton P, Newton P, Russell AJ, Zhou W. A global analysis of the social and environmental outcomes of community forests. Nat Sustain. 2021;4(3):216–24.

  This landmark global study evaluates both social and ecological outcomes of community forestry. Its robust comparative evidence makes it central to debates on whether community forestry can simultaneously deliver livelihood benefits and conservation gains.

- Charnley S, Poe MR. Community forestry in theory and practice: Where are we now? Annu Rev Anthropol. 2007;36(1):301–36.

  This paper provides a foundational synthesis of community forestry concepts and practices, establishing the theoretical grounding for subsequent scholarship. It is pivotal for understanding how community forestry has evolved in both academic and applied contexts.

- Government of India. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. New Delhi: Ministry of Law and Justice; 2007.

  This Act provides the legal foundation for community forest rights in India, redefining governance frameworks and equity in forest access. It remains the most critical policy intervention shaping contemporary community forestry in the Indian context.

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  This paper offers large-scale comparative evidence on the contribution of forests to rural incomes worldwide. It underscores the livelihood significance of environmental resources and strengthens the economic rationale for community-based forest management.

- Shackleton CM, Pandey AK. Positioning non-timber forest products on the development agenda. For Policy Econ. 2014;38:1–7.

  This paper frames non-timber forest products (NTFPs) as central to rural development but under-recognized in policy debates. It highlights their critical role in subsistence, income generation, and resilience, making it highly relevant for integrating livelihoods into community forestry discourse.

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Author Contributions All authors contributed equally to drafting and reviewing the manuscript.

Data Availability No datasets were generated or analysed during the current study.

Declarations

Conflict of interest None.

Competing interests The authors declare no competing interests.

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