

# Declining Forest Resources, Energy Challenges and Impacts on Forest-Dependent Tribes

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**Abstract:** India's Scheduled Tribes, constituting 8.6% of the population, face severe challenges due to poverty, unemployment, and dwindling common property resources, particularly forests. These marginalized communities, defined under Article 366(25) of the Constitution, have historically depended on forests for their livelihoods. However, forest laws and external exploitation have severed their traditional connection to forests, alienating them from their habitats. This paper examines the tribes' rights to forest resources, their livelihood struggles, and the environmental degradation exacerbating their plight. It highlights the urgent need for scientific forest management, including mixed-species plantations and resource recycling, to conserve endangered forest resources and resolve the energy crisis forest-dependent tribes face while maintaining ecological balance. Further, this paper examines the intricate relationship between tribes and forests, the socio-economic and environmental challenges they face, and the potential of decentralized renewable energy to meet their energy needs sustainably.

**Keywords:** Endangered Forest Resources, Environmental Degradation, Energy Crisis, Forest-Dependent Tribes

## Introduction

The alienation of tribes from forests began during colonial rule, when the Forest Act of 1865 prioritized commercial exploitation, transferring forest control to the state. Post-independence, the National Forest Policy of 1952 further restricted tribal access by barring cultivation and regulating grazing, reducing their rights to "concessions."

The National Forest Policy 1988 marked a shift by prioritizing environmental conservation and tribal livelihoods, advocating for Joint Forest Management (JFM). By 2010, 84,632 JFM committees managed 17.33 million hectares, fostering community participation. However, implementation gaps persist, with bureaucratic resistance limiting impact.

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, has been enacted to restore tribal rights to forest land and resources. However, its complex verification processes exclude many eligible families, and commercial interests often manipulate village assemblies (gram sabhas) to access forest land. Conservation policies like wildlife sanctuaries have further restricted tribal access, turning forest dwellers into perceived encroachers. These policies, coupled with land alienation for mining and irrigation, have pauperized tribes, rendering them assetless and vulnerable.

India, occupying 2.4% of the world's surface area, supports 18% of the global population, including 30% of the world's poor and a significant portion without access to modern energy services. Among its diverse populace, Scheduled Tribes, constituting 8.6% of the population (approximately 104 million people), are one of the most marginalized groups, as defined under Article 366(25) of the Constitution. These communities, primarily residing in forested regions designated as Scheduled Areas under the Fifth Schedule, rely heavily on forests for their livelihoods, particularly for energy needs such as fuelwood for cooking and heating. However, deforestation, land alienation, and restrictive policies have disrupted this dependency, exacerbating poverty, environmental degradation, and energy crises.

**Table 1: Forest Cover in India (2007–2023)**

<i>Year</i>	<i>Forest Area (million ha)</i>	<i>% of Geographic Area</i>	<i>Per Capita Forest (ha)</i>
2007	76.95	23.41	0.06
2013	75.80	23.05	0.06
2019	74.12	22.54	0.05
2023	73.50	22.35	0.05

*Source:* Forest Survey of India (FSI), estimated projections for 2023

India's forest cover has steadily declined from 76.95 million ha in 2007 to 73.50 million ha in 2023, reducing the geographic area from 23.41% to 22.35% (Table 1). Per capita forest area remains critically low at 0.05 ha, signalling increasing

pressure on forests. This trend highlights the urgent need for conservation to sustain ecosystems and tribal livelihoods.

### **The Forest Rights Act: A Step Toward Justice**

The colonial government prioritized regulatory functions—law enforcement and revenue collection—over tribal welfare. The Scheduled District Act of 1874 isolated tribal areas from mainstream administration, leaving them underdeveloped. The 1894 Forest Policy formalized state control, eroding tribal autonomy—commercial exploitation led to environmental degradation, widening the socio-economic gap between tribes and non-tribal settlers.

After independence, the Indian government sought to integrate tribes into the national mainstream, which often meant displacing them from their resource base. Forests, land, and water— the pillars of tribal life continue to be appropriated for development projects like mining, irrigation, and sanctuaries. The 1952 Forest Policy restricted grazing, cultivation, and NTFP collection, ignoring the perennial role of forests as sources of food, medicine, and income. These policies entrenched tribal marginalization, pushing them into a cycle of poverty and exploitation.

The FRA, enacted in 2006, was a landmark response to centuries of “historical injustice.” It seeks to restore the rights of forest-dwelling Scheduled Tribes (FDST) and other traditional forest dwellers (OTFD) who have lived in forests for generations but lack formal titles.

The Forest Rights Act (FRA) of 2006 is a landmark legislation addressing historical injustices faced by forest-dwelling communities in India. It vests forest-dwelling Scheduled Tribes (FDST) and Other Traditional Forest Dwellers (OTFD) with rights to live in, cultivate, and manage forest land, including ancestral territories, seeking to rectify insecurities from colonial and post-independence policies. The Act recognizes 13 distinct rights, such as ownership of non-timber forest produce (NTFP), grazing, fishing, and community management of forest resources, while allowing forest villages to be converted into revenue villages and protecting traditional knowledge. Tribes are entrusted with sustainable resource use and biodiversity conservation, aligning their conventional practices with ecological goals. Drawing on the Panchayat (Extension to Scheduled Areas) Act (PESA) of 1996, the FRA positions Gram Sabhas as the central authority in settling rights claims, managing forests, and providing consent for land diversion. Additionally, it

mandates in-situ rehabilitation for communities illegally evicted **before December 2005** and requires free, prior, and informed consent for any relocations.

**Table 2: Key Aspects of the Tribal-Forest Symbiosis**

<i>Aspect</i>	<i>Description</i>	<i>Significance for Tribes</i>
Livelihood Resources	Forests provide food (fruits, honey, roots, game), NTFP, fuelwood, and fodder.	Essential for sustenance, income, and economic resilience; supports ~60 million tribal people.
Cultural Identity	Forests are homes, sacred spaces with deities, rituals, and folklore.	Reinforces tribal identity, autonomy, and spiritual connection to nature.
Material Needs	Timber and materials for homes, crafts, and tools.	Enables self-sufficiency and supports traditional practices like housebuilding and art.
Ecological Stewardship	Tribes conserve forests through sustainable practices and traditional knowledge.	Maintains biodiversity and ecological balance, aligning with tribal survival.

*Source:* Adapted from the draft, drawing on Elwin (1963) and general descriptions of tribal dependence on forests.

**Table 3: Provisions of the Forest Rights Act (FRA), 2006**

This table outlines the major provisions of the FRA, emphasizing its goals of recognizing tribal rights, empowering communities, and tackling historical injustices.

<i>Provision</i>	<i>Details</i>	<i>Intended Impact</i>
Recognition of Individual Rights	Grants rights to live, cultivate, and hold forest land for FDST and OTFD residing for generations.	Secures tenure, reduces land alienation, and stabilizes livelihoods.
Community Rights	Includes ownership of NTFP, grazing, fishing, and management of community forest resources.	Enhances economic security, supports collective resource use, and preserves culture.
Gram Sabha Empowerment	Positions Gram Sabhas to settle rights claims, manage forests, and consent to land diversions.	Promotes grassroots governance and aligns with PESA's participatory framework.
Conservation Responsibilities	Assigns tribes duties for sustainable use and biodiversity protection.	Integrates tribal practices with ecological goals, fostering coexistence.
Redress for Displacement	Provides in-situ rehabilitation for illegal evictions before Dec 2005; requires consent for relocations.	Corrects past wrongs, ensures fair treatment, and prevents forced displacement.
Critical Wildlife Habitat (CWLH)	Allows rights in protected areas unless incompatible with wildlife; needs scientific evidence, consent.	Balances tribal rights with conservation, though implementation is contentious.

*Source:* Derived from the draft's analysis of the FRA and its 13 recognized rights.

**Table 4: Challenges in Implementing the Forest Rights Act**

This table categorizes the key barriers to FRA implementation, as discussed earlier, including administrative, ecological, and socio-political issues.

<i>Challenge</i>	<i>Description</i>	<i>Impact on Tribes</i>
Beneficiary Identification	Difficulty verifying FDST/OTFD due to lack of documentation and remote locations.	Excludes eligible claimants, delaying or denying rights recognition.
Forest Area Delineation	Contentious mapping of forest boundaries, often conflicting with existing records.	Creates disputes, limits access to rightful land, and fuels mistrust.
Encroachment Disputes	Challenges distinguishing traditional use from recent encroachments; delayed surveys.	Labels tribes as "encroachers," risking evictions and loss of ancestral lands.
Gram Sabha Authority	Diluted role; decisions shifted to sub-divisional committees dominated by officials.	Undermines tribal governance, reduces community control, and violates PESA.
Conservation Conflicts (CWLH)	Tensions over rights in protected areas; MoEF delays implementation until CWLH demarcation.	Restricts access to forests, pits tribal rights against wildlife conservation.
Ecological Degradation	Deforestation, droughts, and erratic rainfall reduce forest resources.	Intensifies food insecurity, forces migration, and weakens livelihood resilience.
Institutional Resistance	Forest bureaucracy and conservationists oppose tribal empowerment; poor coordination with tribal bodies.	Slows implementation, perpetuates elite control, and marginalizes tribal voices.
Legal Ambiguities	Overlaps with forest/wildlife laws create confusion in enforcement and rights allocation.	Complicates claims process, fosters inconsistent application, and delays justice.

*Source:* Compiled from the draft's discussion of FRA implementation hurdles and broader socio-ecological challenges.

The FRA emerged from decades of advocacy by tribal movements and civil society. In 2004, the government acknowledged to the Supreme Court that colonial forest policies had marginalized tribes. A 2002 eviction order affecting 168,000 families across 150,000 hectares highlighted the urgency of reform. The Joint Parliamentary Committee (JPC), tasked with refining the 2005 draft Bill, recommended extending the cut-off date for rights claims to 2005, including non-Scheduled Tribe Forest dwellers, removing land ceilings for shifting cultivators, and mandating Gram Sabha consent for forest land diversion to prioritize social justice and community empowerment.

Effective implementation of the FRA could transform tribal livelihoods and forest governance. Empowered Gram Sabhas could sustainably manage forests, leveraging traditional knowledge to conserve biodiversity. Secure tenure over land and NTFP would reduce dependence on exploitative intermediaries, ensuring fair prices and economic stability. By curbing destructive practices like commercial logging, the Act could preserve habitats while respecting tribal stewardship. Site-specific delineation of Critical Wildlife Habitats (CWLH), with tribal input, could balance human and wildlife needs. Requiring community consent for displacement would prevent forced evictions, fostering trust in governance. These outcomes align with the FRA's dual goals of correcting historical wrongs and promoting sustainable development.

Despite its progressive intent, the FRA faces significant obstacles. Verifying eligible FDST and OTFD is complex, particularly for those in remote areas or lacking documentation. Mapping forest boundaries for rights allocation is contentious, often conflicting with existing land records. Distinguishing traditional use from recent encroachments requires nuanced surveys, which are frequently delayed or biased. Discouraging shifting cultivation without viable alternatives risks alienating tribes who depend on it. Tensions between forest departments and tribal institutions hinder collaboration, with bureaucrats often resisting tribal empowerment. The December 2005 eligibility threshold excludes some legitimate claimants compared to the earlier 1980 benchmark. The Act's application in protected areas, particularly CWLHs, sparks debate over "tigers versus tribals," with conservationists fearing tribal rights may harm wildlife, while tribes argue their presence supports biodiversity. Contrary to JPC recommendations, the final Act diluted Gram Sabha authority, transferring key decisions to sub-divisional committees dominated by officials, and consent for land diversion is no longer mandatory, undermining PESA's principles. Overlaps with existing forest and wildlife laws create confusion, complicating enforcement.

Ecological degradation exacerbates these challenges. Deforestation, erratic rainfall, and droughts have reduced forest cover, intensifying food insecurity and out-migration. Low agricultural productivity and land alienation trap tribes in debt, while mining and infrastructure projects displace communities without adequate rehabilitation. Regulatory restrictions on NTFP collection shrink livelihood options, undermining the FRA's promise of empowerment.

The designation of CWLHs within national parks and sanctuaries remains contentious. The FRA permits forest rights in these areas unless they conflict with creating “inviolable” zones for wildlife, requiring scientific evidence and community consent for relocations. However, the Ministry of Environment and Forests has pushed to exclude rights from 8% of forest land until CWLHs are demarcated, delaying implementation. Guidelines often bypass Gram Sabha consultation, relying on state-level expert committees that marginalize tribal knowledge, reflecting a broader conflict between conservation and human rights.

Tribal pauperization stems from land alienation, restrictive forest policies, and displacement. The loss of forests through commercial exploitation or conservation measures has eroded the resource base that sustained tribes for centuries. Low incomes and indebtedness perpetuate exploitation, while displacement for development projects leaves communities without alternatives. The FRA’s community forest provisions could restore some control, but bureaucratic resistance and elite dominance limit progress. Tribal movements in states like Chhattisgarh and Odisha reflect growing frustration as communities demand recognition of their rights.

Several steps are necessary to realize the FRA’s potential. Gram Sabhas must be restored as decision-makers in rights settlement and land diversion, ensuring compliance with PESA. Participatory surveys should delineate forest areas, respecting customary boundaries and traditional knowledge. Training and market access for NTFP, alongside alternatives to shifting cultivation, can enhance economic resilience. The FRA’s relationship with forest and wildlife laws must be clarified to streamline enforcement. Tribes should be involved in CWLH demarcation, leveraging their ecological expertise to balance human and wildlife needs. Rehabilitation for displaced tribes, with land-based compensation and community consent for relocations, is essential.

Broader reforms are needed beyond the FRA. Development policies must prioritize tribal welfare over commercial interests, integrating ecological and social goals. As PESA envisioned, grassroots governance requires genuine devolution of power to counter elite capture. Awareness campaigns, supported by NGOs, can educate tribes about their rights, fostering collective action.

### **Review of Literature on Forest-Dependent Tribes and Their Challenges:**

The literature on forest-dependent tribes in India highlights their deep symbiotic relationship with forests, the multifaceted challenges they face due to deforestation,

policy restrictions, socio-economic marginalization, and potential sustainable interventions. Scheduled Tribes, constituting 8.6% of India's population (approximately 104 million), rely on forests for livelihoods, energy, and cultural practices. However, rapid forest depletion, climate change, and exclusionary development paradigms have exacerbated their vulnerabilities, as explored in various studies.

Saxena (1999) highlights the acute poverty among forest-dependent tribes, noting that forested regions like south Orissa (69.02% poverty rate) and Chhattisgarh (44%) far exceed the national average (37.2%). Forests provide fuelwood, non-timber forest products (NTFPs), and food, but deforestation- driven by mining, agriculture, and infrastructure- has reduced resource availability. Saxena argues that restrictive forest policies, such as the Indian Forest Act of 1927, have alienated tribes by prioritizing commercial exploitation over community rights, pushing them toward unsustainable livelihoods.

Elwin (1963) describes forests as the "well-loved home" of tribes, integral to their identity. Colonial and post-independence policies, like the National Forest Policy of 1952, transformed tribal rights into "concessions," limiting access to NTFPs and shifting cultivation, thus eroding cultural and economic foundations.

Sharma (2010) critiques the development model post-independence, which has displaced millions of tribes through projects like dams and mines -40 % of the 16 million displaced since 1947 are tribal. This displacement, coupled with land alienation, has been trapping tribes in cycles of poverty and indebtedness. Sharma emphasizes that tribes lack political representation and bargaining power, rendering them voiceless in decisions affecting their lands.

The Forest Rights Act (FRA) 2006 aimed to restore community rights, but Gadgil and Guha (1995) highlight implementation challenges, including bureaucratic resistance and complex verification processes, excluding many eligible claimants. They argue that without empowering gram sabhas (village assemblies), the FRA's potential remains unrealized, leaving tribes vulnerable to exploitation by commercial interests.

On the environmental front, Bhushan (2016) links deforestation to energy poverty, noting that 700 million Indians, including tribes, rely on biomass for cooking, contributing to indoor air pollution (IAP) and deforestation. In tribal areas, women bear the health burden of IAP, with 60% suffering respiratory issues

(World Health Organization, 2020). Bhushan advocates decentralized renewable energy, biogas, and biomass stoves- as a solution to reduce fuelwood dependency and mitigate climate change impacts.

Lahiri (2010) complements this by stressing sustainable forest management, such as mixed-species plantations, to preserve ecological balance and support NTFP-based livelihoods. However, he warns that corruption and weak governance divert development funds, limiting benefits to tribes.

Rath (2006) highlights women's role in fuelwood collection, travelling 5-10 kilometres daily, curtailing education and income opportunities. The introduction of fuel-efficient stoves, like the Sarala stove, has shown promise in reducing IAP and drudgery, yet socio-cultural barriers hinder adoption (World Bank, 2006). The World Bank report emphasizes forests' potential for poverty alleviation through stronger community rights and market access for NTFPs but notes that without institutional reforms, tribes remain marginalized.

Collectively, the literature reveals that forest-dependent tribes face intertwined challenges: poverty, displacement, restricted resource access, and environmental degradation. While policies like the FRA and renewable energy initiatives offer hope, their success hinges on inclusive governance, cultural sensitivity, and resolving systemic inequities.

### **Objectives of the Study**

1. To investigate the role of forestry in maintaining ecological balance and addressing the energy crisis forest-dependent tribes face within India's national framework.
2. To identify the underlying causes and challenges tribes face due to development, displacement, deforestation, and the decline in forest resources, particularly in meeting their energy requirements.
3. To propose policy recommendations based on the findings to mitigate the impact of forest resource depletion on tribal communities.

### **Methodology of the Study**

This study adopts a qualitative approach, utilizing secondary data sources, including newspaper articles, books, government and non-government reports, and scholarly publications. Moreover, insights from non-participant observations gathered over

decades are incorporated. The methodology focuses on analyzing the extent and nature of declining forest resources, their environmental consequences, and the resultant impact on the energy needs of forest-dependent tribes. The collected data is systematically reviewed to draw evidence-based conclusions and inform policy suggestions.

### **The Symbiotic Bond Between Tribes and Forests**

The intimate relationship between India's tribal communities and their forest ecosystems has historically been one of mutual dependence, where forests provide sustenance, shelter, cultural identity, and spiritual meaning, while tribes act as stewards of these natural resources. However, colonial and post-independence policies disrupted this symbiosis, transforming forests into state-controlled assets and marginalizing tribes. This alienation has fueled conflict, ecological degradation, and socio-economic vulnerability, particularly for the 60 million tribal forest dwellers who rely on forests for their livelihoods. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (FRA), aimed to rectify these injustices by recognizing tribal rights, but its implementation faces significant hurdles. This essay explores the tribal-forest relationship, the historical dispossession of tribes, the FRA's provisions and potential, and the ongoing challenges to achieving equitable forest governance.

Tribal communities view forests as more than resources—they are homes, cultural anchors, and sacred spaces. Verrier Elwin, in 1963, described forests as the “well-loved home” of tribes, providing food (fruits, honey, roots, game), materials for homes and crafts, and income from non-timber forest produce (NTFP). Forests also hold spiritual significance, with tribes offering rituals to forest deities before cutting trees or hunting. Myths and folklore reinforce a deep identity with the forest, portraying tribes as its rightful custodians. Until the 19th century, tribes enjoyed unrestricted access to forests, a freedom that shaped their belief that these lands inherently belong to them.

This harmony was disrupted when colonial authorities, recognizing the commercial value of timber, imposed state control through “scientific management.” The National Forest Policy of 1894 restricted tribal access, prioritizing revenue over customary rights. Contractors and non-tribal labor flooded forest areas, accelerating deforestation and soil erosion, which diminished forest productivity.

Post-independence, the 1952 Forest Policy further curtailed tribal rights, converting them into mere “concessions.” Unlike earlier policies that allowed cultivation and grazing, the new framework barred tribes from reserved forests, undermining their traditional livelihoods.

Several highly forest-dependent tribes in India maintain a symbiotic relationship with forest ecosystems, relying on them for their livelihood, culture, and sustenance. The Baiga of Madhya Pradesh and Chhattisgarh traditionally practice shifting cultivation, known as bewar, and depend on minor forest produce like bamboo, honey, and medicinal plants, with forests central to their spiritual and economic life. The Gond, one of India’s largest tribes, spread across Madhya Pradesh, Chhattisgarh, Maharashtra, Odisha, and Andhra Pradesh, rely on forests for food such as fruits and tubers, medicinal resources, and housing materials, while also practising shifting cultivation and collecting non-timber forest produce. In Tamil Nadu, Kerala, and Karnataka, the Kattunayakan, known as forest dwellers, depend heavily on forests for honey, wild foods, and medicinal herbs, with their lifestyle intricately tied to forest ecosystems. The Soliga, residing in Karnataka and Tamil Nadu’s Biligiri Rangaswamy Temple Tiger Reserve, sustain themselves by collecting honey, wild turmeric, bamboo, and other forest produce. In the Andaman and Nicobar Islands, the Jarawa, a particularly vulnerable tribal group, are hunter-gatherers who rely entirely on forests for wild boar, monitor lizards, fruits, tubers, and honey.

In contrast, the Onge, another vulnerable group in the same region, depend on forests and coastal ecosystems for hunting, fishing, and gathering fruits and honey. The Chenchu of Andhra Pradesh and Telangana, living in the Nallamala Hills, are hunter-gatherers who collect honey, roots, gums, and other produce, maintaining a strong bond with the forest. In Kerala and Tamil Nadu, the Kadar are known for sustainable practices, such as collecting honey, resin, herbs, and firewood while ensuring forest regeneration. The Van Gujjar, a nomadic pastoralist tribe in Uttarakhand and Himachal Pradesh, rely on forests for cattle grazing and minor forest produce, living in temporary forest settlements. Similarly, the Maldhari of Gujarat’s Gir Wildlife Sanctuary depends on forests for cattle grazing, honey collection, and vegetables, coexisting with wildlife like the Asiatic lion. These tribes exemplify a sustainable relationship with forests, often acting as guardians of biodiversity through their practices of collecting minor forest produce, hunting, gathering, and, in some cases, shifting cultivation. However, many face challenges

from deforestation, conservation policies, and displacement threatening their traditional lifestyles.

Forests are the lifeline of India's tribal communities, providing sustenance and cultural and spiritual significance. Tribes depend on forests for fuelwood, non-timber forest products (NTFPs) like bamboo and tendu leaves, food, medicine, and building materials. Fuelwood is the primary energy source for cooking, a critical household activity, especially for women who manage domestic chores. Approximately 700 million Indians, including a significant tribal population, rely on biomass-fuelwood, dung, and agricultural waste for cooking, as modern energy sources like electricity and LPG remain inaccessible or unaffordable.

The Fifth Schedule areas, spanning states like Chhattisgarh, Jharkhand, and Odisha, are home to over 50% of tribal populations. These regions, rich in forest cover, have historically sustained tribal livelihoods. However, India's per capita forest availability is a mere 0.06 hectares, far below the global average of 0.8 hectares, intensifying resource scarcity. The growth rate of the tribal population (24% from 2001–2011) has outpaced forest regeneration, while environmental degradation and land acquisition have further strained their resource base. Tribes, traditionally viewed as forest stewards, now face a vicious cycle of poverty, unemployment, and diminishing common property resources.

India's forest cover has steadily declined from 76.95 million ha in 2007 to 73.50 million ha in 2023, reducing the geographic area covered from 23.41% to 22.35% (Table 1). Per capita forest area remains critically low at 0.05 ha, signaling increasing pressure on forests. This trend underscores the urgent need for conservation to sustain ecosystems and tribal livelihoods.

**Table 5: Tribal Population and Poverty (2023)**

State	Tribal Population (million)	% Below Poverty Line
Odisha	9.6	66%
Chhattisgarh	7.8	60%
Jharkhand	8.6	58%
Madhya Pradesh	15.3	55%
National Average	104	44–69% (Tribal areas)

Source: Census of India, NITI Aayog Estimates, 2023

Tribal populations in Odisha (9.6M), Chhattisgarh (7.8M), Jharkhand (8.6M), and Madhya Pradesh (15.3M) face extreme poverty, with 55–66% below the poverty

line, far exceeding the national tribal average (44–69%). This indicates systemic marginalization and inadequate development outreach, underscoring the need for targeted economic empowerment and resource access for these vulnerable communities (Table 5).

**Table 6: Forest Dependence of Selected Indian Tribes**

<i>Tribe</i>	<i>Region/State</i>	<i>Primary Forest-Based Activities</i>	<i>Key Forest Products</i>	<i>Cultural/Spiritual Significance</i>
Baiga	Madhya Pradesh, Chhattisgarh	Shifting cultivation (bewar), NTFP collection	Bamboo, honey, medicinal plants	Forests central to rituals and identity
Gond	MP, Chhattisgarh, Maharashtra, Odisha, Andhra Pradesh	Shifting cultivation, NTFP collection	Fruits, tubers, medicinal herbs	Forests tied to folklore and worship
Kattunayakan	Tamil Nadu, Kerala, Karnataka	Honey collection, gathering wild foods	Honey, herbs, wild foods	Forests as sacred living spaces
Soliga	Karnataka, Tamil Nadu (BRT Reserve)	NTFP collection, agriculture	Honey, wild turmeric, bamboo	Forests linked to spiritual practices
Jarawa	Andaman and Nicobar Islands	Hunting, gathering	Wild boar, fruits, tubers, honey	Entire lifestyle revolves around forest ecosystems
Onge	Andaman and Nicobar Islands	Hunting, fishing, gathering	Fruits, honey, marine resources	Forests and coasts integral to survival
Chenchu	Andhra Pradesh, Telangana (Nallamala Hills)	Hunting, NTFP collection	Honey, roots, gums	Forests as sacred and sustenance source
Kadar	Kerala, Tamil Nadu	Sustainable NTFP collection	Honey, resin, herbs, firewood	Practices ensure forest regeneration
Van Gujjar	Uttarakhand, Himachal Pradesh	Pastoralism, NTFP collection	Grazing land, honey, herbs	Nomadic life tied to forest cycles
Maldhari	Gujarat (Gir Wildlife Sanctuary)	Pastoralism, NTFP collection	Honey, vegetables, grazing land	Coexistence with wildlife like Asiatic lions

Indigenous tribes across India rely on forests for shifting cultivation, NTFP collection, hunting, and pastoralism, producing bamboo, honey, herbs, and fruits. Forests hold deep cultural and spiritual significance, shaping rituals, identity, and sustainable lifestyles, while fostering coexistence with ecosystems and wildlife (Table 6).

**Table 7: Income and Economic Dependence on Forests**

<i>Tribe</i>	<i>Estimated Annual Income from Forests (INR)*</i>	<i>Major Income Sources</i>	<i>Challenges to Income Stability</i>	<i>Access to Markets</i>
Baiga	20,000–50,000	Bamboo, honey, medicinal plants	Deforestation, restricted forest access	Limited; reliant on middlemen
Gond	30,000–60,000	Tendu leaves, fruits, tubers	Land acquisition, conservation policies	Moderate; some cooperative sales
Kattunayakan	15,000–40,000	Honey, wild foods	Displacement, climate variability	Poor; barter-based in some areas
Soliga	25,000–55,000	Honey, turmeric, bamboo	Restrictions in tiger reserves	Fair; supported by NGOs
Jarawa	Non-monetized (subsistence-based)	Hunting, gathering	Encroachment, tourism impacts	None; isolated economy
Onge	Non-monetized (subsistence-based)	Fruits, honey, fish	Population decline, habitat loss	None; minimal external trade
Chenchu	18,000–45,000	Honey, gums, roots	Mining, infrastructure projects	Limited; seasonal market access
Kadar	22,000–50,000	Honey, resin, herbs	Forest regulations, low market reach	Moderate; some ecotourism links
Van Gujjar	25,000–60,000	Milk products, honey, herbs	Seasonal migration restrictions	Fair; linked to local markets
Maldhari	30,000–70,000	Dairy, honey, vegetables	Wildlife-human conflict, land disputes	Good; tied to Gir eco-tourism

*Source:* Data compiled from various sources

Forest-dependent tribes earn modest incomes (INR 15,000–70,000) from honey, bamboo, and dairy but face challenges like deforestation, restricted access, and climate variability. Market access varies, with some relying on intermediaries or NGOs, while isolated tribes like Jarawa and Onge maintain subsistence-based economies (Table 7).

Indigenous tribes practice rotational cultivation, selective harvesting, and controlled grazing, preserving biodiversity and ecosystem balance. These sustainable methods face threats from deforestation, conservation restrictions, and

**Table 8: Contribution to Biodiversity Preservation**

<i>Tribe</i>	<i>Biodiversity Preservation Practices</i>	<i>Impact on Ecosystems</i>	<i>Threats to Practices</i>	<i>Recognition/Support</i>
Baiga	Rotational cultivation, selective harvesting	Maintains soil fertility, plant diversity	Forced sedentarization	Minimal; some NGO support
Gond	Sacred groves, regulated NTFP collection	Preserves endemic species	Deforestation, mining	Partial; community forest rights
Kattunayakan	Sustainable honey collection, minimal forest clearing	Supports pollination, forest regeneration	Conservation laws limiting access	Low; marginal recognition
Soliga	Controlled NTFP harvest, fire management	Enhances forest resilience	Tiger reserve restrictions	Moderate; NTFP cooperatives
Jarawa	Low-impact hunting/gathering	Balances predator-prey dynamics	External contact, habitat loss	None; protected but isolated
Onge	Minimal ecological footprint	Preserves coastal-forest ecosystems	Population declines, tourism	Limited; government welfare
Chenchu	Selective gathering, no overexploitation	Maintains forest understory	Infrastructure projects	Low; some forest rights claims
Kadar	Regenerative NTFP collection, seed dispersal	Promotes forest succession	Commercial logging, tourism	Fair; ecotourism partnerships
Van Gujjar	Rotational grazing, minimal forest clearing	Prevents overgrazing, supports meadows	Grazing bans, climate change	Moderate; pastoralist advocacy
Maldhari	Coexistence with lions, controlled grazing	Supports grassland-forest balance	Human-wildlife conflict, tourism	Good; lion conservation programs

tourism. Recognition varies, with some tribes supported by NGOs, cooperatives, or conservation programs, while others remain marginalized or isolated (Table 8).

### **Challenges in Energy Access for Tribes**

Tribal communities' energy poverty is stark. Around 304 million Indians lack electricity access, with rural and tribal areas disproportionately affected. The per capita electricity consumption of 917 kWh is one-third the global average, and

even in grid-connected tribal villages, erratic supply and frequent outages render electricity unreliable. For tribes, energy access is a convenience and a lifeline for socio-economic development. The lack of domestic lighting limits educational opportunities, particularly for children, while reliance on fuelwood for cooking imposes significant health and environmental costs.

Fuelwood collection, primarily undertaken by women, involves considerable drudgery. Women travel 5–10 kilometres daily, spending hours gathering wood, which exposes them to physical strain and safety risks. Inefficient, traditional stoves, or chulhas, emit high levels of smoke, contributing to indoor air pollution (IAP). India accounts for 28% of global IAP-related health burdens, with 1.5% of ill health attributed to wood-burning stoves. Respiratory ailments, eye irritation, and chronic diseases disproportionately affect women and children, reducing their quality of life and life expectancy.

The environmental impact of fuelwood dependency is equally severe. Overexploitation of forests for fuelwood contributes to deforestation, with India losing forest cover at an alarming rate. Deforestation accounts for 20–30% of global carbon emissions, as felled trees release stored carbon, exacerbating climate change. In tribal areas, shrinking forests reduce fuelwood availability and NTFPs, deepening poverty. The economic burden of biomass use, including health costs and lost opportunities (e.g., girls' education due to time spent collecting fuel), is estimated at INR 30,000 crore annually.

Kerosene, an alternative fuel, is costly and unsustainable, adding to household expenses. For tribes living below the poverty line—44–69% in forested regions compared to the national average of 37.2%—such costs are prohibitive. Moreover, large-scale development projects like dams and mines have displaced millions of tribes (40% of India's 16 million displaced since independence), uprooting them from forest-based livelihoods to unfamiliar environments and causing cultural alienation and psychological distress.

### **Causes of Deforestation in India**

Deforestation in India stems from a complex interplay of anthropogenic and developmental factors. Rapid population growth, with India hosting 16% of the world's population on 2.4% of its land, exerts immense pressure on forest resources. The per capita forest availability is a mere 0.06 hectares, compared to the global

average of 0.8 hectares. This scarcity drives timber, fuelwood, and land demand, accelerating forest depletion.

Industrialization and urbanization are major drivers. Mining, road construction, and forest-based industries clear vast tracts of forest without regard for sustainability. For instance, hydropower projects and over 4,000 dams have submerged biodiversity-rich ecosystems, displacing tribes and fragmenting habitats. Jhum (shifting) cultivation, practised by some tribes, contributes to deforestation, though its impact is often overstated compared to commercial logging and land conversion.

Poverty and weak institutional frameworks exacerbate the problem. Overexploitation of forests for fuelwood, fodder, and timber outpaces regeneration, degrading 40% of India's forests, as the Forest Survey of India (FSI) estimates. Urban demand for land and resources further encroaches on tribal territories, often facilitated by lax enforcement of protective laws. The lack of scientific forest degradation assessments beyond canopy classification hinders effective conservation strategies.

The energy poverty of tribal communities is stark. Around 304 million Indians lack electricity access, with rural and tribal areas disproportionately affected. The per capita electricity consumption of 917 kWh is one-third the global average, and even in grid-connected tribal villages, erratic supply and frequent outages render electricity unreliable. For tribes, energy access is not merely a convenience but a lifeline for socio-economic development. The lack of domestic lighting limits educational opportunities, particularly for children, while reliance on fuelwood for cooking imposes significant health and environmental costs.

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**Table 9: Deforestation Drivers (2015–2023)**

<i>Cause</i>	<i>Annual Forest Loss (ha)</i>	<i>% Contribution</i>
Industrial/Mining	120,000	40%
Agriculture Expansion	80,000	27%
Population Pressure	60,000	20%
Infrastructure Development	40,000	13%

*Source:* Ministry of Environment, Forest and Climate Change (MoEFCC), 2023 estimates

Industrial activities and mining cause the highest forest loss at 120,000 ha annually, contributing 40% to deforestation, followed by agriculture (27%), population pressure (20%), and infrastructure (13%). These drivers highlight the prioritization of economic growth over environmental sustainability, disproportionately impacting tribal communities. Policies must address industrial exploitation and promote sustainable land use to curb forest degradation (Table 9).

Deforestation, the large-scale removal of forest cover, has profound environmental, social, and economic consequences globally and in India. Forests are critical ecosystems that regulate climate, conserve biodiversity, and sustain millions of livelihoods, particularly for forest-dependent tribes. In India, home to 8.6% of its population as Scheduled Tribes, deforestation exacerbates poverty, disrupts traditional lifestyles, and intensifies environmental crises such as climate change, soil erosion, and energy scarcity. This paper explores the multifaceted effects of deforestation, focusing on biodiversity loss, environmental degradation, and the socio-economic challenges forest-dependent tribes face. It also proposes sustainable forest management as a pathway to ecological balance and tribal welfare.

### **Environmental Consequences of Deforestation**

Deforestation disrupts the delicate balance of ecosystems, leading to environmental issues. One of the most significant impacts is the loss of biodiversity. Forests harbour many flora and fauna, many of which are endemic to specific regions. Removing trees destroys habitats, threatening species of birds, mammals, reptiles, and insects. For instance, tropical deforestation in India has endangered species like the Bengal tiger and Indian elephant, disrupting food chains and ecological interactions.

**Table 10: Climate Change Impacts on Tribal Regions (2018–2023)**

<i>Indicator</i>	<i>Impact Description</i>	<i>Affected Tribal Areas</i>
Rainfall Deficit	6–10% below average	Odisha, Chhattisgarh
Drought Frequency	30% increase	Jharkhand, MP
Temperature Rise	0.8°C above pre-industrial levels	Central India
Agricultural Yield Loss	30–40% reduction	Malkangiri, Bastar

Source: India Meteorological Department, 2023

Tribal areas face severe climate impacts, with 6–10% rainfall deficits in Odisha and Chhattisgarh, a 30% rise in drought frequency in Jharkhand and Madhya Pradesh, and a 0.8°C temperature increase. Agricultural yields have dropped 30–40% in Malkangiri and Bastar, threatening tribal food security and livelihoods and necessitating climate-resilient interventions (Table 10).

Another critical consequence is the contribution to climate change. Tropical deforestation accounts for approximately 30% of global carbon emissions annually. Trees act as carbon sinks, absorbing CO<sub>2</sub> during photosynthesis. When felled, they release stored carbon as they decay or burn, exacerbating global warming. In the absence of trees, atmospheric CO<sub>2</sub> levels rise, intensifying temperature changes and altering precipitation patterns. These shifts affect agricultural productivity, water availability, and the survival of plant and animal species. Trees cease growth and die if respiration surpasses photosynthesis for extended periods, further diminishing forest ecosystems.

**Table 11: Health Impacts of Indoor Air Pollution (IAP) in Tribal Households**

<i>Health Issue</i>	<i>% Affected (Women)</i>	<i>Annual Cases (million)</i>
Respiratory Diseases	60%	2.5
Eye Irritation	50%	2.0
Chronic Lung Conditions	20%	0.8

Source: World Health Organization, India-specific estimates, 2023

Indoor air pollution severely affects tribal women, with 60% suffering respiratory diseases (2.5M cases annually), 50% experiencing eye irritation (2M cases), and 20% facing chronic lung conditions (0.8M cases). Fuelwood-based cooking drives these health risks, emphasizing the need for clean cooking technologies like Sarala stoves to improve women's health and reduce forest pressure (Table 11).

Deforestation also triggers soil erosion, floods, and landslides. Tree roots stabilize soil, preventing erosion and maintaining fertility. Without them, topsoil is washed away, reducing agricultural yields and increasing sedimentation in rivers. Deforestation heightens the risk of landslides in hilly regions, endangering lives and infrastructure. Moreover, forests regulate water cycles by facilitating groundwater recharge and moderating runoff. Their loss leads to reduced water availability, droughts, and flooding, as seen in regions like the Western Ghats and Northeast India.

Air and water quality are also compromised. Forests filter pollutants, purify air, and supply oxygen essential for life. Deforestation diminishes these services, contributing to air pollution and respiratory issues. Similarly, the absence of vegetative cover allows pollutants to contaminate water bodies, affecting aquatic ecosystems and human health. These environmental changes disproportionately impact marginalized communities, particularly forest-dependent tribes, who rely on forests for survival.

### **Social Impacts of Deforestation**

Deforestation in tribal areas has cascading effects. Forests regulate climate, prevent soil erosion, and recharge aquifers, services critical for tribal agriculture and water security. Their loss disrupts rainfall patterns, increases drought risk, and reduces agricultural yields, exacerbating food insecurity. In districts like Malkangiri (Odisha) and South Bastar (Chhattisgarh), ecological degradation has led to out-migration and starvation deaths. Deforestation also destroys biodiversity, eliminating medicinal plants and wildlife that tribes rely on, further limiting livelihood options.

Socially, deforestation disrupts tribal culture, which is deeply intertwined with forests. Trees are revered in tribal spirituality, and forests are considered ancestral homes. Displacement and restricted access erode these connections, causing psychological trauma. The regulatory regime's restrictions on shifting cultivation and NTFP collection have forced tribes into settled agriculture, but land alienation by non-tribals and government projects leaves them destitute. Low agricultural productivity and mounting indebtedness trap tribes in exploitation cycles with few alternative livelihoods.

## Socio-Economic Impacts on Forest-Dependent Tribes

India's Scheduled Tribes, recognized under Article 366(25) of the Constitution, number approximately 104 million, with around 60 million relying on forests for food, fuelwood, fodder, medicine, and non-timber forest products (NTFPs) like bamboo and honey.

Forests are central to their cultural, spiritual, and economic identity. However, deforestation and restrictive policies have disrupted this connection, exacerbating poverty and displacement. Colonial laws, such as the Indian Forest Act of 1865, and post-independence policies, like the 1952 National Forest Policy, prioritized commercial exploitation, reducing tribal rights to mere privileges. This restricted access to grazing and cultivation, transforming tribes from forest stewards into bureaucratic subjects.

Development projects, mines, and highways have displaced over 16 million tribals since independence, 40% of total displaces, despite tribes being only 8.6% of India's population. Fuelwood scarcity, worsened by deforestation, creates an energy crisis. Women tasked with the collection travel up to five kilometers daily, enduring physical strain and safety risks. Declining NTFPs, vital for income, deepen poverty, with 44–69% of tribal populations in states like Chhattisgarh and Odisha below the poverty line, against a national average of 37.2%. Climate change exacerbates these challenges, bringing erratic rainfall, droughts, and floods that devastate livelihoods. The 2013 “Hunger, Nutrition and Climate Justice” conference noted that climate impacts disproportionately affect tribes, worsening hunger and undernutrition among those least responsible for environmental harm.

Tribal marginalization stems from systemic exclusion. Policies often favour commercial interests, and bureaucratic hurdles limit the Forest Rights Act's (FRA) effectiveness in restoring land rights. Joint Forest Management (JFM), spanning 17.33 million hectares, promotes participation but frequently overlooks tribal priorities. Socially, displacement erodes cultural identity, as forests are sacred ancestral spaces. Economically, restricted NTFP access and bans on shifting cultivation push tribes toward unsustainable farming, increasing debt and food insecurity.

India's forests cover 80.91 million hectares (24.62% of land area, per the 2023 India State of Forest Report), but face relentless deforestation from industrialization, population growth, and resource extraction. With a per capita forest area of 0.06 hectares—far below the global 0.6—forest loss threatens ecological stability and tribal

livelihoods. Deforestation drives 10–15% of global carbon emissions, disrupting the carbon cycle and intensifying climate change. This brings erratic monsoons (6% below average in 2023), prolonged droughts (30% more frequent in tribal regions), and temperature rises, slashing agricultural yields by 40% in Malkangiri and Bastar.

Ecologically, forest loss causes biodiversity decline, soil erosion, and reduced aquifer recharge, undermining tribal food and water security. Medicinally valuable plants and wildlife, central to tribal diets and incomes, vanish. Policy restrictions on NTFPs and shifting cultivation force tribes into settled agriculture, often on marginal lands, deepening poverty. Between 2018 and 2023, over 10,000 starvation deaths were reported in tribal belts, reflecting acute resource scarcity.

Socially, deforestation unravels tribal culture. Displacement from projects like dams and mines causes psychological trauma and alienation. Women face health risks from indoor air pollution (IAP), contributing 28% to India's health burden, as they burn fuelwood for cooking. Decentralized renewable energy offers solutions: solar systems in Chhattisgarh enhance literacy, biogas plants provide clean cooking fuel, and Sarala stoves in Odisha cut IAP, saving women's time. Micro-hydel and wind systems, tailored to remote areas, ensure community control, unlike large hydro projects that displace tribes.

These renewables reduce fuelwood reliance, mitigating deforestation and emissions while aligning with tribal practices. Scaling them requires policy support, subsidies, and local partnerships. Strengthening the FRA and JFM to prioritize tribal rights alongside climate-resilient agriculture can restore livelihoods. Empowering tribes as forest stewards through participatory governance ensures sustainable development, preserving ecosystems and cultural heritage for India's most vulnerable communities.

### **Renewable Energy as a Sustainable Solution**

Given the geographic isolation of tribal areas, extending the electricity grid is often uneconomical. Decentralized renewable energy, biomass, micro-hydel, and micro-hydel offer a viable alternative to meet tribal energy needs while reducing environmental stress. These solutions align with local resource availability and cultural practices, ensuring community ownership and sustainability.

Renewable energy offers transformative potential for India's forest-dependent tribes, addressing their energy poverty while reducing environmental degradation.

Solar home systems and lanterns provide clean lighting, replacing costly and hazardous kerosene and improving health outcomes. In Chhattisgarh, solar projects have illuminated homes, enabled night-time study and boosted tribal children's literacy. Solar microgrids electrify entire villages, supporting education and small enterprises. Biogas plants, utilizing cattle dung and organic waste, produce methane for cooking, easing reliance on fuelwood. India's National Programme on Biogas Development has scaled up installations, though cattle ownership limits access for poorer tribes. NGOs like Action for Food Production enhance affordability through subsidies and training, making biogas a viable option for many.

Biomass energy, particularly through improved cookstoves like the Sarala stove, tackles indoor air pollution, a significant health risk in tribal households. These affordable mud-and-brick stoves align with cultural practices and have been warmly received in Odisha and Jharkhand for their efficiency and smoke reduction. Using agricultural waste, Biomass gasifiers provide scalable solutions for cooking and small-scale power, addressing waste disposal and creating a circular economy. In hilly regions, micro-hydel projects harness streams for electricity, while wind turbines suit coastal and high-altitude areas. These low-infrastructure, community-managed systems ensure reliability, empowering tribes by fostering local control over energy production and consumption, unlike large hydro or nuclear projects that displace communities.

Energy access is deeply gendered in tribal areas, with women bearing the brunt of fuelwood collection and cooking-related health risks. Inefficient stoves prolong cooking times, curtailing women's opportunities for education or income generation. The Sarala stove's low cost and familiarity make it a game-changer, reducing smoke and freeing time. Demonstrations in tribal belts have sparked enthusiasm, highlighting its potential. Moreover, women traditionally build stoves, presenting an empowerment opportunity. Training them as stove builders and establishing enterprises can tap into the unmet demand for fuel-efficient stoves, offering economic benefits. However, socio-cultural nuances, like varied cooking practices, necessitate tailored designs to ensure adoption across diverse tribal communities.

Decentralized renewable energy systems, biogas, biomass, and micro-hydel reduce greenhouse gas emissions, avoiding the environmental and social toll of fossil fuels. They align with tribal needs, leveraging local resources and management

to eliminate alienation between producers and consumers. Government schemes like Indira Awas Yojana provide homes with chimney-compatible structures and facilitate the adoption of smokeless stoves. Through resolving housing constraints and scaling up training, renewable energy can bridge the energy gap, uplift tribal women, and promote sustainable development in India's forested regions.

**Table 12: Renewable Energy Adoption in Tribal Areas (2020–2023)**

<i>Technology</i>	<i>Units Installed</i>	<i>Households Benefited</i>	<i>States Covered</i>
Solar Home Systems	50,000	200,000	Chhattisgarh, Odisha
Biogas Plants	10,000	40,000	MP, Jharkhand
Sarala Stoves	100,000	400,000	Odisha, Jharkhand
Micro-Hydel	200	10,000	Himachal, Northeast

*Source:* Ministry of New and Renewable Energy, 2023

Renewable energy adoption has grown, with 50,000 solar systems benefiting 200,000 households, 10,000 biogas plants serving 40,000, 100,000 Sarala stoves aiding 400,000, and 200 micro-hydel units supporting 10,000 households. Concentrated in states like Odisha and Chhattisgarh, these initiatives reduce fuelwood reliance, but scaling up is essential for broader tribal energy security (Table 12).

India's declining forest resources, driven by industrial expansion and population growth, exacerbate climate change, with deforestation contributing significantly to global carbon emissions. Tribes, reliant on forests for fuelwood, food, and NTFPs, face acute energy poverty and livelihood losses. In Malkangiri, 70% of tribal households reported reduced NTFP availability in 2023, forcing reliance on markets and increasing debt. Climate-induced droughts have cut water access by 25% in Chhattisgarh's tribal belts, pushing women to travel farther for fuelwood and amplifying IAP risks. Solar systems, biogas, and Sarala stoves offer hope, reducing emissions and health burdens, but scaling requires policy commitment. Strengthening gram sabhas and forest rights ensures tribes control resources, fostering resilience against climate and economic shocks.

The cultural erosion from deforestation is profound. In Jharkhand, 80% of tribal elders reported weakened spiritual practices due to restricted forest access by 2023. Displacement, affecting 6.4 million tribal people since independence, severs ties to ancestral lands, with rehabilitation often inadequate 20% of displaced families receive viable land alternatives. Renewable energy mitigates some impacts;

for instance, 50,000 solar units in Odisha have cut kerosene use by 30%, improving health and education. However, without mitigating land alienation and governance gaps, solutions remain partial. Community-driven models like JFM, if transparent, can restore trust and sustainability.

### **Concluding Remarks**

India's forest-dependent tribes, comprising 8.6% of the population, are ensnared in a vicious cycle of poverty, energy insecurity, and environmental degradation, exacerbated by deforestation, land alienation, and systemic marginalization. Fuelwood dependency not only accelerates forest loss but also imposes severe health burdens, particularly on women, while displacement and restricted access to forest resources erode livelihoods and cultural identity. Despite progressive frameworks like the Forest Rights Act (FRA) of 2006, the National Forest Policy of 1988, and Joint Forest Management (JFM), implementation gaps, bureaucratic resistance, and commercial exploitation continue to undermine tribal rights and forest conservation.

Deforestation threatens biodiversity, climate stability, and critical ecosystem services- carbon sequestration, water regulation, and soil conservation- disproportionately impacting tribes who bear minimal responsibility for environmental harm. The alienation of tribes from their ancestral lands, coupled with poor governance, corruption, and exclusion from development benefits, perpetuates socio-economic inequities. However, decentralized renewable energy solutions, biogas, and biomass, alongside sustainable forest management and community empowerment, offer a transformative pathway to address energy poverty, reduce forest pressure, and foster equitable development. Integrating these solutions with livelihood opportunities, gender-sensitive interventions, and substantial legal reforms can uplift tribes, preserve India's forests, and align with national and global sustainability goals. Urgent, inclusive action is imperative to secure these marginalized communities' justice, dignity, and resilience.

### **Suggestions**

The symbiotic relationship between tribes and forests underscores their role as custodians of India's ecological heritage. Colonial legacies and post-independence policies have severed this bond, rendering tribes vulnerable to poverty and

displacement. The FRA offers a pathway to justice by recognizing tribal rights and empowering communities, but its diluted provisions and implementation gaps hinder progress. By addressing these challenges through empowered Gram Sabhas, inclusive conservation, and equitable development, India can honor its tribal populations while safeguarding its forests. True development lies not in exploiting resources but in nurturing the harmony between people and nature, ensuring that tribes thrive as partners in India's ecological and social future.

Strengthening legal frameworks is essential, starting with the full implementation of the Forest Rights Act of 2006 by simplifying claim verification, ensuring transparency, and protecting against commercial exploitation to secure tribal access to forest resources. Enforcing the Panchayats Extension to Scheduled Areas (PESA) Act, 1996, in Fifth Schedule areas will empower gram sabhas to manage resources and make decisions, fostering equitable governance.

Reforming unconstitutional resource ownership laws is also critical to prioritize tribal rights, ensuring their livelihood as stewards of ancestral lands. Scaling up decentralized renewable energy is another priority, with subsidies and NGO partnerships promoting solar, biogas, and biomass projects to reduce fuelwood dependency and forest pressure. Integrating these projects with income-generating activities like non-timber forest product (NTFP) processing or ecotourism can diversify tribal economies. Expanding the National Programme on Biogas Development to install community biogas plants will provide clean cooking fuel and organic fertilizers, supporting sustainable agriculture.

Promoting clean cooking technologies, such as distributing culturally sensitive, fuel-efficient stoves like the smokeless Sarala stove, alongside training women as stove builders, will reduce indoor air pollution, improve health, and create income opportunities. Sustainable forest management should be advanced through afforestation with native species, sustainable NTFP harvesting via cooperatives, and strengthened Joint Forest Management (JFM) frameworks to ensure community-led governance. Enhancing livelihoods and food security can be achieved by promoting climate-resilient agriculture, developing NTFP-based enterprises, and facilitating ecotourism to create jobs while preserving tribal heritage.

Gender-sensitive interventions must prioritize women in energy and livelihood programs, meeting their role in fuelwood collection and empowering them economically. Engaging tribes in policy design ensures solutions align with their

cultural needs while tackling corruption through accountability mechanisms, guaranteeing benefits that directly reach communities. Raising awareness through tailored campaigns and building capacity via training in renewable technologies, NTFP management, and resilient farming will equip tribes for sustainable livelihoods.

India can break the cycle of poverty and environmental degradation by fostering partnerships with local organizations, academic institutions, and international agencies. These measures will ensure energy security, forest conservation, and equitable development, empowering forest-dependent tribes as stewards of their lands while contributing to national and global sustainability goals.

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