



Climate Change Impact on Forest Communities in Jharkhand, India

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ABSTRACT

Impact of climate change on the tribal communities of Jharkhand, India. With approximately 700 tribes in the country, constituting 8.6% of the population according to the 2011 census, and 24.80% in Jharkhand, the research focuses on the implications of climate change on their life, livelihood, and overall survival. The escalating emission of Green House Gases (GHGs) and the concurrent decline in forest coverage have led to climate change, causing discomfort, increased living costs, threats to survival, and various socio-economic challenges for tribal populations. The study explores the climatic changes in Jharkhand, assesses their adverse effects on tribal economies, evaluates existing coping mechanisms – including indigenous practices – and identifies deficiencies in traditional approaches compared to contemporary scientific methods. The ultimate goal is to recommend policy actions and adaptation plans to ensure the sustainable development of Jharkhand's tribal communities amidst changing climatic conditions.

This paper addresses the global development strategy, emphasizing the transnational challenge of climate change. The impact of climate change, leading to natural disasters, sea-level rise, and melting glaciers, has resulted in the displacement of thousands, with indigenous groups being particularly vulnerable. Jharkhand's shifting climate, characterized by historical variability and contemporary unpredictable climatic events, exemplifies the direct threat faced by indigenous populations. Numerous studies underscore the precarious situation of Jharkhand and its indigenous communities, highlighting high climate sensitivity, vulnerability, and a limited adaptive capacity. This research aims to shed light on the urgent need for targeted strategies to safeguard the indigenous population in the face of evolving climatic conditions.

Keywords: Jharkhand, Climate Change, Tribal Livelihoods, Green House Gases, Adaptation Strategies, Sustainable Development, Indigenous Practices, Socio-economic Challenges, Coping Mechanisms, Displacement, Policy Recommendations

1. Introduction

Roughly one-third of the surface on Earth is made up of forests, which are significant to human societies because they provide essential functions [1]. In addition to providing as a natural habitat and a source of raw materials for several enterprises, forests also control the environment by regulating illnesses, preventing floods, preserving soil and water quality, promoting pollination, and balancing climatic conditions [2]. The Asia-Pacific region has seen a major loss in forest cover, with the global forest cover facing significant problems [3]. This huge territory is home to tremendous biodiversity, various ecosystems, and millions of people who rely on trees for their livelihoods.

The Forest Survey of India (FSI) published the State of Forest Report (SFR) 2005 based on satellite data, and it states that Jharkhand has 22,591 sq km of forest cover, or 28.34% of the total geographic area.

When evaluating the total area covered by forest cover, Jharkhand comes in at number ten out of all the States and Union Territories of India. About 15% of the state's land area is covered by dense forest, which is spread throughout the northwest and southeast. The remaining 71.6% of the state's land area is made up of non-forest land, which is equally distributed throughout the north, central, and south-eastern regions. There are reserves within the total documented forest area of roughly 23,605 sq km.

The biodiversity of the state is extremely rich. Ten wildlife sanctuaries and two reserve areas—one for elephants and one for tigers—have been cut out of the area covered by forests in order to preserve and maintain this biodiversity.

Forest in Jharkhand has long been under pressure from mining and for meeting the demands for fuel. Initiatives have been taken by the State government to increase its forest cover. Forest Resource Surveys are also being conducted at district level for better management and planning. The state has also formed Joint Forest Management (JFM) committees besides forest-based livelihood development, wildlife management, biodiversity conservation, clean environment and waste disposal plans. To tackle the impacts of mining, the State Government also proposes to bring legislation in mining sector so that resources

Indigenous peoples face an imminent threat from climate change. In Jharkhand, the effects of climate change are already being felt. The state has seen an increase in average rainfall in some areas, and this increase is not only large but also unquestionably steady, with the potential to alter agricultural practices. The UN has stated that the traditional food-gathering methods used by indigenous populations are being adversely affected by economic pressures and climatic change. Because of their effectiveness, ability to prevent waste, and ability to adjust to changing seasons, these food systems are regarded as some of the most sustainable in the world. But problems like drought, the disappearance of wildlife, and large-scale indigenous community migration from rural to urban regions are being brought on by climate change.

The social determinants of health—clean air, safe drinking water, enough food, and adequate shelter—are impacted by climate change. The predicted variations in temperature, altered rainfall patterns, and extreme weather events, such as droughts, pose a serious threat to public health due to climate change. The burden of illnesses in central India, especially Jharkhand, is predicted to increase due to changing climatic conditions. Although the entire state is expected to be susceptible to health concerns brought on by climate change, the most vulnerable populations will be the indigenous tribes living in remote areas with low incomes and no access to healthcare. The population is more vulnerable to health issues as a result of malnutrition and other inadequacies.

2. Assessment of Literature

The Intergovernmental Panel on Climate Change (IPCC, 2007) acknowledged in its fourth assessment report that social, political, and economic marginalization has forced tribal people and underprivileged communities to inhabit the most vulnerable lands, making their lives heavily reliant on natural resources. Their susceptibility to illnesses, disasters, and heavy workloads has risen because to the recent climate change. Future climate change will exacerbate existing conditions, increasing their frequency and intensity. This will undoubtedly have a negative impact on human welfare, particularly for marginalized and tribal communities. It is quite likely that the observed rise in anthropogenic greenhouse gas concentrations since the mid-20th century is the primary cause of the observed increase in the global average temperature. Because of human activity, greenhouse gasses like carbon dioxide (CO₂) are being released in excess.

The greenhouse gas that is most frequently created by human activity is CO₂, which accounts for 64% of the global warming caused by humans, according to estimates from the European Union. Its content in the atmosphere has increased by 40% since industrialization started. Though they are released in lower amounts, other greenhouse gases trap heat significantly more effectively than CO₂—in some cases, thousands of times more effectively. Methane contributes 17% and nitrous oxide 6%, respectively, to man-made global warming. Although they emit very little, fluorinated gases have a very powerful warming effect that can reach 23000 times that of CO₂. Burning fossil fuels like coal, oil, and gas releases carbon dioxide and nitrous oxide into the atmosphere. Because they absorb CO₂, trees aid in regulating the climate.

3. Climate Change Trends in Jharkhand State

The forestry sector's share of the state's GDP is small—it fell from 2% in 2001–2002 to 1.5% in 2009–2010. In contrast to pond and agricultural production, forest land productivity might be as low as INR 2500/ha.

3.1 Low Productivity

The state's land prices are INR 1.30 lakhs and INR 30000 per hectare, respectively. In parts of the state where residents rely heavily on forest resources (minor forest products) for both sustenance and revenue production, the low productivity has led to extreme poverty. In all, the poverty rate among the impoverished reaches 48%, ranking among the highest in the nation²¹.

3.2 Woodland Fires

A significant risk is posed by forest fires; the state's forests are primarily dry deciduous and are vulnerable to them in the summer. The majority of fires are linked to the efforts of the people that rely on the forest to gather sal and mahua seeds and to encourage stronger undergrowth after rainfall. Mahua collector-caused fires are frequent in March and April and are the reason behind extensive harm to the forest's growth²².

An increase in forest fire incidents is predicted to result from drier soils brought on by global warming, which will reduce evaporation, recycled moisture in the atmosphere, and summer rainfall. Additional fire either accelerates species turnover or favors species that have evolved to fire, so mediating the responses of forests to climate change (Overpeck et al. 1990). Similarly, alterations in the species composition might modify the concentration and configuration of combustible fuels, hence influencing the likelihood of a fire (Bond and Keeley 2005). Given the high potential for interactions and feedbacks between fire and its regulators, it is possible that both direct and indirect climate controls—such as vegetation and human land use—may be reflected in the long-term occurrence of fires.

3.3 Wood fuel Dependence on Forests

In rural Jharkhand, wood is mostly used for wood fuel. However, the precise amount and source of wood fuel consumed in the state are unknown.

Only 25% of freely gathered woodfuel and 20% of all woodfuel in India originated from forests, according to NSSO data on woodfuel collecting. Using this estimate as the most precise, 52 million cubic meters of woodfuel are produced from Indian forests (FSI, 2009b). Taking into account the proportion of population, roughly 1 million cubic meters of woodfuel in Jharkhand originate from state-owned forests.

.Climate change and the gathering of honey

The beekeepers' livelihood, which depends on honey collection to augment their income, is also at risk due to the late rain, which lowers honey output. Honey hives are becoming fewer in number due to climate change.

The stages of tree frutescence and flowering are crucial for honey production. The frutescent stage has been negatively impacted by climate change, which has decreased honey output.

4. Jharkhand's Forests as Carbon Sinks

In addition to being a source of GHG gases like carbon, forests also store them. As trees expand, they serve as carbon sinks by absorbing CO₂ from the atmosphere during the process of photosynthesis.

Year	Carbon stock	Growing stock (m cum) ³³	Million tonne-C sequestered
2011	In forest	116.308	145.86
	In TOF	51.308	
2009	In forest	103.78	136.03
	In TOF	53.32	

Table 1: Jharkhand forests' sequestration of carbon

However, as forests deteriorate—whether as a result of a forest fire, a decaying process, or another degradation of the carbon stock—they release greenhouse gases into the atmosphere, including CO₂.

As was said in the Jharkhand forest state report, the state's forests are expanding and serving as carbon sinks as a result. According to data for the years 2009 and 2011, the state's forests were able to store 136.03 and 145.86 million tonnes of carbon, respectively.

INDEX OF FORESTRY VULNERABILITY TO CLIMATE CHANGE

To conduct a comparative analysis across Jharkhand's administrative units and identify districts where the population is most vulnerable to changes due to climate change, a forest vulnerability index was established. The bulk of the population in the districts' socioeconomic structure, ecosystem, climate, and agricultural characteristics were all taken into account in the analysis. A composite index was developed by choosing landscape level indicators and applying the GIM L1 level planning principles.

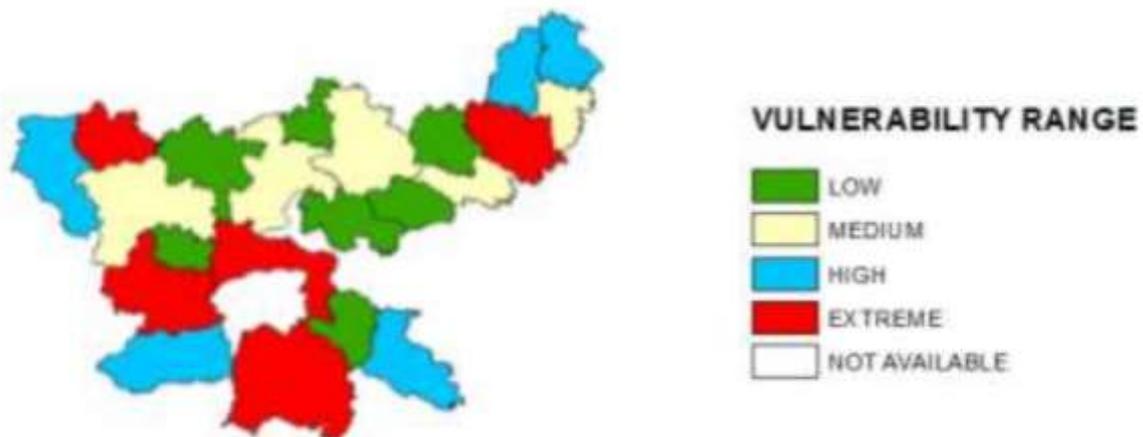


Fig 1: Jharkhand's map of forestry vulnerability

Simultaneously, the state's woods suffered damage from forest fires; as these fires only reach the forest floor, their overall effect on the storage of carbon by forests has not been discounted (data to calculate carbon release

5. Impact on Forest Communities

5.1. The impact of climate change on indigenous people's way of life

In the upcoming years, the effects of climate change will worsen and the scenario that results will get worse. It is anticipated that Jharkhand would experience a rise in precipitation and a shift in the length of rainfall by the end of this century. According to projections, the state's average rainfall will increase by almost 20% by the end of this century, and the number of rainy days would increase by at least 10 days. The average winter temperature will increase by 4.78–5.20C by 2080, while the summer temperature will increase by a maximum of 2–30C between 2020 and 2025.

5.2. Jharkhand's climate change and tribal livelihood

The majority population in the state of Jharkhand is tribal and relies mostly on rain-fed agriculture and, to a lesser extent, forest resources for livelihood. But during the past few decades, the unpredictability and fluctuation of the climate have had a significant impact.

Most of these tribes are in despair as a result of their inability to withstand the extremes of climate, food insecurity, uncertain and declining income, increased health problems, and other related knock-on impacts.

5.3. Impact of climate change on livelihood vulnerability

For the tribal farmers, field crops are the primary source of food. A bad crop affects household food supply in addition to revenue source. When there is a drought or hunger, the locals turn to deforestation as a means of surviving.

The state's already fragile forest and water reserves are seriously threatened by industrial and urban growth, which further exacerbates the state's unhealthy dependence on mineral-based industries. The distribution of these resources is also very inconsistent both in terms of time and location, which exacerbates already-existing problems. Throughout the study, it was noted that an increase in coal mining activities results in the complete elimination of forest cover within the mine region as well as the conversion of nearby agricultural fields into wastelands with a predominance of dense, open scrub. (Jeyaseelan, Mishra, and Singh, 2009). A shifting geo-hydrological regime with the potential risk of groundwater contamination is indicated by the large volumes of stagnant water that developed in the mine's depression areas as a result of surface and groundwater accumulation over time.

5.4. Rehabilitating ejected Native Tribals

A few quick facts: The Pachuvara Central Block in the Pakur district contains 674.02 hectares of agricultural land and around 400 hectares of forest area that the Government of Jharkhand has leased to Penem Coal Mines Ltd. for the purpose of captive mining. The petitioner is acknowledged by the President of the nine villages, Binej Hembrom, who is also the parganeith of the nine villages where the purchased lands are located. The petitioner and Penem Coal Mines Ltd. came to an agreement in a Memorandum of Understanding that specified the tribal people would maintain complete ownership over the lands they had acquired and that the company would replenish and level the areas as soon as the excavation in one village was completed.

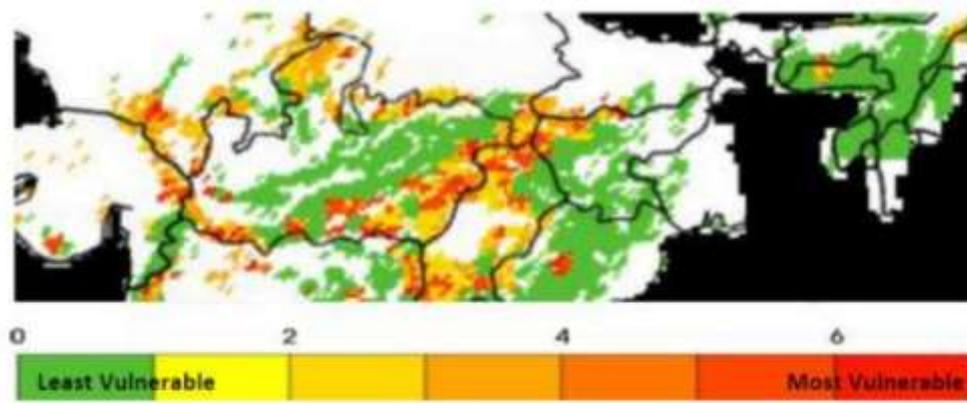


Fig 2: A2 SCENARIO (year 2085) - Jharkhand's forests and the effects of climate change

The maps show the extent of India's forest's vulnerability. The density of the forest's biodiversity and changes in the kind of vegetation have been used as indicators to quantify this susceptibility. The Figure indicates that the northern portion of Hazaribag and the northwestern regions of Jharkhand, including Garhwa, Palamu, Chatra, and Koderma, will be subject to moderate to high risk. Jharkhand is less vulnerable than other Indian states, with the exception of this area in general.

6. Case study

On the effects of climate change on forest products in Khunti, tribal women work in the manufacturing and trade of lac, a naturally occurring polymer made by the small bug *Kerria lacca*, which is raised on the shoots of various tree species, primarily palash (*Butea monosperma*), peepal (*Ficus religiosa*), ber (*Zizyphus mauritiana*), etc. Around mid-March, when the insect is ready to make lac, lac host trees have been negatively impacted for the past three to four years by unseasonal, brief, and intense rains that are followed by extremely cold temperatures and a week-long fog and frost. Extreme cold usually results in the insects dying. Since 2006, this has happened, bringing the amount of lac produced down to 25% of what was obtained in 2004–2005. As such, the local

This case study delves into the ramifications of climate change on forest products, focusing on the production of lac by tribal women in Khunti, Jharkhand. The lac, a natural polymer vital for the local economy, is cultivated on host trees affected by unseasonal weather patterns. The study explores the adverse effects of extreme cold, unseasonal rains, and frost on lac production, leading to a significant decline. As a consequence, the local lac industry has shifted towards importing lac from other regions. The adaptation strategies employed by tribal communities, such as transitioning to commercial logging and agriculture, are also discussed.

Lac Production: Tribal women are traditionally involved in the production and sale of lac, a natural polymer derived from insects cultivated on specific host trees.

Host Trees: Palash (*Butea monosperma*), ber (*Zizyphus mauritiana*), peepal (*Ficus religiosa*) are primary host trees.

3. Climate-Induced Challenges:

Unseasonal Weather: Short and heavy rains, extreme cold, fog, and frost around mid-March affect lac host trees.

Insect Mortality: Extreme cold weather results in the death of lac-producing insects, reducing lac production.

4. Impact on Lac Production:

Production Decline: Lac production reduced to 25% of 2004-05 levels since 2006.

Import Dependency: Local lac industry now imports lac from Thailand due to domestic production constraints.

5. Adaptation Strategies:

Shift to Commercial Logging: Tribal communities adapt by transitioning to commercial logging activities.

Agricultural Diversification: Agriculture becomes a supplementary livelihood as lac production faces challenges.

6. Socio-Economic Consequences:

Livelihood Challenges: Adverse effects on the local economy and livelihoods of tribal women involved in lac production.

Import Dependency Risks: Dependency on imported lac poses economic risks and challenges for the local industry.

7. Community Resilience:

Adaptive Capacity: Despite challenges, tribal communities showcase resilience by diversifying livelihoods.

Traditional Knowledge: Drawing on traditional knowledge, communities explore alternative economic activities.

7. Current Policies, Programmes and Projects to Protect Forests and Biodiversity

Urban and industrial growth pose a major threat to the state's already precarious forest and water sources, exacerbating the state's unhealthy reliance on mineral-based businesses. Additionally, there is a great deal of inconsistency in the allocation of these resources with regard to time and place, which makes pre-existing issues worse. According to Jeyaseelan, Mishra, and Singh (2009), the study found that an increase in coal mining activities leads to the total elimination of forest cover within the mine region and the conversion of neighboring agricultural fields into wastelands with a predominance of dense, open scrub. The significant amounts of stagnant water that formed in the mine's depression areas as a result of groundwater contamination suggest a shifting geo-hydrological regime with the possible risk of groundwater contamination.

1. Tenancy Acts: These Acts, which cover Bihar, Santhal Paragana, and Chotanagpur, provide measures for both the conservation of trees and the regulation of their unchecked destruction. The propagation of TOF (trees outside forests) is also aided by these Acts.

2. Joint Forest Management: The goal of the JFM Regulations is to get the community involved in forest conservation. As an adaptive social process, JFM aims to benefit lakhs of people by providing enough future forest production opportunities to meet potentially competing or competitive interests that, if unresolved, would reduce the forest.

3. Jharkhand Wildlife Management Plans and Forest Policy: The State Government anticipates a 3% SGDP contribution from the forest sector. Restoring degraded woods, planting on private fallow lands, reforesting public wastelands

State initiatives to increase forest productivity and benefit the community: Plantations of desirable species, including fruit grafts, are established under this system on non-forest land, such as gair-majarua land, property owned by to raiyats, or farmers, and government establishments. In addition to completing the ongoing work programs that have been approved under the scheme in previous years, new plantations on non-forest land are proposed to be constructed in 2010–11. It is also suggested to assist villagers in forming Self-Help Groups (SHGs) to seek clean, employment-based forest products cooperatively, as well as to train and equip them with the tools they need to enhance their standard of living.

8. Approaches to Address risks Due to Forestry Climate Change

The community emphasized how their nutritional, social, and economic well-being have been greatly impacted by climate variability, which includes unpredictable rainfall and dry spells. They discussed a few of the measures they have implemented to deal with the shifting climate in light of these changes. Certain adaptation tactics may threaten the historically proven sustainable agricultural and food collecting practices, even though some of these efforts may have positive effects on the environment.

8.1. Community Adaptation Techniques to Climate Variability and Change

1. Creation of Sustainable Forest Management Plans for Various Forest Types in Light of Climate Change: Using various climate and biodiversity models, in-depth research is advised to comprehend the effects of climate change on forest productivity in Various Forest Types. This would support the creation of plans for climate-resilient forest management. It is also advised that yield plots, sample plots, and preservation plots be revived. In order to depart from the status quo, Jharkhand's forest types will need adaptation plans that are designed and upheld based on their unique biophysical characteristics.

2. Encourage Research to Understand the Effects of Climate Change on Forest Ecosystems: The forest department should allocate funds to the establishment of "centers of excellence" that will carry out regional threat analyses related to climate change using climate models. studies to predict

9. Conclusion

In conclusion, climate change has emerged as a critical concern in Jharkhand, significantly impacting the lives, livelihoods, and economy of tribal communities. The visible evidence of increased drought incidents necessitates urgent and concerted efforts for mitigation and adaptation. Key recommendations include enhancing communication from the Meteorological Department to provide timely weather advisories to tribal farmers, promoting clean energy, and implementing climate-smart agricultural practices. Emphasizing alternative farming techniques, water conservation, and sustainable development initiatives is crucial. Leveraging traditional knowledge, such as the System of Rice/Root Intensification, and exploring innovative means of employment can enhance resilience. The state government should establish research institutions, encourage public-private partnerships, and foster tribal participation in policymaking to address climate vulnerabilities effectively. Urgent action is needed to disseminate research findings and implement measures ensuring the sustainable development of tribal regions in Jharkhand.

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