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The Perception Of Locals Regarding The Effects Of Climate Variability On Non-Timber Forest Products In The State Of Jharkhand

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Abstract

Background: The utilization of non-timber forest products (NTFPs) is crucial for the sustenance and cultural customs of indigenous populations in the Indian state of Jharkhand. In contrast, their sustainability and accessibility are gravely threatened by climate variability, which is marked by unpredictable precipitation patterns and increasing temperatures.

Purpose: The purpose of this research is to examine how local communities in Jharkhand perceive the impacts of climate variability on non-timber forest products (NTFPs).

Methodology: The research methodology involved the utilization of semi-structured interviews with a sample size of 96 participants, selected from five distinct forest communities located in Jharkhand. Thematic coding was utilized in the data analysis process to discern significant themes and patterns within the perceptions of the participants.

Findings: According to the research, local communities consider climate variability to be the greatest threat to NTFPs. A reduction in the quantity, caliber, and variety of diverse non-timber forest products (NTFPs), specifically those that are susceptible to variations in temperature and precipitation, was documented. Participants also voiced apprehension regarding the potential repercussions on their means of subsistence, cultural customs, and food security.

Originality/Value: This research endeavor offers significant insights into the practical realities faced by indigenous communities in Jharkhand, thereby enhancing our comprehension of the intricate dynamics between climate variability and non-timber forest products (NTFPs). It emphasizes the need for livelihood diversification strategies and interventions that are climate resilient in order to assist forest-dependent communities in adapting to a changing climate.

Keywords: Climate change adaptation, local communities, non-timber forest products, Jharkhand, India, livelihoods, cultural practices

Introduction

The world's forests are home to almost two billion people who depend on them for food, money, and safety from natural disasters (Ahenkan and Boon, 2011). A number of factors, including the maintenance of rural incomes, the reduction of poverty, the protection of biodiversity, and the promotion of economic development in rural areas, are believed to depend on NTFPs (Maske et al., 2011; Magry et al., 2023). Olaniyi et al. (2013) found that approximately 80% of the population in developing nations relies on NTFPs for their nutritional and health needs, as reported by the World Health Organization. Ajake and Enang (2012) and Islam et al. (2013) both point to NTFPs as having several potential benefits for rural development and improving living conditions. Many tropical regions rely on NTFPs as a vital source of income for residents in places where government assistance is lacking (Bharathkumar et al., 2011; Verma & Paul, 2016; Ranjan et al., 2018). NTFPs are culturally and civilizationally significant, have a positive effect on environmental quality through changes to the life-supporting system, and have a substantial influence on rural socioeconomic development (Ghosal, 2011; Kumar & Saikia, 2020).

Forest fringe communities use non-timber forest products (NTFPs) for a wide variety of purposes, including but not limited to: housing, agricultural tools, weapons, fibers, furniture, packing materials, matches, sports goods, lac, floss, edibles, medicinal, ornamental, and oilseed and packaged materials (Saha & Sundriyal, 2012; Islam & Quli, 2017). Despite the fact that many view the trade of NTFPs as a side hustle, many rural households and communities do benefit economically from it (Chamberlain et al., 2000; Magry et al., 2022). The wide range of socioeconomic services provided by NTFPs, or non-timber forest products, greatly helps to raise living standards. These include supplying households with food, creating opportunities for income generation, providing safety-nets or insurance during catastrophic events, safeguarding cultural heritage and spirituality, and encouraging households to save money (Shackleton & Pandey, 2014; Ahamad et al., 2022).

Forests, in addition to their biological value, are lifelines for numerous people around the world. They supply a kaleidoscope of NTFPs that thread into the very fabric of lives and cultural practices, in addition to timber. NTFPs such as mahua flowers, salai leaves, and tendu leaves are not just resources in the Indian state of Jharkhand, which is teeming with varied forest habitats; they represent the currency of tradition, food security, and revenue for millions of indigenous and local communities (Kumar et al., 2020; Magry et al., 2023). This carefully balanced relationship, however, is facing unprecedented challenges, propelled by the shifting sands of climatic variability (Giri & Baruah, 2015).

In recent decades, Jharkhand's monsoon-dependent climate has seen increasingly irregular rainfall patterns and rising temperatures (Ghosh, 2019). These fluctuations are more than just statistics; they translate into real concerns for communities that are inextricably linked to the cycles of the forest. Unpredictable rainfall, protracted droughts, and heatwaves are now threatening the very NTFPs that have sustained generations (Rai & Bhattacharya, 2017). Concerns about decreased NTFP availability, phenology, and quality echo throughout forest communities (Pullaiah et al., 2009).

In order to negotiate a sustainable future for NTFPs and the livelihoods they sustain, it is vital to comprehend the communities' actual environmental challenges. By examining how local communities in Jharkhand perceive the impact of climate variability on NTFPs, this study delves into the core of this complex equation. Our objective is to enhance comprehension of the matters by means of their perspectives, evaluate the repercussions on means of subsistence and cultural customs, and ultimately shape resolutions for sustainable adaptation to climate change.

Through an examination of the intricacies of regional perspectives, this study endeavors to transcend the analysis of simple numerical values and statistical patterns. It is imperative to formulate effective solutions by comprehending the lived experiences of individuals who are most intimately connected to the forest, in our opinion. This research enhances the collective comprehension of the complex interconnections among NTFPs, climate variability, and the communities that rely on them. By doing so, we aim to establish a foundation for livelihood diversification strategies that are resilient to climate change. This would enable communities reliant on forests to adjust to a shifting environment and ensure a sustainable future for both themselves and the invaluable ecological fabric they protect.

Study Area

The state of Jharkhand is situated between the coordinates of 22°00' and 24°37' N and 83°15' and 87°01' E; it is abundant in forests and minerals. Its total land area is 79,714 km2, which is 2.42 percent of India's overall land area. Three main rivers—the Swarnrekha, the Koal, and the Damodar—and the Chhotanagpur plateau characterize its landscape. Jharkhand experiences a tropical environment with temperatures between 4 and 47 degrees Celsius and an average of about 900 millimeters of rainfall each year.

With an estimated 32 million residents as of the 2011 census, Jharkhand is the thirteenth most populous state in India. With a population of 3.5% (up from 3% in the most recent census in 2001), the state is one of the most populous in the nation. With an area of about 79,000 square kilometers, the state is relatively tiny compared to others in the nation. With 414 people per square kilometer, the population density is 30 points more than the U.S. average. There are eight districts that are mostly inhabited by the Scheduled Tribes, who make up 22.50% of the total population. A little higher than the national average of around 17%, the state's growth rate is close to 22%. As a result of people's ignorance and lack of training in family planning, the state's population is soaring. The state's literacy rate is around 67%, which is an alarmingly low number that requires quick action. Jharkhand has a sex ratio of around 940. The data revealed by the 2011 Jharkhand Census can be crucial in formulating a more effective strategy for the state's economic growth.

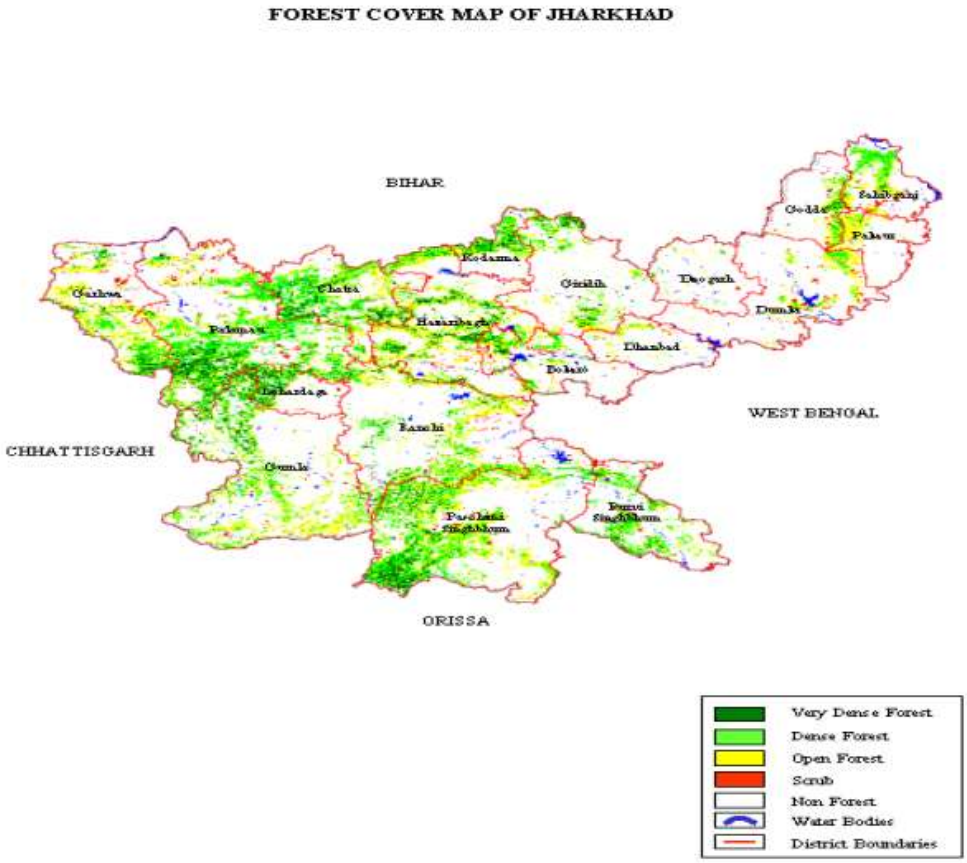
The Jharkhand forests are teeming with species diversity. Forests are a fundamental component of the socio-economic structure of Jharkhand and significantly contribute to the state's economy. Forests cover an area of 23,605 square kilometers in Jharkhand, which is approximately 29.61% of the state's total land area. Additionally, reserve forests comprise 17.5% of the 23,605 square kilometers of forested land, while protected forests occupy 82% of the total area.

The varied flora and fauna of Jharkhand can be found in the state's woods.

The state of Jharkhand is home to two distinct forest types: dry tropical forests and wet tropical forests.

Paid work augments agricultural income, which is the principal source of revenue. Sixty percent of the households are engaged in agriculture, and forty percent work as hired laborers in agriculture, other industries, or in the collecting of non-timber forest products. In some communities, the availability of alternatives to relying on wood has caused many individuals to abandon this practice (particularly wage occupations). Everyone in the villages uses the forest, but mostly for their own subsistence needs, such as fuelwood and feed.

To meet energy demands, 86% of the time fuelwood is burned. About half of the feed needed by domestic cattle comes from forest-based fodder. The annual gross values for fuelwood and fodder, per household, are 2,356/- and 8,507/-, respectively. Although some villages do occasionally sell a few things in local markets, the majority of non-timber forest products are used for subsistence needs. India State of Forest Report (2009) notes that low levels of forest output, community isolation, and limited access to markets caused by deteriorated roads, and inadequate awareness of markets outside of local trade regions contribute to the meager commercial sales of forest goods.



Map 1: Showing Forest Cover of Jharkhand

Table: 1 Recorded Forest Area

Reserve Forest (RF)	4,387 sq. km. (18.58%)
Protected Forest (PF)	19,185 sq. km. (81.28%)
Un-classed Forest (UF)	33 sq. km. (0.14%)
Total	**23,605 sq. km. (100%)**
Percentage of State's Geographical Area	(29.61%)

The state's documented forest area comprises 29.61% of its total geographical area, or 23,605 km^2. As shown in Table 1, Reserved Forest comprises 18.58 percent of the total forest area, Protected Forest 81.28 percent, and Unclassified Forest 0.14 percent. The Chotanagpur plateau is endowed with an abundance of forest resources.

Table: 2 State Forest Cover

Very Dense Forest	2544 sq. km. (11.20%)
Moderately Dense Forest	9137 sq. km. (40.22%)
Open Forest	11035 sq. km. (48.58%)
Total	**22716 sq. km. (100%)**
Percentage of State's Forest Area	(28.50%)

Based on an interpretation of satellite data from October to December 2006, the state's forest cover is 23,605 km2, accounting for 28.72% of the state's geographic area. The state has 2,544 km2 of extremely dense forest, 9,137 km2 of moderately dense forest, and 11,035 km2 of open forest in terms of forest canopy density classes. Table 2 depicts the state's forest cover distribution.

Material and Methods

The study is based on a questionnaire that gathers precise data needed to satisfy a research need on a relevant subject. The study area includes a local market, source forest tracts, and several communities. Household interviews, focus groups, participatory rural assessments, forest surveys, and market surveys were among the research methodologies used for each block. The socioeconomic status of the area was determined by a household survey, and the present state of livelihood pressure on the remaining forest was evaluated using qualitative forest surveys. To further assess the markets of NTFP producers, sales data of various NTFPs were also examined.

In order to gather data for the household survey on socioeconomic status, participant group discussion were conducted, and additional information was gathered through semi-structured interviews with members of the participating households to validate the data and obtain additional insights. In order to gather information regarding the annual revenue generated from the sale of NTFPs and to gather data on local and seasonal variations in product supply and prices, a market survey was undertaken to encompass the local market for a duration of 12 months. All pertinent information was recorded, including the harvested quantity, the forest origin, the final utilization (consumption or trade), and the products collected.

Results and Discussion

Table: 3 Social Profile of the Respondent

Variable	Categories	Frequency	Percentage
Gender	Male	52	54.17
	Female	44	45.83
Caste	SC	23	23.96
	ST	42	43.75
	OBC	31	32.29
Qualification	Matriculation	16	16.66
	Middle School	23	23.95
	Primary School	28	29.16
	Illiterate	29	30.20

Table 2 depicts the social profile of the respondents in your study. It displays an almost equal gender distribution, with 54% males and 46% females taking part. The responses are diverse in terms of caste, with

representation from Scheduled Castes (24%), Scheduled Tribes (44%), and Other Backward Classes (32%). The educational background reveals a range of literacy levels, with the largest groups falling into the categories of 'Primary School' (29%) and 'Illiterate' (30%). 'Middle School' (24%) and 'Matriculation' (17%) were completed by smaller but still considerable cohorts.

This profile gives important background for comprehending your research findings. The sample's various demographics reflect a range of opinions and experiences, which can improve your study and ensure its inclusion. Due to the lower levels of formal education among a major fraction of the respondents, alternative data collection methods and explicit accessibility throughout your research process may be required.

Table 4: Changes in Rainfall and Temperature by Forest Type

Forest Type	Average Rainfall Change	Average Temperature Change
Sal	-15%	+1.5°C
Mixed Deciduous	-20%	+2°C
Dry Deciduous	-30%	+2.5°C

Table 4 delves into the perspectives of local residents in Jharkhand and exposes a troubling reality: climate variability does not affect all woods equally. The table depicting average rainfall and temperature increases across different forest types presents a clear picture of disparities in hazards. Sal forests, with their towering teak giants, have seen a 15% decrease in rainfall and a 1.5°C rise in temperature. This seemingly minor change in precipitation might have serious repercussions, perhaps resulting in lower mahua flower yields and delayed sal leaf maturity, both of which are critical NTFPs for local people.

Moving south, the mixed deciduous forests, filled with tendu leaves and various fruit species, are dealing with a 20% decrease in rainfall. When combined with a 2°C temperature increase, this produces a perfect storm for changing phenology and declining fruit supply, threatening the livelihoods of those that rely heavily on these resources.

The most concerning condition is that of the dry deciduous forests, which are home to bamboo and honeybees. A 30% decrease in rainfall and a 2.5°C temperature increase portray a bleak picture. This substantial decrease in moisture threatens the very survival of bamboo stocks while also shortening the honey gathering season, delivering a double blow to populations that rely on these resources for money and food.

The dramatic difference in rainfall and temperature increases across these forest types emphasizes the complex and nuanced nature of climate variability's impact. Although all forests are vulnerable, the precise threats and vulnerabilities differ greatly. This underscores the importance of context-specific adaptation techniques that recognize the unique challenges that each forest ecosystem and the communities who rely on it confront.

The findings show a patchwork of problems, with different forest types experiencing varying degrees of climate stress. This emphasizes the significance of moving beyond broad generalizations and personalizing adaptation measures to each ecosystem's and community's individual demands and vulnerabilities. By recognizing this uneven environment, we can pave the path for more effective actions that safeguard the long-term sustainability of Jharkhand's valuable forest tapestry and the livelihoods of its people.

Table 5: Livelihood Dependence on NTFPs by Gender:

Gender	% Income from NTFPs	% Affected by NTFP Decline	Coping Mechanisms
Male	60%	45%	Shifting to wage labor, migration
Female	75%	50%	Increasing value-added processing, diversifying crops

The impact of climate variability on NTFP-dependent livelihoods in Jharkhand is starkly gendered, as seen in Table 5. Women are disproportionately affected by the drop in NTFPs, accounting for 75% of their income, compared to males (60%). This increased vulnerability arises from their increased reliance on NTFPs for both revenue and subsistence.

In response, men typically use coping methods such as transferring to wage labor or traveling for job. While this technique provides alternate revenue streams, it can put strain on family relationships and disrupt traditional ways of living. Women, on the other hand, have demonstrated extraordinary resiliency by boosting NTFP value-added processing and diversifying agricultural farming. While these options necessitate additional skills and time investment, they provide better control over revenue and may increase the value of leftover NTFP resources.

This disparity underlines the importance of gender-sensitive adaptation measures. Women's economic resilience can be increased by supporting their efforts in value-added processing through skill development, market access, and infrastructure. Encouragement of diversification of revenue sources within communities, while taking traditional roles and expertise into account, can help to develop a more adaptive livelihood environment. The considerable gender disparity highlights the necessity of identifying and addressing each group's individual vulnerabilities and coping mechanisms when developing effective climate change adaption strategies in NTFP-dependent communities.

Table 6: Local Adaptation Strategies by Community

Community	Traditional Knowledge Applied	Community Initiatives	External Support Needs
North Jharkhand	Seed selection for drought-resistant varieties	Joint NTFP resource management	Improved water harvesting systems
South Jharkhand	Diversified NTFP collection techniques	Collaborative marketing of value-added products	Skills development for alternative livelihoods
Central Jharkhand	Indigenous fire management practices	Collective monitoring of climate changes	Access to climate-resilient seeds and technology

Adapting to a changing climate, the varied forest communities of Jharkhand are demonstrating resourcefulness and fortitude. Table 6 provides a comprehensive depiction of this local adaptation, highlighting distinct community-led initiatives in addition to their particular requirements for external assistance.

As a region contending with ever more unpredictable precipitation patterns, North Jharkhand exemplifies the lasting influence of traditional wisdom. Farmers in this region place a premium on seed selection, selecting for drought-resistant crop varieties and non-timber forest products (NTFPs) to ensure income and sustenance even during arid years. These communities, appreciating the significance of collaborative efforts, have also adopted joint NTFP resource management, which guarantees equitable access to resources and sustainable practices. One of their primary external requirements is for enhanced water harvesting systems, which are vital in preventing droughts and increasing agricultural output.

South Jharkhand is adjusting to alterations in phenology and diminished availability of well-known NTFPs by employing a variety of collection methods. Communities are investigating alternative species, conducting harvesting method experiments, and venturing into previously unexplored regions. This innovative spirit is

also evident in their collaborative endeavors, where they have jointly promoted value-added NTFP products through marketing, thereby increasing revenue and market competitiveness. However, their voyage necessitates the development of skills necessary for alternative means of subsistence. Provision of information and strategies pertaining to a variety of non-forestry revenue streams can serve as an essential safety net in the event that NTFP declines occur.

Central Jharkhand, situated amidst the arid forests of the state, exemplifies a profound comprehension of the ecological significance of fire. Indigenous fire management practices have been revitalized and adapted by communities, thereby assuring controlled burns that facilitate regeneration and reduce the risks of wildfires. Their proactive stance is evident in their collaborative efforts to monitor climate change, including the meticulous tracking of rainfall patterns, temperature fluctuations, and emergent challenges. In order to enhance their resilience, the communities of Central Jharkhand must have access to climate-resilient seedlings and technologies. By furnishing them with cutting-edge instruments and drought-resistant cultivars, we can enable them to flourish amidst an evolving environment.

Table: 7 Perceptions of Respondents from Focus Group Discussion

Theme	Key Findings (Results)	Discussion/Interpretations
Changes in Rainfall Patterns and Temperatures	Participants observed increased erratic rainfall and rising temperatures. Frequency and intensity of droughts reported to be increasing.	Climate variability significantly impacting the forest ecosystem and NTFP availability. Increased vulnerability of communities dependent on NTFPs for livelihoods and food security.
Impact on Abundance, Quality, and Diversity of NTFPs	Decline in abundance reported for various NTFPs, particularly those sensitive to rainfall and temperature. Observed changes in phenology and flowering/fruiting patterns. Concerns expressed about reduced quality and appearance of NTFPs.	Climate variability directly impacting NTFP productivity and sustainability. Reduced availability and quality of NTFPs affecting income generation and traditional practices.
Consequences for Livelihoods and Cultural Practices	Difficulties in meeting NTFP-based livelihood needs reported. Increased dependency on market sources and outside income. Cultural practices and rituals dependent on NTFPs facing disruption.	Climate change posing significant challenges to traditional way of life in forest communities. Need for diversification of livelihood options and adaptation strategies.
Local Coping Mechanisms and Adaptation Strategies	Traditional knowledge and practices used to identify alternative NTFPs and optimize collection. Diversifying income sources through agriculture, handloom weaving, etc. Building community resilience through resource sharing and collective action.	Importance of traditional knowledge and community-based adaptation strategies in responding to climate challenges. Need for external support to enhance adaptive capacity and build sustainable livelihoods.

Conclusion

This study looks into local community perspectives in Jharkhand and presents a vivid image of a landscape transformed by climate variability. Because of uncertain rainfall, rising temperatures, and changed phenology, the very NTFPs that are woven into the fabric of livelihoods and cultural activities face enormous threats. Despite this tragedy, a profound spirit of perseverance arises.

An assortment of indigenous forest communities exhibits a rich tapestry of adaptation strategies. Collective resource management and drought-resistant variants are embraced in North Jharkhand. South Jharkhand innovates and diversifies its NTFP accumulation by producing products with added value. Central Jharkhand reestablishes traditional fire management practices and monitors climate change with vigilance. These endeavors, which are driven by community unity and traditional wisdom, provide compelling opposition to the narrative of susceptibility.

Conversely, the pursuit of resilient futures necessitates cross-community collaboration. Critical external supports include enhanced water harvesting systems, skill development to facilitate alternative livelihoods, and access to climate-resilient seedlings and technology. It is critical to acknowledge and magnify local knowledge in order to guarantee that interventions are tailored to the specific context and enable communities to take charge of their own adaptation process. Additional research is required to determine the scalability and reproducibility of these local methods, in addition to their long-term viability in diverse social and environmental contexts. It is crucial to comprehend the interplay between external support mechanisms and local adaptation in order to optimize intervention and policy initiatives. In conclusion, through the integration of scientific understanding, collaborative effort, and local resilience, it is possible to guarantee not only the survival but also the flourishing of Jharkhand's dynamic communities amidst the challenges posed by climate change, while simultaneously preserving the ecological and cultural treasures that they diligently defend.

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