



Socioeconomic Assessment of NWFP-Based Livelihoods in Tribal Communities of the Bundelkhand Region, India

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Authors' contributions

This work was carried out in collaboration among all authors. Author YYS has conducted the survey study and compiled the original draft, Authors NPS and ACM author have reviewed the draft and corresponding author have formulated the draft and finalise the manuscript. All authors read and approved the final manuscript.

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Abstract

Non-Wood Forest Products (NWFPs) play a crucial role in sustaining the livelihoods, food security, and socio-economic resilience of rural and tribal communities in Bundelkhand amid increasing environmental and economic uncertainties. The present study aims to analyze the socio-economic status of tribal populations and rural communities dependent on Non-Wood Forest Products (NWFPs) in four districts of Bundelkhand, India, namely Banda, Chitrakoot, Lalitpur, and Sonbhadra. Their economy depends widely on NWFPs to sustain the livelihoods of residing communities in semi-arid region of Bundelkhand where low erratic rainfall (250-600mm/year) hinders agriculture. Though region is blessed with diversity of natural resources available in residing forests, still community faces some challenges. Hence, the present survey study is based on primary data collected through field surveys by interviews from tribal people representing 10 per cent of total population from each district. The analysis of collected data and information indicate that a significant

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proportion of households *i.e.*, about 45 per cent of community depend on NWFPs for income generation and subsistence needs, especially during agricultural lean periods. Study has compiled the information collected more than 300 respondents belonging age group 25-50 years old using structured questionnaires. It was found that despite importance of NWFPs in studied region, these products have remain underutilized due to policy, institutional constraints, low literacy levels, exploitation by middlemen, lack of awareness rights etc. Though, tribal women play a dominant role in the collection and selling of extracted products from trees such as tendu leaves, mahua flowers and medicinal parts in the local markets. However, issues such as lack of market access, inadequate infrastructure, and exploitation by intermediaries limit the economic potential of raw products other than timber. Additionally, traditional knowledge should be documented and evaluated to ensure sustainability and conservation awareness. The extension activities along with present surveys have been conducted to create awareness on value addition of procured raw products from forest such as 'Mahua laddu' has been prepared using flowers of *Madhuca longifolia*.

Keywords: NWFPs; Tribal livelihood; Socio-economic status; value addition.

1. Introduction

In developing countries like India, forests play a particularly important role in sustaining rural and tribal populations, who depend on forest resources for food, fuel, fodder, and income generation. And it is estimated that over 275 million people *i.e.*, 27 per cent total population rely on forests for their livelihoods, with a substantial proportion depending on Non-Wood Forest Products (NWFPs) as a primary source of income (Pandey *et al.*, 2016). Additionally, forests constitute one of the most vital natural resources, providing ecological stability and supporting the livelihoods of millions of people worldwide (FAO, 2020). 'NWFPs', alternately termed as Non-Timber Forest Products (NTFPs), include a wide range of biological materials such as wild fruits, nuts, medicinal plants, fibers, resins, honey etc that are harvested or extracted from forests without cutting trees. The forest flora also provides the raw material for the production of traditional medicines (FAO, 2005) which has high demand in pharmaceutical sector. These products contribute significantly to the livelihoods of forest-dependent communities by providing both subsistence and cash income opportunities but with un-regulated market. NWFPs have been widely recognized as an essential component of rural livelihoods, particularly in developing countries where forest-dependent communities rely heavily on natural resources for subsistence and income generation.

Several studies have emphasized the socio-economic importance of NWFPs in reducing poverty, enhancing food security, and promoting sustainable development such as Pandey *et al.*, (2016). This indicates that these diversified products serve as a buffer during economic shocks such as crop failure and drought in which small and marginal farmers are at risk (Singh *et al.*, 2023). They have not only provided the income but also contributed to the food and nutritional security by supplying essential dietary components (Endamana *et al.*, 2016). Maske *et al.* (2011) conducted a study on rural livelihoods and observed that households engaged in forest products collection exhibited better resilience compared to those solely dependent on agriculture. However, the study also highlighted challenges such as limited access to markets, lack of storage facilities, and price fluctuations. Forests constitute one of the most vital natural resources, providing ecological stability and supporting the livelihoods of millions of people worldwide (FAO, 2020). The previous report suggests that improving market access, promoting value addition, and providing institutional support can significantly increase the economic benefits derived from forest resources. Next, the overexploitation of forest resources and ill-management in collection/extraction can lead to depletion of NWFPs, affecting both the environment and the livelihoods of dependent communities. United Nations Development Programme (UNDP) stressed the importance of integrating livelihood development with environmental conservation. Hence priority is to sustain adaptive conservation measures include both in-situ and ex-situ along with engaging and awaring the local tribal communities importance's, medicinal uses and its cultivation techniques (Rana *et al.*, 2024). The organization advocates for community-based forest management and capacity-building initiatives to empower local populations and improve their socio-economic conditions. Overall, the literature indicates that while NWFPs play a vital role in supporting rural livelihoods, several challenges hinder their optimal utilization. Addressing these challenges requires a holistic approach involving policy interventions, market development, and community participation. However, the indigenous knowledge based on natural resources is increasingly at risk due to advancement in modernization, generation gaps and shift in socio-economic status in tribal region (Dhiman *et al.*, 2026). Various practices such as deforestation, agricultural activities, and developmental changes

are also creating threat to natural resources and traditional wisdom. Understanding these factors is essential for designing effective policies and interventions aimed at improving livelihoods and promoting sustainable development. Chavan *et al.*, (2016), have document the livelihood dependency of Bundelkhand community on trees providing NTFPs such as gum, dona pattal, lac from Butea; brooms, jaggery and baskets from Phoenix; flowers and seeds from mahua; bidi leaves from tendu and sticks from bamboos. Agricultural income is often uncertain due to erratic rainfall, making NWFPs a reliable alternative source of livelihood (Gupta *et al.*, 2014). This led to variation in employment which is affected by factors such as forest availability resources, population density, and economic conditions of that particular region. Gupta *et al.*, (2014) analysed the environmental and climatic conditions of Bundelkhand and concluded that frequent droughts and water scarcity have significantly impacted agricultural productivity, forcing rural populations to depend more on forest resources. This increased dependency has both positive and negative implications, as it provides livelihood opportunities while also exerting pressure on forest ecosystems.

The present study aims to provide a comprehensive analysis of the socio-economic conditions of tribal and rural communities in Bundelkhand, with a focus on their dependence on NWFPs. By examining patterns of resource use, income generation, and livelihood strategies, the study seeks to identify key challenges and opportunities for enhancing the role of NWFPs in rural development

1.1 Study Area

The present study was conducted during year 2023-24 in the Bundelkhand region of Uttar Pradesh, focusing on four districts: Banda, Chitrakoot, Lalitpur, and Sonbhadra. The district Bundelkhand, a semi-arid region spanning parts of Uttar Pradesh and Madhya Pradesh, is characterized by low rainfall, frequent droughts, poor soil fertility, and limited irrigation facilities (Gupta *et al.*, 2014). These factors have led to chronic poverty, food insecurity, and migration among rural populations. In such conditions, forests and NWFPs play a critical role in sustaining livelihoods and providing a safety net during periods of economic distress. The mentioned study districts of Banda are among the most backward regions in Uttar Pradesh, with a high concentration of tribal and marginalized communities.

2. Methodology

The present study adopts a descriptive and analytical research design to assess the socio-economic status of tribal and rural communities in the Bundelkhand region. Primary data were collected through field surveys using structured questionnaires, personal interviews, and direct observations during 2023. The questionnaire was designed to capture information related to demographic characteristics, income sources, occupation, education, and dependency on NWFPs. Both formal and informal interviews were conducted with local villages are near forest fringe area of Kalinjar area in Banda and Karvi range of Chitrakoot, Sonbhadra, Lalitpur. A survey sample representing approximately 10 per cent of the village population was selected using random sampling techniques. Both male and female respondents have been targeted for interview to capture gender-based differences in livelihood activities carried out in communities. About 40, 100, 100 and 105 respondents (Total-345), majority belongs to 30 to 50 age group have responded the survey questionnaire from Banda, Chitrakoot, Lalitpur, and Sonbhadra respectively. The informants included old and experienced males and females who were well acquainted with the plants and who could thus easily identify them. The secondary data were collected from various sources such as related government reports, research papers, and publications. Both primary and secondary data sources were utilized to ensure a comprehensive analysis. The district wise NWFP dependency levels by community was explored as per utilization of diverse forest products and engagement of Self-help group having coordination with forest department of concern district. The information on market price of raw collected product has been collected through survey questions through panchayat samhiti chairman (village authority) and at the selling sites. The collected data were verified by with previous studies as well as analysed by using descriptive statistical tools. Comparative analysis was also conducted to identify variations across studied districts. Ethical considerations were maintained throughout the study by ensuring informed consent from respondents and maintaining confidentiality of the data collected.

3. Result and Discussion

The analysis and interpretation focuses on demographic characteristics, occupation patterns, income sources, and dependency on NWFPs.

3.1 Demographic Characteristics

The table1 represents the demographic profile of the respondents by including gender distribution, age group distribution and educational Status. The gender-wise distribution of respondents reveals that approximately 60 per cent of the respondents are female, while 40 per cent were male. This indicates that women play a dominant role in forest-based livelihood activities, particularly in the collection and processing of NWFPs. Tribal women are actively involved in gathering products such as tendu leaves (*Diospyros melanoxylon* Roxb), mahua flowers (*Madhuca longifolia* (L.) J.F.Macbr.) as well as medicinal plants, which are later, sold in the local markets. Their contribution to household income is significant, although often undervalued in economic assessments (Endamana et al., 2016). Pradhan et al., (2025) emphasized the gender dimension of forest product collection, noting that women contribute a significant role in gathering, processing, and marketing forest products but their contribution is usually unsung and unseen.

Table 1. Demographic characteristics of total respondents actively participated in Survey

Gender Ratio M:F = 1:1.5		Age Group Category	
Total respondents-345			
Male	Female	25-50 years (Active)	Below 25 years
138 (40 %)	207 (60 %)	Majority (Primary/ No Formal Education)	Lower (Significant higher education)

Under the age group distribution, the age group of 25–50 years have been dominating, representing the economically active population. It was found that younger individuals (below 25 years) have least interest in forest-based activities due to migration and for the search for alternative employment opportunities. Whereas, older individuals (above 50 years) are involved in traditional knowledge-based activities such as medicinal plant collection, highlighting the importance of indigenous knowledge systems in NWFP utilization. As per the educational status of respondents, it indicates a low literacy rate in tribal communities. Only few individuals have accessed primary-level education. This lack of education limits their ability to access better employment opportunities and adopt modern techniques for value addition. Women respondent percentage i.e., 70 per cent was found highest in Chitrakoot district.

3.2 Occupation Pattern

The occupation pattern of respondents has been shown in figure 1 where maximum residents i.e., 45 per cent depend on forest-based activities; about 30 per cent are engaged in agriculture. As, the agriculture in this region is rainfed, diverse, complex, under-invested, risky and vulnerable (Jain, 2020). Thereafter 20 per cent depend on wage labor or daily paid works and least 5 per cent were involved in other activities. The high level of dependency on NWFPs is due to limited livelihood options in the region (Pandey et al., 2016). Additionally, the socio-economic conditions of study districts are characterized by low literacy rates, limited access to healthcare, poor employment and lack of basic education. These factors contribute to the dependence on NWFPs as a primary source of income and subsistence. Despite their importance, the potential of NWFPs remains largely untapped due to several constraints, including lack of awareness, poor market access, inadequate infrastructure, and exploitation by middlemen (FAO, 2020). Moreover, unsustainable harvesting practices and deforestation pose significant threats to the availability of NWFPs, thereby affecting the livelihoods of forest-dependent communities. Hence, the community awareness on Rapid Vulnerability Assessment (RVA) on biodiversity and indigenous traditional knowledge (ITK) are needed through government training programs which could sensitise the local communities to preserve natural resources (Dhiman et al., 2025).

3.3 Income Sources

The analysis of income sources reveals that NWFPs contribute significantly to household income, particularly during non-agricultural seasons. This shows positive and strong relation of community with natural resource available there (Figure-2). The different potential NWFPs categories and majority collection have been shown in table 2. Through survey study it was found that rate of collected raw NWFPs products and their distribution are decided by *Gram-pramukh* (village authority) after group discussion with locals. As mentioned by Handa and

Mohapatra (2021) that in dominating tribal villages in India, gram sabha is allowed or have authority to sell minor forest produce, such as tendu leaves, under the Panchayats (Extension to Scheduled Areas) Act (PESA).

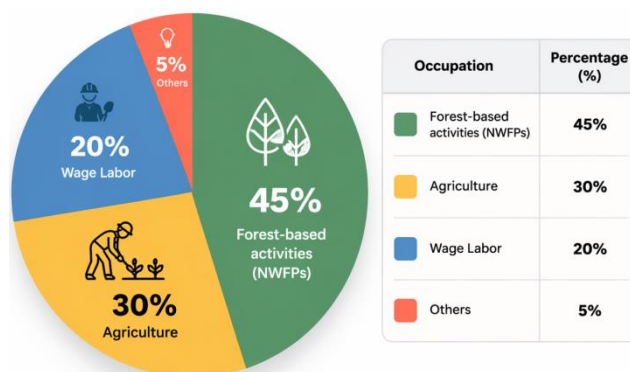


Fig. 1. Primary Occupation of respondents

Table 2. Major NWFPs and their Utility

NWFP Name	Primary Use	Collection Role
Tendu Leaves	Commercial and income	Predominantly women
Mahua Flowers/ Seeds	Food and income	High house hold value
Honey	Consumption and sale	Traditional knowledge
Medicinal Plants	Traditional medicine	Older generation knowledge



Fig. 2. a) Collected flowers of *Madhuca longifolia* (L.) J.F.Macbr.; b) Tribal women practicing the Bamboo handicraft; c) flowers of *Diospyros melanoxylon* Roxb

Non-Timber Forest Products (NTFPs) are a significant source of subsistence products, employment, and household income in areas near forests. At local market sites such as Nareni (Banda), Shimoni (Chitrakoot),

Kamalnath temple (Sonbhadra) and at Lalitpur, where mahua seeds found to be roughly sold at rate of 50Rs/Kg, mahua flowers @ 60Rs/ kg and 100 tendu leaves @ 250 Rs. The same description on price rate has been mentioned by Panda *et al.*, 2024. It was found that rate fluctuation in raw product was more where area suffers with low literacy rate and having limited produces. Earlier studies have highlighted the scenario of forest-dependent communities- such as about 30–50 per cent of their annual income derives from NWFPs and ensuring livelihood security. The collected information formally stated that NTFPs have been estimated to account for nearly 50 per cent of state forest revenues.

Women in the tribal communities were largely engaged in collecting NTFP's from the forests and selling this in the markets nearby directly rather than going for value addition. Furthermore, local collectors often receive low prices for their products and reducing their income due to unawareness of importance of raw natural product in open market. In recent scenario, various minor forest products are getting obsolete at international market as with advancement in chemical industries who have successfully synthesized the alternatives (Muir, 2021).

3.4 Dependency on NWFPs

From table 3, it is clear that out of all studied districts which have highest NWFP dependency are Sonbhadra (80 %) and Chitrakoot (60 %) having tribes such as Gond and Kol are blessed with traditional knowledge on utilization of natural resources. Forest community rights (FCR) are available at both Sonbahadra and chitrakoot district with community is still involved in indigenous practices whereas collection rights are restricted in Lalitpur and Banda districts having less forest cover and moderate to least NWFP dependency comparatively.

Table 3. District- wise NWFP dependency levels

District	Level of Dependency	Key Factors	Number of Active SHGs for NWFP collection
Sonbhadra	Highest (80 %)	Presence of dense forest cover; with settled Gond, Kol and Sahariya tribes with highest NTFP collection rights	08
Chitrakoot	High (65 %)	Diverse forest products with more forest dependency by migrant Gond and Kol tribes,	07
Lalitpur	Moderate (50 %)	Mixed forest, agricultural land, local tribes Sahariya and Bhaini are dependent	05
Banda	Mixed (25 %)	Mixed forest, limited forest resources, open agriculture lands	05

The high level of dependency on forest resources highlights the limited availability of alternative income sources such as Agriculture based, labour or daily paid works etc, especially in the region of Sonbhadra and Chitrakoot. Both have found with highest number of Self-help groups (Sonbhadra-8 and Chitrakoot-7) which are actively contributing in collection of natural resource. Hence traditional practices of connection with forest and nature are still followed in regions with high dependent NWFPs. Furthermore, about 22 NWFP have been identified which are predominately collected for income generation, food security, and subsistence needs. List of trees recognised for procurement of NWFPs have been shown in table 4. Products such as tendu leaves, Mahua flowers, honey, and medicinal plants are major sources of income.

Table 4. List of wild trees having important role in NWFP

Sl. No.	Botanical Name	Local/Vernacular Name
1.	<i>Aegle marmelos</i>	Bael
2.	<i>Ageratum conyzoides</i>	Affo
3.	<i>Ailanthus excelsa</i>	Shesh
4.	<i>Amorphophallus paeoniifolius</i>	Kand
5.	<i>Bambusa spp.</i>	Bamboo
6.	<i>Cissampelos pareira</i>	Gurbel, Gad, Gauli
7.	<i>Cissampelos pareira</i>	Bilcha
8.	<i>Clerodendrum serratum</i>	Angeetha

Sl. No.	Botanical Name	Local/Vernacular Name
9.	<i>Diospyros melanoxylon</i>	Tendu
10.	<i>Entada rheedii</i>	Jangal Jalebi
11.	<i>Ficus palmata</i>	Papari
12.	<i>Hedychium spicatum</i>	Nadi
13.	<i>Holarrhena antidysenterica</i>	Kwa
14.	<i>Imperata cylindrica</i>	Bara Ghas
15.	<i>Kydiacalycina</i>	Kaha
16.	<i>Limonia acidissima</i>	Achar
17.	<i>Madhuca longifolia</i>	Mahua
18.	<i>Moringa oleifera</i>	Sahjan
19.	<i>Phyllanthus emblica</i>	Amla
20.	<i>Sarcostemma acidum</i>	Sareta
21.	<i>Thysanolaena maxima</i>	Broom Grass
22.	<i>Ziziphus mauritiana</i>	Jangli Ber

The forests of the study areas are multi-layered comprising a dry deciduous type of forest which yields rich and diverse types of forest products. NTFPs are crucial because of their richness of biodiversity, as source of food, fodder, fibre, fertilizers, herbal products, construction material, cosmetics and cultural products and support village level craft activity as well as raw materials to support processing enterprises. The tree species with valuable NWFP provide ecological services must grow in agroforestry system in Bundelkhand region (Dobriyal, 2026). The information on potential NWFP with their use categories and their collection time has been compiled during survey, have been shown in Table 5.

Table 5. Different potential NWFP categories and their collection period

S.NO.	NWFP categories	Collection period (Months)
1.	Fibres and Flosses :	
	(i) Fibre	March-May
	(ii) Kapok floss	May-June
	(iii) Grasses	October-March
2.	Bamboo and cane :	
	(i) Bamboo	All year round
	(ii) Canes	All year round
3.	Essential oils :	
	(i) Lemon grass	May-June
	(ii) Palmarosa	October-November
	(iii) Eucalyptus	All year round
	(iv) Cinnamom	All year round
	(v) Sandal	All year round
	(vi) Deodar	All year round
	(vii) Pine	All year round
4.	Non-edible oil seeds:	
	(i) Mahua	April-June(northern), Oct-Nov(southern)
	(ii) Neem	May-June
	(iii) Karanj	June-October (Different parts of the country)
	(iv) Kusum	June-July
	(v) Sal	April-June
	(vi) Kokum	May-June
	(vii) Nahor	May-June
	(viii) Undi	April-June and September-November

S.NO.	NWFP categories	Collection period (Months)
5.	Tans and dyes: (i) Babul bark (ii) Avaram bark (iii) Wattle bark (iv) Myrobalan	All year round All year round All year round January-March
6.	Gums and Resins: (i) Karaya gum (ii) Ghatti and babul (iii) Resins	April-June April-June March-June
7.	Lac and tasarsilk : (i) Lac and lac products (ii) Tasar silk (iii) Tendu leaves	October-January and April-July August-December April-June
8.	Drugs, spices and insecticides : (i) Sarpagandha (ii) Kuth (iii) Cinchona (iv) Edible products	Not available October Not available Not available



Fig. 3. Value addition of Mahua flowers through making of 'Mahua Laddu'

In this survey, the locals have been acquainted with processing protocol of Laddu making from Mahua flowers (Figure 3) and awareness on importance of value added product was conducted. The copyright of processing and nutritional value of "Mahua Laddu" have been register with Copyright Certificate No. LD-2025017022 filled on dated 05.04.2025 and issued to Dr. Yogesh Y. Sumthane, Professor, and Department of Forest Products Utilization, College of Forestry, Banda University of Agriculture and Technology, Banda UP-210001. The preparation protocol includes with cleaning of dried mahua flower for removing adhesive and other impurities. Then, it is processed further with dry roasting of flowers (corolla) over a low flame until they developed a characteristic aroma as well as the crisp texture. Thereafter, roasted sesame seeds or peanuts alongwith roasted mahua flowers are ground together to prepare a coarse ground mixture. Another, syrup of jaggery in ghee has been prepared separately. The flower mixture along with cardamom powder is blend uniformly in prepared syrup on low flame. The mixture is allowed to cool slightly to attain a handling consistency. The compact spherical laddu are being prepared with hands and allowed them to cool completely before storing in an airtight container. The processed product is edible for 10 days without freezing and can be store for a month when in freezer with intact taste. As majority of collectors sell their raw products directly to middlemen and in the local market rather than thinking of value addition (Panda *et al.*, 2024). One of the key findings is the significant role of women in NWFP collection and marketing, where they are not only contributing to household income but also play a vital role in ensuring food security to family. Women have taken intensive interest in knowing the methods of preparation of 'Mahua Laddu'. This reflects their growing enthusiasm and proactive participation to

acquiring knowledge in value added processing activities. Singh, (2018) described that dried flowers of *Madhuca indica* can also be boiled with sattu and recommended during rheumatism and local also prepare 'Mahudi' a local vine through fermentation process.

4. Conclusion

The present study highlighted the importance of NWFPs in Bundelkhand where agricultural productivity is low and alternative employment opportunities are limited. Based on interpretation from recorded survey information, present paper emphasizes the need for policy measures to improve the market by linking the local collectors and seller. It further emphasizes on the need of integrated policy interventions with improving market access to local sellers, promoting value addition, and ensuring sustainable forest management. By strengthening the institutional support and by enhancing awareness among communities through programmes and with demonstration extension activities can improve their present conditions. Furthermore, by strengthening value chains and promoting sustainable harvesting practices could enhance the socio-economic conditions of forest-dependent farmers. In conclusion, NWFPs have immense potential to contribute to rural development and poverty alleviation in semi-arid regions like Bundelkhand, where women are potential role from collection to selling at market. By recognizing and supporting the role of women in NWFP activities can improve household income and overall socio-economic conditions. Through training in processing, packaging, and marketing could promote the value addition and further increase their income surely. Harnessing this potential requires a coordinated effort involving government agencies, non-governmental organizations, and local communities.

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Disclaimer (Artificial Intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Competing Interests

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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