EXAMINING CUSTOMARY OWNERSHIP OVER FOREST TREES AND ITS INFLUENCE ON HOUSEHOLD PARTICIPATION IN FOREST MANAGEMENT ACTIVITIES IN JHARKHAND, INDIA

by

SABYASACHI KAR

(Under the Direction of Puneet Dwivedi)

ABSTRACT

In India, tribal communities have developed customary ownership of trees present in public forestlands. It is essential to understand the unique relationship of local people with their trees, considering ongoing efforts to decentralize forest management nationwide. Various qualitative and quantitative methods were used for data collection and analysis across four villages in the Dumka District of Jharkhand, India. Research findings revealed that tribal communities have developed a set of customary norms to govern forest trees around ownership creation, intergenerational transfer, and distribution. Additionally, factors such as the presence of ethnic communities, land titling, and commercialization of forest-based activities influence customary norms. Regression analysis identified a negative relationship between the forest trees under customary ownership and participation in participatory forest management activities. This study provides insights for implementing community-based sustainable forest governance in India.

INDEX WORDS: Participatory forest management, customary tree ownership, customary norms, household participation, sustainable forestry

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EXAMINING CUSTOMARY OWNERSHIP OVER FOREST TREES AND ITS INFLUENCE ON HOUSEHOLD PARTICIPATION IN FOREST MANAGEMENT ACTIVITIES IN THE DUMKA DISTRICT OF JHARKHAND, INDIA

by

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DEDICATION

I dedicate this thesis to my family.

To my grandparents, Late Kalidas (Dadu) and Late Indumati (Nano), my parents Gouri and Panchanan, and my in-laws Padmalochan and Saraswati for their encouragement and support to make a transition from secured jobs to educational journey.

To my son Swetbahan (Rio) and daughter Bihan (Buri) to make me feel special in their life.

To Shreyasi and Debayan, as both are doing everything for our parents while I'm away.

To my wife, Lalita, for her love and encouragement, and she always stands with me in all that I am doing and wish to do.

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CHAPTER 1

INTRODUCTION

Background

India's dominant forest types are tropical dry deciduous and tropical moist deciduous, covering 21.7% of the country's geographical area (Forest Survey of India, 2021). While India's overall forest cover increased by 2,261 km^2 between 2019 and 2021, at the same time, 1582 km^2 of moderately dense, natural forest disappeared from public lands (Forest Survey of India 2021). There are conflicting viewpoints on the cause for this decline, with public officials highlighting population growth and increased resource demand and placing blame on local people who are not interested in forest conservation, while others blame poor forest bureaucracy efforts in ensuring community participation in forest conservation and management (Chakraborty, 1994; Punia & Jakhar, 2022; Singh et al., 2017a). To understand this, it is also important to understand the historical context of India's forest policy and governance.

Historical background of Indian Forests

Before the British era (1865), local rulers, or Zamindars, owned forests (Gadgil, 1990; Sonowal, 2007). Their objective was to collect taxes from those lands, but forests were primarily managed by local communities, often with cultural and religious significance (Ormsby & Bhagwat, 2010; Tripathi, 2016). In 1865, the British government took over India's forests with a desire to make ships to transport raw materials and bolster economic development by mining, constructing dams, and expanding railways while restricting the rights of forest dwellers (Cultural, 2010; Haeuber,

1993; Sonowal, 2007). However, the shift in forest ownership and management of forestland from the community to the British had a lasting impact on the environment and the livelihoods of the forest-dwelling or tribal communities (Baviskar, 2001; Ramakrishnan, 2007). The shift led to the displacement of forest-dwelling people, particularly indigenous communities, impoverishment, social dislocation, and loss of livelihoods, and hampered the fundamental human right to life, leading to exclusion, contestation, and conflict (Banerjee & Madhurima, 2013; K. Kumar & Kerr, 2013; Rangarajan & Shahabuddin, 2006). This trend of exploitation of forests continued even after India gained independence, with forest resources being perceived as integral to economic development (Gadgil, 1990; Singh et al., 2017b).

After independence in 1947, India followed a similar path to the British and adopted a conservation approach that isolates forests from human interaction (Dehradum, 2011). Expanding the number of protected forests, a strategy for conservation approach by removing the native forest-dwelling communities from those areas has yielded mixed results. Some studies have identified success in increasing forest cover in some regions, while some studies revealed a trend of decline in forest cover in other areas (Krishnadas et al., 2018; Miranda et al., 2014). However, the displacement of local communities is a significant concern (Fanari, 2019; Rangarajan & Shahabuddin, 2006). The tension between the conservation approach and human well-being was evident, and the government of India at that time felt the need for a balanced approach that considered both human and forest well-being (Bawa et al., 2021; Ghazoul, 2007; Madhusudan & Raman, 2003).

In the late 1970s and 1980s across India, the tension between the conservation approach and human well-being created unrest, protests, and many movements that compelled the Government of India

to introduce several policies to rectify “historical injustice” towards forest dwelling communities (Kalpavriksh, 2015) and to revert care and management of the forests to those living on the land (Bhattacharya et al., 2010). Unfortunately, these policies have not shown the intended success because there have been political interferences by groups, such as local elites and conservation groups, with conflicting interests (Kashwan et al., 2021; Satpathy, 2015; Sen & Pattanaik, 2019). The implementation of these policies, grounded in a conservationist framework that assumes a human-nature divide, frequently fails to recognize the interests of the most marginalized communities and often ignores communities' traditional knowledge, customary norms, and caretaking practices over forest trees (Baral, 2023; Dhanapal, 2019; Nagahama et al., 2022).

Specifically in Jharkhand, where the study was conducted, two large-scale Santhal movements, the Birsa Munda Movement and the Sidhu Kanhu, took place during the years 1855 and 1898 against the unfair land grabbing by the British, Zamindars, and Moneylenders (Sahare, 2021; Sengupta & Lochan, 2015). These movements took place to safeguard tribal land and forest rights, resulting in pro-tribal policies such as the 1949 Act of Santhal Pargana Tenancy. However, the outcome of these movements and the pro-tribal policies are often overshadowed by a long list of conflicting legislation that empowered the state to acquire forestland governed by tribals for development projects (H. C. Behera, 2019). Such legislation includes the Land Acquisition Act of 1894, the Coal Bearing Areas (Acquisition and Development) Act of 1957, and the Indian Wildlife (Protection) Act of 1972. H. C. Behera (2019) also explained these often-created conflicts, particularly when tribal land holds mineral deposits and natural resources vital for economic development. Studies also highlight that, between 1951 and 1995, the government acquired 138,034 hectares of forestland in Jharkhand for development activities such as dam construction,

mining, and industrialization (Venkteshwar, 2023). These forestlands were predominantly inhabited by indigenous communities such as Santhals and Pahariyas. These development activities in Jharkhand led to the displacement of the indigenous tribal communities, particularly a significant number of Pahariyas who often resided in the hilltop areas without a formal land title (Rao, 2003). Consequently, Pahariyas lost land ownership and their rights to trees (Ekkā, 2011).

Finally, the Forest Rights Act 2006, a landmark legislation in India, secured thirteen types of customary forest rights, including the right to hold and stay in forest land to the forest-dwelling communities, but surprisingly remained silent on customary tree ownership that are prevalent in tribal regions of the country (FRA, 2006). Fortmann (1985) highlighted that securing rights over trees by understanding the social and customary norms of tree ownership and tenure helps prevent unintended infringements on existing forest rights, ensures equitable distribution of forest resources, and guards against exploitation by privileged groups.

Therefore, the second chapter delves into the socio-cultural norms governing forest tree ownership and the factors influencing their evolution and application. In the third chapter, how households' customary rights over the number of forest trees, along with other socio-economic characteristics, influence the households' participation in participatory forest management practices for better forest conditions was examined.

Study Area

To select villages for study, a local non-profit, PRADAN, was contacted. Initially, 15 candidate villages were identified, and factors such as the availability of villagers to participate in the

research process and distance were used to reduce the list to four villages: Asurdaha, Dhawadangal, Sahritola, Bara Chaparia. Collaboratively with PRADAN, these villages were chosen to investigate various factors, such as displacement, the presence of particularly vulnerable tribal groups, a significant presence of ethnic communities in the villages, impacts of land titling, and the impacts of commercialization on customary norms governing customary tree ownership.

Figure 1.1 shows the geographical location of four villages selected for the study in the Rajmahal hills of Dumka District in the Central Indian State of Jharkhand. Jharkhand is a tribal-dominated state with 32 tribes and a tribal population of over seven million. Approximately 92% of the Scheduled Tribe (ST) population resides in villages. Jharkhand was the second poorest state in India, with 48.3% of the total rural population living in poverty (NITI Aayog, 2021). Additionally, Jharkhand had an overall forest cover of 29.6% of its geographical area, among these 11% constituted very dense forest[1], 41% moderately dense forest[2], and 48% open forest[3] (Forest Survey of India, 2021). Dumka District was the sixth poorest district of Jharkhand's 24 districts, with 56.2% of the rural population living in poverty (NITI Aayog, 2021). This district had an overall forest cover of 15.3%; among these, 45% constituted moderately dense forest and 55% open forest (Forest Survey of India, 2021). Scheduled Tribe (ST) population of the district was 43.2% (Census, 2011).

Table 1.1 shows that in the selected block, namely Dumka Sadar, two villages, Asurdaha and Dhawadangal, were chosen for closer examination. Dhawadangal stands out as a village where all

[1] Very Dense Forest defined as all lands with a forest cover having a canopy density of 70 percent and above.
[2] Moderately dense forest defined as all lands with a forest cover having a canopy density between 40-70 percent.
[3] Open forest defined as all the lands with a forest cover having a canopy density between 10-40 percent.

the households belonged to Scheduled Tribe (ST), among which 75% of its population were Particularly Vulnerable Tribal Groups (PVTGs), primarily the Pahariyas, who were displaced from nearby villages due to the construction of the Massanjore dam. The remaining 25% of the population comprises Santhal communities. Displaced by the dam construction, the PVTG community resettled in the forestlands of Dhawadangal and obtained land titles initially from the village head to construct their houses. Dhawadangal is the smallest of the studied villages, spanning 68 hectares, with 33% of its area covered by moderately dense and open forests. The primary livelihood activities of the PVTG community include migration to nearby cities for work, fishing in the Massanjore dam, shifting cultivation on forest land, and collecting forest products such as Simul cotton and medicinal plants. In contrast, Santhal communities in Dhawadangal primarily relied on agriculture, migration, and fishing in the nearby dam. The village's forests harbored over 30 tree species, though notably absent were Saal trees, replaced with teak trees by the forest department 30 years before this study. The village forest was also dominated by Simul trees and different types of medicinal plants. The village head oversaw the protection of these trees; the village committee, under the village head's facilitation, allowed villagers to cut down teak trees for repair and construction purposes.

In contrast, Asurdaha contained the most households belonging to Santhal communities. Encompassing a geographical area of 234 hectares, Asurdaha boasted a moderately dense and open forests forest cover of approximately 52%. The primary livelihood activities in Asurdaha revolved around agriculture, shifting cultivation in forestlands, and migration to nearby cities for work. Moreover, the village's forest harbors over 30 tree species, including Saal trees, mahua trees, other fruit trees, and several medicinal plants.

Additionally, two other villages were selected from a different block, namely Kathikund. These villages were Sahritola and Bara Chaparia. In Sahritola, 83.5% of households belonged to Santhal Communities, while 15% were classified as Other Backward Classes (OBC), and less than 2% were PVTG households, making it the wealthiest village studied. Covering a total geographical area of 184 hectares, Sahritola had a forest cover (moderately dense and open forests) of around 32%. The primary livelihood for households here was agriculture, particularly paddy cultivation and tasar silkworm (*Antheraea mylitta*) cultivation. Since 2000, PRADAN has been actively involved in the village, introduced scientific commercialized tasar cultivation, and organized funds for new plantations in private uplands. They also educated residents on scientific silviculture practices to care for newly planted trees, including existing Asan trees in forest land. In addition to Asan trees, Sahritola's forest also contained other major forest tree species, such as Mahua and Saal.

Similarly, in Bara Chaparia, 98% of households were Santhal, including non-displaced Pahariyas, and their primary livelihoods were agriculture and Tasar silkworm cultivation. The total geographical area was 244.24 hectares, with a forest cover (moderately dense and open forests) of 42%. Much like Sahritola, PRADAN has introduced commercialized tasar cultivation in Bara Chaparia. The village’s forest boasted approximately 15 different forest tree species.

Table 1.1. Characteristics of four study villages

	Bara Chaparia	Sahritola	Asurdaha	Dhawadangal
CD Block	Kathikund	Kathikund	Dumka Sadar	Dumka Sadar
Gram Panchayats	Bara chaparia	Bara chaparia	Darbarpur	Darbarpur
Total Population	400	303	260	236
Total households	91	63	54	51
Density (population per hectare)	2	2	1	3
Total schedule tribe population (%)	98	83.5	100	100
Male literacy Rate (%)	76	41	81	78
Female literacy rate (%)	59	18	74	55
Sex ratio	961	968	1114	1165
Total Area (hectare)	244.24	184	234.1	68
*Forestland (%)	42	34	52	33

Source: (Census, 2011)

*Forestland data collected from the local block office

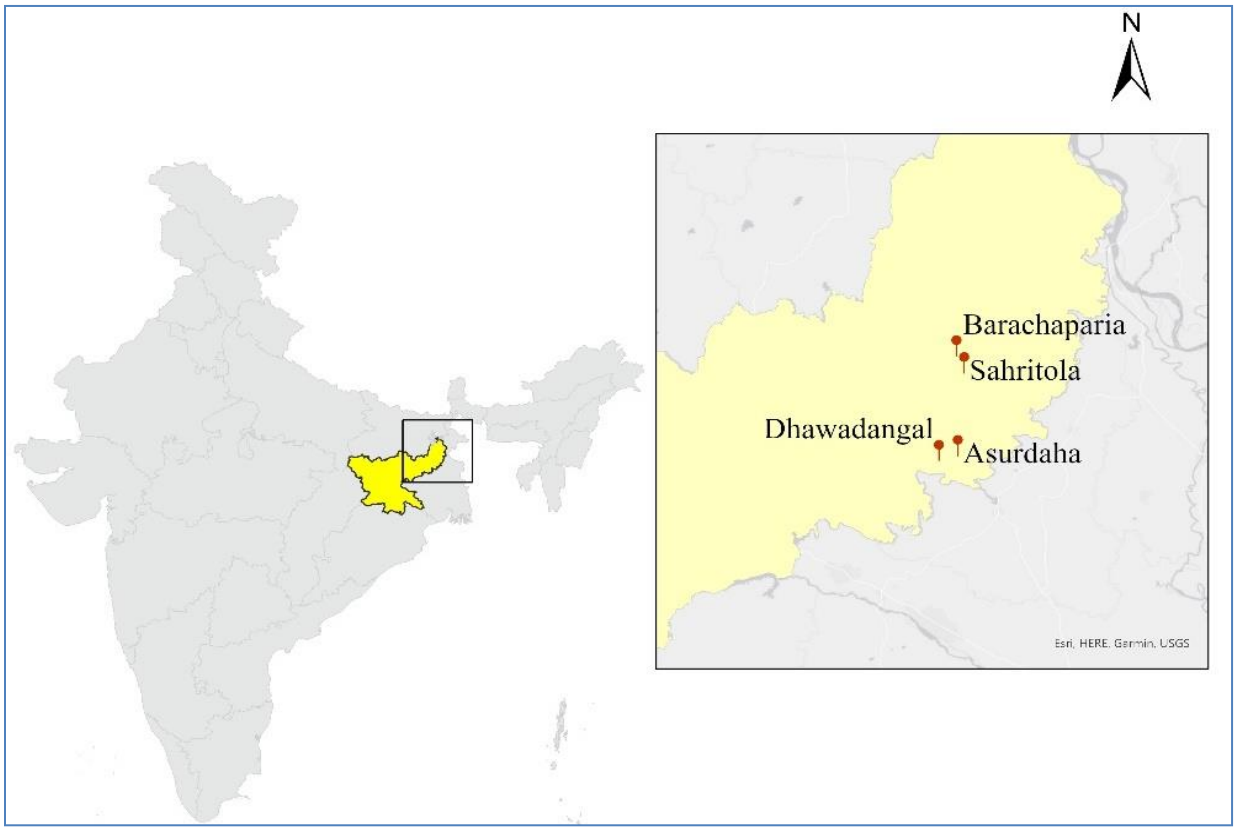

Figure 1.1: Study Areas, geographical locations of four project villages located in Dumka District of Jharkhand, India

CHAPTER 2

EXAMINING SPATIAL CONFIGURATION OF TREES WITH CUSTOMARY OWNERSHIP ON FORESTLAND AND RELATED SOCIO-CULTURAL NORMS IN JHARKHAND, INDIA

Introduction

Customary forest tree ownership has deep historical roots, leading to a stronger social and spiritual connection among forest dwellers (Howard & Nabanoga, 2007). Customary forest tree ownership involves a diverse set of entitlements over forest trees and their produce, which include the right to own or inherit trees, the right to plant trees, the right to use trees and tree products, the right to dispose of trees and the right to exclude others from the use of trees and tree products (Fortmann, 1985). Forest dwellers, such as tribal communities, have developed norms governing customary tree ownership (Sonowal, 2007). These customary norms are developed through an in-depth understanding of the forest, real-life experiences, and close interaction with nature over generations (Dattagupta & Gupta, 2014; Howard & Nabanoga, 2007). These customary forest rights are unwritten but govern forest conditions, are often passed down through generations, and are implemented repeatedly without any external influence, contributing significantly to sustainable forest management, environmental preservation, and the livelihood of communities (Mayastuti & Purwadi, 2023; Sahib et al., 2019).

It becomes complex and dynamic when customary tree ownership interacts with forest tenureship, as there is a range of factors, including land tenure, policy change, the presence of ethnic community, tree species availability, sustainable forest management, local rules, and gender dynamics that influence the relationship (Devi & Das, 2013; Kala, 2011; Mahalwal & Kabra, 2023; Miyakun, 1999; Rocheleau & Edmunds, 1997; Sather, 1990). Thus, the purpose of this chapter is to explore different aspects relating to forest ownership, including socio-cultural governance norms, the factors that influence those customary norms, and the spatial distribution of the forest trees owned customarily by the forest-dwelling communities in four tribal villages in Jharkhand, India.

Methods

Research sites

Data were collected from four villages: Dhawadangal, Asurdaha, Sahritola, and Bara Chaparia. Among these, Dhawadangal and Sahritola were identified as focal villages for intensive investigation due to reasons including displacement, presence of primitive tribe, land titling issues, and commercialization of forest trees-related livelihood activities. In these villages data collection included focus group discussions, household interviews, and recording GPS coordinates for houses and customarily owned forest trees to gain a comprehensive understanding of customary forest tree ownership.

Asurdaha and Bara Chaparia served as non-focal villages where focus group discussions were conducted to understand broader community contexts and community's perspectives of customary

forest tree ownership. Less extensive data collection was done in these villages due to time constraints. Household interviews and GPS data collection were not conducted in these villages.

Participants selected for focus group discussions and interviews represented diverse backgrounds such as age, gender, tribal groups, and occupation. This approach was aimed to capture different perspectives within the community. Additionally, GPS locations of forest trees were collected to investigate customarily owned forest trees, their location, and variations in customary forest tree ownership across different tree species.

Data collection

During June and July of 2023, spatial locations were recorded using a Global Positioning System (Brand: Garmin 64) unit for the houses of willing participants and their trees located on public forestlands.

Before data collection, four village meetings were held in each village to explain the study's objectives. Each meeting had 20-30 participants, including village residents, heads such as ward members, and the village head (Sarpanch). Detailed descriptions of the research objectives, the methodology employed, the expected time commitment for each household, and the voluntary nature of participation were provided in these meetings. It was explicitly emphasized that no compensation would be offered for participation, and informed consent would be sought before data collection. A list of participating households was finalized during these meetings, with the assistance of PRADAN, a non-profit working in these villages for over two decades. As a rural development organization, PRADAN primarily focuses on social mobilization, ensuring food

security, introducing suitable technologies, and bringing technologies. These efforts aim to improve natural resource management, livelihood promotion, market linkages, and strengthen grassroots governance.

Locations of Households and Trees with Customary Right: The house coordinates of all 144 participant households (Dhawadangal: 67, Sahritola: 77) were collected using GPS (Garmin 64). To collect GPS coordinates for trees under customary ownership, each forest patch associated with households that hold customary tree ownership was visited. Only one GPS coordinate was collected per species group at a given forest location. These coordinates were then associated with the corresponding household coordinates. For cases of shared ownership, the GPS location of each species group was mapped to all households with shared customary ownership of that group. This approach ensured that the spatial distribution of tree species for each household with customary ownership rights, considering instances of individual and shared ownership, was captured. Using this method, 113 tree coordinates were collected, covering 313 trees for Dhawadangal village, and over 300 tree coordinates were also collected, covering 18,143 trees for Sahritola village.

Focus Group Discussions (FGDs): For FGDs, male and female key informants with deep knowledge of the research topic were identified as participants. The purpose of the FGDs was to explore the norms around customary forest tree ownership and the factors shaping those norms. Four FGDs were conducted with male key informants in each village, three FGDs were conducted with female key informants in three of the villages (Dhawadangal, Sahritola, Bara Chaparia), and one FGD was conducted with the Particularly Vulnerable Tribal Group (PVTG) in Dhawadangal village. An FGD with female key informants could not be conducted in one village because the

women were not available due to engagement in agriculture operations for the sudden arrival of the monsoon season. Each FGD had approximately 8-10 participants. Topics such as reliance on forests for daily livelihood, current condition of forests, the factors impacting forest conditions, and the customary systems governing forest tree ownership. These discussions were audio-recorded with permission from the participants.

Household Interviews: The household survey questionnaire was prepared according to an existing FAO framework because this framework was designed to capture data for forest tree tenure systems (Bruce, 1989). The questionnaire was translated into Hindi, and all responses were collected in Hindi and translated into English for analysis purposes. Both structured and semi-structured household interviews were conducted by five interviewers recruited from neighboring villages. The interviewers were given specific training for the study, including instructions on obtaining informed consent, using the questionnaire, empathic interviewing, key principles of scientific studies, confidentiality, and the overall project. Household interviews were collected from 144 out of 156 total households in the two villages, Dhawadangal and Sahritola. Ten households were not included due to lack of availability, and two were unwilling to participate. The structured interviews were focused on the demographic information of the participants. In addition to the semi-structured interviews, 30% of the households (n = 47) were randomly selected, and eight specific qualitative questions were asked to delve into participants' experiences of living in the village, their relationship with the forest, and their perspectives on customary forest tree ownerships and various traditional and unwritten customary norms governing those customary forest tree ownerships.

Data Analysis

Spatial and Network Analyses: After obtaining GPS coordinates for houses and tree locations, the Euclidean distance between houses and tree locations was calculated using ArcGIS Pro software (Esri., 2022). Subsequently, Gephi software was used to visually represent the ownership distribution of the trees.

Qualitative Assessment and Analysis: For analyzing the data collected through FGDs, a multi-step process was undertaken (see Table 2.1). First, recordings of FGD were transcribed from the local Santhal language to Hindi, and then translated into English. After English translation, they were documented in an Excel file. Thematic analysis was employed, beginning with open coding to identify initial categories and labels, and categories led to the identification of more nuanced, complex, and inclusive categories (Creswell & Creswell, 2013; Saldaña, 2016). This method is used in research studies to analyze open-ended responses from surveys or interviews (Braun & Clarke, 2006). It allows researchers to explore the context at a deep level. It also provides flexibility in interpretation when analyzing the data and it can address a wide variety of research questions and topics. Therefore, thematic analysis aligns well with my research analysis, as it begins with the coding cycle that involves organizing and ordering data through multiple rounds of coding, memo writing, and code refining (John, 2000; Madden, 2022)(John, 2000; Madden, 2022; Saldaña, 2014). Memo writing was an integral and continuous activity of this qualitative research that helped in capturing thoughts, data exploration, making conceptual connections, and coding data (Birks et al., 2008; Rogers, 2018). Following Strauss (1987), an axial coding approach was used to compare and analyze the initial labels. The final step involved selective coding, which aimed at identifying the core category and establishing its connection with other categories. After

data saturation, meaning the analysis produced no new codes or categories and that all data were accounted for in the core categories, the final categories were coded into broader themes to document the traditional and customary norms governing forest tree ownership and the factors that influence those customary norms.

Results

This section presents the findings of this study in the following order: (a) sample characteristics, (b) spatial analysis, (c) norms around customary forest tree ownership, and (d) factors shaping those norms.

Sample characteristics

Most of the households in this sample depended on agriculture on designated (or titled) tribal land. These titled agricultural lands were a result of two major policies: (a) the Santhal Pargana Tenancy Act of 1949 and (b) the Land Ceiling Act, 1972, focused on safeguarding the tribal land and the distribution of surplus land. As evident in Table 2.1, 99% of households possess titled agricultural land in Saharitola. In contrast, only a third of the households in Dhawadangal had titled land. Additionally, the Pahariyas displaced by the Massanjore Dam construction had no titled agricultural land.

Table 2.1. Demographic details of Dhawadangal and Sahritola villages derived from household interviews.

Details	Dhawadangal	Sahritola
PVTG households with ownership over forest trees with customary rights	32	2
ST households with ownership over forest trees with customary rights	17	59
OBC households with ownership over forest trees with customary rights	NA	12
Households with less than one acre of agricultural land	57%	68%
Households with more than one acre of agricultural land	10%	31%
Households with agriculture as the primary source of income	41%	4%
Households with migration as the primary source of income	50%	43%
Households with forest products as the primary source of income	2%	53%
Households with no agricultural land	33%	1%

*Source: Household interviews

Spatial distribution

Figure 2.1 shows the spatial arrangement of households along with the customary ownership of forest trees by these households. Notable differences were observed in the number of forest trees owned by households between Dhawadangal and Sahritola villages. Specifically, Dhawadangal village accounted for 313 forest trees with customary ownership, whereas Sahritola village accounted for 18,143 forest trees with customary ownership.

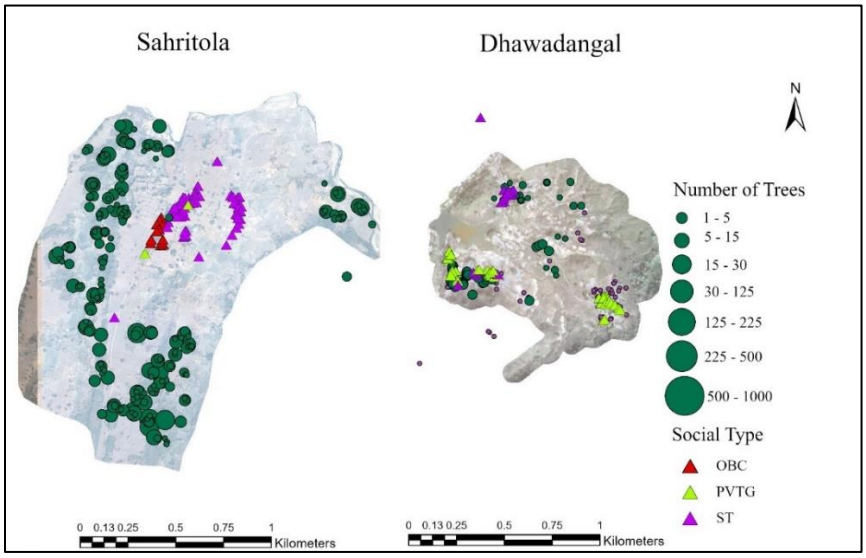

Figure 2.1. Spatial distribution of households and count of forest trees with customary ownership in Dhawadangal and Sahritola Villages.

Figure 2.2 highlights the spatial distribution of different tree species across two focal villages. Notably, in Dhawadangal, the number of trees under customary ownership was significantly lower compared to Sahritola. However, Dhawadangal's forest had over thirty tree species, while Sahritola's forest contained approximately fifteen. The diversity of tree species was deeply interconnected with the socio-economic status of the communities residing in those villages, shaping customary ownership patterns and resource management practices.

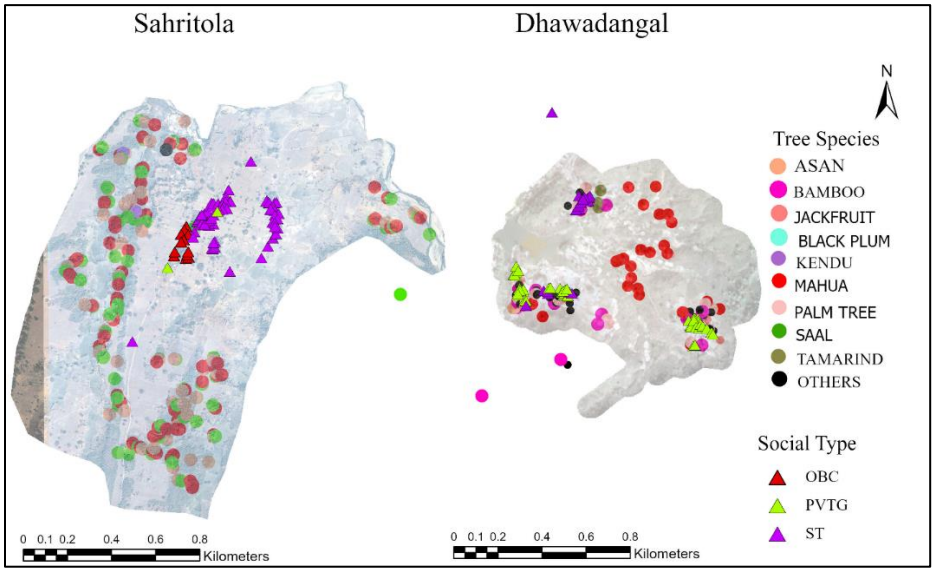

Figure 2.2. Spatial distribution of different forest tree species with customary individual and joint ownership in Sahritola and Dhawadangal villages.

Figure 2.3 shows the spatial distribution of the individual and joint ownership over tree species. In Sahritola, the ownership of forest trees was more complex than in Dhawadangal village. This was because 75% of Dhawadangal village's population were displaced communities. They lost customary tree ownership in their previous village, but their history at Dhawadangal village was very brief; therefore, the intergenerational transfer and distribution of customary tree rights had just been initiated.

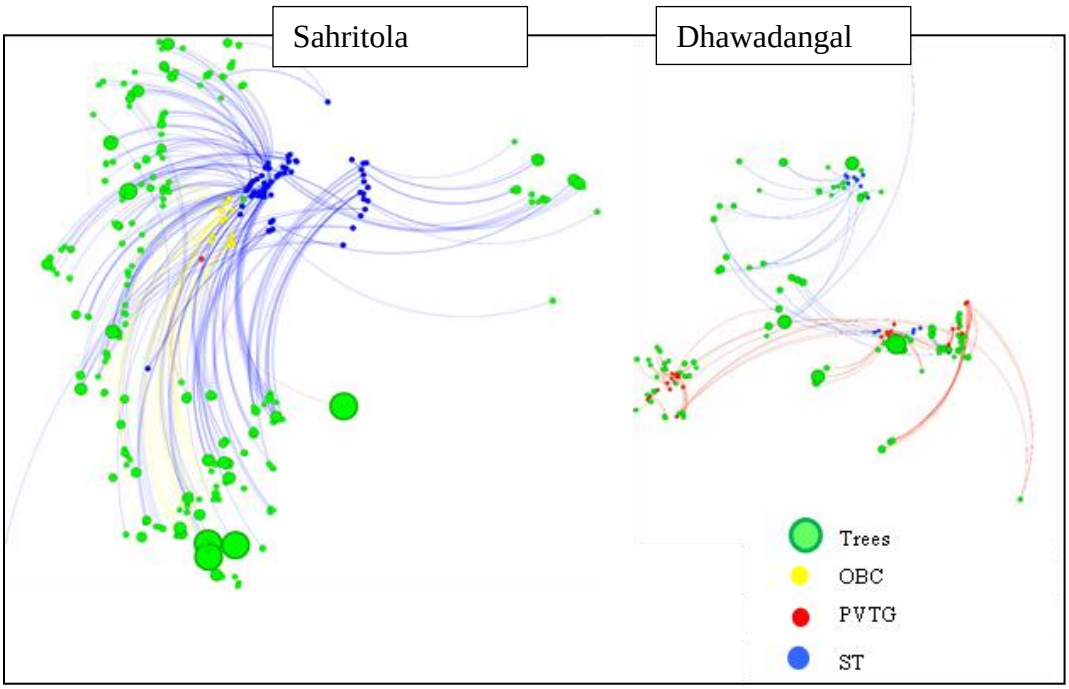

Figure 2.3. Geospatial Visualization of Individual and Joint Forest Tree Ownership under customary rights, depicting distances between households and their respective forest trees, implemented through Geo layout in Gephi Software. Blue edges indicate distances between ST households and their owned trees, yellow edges represent distances for OBC households, and red edges signify distances for PVTG households.

Customary Forest Tree Ownerships

This section delves into the customary forest tree ownership system in the studied villages. I shall begin by exploring the different types of customary forest tree ownership for various forest tree species. Following this, I shall examine the various norms that govern it, including those related to inheritance, distribution of ownership rights, adjudication mechanisms, and management practices. Finally, I shall examine the factors influencing these norms, such as displacement due to development projects (dam construction), land reform initiatives, changes within community institutions, and the growing commercialization of forest-based activities. The qualitative findings presented in Table 2.2 served as the code book for this study.

Table 2.2. Qualitative data analysis and coding

Elective Coding	Axial Coding	Open Coding
Tree Rights	Tree ownership and inheritance	Planting and protecting trees from danger create exclusive tree ownership Intergenerational transfer of tree rights to male Permission is required from other joint owners to cut trees for sale or for any other purposes that would benefit individuals. Male household head's decisions over forest tree rights are final
	Tree rights transfer and distribution	Equal distribution of tree rights and ownership among brothers Distribution of forest tree rights happens due to conflicts among siblings Distribution of forest tree rights happens only after the marriage of all the brothers in a family. Tree-based land distribution
	Gender in Tree Rights Inheritance	No tree rights to daughters or women Male members in the village participated tree rights distribution meeting Men head and women head discuss privately before making any final decision
Management Practices, Sustainability, and Livelihood	Management practices and sustainability	Forest committees protecting forests from illegal logging and corruption No fires allowed inside the forest Restriction on tree-cutting Tree ownership and collection norms by species Patrolling the forest to prevent illegal logging
	Norms Governing Forest Resource Use for Livelihoods	Consent is not required from other joint owners to cut trees for household purposes including the construction and repair of houses and making agricultural instruments. Households can mortgage Asan trees for Tasar Cultivation Households can sell trees to mitigate crisis
	Collective forest rights	Free forest product collection for Pahariya Community Shifting Cultivation Norms in Community Forests Forest product collection from trees under joint ownership based on species and livelihood significance Tree rights are distributed equally, irrespective of land ownership
Community Governance	Community institutions vis-à-vis tree rights	Community institutions protect villager's interests from exploitation Village committee can allow households to cut trees for house construction The village head in the village meeting allows families to cut forest trees during the crisis Village head permission is required for tree cutting for a specific reason Adjunction of tree rights by community head Forest Trees ownerships are identified by using local methods Traditional tribal institutions take care of intergenerational transfer, distribution of ownership, dispute resolution, traditional practices New-generation institutions take care of policy implementation
Factors shaping rights	Land reform	Policy changes, land grabbing due to mining, and dam construction make people protective of their land Ownership over Mahua trees lost due to land titling Displacement due to the construction of Massanjore Dam
	Commercialization	Tasar cultivation introduced by PRADAN Households clear other tree species nearer to host tree for commercial Tasar cultivation Households can mortgage trees, take loans in place of Asan, and Mahua
	Tree species prevalence and tribal group	Pahariya can collect Simul cotton, seasonal medicinal plants from their own and nearby village forest Paharaiyas practice indigenous method to manage collectively owned trees

Ownership types of different forest tree species

Three main types of customary ownership of forest trees exist in the villages: individual, joint, and collective. These ownership structures grant a bundle of rights to both individual households and a group of people. Table 2.3 identifies different ownership types and different forest tree species where they apply. Three types of customary ownership over forest trees were individual, joint, and collective ownership. These norms were different for different types of trees depending on their social, cultural, and economic significance. Individual customary ownership occurred when one house had exclusive rights to access trees and withdrawal of resources. In joint ownership, by comparison, two fraternally related households shared access and withdrawal rights between them. Collective ownership applied when all the villagers or a specific tribal group held access and withdrawal rights.

For example, Saal trees held immense cultural significance in tribal societies, and in Sahritola and Bara Chaparia, Saal trees were primarily owned by individual households or jointly by groups of households. The ownership patterns of Saal trees varied across villages and were influenced by historical practices and community movements. However, in Asurdaha, the villagers customarily owned the Saal trees, as the villagers collectively saved their Saal Forest, reflecting the community's resilience in protecting their natural heritage. Similarly, Asan and Mahua trees were predominantly owned individually or jointly by households within the community. This individual ownership highlights the historical evolution of property rights.

In Dhawadangal, Government-initiated teak plantations in forest lands were owned by the village as a collective entity, with decision-making authority vested with the village head. This communal

ownership reflected the broader socio-political dynamics and governance structures within the village. Similarly, Simul trees (*Bombax ceiba*) were utilized by the Pahariya community to collect Simul cotton to earn income, and the Simul trees were owned collectively. These communal ownerships not only reflected the ecological significance of Simul trees but also the cultural practices and livelihood strategies that were developed over generations by the Pahariya people. Bamboo trees, a vital resource for constructing and repairing houses in both Santhals and Pahariya households, were collectively held by the community, with some instances of individual or joint ownership, particularly when the Bamboo trees (*Bambusa vulgaris*) are located close to houses.

Furthermore, the ownership and utilization of fruit trees and medicinal plants also vary within the community. Fruit trees were predominantly owned by individual households, while traditional knowledge and practices regarding the extraction of medicinal plants were held by Pahariya households. Pahariya households are allowed to harvest these plants in neighboring villages as well as their own, reflecting their unique traditional indigenous knowledge and ecological expertise. Additionally, seasonal forest trees used as food are accessible to all households in the villages without any restrictions on collection. This egalitarian approach to resource utilization underscores the communal ethos and shared stewardship of natural resources within the community. However, the other rights, such as management, exclusion, and alienation, vest with the village institutions.

Table 2.3: Tree Species Ownership and Uses in Sahritola and Dhawadangal Villages

Local name of tree species	Scientific Name	Use	Ownership types	Village
Asan	*Terminalia tomentosa*	Tasar Cultivation	Individual or Joint	Sahritola
Bamboo	*Bambusa vulgaris*	House repairing	Individual/Joint/Collective	Sahritola, Dhawadangal
Mahua	*Madhuca longifolia*	Fruit and Flower selling	Individual or Joint	Sahritola, Dhawadangal
Mango	*Mangifera indica*	Fruit household consumption	Individual or Joint	Sahritola, Dhawadangal
Palm Tree	*Borassus flabellifer*	House repairing	Individual or Joint	Sahritola, Dhawadangal
Saal	*Shorea robusta*	Logging and house repairing	Individual/Joint/Collective	Sahritola
Teak	*Tectona grandis*	Logging and house repairing	Collective	Dhawadangal
Other Fruit trees – over 7 different types		Seasonal consumption	Collective	Sahritola, Dhawadangal
Edible plants – Over 10 different tree species		Seasonal consumption	Collective	Dhawadangal
Medicinal Plants - Over 10 different tree species		Seasonal selling	Collective	Dhawadangal

Norms around customary forest tree ownership

Inheritance norms

Ownership of forest trees belongs to a man; future ownership over customary forest tree rights was determined by the head of the family. Eventually, the rights were transferred to the male members of the family. In the case of two or more sons, the ownership was divided equally, but the youngest son was entrusted with the responsibility of caring for the parents.

In the absence of a male member in the family, the rights were transferred to a son-in-law, who must stay with the family. While interviewing, one of the male respondents said, "*This isn't my village. I came here to my in-laws' family ten years ago, after my father-in-law passed away. My mother-in-law was alone and invited me, along with her daughter, to stay with her, and take care of her assets, as she doesn't have any sons. Now, I am overseeing agriculture and tasar cultivation as the owner.*"

If a family did not have children, an adopted son became the owner of the family in exchange for his agreement to take care of the parents in their old age. For example, one of the families shared how they adopted their brother's son as they did not have children. However, as they mentioned, "*our adopted son has to leave their ownership rights over their parental trees*."

Although trees were generationally transferred to male members of the family, the acquisition of trees sometimes depends on ancestral actions to save trees. For instance, one respondent stated "*The ownership is complex as my father who saved a tree from fire or illegal logging was assigned customary rights over trees. And now as his son, I am the owner of those trees*."

In this tribal society, customary ownership of forest trees predominantly follows a patrilineal transfer, where women were typically excluded from this ownership structure. This was further highlighted during a FGD with women, where one participant shared her experience: "*After my husband passed away and with no children of my own, I am currently living with my father. He has provided me with a house to live in, some land for cultivation, and two Mahua trees for collecting and selling flowers to sustain myself.*" Upon probing further into the matter, I inquired about the ownership structure of these trees, then she responded, "*My brother holds ownership rights; I am only allowed to use them. Upon my death, ownership will either revert to my brother or be transferred to my brother's son.*"

Distribution norms

When the patriarch passes rights on to the male heirs, the distribution of tree rights happens at the time same time as the distribution of land rights. Most communities distribute customary tree rights in two ways: individual ownership and joint ownership. Customary tree rights are distributed based on the number of trees, but also consider the age, health conditions, and fruit and flower-bearing capacities.

If the number of trees could be evenly divided, individual ownership was distributed equally among brothers. However, if the number of trees with customary rights could not be divided evenly, or if the trees were spread across different forest patches, the brothers might opt to transfer the rights of certain trees situated on the land owned by one brother to another to achieve a more equitable distribution. In such instances, the brother holding the land rights retained the right to use the land for agricultural purposes, while the brother with individual customary tree rights got the right to collect flowers or other forest products from the trees on that land. One of the participants explained *"I have three sons and my land was scattered in four different patches. During distribution, my eldest son got the titled land with the Arjun trees. I knew he could make good use of them for tasar silkworm stuff. Then, for my other two sons, I divided things up a bit differently. One got a piece of land with older Asan trees, and the other got two patches with more trees but they are newer trees. Now, when it comes to the distribution of Mahua trees, Saal trees, bamboo, and other fruit trees, we decided to keep them under joint ownership. That means everyone in the family can go and collect fruits, and flowers, or use the wood to repair homes. Me? Well, I don't have much else to do. Currently, I stay with my younger son, and I spend my*

time looking after our trees in the forest and managed to save more than 25 Saal trees and Mahua trees. Just doing my bit to keep things protected."

In Asurdaha village, the distribution of Mahua trees deviated from that of other villages due to unique natural and social factors. First, the villagers assigned two hill ranges to two different hamlets, a deliberate effort to organize resource management. Second, the villagers of each hamlet counted the number of mahua trees on their respective hills and distributed them equally among the households in that hamlet. However, disparities arise in tree distribution, with one hamlet enjoying significantly more trees per household due to enhanced capabilities in tree care and protection. Interestingly, households from the different hamlets with fewer trees may collect Mahua from the opposite hills, showcasing a form of reciprocal resource sharing. This kind of distribution was facilitated by the village committee.

The committee headed by the village head protected forest trees, specifically the Saal and Mahua trees, by strengthening their customary norms against illegal logging. This initiative exemplifies a collective effort to protect Saal trees, demonstrating the community's resilience in safeguarding valuable resources. Moreover, this village not only rejuvenates a large portion of forest trees but also extends support to families in distress. One participant explained, *"A few years ago, three villagers were suffering from tuberculosis and cancer. They could not afford treatment due to their very poor financial situation. At that time, we, the villagers, met and decided to support these families by allowing them to cut down 20-25 Saal and Simul trees and sell them at the market to get money for treatment. This kind of situation has not occurred since, we may make a similar decision if a similar situation arises with very poor families in the future."* This incident highlights

the efficacy of villagers' customary distribution systems developed through close interaction with forests and real-life issues. It not only ensures sustainable forest but also ensures equitable distribution of forest trees.

The distribution norms of customary tree rights were deep-rooted within indigenous social practices within the traditional village communities. In these societies, customary tree ownership was not only a matter of economic significance but also a reflection of familial ties and community cohesion. This customary tree right distribution was facilitated by the village head in front of the other villagers for social approval.

Adjudication norms

In the traditional process of patrilineal transfer of customary ownership over forest trees within the village, the authority was vested with the village head, who facilitated the process. A household head expressed the need for redistribution among his sons. A household head expressed, "*All my sons are now married, and with the increased number of individuals in my family, it's time to distribute ownership among my sons. Therefore, I have invited the village head for the distribution.*" The adjudication process underscores its informal nature, emphasizing the reliance on verbal communication and community consensus. This insight deepens the understanding of indigenous traditional knowledge, which was based on an in-depth understanding of power structures and real-life experiences. These unwritten practices, transferred from generation to generation, repeat without the intervention of any external legal formalization process, illustrating a de facto decision-making process rooted in cultural norms and social dynamics.

One of the village heads, in describing the adjudication process, "*Upon receiving a request from a household head, I issue a verbal notice to all villagers and schedule a date for the distribution. On the appointed day, typically one representative from each household gathers. Leveraging my local experience and with assistance from the household head, and some other senior villagers, I oversee the distribution of tree ownership among the brothers.*" Notably, the involvement of other villagers served both practical and symbolic purposes, facilitating demarcation to prevent future disputes while affirming the legitimacy of the transfer. The village head further explained, "*The presence of other villagers serves to validate the process, and they provide social approval. Given the proximity of forest trees to one another, the presence of other villagers facilitates the demarcation of tree ownership, thereby mitigating potential conflicts in the future*. *Following the distribution, the household head arranges food for all households attending the meeting*". Additionally, while men predominantly participated in the formal adjudication proceedings, insights from FGDs unveil the nuanced role of women. Despite their limited involvement in public meetings, women were influenced through private meetings with household heads, underscoring their subtle yet significant contributions to decision-making within the familial domain. One of the women participants stated, "*We discuss in advance and decide which son will receive which tree and which land.*"

Norms around management practices and livelihood

After the distribution of ownership among the household members, the household jointly determined management practices for the forest trees with joint ownership. The management rules for jointly owned trees were very dynamic, and they ensured the equitable distribution of forest products among the household members. Rights such as access and withdrawal, granted with the

bundle of rights, are negotiated between households. These rights were applied differently for different tree species, depending on their economic and social values. For example, in the case of flower collection, the rules for the Mahua tree were as follows. For each rule, relevant rights are listed in parentheses.

Rule 1: *If the trees are old and bear a lot of flowers, all the families who jointly own the trees (flowers, fruits, and the whole tree) come together to collect the flowers and then distribute them equally*. (Access/Withdrawal)

Rule 2: *If the trees are young and do not bear many flowers, the families who jointly own the tree collect the flowers on alternate days or even in alternate years. Similarly, for Tasar cultivation on Asan trees, they will cultivate Tasar in alternate years.* (Access/Withdrawal)

Rule 3: *If one of the families migrates to another city for work, they either share the selling amount of the flowers with the other families or alternate collection and migration years with other families.* (Access/Withdrawal)

Rules for bamboo trees (*Bambusa bambos*): *Everyone is allowed to cut bamboo for construction or repair work on their houses without restrictions. However, for selling purposes, one must get permission from other household members. Sometimes, after selling bamboo, they divide the amount equally among themselves.* (Alienation)

Factors Shaping Customary Forest Tree Ownership

Displacement

Customary ownership over forest trees of the Pahariya became more problematic due to the construction of the Massanjore Dam. There were two kinds of displacement. Firstly, in the initial

years when the dam was constructed, over 5000 households from 144 villages were displaced (Rao, 2003). Secondly, the rising riverbed due to siltation has exacerbated challenges, with cultivable lands facing submergence during the monsoon, converting them unsuitable for cultivation due to deposited sand layers. This displaced many tribal households, including both Santhal and Pahariyas. In that case, the households didn't receive monetary compensation but rather received land in exchange for their submerged land. The new agricultural land was situated far away from their existing village. Therefore, a few Pahariyas approached the village head of Dhawadangal who allowed them to stay in the forest areas of Dhawadangal. One of the participants explained, "*Originally, we were residing in X village, but due to the submergence of our agricultural land, we do not have any other option to migrate. My grandfather received agricultural land 22kms away from our original village, therefore he didn't move there. Rather he approached the nearby village head of Dhawadangal, the Dhawadangal's village head allowed us to stay in their forest areas. We did not receive any monetary compensation. After a few years, when we enquired about the new agricultural land we received in exchange for submergence, the land settlement officer did not find them because my grandfather's name did not match with the name mentioned in the record. Recently, we applied for agricultural land under FRA 2006 with the help of PRADAN*".

As a result of these challenges, many villagers were forced to migrate, seeking employment in agricultural labor or stone-crushing factories. Struggling for sufficient income, households become vulnerable to exploitation by a corrupt network involving the forest department, local administration, politicians, and local middlemen (M. Kumar, 2016). This critical situation enhanced large-scale deforestation through illegal logging and trade, exacerbating the environmental and

socio-economic challenges and loss of customary tree ownership. The connection between displacement, customary forest tree ownership system, and exacerbated deforestation becomes evident when comparing Dhawadangal, Sahritola, and Bara Chaparia. In Dhawadangal, where displaced Pahariya households lack customary forest tree ownership, face economic hardship and exploitation, and pressure for illegal logging and unregulated resource extraction leading to forest degradation. One Pahariya participant explained, "*I don't have land for agriculture, and we struggle to find work from March to May. So, to feed my kids, I engaged in illegal logging for daily wages.*" Another participant described, "*If we try to stop them, they threaten, abuse, and sometimes even hit us in front of officials, so we stay quiet.*" Moreover, in the FGDs with women, one participant explained, "*There were more than 14 illegal wood-cutting mills in the nearby villages, and more than 20 wood-loaded carts passed through every day. Such huge wood carts open transport is impossible without the forest department's knowledge and involvement. Everyone was involved in this illegal logging business.*"

Conversely, the non-displaced households of the Sahritola and Barachaparia, which heavily relied on forest trees for Tasar cultivation, had been actively guarding their forest trees through a strong customary tree ownership system from illegal logging forest fires to maintain their livelihood. One of the aged participants explained, "*As we have been engaging in Tasar cultivation for generations, we used to organize rallies in nearby villages with drums and announce that tree felling, and forest fires are prohibited in our village forest. If we found anybody is cutting trees or setting fire in the forest, we would take away their cutting tools and impose monetary fines.*" Another person explained, "*Whenever we hear a tree felling or spot a forest fire, we gather and rush to the location to stop the activity. Through repeated efforts in the past, we successfully put an end to illegal*

logging and forest fires. Consequently, neighboring villagers have also begun engaging in Tasar cultivation and started protecting their forest trees, leading to a significant reduction in illegal logging and forest fires."

Therefore, displacement emerged as a significant factor influencing customary tree ownership, with its impacts being extended to exacerbating deforestation and the socio-economic vulnerability of forest-dependent communities.

Changes in village institutions

Rules relating to rights such as Management, Exclusion, and Alienation have been self-governed by customary tribal institutions headed by the village head (*Manjhi*), throughout history. The village head (Manjhi) looked after matters such as community affairs, dispute resolutions, governing and managing forest areas, and maintaining village customs and identity. These matters included overseeing patrilineal inheritance of customary tree rights, excluding neighboring villages from village forest areas, and shifting cultivation.

However, these rules were very dynamic and differed across villages with the influence of internal factors such as tree species and their prevalence, commercialization of activities, land titling, and ethnicity, and external factors like changing policies such as PESA and FRA. For example, since the formation of the forest committee, Gram Sabha, in the villages, with the support of the forest department and non-profits like PRADAN, which supported FRA implementation, they established and implemented various norms to protect their forest. The norms included banning fires inside the forest areas, patrolling the forest to prevent illegal logging, collecting of fines from

persons who did not participate in forest protection, and prohibiting villagers from other villages from entering their forest territories and cutting trees. If anyone was found cutting forest trees within their village boundaries, they were apprehended, their cutting tools seized (such as axes), and sometimes monetary fines were imposed by the village forest committee.

Commercialization of forest products

Another way in which village norms shifted in recent times is because of the cultivation of Tasar silkworm. Villagers previously cultivated Tasar silkworms for more than 50 years. Commercial Tasar silkworm cultivation, bringing modern practices, was introduced by PRADAN at Sahritola and other nearby villages in the 2000s. In Sahritola, Tasar silkworm cultivation was the primary source of income for over 90% of households, out of which 53% of households cultivated Tasar silkworm using forest trees like Asan tree, and the rest of the households did it in the newly planted Arjuna trees (*Terminalia Arjuna*) in the titled upland. The commercialization of forest products introduced notable changes to customary tree rights. When households faced hardship, particularly arising from critical health issues or other vulnerabilities, a practice known as "tree loan" emerged. In this arrangement, households facing difficulties approached another household to purchase one or more trees with customary ownership. Simultaneously, they lent a specified amount of money for a predetermined period. Mahua and Saal trees were commonly involved in such transactions due to their economic value. Upon timely loan repayment, ownership of the tree(s) reverted to the borrower. Until repayment, the lender retained the right to harvest flowers and fruits from the tree(s). Failure to repay within the specified period granted the lender the authority to cut down and sell the tree(s). The commercialization of forest tree-related livelihood activities also significantly influenced established norms regarding customary rights, encompassing access,

withdrawal, and exclusion. In instances where households held limited land and few trees, there was a practice of acquiring additional trees through mortgages with other villagers, particularly for Tasar cultivation. As one-woman participant explained "*We have 35 Asan trees which are situated away from my main cultivation area. Therefore, I frequently mortgage these trees to individuals who lack trees for Tasar cultivation. In such scenarios, I charge a mortgage fee of Rs. 150-200 ($2 to $3) per tree per season. The price per tree is negotiable and depends on the health conditions of those trees.*"

Observations indicate that in villages where the commercialization of forest tree-related livelihood activities was prevalent, such as Sahritola and Bara Chaparia, the availability of tree species in forest areas was comparatively lower than in villages where commercialization had not taken root, such as Dhawadangal and Asurdaha. This was because, as a practice to protect the silkworm, the villagers cleared the surroundings of the Tasar Host Tree.

Land titling

Land titling has historically been a controversial issue in Santhal Parganas, due to land-grabbing by moneylenders and forcible dispossession by local officials. This has created a protectiveness over land, as well as confusion over land ownership due to many policy changes and systems governing ownership. Stemming from this, there were incidents like households protecting 15 mahua trees on a patch of land they believed to be forest land. They had been collecting Mahua flowers from the trees for a long time. However, a nearby landowner claimed that the land where the 15 mahua trees were located belonged to him. He called the village head and the land settlement officer, who measured the land and confirmed that it was indeed on the landowner's titled land. As

a result, the household that protected the 15 Mahua trees had to give up ownership of those trees and could no longer collect Mahua flowers. Instead, the landowner collected and sold the flowers protected by the earlier households.

To avoid future conflicts, when distributing land property among brothers, such as upland or unfertile land for agriculture, where cultivation of paddy or vegetables was not very profitable, the land was often distributed based on the availability of trees rather than land title. The distribution of customary forest tree rights and land title rights occurred simultaneously among the brothers. Generally, the land was distributed equally, but the customary rights of trees were distributed irrespective of land ownership. For example, a participant explained, "*I have two types of land: forest land with Asan trees and titled upland with Arjun trees (Terminalia arjuna). During distribution, I gave titled land with Arjun trees to my elder son, while my younger son got the forest land without a land title. The land title did not matter as much as the trees and the associated livelihood.*" Sometimes, land titling altered the land and tree ownership. A participant explained, "*In our situation, the number of Mahua trees with customary rights couldn't be divided evenly. I decided to transfer the ownership of the Mahua trees located on my land to my brother for equitable distribution. As a result, I retained the land rights for agricultural purposes, while my brother, now possessing customary ownership of Mahua trees, also got the rights to collect flowers and fruits from the Mahua trees located on my land.*"

Overall, customary tree ownership was shaped by a complex interplay of social, cultural, and ecological factors, reflecting the rich story of the community's social and natural history. The customary norms surrounding forest tree ownership rapidly adjusted to factors such as policy

changes, land ownership reform, community displacement due to dam construction, and commercialization of forest-based activities. These changes were reflected in the lyrics of a local tribal song, which affirms the commitment to regrowing and protecting the forest:

In the heart of a forest, where the trees stand tall,

Our simple home, within nature's lap.

The birds sing beautifully, their melodies so sweet,

Echoing through villages what a pleasant feeling.

Wild animals roam, in the depths of the woods,

Their cries and calls echo in the villages.

But amidst this beauty human growth in nestled huts

Where no food no work and hunger concerned deep,

The forest, a mother, her bounty to keep.

Free desires grew, wild and limitless,

No law to restrain, all wisdom is helpless.

The fire raged violently, destroying all in its path,

Leaving behind devastation, in its aftermath.

Fruits and flowers dwindled, in the forest's despair,

As the land sorrowed, in silent prayer.

But hope still blinks, like a flame in the night,

For those who fight, to set things right.

No more axes, no more wooden carts,

Only preservation, in our hearts.

Rain will come, to quench the earth's thirst,

And new life will bloom, from the ashes dispersed.

The birds will sing, their joyful chorus,

As the forest rises, from sorrow and pain.

So don't cry, dear bird, nor cry your plight,

For the forest will heal, in the morning light.

Together we'll stand, hand in hand,

Protecting our home, this magical land.

Discussion

The study sought to examine the spatial configuration of trees with customary rights on forestland and related socio-cultural norms. My study has three major findings. First is how patrilineal inheritance is embedded in the tribal societies that influence the transfer of customary forest tree ownership, resulting in unequal distribution between men and women. The second finding is that displacement not only dismantles the traditional social structure and increases vulnerability to exploitation but also weakens forest tree ownership systems, exacerbating inequalities and contributing to further forest degradation. Finally, the third finding shows that the traditional community institutions, with their deep-rooted systems and practices, can protect their forest rights

from exploitation by privileged groups and can rejuvenate the forest by maintaining a symbiotic relationship through systems like forest tree ownership. These findings have implications for local people, as well as policymakers. These implications are discussed below.

My study delved into women's ability to access and use forest trees. The findings highlight that customary norms give men more control over forest trees than women. The study finding is consistent with other studies that show traditional institutions practice patrilineal inheritance (Bara, 2022; Bonye, 2012; Ekkā, 2011). However, in the Garo and Khasi hills of Meghalaya state of India, the tribal communities practice matrilineal inheritance, but the society is dominated by rules that favor men's decisions (Krishna, 2012). As Krishna (2012) explained, "*in matrilineal tribes both descent and inheritance are through the woman, but their tribe too is patriarchal and man control society*". These practices are in contrast with India's constitutional right to property, which provides equal rights to men and women. It would be interesting to examine women's perception of traditional ownership of trees as a property right in tribal communities in future studies.

The study findings align with other study findings conducted specifically on the displacement issues of Santhal Pargana (Rao, 2003; Venkteshwar, 2023). Rao (2003) highlights that the Pahariya communities of Dhawadangal were displaced from nearby villages due to the riverbed rise of the Massanjore Dam and the submergence of previously unaffected agricultural lands during monsoons, rendering them unsuitable for cultivation and lost their customary tree rights and land rights. Similarly, in this study, we found that displacement due to the riverbed and submergence of the agricultural land, the Pahariya communities resettled at Dhawadangal village and lost their customary forest tree ownership at their native village. I also found that the displaced Pahariya

communities of Dhawadangal village have very limited customary forest tree ownership compared to the Pahariyas residing at Bara Chaparia village, who are not displaced.

The study findings also echo with the consequences of displacement extend far beyond the immediate loss of land and tree ownership (Rao, 2003; Venkteshwar, 2023). Displaced households, in this case, received no financial compensation, pushing them into severe economic hardship and making it difficult to meet their basic needs. This vulnerable situation left them susceptible to exploitation by local businessmen and corrupt officials who pressured them into illegally logging Saal trees as daily wage labor. The study indicates high levels of socio-economic pressures faced by the displaced, economically vulnerable Pahariya households. This resulted in the large-scale deforestation of the Saal forest at Dhawadangal. These findings are consistent with a study in Indonesia (Hiller et al., 2008) and Bangladesh (Islam & Sato, 2012). Hiller's study highlights how extreme economic hardship with limited economic alternatives drives poor households residing in and around forest fringe villages towards unsustainable practices like illegal logging to meet basic needs (Hiller et al., 2008). Similarly, Islam & Sato's study (2012) illustrates how forest-dwelling communities with limited economic options were pressured into illegal logging by powerful individuals connected to the police and forest department, which has resulted in large-scale deforestation of the culturally significant Saal forest. Understanding the long-term social and economic impacts of such displacement on tribal communities is crucial. Future research could explore how displaced communities rebuild their livelihoods, tree tenure, and land tenure in their newly settled villages. This knowledge can inform policy changes that better balance economic development with the protection of tribal land and forest rights.

This study further supports the idea that traditional institutions play a significant role in governing customary forest tree ownership. Traditional institutions ensure intergenerational transfer of tree ownership, adjudicate the distribution of tree rights, resolve disputes related to tree and land tenure, and oversee forest management practices. This study also identifies a local commitment to the protection of the Saal forest, where Sahritola, Bara Chaparia, and Asurdaha's traditional community institution protect their Saal trees from illegal logging and forest fires, rejuvenating their village Saal forest. Additionally, the study found that the village head actively participates in customary stewardship; however, modern institutions are more active in implementing policies such as FRA and managing commercial forest-based activities. These findings align with the previous studies that show informal institutions act as custodians of natural resources, including forests, throughout their designated areas (Tiwari et al., 2013). Similarly, Sather (1990) highlights the central role of community institutions in the governance of tree tenure and land tenure through designated longhouse territories of Iban Paku societies of Malaysia. Furthermore, previous studies from India show that tribal traditional institutions initiated a community movement when the state instituted the promotion of Teak plantations in the 1980s by replacing the Saal trees. To save Saal trees, which hold immense cultural significance in tribal societies, the movement "Jungle Bachao Andolan" was initiated in 1980 (Jena & Pattanaik, 2019; M. Kumar, 2016). The initiation of the Jungle Bachao Andolan underscores the community's collective efforts to protect native Saal trees in the village forest from the government's efforts to replace them with commercial Teak plantations. On the other hand, Sharma et al. (2024) highlight the weakening influence of traditional institutions with the introduction of modern institutions by PRADAN, affecting the socio-economic structures of the tribal villages of Jharkhand. Therefore, future research could investigate the factors that ignite and empower community institutions, like those observed in the

study villages, to rejuvenate village forests, which in turn strengthen their ability to stand up against exploitation and infringements of their forest rights by privileged groups. Building upon this understanding, further research could explore how to strengthen the collaboration between these traditional institutions and modern institutions. Such collaboration is crucial to ensure the continued effectiveness of customary stewardship in the face of contemporary changes. By fostering stronger integration, valuable insights and knowledge can be gained to inform policy development. These policies could aim at strengthening community-based forest management and fostering more equitable forest governance, ultimately leading to better forest conditions.

This study is one of the few to comprehensively examine the entire process of creation, intergenerational transfer, and distribution of forest tree ownership rights in India. These customary norms are a valuable resource for sustainable forest management. The study also introduces novelty by mapping the spatial distribution of tree numbers and the specific locations of forest trees under customary rights. This aspect is significant because it provides valuable insights into how these distribution patterns influence resource access, livelihood, and conservation within different social groups, particularly the displaced communities. By understanding the complex interplay between customary norms, the spatial distribution of forest trees, and customary forest management practices, more effective forest policies can be developed, acknowledging traditional indigenous wisdom and expertise that reconcile the needs of indigenous communities with the economic growth of the country and promote better forest conditions.

CHAPTER 3

EXAMINING THE INFLUENCE OF CUSTOMARY FOREST TREE OWNERSHIP ON HOUSEHOLD PARTICIPATION IN FOREST MANAGEMENT ACTIVITIES IN THE DUMKA DISTRICT OF JHARKHAND INDIA

Introduction

Participatory Forest Management (PFM) in India has a long and complex history (Blaikie & Springate-Baginski, 2006). In the late 1970s and 1980s, there was growing unrest and protests that compelled the Government of India to make more pro-indigenous community policy decisions. At the same time, the Government of India conducted a few experiments related to PFM in West Bengal, Madhya Pradesh, and Haryana that led to the emergence of PFM programs and policies to revert care and management of the forests to tribals living in the land (Bhattacharya et al., 2010).

There are many studies in India (Table 3.1) and in other developing countries (Table S3.1) that show PFM practices improve forest conditions. By empowering communities to manage their forests sustainably, PFM tackles the challenges of open access, promotes conservation, unlocks the potential of forests to drive rural development and alleviate poverty, and ensures gender equity and social and environmental justice (Blaikie & Springate-Baginski, 2006; Winberg, 2010). Factors such as household socioeconomic status and demographics influence participation in forest management. Other crucial factors related to the success of PFM are favorable policy regimes,

conducive property rights, and the intricate system of land tenure arrangements (Bandyopadhyay & Shyamsundar, 2004; Basu, 2021; Baynes et al., 2015; Berkes et al., 1989; Ghosh & Basu, 2021).

At present, literature that analyzes the relationship between the number of forest trees with customary ownership and households' participation in PFM activities is limited. Therefore, the study's objective is to investigate the intricate relationship between households' customary ownership of forest trees, including their sociodemographic characteristics, and their participation in participatory forest management (PFM) activities in two tribal villages in Jharkhand, India.

This chapter presents the quantitative findings of this study. I first present a detailed description of the methods, followed by the statistical results and a discussion of this study.

Table 3.1. Analysis of determinants of participation in forest management activities in India using various independent variables and methodologies.

Study Area	Participation in forestry institutions	Independent variables found significant	Method used	Source
Bankura, West Bengal, India	Yes	Caste and sex of the respondent, Age of the head of households, Occupation of the head of households, Landholdings of the households, Monitoring Index	MLR	Ghosh & Basu (2021)
Purulia Forest Division in the district of Purulia of West Bengal, India	Yes	Caste of the household, Family size, Gender of household head, and Educational Index are measured based on UNDP methodology, Number of occupations, land holdings, % of forest income to total income (monthly), Distance between residence and forest, Distance between residence and market, Cooperation from forest authority.	MLR	Basu (2021)
Haryana, Uttar Pradesh and Bihar, India	No	Caste and religion of the respondent, Forest dependence, Years of schooling of the respondent, Consumption per capita (rupees/year), Income per capita (rupees/year), and Capital per capita (rupees).	MLR	Lise (2000)
Visakhapatnam, Adilabad, and Kadapa Districts of Andhra Pradesh, India	Yes	The total population in the community forest has valuable tree species, Number of active community-based organizations in the village, Population per hectare of JFM forest areas, and Access rights over JFM forest resources.	OLR	Behera (2009)
Sariska Tiger Reserve, Rajasthan in the semi-arid northwest of India	Yes	The size of the user group is measured as the log of the village population, Resource scarcity is measured as the log of the village population relative to the area of forest and commons, and Infrastructure development is measured with the Development Index and the existence of a Temple Land.	LR	Heltberg (2001)
Jharkhand, Orissa and West Bengal, India	Yes	Leadership styles and attributes of leaders (Manipulative, Authoritarian, Participative, Charismatic, Members' closeness to the leader, Leader's virtues, Relationship maintenance, Idealized behaviour, Direct participation, Indirect participation).	MLR	Sinha & Suar (2005)
Paschim Medinipur, West Bengal, India	Yes	Respondent's Years of education and Gender; Household size, Religion, Number of meetings, Willingness to pay for the forest, Land ownership, Forest dependence, Consumption per capita (household consumption divided by household size), Capital per capita (household capital divided by household size).	OLS	Jana et al. (2014)
Andhra Pradesh, Madhya Pradesh, Orissa, Uttar Pradesh, and West Bengal, India	Yes	Fuelwood used for consumption & enterprise, Caste, Reading newspaper by the respondents, Total Village Common Land ('000 ha), Proportion of CF households in Village, Fuelwood Price (Rs/Kg), Non-Agricultural Labor.	PR and MLR	Bandyopadhyay & Shyamsundar (2004)

*MLR – Multiple linear regression, OLR – Ordered logit regression, LR – Logit regression, OLS – Ordinary least squares, PM – Probit Model

Methods

Data Collection

Village-level Meetings: To ensure the participation of villagers, local meetings were conducted in each selected village. Approximately 20-30 villagers were in attendance, including village leaders such as Ward members and the Sarpanch. The information on research goals, methods, and expected time commitment for households participating in surveys was shared, specifically stressing the voluntary nature of the study. Participants were informed that participation carried no financial incentive and informed consent would be obtained before data collection. These meetings were organized by PRADAN, a local non-profit with over two decades of experience in the region. These village-level meetings helped finalize the list of those households who wanted to participate in the research voluntarily.

Participatory Rural Appraisal (PRA): PRA was adopted to actively engage local communities in data collection and to gain insights into their socioeconomic characteristics (Chambers, 1994). To understand household diversity, wealth ranking tool was used as described by Adams et al. (1997), which facilitated collaborative discussions and knowledge exchange between researchers and community members.

To ensure inclusive participation, participation of at least 50% of total households was ensured in the planned meeting from each village (Sahritola - 40 participants, Dhawadangal - 30 participants, including men and women). The wealth ranking process involved five key steps. The first step was categorization. Participants categorized all households into four wealth groups based on their understanding of socioeconomic indicators (i.e., rich, better off, poor, very poor). The second step

was household listing, which involved writing all household heads' names on small pieces of paper and visually displaying them for community discussion. In the third step, characteristics that defined each wealth group were identified, enriching my understanding of their socioeconomic profiles (Table 3.2). The fourth step was to use four differently sized plates symbolizing each wealth group (larger for richer, smaller for poorer). Participants discussed and placed individual household head names into the corresponding plate based on their socioeconomic status. The final step was to ensure consensus and validity throughout the process. Following the initial ranking, all participants reviewed the categorized households to ensure consensus on their assigned wealth group. Divergent opinions were addressed through further discussion until an agreement was reached. In addition, participants were encouraged to propose changes to the rankings throughout the process if necessary.

Table 3.2. Characteristics of the wealth group.

Wealth Group 1 (Rich)	Wealth Group 2 (Better off)	Wealth Group 3 (Poor)	Wealth Group 4 (Very Poor)
- Round-the-year food security - Landholding between 0.40 Ha and 0.60 Ha. - Own a good number (8 - 10) of livestock including cows, goats, and hens. - One or more household members work in government or private organizations or have business. - One of the household members: village head, ward member, retired government officer, Anganwadi member, etc. - Many household assets include luxuries such as motorcycles and televisions. - Yearly household income is around Rs.150,000.	- Food security for eight to nine months. - Landholding between 0.50 and 0.20 Ha. - Own a medium number (5 – 8) of livestock including cows, goats, and chicks. - Major livelihoods include agriculture, tsar silkworm cultivation, and small business. - Very few members migrate to earn a livelihood. - Few household assets, only necessities - Less migration - The workforce is healthy and commands good wages. - Annual income between Rs.60,000 and Rs 70,000.	- Food security for five to six months with seasonal food insecurity - Landholding between 0.20 and 0.08 ha. - Own a small number (less than 5) of livestock including goats and chicks. - Very few assets - Major livelihoods are migration, or tsar silk warm cultivation, agriculture in small plots, fishing, and wage labour. - Annual income between Rs.40,000 and Rs.60,000.	- Food security for less than four months and rely heavily on government welfare schemes. - No land for agriculture but they received land from the government to construct their houses. - Lack of livestock. - Primary sources of income include migration, fishing, and wage labor. - Limited assets and shortage of necessities. - The adult workforce is weakened by death, absenteeism, or chronic illness. - The household workforce mainly comprises children, women, and the elderly, who command a low daily wage. - Annual income less than Rs.40,000.

Household Interviews: Household interviews were conducted using the FAO's Community Forestry rapid rural appraisal of tree and land tenure framework (Bruce, 1989). The questionnaire was translated into Hindi, and all responses were recorded in Hindi, subsequently being back-translated into English for analytical purposes. Five interviewers from neighboring villages were recruited for the household interviews. These interviewers underwent training specifically tailored to this study. The training encompassed various aspects, including securing informed consent, employing the questionnaire effectively, conducting empathic interviews, adhering to key scientific study principles, ensuring confidentiality, and understanding the project holistically. Household interviews were successfully gathered from 144 out of the 156 households in Dhawadangal and Sahritola using a semi-structured interview format. Seven households could not

be included in the study. This exclusion resulted from some households having migrated to other cities for employment, rendering them unavailable during the field study, while others expressed disinterest in participating in the interview process. The interviews were designed to focus on multiple aspects, including demographic information, their relationship with the forest, and their perspectives on customary forest tree rights.

Identification of locations of households and forest trees with customary ownership: The lead author used GPS (Garmin 64) to collect the coordinates of all 144 households (Dhawadangal: 67, Sahritola: 77). The lead author also collected GPS coordinates for forest trees under customary ownership. To collect GPS coordinates of forest trees with customer ownership, different forest plots were visited. Within each forest plot, all tree species with individual ownership or joint ownership were identified. If there was a single tree with customary rights for a given species, then the GPS location of the tree was noted. Else, one GPS coordinate for every group of similar tree species was collected. If ownership of a tree species was shared between households, the corresponding GPS coordinate was linked to the coordinates of all involved households. This approach yielded 113 tree coordinates (covering 302 trees) for Dhawadangal village and 223 tree coordinates (covering 17,692 trees) for Sahritola village.

Data Analysis

Dependent variable: The dependent variable, participation, measures the household-level participation in PFM activities. These questions assess the extent of household participation in various aspects of forest management. The respondents were asked the following questions. How often do households attend forest committee meetings? To what extent do households participate

in emergencies like forest fires? During conflict resolution regarding forest resources, how frequently do households share their opinions? To what extent do households follow recommended forest tree management practices? How actively do households participate in forest protection activities? Responses were captured on a five-point Likert scale (0-4), ranging from “Always” (4) to “Never” (0), with intermediate points signifying “Very often” (3), “Sometimes” (2), and “Rarely” (1). The overall *participation value* for each household was calculated by summing their responses to the five questions.

Independent variables: Recognizing the crucial role of resource ownership in shaping participation, customary ownership over the number of forest trees possessed by each household as a key independent variable was included. Another 15 sociodemographic variables were identified and considered through a thorough literature review (Table 3.3). Each variable was chosen based on its connection to PFM participation in the existing research (Table 3.1 & Table S3.1). The independent variables are described in Table 3.3.

Table 3.3. Definition of independent variables.

Variable	Type	Description	Source
FORESTTREE	Continuous	Number of trees with customary rights situated in government-owned forestland.	Survey information
FEMMEM	Continuous	Total female members above 10 years of age.	Basu (2021), Ghosh & Basu (2021)
AVGEDU	Continuous	Average schooling years of the members, both male and female, above 10 years old.	Lise (2000), Jana et al. (2014)
AVGAGE	Continuous	The average age of the house is calculated as the sum of the age of all the household members divided by the total number of household members in years.	Survey information
AGEHHHD	Continuous	Age of the household head in years.	Jatana & Paulos (2017)
EDUHHHD	Continuous	Number of schooling years attended in years.	Dolisca et al. (2006)
TOTHHMEM	Continuous	Total household members above 10 years of age.	Jana et al. (2014)
AGRLAND	Continuous	Total agricultural land in acres with legal title.	Basu (2021)
FORESTLAND	Continuous	Total forest area (in ha) accessed by households from generation to generation for either shifting cultivation, silkworm farming, or NTFP collection.	Dolisca et al. (2006)
AVGTREEDIS	Continuous	Euclidean distance between houses and the forest trees with customary rights	Basu (2021)
RELIGION	Categorical	Hindu - coded as 1 and Christian - coded as 2	Lise (2000)
CASTE	Categorical	Schedule Tribe (ST) - coded as 1, particularly vulnerable tribal group (PVTG) - coded as 2, Other Backward Caste (OBC) - coded as 3	Lise (2000)
BPL	Categorical	Below poverty level - Coded as Yes 1 and No 0	Oli & Treue (2015)
DISPLACE	Categorical	Households displaced from their original village during their lifetime are coded as 1 (Yes) and those that have not are coded as 0 (No).	Survey information
ECONSTATUS	Categorical	The economic status in this study is determined through a wealth ranking activity, a Participatory Rural Appraisal (PRA) tool. This activity identifies four categories: Rich (4), Better-off (3), Poor (2), and Very Poor (1).	Lise (2000)
LIVELIHOOD	Categorical	Identified four main categories of income sources that contribute primarily to household income: agriculture (1), forest-based activities (2), wage labor and migration (WM) (3), and other (e.g., services, income from social welfare schemes, and livestock rearing) (4).	Maung & Ichikawa (2023)

Spatial Analysis by calculating Euclidean distance between houses and forest tree locations with customary ownerships.

After obtaining GPS coordinates for houses and forest tree locations, two village maps of Sahritola and Dhawadangal villages were created to highlight the location of houses, the centroid of the village, and forest trees with customary ownership (Figure 3.1). The Euclidean distance between

houses and tree locations with customary rights was then calculated using ArcGIS Pro software (Figure 3.2) (Esri., 2022).

Statistical analysis

Before performing the multiple linear regression analysis, a preliminary assessment of the distribution of the dependent variable was conducted. This assessment revealed a right-skewed distribution, thus necessitating a transformation to align with the assumptions of normality underlying the regression model. To address this skewness, a square transformation of the dependent variable was implemented (Lee, 2020). Figure S3.1 shows the decreased right-skewed distribution after square transformation.

The multicollinearity test was conducted, and the correlation coefficient between the average age of the household (AVGAGE) and the average age of the household's head (AGEHHHD) was 0.7 (Figure S3.2). The same correlation coefficient (0.7) was also observed between the average education of the household (AGEHHHD) and the average education of the household's head (EDUHHHD). After the multicollinearity test, the age of the household head (AGEHHHD) and education of the household head (EDUHHHD) were dropped, and the final model was selected based on the AIC and adjusted R-squared.

Linear regression was used to study the relationship between the customary ownership of forest trees by households, including their sociodemographic characteristics, and their participation in forest management activities.

$$PARTICIPATION = \beta_0 + \beta_1 \times FORTTREE + \beta_2 \times FEMMEM + \beta_3 \times AVGEDU + \beta_4 \times AVGAGE + \beta_7 \times TOTHHMEM + \beta_8 \times AGRLAND + \beta_9 \times FORESTLAND + \beta_{10} \times AVGTREEDIS + \beta_{11} \times RELIGION + \beta_{12} \times CASTE + \beta_{13} \times BPL + \beta_{14} \times DISPLACE + \beta_{15} \times ECONSTATUS + \beta_{16} \times LIVELIHOOD + \varepsilon$$

where PARTICIPATION = degree of participation in PFM activities; β_0 is a constant, β_i is the coefficient of independent variables, and ε is the error term.

Results

Demographic data such as forest trees managed per household (FORESTTREE), education status (AVGEDU), and average household size (TOTHHMEM) provide a relevant backdrop for understanding participation in PFM (Table 3.4 & Table 3.5). The data highlight large disparities in total number of trees managed per household (range: 0-3064 trees), education (range: 0-12 years), and agricultural land per household (range: 0-1.72 hectares) within the villages (Table 3.4).

Table 3.4. Descriptive statistics of variables (n = 144)

Name of the Variables	Mean	Standard deviation	Min	Max
FORESTTREE	128.17	292.89	0.00	3064.00
FEMMEM	2.33	1.38	0.00	7.00
AVGEDU	4.37	2.65	0.00	12.00
AVGAGE	29.07	13.31	11.50	68.00
AGEHHHD	42.49	14.08	3.00	80.00
EDUHHHD	3.98	3.71	0.00	15.00
TOTHHMEM	3.51	1.41	1.00	8.00
AGRLAND	0.33	0.26	0.00	1.72
FORESTLAND	0.23	0.22	0.00	1.32
AVGTREEDIS	407.46	361.47	0.00	1632.95
PARTICIPATION	14.17	5.35	0	20

Additionally, 66% of village households are described as either Poor or Very Poor, with 32% having been displaced by the Massanjore dam construction, which reflects the effects this displacement has on the economic status of tribal groups.

Table 3.5. Descriptive statistics of variables (n=144)

Name of Variables	Number of Households	Percentages
RELIGION		
Hindu	104	72%
Christian	40	28%
CASTE		
ST	80	56%
PVTG	52	36%
OBC	12	8%
BPL		
Yes	71	49%
No	73	51%
DISPLACE		
Yes	46	32%
No	98	68%
ECONSTATUS		
Rich	24	17%
Better off	24	17%
Poor	32	22%
Very Poor	64	44%
LIVELIHOOD		
Agriculture	12	8%
Forest-based activities (FBA)	40	28%
Wage labor and migration (WM)	65	45%
Others	27	19%

The total number of trees with customary ownership, as well as the average distance to those trees from the household that manages them, varied greatly between villages (Table 3.6, Figure 3.1 & Figure 3.2). In Dhawadangal, over ten tree species were managed through PFM, with a total of 313 trees, which were an average of 156.3 meters from the household managing them. Comparatively, Sahritola had approximately three species, with an average distance of 652.94 meters from households. This reflects that Sahritola relied heavily on Asan trees for commercial Tasar silkworm cultivation, which was kept intentionally distant from houses.

Table 3.6. Details of tree species with customary ownership, their total number, and the average distance from houses in Dhawadangal and Sahritola villages.

Tree Species	Total number of forest trees with customary ownership	The average distance from houses (m)
Dhawadangal		
Jack Fruit (*Artocarpus heterophyllus*)	18	150.61
Bamboo *(Bambusa vulgaris)*	39	220.63
Mahua *(Madhuca longifolia)*	80	238.33
Mango *(Mangifera indica)*	28	117.40
Palm Tree *(Borassus flabellifer)*	92	199.10
Teak *(*Tectona grandis)	23	74.19
Other	33	82.75
Total Number of trees with customary rights at Dhawadangal Village	**313**	**156.30**
Sahritola		
Asan *(Terminalia elliptica)*	14790	693.87
Mahua *(Madhuca longifolia)*	598	646.31
Saal *(Shorea robusta)*	2752	636.26
Other	3	362.66
Total Number of trees with customary rights at Sahritola Village	**18143**	**652.94**

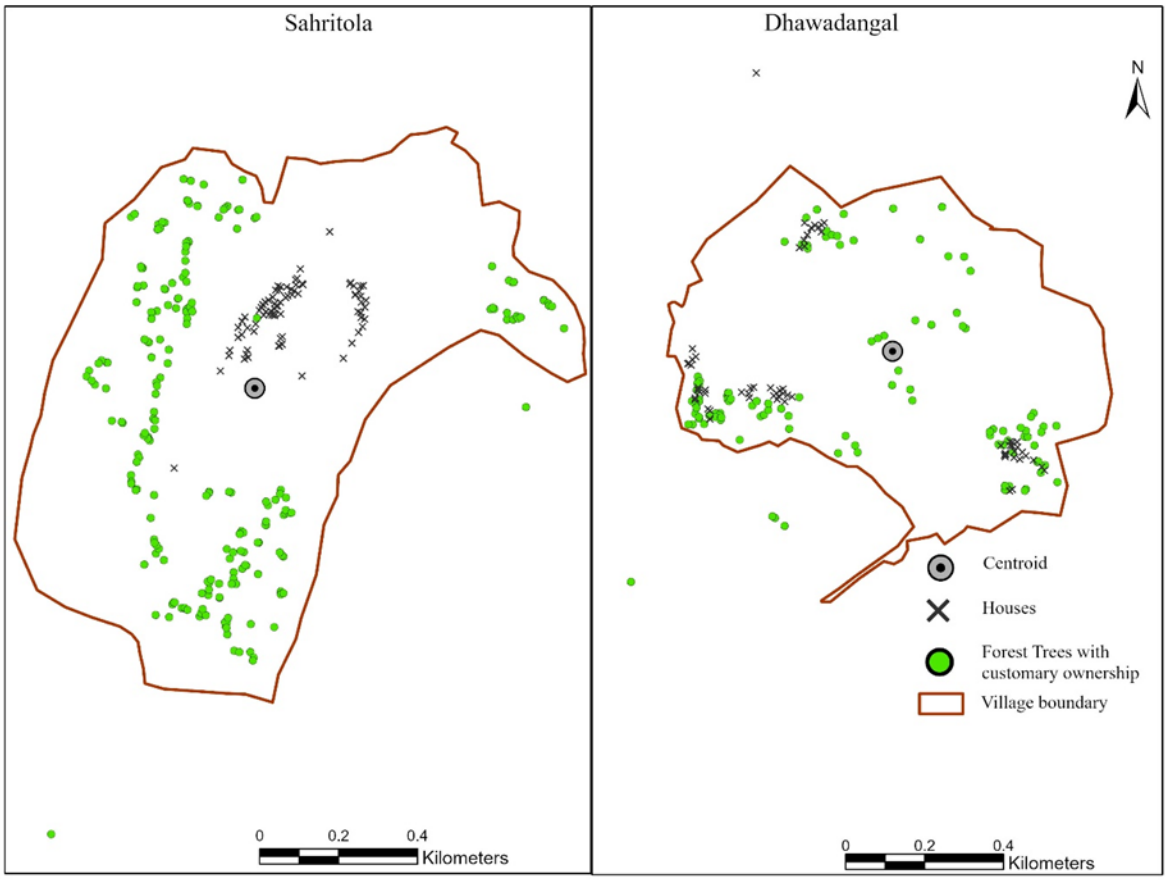

Figure 3.1. A map of Sahritola and Dhawadangal villages, highlighting the location of houses, the centroid of the village, and forest trees with customary ownership.

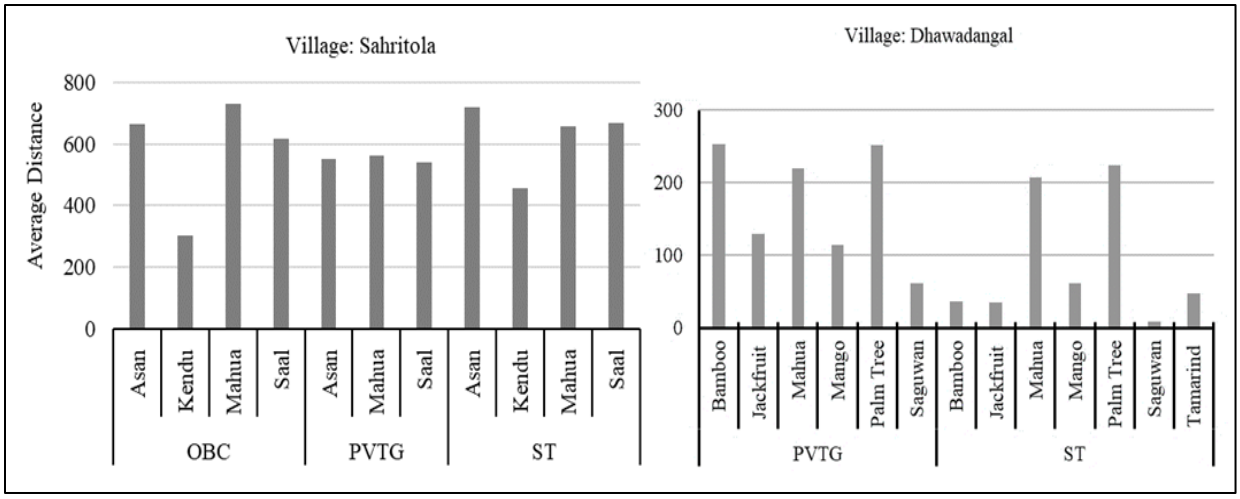

Figure 3.2 Forest tree species with customary rights and their average distance from houses among social groups

A significant disparity in customary tree ownership between villages of different economic statuses. In both villages, wealthier households have a higher average number of trees per household than poorer households (Table 3.7). For example, in Sahritola, very poor households have an average of 148.77 trees, while better-off households have an average of 371 trees. This trend holds for both Dhawadangal and Sahritola. The reasons for the disparity were discussed in Chapter 2.

Table 3.7: Customary tree ownership distribution across villages with varying economic statuses.

Village	Economic Status	Number of households	Total trees with customary ownership	Average number of trees with customary rights
Dhawadangal	Very poor	48	174	3.63
	Poor	10	70	7.00
	Better-off	4	26	6.50
	Rich	5	43	8.60
Sahritola	Very poor	16	2380	148.77
	Poor	22	4655	211.58
	Better-off	20	7420	371.00
	Rich	19	3688	194.10

The linear regression analysis yielded compelling evidence of a statistically significant relationship between the dependent and independent variables, as indicated by an R-squared value of 30.21% and a p-value of <0.05, surpassing the significance threshold of 0.05 (Table 3.8). Subsequent

verification of the model assumptions, through the Shapiro– Wilk test (p-value = 0.07), Box–Ljung test (p-value = 0.39), and examination of Figure S3.2, affirms the model's adherence to the assumptions of linearity, homoscedasticity, independence, and normality of residuals.

Table 3.8: Results of multiple linear regression model to predict the participation of households in participatory forest management activities at Sahritola and Dhawadangal village of Dumka District of Jharkhand, India.

Independent variables	Estimates	Std. Error	Pr(>|t|)	Significance
FORESTTREE	-0.07	0.02	0.003	**
FEMMEM	-11.20	8.80	0.21	
AVGEDU	14.32	5.39	0.01	**
AVGAGE	2.08	1.14	0.07	
TOTHHMEM	23.00	10.17	0.03	*
AGRLAND	-44.24	47.24	0.35	
FORESTLAND	122.80	40.00	0.00	**
AVGTREEDIS	-0.08	0.04	0.02	*
RELIGION | Christian	-2.00	22.66	0.93	
CASTE | PVTG	47.74	30.47	0.12	
CASTE | OBC	83.51	23.26	0.00	***
BPL | Yes	14.66	21.76	0.50	
DISPLACE | Yes	-147.38	28.75	0.00	***
ECONSTATUS | Poor	46.73	28.93	0.11	
ECONSTATUS | Better-off	76.12	27.98	0.01	**
ECONSTATUS | Rich	45.18	36.75	0.22	
LIVELIHOOD (FBA)	-14.27	45.65	0.76	
LIVELIHOOD (WM)	-46.82	40.26	0.25	
LIVELIHOOD (Others)	6.02	46.31	0.90	

Adjusted R-squared = 31.77%, p-value: 2.566e-07
*, **, and ***, indicate statistical significance of the coefficients at 10%, 5%, and 1% levels, respectively.

Statistical analysis revealed a negative but small association between the number of FORESTTREE and participation in forest management activities. The regression coefficient of -0.07 implied that each additional tree under customary ownership was associated with a statistically significant, yet minimal, decrease in the participation rate (approximately 0.07%). The quantitative results support the qualitative findings outlined in Chapter 2, which highlighted that households with a higher number of trees under customary ownership tend to relocate to urban areas for their children's better education and better health facilities, outsourcing forest management activities to local laborers. Therefore, as the number of trees with customary ownership increases, it reduces the participation in PFM activities.

There was a significant positive association between AVGEDU and participation in participatory forest management activities. The regression coefficient of 14.32 indicated that each unit increase in the average household education level was associated with a substantial increase in the participation rate of approximately 14.32%. This finding underscored the crucial role of education in fostering engagement in forestry initiatives. The result showed that higher educational attainment equipped households with the knowledge, skills, and motivation necessary to actively participate in collective resource management.

Household size (TOTHHMEM) emerged as a strong predictor of participation. A positive association with a coefficient of 23.00 indicated that the larger households had a substantially higher participation rate (approximately 23.00% increase per additional member). This finding aligned with the notion of just having disposable labor to engage in elective activities.

Finally, the extent of holding of forest land (FORESTLAND) within the community emerged as a statistically significant predictor of participation in PFM activities. Statistical analysis revealed a robust positive association between FORESTLAND and participation. The regression coefficient of 122.80 implied that each additional acre of forestland holding was associated with a substantial increase in the participation rate of approximately 122.80%. Households with larger forest holdings had greater reliance on income directly or indirectly sourced from forestry, thereby leading to stronger motivation to engage in collective management efforts to protect and sustain this important resource.

Statistical analysis revealed a negative but small association between the distance of forest trees with customary ownership and participation in forest management activities. The regression coefficient of -0.08 implied that each additional tree under customary ownership was associated with a statistically significant, yet minimal, decrease in the participation rate (approximately 0.08%). This finding implied participation in PFM decreases when the distance of the forest trees with customary ownership increases. Qualitative findings of Chapter 2 affirm this result. Qualitative findings revealed that the forest trees that were located away from the houses, the households preferred to rent out those trees to other households who had fewer trees customarily.

Categorical variables offered further insights. Displacement status (DISPLACE) had a strong negative coefficient (-147.38), indicating a substantial decrease in participation for displaced individuals (approximately 147.38% decrease compared to non-displaced). This underscored the negative impact of displacement on access to and engagement with forests. Caste status (CASTE) demonstrated nuanced effects, with OBC (Other backward classes) families (8%) showing a substantial positive association (coefficient: 47.74), implying an increase in participation (approximately 47.74%) compared with the reference level. Similarly, economic status (ECONSTATUS) demonstrated nuanced effects, with better-off families (17%) showing a substantial positive association (coefficient: 76.12), implying an increase in participation (approximately 76.12%) compared with the reference level. This hinted that financial constraints could limit participation at lower economic levels, while higher economic status could enable greater involvement.

These findings provided a comprehensive understanding of the diverse factors influencing participation in forestry programs, highlighting the interplay of forest trees with customary ownership, individual characteristics, household dynamics, land ownership, and socioeconomic circumstances.

Discussion

Out of the 14 variables included in the model to investigate determinants of participation, eight namely, FORESTTREE (more forest trees with customary ownership, lower the participation); AVGEDU (more educated household, higher participation); TOTHHMEM (more number of household members in a family, higher the participation); FORSTLAND (more forestland holding, higher participation); AVGTREEDIS (more distance from houses to trees with customary ownership, lower the participation), CASTE (higher the caste status, higher the participation), DISPLACE (more displaced household, less participation); ECONSTATUS (higher economic status, higher participation) were found to be statistically significant. The outcomes of this study are in accordance with prior research mentioned in Table 3.2.

The influence of education on participation in PFM activities remains a subject of debate. While some studies suggest a positive relationship, with education leading to increased engagement due to greater awareness of potential benefits and stronger environmental attitudes (Basu, 2021; Dolisca et al., 2006; Lise, 2000b), others argue that higher education can reduce participation by offering alternative income opportunities and diminishing dependence on forest resources (Agrawal & Gupta, 2005). Chhetri et al. (2012) further add to the complexity by finding no significant link between education and participation in their study. In the context of study sites, a

significant positive relationship was found between household education level with participation in PFM activities.

Several studies have shown a positive correlation between household size and participation in PFM activities (Agrawal & Gupta, 2005; Basu, 2021; Bista et al., 2023; Chhetri et al., 2012; Coulibaly-Lingani et al., 2011; Oli & Treue, 2015). This study aligns with these findings, revealing a positive relationship between household size ("HH Size") and participation in PFM activities. This suggests that larger households, with their greater labor resources and reliance on forest resources, may be more likely to invest time and effort in community forestry initiatives.

Studies highlight land tenure positively influences investment in silviculture activities (Zhang & Pearse, 1996). Certain land-related factors, like a low land-to-man ratio, a high ratio of forest area to the village population, and good quality forest land, can contribute to a more favorable environment for PFM participation (Coulibaly-Lingani et al., 2011; Naik, 1997). Further supporting these findings, this study reveals a positive relationship between forest land holdings (FORSTLAND) and participation in PFM activities. However, it's important to acknowledge that the relationship between land tenure and participation is likely to be complex and context dependent. Factors beyond land ownership, such as equitable distribution of resources, effective governance structures within the community, and individual livelihood strategies, can also significantly influence participation levels. Therefore, future research should delve deeper into these nuances and explore how different land tenure arrangements interact with other socio-economic and cultural factors to shape the dynamics of PFM participation in diverse contexts.

The relationship between economic status and participation in PFM appears to be more intricate, as evidenced by diverse findings across studies and contexts. In this study, a positive association between higher economic status and participation was observed, suggesting that wealthier households may have greater resources and flexibility to dedicate time and effort to PFM activities (Lise, 2000b). Others have observed negative or non-significant relationships (Lise, 2000b; Oli & Treue, 2015). This variability may be due to differences in the specific wealth indicators used (consumption, income, capital), regional contexts, and the nature of PFM programs. For instance, Dolisca et al. (2006) found that increasing annual income could enhance participation in participatory management processes, suggesting that wealth might be relevant in specific contexts where it facilitates engagement.

CHAPTER 4

CONCLUSION

The study investigated the customary ownership on trees located on state-owned forestland in four villages of Dumka Districts, Jharkhand, India. Utilizing a combination of qualitative and quantitative methods, this study explored the customary norms established by tribal communities to govern customary forest tree ownership. The study revealed that tribal communities have developed a set of well-defined customary norms governing forest trees. These norms encompass ownership creation, intergenerational transfer, and distribution of forest resources. The research further identified that factors such as the presence of distinct ethnic communities, land titling status, and the commercialization of forest-based activities influence the specific nature of these customary norms. Interestingly, the study's regression analysis found a negative correlation between the number of forest trees under customary ownership and the level of participation in formal forest management activities.

There are limitations in the study. One of them is the qualitative nature of the interviews. Only 144 household interviews were conducted in two villages for this study, which limits the degree to which these findings may be generalized to the broader population of forest-dwelling tribal groups. It would be necessary to gather data from households in multiple additional villages to observe which norms are more strongly affected by local dynamics and which are more generally consistent.

Another limitation of the data lies in potential biases in interview question responses. These biases can include issues such as selective memory, misattribution, and exaggeration. Since the local villagers speak neither Hindi nor English, residents of nearby villages had to be recruited to conduct individual interviews and translate focus-group discussions. While the training these locals received was carefully designed, this added a layer of complexity to data analysis, as results had to be translated first to Hindi and then to English.

The study primarily focuses on the present state of customary tree rights, the factors affecting those customary norms, and their current impacts. While it acknowledges the dynamic nature of these norms, a deeper exploration of historical transformations, macro-level issues such as policy reformation, geo-political issues, and their influence on current practices could provide richer insights.

A limitation of this study is using a single GPS location for each group of tree species in a specific area, chosen for simplicity in data collection. However, this approach may oversimplify the distribution of trees around households with customary ownership rights, potentially leading to an incomplete representation of the spatial arrangement of tree species in those areas.

Despite these limitations, many of the findings can be extended beyond the specific context of the study villages because multiple steps were taken, including peer debriefing sessions between members of the research group to minimize bias in data analysis. Additionally, local data collectors, a few community members, and the non-profit staff were consulted when reviewing and validating the preliminary findings. This iterative process allowed me to incorporate local

perspectives, refining interpretations to better align with the lived experiences of the community. Furthermore, transcript reviews were carried out to meticulously examine the accuracy of the translated and interpreted data. The systematic approach adopted in this research process enhances the reliability and transferability of the study findings, making them valuable for informing practices and policies in diverse settings.

This study has made a significant contribution to the understanding of customary norms around forest tree rights, the factors that influence these norms, and how these norms shape forest management practices, livelihoods, and sustainability. Future studies can use this knowledge to develop theories in this area further and expand theory development to forest-dependent communities in other geographies and situations. These findings can also be used to create interventions and encourage further research into some of the important practical implications.

The study has identified several major factors contributing to current customary norms in these villages. First, customary forest tree ownership is managed by traditional tribal institutions that shape these norms and safeguard the villagers and forest trees from exploitation and overcome socioeconomic hardships such as those caused by displacement or illness. The tribal traditional institutions oversee all norms around tree ownership but are weakened by the other village institutions, which were formed for commercial Tasar silkworm cultivation and governmental policy implementation. Given the success traditional institutions have achieved in maintaining customary forest tree ownership and protecting forests for generations, policymakers and non-profits should consider how best to integrate new policies into existing systems rather than weaken

them. Bridging this gap will allow traditional knowledge to govern tree ownership and introduce new ideas that can better the lives of villagers and ensure better forest conditions.

Another major factor impacting tree ownership systems and participation in forest management is community displacement. In this study, large effects were identified for the displaced Pahariya communities due to the construction of the Massanjore dam. These displaced communities migrated to new villages, whose village heads made accommodations, including changes in tree ownership norms in that village, to support their livelihoods. Despite this, however, displaced communities have the lowest participation in forest management practices. Taken together, the impact of community displacement is very large on both the individuals displaced, the villages in the surrounding area, and the forest conditions surrounding these villages. Therefore, further research into this impact and how it can be minimized is critical for preserving the well-being of tribal communities and forest land.

Other factors affecting participation in forest management include educational status and commercialization. The number of years in education in areas is positively correlated with involvement in forest management. Critically, the flexibility of tree ownership has allowed for new practices, such as new Tasar cultivation techniques, to be introduced by PRADAN, which has positive effects on villagers' income and forest health.

Overall, the study findings demonstrate customary forest tree ownership is a deep-rooted, robust, and well-defined system that has been managed by traditional institutions for generations to the benefit of the villagers and forests alike. More research must be done on the tree ownership system

as it exists in other tribal contexts, where other traditional institutions may have unique ideas and wisdom, leading to different sets of strengths and challenges. This new knowledge base surrounding tree ownership can be used to inform policymakers about the existence, nature, and success of tree ownership. This will ensure that future policies can be designed to incorporate forest tree ownership systems, which will preserve traditional institutions, promote community well-being, and improve forest conditions.

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APPENDIX A

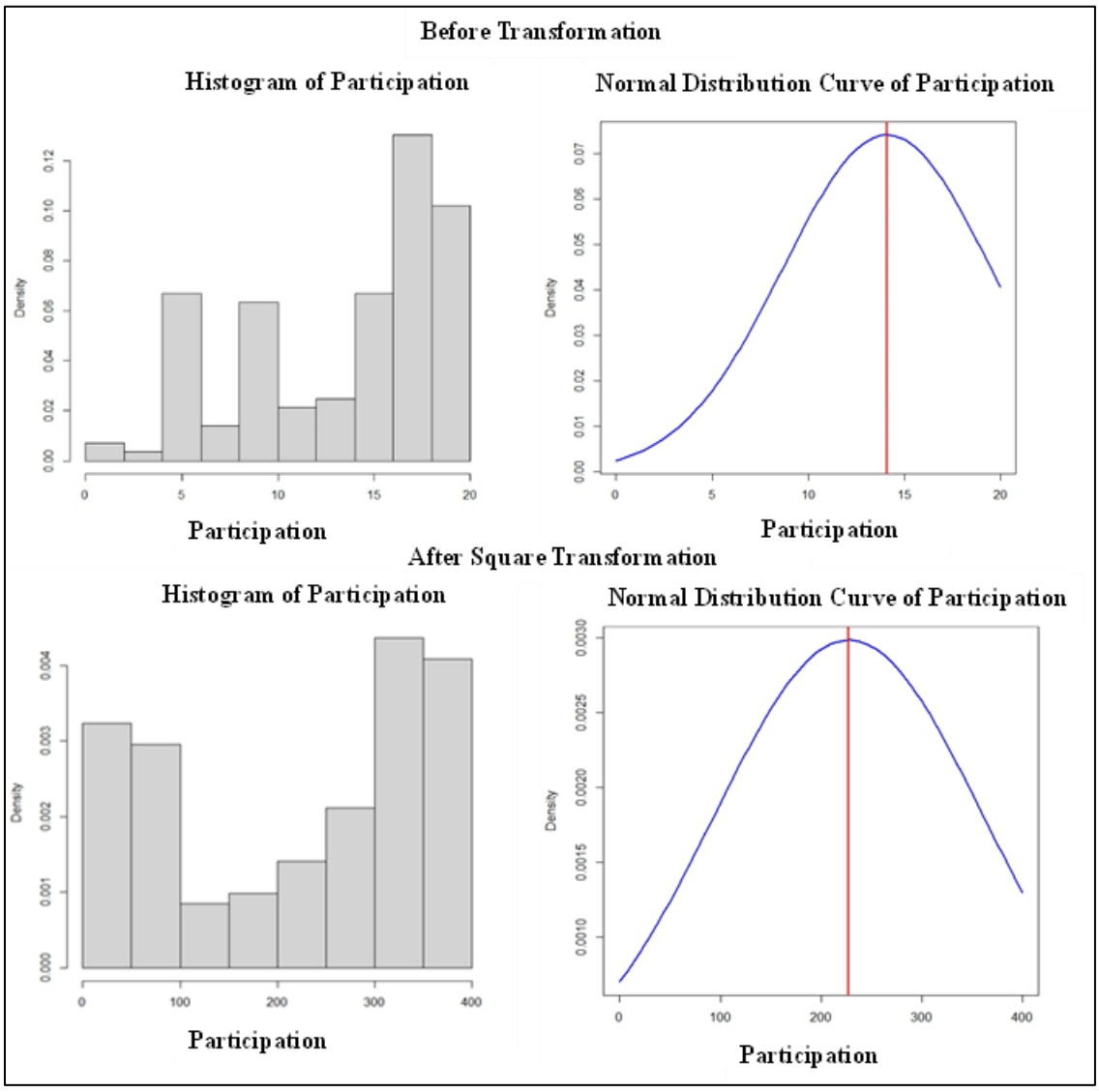


Figure S3.1: Distribution of the dependent variable PARTICIPATION before and after square transformation, showing decreased skewness.

APPENDIX B

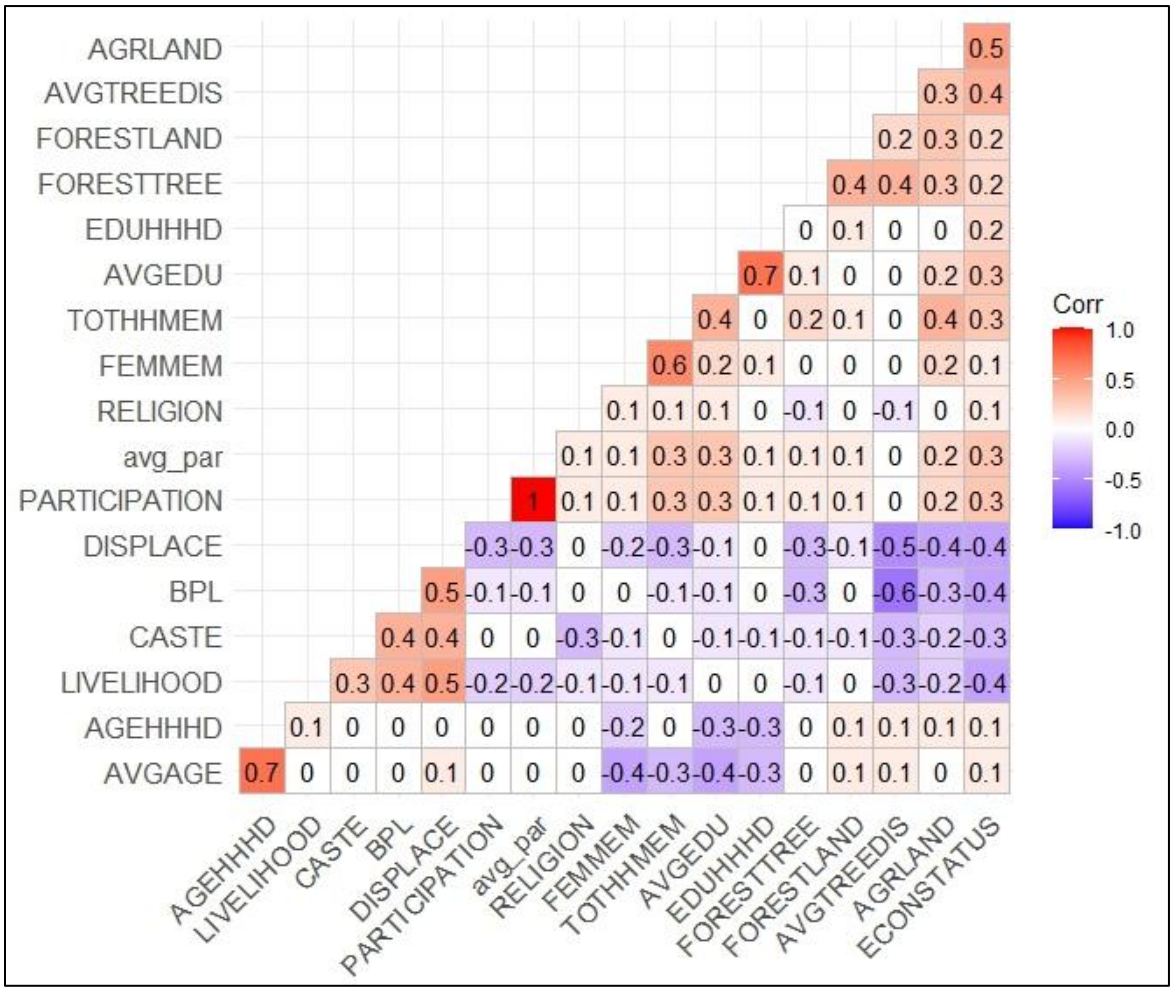


Figure S3.2: Diagnostic plots for assessing the multicollinearity between independent variables.

APPENDIX C

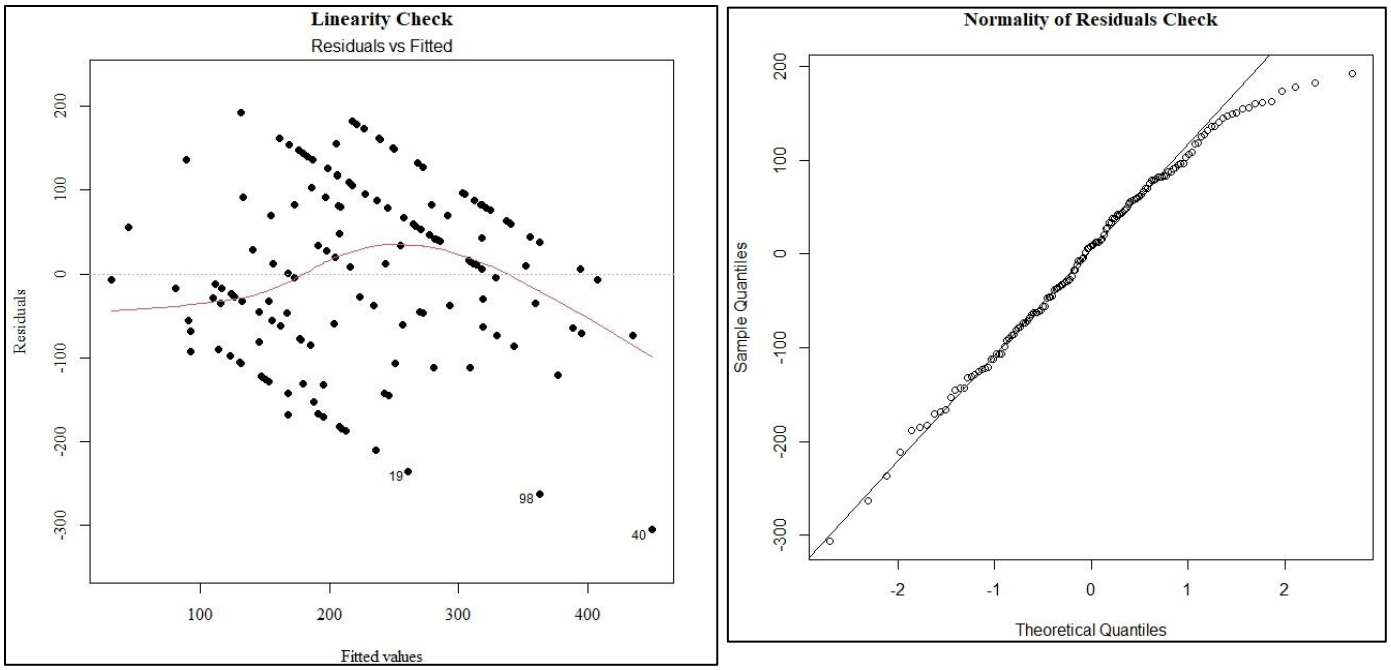
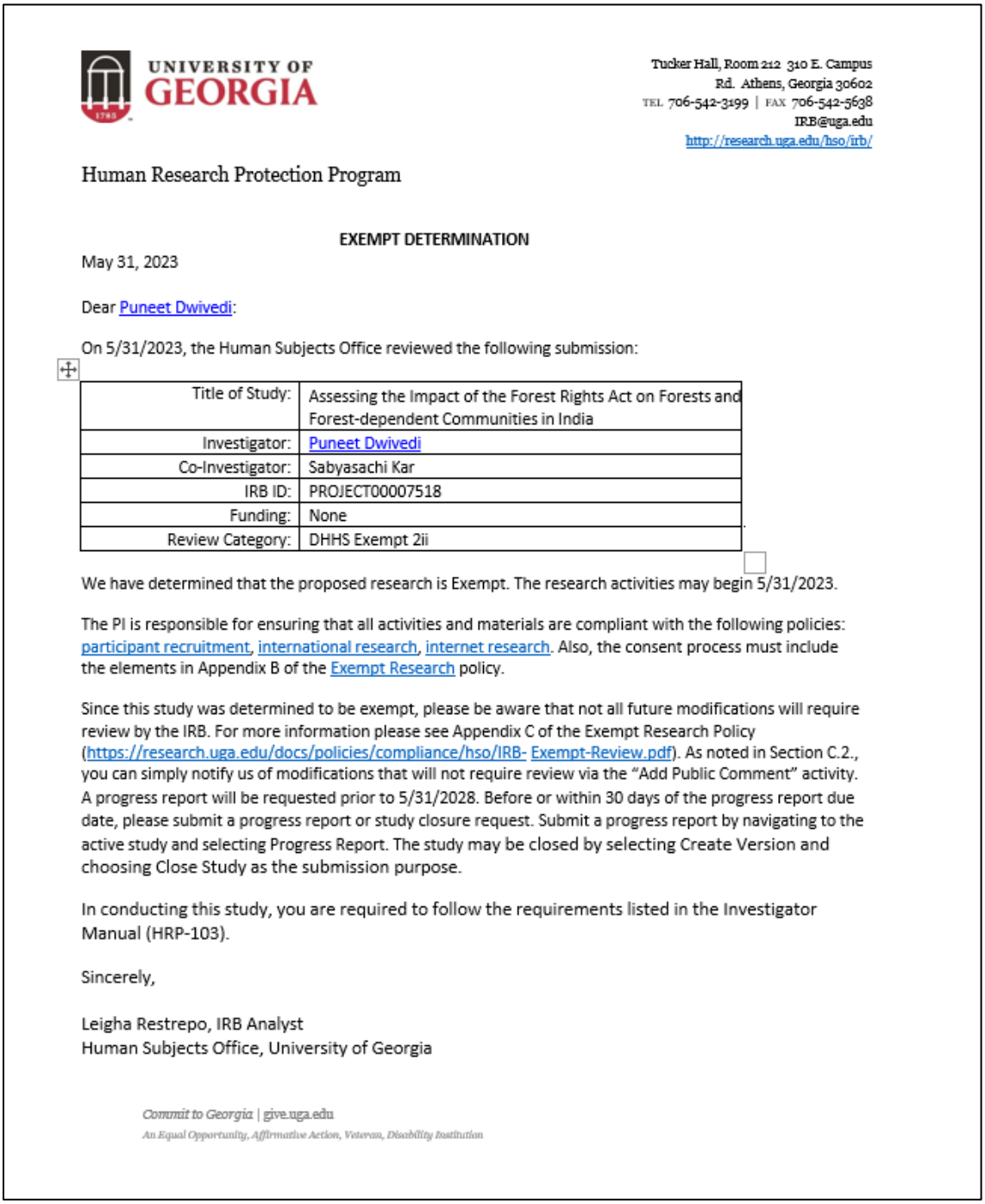


Figure S3.3: Diagnostic plots for assessing the assumptions of linearity, independence, homoscedasticity, and normality of the linear regression model.

APPENDIX D



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Human Research Protection Program

EXEMPT DETERMINATION

May 31, 2023

Dear Puneet Dwivedi:

On 5/31/2023, the Human Subjects Office reviewed the following submission:

Title of Study:	Assessing the Impact of the Forest Rights Act on Forests and Forest-dependent Communities in India
Investigator:	Puneet Dwivedi
Co-Investigator:	Sabyasachi Kar
IRB ID:	PROJECT00007518
Funding:	None
Review Category:	DHHS Exempt 2ii

We have determined that the proposed research is Exempt. The research activities may begin 5/31/2023.

The PI is responsible for ensuring that all activities and materials are compliant with the following policies: participant recruitment, international research, internet research. Also, the consent process must include the elements in Appendix B of the Exempt Research policy.

Since this study was determined to be exempt, please be aware that not all future modifications will require review by the IRB. For more information please see Appendix C of the Exempt Research Policy (https://research.uga.edu/docs/policies/compliance/hso/IRB- Exempt-Review.pdf). As noted in Section C.2., you can simply notify us of modifications that will not require review via the "Add Public Comment" activity. A progress report will be requested prior to 5/31/2028. Before or within 30 days of the progress report due date, please submit a progress report or study closure request. Submit a progress report by navigating to the active study and selecting Progress Report. The study may be closed by selecting Create Version and choosing Close Study as the submission purpose.

In conducting this study, you are required to follow the requirements listed in the Investigator Manual (HRP-103).

Sincerely,

Leigha Restrepo, IRB Analyst
Human Subjects Office, University of Georgia

Figure S3.4: IRB Approval