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Unsettled Tenure: Indigenous Land Rights Conflicts in Madhupur Sal Forest of Bangladesh

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Abstract: This research investigates the chronic struggle over land rights in a community-based forest management system. The Madhupur Sal Forest (MSF) of Bangladesh, inhabited by indigenous Garo and Koch communities. The aim of this research was to examine the determinants of conflicts over land rights for the case of community-based forest management in Bangladesh's Madhupur Sal Forest. Both quantitative and qualitative data were gathered from 150 samples (75 each village of Magontinagor and Gachabaria) using semi-structured questionnaire. The results showed that over half (57%) of ethnic respondents disputed the Forest Department's claim on their ancestral land, and three-quarters (74%) sought for customary rights to be reinstated. We found a statistically significant positive correlation between the amount of land claimed by the Forest Department and fear for loss of land ($\rho = 0.931, p < 0.001$) in being sure about forest development ($\rho = 0.834, p < 0.001$), regarding the illegal occupation of lands in forests ($\rho = 0.748, p < 0.001$). Official records indicate that more than 57,000 hectares of reserved forest land in Bangladesh have been encroached, reflecting broader governance and enforcement challenges related to forest management. These conflicts severely affect local livelihoods, foster distrust toward the Forest Department, and challenge conservation efforts. The findings emphasize that recognizing customary land tenure and ensuring participatory decision-making are essential to control conflicts and promoting sustainable forest management. These findings will help the policymakers to reform land tenure policies and integrate indigenous rights into national forest management strategies. This study also contributes to hazards and risk resilience by demonstrating how land tenure insecurity functions as a socio-institutional driver of risk, amplifying vulnerability and weakening community and ecosystem resilience in forest-dependent systems.

Keywords: Bangladesh; conflict management; forestry; land rights; Madhupur Sal forest

1. Introduction

Forests are defined as land larger than 0.5 hectares with a tree canopy cover of more than 10% that is not primarily used for agriculture or urbanization. The FAO defines forests and forest areas based on the following criteria: area covered percentage of crown cover, average tree species height, and other related factors. Shrub cover



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and forest fallow are two other forms of woodland. A shrub is a woody perennial plant that does not have a distinct crown and grows to a height of 0.5 to 5 m when fully grown. The minimum and maximum heights for shrubs and trees should be interpreted with some flexibility, particularly the minimums of 5 and 7 m, respectively [1]. Worldwide, tropical forests and biodiversity are disappearing, with nearly 80% of new agricultural lands coming from forestland [2]. The main factors contributing to deforestation and forest degradation include population growth, poverty, the need for fuelwood, fodder, and timber, the scarcity of arable land, industrialization, development initiatives, and natural disasters [3,4]. Over time, non-participatory forest management and overexploitation have exhausted more than 50% of forest resources [5]. However, the widespread exploitation and deterioration of forest resources were not stopped by the centralized system of forest management [6]. In terms of natural management, the plantation, number of plants, and forestation of Madhupur Sal Forest (MSF) (*Shorea robusta*) are continuing to worsen [3]. The unstable political condition and malpractice of politics by local people and community leaders have accelerated the degradation of this forest [7]. The Sal Forest is surrounded by dense populations that include ethnic minorities such as the Garo and Koch communities [3]. The Garos have a rich historical presence in the forests of the Madhupur region, with a deep connection to the land and a lifestyle that revolves around forest resources. The forest is a primary source of income for many poor residents in the surrounding area. They collect honey, leaves, and tree branches for cooking, and occasionally cut trees to support their daily financial needs [8]. Their livelihoods and cultural traditions are intricately intertwined with the forests they inhabit. The degradation of forests and conflicts over land rights predominantly threaten impoverished forest-dependent individuals, who rely on land for their subsistence. As Bangladesh is one of the most densely populated countries in the world 1333 people per square kilometer (3453 people per square mile) [9], with severe shortages of land for accommodation, it is impossible to rehabilitate all the forest dwellers along with the encroachers outside the forest to ensure its full protection. At the same time, Bangladesh cannot undertake social forestry on a large scale due to land shortage. However, the forest-centred lifestyle and cultural heritage of the Garo community face significant threats today [10].

The initial threat emerged in 1984 when the government declared a major portion of the Madhupur region as government forest land without involving or consulting the Garo community. This decision was communicated through a gazette notification, disregarding the input and participation of the Garo people [11]. According to Muhammed et al. [12], land ownership is a significant problem in the Sal forests, where the Garo community resides. Forest land rights conflicts caused severe problems in several countries around the world. There are several forest disputes in Nepal, both between the government and communities, and even between groups themselves [13]. Forest property ownership conflicts have a long and controversial history in India [14]. In Malaysia, indigenous communities hope to benefit from economic development without having to give up their lands, customs, or identities [15]. Unsettled land tenure issues may render the long-term effectiveness of sustainable practices, such as participatory social forestry, uncertain [16]. The Indigenous belief system, that is, their cultures, languages, and ways of life continue to be threatened, and are sometimes even vulnerable to extinction [17]. Except for the mangrove forests of Sundarbans, the major natural forests are the dwelling place of most of the Indigenous communities in Bangladesh. As the state agency responsible for forest management in Bangladesh, the Forest Department considers the Indigenous people as a major threat to forest management [18]. Therefore, an antagonistic relationship has long existed between Indigenous people and the Forest Department. Hence, it is difficult to utilize the forest resources properly to obtain the full potential of this forest under the prevailing circumstances.

A study [19] exists on Madhupur Sal Forest regarding land legislation in Bangladesh, but the actual conflicting situation between the Forest Department and indigenous people is not clear. Another study [16] discussed the adverse situation of local communities in Madhupur Sal Forest due to the government policy, but it is not focusing land rights conflicts. Similarly, a study exists on Chittagong Hill Tracts of Bangladesh regarding conflict and corollaries on forest and indigenous people focusing on the systemized administrative corruption, syndicated illegal logging, poor transit rules, and inappropriate forest management systems, but land rights conflicts are not discussed [12]. Since both the forest and Indigenous people are struggling, it was thought necessary to conduct a study to explore the existing factors of conflicts related to land rights in this community-based forest management.

The previous studies focused on the adverse situation of the indigenous people due to government policies, conflicts on systemized administrative corruption, and inappropriate forest management but did not discuss the conflicts on land tenure. As the forest is a significant vital resource for the local communities, this study will help to explore the balance between conservation efforts and the needs of these communities. The study will help policymakers identify gaps in existing laws and policies to recognize and protect the historical land rights of indigenous communities by reducing conflicts and promoting equitable access to resources. As land rights conflicts can escalate into broader social tensions and even violence, this study may contribute to conflict resolution by

drawing attention to government policymakers indicating the social impacts of these conflicts. Under this condition, the findings may be helpful for policymakers of the concerned organizations, both government and non-government, in recognizing land rights conflict management for sustainable Social Forestry. In this regard, the study examines how various factors contribute to the land rights conflicts surrounding the management of Madhupur Sal Forest, what are the perceptions of indigenous communities regarding these land rights conflicts, and how these conflicts impact forest management and the livelihood of the community. Considering these questions the study objects to explore the existing factors of land rights conflicts related to MSF management, to find out the impact of this conflict on forest management and the livelihood of the community, and to provide a way out and suggest a policy implication to resolve these conflicts.

This study is informed by several interrelated conceptual frameworks. First, the concept of social vulnerability highlights how marginalized groups, such as Indigenous communities, are disproportionately exposed to risks due to limited access to resources, insecure tenure, and political exclusion. Second, risk governance emphasizes the role of institutions, policies, and power relations in shaping how risks are produced, distributed, and managed. Third, social-ecological resilience provides a lens to understand how human-environment systems respond to disturbances, including conflicts that disrupt resource management and adaptive capacity. Fourth, the lens of environmental justice draws attention to inequities in access to land, decision-making processes, and the distribution of environmental benefits and burdens. Finally, the concept of legal pluralism is relevant in this context, where statutory laws imposed by the state coexist and often conflict with customary land tenure systems practiced by Indigenous communities. By integrating these perspectives, this study moves beyond a descriptive account to provide a more comprehensive understanding of land rights conflict as a multidimensional risk and resilience issue. In this context, land tenure insecurity is conceptualized as a socio-institutional risk factor that increases exposure to livelihood insecurity, social marginalization, and environmental degradation. Exclusion of Indigenous communities from governance processes limits their adaptive capacity and weakens collective responses to ecological and socio-economic stresses. The interaction between insecure tenure, institutional mistrust, and unequal power relations therefore undermines both community resilience and the long-term sustainability of forest ecosystems.

While previous studies have examined forest governance and Indigenous livelihoods in the Madhupur Sal Forest, limited attention has been given to how land rights conflicts interact with broader processes of vulnerability, risk production, and resilience. This study addresses this gap by applying an integrated conceptual framework that links tenure insecurity with risk governance and social-ecological resilience. In this regard, the study examines how various factors contribute to the land rights conflicts surrounding the management of Madhupur Sal Forest, what are the perceptions of indigenous communities regarding these land rights conflicts, and how these conflicts impact forest management and the livelihood of the community. Considering these questions the study objects to explore the existing factors of land rights conflicts related to MSF management, to find out the impact of this conflict on forest management and the livelihood of the community, and to provide a way out and suggest a policy implication to resolve these conflicts. To address the above research gap, this study is guided by the following research questions:

- (1) What are the key drivers of land rights conflict between Indigenous communities and the Forest Department in the Madhupur Sal Forest?
- (2) How do the Garo and Koch communities perceive land tenure insecurity and institutional governance?
- (3) In what ways do land rights conflicts affect livelihoods, resource access, and forest management practices?
- (4) How do these conflicts shape social vulnerability and resilience at the community and ecosystem levels?
- (5) What policy and governance measures can help reduce conflict and enhance equitable and sustainable forest management?

2. Land Tenure and Indigenous Rights

The issue of land tenure has a long history dating back to the Mughal era, British rule, and the Pakistani regime (Table 1). Forest policies in the Indian sub-continent, including Bangladesh, are focused on the promotion of forestry as a commercial venture by the state, and the gradual marginalization of forest-based communities from the management and utilization of forests [20]. According to Cadastral Survey (CS) records extending back to 1918, the government denied the traditional rights of over 25,000 forest dwellers who had lived in the Madhupur Sal forest for a long time by demanding that all forestlands be government lands under FD authority. The CS is a legal document that records the ownership of property by certain Garos in the Madhupur Sal forest. The Garos, who had long lived in forest areas, were resistant to the government's demands [21]. The Bengal Private Forest Act of 1945 addressed this conflict by transferring land rights to the government. The State Acquisition and

Tenancy Act of 1950 aimed to expedite land acquisition by abolishing private ownership and subletting. After Bangladesh gained independence in 1971, the first forest policy viewed forestry as a government affair that neglected local rights and demands [22]. The government acquired the Sal forests and declared them protected. However, multiple ownership claims remained, leaving the Garo people marginalized on their land [23]. The issue of land tenure remains unresolved and has become a sensitive and controversial topic. Forest policy did not focus on crucial aspects such as land-use classification, community participation, private sector involvement, forest product processing, and rural energy needs [18]. In the context of Bangladesh's Sal forests, the Forestry Department allocated land user rights, ranging from 12 years to occasionally 30 or 40 years, to governmental, semi-governmental, and non-governmental concession entities [19]. Nevertheless, certain provisions and policies of the 1992 National Environment Policy continued to pose challenges for the Garo communities residing in the study area [12]. As per Nandwani [14], the government project jeopardized Garo culture and livelihoods. The expansion of the commercial economy has resulted in landlessness, poverty, and gender inequality among the Garos [24]. In various parts of the world, indigenous forest dwellers have demonstrated the successful application of traditional knowledge with innovative tools and techniques to effectively manage forests. Over the past 20 years, the significance of farmers' Indigenous Knowledge (IK) in managing natural resources and the environment has been increasingly acknowledged [25]. Regrettably, policy and implementation authorities have overlooked the Garo people and their IK [12].

Table 1. Chronology of historical developments in Bangladesh's forest policies and management (Forest Department [26]; Islam & Sato [27]; Alam et al. [28]; Salam & Noguchi [29]; Ahmed [30]; Salam & Noguchi [31]).

SL	Year	Key Components of Forest Policy	Management Authority
1	1917	British Governor General created the first Sal Forest policy and management plan in Indian sub-continent	British Governor
2	1950	The formation of the EBSATC removed the Zamindar system and gave the FD responsibility over all natural forests. The Madhupur National Park (MNP) in MSF was founded on this act	Government of Pakistan
3	1956	The Dhaka administration Separation and creation of Mymensingh Forest Division. Again, separated into Tangail and Mymensingh Forest Divisions	East Pakistan Forest Dept.
4	1962	The Pakistani government established the Madhupur National Park (MNP) for conservation, education, and enjoyment	East Pakistan Forest Dept.
5	1972	All Sal Forest resource harvesting was restricted this year due to extreme deterioration and deforestation	Bangladesh Forest Dept.
6	1979	First Bangladeshi national forest policy centered on conservation	Government of Bangladesh
7	1982	Bangladesh officially gazette the Tangail and Mymensingh Forest Division MNP	Government of Bangladesh
8	1986	FD began rubber plantation in damaged MSF	Bangladesh Forest Dept.
9	1989	Started social forestry in MSF with Asian Development Bank (ADB) funding.	Bangladesh Forest Dept.
10	1992	The Forestry Master Plan, which efficiently managed Sal forests in the future, appeared	Bangladesh Forest Dept.
11	1994	Updated national forest policy to emphasize protected area production and biodiversity conservation	Government of Bangladesh
12	1997	Launch of 1997–2004 Forestry Sector Project. This project aimed to facilitate co-management in the MSF's degraded region	Bangladesh Forest Dept.
13	2001	The Sal Forest participation forestry plantation began harvesting mature trees	Bangladesh Forest Dept.
14	2004	Formation of National Social Forestry laws, implemented in MSF	Government of Bangladesh
15	2009	A forest conservation and rehabilitation project were undertaken for poor MSF ethnic and non-ethnic people. The goal is to rehabilitate 5000 houses with the active participation of forest-dependent individuals	Bangladesh Forest Dept.
16	2013	Rehabilitation continued until 2013 and developed community forest workers who managed Sal forests	Bangladesh Forest Dept.

3. Methodological Approach

Both qualitative and quantitative methodologies were used in this research to get the in-depth analysis of land rights conflict in community-based forest management in madhupur region of Bangladesh. Aside from this the elements that now contribute to conflicts over land rights about community-based forest management were examined using theoretical and analytical frameworks.

3.1. Study Area

The agroecological zones (AEZs) of Bangladesh have been identified based on four elements: physiography, soil, land levels in relation to flooding, and agroclimatology. A provisional categorization of Bangladesh into 30 agroecological zones (Figure 1). The Madhupur Tract is designated as AEZ number 28, encompassing an area of 4244 square kilometres (Figure 1). This region is distinguished by its topographical complexity and the presence of soils that have been developed over the Madhupur Clay. The topography of the landscape is characterized by the presence of level uplands, which are often accompanied by terraces that exhibit either shallow or broad, deep valleys. These terraces are a result of the dissection of the landscape, which is either shallow or broad. A total of eleven distinct soil types has been identified within the study area. The most prevalent types include deep red brown terrace soils, shallow red brown terrace soils, and acid basin clays. The soils in the valleys are characterized by a dark gray hue, indicative of substantial clay content. The elements exhibit a high degree of acidity when subjected to a reaction with low levels of organic matter, minimal moisture-holding capacity, and low fertility levels.

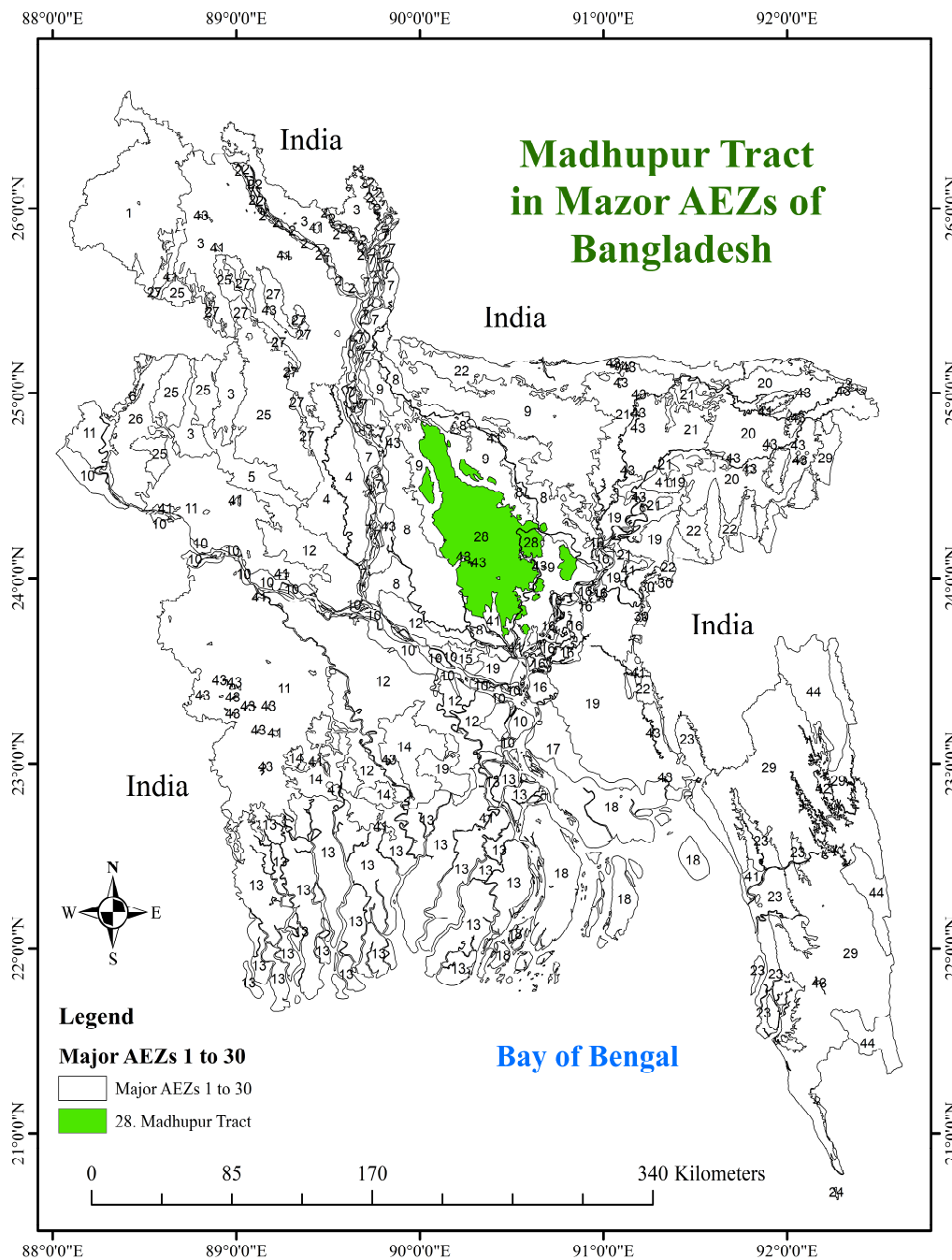


Figure 1. Madhupur Tract of the of Madhupur Sal Forest region in Bangladesh as one of major agroecological zones (AEZs) (Author Generated, 2025).

A considerable portion of the Sal forests in the Madhupur Tract, also referred to as Madhupur *Grah* in local parlance, is situated in the central region of the country, encompassing the districts of Dhaka, Mymensingh, Tangail, and Gazipur [28,32–34]. Madhupur Sal Forest is the third-largest forest ecosystem in Bangladesh [35]. The majority of Madhupur Tract, which covers around 8439.59 hectares, is in the Tangail District, with a small portion extending into the Mymensingh District, encompassing 239.98 hectares in Bangladesh [21,33]. Madhupur Tract covers almost 46% of Bangladesh's Sal forests and is located between 23°50' to 24°50' north latitude and 89°54' to 90°50' east longitude [19]. These woodlands are found in heavily populated areas where ethnic minority groups like the Koch (about 5%) and Garo (about 95%) populations are present [27]. The systematic and historical history of Madhupur forest ethnic groups, particularly the Garo and Koch, was under-represented in literature. They are Tibeto-Burmese Bodos [36,37] who speak Bengali, although their native language is distinctive. The literature also claimed that the MSF's initial people were the Garo and Koch, two of India's most well-known ethnic tribes. As one of Bangladesh's major forest ecosystems, the Madhupur Sal woods (*Shorea robusta*) are of great agroecological significance. The two study villages were purposively selected based on their proximity to the Madhupur Sal Forest, the presence of Indigenous Garo and Koch communities, and documented histories of land-related conflicts with the Forest Department. These sites provide a representative context for examining tenure insecurity and its socio-ecological implications.

3.2. Sampling and Data Collection

A total of 150 respondents were selected using a stratified random sampling approach to ensure representation across gender, age groups, and socio-economic categories. Household lists were obtained with the assistance of local leaders, and respondents were randomly selected within each stratum. This study used a sample size of randomly selected 75 people from Magontinagor and 75 from Gachabaria, two distinct villages located within the Madhupur Sal Forest under Beribaid and Aronkhola Union Parishad of Madhupur Upazila (Sub-district). The sample size of 150 respondents was determined based on field feasibility, time constraints, and consistency with similar studies on land tenure and forest-dependent communities. Given the relatively homogeneous population and exploratory nature of the study, this sample size was considered sufficient to capture representative perceptions and experiences. Participants were selected based on the following criteria: (i) residence within or adjacent to the Madhupur Sal Forest, (ii) membership in Indigenous Garo or Koch communities, and (iii) direct or indirect dependence on forest resources. This ensured that respondents had relevant knowledge and experience regarding land rights conflicts.

There are 41 villages in the Madhupur Sal forests, but these two villages were deliberately chosen because most residents, particularly from the Garo community, have been traditional inhabitants of the area for generations. The ongoing land rights disputes have disrupted their ancestral ties and livelihoods, making this region a significant case for study. Primary sources indicate that similar issues exist in other villages as well. Nonetheless, the number of ethnic groups inhabiting the villages surrounding the Madhupur Sal forest area is substantially lower than that of the population who live within the forest, and their reliance on the Sal Forest has decreased. A structured questionnaire was developed based on existing literature on land tenure, vulnerability, and forest governance. The questionnaire included sections on demographic characteristics, land ownership perceptions, conflict experiences, livelihood dependence, and institutional trust. A pilot survey was conducted to refine the instrument prior to full data collection. This questionnaire was used to gather quantitative data on several study-related topics. Qualitative data were collected through key informant interviews (KIIs). A total of ten KIIs were carried out with local leaders, Forest Department officials, and relevant stakeholders to supplement and contextualize the study. Interviews focused on lived experiences of land conflict, perceptions of governance, customary land practices, and coping strategies. Interviews were recorded, transcribed, and thematically analyzed.

3.3. Data Analysis

The data was analyzed and summarized using Microsoft Excel and SPSS to provide a descriptive study of the respondents' viewpoints. To analyze the impact of the conflict over land rights Spearman's Rho correlation test was conducted using respondents' perceptions. Spearman's rank correlation coefficient (ρ) was used to examine relationships between key variables, as the data were derived from ordinal-scale responses (e.g., Likert-type perception measures) and did not meet the assumptions of parametric tests. The analysis is intended to identify associations between variables rather than to establish causal relationships. Understanding the larger context, historical background, and current policy surrounding land rights conflicts was made possible in large part by this material. Quantitative data were analyzed using descriptive statistics (percentages and frequencies). Qualitative data were analyzed using thematic analysis, where responses were coded and categorized into key themes such as

tenure insecurity, governance challenges, and resilience strategies. The integration of quantitative and qualitative findings allowed for triangulation and enhanced the validity of the results. Furthermore, since most of the quantitative analysis were based on perception-oriented responses, the findings primarily reflect the experiences, attitudes, and interpretations of the respondents rather than independently verified causal relationships. Broader conclusions regarding governance practices, institutional behavior, and environmental outcomes were interpreted cautiously and supported, where possible, with secondary literature and official records.

4. Results and Discussions

In this section, the results are interpreted not only in relation to local perceptions and experiences but also through the broader lenses of social vulnerability, risk governance, environmental justice, and social-ecological resilience. Rather than viewing land conflict solely as a legal or administrative issue, the discussion examines how tenure insecurity interacts with institutional exclusion, livelihood risks, and ecosystem pressures to shape long-term sustainability outcomes in forest-dependent communities.

4.1. General Perception on Forest Management

This study examined the local community's viewpoints on forest management from a broader perspective to gain a complete grasp of the specifics of the land rights conflict in this region. The goal of this study was to categorize the ethnic community's collective opinions, attitudes, and perceptions into distinct groups, each addressing a distinct aspect such as the community's representation in development projects, the equitable distribution of project benefits, the perception that elite groups are capturing project benefits, and concerns about potential environmental degradation by ethnic communities with unrestricted access to forests.

This data (Figure 2) suggests that most respondents (67%) expressed a lack of confidence that forest rules adequately consider the interests of the people. These findings indicate a high level of tenure insecurity among Indigenous communities, which is a key dimension of social vulnerability. The widespread rejection of Forest Department claims reflects not only contested property rights but also a deeper lack of trust in formal governance institutions. These responses suggest that many respondents perceive a gap between existing forest regulations and the needs and expectations of the ethnic community, possibly leading to challenges in sustainable resource management. The data also highlights a parallel lack of confidence (67%) in understanding how the Forest Department makes decisions regarding the Madhupur Sal forest. These perceptions may reflect weaknesses in participatory risk governance and institutional communication mechanisms, where institutional arrangements fail to ensure inclusive decision-making and equitable resource access. Such governance gaps can exacerbate conflict and increase socio-environmental risks. The implementation of participatory agroforestry programs was mostly controlled by the local forest department, and the poor were not included in management planning or decision-making regarding the agroforestry models in the Madhupur area [38]. The Forest Department, being a government body, did not fulfill its executive duty and is unable to create an environment conducive to collaboration among many stakeholders together for forest management [39]. Additionally, the expressed concerns about community representation (63%) and the perceived unfair distribution of benefits (60%) in developmental projects within the forest further emphasize the importance of inclusive and equitable approaches in promoting sustainable development. In most cases, the members of project implementation committees are either nominated by politically associated Members of Parliament (MPs) or selected by local authorities, rather than by actual community representatives. That is why local communities have very little say in community development initiatives [40]. The beneficiary selection criteria were not followed properly; instead of helping the Garo community, the program favoured politically supported groups and thus did not fulfil all objectives of the Social Forestry in the Sal forests [16]. According to ADB [41], although community involvement in forest management has increased, people are unable to fully benefit from it because there are no legal recourse options available in the event of disputes. Sal forest management has a significant challenge due to the FD's adversarial relationship with local people [42], as does the long-standing conflict between the FD and ethnic communities. Consequently, the social forestry initiative has not succeeded in bringing about any positive transformation within the Garo community. A substantial percentage (69%) believed that ethnic people would not destroy the forest if given free access which indicates the potential opportunity for the utilization of forest resources with traditional management. Indigenous peoples have a long-standing connect with their environment. Cultural or spiritual beliefs that emphasize respect for the natural world are widespread in a variety of ethnic communities. The local inhabitants rely on forests for a living, and the restrictions on access to Sal forests have had a significant economic impact on their everyday lives [27,43,44].

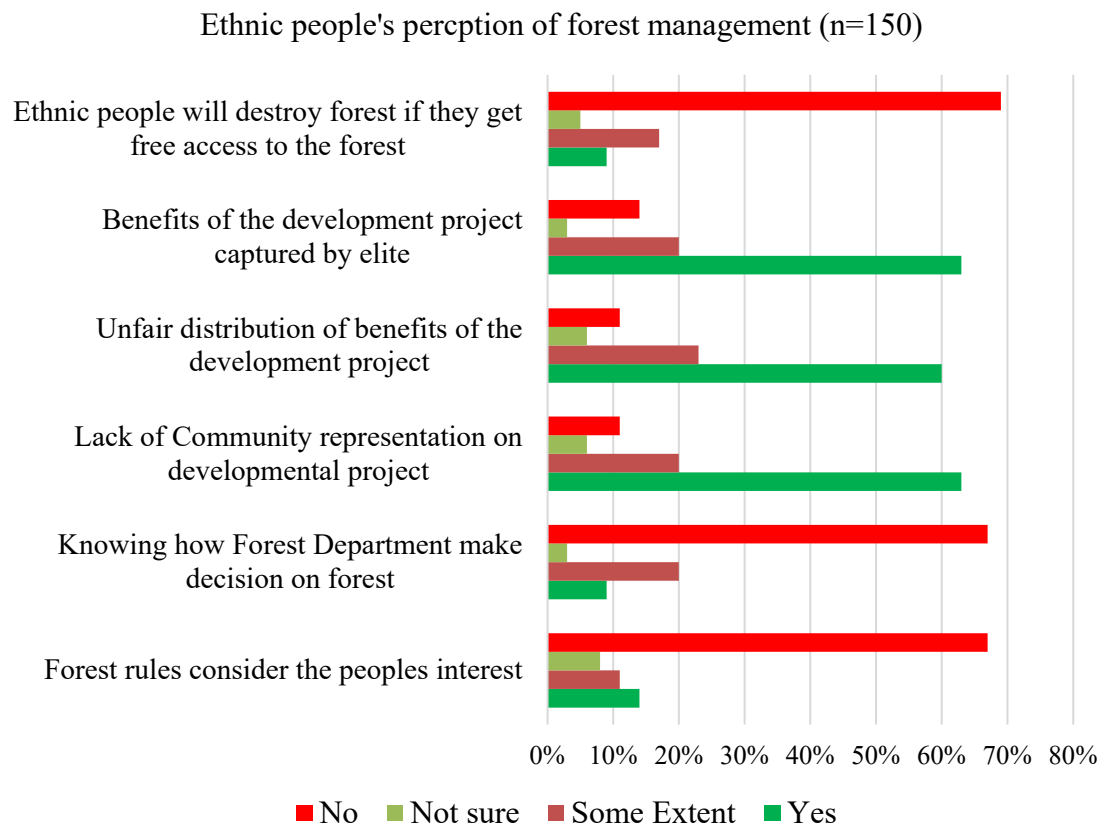


Figure 2. Ethnic people's perception of Forest Management.

In the absence of regulation, ethnic communities may put economic gain over conservation. Besides these, several non-ethnic individuals (building homes and farms) and institutions also illegally concessioned 8307 acres of MSF land [35]. With free access to forest resources, some people may damage the forest by excessive logging, overharvesting timber or non-timber goods, or converting land for agriculture. The demand for agricultural expansion, charcoal, and timber may exert pressure on ethnic communities. This pressure may encourage unsustainable practices. Decentralization of natural resource management is favoured by many national governments, non-governmental organizations, and international organizations. They think that by giving local people who depend on natural resources for their subsistence solid resource rights and decision-making authority, these communities will practice sustainable management [45]. Forest dwellers perceived ecosystem services compared to urban citizens [46]. The findings from respondents' perceptions suggest that exclusion from decision-making processes may weaken the adaptive capacity of Indigenous communities, which ultimately decreases overall social-ecological resilience. The observed mistrust toward the Forest Department undermines collective action, which is essential for sustainable forest management and effective risk mitigation. The findings further demonstrate that institutional exclusion contributes to procedural injustice, where Indigenous communities are denied meaningful participation in governance processes affecting their livelihoods and ancestral territories. Such exclusion increases social vulnerability by reducing access to information, representation, and adaptive decision-making opportunities. As trust in institutions declines, cooperation between communities and the Forest Department weakens, thereby reducing the effectiveness of collective forest conservation initiatives and resilience-building efforts.

4.2. Conflict on Land Ownership

Land ownership conflicts have emerged as a recurrent issue in the Madhupur Sal forest area. Designated as a completely reserved area by the government, this region presents a unique scenario in which indigenous inhabitants lack legal documents substantiating their land claims despite their longstanding residence.

The data in Figure 3 suggests a significant land rights conflict between the Forest Department and the communities regarding land ownership. A majority of respondents (57%) reported that they perceived the Forest Department as claiming portions of their ancestral land. The large number of respondents who said they always dealt with this issue suggests that it is a widespread issue that needs immediate response. For many years, multiple

indigenous groups have called the Madhupur Sal Forest home [16]. These communities have historically been involved in agriculture, shifting cultivation (also referred to as slash-and-burn farming), and collecting of forest products for their daily requirements. Indigenous individuals depend on the forest for fuelwood, timber, medicinal plants, herbs, natural fruits, and vegetables [47]. Resources from these forests are indispensable for medicinal, culinary, and housing purposes. Indigenous populations regularly face challenges in terms of land rights and tenure, with numerous displacements caused by encroachment, deforestation, and agricultural expansion. They frequently face economic insecurity because of landlessness and marginalization. However, the government's declaration of the region as a completely reserved area disrupted indigenous inhabitants' conventional land tenure systems. The land rights of ethnic communities living in the MSF were ignored by the Pakistani government, while Bangladesh continued and amended the same forest policy [19]. Social forestry and rubber planting schemes were launched by the FD, but none were successful in conserving forests or improving local livelihoods [16,27,28,48]. Furthermore, these initiatives created extra issues for ethnic minorities. As per the FD, the government-owned Sal forestland includes the residential space of the indigenous population [19]. Deprived of legal documentation, local communities face challenges in asserting their ancestral land rights, which escalates tensions with forest departments. Nevertheless, the indigenous individuals were regarded as the initial dwellers of the Sal forests residing in the MSF region for over two centuries [49]. The indigenous community had been utilizing the resources and lands of the Sal Forest since ancient times, and the British Government had officially granted land rights to the ethnic community [49]. Due to this legislation, the Forest Department (FD) gained authority over the natural Sal forests, triggering formal disputes between the FD and ethnic communities. Over time, the situation deteriorated, culminating in a clash on 10 April 1996, where a Garo man named Buhen Norek lost his life in the confrontation between the two entities [27]. Official conflicts arose between the local government and the ethnic community, resulting in the loss of two lives from the ethnic group in clashes in 1986 and 2008 [19]. Hence, the operational acknowledgment of the traditional land ownership structure of the ethnic minority has never taken place in Bangladesh [27]. Furthermore, land concession entities and non-ethnic settlers have extensively violated the land rights of the ethnic community by forcefully seizing their traditional land [28]. Throughout this process, local government, political leaders, and elites have provided support to the non-ethnic settlers [49]. Despite their historical presence and continuous habitation in the region, the lack of official land titles renders their claims vulnerable to contests by forest departments. The findings, together with evidence from previous studies, suggest that these tenure disputes may contribute to long-term socio-environmental risks by destabilizing traditional livelihood systems and disrupting Indigenous stewardship practices that historically contributed to forest conservation. The uncertainty surrounding land ownership reduces incentives for sustainable land management and limits the capacity of communities to adapt to environmental and economic changes, thereby weakening both social and ecological resilience.

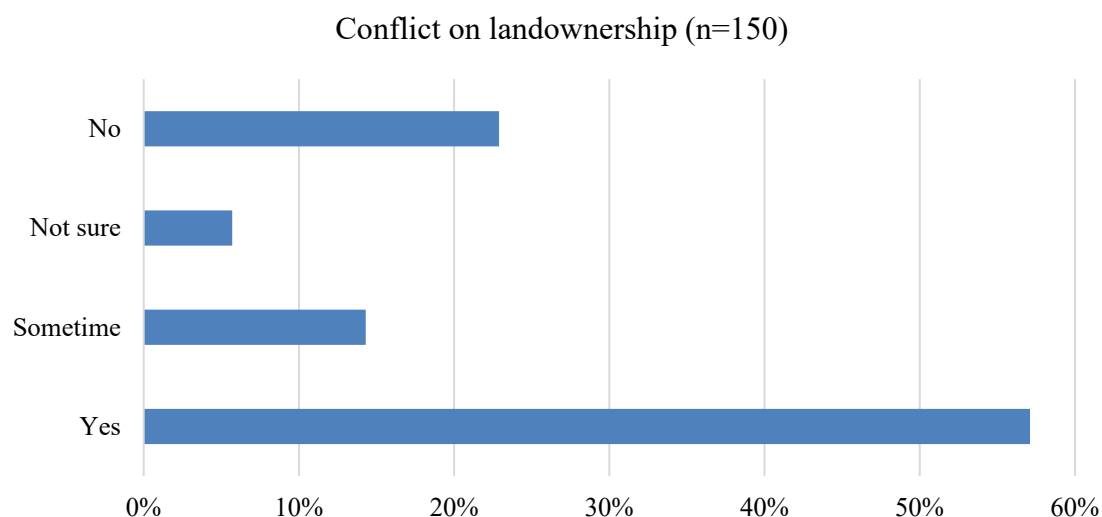


Figure 3. Land of people claimed by Forest Department.

4.3. Perceptions on Forest Land Rights

Ethnic populations feared losing their traditional forest access and land rights after the 1950 Act. Between 1963 and 1982, the Sal forests were deforested and non-ethnic people settled illegally. After the national park's official gazette in 1982 and land concession, the formal confrontations between ethnic peoples and the FD were severe. After 1982, the ethnic people's rights to forest resources and land were completely gone, thus they now work daily wage labour. Furthermore, the Sal Forest is near extinction due to biodiversity loss.

The majority (74.3%) of the ethnic community demanded the return of land rights (Figure 4). This reflects the community's strong desire to take back control and ownership of the areas they have historically inhabited. In the same way, 68.6% of participants said that they needed to register or document the land they owned. This implies that they understand how crucial legal recognition and documentation are to protecting their land rights from future conflicts or encroachments. The demand for recognition of ancestral land rights reflects broader issues of environmental justice, particularly the need for recognition, participation, and equitable distribution of resources. It also highlights the limitations of existing legal frameworks in accommodating customary tenure systems.

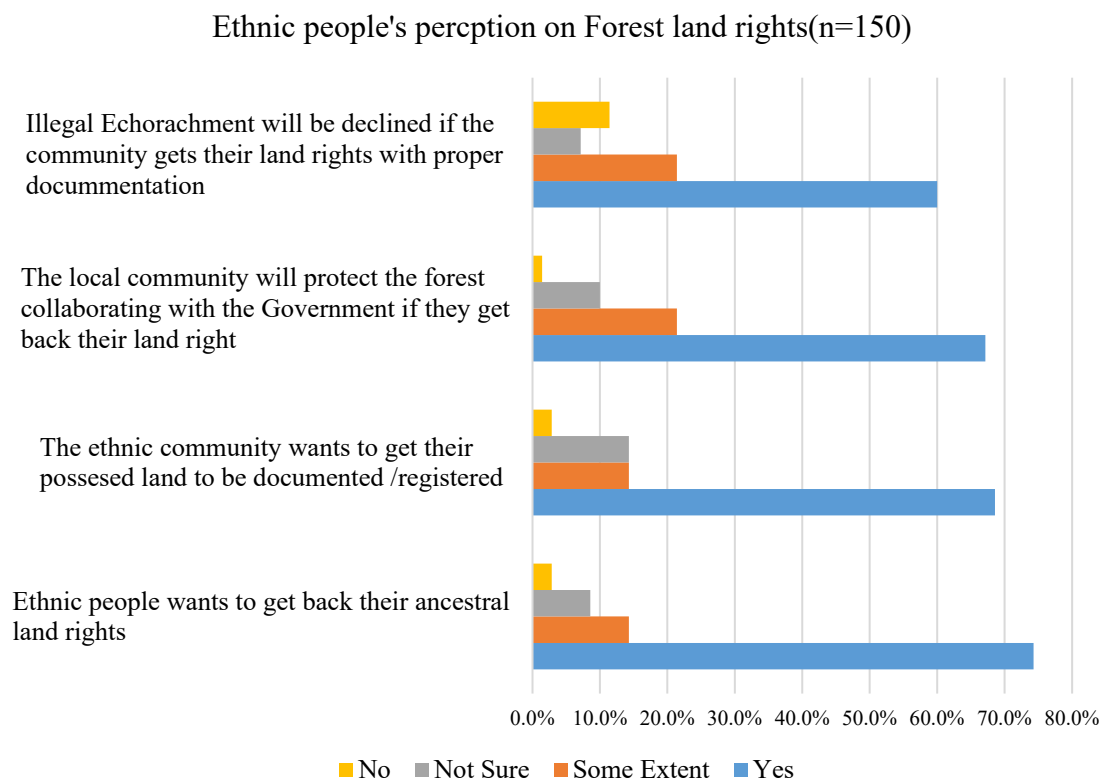


Figure 4. Ethnic community people perception on forest land rights.

A significant portion of the community (67.1%) indicated that they would be willing to work with the government to maintain the forest, provided they were granted their property rights back. Several government and non-governmental organizations (NGOs) have worked to reduce encroachment in the Madhupur Sal Forest [50]. These include measures to improve indigenous communities' land tenure rights, promote community-based forest management, and engage locals in sustainable forest practices [51]. This suggests that community land rights and forest conservation efforts could work together. Local forest protection committees, organized by indigenous groups, play an important role in preventing illegal activities such as logging, grazing, and encroaching [52]. NGOs and community groups have held awareness campaigns to educate people on the importance of forest protection, the dangers of encroachment, and sustainable forest management techniques [53]. Most people (60.0%) said that if the community's land rights were officially acknowledged and recorded, the illegal encroachment of forests would be decreased. These perceptions indicate that respondents associate secure land tenure with reduced risks of unauthorized settlement and unsustainable resource use. The findings also suggest that secure land tenure can function as a resilience-enhancing mechanism by strengthening local stewardship, encouraging cooperation in forest governance, and reducing conflict-driven resource exploitation. The findings suggest that recognition of customary rights may contribute to improved livelihood security and ecosystem stability.

4.4. Impact of Land Right Conflict

This study examines the profound impact of these conflicts on the emotional and practical aspects of the indigenous residents, exploring the dynamics of fear, confidence, and illegal encroachment in the study area. The fear of losing land is a prevalent concern among ethnic communities as their traditional territories are claimed by external entities. This research aims to unravel the intricate relationship between land ownership disputes and diminished confidence in developmental interventions. Furthermore, the study addresses the alarming rise in illegal forest encroachment attributed to land rights conflicts.

Table 2 revealed a statistically significant positive correlation (Spearman's rho = 0.931, $p < .001$, $N = 150$) between the fear of losing land and the Forest Department's land claim. This suggests that the local population's anxiety about possible land loss is significantly growing as the Forest Department claims control over more property. The situation changed once the 1950 Act was put into effect, and the native people started to worry that they may lose their long-standing access to traditional woods and the land rights that go along with it [19]. A substantial number of indigenous individuals experienced the unfortunate loss of their ancestral forestlands, primarily attributed to concessions, coupled with restrictions imposed by the Forest Department (FD) [19]. The positive correlation between perceived Forest Department land claims and fear of land loss suggests that respondents who perceive stronger institutional claims also tend to report higher levels of insecurity. This should be interpreted as an association in perceptions rather than a causal relationship.

Table 2. Correlation between Land Rights Conflict and Its Impacts.

	Spearman's Rho	Fear of Losing Land	Lack of Confidence in Forest Development Activities	Illegal Forest Encroachment Due to Land Rights Conflict
Land of people claimed by Forest Department	Correlation Coefficient	0.931 **	0.834 **	0.748 **
	Sig. (2-tailed)	<0.001	<0.001	<0.001
	N	150	150	150

** Correlation is significant at the 0.01 level (2-tailed).

A similarly strong positive correlation (Table 2) was observed between the lack of confidence in forest development activities and the claim of land by the Forest Department (Spearman's rho = 0.834, $p < 0.001$, $N = 150$). Respondents' perceptions and supporting literature together suggest that land conflict may undermine livelihood security, thereby increase vulnerability and reduce the capacity of communities to cope with environmental and economic shocks. It is important to note that these correlations reflect perceived relationships reported by respondents and do not establish causality. The findings should therefore be interpreted as indicative of how different dimensions of tenure insecurity and governance are experienced and understood by local communities. The observed associations suggest that tenure insecurity may function as an important contributor to long-term vulnerability, limiting livelihood stability and increasing exposure to socio-economic and environmental risks. This indicates that the Forest Department claims more land, and there is a significant rise in the lack of confidence among the local community regarding the efficacy of forest development initiatives. Hence, the Forest Department (FD) introduced various management initiatives such as social forestry and rubber plantation. However, none of these programs proved successful in terms of forest conservation or enhancing the local communities' livelihoods [27]. Consequently, the forest management strategies failed to establish a mutually beneficial situation, and certain endeavors, such as rubber plantation and social forestry programs, had adverse impacts on the well-being of the ethnic communities [49]. Moreover, woodlots also produced major ecological difficulties by clearing coppices of Sal trees and other indigenous species for woodlot blocks in various parts of the forest. This prevented forest recovery in several regions. Clearing the forest for woodlots and rubber plantations was especially harmful to faunal variety because these trees do not provide fruit or nectar for wildlife [54]. In 2003, the Forest Department constructed a 3-m-high wall around Madhupur forests to establish an eco-park, restricting access for the Garo community. The move led to protests, during which two Garo youths lost their lives, and twenty-two others were injured. Following national and international pressure, the Forest Department halted the construction [55]. Since the 1980s, the Forest Department (FD) has specifically focused on ethnic minorities to acquire their customary forestlands through initiatives like rubber plantations and social forestry programs. Because of these plantation schemes, a considerable number of ethnic individuals faced displacement and were compelled to relocate due to the land concessions granted by these programs [19]. However, the conventional forest policy and management plan implemented by the Government of Bangladesh had consistently overlooked the matter of traditional land rights belonging to ethnic communities [56]. The land rights disputes fostered a profoundly adverse relationship between ethnic minorities and the Forest Department (FD) [27].

Respondents reported a strong perceived association (Table 2) between Forest Department land claims and illegal forest encroachment (Spearman's $\rho = 0.748$, $p < 0.001$, $N = 150$). This suggests that as the Forest Department claims more land, there is a notable increase in instances of illegal forest encroachment, likely stemming from conflicts over land rights. It is evident from this study that ethnic minorities were deprived of legal documentation of their land rights. Due to this several non-ethnic individuals, engaged in activities such as establishing residences and cultivating agricultural land, along with various institutions (e.g., educational and religious establishments, political party offices, orphanages, clubs, nurseries, NGOs, etc.), were implicated in the illegal encroachment of Madhupur Sal Forest (MSF) land [19]. It became evident that a considerable number of individuals had established illegal settlements in the Madhupur Sal Forest (MSF) area since 1971 [56]. In 1989, the government took a significant portion of the Madhupur Sal forest to create rubber and social forestry projects [48,49,57]. The government outlawed industrialization in and around forests, but industries controlled by the country's politically prominent leaders continued to operate [32,55,58,59]. The ecologically and economically important Sal forests of Bangladesh are under great threat from land grabbing, making them vulnerable and endangered ecosystems [28,32].

According to the Forest Department, a total of 56,094.72 hectares of reserved forest land in the country had been illegally grabbed in different forms of encroachment and legal actions are going against these encroachments over 4943.19 hectares of land (Table 3). The data underscores the urgent need for intervention and regulatory measures to address the widespread issue of illegal land grabs within reserved forest areas. In developing nations such as Bangladesh, the loss of natural resources due to land grabbing is causing major ecological and economic decreases [19]. A substantial portion of the MSF land had been converted for various commercial purposes [28]. Surprisingly, non-ethnic backgrounds illicitly seized land belonging to ethnic communities, aided by security forces. The ethnic participants further asserted that these settlers had gained control over their customary land through the fabrication of fraudulent documents [19]. Land-use policies specifically prohibit developing industries on privately or government-owned forest land. It expressly prioritizes natural resource conservation and prevents companies from being built on forest property [60]. However, there has been no collaboration between Bangladesh's land ministry, forestry, and agriculture agencies, failing to establish efficient governance for the Sal forests [19]. Collective action is crucial for sustainable natural resource management [43].

In the context of community-based forest management, the establishment of secure land rights is of paramount importance, as it empowers local communities to effectively manage and protect their forest resources in a sustainable manner (Figure 5). It has been demonstrated that communities are more inclined to make investments in sustainable practices and long-term conservation when they have legally recognized rights to their land. This sense of ownership fosters a greater dedication to protecting biodiversity, stopping deforestation, and improving the ecosystem's general health. Moreover, the provision of consistent access to resources and opportunities for revenue generation through sustainable forestry practices can contribute to the enhancement of community members' quality of life. The viability and sustainability of community-based forest management programs are contingent upon the secure tenure of protected land rights.

Table 3. Illegal Encroachment in Reserved Forest of Bangladesh (Forest Department [26]).

Scheme	Types of Encroachment	Number of Incidents	Encroached Area (Hectare)
1	Industrial Project/Factory Project with Permanent Establishment	172	331.90
2	Other institutes (Market, Schools, Resort, etc.)	3329	1988.80
3	Privately owned house	58,407	23,342.70
4	Privately owned farming land	26,307	30,431.25
	Total	88,215	56,094.72
	Ongoing Legal actions/cases taken by the Government	4758	4943.19

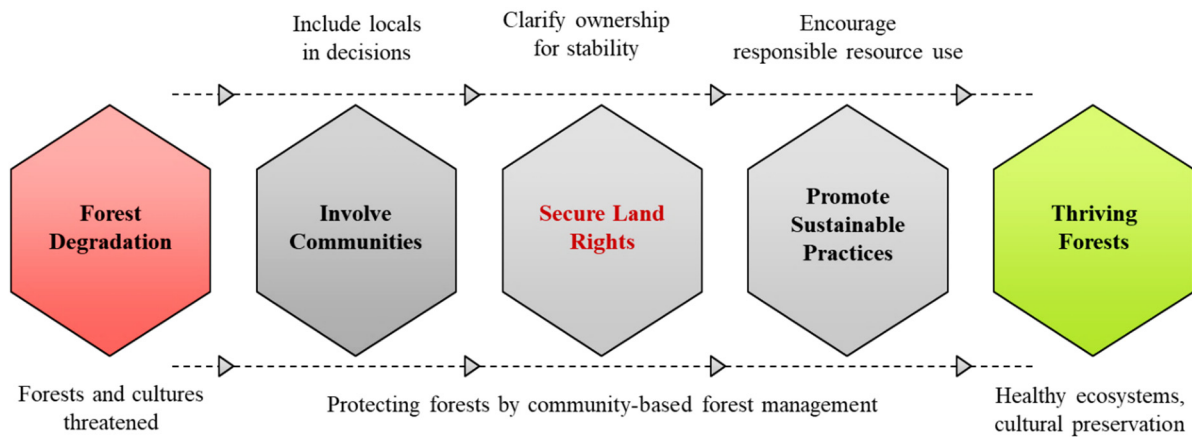


Figure 5. Secure land rights in community-based forest management.

The findings of this study, interpreted alongside previous literature and official records, suggest that land rights conflict may act as a multidimensional driver of socio-ecological risk. Tenure insecurity increases livelihood vulnerability by limiting long-term access to land and forest resources, while exclusion from institutional decision-making processes decrease adaptive capacity and procedural equity. At the same time, mistrust toward formal institutions weakens collective action among stakeholders, making collaborative forest management more difficult. These interacting processes undermine community resilience by reducing social cohesion, economic security, and coping capacity during periods of stress or environmental change. At the ecosystem level, conflict-driven encroachment, unsustainable resource extraction, and weak governance further reduce ecological resilience and threaten the sustainability of the Madhupur Sal Forest. The interaction between tenure insecurity, institutional exclusion, and limited recognition of customary systems creates conditions that amplify risk and weaken both community and ecosystem sustainability.

Overall, the findings demonstrate that unresolved land tenure conflict extends beyond disputes over property ownership and functions as a broader socio-institutional driver of vulnerability and weak governance. Insecure tenure reduces livelihood stability, discourages long-term investment in sustainable land management, and increases dependence on vulnerable coping strategies. At the same time, limited participation of Indigenous communities in forest governance weakens institutional legitimacy and reduces opportunities for collaborative decision-making. The resulting mistrust between local communities and formal institutions undermines collective action, which is essential for sustainable forest management and effective resilience building. These interconnected dynamics contribute not only to social insecurity but also to ecological degradation through conflict-driven encroachment, resource pressure, and reduced stewardship incentives. Therefore, the Madhupur Sal Forest case illustrates how unresolved tenure systems can simultaneously weaken governance capacity, increase vulnerability, and reduce social-ecological resilience in forest-dependent regions.

This study has several limitations. The sample size, while adequate for exploratory analysis, does not allow for broad generalization. The reliance on perception-based data may introduce subjective bias, although it provides valuable insights into lived experiences. Additionally, the study does not employ advanced causal or longitudinal analysis. Future research could incorporate larger sample sizes, apply advanced statistical or econometric techniques, and explore longitudinal dynamics of land conflict and resilience. Further work could also examine institutional interventions and comparative case studies across different forest regions.

5. Conclusions and Recommendations

Significant land ownership disputes between the Forest Department and the indigenous community are highlighted in this survey. The Madhupur Sal forest area holds historical significance for indigenous tribes, indicating the need to address their land rights. Due to legal issues arising from the government's declaration of the area as a fully reserved area, the local communities are now at risk, and their claims to ancestral lands are under threat. The study also revealed a possible gap between community needs and regulations by arguing that respondents had a substantial lack of confidence in how forest policies take the interests of the ethnic community into account. The need for greater openness and inclusivity is highlighted by concurrent worries about community representation, comprehension of Forest Department decisions, and alleged unequal benefit distribution. Social forestry programs proved unsuccessful, favouring the leader group over the Garo community. In many cases, local leaders had more direct access to political and administrative power. This influence allowed them to secure benefits from Social

Forestry projects, such as control over forest land and resources emphasizes how crucial equitable methods are needed for achieving sustainable development to reduce land rights conflicts (Figure 6). The findings highlight that land rights conflict acts as an important contributor to social and ecological risk by increasing vulnerability, weakening governance systems, and undermining resilience at multiple scales. Addressing tenure insecurity is therefore not only a matter of justice but also essential for effective risk reduction and long-term resilience building. The study demonstrates that unresolved land tenure conflicts generate interconnected social, institutional, and ecological risks. Indigenous exclusion from governance processes increases vulnerability, while persistent mistrust toward state institutions weakens cooperation and collective resource management. Strengthening resilience therefore requires not only legal recognition of customary land rights but also inclusive governance systems that promote participation, institutional accountability, and community-based adaptation strategies.



Figure 6. Unveiling strategies for reduction of land rights conflicts in Madhupur Sal Forest.

Furthermore, it was thought that allowing ethnic groups unrestricted access to the forest would present a chance to use traditional methods for sustainable resource management. The distinct social structure and cultural norms of the Garo community were shaped by their reliance on the forest for their livelihoods, which raised awareness of the need to conserve forest resources [20,61–63]. The study found a complicated relationship between the local populations' concerns about losing their land, the Forest Department's land claims, and the effects on ethnic minorities in the Madhupur Sal Forest (MSF) area. The complex issues that faced by indigenous populations are shown by the strong positive correlation found between the Forest Department's land claims and concerns about losing their land, mistrust of programs for forest development, and illegal forest encroachment. The study also emphasizes how common unlawful forest encroachment is, which is fuelled by land rights disputes and ethnic minorities' lack of legal documents. Several institutions and non-ethnic people were found to have engaged in illegal encroachments that resulted in the conversion of significant MSF property for commercial use. The results highlight the necessity of an all-encompassing and inclusive strategy that considers the customary land rights of nearby people to accomplish fair and sustainable forest management. Based on the findings, several policy measures are recommended. First, there is a need to establish formal conflict resolution mechanisms, such as multi-stakeholder platforms involving Indigenous representatives, local government, and Forest Department officials, to address land disputes transparently and inclusively. Second, the Forest Department should adopt participatory forest governance approaches, ensuring meaningful involvement of Indigenous communities in decision-making, planning, and benefit-sharing processes. Third, tenure reform is necessary to recognize customary land rights, potentially through co-management arrangements or community-based forest management models that integrate statutory and customary systems. Fourth, efforts should be made to build institutional trust, including improved communication, grievance redress systems, and accountability mechanisms. These measures can help reduce

conflict, enhance equity, and strengthen long-term social-ecological resilience. Agroforestry practices offer a potential pathway to reconcile livelihood needs with forest conservation objectives. Integrating trees with agricultural systems can enhance income diversification, improve ecological sustainability, and reduce pressure on forest resources. Previous studies have shown that agroforestry can support both conservation and community resilience by aligning economic and environmental goals. In the context of Madhupur, promoting community-based agroforestry systems may help reduce land conflict while supporting sustainable resource management. As the study relies substantially on perception-based data, the findings should be interpreted primarily as reflecting community experiences and attitudes regarding land rights conflicts and governance processes. While these perceptions provide important insights into lived realities, broader structural conclusions were supported through triangulation with existing literature and official records.

Several important recommendations can be considered to address land ownership conflicts and promote sustainable land management in the Madhupur Sal forest area.

- First and foremost, it is critical to increase community involvement in decision-making processes. A deeper comprehension of local populations' customs, land tenure schemes, and conservation techniques can be attained by incorporating them into conversations.
- Second, legal reforms must be implemented to acknowledge and safeguard the customary land rights of the indigenous tribes. Conflicts over land ownership may be settled more securely if these rights are formalized and documented. Processes for allocating land that is fair and transparent must be established to avoid conflicts brought on by unauthorized tenants.
- Strengthen community resilience through participatory risk governance approaches that integrate Indigenous knowledge, customary land management systems, and inclusive decision-making mechanisms. Building trust between indigenous communities and the Forest Department is essential for improving collective action, reducing socio-environmental risks, and enhancing long-term ecosystem sustainability.
- Finally, it is critical to conduct routine monitoring and assessment of implemented interventions. Evaluating the efficacy of dispute resolution procedures and land management plans will allow for any necessary adaptive adjustments. A fair and balanced conclusion can be reached by placing a high priority on community involvement, acknowledging customary land rights, putting in place efficient dispute resolution procedures, and encouraging sustainable land management techniques.

Author Contributions

M.M.A.M.: Data collection, data analysis, writing original draft; N.T.: Conceptualisation and supervision; M.S.: Formal analysis, review and editing of the manuscript; M.G.K.: Review and editing of the manuscript; M.A.A.: Supervision, conceptualisation and review and editing of the manuscript. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

Ethical review and approval were waived for this study, because this research was classified as empirical social science research. The authors of this study have also been recognized as practitioners of nondestructive and computer-based analysis approaches that didn't result in harm to any humans or animals.

Informed Consent Statement

This study followed standard ethical research practices for research involving human participants. Informed consent was obtained from all respondents after explaining the purpose of the study, the voluntary nature of participation, and their right to withdraw at any time. Confidentiality and anonymity were strictly ensured, and no personally identifiable information has been included in the analysis or reporting. The study was conducted in accordance with accepted ethical guidelines in the absence of a formal institutional review process. Respondents' identities and their information were not disclosed anywhere. Before completing the questionnaire, all respondents were informed of the study's purpose. If they were willing to participate, they were asked to sign a consent document. Copyright consent was also obtained for the use of their comments and photos, and for photos of the slum area. Appropriate citations and copyright rules were followed when using secondary data and images. The contributions of all individuals and organizations were appropriately acknowledged.

Data Availability Statement

The data are available from the corresponding author upon reasonable request.

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Conflicts of Interest

The authors declare no conflict of interest. Given the role as an Editorial Board Member, Md. Shamsuzzoha had no involvement in the peer review of this paper and had no access to information regarding its peer-review process. Full responsibility for the editorial process of this paper was delegated to another editor of the journal.

Use of AI and AI-Assisted Technologies

During the preparation of this work, the authors used various online AI-assisted platforms solely for language editing purposes, including the improvement of grammar, spelling and readability of the manuscript to a very small extent. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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