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Socio-economic vulnerability and livelihood challenges among tribal communities: A study of drought-prone areas in Purulia District, West Bengal

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Abstract
This study investigates the socio-economic vulnerability and livelihood challenges faced by tribal communities residing in drought-prone areas of Purulia District, West Bengal. The research employs a mixed-method approach, combining primary surveys of 150 households across Jhalda, Bagmundi, and Manbazar blocks with key informant interviews and field observations, alongside secondary data from government reports and meteorological records. Quantitative data were analyzed using descriptive statistics, cross-tabulation, and vulnerability indices, while qualitative insights were interpreted thematically to capture local perspectives on coping mechanisms. The findings reveal that recurrent droughts have led to substantial livelihood loss, with 61% of households reporting crop failure, 42% experiencing temporary migration, and 48% falling below the poverty line during drought periods. Dependence on forest resources was high, with significant seasonal variation in income sources. The study also identifies adaptive strategies such as labor migration, reliance on non-timber forest products, and small-scale water conservation practices. These results underscore the urgent need for targeted policy interventions and sustainable livelihood programs to enhance resilience and reduce vulnerability among drought-affected tribal populations in Purulia.Areas of Purulia District, West Bengal"

Keywords: Vulnerability, livelihood challenges, tribal communities, drought, migration, forest dependence

Introduction

Drought is one of the most severe climatic hazards affecting livelihoods, food security, and socio-economic stability, particularly in semi-arid regions of India. It not only leads to agricultural decline but also triggers migration, poverty, and long-term vulnerability among marginalized communities (Kumar *et al*., 2019; Mishra & Singh, 2010) [15, 16]. The impacts of drought are more pronounced in areas where agriculture and forest resources form the backbone of rural livelihoods, leaving tribal and forest-fringe populations disproportionately exposed. Vulnerability to drought is a complex outcome of exposure to climatic stress, socio-economic sensitivity, and limited adaptive capacity (Adger, 2006; Hahn *et al*., 2009) [1, 12]. Purulia district of West Bengal, located in the Chotanagpur plateau fringe, is one of the most drought-prone areas in eastern India. Its undulating topography, lateritic soil, and erratic rainfall patterns make it highly susceptible to recurrent droughts and water scarcity (Chattopadhyay, 2017; Ghosh, 2020) [7, 11]. The district has a high concentration of tribal communities such as the Santhal, Oraon, and Munda, who are dependent on subsistence agriculture, wage labor, and forest resources for their livelihoods. Historical patterns of drought in Purulia have led to crop failures, livestock losses, seasonal migration, and increased poverty, which deepen socio-economic vulnerabilities and weaken community resilience (Banerjee & Das, 2017; Chakraborty, 2015) [3, 6]. Understanding the livelihood challenges and socio-economic vulnerability of these communities is therefore crucial in the context of climate variability and sustainable development. While several studies have analyzed the climatic dimension of drought, fewer have focused on its social and economic impacts on tribal and forest-dependent households in Purulia. This study aims to fill this gap by examining the ways in which recurrent droughts shape patterns of livelihood loss, poverty, and migration, and by assessing community-level adaptive strategies. By applying both quantitative and qualitative approaches, the research provides a comprehensive picture of vulnerability that can inform policy interventions and resilience-building programs tailored to drought-prone tribal regions of eastern India.

Drought is widely recognized as a slow-onset disaster with far-reaching implications for agriculture, livelihoods, and human well-being. Mishra and Singh (2010) [16] note that recurrent droughts in India have consistently reduced crop yields, leading to food insecurity and poverty. Kumar *et al*. (2019) [15] highlight that the socio-economic impacts of drought are more severe in rain-fed agricultural regions, where adaptive capacity remains limited. According to IPCC (2014), climate variability intensifies the frequency and severity of droughts, disproportionately affecting marginalized groups. Vulnerability is defined as the degree to which a system is exposed and sensitive to hazards, while lacking the capacity to adapt (Adger, 2006) [1]. Several frameworks, including the Livelihood Vulnerability Index (LVI), have been developed to quantify vulnerability by integrating exposure, sensitivity, and adaptive capacity (Hahn *et al*., 2009) [12]. Studies by O'Brien *et al*. (2004) and Vincent (2007) [25] demonstrate that vulnerability is not merely climatic but deeply rooted in socio-economic conditions such as poverty, land ownership, and access to resources. Tribal communities across India are highly dependent on subsistence agriculture, forest resources, and wage labor, which makes them particularly vulnerable to drought. Studies in Jharkhand and Odisha show that drought

conditions compel tribal households to diversify livelihoods, migrate seasonally, and rely on forest produce for survival (Jha, 2011; Sahu & Mishra, 2013) [14, 21]. Banerjee and Das (2017) [3] observed that droughts exacerbate socio-economic stress among tribal households in eastern India, reducing food availability and forcing large-scale out-migration. Migration is often seen as an adaptive strategy in drought-affected areas, but it also creates new vulnerabilities. Ellis (2000) [10] emphasized that livelihood diversification through migration provides short-term relief but fails to ensure long-term security. In Purulia and adjoining regions, Chakraborty (2015) [6] documented that recurrent drought has led to cycles of poverty and distress migration, particularly among Santhal and Oraon households. Such migration often results in exploitative labor conditions in urban areas, reflecting the structural dimensions of vulnerability. Purulia district, located on the fringe of the Chotanagpur plateau, has long been identified as one of the most drought-prone regions of West Bengal (Chattopadhyay, 2017) [7]. Ghosh (2020) [11] highlighted that erratic monsoon rainfall, lateritic soils, and deforestation have worsened water scarcity in the district. Studies by Mukherjee (2016) [18] and Banerjee (2014) [2] show that tribal communities in Purulia face high livelihood insecurity, with drought intensifying their dependence on forest resources and pushing many households into poverty. Despite these insights, research linking drought vulnerability, socio-economic challenges, and tribal adaptive strategies in Purulia remains limited, creating a gap that this study seeks to address. The literature underscores that drought has profound socio-economic implications, particularly for tribal communities dependent on fragile livelihoods. While vulnerability frameworks such as the LVI have been applied globally, their use in understanding the tribal context of Purulia is limited. Previous studies highlight migration, poverty, and livelihood loss, but few provide a comprehensive vulnerability assessment combining exposure, sensitivity, and adaptive capacity. This research therefore contributes to filling this gap by offering an integrated analysis of socio-economic vulnerability in drought-prone tribal communities of Purulia.

Material and Methods

This study adopts a mixed-method research design, integrating quantitative and qualitative approaches to assess the socio-economic vulnerability and livelihood challenges of tribal communities in drought-prone areas of Purulia District. The research was conducted in selected drought-prone blocks, namely Jhalda, Bagmundi, and Manbazar, which are characterized by high tribal populations and a strong dependence on agriculture and forest resources. A stratified random sampling technique was employed to select households, ensuring representation across different tribal groups (Santhal, Oraon, Munda) and villages with varying levels of drought severity. The final sample size comprised 150 households, with stratification based on village, household size, and livelihood type to capture diverse socio-economic conditions. Primary data were collected through structured household surveys, which gathered information on demographics, income sources, agricultural yields, forest resource dependence, migration patterns, and poverty indicators. Additionally, key informant interviews with local leaders, forest officers, and NGO representatives provided qualitative insights into the impacts of drought and community coping strategies. Field observations supplemented survey data, documenting water availability, agricultural conditions, and forest use. Secondary data were obtained from government reports on rainfall, agricultural output, and socio-economic indicators, as well as meteorological records from the Indian Meteorological Department (IMD), providing a comprehensive understanding of drought impacts and socio-economic vulnerability in the study area.

Data Analysis

Quantitative data were analyzed using descriptive statistics (mean, frequency, percentage, and standard deviation) to summarize household income, crop loss, and migration trends. Cross-tabulation was employed to examine relationships between drought exposure and socio-economic outcomes such as poverty and migration. The Livelihood Vulnerability Index (LVI) was calculated to assess overall vulnerability, using the formula:

$$LVI=\sum^{n}{}_{i}\text{-}1\ WiXi/\sum^{n}{}_{i}\text{-}1\ Wi$$

Where Xirepresents standardized indicators of exposure (e.g., rainfall deficit, drought frequency), sensitivity (e.g., dependence on agriculture or forest resources), and adaptive capacity (e.g., alternative income sources, water conservation practices), and WIdenotes the weight assigned to each indicator. Qualitative data from interviews and field observations were analyzed thematically, with responses coded into themes such as livelihood loss, coping strategies, and migration patterns. Triangulation of quantitative and qualitative data ensured validity and reliability of the findings.

Results and Discussion

The socio-economic vulnerability and livelihood challenges of tribal communities in drought-prone regions are complex and multidimensional, shaped by ecological, economic, and social factors. The results presented in this study provide insights into household characteristics, livelihood strategies, adaptive capacity, and migration patterns, highlighting the interplay between environmental stress and socio-economic marginalization. Understanding these patterns is critical for identifying the most vulnerable groups and designing targeted interventions to enhance resilience. Previous research has demonstrated that drought-prone regions in India disproportionately affect tribal populations due to their dependence on rain-fed agriculture, limited access to irrigation, and low levels of education and financial capital (Banerjee & Das, 2017; Choudhury, 2021) [3, 4]. These factors increase both the exposure and sensitivity of households to climatic shocks while constraining their adaptive capacity (Sharma & Singh, 2017; Samantray, 2025) [22, 23]. Livelihood diversification, including wage labor, forest resource collection, and migration, is often employed as a coping strategy, particularly among landless and small-landholding households (UNDP, 2016) [24]. This section presents a detailed analysis of the sampled households' socio-economic profiles, landholding-dependent livelihood strategies, vulnerability index scores, and migration patterns. Each aspect is discussed in relation to existing literature to contextualize the findings and highlight the structural and environmental factors that exacerbate vulnerability. By integrating quantitative data

with qualitative observations, this discussion aims to provide a comprehensive understanding of the livelihood challenges faced by tribal communities in drought-prone areas, which is essential for designing effective policy measures and sustainable interventions.

Socio-Economic Profile of Tribal Households in Drought-Prone areas

Understanding the socio-economic characteristics of tribal households is critical to assess their vulnerability and livelihood strategies in drought-prone regions. The sampled households in Purulia District display patterns typical of communities dependent on subsistence agriculture and natural resources. Results indicate that the average household size is 5.4 members, with 62% male-headed households and 38% female-headed households. The average literacy rate among household heads is 46%, significantly below the district average (Census, 2011) [8].

Table 1: Socio-Economic Profile of Sampled Households

Variable	Mean / %	Std. Dev.	Remarks
Household size	5.4	1.2	Larger family size increases dependency ratio
Male-headed households	62%	-	Female-headed households more vulnerable
Literacy rate (HH head)	46%	8.1	Below state average
Primary occupation: agriculture	71%	-	Highly dependent on rain-fed agriculture
Secondary occupation: wage labor	58%	-	Seasonal migration common

Source: Field data (2025)

The socio-economic profile (Table 1) of the sampled households highlights the structural vulnerabilities of tribal communities living in drought-prone areas. The average household size is 5.4 members, which is relatively large and implies a high dependency ratio. Larger families often face greater strain on household resources, especially when livelihoods are dependent on subsistence agriculture and irregular wage labor. A majority of households (62%) are male-headed, while the presence of female-headed households, though smaller in proportion, is notable for their increased vulnerability, given women's limited access to land, credit, and decision-making power. The literacy rate of household heads is only 46%, which is significantly below the state average, indicating limited human capital and reduced opportunities for formal employment. Low literacy also constrains awareness about government welfare schemes and adaptation strategies, thereby deepening socio-economic risks. In terms of occupational structure, 71% of households rely primarily on agriculture, which is predominantly rain-fed and highly exposed to drought risks. The lack of irrigation and modern inputs makes agricultural productivity unstable. As a coping strategy, 58% of households engage in wage labor as a secondary occupation, often involving seasonal migration to nearby towns and urban centers. This dual dependence on vulnerable agriculture and insecure wage labor underscores the precarious nature of tribal livelihoods. Overall, the socio-economic profile reflects a cycle of marginalization where low literacy, dependence on climate-sensitive agriculture, and reliance on seasonal wage labor contribute to heightened livelihood insecurity and long-term socio-economic vulnerability.

Livelihood dependence and income diversification strategies

Cross-tabulation between landholding size and income sources shows that households with smaller landholdings (<1 acre) are more dependent on forest produce and wage labor, while households with moderate land (1–3 acres) attempt crop diversification.

Table 2: Cross-Tabulation of Landholding and Livelihood Strategies

Landholding Size	Agriculture Only	Agriculture + Wage Labor	Agriculture + Forest Collection	Migration Dependency
<1 acre (38%)	12%	42%	31%	15%
1–3 acres (44%)	34%	28%	26%	12%
>3 acres (18%)	51%	22%	17%	10%

Source: Field data (2025)

Table 2 illustrates the relationship between landholding size and the livelihood strategies adopted by households in drought-prone tribal areas. The data reveal a clear pattern where land size significantly influences livelihood diversification and dependency. Among households with less than 1 acre of land (38%), only 12% depend solely on agriculture, while a majority diversify their livelihood through agriculture combined with wage labor (42%) or agriculture combined with forest collection (31%). This indicates that small landholders are highly dependent on multiple income sources to meet subsistence needs, highlighting their vulnerability to both climatic shocks and market fluctuations. Notably, 15% of these households depend on migration, reflecting the extreme coping strategy employed by land-constrained families. Households with 1–3 acres of land (44%) show a relatively higher proportion (34%) relying exclusively on agriculture. However, a significant share still engages in wage labor (28%) or forest collection (26%), suggesting that even medium-sized landholders require supplementary income, though their dependence on migration (12%) is slightly lower compared to smallholders. In the case of households owning more than 3 acres of land (18%), 51% are solely dependent on agriculture, indicating that larger landholdings provide greater self-sufficiency and reduce the need for supplementary livelihood activities. The proportion of households engaging in wage labor (22%) or forest collection (17%) declines, and migration dependency (10%) is the lowest among all categories. This trend confirms that larger landholdings buffer households against livelihood insecurity and reduce exposure to socio-economic vulnerability. Overall, the cross-tabulation demonstrates that

landholding size is a critical determinant of livelihood strategies, with smaller landholders forced into diversification, forest resource dependence, and migration, whereas larger landholders enjoy relative stability. These patterns underscore the interlinkage between land scarcity, livelihood vulnerability, and adaptive strategies in drought-prone tribal communities.

Socio-Economic Vulnerability of Households

The Livelihood Vulnerability Index (LVI) (Hahn *et al*., 2009) [12] was applied, incorporating dimensions of exposure, sensitivity, and adaptive capacity. Indicators included income level, food security, health access, education, and migration stress.

Table 3: Household Vulnerability Index Scores

Vulnerability Dimension	Mean Score (0–1)	Interpretation
Exposure (drought frequency, rainfall variability)	0.71	Very High
Sensitivity (crop failure, food insecurity)	0.64	High
Adaptive Capacity (education, savings, access to govt. schemes)	0.39	Low
Composite LVI	0.58	Moderate to High Vulnerability

Source: Field data (2025)

Table 3 presents the Livelihood Vulnerability Index (LVI) scores for sampled households, capturing their exposure, sensitivity, and adaptive capacity in drought-prone areas. The exposure dimension, which considers factors like drought frequency and rainfall variability, has a high mean score of 0.71, indicating that households are very highly exposed to climatic stresses. This reflects the recurrent nature of droughts and erratic rainfall patterns in the study area, which directly threaten agricultural productivity and water availability. The sensitivity dimension, incorporating aspects such as crop failure and food insecurity, has a mean score of 0.64, signifying high sensitivity. This shows that households are significantly affected when climatic shocks occur, largely due to their dependence on rain-fed agriculture and limited access to alternative income sources. In contrast, the adaptive capacity dimension, which includes literacy, savings, and access to government schemes, has a relatively low mean score of 0.39. This suggests that households have limited ability to cope with or adapt to drought impacts, reflecting low human capital, inadequate financial reserves, and insufficient utilization of support programs. The composite LVI score of 0.58 indicates moderate to high overall vulnerability. This implies that the tribal households in the study area are not only highly exposed to climatic hazards but also face substantial constraints in coping with these stresses, making them socio-economically and environmentally vulnerable. Overall, the LVI analysis reinforces the patterns observed in landholding and livelihood strategies: smaller landholders and households dependent on multiple livelihood sources are particularly susceptible, while limited adaptive capacity exacerbates their vulnerability to recurring droughts.

Impact of Recurrent Droughts on Livelihoods

Recurrent droughts in the study area have significantly affected agricultural productivity, household income, and food security among tribal communities. Table 1 summarizes the impact of drought on key livelihood indicators, based on the surveyed households.

Table 4: Impact of Recurrent Droughts on Livelihoods

Indicator	% of Households Affected	Remarks
Crop failure (partial/total)	68	Most households rely on rain-fed agriculture
Reduction in household income	59	Significant decline during drought years
Food insecurity (less than 2 meals/day)	41	Seasonal hunger observed during droughts
Livestock loss	28	Livestock mortality due to scarcity of fodder and water
Dependence on wage labor	54	Increased during drought years
Forest resource collection	36	Increased reliance on forest products as alternative income

The data (Table 4) indicate that 68% of households experienced partial or total crop failure during recurrent droughts, reflecting the vulnerability of rain-fed agriculture in the study area. Consequently, 59% of households reported a reduction in household income, which exacerbates poverty and restricts expenditure on food, health, and education. Food insecurity affected 41% of households, with many experiencing seasonal hunger during peak drought periods. Livestock losses were reported by 28% of households, mainly due to the scarcity of fodder and water. In response to these stresses, 54% of households increased their dependence on wage labor, and 36% relied more on forest resources for supplementary income. These findings highlight the direct and indirect effects of recurrent droughts on tribal livelihoods, emphasizing the need for adaptive strategies such as crop diversification, irrigation facilities, and livelihood support programs to reduce vulnerability and enhance resilience (Banerjee & Das, 2017; Choudhury, 2021) [3, 4].

Migration Patterns among Households

The chi-square analysis indicates a statistically significant association between drought occurrence and seasonal migration ($p < 0.05$), confirming that households in drought-affected areas are more likely to send members to seek temporary employment elsewhere. Migration is particularly prevalent among young male members, reflecting gendered labor patterns where men are primarily responsible for earning wages outside the village. Approximately 57% of households reported at least one migrant worker, with most engaged in low-paid construction or quarry work in nearby districts. This trend highlights how recurrent droughts exacerbate household poverty by reducing agricultural income and compelling households to rely on precarious,

irregular labor opportunities. Seasonal migration thus emerges as both a coping strategy and an indicator of livelihood vulnerability, reinforcing the cycle of poverty and limited adaptive capacity in drought-prone tribal communities.

Table 5: Migration Patterns among Households

Migration Status	% of Households	Destinations	Remarks
No Migration	43	-	Mostly landowners with irrigation
Seasonal Migration	38	Asansol, Durgapur, Ranchi	Linked with drought years
Permanent Migration	19	Kolkata, Jamshedpur	Linked with distress and landlessness

Source: Field data (2025)

Table 5 presents the migration patterns observed among households in the drought-prone tribal communities. Migration emerges as a key livelihood strategy, particularly in response to climatic stress and socio-economic vulnerability. Approximately 43% of households do not migrate, which is largely comprised of landowners with access to irrigation. These households are relatively self-sufficient and less dependent on external income sources, reflecting their ability to sustain livelihoods locally even during droughts. Seasonal migration accounts for 38% of households, with key destinations including Asansol, Durgapur, and Ranchi. This form of migration is typically linked to drought years, when agricultural yields are insufficient to meet household needs. Seasonal migrants often engage in wage labor or casual employment in urban or peri-urban areas to supplement household income, reflecting a coping mechanism to buffer against agricultural and climatic uncertainty. Permanent migration is reported by 19% of households, primarily to Kolkata and Jamshedpur. This group generally includes landless or extremely small-landholding households, whose migration is driven by distress rather than choice. Permanent migration indicates severe livelihood vulnerability, as households are compelled to relocate entirely in search of stable income and survival opportunities. Overall, migration patterns underscore the link between landholding, drought exposure, and livelihood insecurity. Smaller and landless households are disproportionately affected and are more likely to adopt migration—seasonal or permanent—as a strategy to mitigate the adverse impacts of drought and limited local opportunities.

Coping Mechanisms and Adaptive Strategies

Households in the drought-prone tribal areas of Purulia adopt multiple coping mechanisms and adaptive strategies to mitigate the adverse impacts of recurrent droughts. These strategies range from livelihood diversification to reliance on social networks and government programs. Table 3 summarizes the major coping mechanisms identified among the surveyed households.

Table 6: Coping Mechanisms and Adaptive Strategies of Households

Coping Mechanism / Strategy	% of Households	Remarks
Diversification of livelihood (agriculture + wage labor)	58	Reduces dependence on a single income source
Seasonal migration	38	Temporary employment during drought periods
Forest resource collection	36	Supplements income and food requirements
Borrowing / taking loans	29	Short-term coping for income deficit
Participation in government schemes (MGNREGA, PDS, subsidies)	42	Provides limited financial and food security
Water conservation / storage practices	27	Rainwater harvesting, small-scale irrigation

Source: Field data (2025)

The results (Table 6) indicate that 58% of households diversify their livelihoods by combining agriculture with wage labor to reduce vulnerability to crop failure. Seasonal migration (38%) and forest resource collection (36%) serve as alternative income sources during drought years, reflecting households' reliance on multiple strategies to cope with environmental stress. Borrowing and taking loans (29%) is a short-term strategy used to meet immediate financial needs but can increase household indebtedness. Participation in government schemes (42%) such as MGNREGA, public distribution system (PDS), and subsidies provides partial support for income and food security. Some households (27%) have adopted water conservation and storage practices, including rainwater harvesting and small-scale irrigation, to improve agricultural resilience. These findings suggest that tribal households employ a combination of reactive and proactive strategies to manage drought-induced risks. While diversification and migration help sustain livelihoods in the short term, low access to formal adaptive resources and limited financial capital constrain long-term resilience (Banerjee & Das, 2017; Choudhury, 2021; UNDP, 2016) [3, 4, 24].

Major livelihood challenges and coping strategies

Tribal communities in drought-prone areas of Purulia District face multiple livelihood challenges that are closely linked to environmental, socio-economic, and structural factors. These challenges not only threaten household income and food security but also shape the adaptive strategies employed by these communities.

Table 7: Major Challenges and Coping Mechanisms

Challenges (Ranked)	% of Households	Coping Strategy Adopted
Water scarcity	78	Migration, wage labor
Crop failure	65	Borrowing, livestock sale
Lack of irrigation	62	Shift to drought-resilient crops
Low market access	49	Barter, informal trade
Health service inaccessibility	38	Traditional healers

Source: Field data (2025)

The table -7 highlights the major challenges faced by households in the study area and the strategies they adopt to cope with these adversities. Water scarcity emerges as the most prevalent issue, affecting 78% of households. To manage this, households' resort to migration or taking up wage labor, indicating a high dependence on labor mobility as a coping strategy. Crop failure, reported by 65% of households, forces families to borrow money or sell livestock, showing that agricultural setbacks directly impact both financial stability and asset holdings. Similarly, lack of irrigation, affecting 62% of households, has led many to shift toward drought-resilient crops, reflecting adaptation through agricultural diversification. Low market access is a concern for 49% of households, who cope by engaging in barter or informal trade, suggesting limited integration into formal economic systems. Finally, health service inaccessibility, noted by 38% of households, results in reliance on traditional healers, indicating a gap in formal healthcare infrastructure and the persistence of indigenous health practices. Overall, the data suggest that the households employ a mix of migration, asset liquidation, agricultural adaptation, informal economic activities, and traditional knowledge to navigate socio-economic and environmental vulnerabilities. These coping mechanisms reflect both resilience and exposure to structural limitations in the region.

Conclusion

The present study highlights that drought has emerged as a critical driver of socio-economic vulnerability and livelihood insecurity among tribal communities in the drought-prone areas of Purulia District. Findings indicate that households are largely dependent on rain-fed agriculture and forest resources, with limited adaptive capacity due to low literacy, inadequate irrigation, and poor institutional support. The application of the Livelihood Vulnerability Index (LVI) reveals a moderate to high level of vulnerability (0.58), primarily shaped by high exposure to recurrent droughts and limited diversification of income sources. A significant proportion of households are compelled to resort to seasonal and permanent migration, which functions as both a coping strategy and a symptom of livelihood stress. Such migration often results in precarious employment and deepens cycles of poverty and indebtedness (Deshingkar & Start, 2003; Mosse *et al*., 2005) [9, 17]. Coping mechanisms, such as selling livestock, borrowing at high interest, and distress migration, are largely unsustainable and intensify long-term vulnerability (Chambers, 1989; Scoones, 1998) [5, 20]. The study further emphasizes that forest-fringe tribal households—particularly Santhal, Oraon, and Munda communities—face heightened risks due to their dual dependence on fragile ecosystems and marginal agriculture (Saha, 2012; Banerjee & Das, 2017) [3, 19]. Institutional interventions such as watershed management, livelihood diversification, community-based water harvesting, and social safety nets are urgently required to strengthen adaptive capacity (Adger, 2006; IPCC, 2014) [1]. In conclusion, the research underscores that addressing socio-economic vulnerability in Purulia's tribal communities requires a multi-dimensional strategy combining ecological resilience, livelihood diversification, and inclusive policy measures. Without such interventions, recurring droughts will continue to exacerbate migration, poverty, and livelihood loss, deepening the structural marginalization of tribal households in Purulia.

Recommendations

A sustainable pathway to reducing socio-economic vulnerability in drought-prone areas of Purulia lies in integrated water resource management. Given the high dependence of tribal households on rain-fed agriculture, interventions such as rainwater harvesting, watershed development, and revival of traditional tanks and check dams are crucial for improving water availability during dry spells. These measures not only enhance agricultural productivity but also reduce the frequency of distress migration by stabilizing local livelihoods. Strengthening irrigation infrastructure alongside community-led water governance can ensure equitable access to water, thereby enhancing the adaptive capacity of marginalized tribal groups and fostering long-term resilience against recurring droughts (Chambers, 1989; Adger, 2006; IPCC, 2014) [1, 5].

1. **Water Resource Management**
   - Promote rainwater harvesting, watershed development, and revival of traditional tanks and check dams to reduce dependence on erratic rainfall.
   - Strengthen small-scale irrigation infrastructure to improve crop security during drought years.

2. **Livelihood Diversification**
   - Encourage non-farm employment opportunities (handicrafts, poultry, goat rearing, small-scale enterprises).
   - Enhance skill development programs under MGNREGA, NRLM, and tribal welfare schemes to reduce distress migration.

3. **Climate-Smart Agriculture**
   - Introduce drought-resistant crop varieties (e.g., millets, pulses) and promote mixed cropping systems.
   - Provide training in sustainable agricultural practices and integrated farming systems.

4. **Social Security and Safety Nets**
   - Expand coverage of PDS and food security programs during drought years.
   - Improve access to healthcare, education, and nutrition programs, especially for women and children.

5. **Forest-Based Livelihood Support**
   - Strengthen market linkages for Non-Timber Forest Products (NTFPs) such as mahua, sal leaves, and kendu leaves.
   - Encourage community-based forest management (CBFM) to balance livelihood needs and conservation.

6. **Migration Management**
   - Establish migration support centers to provide skill training, legal protection, and welfare measures for migrants.
   - Generate local employment opportunities to reduce distress-driven migration

   .

7. **Institutional and Community Strengthening**
   - Involve Panchayats, NGOs, and tribal cooperatives in drought mitigation planning.
   - Ensure active participation of women and marginalized groups in decision-making processes.

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