INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
ISSN Print: 1560–8530; ISSN Online: 1814–9596
25–295/2025/34:340410
http://www.fspublishers.org

Full Length Article

Community Engagement Under Green India Mission: Benefits and Challenges in Balangir District, Odisha, India

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Received 25 March 2025; Accepted 05 May 2025; Published online 21 June 2025

Editor: Mubasher Hussain

Abstract

Reforestation has become a global priority for combating climate change, restoring degraded ecosystems, and sustaining livelihoods, particularly for forest-dependent communities. Green India Mission (GIM) plays a critical role in promoting large-scale reforestation efforts in India. This study evaluated the effectiveness of GIM initiatives in Balangir District, Odisha, focusing on the benefits achieved and the challenges faced by local communities. The research utilized a semi-structured survey of 60 participants, supported by descriptive statistics, multivariate probit modeling, and structural equation modeling to identify factors shaping perceptions of reforestation. The results revealed that 30% of respondents reported enhanced forest cover and ecosystem health, 20% cited climate change mitigation benefits, and 15% observed livelihood improvements. Multivariate probit modeling indicated a strong positive relationship between age and beliefs about reforestation ($P = 0.041$), and between sources of income and strong belief in reforestation benefits ($P = 0.000$). Structural equation modeling demonstrated significant associations between agricultural experience and climate responsibility, and between risk awareness and perceptions of reforestation benefits. Recognition of reforestation's importance also significantly improved the ability to address displacement ($\beta = 0.330$) and land access issues ($\beta = 0.111$). The findings underscore the critical need for inclusive, community-driven strategies to enhance the impact and sustainability of GIM and similar reforestation programs.

Keywords: Climate change; Community engagement; Green India Mission; Livelihood; Reforestation

Introduction

Global decline in forest cover, driven by wildfires and deforestation, and other human- induced factors, threatens ecosystems, climate stability and community livelihoods. Restoration efforts aim to revive degraded forests and support communities through forest-based resources (Behera *et al*. 2024). Several countries, including China, the Philippines, and India, have launched major reforestation initiatives aimed at restoring degraded forest lands and promote both environmental health and sustainable livelihoods (Wang *et al*. 2021; Angom and Viswanathan 2022). Forest degradation contributes nearly 17% of global carbon emissions (Baccini *et al*. 2012), emphasizing the critical role of the forestry sector in climate change mitigation, as acknowledged by international frameworks like the Kyoto Protocol's Clean Development Mechanism (Damodar and Nibal 2020; Psistaki *et al*. 2024; Rana *et al*. 2024).

In India, forests and tree cover span approximately 24.62% of the total geographical area (Singh 2024), with Odisha contributing significantly to a net increase of 1,445 sq. km in forest cover between 2021 and 2023 (India State of Forest Report 2023). India's progress in enhancing its carbon stock by 2.29 billion tons since 2005 (India State of Forest Report 2023), aligns with its Paris Climate Agreement target of 3 billion tons by 2030 (Iqbal *et al*. 2023; Mudhee *et al*. 2024). To further combat forest degradation, mechanisms like REDD/REDD+ have been adopted globally (Obersteiner *et al*. 2009) and India has pledged to restore up to 26 million ha of degraded land under the Bonn Challenge (Borah and Ishwar 2018).

As part of its national efforts, the Government of India launched the Green India Mission (GIM) in 2014, one of the eight Missions under the National Action Plan on Climate Change (NAPCC), aligning with earlier forest policy frameworks. The mission aims to enhance carbon sequestration and ecosystem sustainability (Clark *et al*.

To cite this paper: Jena D, N Dibiat, S Patnaik, P Mishra, NR Parida, D Mohapatra, HS Ganesha (2025). Community engagement under green India mission: Benefits and challenges in Balangir District, Odisha, India. *Intl J Agric Biol* 34:340410. https://doi.org/10.17957/IJAB/15.2382

2021; Duraisami *et al*. 2022), while ensuring equitable resource access for local communities (Meena *et al*. 2022). It also targets the expansion of forest and tree cover by 5 million ha and the improvement of forest quality across an additional 5 million ha of forest and non-forest lands (Singh *et al*. 2016).

Key reforestation terms essential to this study include rehabilitation (restoring forest stability and native vegetation) (Jong 2010), afforestation (tree planting on previously forested land) (Pommerening and Murphy 2004) and restoration (re-establishing original forest ecosystem structure and functions) (Jacobs *et al*. 2015). In this study, rehabilitation refers specifically to reforestation activities undertaken for livelihood, environmental, or productive purposes, treated synonymously with reforestation efforts in India.

Although the ecological benefits of reforestation are well documented, limited research exists on its socio-economic impacts, particularly concerning livelihoods, household incomes, and social resilience among impoverished communities (Le *et al*. 2012; Angom and Viswanathan 2022). Despite substantial investments, comparative studies identifying cost-effective, scalable, and locally tailored solutions remain scarce (Behera *et al*. 2024). Few studies investigate how communities perceive and interact with reforestation projects (Nagendra 2007; Kumsap and Indanon 2016; Kumar *et al*. 2021), and region-specific analyses, such as for Balangir, Odisha, are particularly limited (Fleischman *et al*. 2021; Rana and Miller 2021).

Balangir District was selected for this study due to its significant forest-dependent population, history of land degradation, and active implementation of the Green India Mission. The district presents a valuable case to assess how reforestation initiatives influence both ecological restoration and community livelihoods in a semi-arid, socio-economically vulnerable region.

The study aimed to assess the effectiveness of the Green India Mission's reforestation initiatives in Balangir District, Odisha, focusing on ecological restoration, livelihood enhancement, and social outcomes. The objectives were to identify key benefits and challenges of reforestation, analyse community perceptions, and explore factors that influence the long-term sustainability of reforestation efforts and engagement, and identify factors influencing the sustainability of reforestation efforts. This study was required to understand region-specific challenges, strengthen community involvement, and offer actionable insights for making reforestation initiatives more inclusive, effective, and sustainable. By addressing these gaps, the research seeks to contribute to improving the long-term success and policy relevance of the Green India Mission and similar programs.

Materials and Methods

Study area

This study was conducted in Balangir District, which spans approximately 6,575 square kilometers and consists of 14 administrative blocks. Geographically, the district lies between 20°11'40 - 21°05'08 N latitude and 82°41'15 - 83°40'22 E longitude, bordered by several neighboring districts: Bargarh to the north, Kalahandi to the south, Sonepur to the east and Nuapada to the west. The average maximum temperature in the study area is 34.9°C, while the average minimum temperature is 21.0°C. The region receives an average annual rainfall of 1,289 millimeters during the monsoon season, which occurs between June and August, with prevailing southwesterly monsoon winds. These climatic data are based on agricultural records from the Government of Odisha. The forests of Balangir District are home to a variety of medicinal plants, bamboo, timber species, and Sal (*Shorea robusta*), among others. In the region, hilly areas are largely dominated by forests, with agricultural patches scattered across the slopes. Conversely, flatlands present ideal environments for various farming practices. Among the crops grown, paddy and pulses are the most significant. It is important to note that merely 12.50% of the total agricultural land is irrigated, with wells and tube wells serving as the main sources of irrigation as illustrated in Fig. 1.

The Green India Mission (GIM) has initiated the planting of a variety of tree species across Odisha, focusing on the enhancement of forest cover and the promotion of biodiversity. In Balangir district, although comprehensive data remains limited, the following species have been consistently selected for afforestation efforts, aligning with the mission's broader environmental and ecological goals:

1. Timber species

- **Teak** (*Tectona grandis*): Valued for its high-quality wood, commonly planted in suitable forest areas.
- **Rosewood** (*Dalbergia latifolia*): Known for its durable and decorative timber.
- **Sisso** (*Dalbergia sissoo*): A fast-growing, deciduous tree with valuable hardwood.
- **Mahogany** (*Swietenia macrophylla*): Prized for its straight-grained, reddish-brown timber.
- **Bija** (*Pterocarpus marsupium*): Also known as Indian Kino, valued for its hardwood and medicinal properties.
- **Sal** (*Shorea robusta*): A significant timber species in Odisha, known for its hard, durable wood.

2. Fast-growing species

- **Brown salwood** (*Acacia mangium*): A species used for its rapid growth and adaptability to various soil types.
- **Gambhar** (*Gmelina arborea*): A fast-growing tree with versatile timber used in construction and furniture.
- **K*asi*** (*Bridelia retusa*): A medium-sized deciduous tree used in afforestation.

- **Tentra** (*Dillenia pentagyna*): Known for its ecological benefits and use in traditional medicine.

3. Bamboo species

- **Bamboo** (*Bambusoideae* spp.): Planted for its ecological benefits and economic value, supporting local livelihoods.

4. Fruit-bearing species

- **Mango** (*Mangifera indica*): Cultivated for its fruit and to support agroforestry initiatives.
- **Jackfruit** (*Artocarpus heterophyllus*): Planted for its large, nutritious fruit and as a shade tree.
- **Jamun** (*Syzygium cumini*): Known for its edible fruit and medicinal properties.

5. Medicinal and NTFP species

- **Neem** (*Azadirachta indica*): Valued for its medicinal properties and used in various traditional remedies.
- **Karanja** (*Pongamia pinnata*): Known for its oil seeds and use in traditional medicine.
- **Mahua** (*Madhuca indica*): A vital source of flowers and seeds used in local cuisine and traditional practices.

These species are carefully selected for their ecological adaptability, economic significance, and benefits to local communities. The choice of species aims to balance environmental restoration with sustainable livelihoods opportunities, ensuring the dual benefits of ecosystem recovery and resource provision for the well-being of the local population (Sacco *et al*. 2021).

Data collection

A survey was conducted among households participating in activities related to the GIM project, specifically those involved in tree planting over the past three years and willing to increase their participation. The survey conducted in June and July 2024, included 60 households and utilized a semi-structured questionnaire. The questionnaire covered topics such as households' attitudes toward reforestation, the benefits of tree planting, and the challenges associated with reforestation in the study area.

To refine the instrument, a preliminary survey of 10 households was conducted to ensure completeness and assess the time required for responses. The questionnaire was finalized with participants' approval, ensuring confidentiality of personal data. The questionnaire included closed-ended questions (*e.g*., multiple-choice) and was divided into three sections: respondents' demographic characteristics, cognitive factors (*e.g*., perceptions of reforestation benefits and challenges),

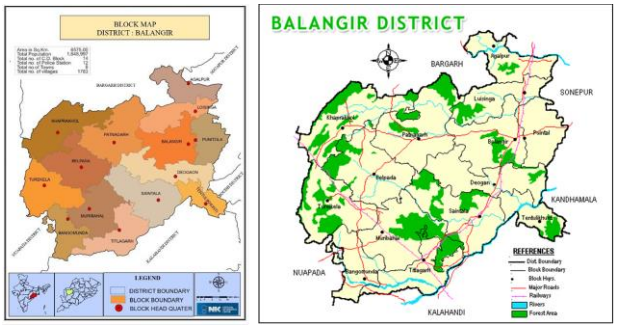

Fig. 1: Location map and forest cover map of the study area
Source: National Informatics Center (GIS Division), Bhubaneswar, Odisha, India

and other relevant aspects. The structure and content of the questionnaire were informed by a review of relevant literature on reforestation.

Reliability was assessed using Cronbach's alpha, which yielded a score of 0.81, indicating satisfactory internal consistency. This result validates the trustworthiness and suitability of the data for further analysis, providing a robust foundation for understanding household perspectives and improving future reforestation efforts.

Data analysis

This investigation utilized a range of statistical techniques with IBM SPSS Statistics version 21 for data analysis. The initial phase involved deriving essential descriptive statistics, such as means, frequencies, and standard deviations, to profile farmers and their agricultural practices. The study encompassed nine independent variables: gender, age, educational qualifications, duration of agricultural experience, income level, and aspirations related to agricultural engagement. Additionally, the survey sought to identify the geographical areas where reforestation initiatives had been executed. Dependent variables were farmers' awareness of reforestation benefits and challenges.

The survey incorporated ten questions to assess awareness of reforestation benefits, capturing respondents' perceptions, beliefs, sense of accountability, and the challenges associated with reforestation. Binary logistic regression analyses with parametric and non-parametric correlation techniques, such as Pearson's r, Kendall's tau, and Spearman's rho, were employed to explore variety of bivariate approaches in order to examine variations among respondents and identify factors influencing the proposed hypotheses.

A Structural Equation Model (SEM) was employed to further explore potential causal relationships and latent variables influencing decision-making. A Partial Least Squares Structural Equation Model (PLS-SEM) was constructed with the help of SmartPLS v. 4.0.8.8, which also helped to clarify the causal relationships between independent and dependent variables, predict both visible and hidden effects, and identify interdependencies among variables influencing their beliefs (Fig. 2).

Table 1: Explanatory variables

Symbol	Explanatory variables	Range value	Explanation
Respondent characteristics (Xi)			
X1	Age	1-4	(15-30) years (1); (31-45) years (2); (46-60) years (3); (> 60) years (4)
X2	Gender	1-3	Male (1), Female (2), Prefer not to say (3)
X3	Education	0-4	Illiterate (0), Primary stage (1), Secondary (2), Tertiary (3), Vocational training (4)
X4	Farming experience	1-4	Less than 4 years (1), 4-10 (2), 11-15 (3), More than 15 years (4)
X5	Labour force	1-3	Family members (1), non-family members (2), both family and non-family members (3)
X6	Occupation type	0-1	Off-farm activity (non-farm income) (0), Farm activity (1)
X7	Household size	1 - 3	1-(2); 2-(3); 3-(> 3)
X8	Land size (ha)	0-1	Less than 1 ha (0), 1-5 ha (1)
X9	Main crop	1-6	paddy (1), mango (2), maize (3), and coconut (4), vegetables (5), other (specify) (6)
X10	Livestock	1-2	Yes (1) No (2)
X11	Working hours	0-6	By hours
X12	Farm management practice	0-2	Rainfed (0), irrigated (1), mixed (2)
X13	Tree survival rates	%	Percentage of tree survival
X14	Main Income	INR	Forest-based resources (Indian Rupees) (1), Others (Indian Rupees) (2)
X15	land ownership	1-2	Private holdings (1), community land (2)
The Benefits of Reforestation (BRi)			
BR1	Enhancement of forest cover and ecosystem health	0-1	No (0), Yes (1)
BR2	Climate change mitigation	0-1	No (0), Yes (1)
BR3	Livelihood improvements	0-1	No (0), Yes (1)
BR4	Soil and water conservation	0-1	No (0), Yes (1)
BR5	Community training and awareness programs	0-1	No (0), Yes (1)
BR6	Promotion of native species	0-1	No (0), Yes (1)
The Challenges of Reforestation (CRi)			
CR1	Displacement and access restrictions	0-1	No (0), Yes (1)
CR2	Conflict with land rights	0-1	No (0), Yes (1)
CR3	Monoculture plantations	0-1	No (0), Yes (1)
CR4	Livelihood disruption	0-1	No (0), Yes (1)
CR5	Lack of community Involvement	0-1	No (0), Yes (1)
CR6	Ecological concerns	0-1	No (0), Yes (1)
Climate change awareness (CCA)			
CCA	Climate change awareness	0-1	No (0), Yes (1)

Results

The survey included 60 respondents, comprising 40 males and 20 females. The project's objectives and a strong desire to plant trees were reflected in the fact that most of these people resided in wooded areas. The age of the respondents ranged from 20 to 55, with an average age of 37.5. Regarding land ownership, 90% of households operated traditional private holdings, while 10% relied on community land for farming and livestock purposes. Participants reported growing ten different food crops, such as paddy (*Oryza sativa* L.), mango (*Mangifera indica*), maize (*Zea mays* L.) and coconut (*Cocos nucifera)*, on landholdings that ranged from 0 to 5 ha. Additionally, 20% of respondents were engaged in livestock rearing. Interviews were conducted in the participants' native language, covering demographic factors such as gender, household size, and age (Table 1). Respondents also provided details about their cultivated land area, the types of crops they grow, tree survival rates, management practices, and the challenges in tree planting. Additionally, they shared insights into their working hours, income and biodiversity in their environment. To further explore the benefits and challenges of tree planting, comprehensive qualitative interviews were conducted, offering a nuanced understanding of the respondents' experiences and perspectives:

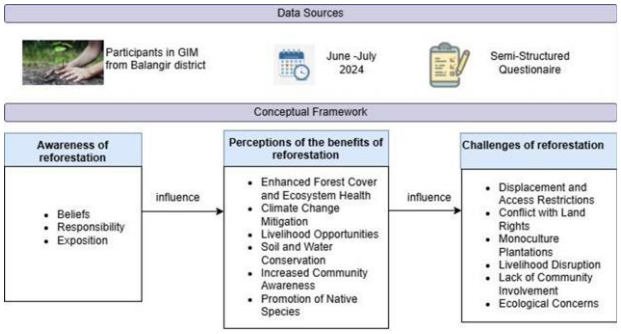

Fig. 2: Data sources with conceptual framework of the study
Source: Designed by author

Reforestation and its benefits

The Green India Mission (GIM) has yielded significant benefits in regions like Balangir, as reported by the 60 participants surveyed. About 30% of respondents highlighted the enhancement of forest cover and ecosystem health, including enhanced biodiversity, soil fertility, and natural habitat restoration. Another 20% recognized the role of GIM in climate change mitigation, noting that increased forest biomass aids carbon sequestration and helps regulate local microclimates. Around 15% observed livelihood

Table 2: Results of believes respondents about the benefits of reforestation

Benefit Category	Frequency	Percentage
Enhancement of forest cover and ecosystem health	18	30
Climate change mitigation	12	20
Livelihood improvements	9	15
Soil and water conservation	9	15
Community training and awareness programs	6	10
Promotion of native species	6	10

Source: Field survey 2024

Table 3: Results of believes respondents about the challenges of reforestation which they faced

Challenge Category	Frequency	Percentage
Displacement and Access Restrictions	18	30
Conflict with Land Rights	12	20
Monoculture Plantations	10	16.67
Livelihood Disruption	8	13.33
Lack of Community Involvement	7	11.67
Ecological Concerns	5	8.33

Source: Field survey 2024

improvements through jobs created in nursery development, plantation drives, and forest management, as well as the promotion of sustainable practices like agroforestry. Similarly, 15% noted better soil and water conservation, citing reduced soil erosion, improved groundwater recharge, and enhanced water availability. Meanwhile, 10% of participants appreciated the community training and awareness programs that empowered locals to adopt eco-friendly practices. Lastly, 10% acknowledged the promotion of native species, ensuring a balance between biodiversity and traditional forest use (Table 2). These findings underscore the multi-faceted benefits of the GIM project while highlighting its importance for environmental restoration and community welfare in Balangir.

The respondents identified the enhancement of household income through tree-related payments as the foremost advantage of tree farming. Among the eight farmers interviewed, seven underscored the significance of tree planting as a long-term financial strategy, particularly regarding potential revenue from timber and the provision of materials for construction, which they perceived as essential for their children's future well-being. In contrast, one participant raised concerns about the dependability of these future benefits, noting that the value of the trees could vary based on market fluctuations and shifting government priorities.

According to data collected from the survey, a considerable 99% of participants expressed favorable opinions about the tree-planting initiative, recognizing its valuable contributions to both ecological and economic aspects. Since 2021, many respondents 80% have noted significant changes in wildlife populations on their properties, attributing these observations to the increased tree density that has drawn a diverse array of species. The local environment has been enhanced by this increase in biodiversity, and families now have the chance to re-establish a connection with creatures that hold cultural significance. Moreover, among those surveyed, an impressive 98% expressed a strong enthusiasm for broadening their planting efforts to include a greater diversity of tree species and ground-cover vegetation.

The challenges of reforestation

Based on the feedback from 60 participants, the major issues faced by the Balangir population during the Green India Mission plantation project include: 30% of respondents reported displacement and restricted access to forest resources, emphasizing their reliance on forest produce for livelihood. Conflicts over land rights due to overlapping claims under the Forest Rights Act were noted by 20%. Issues arising from monoculture plantations, such as soil degradation and biodiversity loss, accounted for 17%. Livelihood disruptions due to restricted access to grazing and agricultural lands were highlighted by 13%. A lack of community involvement in project planning was reported by 12%, leading to resistance and mistrust. Finally, ecological concerns, including habitat disturbance and water resource depletion, were identified by 8% of respondents (Table 3).

Individual's perspective on reforestation

Using a multivariate probit model, the analysis showed that individuals' perspectives on the benefits of reforestation as a climate change mitigation method are strongly influenced by their age. The negative impacts of climate change are more likely to affect older farmers in particular (*P* value = *0.041*, coefficient = 0.082). Gender and occupation type also influence perceptions of the need for human intervention to alleviate difficulties related to climate change issues. Compared to people with additional sources of income, those whose primary sources of income rely on forest-based resources are more likely to see reforestation as a necessary solution (*P* value = *0.000*, coefficient = 0.239). Women, however, typically exhibit lower confidence in the effectiveness of such initiatives (*P* value = *0.005*, coefficient = -0.088) (Table 4).

When considering agricultural experience, the study finds a notable divergence in how responsibility for climate action is attributed. While more seasoned farmers prefer to emphasize the role of economic sectors, more recent agriculturalists are more likely to place accountability on outside organizations or individuals. Higher-income respondents tend to possess a heightened awareness of climate change risks, notably regarding the potential devastation of extensive forest areas. This awareness correlates positively and significantly with strong beliefs in the advantages of reforestation. To investigate how independent variables might predict dependent behaviors, particularly focusing on the influence of awareness on perceived impacts, a structural equation model (SEM) was utilized. Understanding the significance of reforestation is a reasonable predictor of differences in how farmers react to

Table 4: Parameter estimation of multivariate probit model between respondent' characteristics and perspectives on the benefits of reforestation

Symbol	Variables	BR1	BR2	BR3	BR4	BR5	BR6
X1	Age	0.016	0.082*	0.003	0.003	0.071	0.044
X2	Gender	0.041	-0.136	0.062	0.009	-0.088*	0.005
X3	Education	0.004	0.128	0.019	-0.071	-0.041	0.002
X4	Farming experience	-0.008	0.079	0.042	0.027	0.050	0.003
X5	Labour force	0.061	-0.020	0.062	0.008	0.001	-0.113
X6	Occupation type	0.001	0.053	-0.024	0.005	-0.034*	0.001
X7	Household size	0.063	-0.034	0.054	-0.0057	0.021	-0.032
X8	Land size (ha)	0.025	0.005	-0.022	0.001	0.072	0.041
X9	Main crop	0.018	-0.090	0.071	-0.021	0.041	0.002
X10	Livestock	-0.046	0.068	0.022	0.022	0.022	-0.001
X11	Working hours	-0.040	-0.064	0.014	0.002	0.000	-0.021
X12	Farm management practice	0.088	0.005	0.018	-0.007	0.011	0.041
X13	Tree survival rates	0.069	0.001	0.003	0.008	0.021	0.011
X14	Main Income	0.239**	0.002	0.001	0.010	0.007	0.017
X15	land ownership	0.051	0.002	0.004	0.007	0.032	0.001

Note: Significance levels * = $P \leq 0.05$ and ** $P \leq 0.01$

Table 5: Summary of predictive effects between climate change awareness and perspectives on the challenges of reforestation

Endogenous constructs	Path (ß)	t-value	p-value	f^2	R^2	Q^2
Risk awareness of climate change » CR1	0.330	2.088	0.003	0.012*	0.413	0.300
Risk awareness of climate change » CR2	0.111	3.022	0.000	0.013*	0.191	0.236
Risk awareness of climate change » CR3	0.121	0.021	0.111	0.017	0.110	0.244
Risk awareness of climate change » CR4	0.118	0.412	0.213	0.215	0.143	0.211
Risk awareness of climate change » CR5	0.112	0.224	0.357	0.120	0.103	0.202
Risk awareness of climate change » CR6	-0.201	0.102	0.219	0.032	0.137	0.275

The path coefficient (ß) functions as a standardized regression coefficient, ranging between ±1, indicating the strength of influence one variable has on another. A t-value greater than 1.96 signifies significance at the 95% confidence level (two-tailed). The p-value and effect size (f^2) should exceed 0.05 for 95% confidence. The coefficient of determination (R^2) ranges from 0 to 1. For predictive relevance, the Q^2 value must be above 0, with three tiers of interpretation: Q^2 = 0.02 suggests weak predictive power, 0.15 indicates moderate and 0.35 reflects strong predictive capability

the negative effects of climate change. The SEM revealed a moderate link between risk awareness and perceptions of reforestation benefits. Moreover, when reforestation is recognized as a critical issue, it strengthens the ability to address various challenges. This recognition enhances the ability to manage issues such as land rights conflicts ($\beta = 0.111$, t = 3.022, $P = 0.000$, R^2 = 0.191, Q^2 = 0.236) as well as displacement and access restrictions ($\beta = 0.330$, t = 2.088, $P = 0.003$, R^2 = 0.413, Q^2 = 0.300). The limited effectiveness of India's Greening Mission on local livelihoods may account for the negative correlation found between reforestation and livelihoods disruptions, as indicated by path analysis (R^2 = 0.79–0.86). Factors such as the long maturation period of trees and the delayed economic benefits resulting from reforestation initiatives contribute to these challenges (Table 5).

Discussion

Reforestation is a critical process that enhances environmental equilibrium, particularly for forest-dependent communities whose livelihoods are directly tied to the health of their ecosystems (Xu *et al*. 2022; Ullah 2024). Raising awareness of reforestation among these communities is essential, as it aligns their cultural and spiritual values, motivating responsible environmental stewardship (Bhagwat *et al*. 2014; Haq *et al*. 2023; Bhatt *et al*. 2024). Reforestation acts as a vital tool to combat rising temperatures, sequester carbon dioxide, and restore biodiversity (Singh and Kushwaha 2008; Wheeler *et al*. 2016; Gopalakrishna *et al*. 2022). Engaging forest communities in educational initiatives and reforestation efforts empowers them to contribute meaningfully to climate action, reinforcing the interconnectedness of human and environmental systems (Rajasugunasekar *et al*. 2023; Ewane 2024). Their participation underscores the interconnectedness of human and environmental systems and highlights the importance of collective responsibility for a sustainable future.

The results show that while the GIM has provided significant benefits; including enhanced forest cover (30% of respondents), climate change mitigation (20%) and livelihood improvements (15%), substantial challenges persist. Displacement and restricted access to forest resources were reported by 30% of respondents, land rights conflicts by 20%, and negative ecological impacts from monoculture plantations by 17%. Livelihood disruptions (13%) and a lack of community participation (12%) further undermined program success. Multivariate probit analysis revealed that older farmers (P value = 0.041) and forest-dependent households ($P = 0.000$) showed stronger belief in reforestation benefits, while women expressed lower confidence (P value = 0.005). Structural Equation Modeling (Krivoguz *et al*. 2024; Thiam *et al*. 2024) indicated that risk awareness and the perceived critical importance of reforestation significantly improved the capacity to address land disputes ($\beta = 0.111$) and displacement ($\beta = 0.330$).

However, the study faces certain limitations. The sample size was relatively small (60 respondents), potentially limiting the generalizability of findings. Additionally, the cross-sectional nature of the survey restricts the ability to capture long-term changes in perceptions and ecological outcomes. Future research should adopt longitudinal approaches, include larger and more diverse samples, and integrate ecological monitoring to better assess the sustained impacts of reforestation efforts.

To strengthen reforestation outcomes, it is crucial to foster active community engagement by involving local populations in planning and implementation, thereby building trust and ownership. Promoting native and mixed species should be prioritized to enhance biodiversity and ecological resilience. Developing alternative livelihoods such as agroforestry, ecotourism and forest-based value-chain activities can help mitigate livelihood disruptions. Strengthening legal safeguards under the Forest Rights Act is essential to address land conflicts, while establishing inclusive and transparent feedback mechanisms will ensure that community grievances are heard and resolved effectively.

Conclusion

This study aimed to assess community engagement, benefits, and challenges associated with the Green India Mission (GIM) reforestation efforts in Balangir District, Odisha. By combining quantitative modeling with socio-economic analysis, the research highlights the significant ecological and livelihood improvements achieved through reforestation, alongside persistent challenges such as displacement, land rights conflicts, and ecological concerns from monoculture plantations. The findings underscore the critical role of demographic factors such as age, income source, and gender in shaping perceptions of reforestation benefits. Importantly, the study emphasizes that active community involvement, protection of land rights, and diversification of livelihoods are essential for enhancing the success and sustainability of reforestation programs.

The study offers actionable insights for policymakers and practitioners aiming to design more inclusive, equitable, and ecologically resilient reforestation strategies. By aligning reforestation efforts with local needs, cultural values, and livelihood priorities, reforestation efforts can achieve both environmental restoration and socio-economic upliftment, serving as a scalable model for similar forest-dependent regions across India and beyond.

Acknowledgements

We sincerely acknowledge the unconditional support provided by our valued respondents of this study.

Author Contributions

These authors contributed equally to this work and agree to be accountable for the content of the work.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data Availability

The authors are solely responsible for the analysis and interpretation of the data presented in this article.

Ethics Approval

Not applicable to this paper.

Funding Source

No funding was received for this study.

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