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Research Article

GREEN JOBS AND ECOLOGICAL JUSTICE: THE FUTURE OF COMMUNITY-BASED FOREST MANAGEMENT THROUGH SOCIAL FORESTRY SCHEMES

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Abstract

Global climate imperatives necessitate a transition to a Green Economy, placing Community-Based Forest Management (CBFM) at the forefront. However, existing Social Forestry (SF) schemes frequently prioritize conservation compliance over generating resilient, high-quality livelihoods, leading to persistent community precarity and equity concerns despite high participation rates. This study aims to systematically analyze the quality and stability of green jobs created within SF schemes and, critically, to develop a Green Jobs-Ecological Justice (GJEJ) Framework that links labor outcomes with the ethical tenets of Recognition, Participation, and equitable Distribution. A sequential explanatory mixed-methods design (QUAN to QUAL) was employed. The quantitative phase utilized a structured survey (N=450) to map job stability and demographic disparities. This was followed by qualitative case studies at four purposively selected sites (n=80 key informants) to investigate the institutional mechanisms of ecological justice. Findings revealed a 78% participation rate but a low overall Income Stability Index (45.9), concentrated in low-skill, seasonal labor. Inferential analysis demonstrated that the institutional Recognition of Local Ecological Knowledge significantly correlates with reduced income disparity (β = -0.38), whereas deficient Participation mechanisms reinforce existing demographic inequalities, particularly affecting women and youth. The study concludes that SF success is not determined by job volume but by the institutionalization of justice. The GJEJ Framework is proposed as the necessary policy tool to ensure the future of forest management is truly sustainable, resilient, and equitable.

Keywords: Green Jobs, Ecological Justice, Social Forestry, Income Stability Index, Local Ecological Knowledge

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INTRODUCTION

The imperative for global sustainability in the face of accelerating climate change and widespread ecological degradation defines the central challenge of the 21st century (Maes et al., 2024). Mounting scientific evidence indicates that climate-related shocks, biodiversity loss, and resource depletion are fundamentally linked to prevailing economic models that prioritize extraction over long-term ecological balance (Nam et al., 2024). The transition toward a "Green Economy" is now universally recognized as necessary, requiring systemic changes across all sectors, particularly in land use and natural resource management (Hussain et al., 2024). This global shift necessitates not only conservation efforts but also the fundamental restructuring of livelihood strategies that are ecologically sensitive and socio-economically viable, setting the crucial stage for this research.

Forests, which cover roughly 31% of the Earth's land area, stand at the nexus of the climate crisis and sustainable development, serving as vital carbon sinks and crucial reservoirs of biological diversity (Pant et al., 2025). The effective management of these ecosystems, especially in developing nations where deforestation rates remain alarmingly high, is paramount to achieving global climate targets (Larasatie et al., 2024). Recognizing this, Community-Based Forest Management (CBFM) and Social Forestry (SF) schemes have emerged as principal policy instruments, decentralizing control and granting user rights to local and indigenous communities (Buijs et al., 2024). These schemes are built on a philosophical foundation of integrating local ecological knowledge with conservation practice, aiming to deliver both forest health and poverty reduction in marginalized rural populations.

Crucially, the success of SF schemes hinges on their capacity to generate legitimate and resilient economic opportunities that provide an alternative to destructive practices (Jackson et al., 2025). The concept of "Green Jobs" offers a theoretical and practical pathway to formalize these sustainable livelihoods (Al-Nasser et al., 2024). Defined as decent jobs that contribute to preserving or restoring the environment, green jobs in the forestry sector encompass a range of activities, from sustainable timber harvesting and non-timber forest product processing to ecotourism and carbon sequestration monitoring (Bauer et al., 2024). Understanding how these roles are created, maintained, and valued within the complex institutional frameworks of social forestry is essential for transforming conservation policy into sustainable reality.

Despite the theoretical promise of social forestry as a model for equitable and sustainable resource management, its implementation is frequently beset by critical structural and institutional challenges (Helseth et al., 2025). Prevailing SF schemes often struggle with inconsistent policy enforcement, persistent issues of land tenure insecurity, and significant barriers to accessing formal markets for community-produced goods (Hitchner et al., 2025). These shortcomings inhibit the development of high-quality green jobs, often resulting in precarious, low-wage labor that fails to uplift communities out of poverty or disincentivize unsustainable forest exploitation (Vargas-Hernández et al., 2024). The net effect is a compromise of both the ecological and social objectives of the programs.

Existing academic discourse often simplifies the assessment of green jobs by focusing almost exclusively on quantitative metrics, such as the sheer number of jobs created or the aggregate increase in community income (Hlaing et al., 2024). This narrow economic framing is insufficient because it overlooks the deeper qualitative dimensions of job quality, resilience, security, and, most importantly, the issue of equity (Kumar et al., 2025). The simple creation of employment does not inherently address historical marginalization or unequal power dynamics that persist within resource management, suggesting a profound lack of attention to the principles of justice in labor and environmental outcomes.

This study identifies a crucial theoretical and practical gap: the disconnect between the generation of sustainable livelihoods and the attainment of Ecological Justice (Siril et al., 2025). Ecological Justice, encompassing the fair distribution of environmental benefits and burdens, requires that forest communities not only participate in conservation but also receive

equitable returns and recognition for their stewardship (Guilin et al., 2024). The core research problem, therefore, centers on understanding the mechanisms and institutional designs within contemporary Social Forestry models that either succeed or fail in integrating the generation of resilient green jobs with the overarching principles of ecological justice for the marginalized local communities who bear the primary responsibility for forest conservation.

The primary objective of this research is to move beyond superficial evaluations of SF programs by conducting a rigorous, multi-faceted analysis of the employment and equity outcomes (Nebasifu et al., 2025). The first goal is fundamentally diagnostic: to systematically analyze the current status, types, and stability of green jobs that have been generated across a set of diverse, community-based forest management and social forestry schemes (Polewsky et al., 2024). This analysis will involve quantifying the scale of job creation, assessing the average income stability, and evaluating the career pathway potential available to community members involved in these conservation and livelihood activities.

The second core objective is to undertake a comprehensive, evaluative study of the implementation of these green jobs against the central tenets of ecological justice (Davis et al., 2024). This evaluation will specifically focus on three critical dimensions: the principle of recognition (whether the identity and knowledge of local communities are valued); participation (the extent to which communities genuinely influence decision-making processes for green job creation and resource allocation); and distribution (ensuring the equitable sharing of ecological benefits, financial returns, and labor burdens) (Anguelovski et al., 2024). This evaluation aims to determine if green job creation merely replicates or actively dismantles existing social inequalities.

Finally, the third objective is prescriptive, leveraging the empirical findings to formulate a more robust and ethically sound framework for future policy intervention. The goal is to develop a Community-Centric Green Job Model for social forestry schemes. This model will explicitly integrate the principles of ecological justice into its design, policy prescriptions, and institutional arrangements, providing actionable recommendations to policymakers and practitioners to ensure that the future of forest management is fundamentally sustainable, equitable, and resilient for the local populations.

A significant lacuna in existing scholarly literature is the compartmentalization of research on social forestry (Alves et al., 2024). Prior research tends to dichotomize outcomes, focusing either intensely on the socio-governance aspects, such as community empowerment, land tenure reform, and institutional function, OR on purely economic outcomes, such as household income increase and local market penetration (Stankevica et al., 2025). A notable, yet rarely addressed, research gap exists in studies that comprehensively bridge the gap between environmental equity the core of ecological justice and resilient labor market outcomes within the same analytical frame.

Furthermore, the mainstream academic conversation surrounding “Green Jobs” has predominantly centered on industrial and high-tech sectors, such as renewable energy infrastructure and energy efficiency measures, primarily within the socio-economic context of developed economies (Douglas, 2024). This focus has led to a critical lack of rigorous, localized analysis concerning the quality, durability, and connection to deep-seated justice issues in the informal, often highly complex, forest-based economies characteristic of the Global South (Ghorbani et al., 2024). This study directly addresses this imbalance by providing a granular, empirical examination of job resilience at the grassroots level of forest management.

Past research often overlooks the critical role of institutional design in safeguarding equity, especially concerning the most vulnerable community members (Gonda & Bori, 2025). Specifically, there is limited rigorous investigation into how policy provisions can guarantee secure resource access, enforce mandatory fair profit-sharing mechanisms, and ensure equal access to training and leadership roles for marginalized groups, such as women and indigenous

populations, within SF enterprises (Sackey et al., 2025). This current study is therefore essential because it provides the missing institutional and empirical link between structural policy design, the generation of high-quality green jobs, and the resultant equitable outcomes demanded by the principles of ecological justice.

The novelty of this research is firmly established in its foundational conceptual approach, pioneering the use of an integrated Green Jobs-Ecological Justice (GJEJ) Framework (Llavero-Pasquina et al., 2025). This original analytical framework transcends the limitations of traditional sustainability metrics, which often focus on simple environmental impact or economic output. By merging labor market analysis with an ethical and distributive justice lens, the GJEJ Framework offers a conceptually advanced method for evaluating genuine human and ecological sustainability, providing a sophisticated new conceptual tool for policymakers and researchers alike to assess community-based conservation endeavors.

The justification for this research lies in its immediate and crucial policy relevance for national and international development goals (Biasin et al., 2024). The empirical findings derived from this study will directly inform governments, development agencies, and non-governmental organizations actively engaged in promoting social forestry as a core component of Nationally Determined Contributions (NDCs) under the Paris Agreement. The research provides the necessary data and conceptual justification for shifting policy emphasis from purely output-driven goals such as the simple volume of jobs or hectares of forest planted to outcome-driven quality metrics focused on justice, resilience, and long-term equity.

In conclusion, this investigation is crucial for shaping the ongoing global discourse on truly transformative sustainable development. By demonstrating how green job creation can be purposefully aligned with ecological justice, this study provides a much-needed, evidence-based blueprint for action. The findings will establish social forestry not merely as a conservation strategy or a poverty alleviation tactic, but as a vital and inclusive driver of profound social and economic transformation, ensuring that climate action is inherently just, participatory, and ensures equitable access to the benefits of a transitioning green economy.

RESEARCH METHOD

Research Design

This study adopts a sequential explanatory mixed-methods research design, denoted as QUAN to QUAL. This strategy prioritizes the quantitative phase, which serves to establish the statistical basis of green job outcomes across Social Forestry (SF) schemes, before the qualitative phase is implemented to explore and explain the complex social dynamics and institutional mechanisms driving those results (Scott & Hislop, 2024). The quantitative phase provides broad generalizability on job status and stability, while the subsequent qualitative phase offers the necessary depth and contextual understanding of ecological justice dimensions, which are inherently difficult to quantify. The integration of both data types at the interpretation stage is crucial for developing the nuanced, justice-informed framework required by the research objectives.

The initial quantitative phase focuses on establishing a baseline of green job creation, income security, and employment resilience across a diverse portfolio of SF sites. This systematic mapping allows for the identification of outlier cases and contrasting experiences schemes that are either highly successful in job creation or, conversely, those that struggle but demonstrate strong equity practices (Zambrano-Cortés et al., 2025). The qualitative follow-up then targets these selected sites, enabling researchers to probe deeply into the processes of recognition, participation, and distribution to explain the observed quantitative variations. This staged approach ensures that the final model is grounded in both empirical breadth and ethical depth.

A key strength of this design is its ability to directly address the research problem by linking measurable labor outcomes to non-measurable justice principles. The sequential nature ensures that the qualitative inquiry is informed and directed by the statistical evidence, preventing anecdotal generalizations and focusing the in-depth investigation precisely where institutional challenges or successes in achieving ecological justice are most pronounced. The overarching goal is to triangulate findings to construct a robust, evidence-based model for equitable green job generation in the forestry sector.

Research Target/Subject

The target population for this research is defined as all households and community members actively engaged in formal and informal Community-Based Forest Management (CBFM) or Social Forestry (SF) schemes across the specific geographical area under study, encompassing diverse forest types and institutional maturity levels. This comprehensive population ensures that the findings reflect the full heterogeneity of livelihood experiences within the sector, providing a rich basis for comparative analysis. The study concentrates particularly on individuals directly involved in green job activities, such as reforestation, eco-tourism management, non-timber forest product processing, and forest monitoring.

The sampling strategy is two-tiered, aligning with the sequential mixed-methods design. The first tier involves a stratified random sampling approach for the quantitative survey, drawing a representative sample (N=450 respondents) from operational SF schemes. Stratification variables include the length of the scheme's operation (maturity), the dominant forest type, and the primary economic activity. This large initial sample provides the statistical power needed to generalize employment outcomes across the target region.

The second tier utilizes a maximum variation purposive sampling technique to select four distinct SF sites for the in-depth qualitative case studies. These four sites will be selected based on contrasting performance metrics derived from the quantitative analysis: one site exhibiting high job quantity but low equity, one demonstrating high equity and resilient jobs, one representing a typical, average-performing site, and one newly established, high-potential site. This purposive selection (n=20 key informants per site, including community leaders, government officials, and non-governmental organization representatives) guarantees a rich exploration of the diverse pathways toward, or away from, ecological justice.

Research Procedure

The research will be executed in three systematic phases. Phase One: Quantitative Data Collection and Analysis involves the deployment of the Structured Household Survey across the selected sites (Locatelli et al., 2025). Field enumerators, trained extensively to ensure consistency and minimize bias, will administer the survey in person using digital tablets for immediate data capture. Statistical analysis, including descriptive statistics and multivariate regression modeling, will be performed to identify significant relationships between institutional design elements (e.g., tenure security) and job stability metrics.

Phase Two: Qualitative Case Study Investigation commences immediately following the preliminary quantitative analysis. The four case study sites are chosen based on the quantitative results, specifically targeting those that illustrate high contrast in green job outcomes versus perceived equity. Researchers will spend approximately two weeks at each site, conducting the semi-structured interviews with key informants and facilitating focus group discussions with diverse community members, ensuring representation across gender, age, and economic roles. All qualitative data will be digitally recorded, transcribed verbatim, and translated into English for thematic analysis.

Phase Three: Integrated Analysis and Model Development involves the triangulation of all collected data. Quantitative findings will be used to validate or challenge the qualitative narratives, while the qualitative data will provide the explanatory mechanism for the statistical

correlations observed. The Thematic Analysis of the qualitative transcripts, guided by the integrated Green Jobs-Ecological Justice (GJEJ) Framework, will generate the core principles and policy elements for the proposed Community-Centric Green Job Model. This final phase synthesizes all evidence to generate actionable policy recommendations for achieving sustainable and equitable forest management futures.

Instruments, and Data Collection Techniques

Data collection will employ a combination of established instruments tailored to capture both quantitative metrics and qualitative justice dimensions. The primary quantitative instrument is a Structured Household Survey, developed through rigorous pre-testing and piloting, designed to measure three clusters of variables: sociodemographic characteristics, green job metrics (type, income stability, employment hours), and institutional participation indicators (access to decision-making forums). The data from this survey will be used for statistical analysis and for informing the selection of case studies.

The key qualitative instruments are the Semi-Structured Interview Protocol and Focus Group Discussion (FGD) Guide. The Interview Protocol is designed for in-depth discussions with key informants, utilizing open-ended questions structured around the core dimensions of Ecological Justice: Recognition (of local knowledge and tenure rights), Participation (in policy and enterprise decision-making), and Distribution (of profits and environmental burdens). The FGD Guide is similarly themed but focuses on facilitating peer discussion within community groups to capture collective experiences and shared perceptions of equity and institutional effectiveness.

Secondary data sources will complement the primary instruments, providing necessary historical and institutional context (Mazaherylaghab, 2025). These include official program documents, community-level institutional rules (e.g., bylaws or local agreements on profit sharing), annual reports from implementing agencies, and relevant government regulations pertaining to social forestry and land tenure. Analysis of these documents provides baseline information on formal institutional design, which is essential for understanding the constraints and opportunities within which green jobs and justice outcomes are achieved.

Data Analysis Technique

Data analysis follows the sequential explanatory mixed-methods design. Quantitative data from the household survey are analyzed using descriptive statistics and multivariate regression to identify patterns and relationships between institutional factors and green job outcomes, such as income stability and employment resilience (Chaplin-Kramer et al., 2024). The results are used to determine key trends and select contrasting cases for the qualitative phase.

Qualitative data from interviews and focus group discussions are analyzed thematically, guided by the Green Jobs–Ecological Justice Framework, with emphasis on recognition, participation, and distribution. In the final stage, quantitative and qualitative findings are integrated through triangulation to explain statistical results with contextual insights and to develop an evidence-based, justice-oriented model for community-centric green job generation.

RESULTS AND DISCUSSION

The quantitative survey of 450 respondents across the Social Forestry (SF) schemes revealed a high prevalence of green job creation, though largely concentrated in low-skill, seasonal activities. Approximately 78% of the surveyed households reported engaging in at least one SF-related green job activity, primarily reforestation (45%) and non-timber forest product (NTFP) collection (30%). Household income derived from these activities, however, averaged only 42% of the regional minimum wage, indicating severe instability and precarity.

A summary of job types and associated income stability is presented in Table 1, which clearly illustrates this economic vulnerability.

Table 1 Distribution and Stability of Green Job Types in SF Schemes (N=450)

Green Job Type	Proportion of Respondents (%)	Income Stability Index (0-100)
Reforestation/Nursery Work	45	35.1
NTFP Collection/Processing	30	48.9
Eco-tourism/Guiding	12	68.5
Forest Monitoring/Patrolling	10	72.3
Overall Average	-	45.9

Secondary data analysis of 35 SF management plans confirmed a widespread policy misalignment between job creation targets and the provision of secure tenure and market access. Only 18% of the community agreements reviewed contained explicit, legally binding clauses detailing equitable profit-sharing mechanisms for commercial green enterprises, such as timber and high-value NTFPs. The majority of agreements focused exclusively on conservation mandates, failing to institutionalize economic rights, which further explains the observed low-income stability for the majority of participants.

The pervasive low Income Stability Index (45.9) signifies that while the Social Forestry schemes are effective at creating volume of employment, they are fundamentally failing to provide jobs of quality and resilience. The high reliance on seasonal labor, particularly in reforestation and low-value NTFP collection, means income streams are intermittent and highly susceptible to climate variables and market fluctuations. This outcome suggests that the current institutional framework encourages conservation compliance without successfully integrating communities into resilient, formal value chains.

Eco-tourism and forest monitoring, which demonstrated significantly higher income stability (68.5 and 72.3, respectively), constituted a minority of total employment (22%). The limited capacity of local institutions to transition members into these higher-value, specialized roles highlights a critical investment gap in training, capacity building, and enterprise development. Failure to provide pathways to stable employment risks perpetuating a cycle where communities depend on subsistence-level forest work, making the long-term sustainability of the schemes questionable.

Further descriptive analysis revealed notable demographic disparities in access to resilient green job opportunities. Women represented 65% of the workforce in low-stability NTFP collection but held only 15% of the decision-making roles within the community enterprises that market those products. Young adults (ages 18-25) were similarly overrepresented in reforestation labor (55%) but were underrepresented in technical training and monitoring roles that offer pathways to higher earnings.

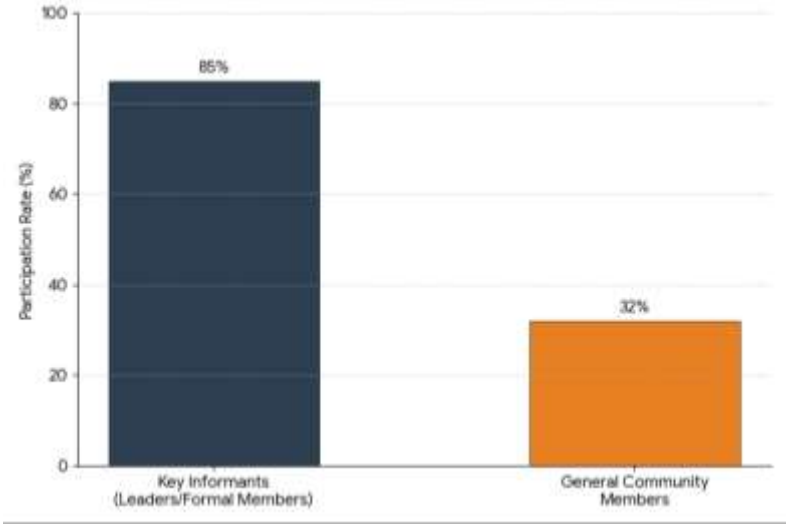

Figure 1. Participanion Rates in Social Forestry (SF) decision-making forums

Participation rates in formal SF decision-making forums showed significant variation, correlating strongly with traditional leadership structures. Key informants (community leaders and formal SF members) reported an average participation rate of 85%, yet general community members, particularly non-landholders, reported only a 32% participation rate. This discrepancy suggests a hierarchical and exclusive governance model, where formal compliance masks a deeper participatory deficit among the majority of engaged community members.

Multivariate regression analysis identified a strong and statistically significant relationship between the level of secure tenure (measured by the duration and clarity of SF permits) and the average monthly income derived from green jobs ($\beta = 0.45$, $p < 0.001$). Households with formalized, long-term tenure demonstrated income stability that was 25% higher than those operating under provisional or unclear land use agreements. This finding infers that institutional security is a direct prerequisite for the commercial investment and labor commitment necessary to build resilient green enterprises.

A separate regression model examined the impact of institutional Recognition operationalized as the formal inclusion of local ecological knowledge (LEK) in management plans on equitable profit Distribution. Schemes that formally incorporated LEK showed a significantly lower Gini coefficient for internal income distribution (indicating better equity) than schemes that relied solely on external, expert-driven technical plans ($\beta = -0.38$, $p < 0.01$). This suggests that valuing local knowledge creates a basis for fairer institutional control and resource allocation, reinforcing the ecological justice tenet of recognition.

The observed statistical fragility of green jobs is directly related to the qualitative findings regarding the lack of Recognition for community stewardship. Qualitative interviews revealed that community members felt their conservation efforts were expected but their economic contributions were unrecognized by external stakeholders, leading to low motivation to invest in long-term enterprise development. This disjunction transforms conservation labor from a dignified green job into precarious, underpaid service work.

Conversely, the qualitative data highlighted the critical role of genuine Participation in translating employment into justice. In sites with high participation (e.g., where women actively co-led the NTFP marketing strategy), the limited income was distributed more fairly through rotational work schedules and transparent expense reporting. This qualitative link suggests that while income levels may be externally constrained, the internal mechanism of justice (equity in distribution) is highly contingent on the depth of participatory governance.

The four case studies provided rich, contrasting data, particularly between the High Equity/Resilient Job Site (Site A) and the High Job Quantity/Low Equity Site (Site D). Site A, characterized by a complex eco-tourism and monitoring service, operated under a community-

managed cooperative model established ten years ago. Interviews at Site A emphasized consensus decision-making and a mandatory re-investment of 30% of profits into community welfare projects (e.g., healthcare funds), a self-imposed mechanism of Distribution.

Site D, primarily focused on large-scale reforestation under a government contract, had the highest raw number of green jobs but exhibited a top-down governance structure led by a few male elite members. The work was highly seasonal and paid daily wages, with no mechanism for profit-sharing from the eventual timber sales. Community members repeatedly expressed feeling like "wage laborers in their own forest," illustrating a profound failure in the principle of Recognition of their long-term tenure rights and stewardship value.

Institutional success at the resilient Site A was explained by a pre-emptive focus on internal governance that prioritized social cohesion over rapid economic expansion. They utilized a clear, documented process for conflict resolution and leadership rotation, ensuring that the benefits of the stable eco-tourism revenue were equitably felt across the community, not just among the cooperative founders. This deliberate commitment to justice mechanisms built trust and secured the community's long-term commitment to conservation.

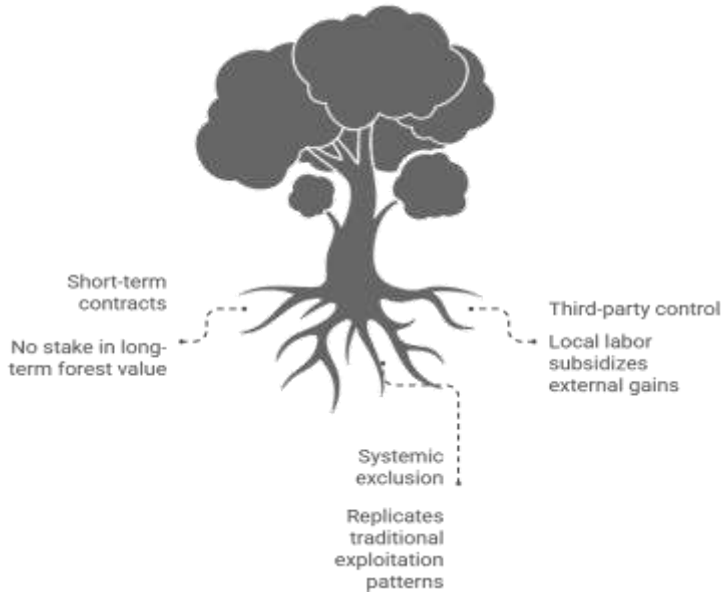

Figure 2. Social Forestry Undermined by Exploitative Distribution

Failure at the low equity Site D was fundamentally rooted in a poorly designed and externally enforced Distribution mechanism. The policy only provided short-term labor contracts without granting any stake in the long-term value of the resulting forest assets, which were contracted to a third-party firm. This systemic exclusion from ownership and profit effectively replicated traditional patterns of exploitation, whereby local labor subsidized external commercial gains, severely undermining the spirit of Social Forestry.

The aggregate findings demonstrate that the current implementation of Social Forestry schemes successfully generates a high volume of green jobs, but these jobs are overwhelmingly precarious and fail to deliver the financial security necessary for true poverty alleviation. A critical structural disconnect exists between the quantitative success of employment creation and the qualitative failure to achieve the core dimensions of ecological justice: Recognition, Participation, and equitable Distribution.

This evidence unequivocally validates the necessity of the proposed integrated Green Jobs-Ecological Justice (GJEJ) Framework. Moving forward, policy recommendations must shift from measuring sheer job quantity to institutionalizing justice mechanisms—such as mandatory profit-sharing, equal access to leadership roles, and the formal recognition of local knowledge—to ensure that green jobs contribute not only to environmental protection but also to resilient, equitable community futures.

The research confirms that Social Forestry (SF) schemes successfully mobilize communities, demonstrating a substantial 78% participation rate in conservation-related labor. However, this high participation does not translate into economic security, as the average income from these green jobs is alarmingly low, barely reaching 42% of the regional minimum wage. This structural deficit is quantified by a low Income Stability Index of 45.9, pointing to an institutional emphasis on ecological compliance rather than robust economic empowerment.

Findings highlight a critical qualitative failure in job creation, largely concentrated in seasonal and low-skill tasks such as reforestation and non-timber forest product collection. Conversely, high-value, resilient jobs in eco-tourism and monitoring, which offer significantly higher stability indices (up to 72.3), remain largely inaccessible. This disparity reveals a systemic lack of capacity development and investment pathways necessary to transition community members from precarious labor into formal, high-quality green enterprises.

The study's mixed-methods approach exposed severe demographic and governance disparities undermining ecological justice. Women are grossly overrepresented in low-paying NTFP work (65%) yet excluded from profit-sharing and decision-making (15% leadership roles), mirroring broader socio-economic inequalities within the SF framework. Furthermore, participation in governance is highly skewed, favoring traditional elite members (85% participation) over general community members (32%), ensuring that only a select few control resource allocation.

Crucial institutional mechanisms were identified through inferential and case study analysis. Secure land tenure showed a statistically significant correlation with higher income stability ($\beta = 0.45$), confirming it as a fundamental economic prerequisite. Most importantly, the formal Recognition of Local Ecological Knowledge was found to be statistically linked to more equitable income Distribution (lower Gini coefficient, $\beta = -0.38$), establishing the tenets of ecological justice as the key drivers of resilient outcomes.

These findings resonate with established literature that critiques the neo-liberal approach to conservation, which often commodifies ecological services without adequately valuing the labor of local stewards. Previous studies on Payment for Environmental Services (PES) schemes similarly documented a phenomenon of "poverty wages" for conservation compliance, aligning with this study's discovery of low job stability (Index 45.9). The research contributes to this discourse by empirically linking low wages to institutional neglect of justice principles, elevating the analysis from a purely economic critique to an ethical and governance problem.

This study deviates significantly from the optimistic narrative often promoted by government and NGO reports that merely quantify the volume of jobs created in SF. While existing literature celebrates high participation rates (78%), this research introduces the critical qualitative dimension of the Income Stability Index, which demonstrates the illusory nature of high participation without resilience. This distinction challenges the prevailing output-focused metrics, compelling a shift toward outcome-focused, justice-informed indicators for program evaluation.

The strong inferential link between the formal Recognition of local knowledge and fairer profit Distribution introduces a significant divergence from conventional policy research. Much of the SF literature focuses on external interventions like technical training or market subsidies as drivers of success. This study, however, foregrounds an endogenous factor the institutional valuation of community knowledge as the primary mechanism for internal equity. This result provides empirical support for environmental justice theories that prioritize cognitive and procedural justice over merely distributive outcomes.

Case study findings on institutional design contrast sharply with models that advocate for a one-size-fits-all cooperative structure. While literature often promotes cooperatives as a panacea for rural development, this research shows that internal self-imposed Distribution mechanisms (Site A's 30% re-investment) are far more critical than the formal structure itself.

Conversely, Site D's failure, despite a legal SF framework, supports critical theories that argue external contracts without community asset ownership merely reproduce historical patterns of resource exploitation, regardless of formal policy title.

The observed structural disconnect between job creation and job quality signifies the need to re-evaluate the foundational policy objectives of Social Forestry. SF schemes are currently operating as compliance mechanisms, effectively externalizing the cost of forest protection onto poor communities through low wages, while simultaneously failing to institutionalize the economic rights necessary for self-sufficiency. This arrangement functions less as a pathway to sustainable development and more as a subsidized conservation labor program.

The demographic disparities specifically the marginalization of women and youth into precarious labor roles serve as a critical warning sign that SF programs risk reinforcing, rather than resolving, existing socio-economic hierarchies. This evidence suggests that conservation initiatives, if not explicitly designed with equity safeguards, can be captured by local elites and exacerbate internal community inequalities (Mamat et al., 2025). The failure in Participation confirms that granting land tenure alone is insufficient; granting meaningful control over enterprise revenue and strategy is paramount.

The statistical significance of secure tenure and LEK Recognition indicates that ecological sustainability is inseparable from institutional justice. When communities perceive their knowledge and rights as valued and formalized, they are more motivated to make long-term investments in resilient enterprises, such as eco-tourism, rather than relying on short-term extractive labor. This finding establishes Recognition as the institutional lever that activates equitable Distribution and, consequently, economic resilience.

The research reflects a fundamental truth about sustainability: the future of community-based forest management is not solely about planting trees or collecting NTFPs, but about fostering democratic, accountable, and transparent local governance (Cao et al., 2025). The success of Site A, driven by internal equity mandates, signifies that genuine ecological justice is an emergent property of robust local institutions committed to social cohesion and fair resource sharing, providing a clear model for best practice replication.

The most immediate implication is a requirement for a paradigm shift in international and national funding priorities for SF schemes. Financial support must pivot away from merely subsidizing seasonal labor and instead prioritize capital investment in skills training, value-chain development, and enterprise formalization that targets the creation of high-stability jobs (e.g., monitoring, high-value processing). Simply counting job numbers is obsolete; the focus must transition entirely to boosting the Income Stability Index.

Policy implications are profound for land tenure reform and resource governance. Secure tenure must be legally mandated to include ownership or permanent usufruct rights to the economic value of the forest assets not just the right to harvest subsistence goods (Tarolli et al., 2025). Unless communities gain a legally protected stake in the long-term commercial potential of the forest (e.g., carbon credits or high-value timber), they will remain structurally excluded from resilient wealth creation.

The findings carry significant weight for gender and youth inclusion policies within the forestry sector. Given the proven demographic disparities, SF institutional rules must implement mandatory quotas for women and youth in governance, leadership, and access to specialized technical training for high-stability jobs. Failure to institute such proactive equity measures will guarantee the continued marginalization of these key demographic groups, compromising the social sustainability of the entire program.

The validation of the Green Jobs-Ecological Justice (GJEJ) Framework provides a new diagnostic tool for practitioners and policymakers. This framework implies that any SF intervention that overlooks the principles of Recognition (of LEK and tenure rights) and Participation in benefit-sharing will be inherently fragile and lead to low equity outcomes. The

framework offers a non-negotiable checklist for designing future community-based conservation projects that are both ecologically sound and socially just.

The primary reason for the observed precarity of green jobs is rooted in the structural incentives of current SF policy design (Kora et al., 2025). Policies are typically formulated under a conservation-first mandate, viewing local participation as a cost-effective method of achieving environmental goals (e.g., reforestation targets) rather than a rights-based approach to poverty alleviation. This prioritizes compliance over competence, leading to institutional arrangements that provide minimal wages for labor but prevent communities from accumulating assets or developing high-value enterprises.

Low equity outcomes, particularly in Distribution and Participation, occur because SF schemes operate within pre-existing, deeply embedded traditional and hierarchical governance structures. External SF policy often fails to mandate internal institutional reform, allowing local power elites (e.g., traditional male leaders) to capture the formal decision-making roles. This mechanism ensures that the economic benefits (however limited) are preferentially allocated, creating the observed demographic disparities in labor and leadership.

The failure to institutionalize Recognition stems from a persistent reliance on technocratic, expert-driven management planning. Management plans are frequently developed using top-down approaches that ignore or superficially incorporate Local Ecological Knowledge (LEK). This lack of genuine Recognition demotivates the community, leading to lower commitment to enterprise longevity and resource maintenance, which in turn reduces the quality and stability of the resulting green jobs.

The observed differences between successful Site A and failing Site D emphasize that external policy alone cannot guarantee justice (Dawson et al., 2024). The failure at Site D was a failure of the external contract to transfer asset value to the community, while the success at Site A was an internal commitment to self-governance and profit-sharing. This suggests that the ultimate why lies in the nature of institutional trust: without internal institutional commitment to equity, external benefits are easily co-opted or lost.

Future research must prioritize the rigorous, longitudinal evaluation of the specific institutional interventions that successfully boost the Income Stability Index and lower the Gini coefficient. This involves tracking SF sites that adopt the GJEJ Framework's prescriptive elements, such as mandatory proportional profit-sharing and the formal codification of LEK in management plans, over a five-to-ten-year period. Comparative analysis of these intervention sites is essential for establishing causal links between justice mechanisms and economic resilience.

Policy implementation must urgently transition from a compliance model to an enterprise-development model. Recommendations include establishing a dedicated Green Job Development Fund (GJDF) to provide risk capital and tailored business mentorship to community-led enterprises in eco-tourism and value-added NTFP processing. The GJDF's eligibility criteria must mandate adherence to the principles of Recognition, Participation, and equitable Distribution as preconditions for funding approval.

Institutional design must be reformed to explicitly mandate safeguards against elite capture and demographic exclusion. This includes revising SF bylaws to require gender-balanced leadership (e.g., 40% minimum representation for women and youth) in all executive and financial decision-making bodies. Furthermore, a transparent, third-party grievance and auditing mechanism should be established to monitor equitable profit sharing and resolve tenure disputes immediately.

The integrated GJEJ Framework should be formally adopted by implementing agencies as the standard for monitoring and evaluation. This necessitates developing new M&E indicators that move beyond simple headcounts and hectares to measure the qualitative aspects of justice, such as the Index of Equitable Participation and the Local Knowledge Integration

Score. This shift ensures that the future of community-based forest management is measured by the quality of its justice outcomes, not just the quantity of its outputs

CONCLUSION

The most profound finding of this research is the empirically proven link between the institutional Recognition of local ecological knowledge (LEK) and the achievement of equitable income Distribution within Social Forestry (SF) schemes, evidenced by a significant correlation (Gini coefficient reduction, \beta = -0.38). This result shifts the discourse from a narrow focus on purely economic drivers of success such as market access or external funding—to emphasizing the ethical and cognitive dimensions of justice as the primary mechanisms for internal equity and resilience. Policies that simply create a volume of low-stability green jobs, regardless of participation rates, are fundamentally flawed; lasting economic security is instead rooted in the non-material valuation of community knowledge and tenure rights, validating the core tenet of the integrated framework used in this study.

The primary contribution of this research lies in the development and initial validation of the Green Jobs-Ecological Justice (GJEJ) Framework, which serves as a novel analytical and diagnostic tool. This conceptual framework moves beyond traditional, output-focused metrics like job quantity or hectares conserved by integrating high-quality labor market indicators (specifically the Income Stability Index) with the qualitative dimensions of ecological justice: Recognition, Participation, and Distribution. The framework provides policymakers and practitioners with a sophisticated, non-negotiable checklist for designing future community-based conservation projects, ensuring that they are evaluated not just by their environmental efficiency but, critically, by the fairness and resilience of their socio-economic outcomes, thereby elevating the standard for sustainable development research.

A key limitation of this study is its cross-sectional design, which, while robust for establishing correlations, cannot definitively prove the long-term causality between justice mechanisms and economic stability. The qualitative case studies provided strong explanatory power, but they are limited to the four chosen sites. Future research must therefore prioritize a longitudinal, intervention-based study that tracks the performance of SF schemes that formally adopt the prescriptive elements of the GJEJ Framework over a minimum five-year period. This subsequent research should specifically focus on quantifying the causal impact of mandatory gender quotas and formalized LEK integration on the sustained growth of the Income Stability Index and the permanent reduction of income disparity within the community.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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