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Impact of Forest Rehabilitation on Socio-Economic Development of Communities in Rwanda, A Case of the Green Gicumbi Project Intervention Area (2015-2024)

[1]Mr. Innocent NTAWUKIRABIZI, [2]Dr James Kant KAMUHANDA

[1]Author, [2]Co-author

[1](Faculty of Environmental Studies, University of Lay Adventists of Kigali)

[2] (Faculty of Environmental Studies, University of Lay Adventists of Kigali)

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Abstract: **This study examines the socio-economic impacts of forest rehabilitation under the Green Gicumbi Project in Gicumbi District, Northern Rwanda. It addresses the issue of persistent deforestation and the need for ecosystem restoration by assessing how forest rehabilitation influences local livelihoods. The research adopted a descriptive design, combining qualitative and quantitative approaches, and utilized questionnaires, interviews, focus groups, and document reviews. Results indicate a positive correlation between forest rehabilitation and improved community well-being, particularly through employment creation, increased forest productivity, and enhanced environmental awareness. However, benefits were found to be unevenly distributed, favoring those directly engaged with the project, such as forest owners and laborers, while vulnerable groups like the elderly and landless received limited support. The study recommends promoting inclusive reforestation schemes, supporting small-scale forestry for firewood and timber, and introducing alternative income-generating activities such as agroforestry, beekeeping, and ecotourism. These measures can ensure broader participation and enhance the sustainability of forest rehabilitation initiatives.**

Keywords: **Forest Rehabilitation, Socio-Economic Development, Communities, Green Gicumbi Project Intervention Area, Rwanda.**

I. INTRODUCTION

The critical global challenges that threaten human welfare and its crucial foundation—nature—range from biodiversity loss and climate change to interrelated problems of poverty, hunger, inequality, and global health risks, such as the COVID-19 pandemic. The common denominator of these challenges is that they are largely caused by human (in) action severely altering natural ecosystems and leading to resource degradation, pollution, and climate warming (Díaz et al. 2019). The World Economic Forum's Global Risks Report 2021 (WEF 2021) ranked human-induced environmental damage, extreme climate, climate action failure, and biodiversity loss among the most severe long-term risks. The central role nature plays in addressing global challenges is increasingly being recognized; nature features more and more in the approaches to address and find solutions to different social, economic, and ecological problems and challenges

Forest restoration is a complex undertaking that is closely linked to the global environmental agreements and related goals (Jauffret et al. 2020). Under the Convention for Biological Diversity (CBD), the post-2020 global biodiversity framework adopted in December 2022 aims at bringing 30% "of degraded terrestrial, inland waters, and coastal and marine ecosystems under effective restoration" (CBD 2022, 9).

The prevention of forest and tree loss and the restoration or rehabilitation of degraded areas feature prominently in the efforts to combat desertification and land degradation under the UN Convention to Combat Desertification (UNCCD), established in 1994, and are seen as essential elements in countries' efforts toward land degradation neutrality (UNCCD 2019). The Paris Agreement of the UNFCCC (United Nations Framework Convention on Climate Change) makes an explicit reference to the need to "take action to conserve and enhance . . . sinks and reservoirs of greenhouse gases . . . including forests" (UN 2015b, Article 5, 6) and encourages countries to implement and support reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries (REDD+) (UN 2015b).

In alignment with the global environmental agreements and the SDGs, the global voluntary restoration initiatives, the Bonn Challenge and the UN Decade on Ecosystem Restoration (2021–2030) aim at restoring millions of hectares of degraded ecosystems and deforested landscapes through voluntary actions spearheaded by countries, organizations, and private entities. The underlying discourse of these initiatives integrates the different goals of the more siloed global agreements and emphasizes the potential contributions of restoration to support ecological integrity, address climate change, and enhance human well-being (Sayer et al. 2019).

The 2018 Rwanda Climate Change Vulnerability Assessment indicates that Gicumbi District in Northern Province ranks highest in exposure to climate hazards and second-highest in sensitivity to climate impacts, making it particularly vulnerable to climate risks.

In 2019, the Government of Rwanda secured USD 32 million from the Green Climate Fund (GCF) for the "Strengthening Climate Resilience of Rural Communities in Northern Rwanda" project, also known as the Green Gicumbi Project. This six-year project aims to reduce climate vulnerability and improve the adaptive capacity of rural communities in the region. The main objective of this study wasto assess the impact of rehabilitating forests on socio-economic development in Rwanda.

II. RESEARCH METHODOLOGY

Research Design

This study adopted a descriptive research design that incorporates both qualitative and quantitative research approaches.

Profile of the study area

Gicumbi District is one of five the Districts of Northern Province created by organic law No 29/2005 of 23/12/2005 related to the administrative entities of the Republic of Rwanda. Gicumbi district is spreads over 829 km2 and composed of 21 sectors, 109 cells and 630 villages.

Target Population

The target population includes all heads of households in the Gicumbi district of Northern Province, spread across the following sectors: Bwisige (4,484 households), Byumba (10,497 households), Cyumba (4,512 households), Kaniga (4,460 households), Manyagiro (5,777 households), Mukarange (4,782 households), Rubaya (3,202 households), Rukomo (7,163 households), Rushaki (3,852 households), and Shagasha (4,760 households). The study also included 12 local leaders: 10 Sector Forest Officers (SFOs), 1District Forestry and Natural Resources Officer (DFNRO), and 1 Field Technician (FT). The total target population was 53,501 respondents.

Sample Size and Sampling Techniques

The sample size was calculated based on the number of household heads in the population, which is 53,489.

The researcher determined the sample size using the Taro Yamane formula for calculating sample sizes.

$$n = \frac{N}{1 + N(e)^2}$$

Where n: the sample size

N: Household size

(e): Error tolerance

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Assume that a confidence level of 90 percent (which give a margin error of 0.05 was used).

$$n = \frac{53,489}{1+53,489(0.05)2} = \frac{53,489}{134.72} = \mathbf{397}$$

Data Collection Methods

The study employed multiple data collection methods to ensure the validity and reliability of findings. Questionnaires were administered to 397 household heads, using both closed and open-ended questions, and translated into Kinyarwanda for clarity and inclusiveness. To gain deeper insights, face-to-face interviews were held with 12 key informants, including forestry officials and a field technician. Focus group discussions were also conducted with project beneficiaries and community members engaged in forestry-related activities, allowing participants to share experiences and perspectives. Observation complemented these methods by enabling the researcher to directly assess forest rehabilitation processes and their socio-economic impacts, which helped validate information obtained through other tools. Finally, documentary review was used to analyze existing reports, studies, and records, enriching the primary data with secondary sources and providing a broader context for interpretation.

III. RESEARCH FINDINGS

1. Respondent identification

Gender of respondent

As indicated in Table 2, 59% of respondents were male and 41% were female, reflecting relatively balanced participation in forest rehabilitation activities. While men were slightly more engaged, the notable involvement of women highlights a commendable degree of gender inclusivity within the Green Gicumbi Project, reinforcing global calls for gender-sensitive climate action.

Table 1: Gender of respondent

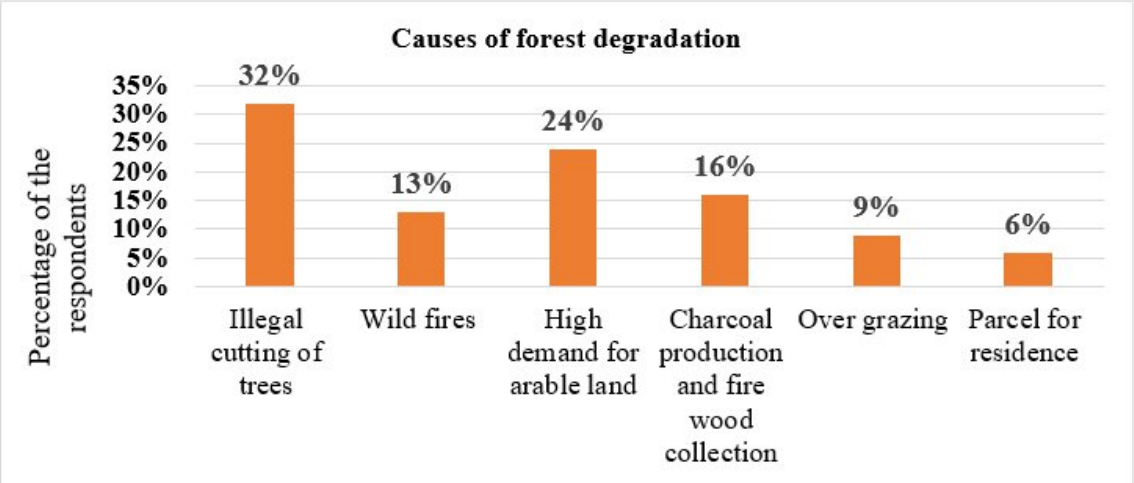
Gender	Frequency	Percentage (%)
Male	237	59%
Female	160	41%
Total	**397**	**100%**

Source: Primary data, 2025

2. The community perception on the role of forest rehabilitation

2.1 The cause of forest degradation in Green Gicumbi Project Intervention area

Figure 1: Causes of forest degradation



Source: Primary data, 2025

Figure 1 highlights illegal tree cutting (32%) and agricultural expansion (24%) as the leading causes of forest degradation, followed by charcoal production (16%), wildfires (13%), overgrazing (9%), and settlement expansion (6%).

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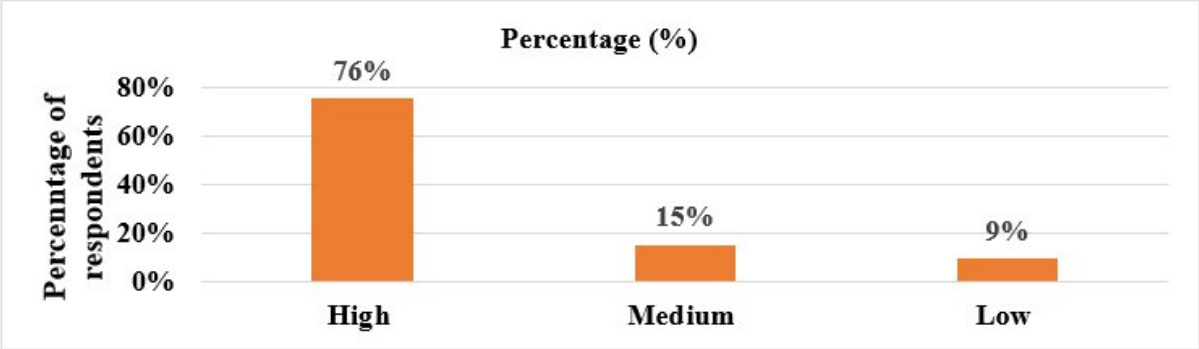
2.2 The perception of community on the forest degradation before the GGP

Figure 2: The perception of community on the forest degradation before the GGP

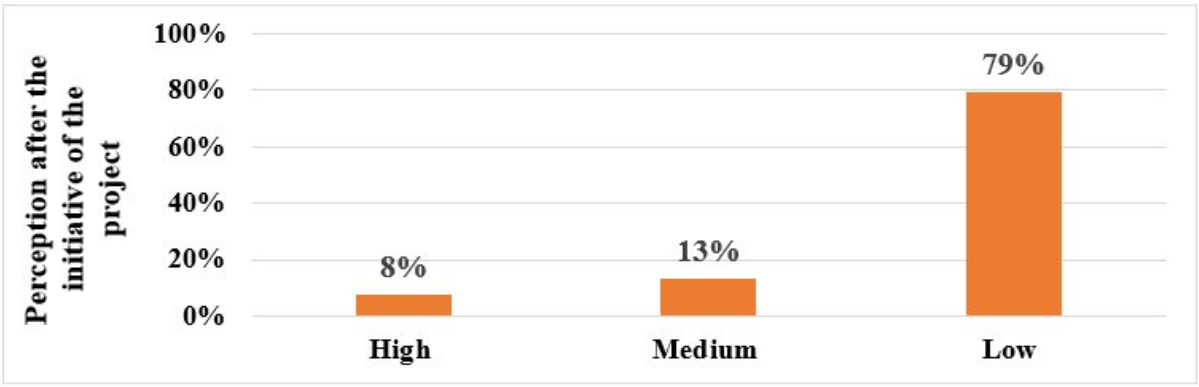


Source: Primary data, 2025

Before the project's introduction, 76% of respondents perceived forest degradation levels as high (Figure 3), signaling an urgent need for restoration.

2.3 The perception of community on the forest degradation after the initiative of GGP

Figure 3: The perception of the community on the forest degradation after the initiative of the GGP

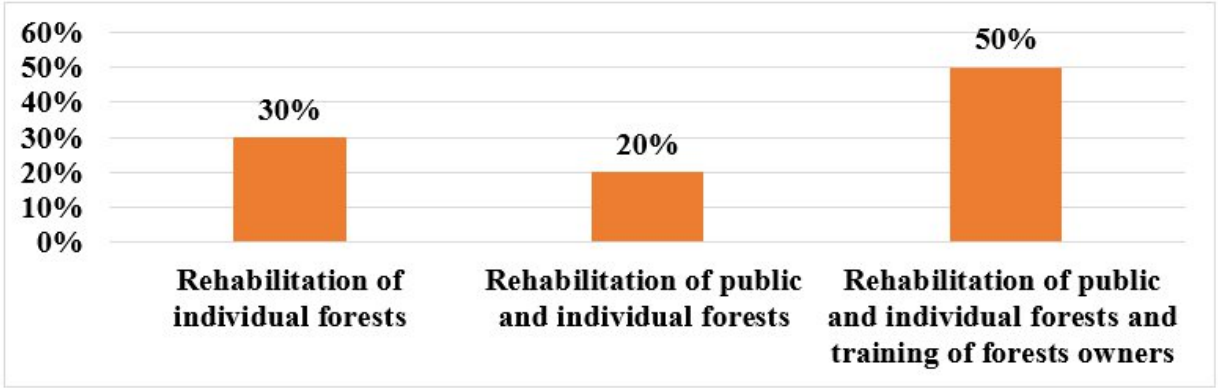


Source: Primary data, 2025

Post-intervention, 79% of respondents reported low degradation levels (Figure 3), demonstrating notable success in forest restoration efforts.The project's interventions have yielded tangible ecological benefits, affirming the value of community-based restoration strategies.

2.4 The contribution of the Green Gicumbi project on the forest rehabilitation

Figure 4: The contribution of the GGP on the rehabilitation of forests



Source: Primary data, 2025

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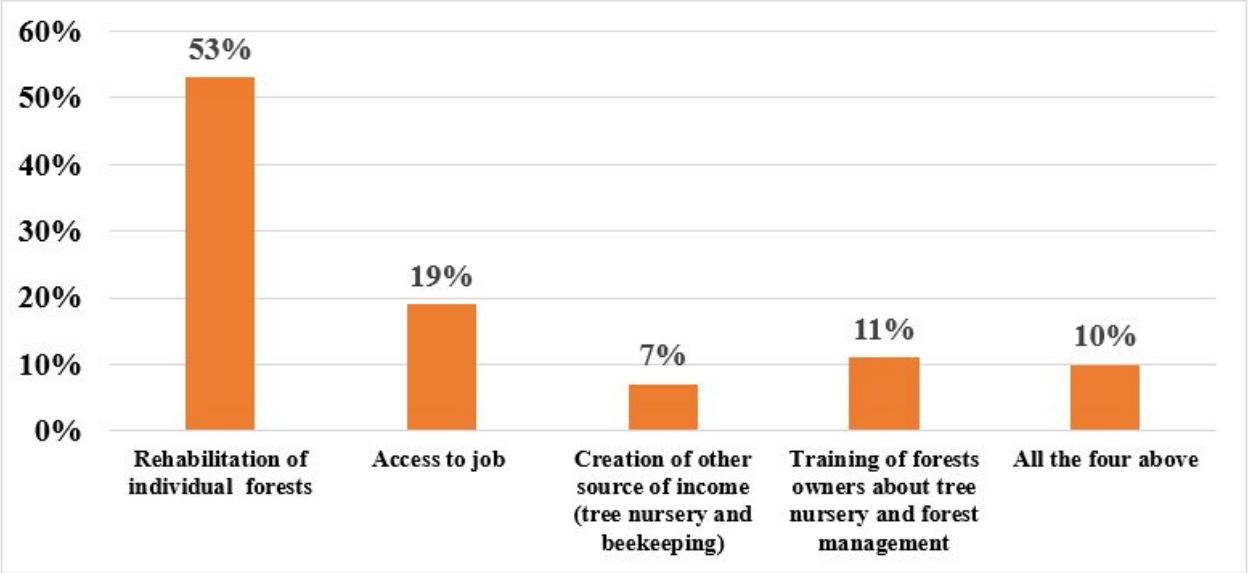
Figure 4 shows that 50% of respondents acknowledged the dual impact of forest rehabilitation and training for forest owners. Combining technical capacity building with restoration efforts has proven effective in ensuring sustainable forest management outcomes.

2.5 Community perception on the role of forest rehabilitation in GGP Intervention area

Figure 5: Community perception on the role of forest rehabilitation



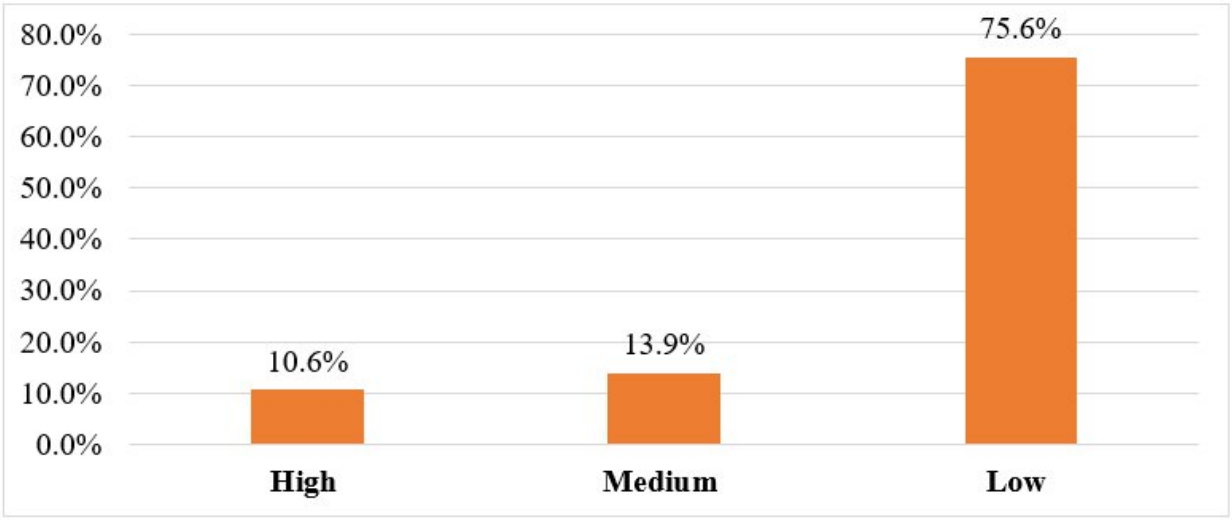
Source: Primary data, 2025

The community largely perceived benefits in forest restoration (53%), job creation (19%), income diversification (7%), and training (11%) (Figure 5). Forest rehabilitation efforts are recognized not only for environmental gains but also for advancing socio-economic development, underscoring the project's multi-dimensional impact.

3. Assessment of the socio-economic status of people before and after introduction of the project

3.1 Socio-Economic Status of People Before Introduction of the Project

Figure 6: Socio-economic status of people before introducing of the project



Source: Primary data, 2025

Prior to project implementation, 75.6% of the community was in the low socio-economic bracket (Figure 6). This baseline highlights the pre-existing economic vulnerabilities that the project sought to address.

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3.2 The monthly income of people before introduction of the project

Table 2: The monthly income of people before introduction of the project

Income	Frequency	Percentage (%)
Under 10,000 Frw	24	6%
10,000 Frw-30,000 Frw	242	61%
30,000 Frw-50,000 Frw	71	18%
50,000 Frw-80,000 Frw	40	10%
80,000 Frw-100,000 Frw	12	3%
Above 100,000 Frw	8	2%
Total	**397**	**100%**

Source: Primary data, 2025

Most respondents (61%) earned between 10,000–30,000 Frw (Table 2), reinforcing evidence of widespread poverty.

3.3 Socio-Economic Status of People After Introduction of the Project

Table 3: Socio-economic status of people after introduction of the project

Status	Frequency	Percentage (%)
High	99	25%
Medium	111	28%
Low	187	47%
Total		**100%**

Source: Primary data, 2025

Following the project, 25% of respondents reported high socio-economic status and 28% medium status (Table 3). These improvements signal that forest rehabilitation has served as a catalyst for enhanced livelihoods and income diversification.

3.4 The monthly income of people after introduction of the project

Table 4: The monthly income of people after introduction of the project

Income	Frequency	Percentage (%)
Under 10,000 Frw	3	1%
10,000 Frw-30,000 Frw	6	2%
30,000 Frw-50,000 Frw	28	7%
50,000 Frw-80,000 Frw	249	62%
80,000 Frw-100,000 Frw	103	26%
Above 100,000 Frw	8	2%
Total	**397**	**100%**

Source: Primary data, 2025

Income data (Table 4) shows that 62% of respondents now earn between 50,000–80,000 Frw, a substantial leap compared to pre-project income levels.Forest rehabilitation, when integrated with employment opportunities and sustainable harvesting models, substantially uplifts community incomes, though ongoing efforts are needed to ensure inclusivity

4. Relation between forest rehabilitation and socio-economic development in the community.

Forest rehabilitation has demonstrated profound positive linkages to socio-economic advancement, including:

- Job creation
- Improved food security through erosion control
- Greater climate resilience
- Emergence of ecotourism opportunities
- Long-term income from sustainable forestry

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While temporary harvest restrictions reduced short-term income for some, long-term benefits are expected to outweigh initial losses.

4.1 The impact of forests rehabilitation on socio-economic development of the direct beneficiary

Table 5: The impact of forests rehabilitation on socio-economic development of the community of the project

Response	Frequency	Percentage (%)
Job creation and access to education for their children	97	24%
Job creation, and access to health care	112	28%
Job creation, access to education for their children and access to health care	85	22%
Increasing the number and quality of trees per ha on rehabilitated forests	68	17%
Training of forests owners tree nursery and forest management	35	9%
Total	**397**	**100%**

Source: Primary data, 2025

As per Table 5, 28% cited job creation and healthcare access, 24% cited education opportunities, and 22% cited improvements across education, healthcare, and employment.Forest rehabilitation has holistically improved livelihoods, environmental awareness, and human capital development.

4.2 The impact of forests rehabilitation on socio-economic development of the indirect beneficiaries

Forest rehabilitation positively impacts the socio-economic development of indirect beneficiaries by creating employment opportunities in sectors such as ecotourism. Additionally, restored forests strengthen climate resilience, reducing the risks of natural disasters that could disrupt livelihoods. Indirect beneficiaries also gain from increase of carbon sequestration and footprint reduction, however. Special consideration should be given to vulnerable groups, such as the elderly and those without forests to ensure inclusive development.

4.3. The general challenges of forests rehabilitation and socio-economic development

Table 6: The general challenges facing the project community on forest rehabilitation and socio-economic development

Challenge	Frequency	Percentage (%)
Many people do not have forests	160	40%
Many people are using wood for cooking and it is difficult to get them after forest rehabilitation	111	28%
Some people are unable to work in forests rehabilitation activities	83	21`%
Delay in forest harvesting to gain money	43	11%
Total	**397**	**100%**

Source: Primary data, 2025

The main challenges include:

- Lack of forest ownership (40%)
- Scarcity of firewood (28%)
- Inability to participate in labor-intensive activities (21%)
- Delayed financial returns (11%) (Table 6)

Structural inequalities and resource access constraints must be addressed to ensure broader and more equitable benefits.

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4.4. Proposed measures and recommendations from the community

Table 7: Proposed measures and recommendations

Response	Frequency	Percentage (%)
Supporting farmers in plantation of small forests	214	54%
Promotion of other sources of energy for cooking	111	28%
Assist farmers unable to work in terms of their socio-economic development	72	18`%
Total	**397**	**100%**

Source: Primary data, 2025

Key solutions proposed include:

- Supporting smallholder forest plantations (54%)
- Promoting alternative energy sources (28%)
- Supporting socio-economic inclusion of vulnerable groups (18%) (Table 7)

Sustainable community development demands a synergistic approach, combining environmental goals with social equity and economic empowerment. In conclusion, the Green Gicumbi Project stands as a powerful example of how forest rehabilitation, when implemented through participatory and inclusive approaches, can simultaneously restore degraded ecosystems and uplift vulnerable communities. The study reaffirms that environmental conservation and socio-economic development are not opposing goals, but rather mutually reinforcing pillars of sustainable progress. Moving forward, scaling up such integrated models will be crucial for achieving Rwanda's climate resilience goals, enhancing rural livelihoods, and securing a greener, more equitable future for all.

IV. CONCLUSION

The findings of this study strongly demonstrate that forest rehabilitation, particularly through the Green Gicumbi Project (GGP), has had a significant positive impact on the socio-economic development of communities in Gicumbi District. The project contributed to reducing forest degradation, promoting sustainable livelihoods, and improving household income levels. Notably, community engagement in forest activities was substantial, with a relatively balanced gender participation and active involvement from the economically active age group. The project's multifaceted approach—including reforestation, capacity building, and promotion of sustainable land use practices—proved instrumental in achieving both environmental and socio-economic outcomes.

Before the intervention, forest degradation levels were critically high, and community livelihoods were predominantly characterized by low incomes and poor socio-economic status. However, post-GGP implementation, the level of forest degradation significantly declined, and a noticeable improvement in income and livelihood standards was observed among beneficiaries. The creation of employment opportunities, enhancement of forest productivity, access to education and healthcare, and community training have been central to this transformation.

Despite these successes, challenges such as lack of forest ownership, limited access to firewood after rehabilitation, delays in forest harvesting, and the inability of some groups to fully participate in forest activities remain significant concerns. Encouragingly, the community proposed practical, inclusive solutions, including promoting alternative energy sources, supporting smallholder forest plantations, and strengthening assistance to vulnerable groups.

In conclusion, the Green Gicumbi Project serves as a vital model for how integrated, participatory forest rehabilitation efforts can achieve both environmental restoration and socio-economic advancement. To ensure the long-term sustainability of these gains, future interventions should prioritize inclusive participation, policy support for smallholder forestry, enhanced training and capacity building, and continuous monitoring of both ecological and socio-economic impacts. By doing so, Rwanda can strengthen community resilience, achieve greater equity, and contribute meaningfully to national and global climate adaptation and sustainable development goals.

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