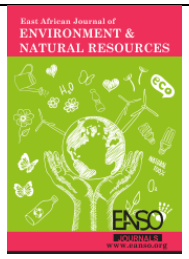

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Original Article

Impact of Forest Landscape Restoration on Socio-Economic and Environmental Benefits in Rwanda, a Case Study of Fumbwe Sector in Rwamagana District

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ABSTRACT

The study assessed the impact of forest landscape restoration on socio-economic and environmental benefits in Rwanda, focusing on the Fumbwe Sector in Rwamagana District. It aimed to evaluate the current status of forest restoration, its benefits to the community, and the relationship between forest restoration and socio-economic and environmental outcomes. Using a descriptive and correlational design with questionnaires for data collection, the findings indicated that tree species are chosen based on soil type and altitude, with a high mean score of 3.49, suggesting good community practices. Overall, forest restoration in Fumbwe is well-managed, reflected by an average mean of 3.90. Regarding socio-economic and environmental benefits, restoration efforts were found to significantly combat erosion and protect soil, with a high average mean of 3.55. The results also revealed a strong positive correlation (0.713) between forest restoration and its socio-economic and environmental impacts, indicating substantial benefits to the community. The study concluded that forest landscape restoration contributes meaningfully to rural livelihoods and environmental protection. It recommended enhancing community involvement, planting diverse tree species suitable to the local environment, and enforcing regulations to prevent illegal forest harvesting.

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INTRODUCTION

Through their agricultural endeavours, humans have had a detrimental impact on the global ecology. The neighbouring population has cleared forest restoration in numerous forest areas in search of cultivable and grazing land. Soil erosion, infertility, lack of firewood, lack of feed, lack of lumber, and lack of raw materials are just a few of the environmental degradation issues that have come from this (Sayer, The restoration of forest biodiversity and ecological values, 2004). Agroforestry is thought to provide answers to the aforementioned issues. In many developing nations, the use of forest resources presents a significant threat to the delicate balance between sensitive and complex ecosystems. Around 60% of the world's forests, or 2.4 billion hectares, are used either entirely or in part for the production of wood and non-wood forest products. About half of the world's round wood production comes from wood fuel, such as charcoal, while the other half comes from industrial round wood. The majority of wood fuel is produced in 113 countries, mostly in rural and developing nations, and utilised for cooking and heating, mainly in basic cookstoves or over open fires . Over two-thirds of the population in Africa depends in part on forest products to meet their basic needs . About 80% of the indigenous communities in Central African forest areas depend on NTFPs for between 29 and 39% of their food, medicine, and income needs in addition to timber .

Known as the "land of a thousand hills," the Republic of Rwanda is a landlocked nation in East Africa that is home to an estimated 12 million people as of 2017. With consistent yearly temperatures between 16 and 24°C and annual rainfall between 700 and 1,400 mm in the drier regions and up to 2000 mm in the wetter western provinces, Rwanda boasts an equatorial climate primarily influenced by topography . One of Rwanda's current problems is its dense population (estimated at 490 people per km2), which has a significant effect on the country's limited and fragile land supply, which is defined by its steep topography, heavy rains, and erodible soils. The pattern of land use/land cover (LULC) in Rwanda has been significantly impacted by economic development and population growth in recent decades. However, little is known about LULC patterns and the underlying mechanisms of change under future climatic conditions. The direction of LULC transfer in the research region, the factors influencing the transfer of various LULC types and their modifications, and the simulation of future LULC patterns under future climatic circumstances are, therefore, especially crucial. An LULC transition matrix, random forest sampling, the Markov chain model, and the PLUS model were used to simulate the LULC pattern of Rwanda during the following 30 years, based on LULC analyses conducted in 1990, 2000, 2010, and 2015.

According to the findings, the main components of LULC change in the research area were an increase in cropland and a decline in forest area, with a little increase in grassland and an annual rise in urban land area. With a ratio of 0.72:0.28, Rwanda's LULC was primarily transformed from forest and grassland to farmland before 2000. With a ratio of 0.83:0.17, the LULC primarily changed from forest to crops and grassland after 2010. Whereas changes in wetlands, water, urban land, and unoccupied land are more likely to be caused by a single reason, changes in forests, grasslands, and farmland are driven by multiple variables. (Li et al., 2021). About 704,997 hectares, or 29.6% of Rwanda's total land area, are covered by forest and shrubland, with 17.7% of that being plantation forests and 11.9% being wild mountain forests.

National parks preserve savannah shrub areas, such as the Akagera savannah shrub in the east, the Nyungwe forest in the southwest, the Gishwati & Mukura forests in the central-west, and the Volcanoes Forest in the north (MINILAF, 2017).

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The ability to map forests as a group of forest restoration higher than 7 m and a canopy cover of more than 10%, or the ability to reach these thresholds in situ on a land area of 0.25 ha or more, was the basis for the 2012 Forest Cover Mapping of Rwanda by Orthophotos (FAO and UNEP, 2020). According to FAO and UNEP (2020), the total forest area was made up of 43% (286,811 hectares) forest plantations, 39% shrublands (260,569 ha), and 18% natural forests (123,538 ha).

Rwanda's economy largely benefits from its forest wood. Forestry was expected to have contributed US$365 billion (or 5% of the total GDP) to the economy in the fiscal year 2016–17 (NISR, 2015). The development of Rwanda is significantly influenced by its forests. They supply 86% of the primary energy source, mostly for cooking in the home. They serve as the foundation for the nation's tourism industry, which brought in $294 million in 2013 and is expected to reach over US$600 million by 2020. Rwanda's forests sustain agriculture, which contributes 36% of GDP, 80% of jobs, and more than 45% of export earnings, by safeguarding watersheds and downstream wetlands (NISR, 2014). Although this economic value is not entirely measurable, it is translated into material assets such as fruit sales, erosion control, wood consumption (for construction, sawing, and domestic and industrial energy), and ecosystem services like climate, landscape quality, tourism, and recreation. Forests and forest restoration are now highly valued for their contribution to these benefits (MINILAF, 2017). They assist Rwanda's rural industries, offer a safe habitat and network for wildlife, and are more seamlessly linked with other land uses—all while preserving the country's climate.

Resilient ecosystems, clean water from well-managed supplies, and high air quality can all be provided by healthy forests, woodlands, and forest restoration (MINILAF, 2017). Rwanda's population is predicted to increase from 12 million registered in 2017 to 13.5 million by 2020, and it will reach 26 million by 2050, with roughly 35% of that number residing in Kigali and Rwanda's municipalities. This will significantly strain Rwandan forests for wood energy and construction. New knowledge on species selection, woodland management and restoration, land use and management, and pest epidemiology and control is necessary in light of the current dangers and difficulties facing Rwanda's forest wood. For Rwandan society to continue receiving the vital benefits that forests offer, it is imperative that the resilience and adaptability of forest ecosystems to the changing climate be recognised and regarded as critical (MINILAF, 2017). Global warming and climate change brought on by greenhouse gas emissions are real. By 2050, Rwanda's climate is predicted to shift toward one that is warmer and wetter. Despite having some of the lowest emissions in the world, a significant portion of Rwandan land will degrade due to ongoing deforestation to meet the country's expanding population's energy and timber needs, as well as unchecked forest land use change to agricultural and human settlements. The cost of doing nothing will be greater than the cost of taking action when the time comes (MINILAF, 2017). The demand-to-supply ratio for wood is 2:1, according to an analysis, and unless other sources of wood energy are found, the shortfall is expected to worsen in the future. An estimated 2.7 million tons of fuelwood are consumed annually by Rwandan households, with around half of that amount going toward the production of charcoal (RNRA, 2015).

METHODOLOGY

Description of the Study Area

Situated in the southwest of the Eastern province, between latitudes 1°57'2' 7" and longitudes 30°26'8", Rwamagana district is encircled by other districts. Its 682 km^2 are separated into 456 villages, 82 cells, and 14 administrative sectors. It has four distinct seasons and a moderate tropical climate. With an average elevation of 1528–1825 meters and four distinct seasons, the district is known for its varied terrain, which includes valleys, rolling hills that are prone to soil erosion, and some flat areas. Its problems include water scarcity, especially during the dry seasons, which run from June to September and have average

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temperatures between 19° and 30°C. The hydrograph is divided into the Akagera river basin, and its tributaries influence the hydrological patterns in the region, which implies the bimodal rainfall pattern, with two rainy seasons: a major one from March to May and a minor one from October to December. The district's soil is characterised by predominantly fertile soil found in fewer sloped areas and valleys, which are rich in organic matter and have a good water-holding capacity and are suitable for agriculture. Lateritic soil, which is often less fertile and can be prone to erosion, they are found in hill regions like Nzige, Fumbwe, Karenge, Munyaga, Gahengeri and Muyumbu and is characterised by high iron and aluminium oxide content. The marshlands in Rwamagana occupy 1209 ha. Its population is 313,461 at a population density of 460 people/Km^2 with 74,175 families extended to 682Km^2. The major economic activity of Rwamagana District is agriculture, with some other secondary economic activities, which include fishing, which is done in different small lakes such as Muhazi, Mugesera, that are found in this district, tourism attracted by some caverns as well as the crafts.

Research Design

Both quantitative and qualitative methodologies were employed by the researcher. Cross-sectional qualitative and quantitative data were gathered through household surveys. The qualitative data was gathered by assessing these perceptions and adoptions at the household level, while the quantitative data was gathered, specifically by analysing the amount gained while working on forest restoration projects and the maximum or minimum amount gained when harvesting forest products. Landsat image provided quantitative data of degraded landscape restored, while Copartners in restoration activities were provided insight on field inventory to make projections of potential productivity to be expected, as well as the actual biomass stock for five years, from 2018/2019 to 2024 in the Fumbwe Sector of the Rwamagana district. In this design, the researcher utilised questionnaires as a method of collecting information from the selected respondents and local leaders as key informants from the targeted sectors.

Sampling Design

Target Population

The total number of people or things under study, including any groups or organisations for which conclusions can be made, is referred to as the population (Shukla, 2020). The total population is 313,461, all residents in the district of Rwamagana, with 21,682 households in the Fumbwe sector.

Sample Size

A useful tool in this study is Yamane's Simplified Formula for Sample Size, which is frequently applied when a researcher has to choose a suitable sample size from a large and well-known population. A useful and effective technique for choosing a representative sample for a study is Yamane's formula, where n is the sample size, N is the size of the entire population, and e is the intended margin of error. When surveying the entire population is impractical or requires a lot of resources, it is especially helpful. Researchers can ensure valid and generalizable findings by determining the ideal sample size, which allows them to draw trustworthy statistical conclusions about the larger population (Yamane, 1973).

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

N: Total household

e: Margin error (7%)

n: Sample Size

Given that the total residents (N) of Rwamagana is 313,461 with 21,682 households in Fumbwe sector, and assuming a common margin of error of, for example, 7% (0.07), we can substitute these values into the formula to find the sample size

Now, let's calculate: Substitute the given values into the formula:

Now, calculate:

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$$n = \frac{21{,}682}{1 + 21{,}682(0.07)^2} = 202$$

So, the calculated sample size using Yamane's Simplified Formula for Rwamagana with a total household of 313,461 (NISR, 2023) and a 7% margin of error is approximately 202. Thus, the sample size would be approximately 202. A contingency of 10% was applied to account for the non-response rate. Therefore, the final sample was 222 household representatives.

Sampling Techniques

The sample size for the study was established by the researcher using a simple random sampling technique. The sector's participants were chosen through random sampling, guaranteeing accuracy in the estimation of population parameters. Subsequently, the simple random sampling process was used to select the sample size of Fumbwe sector in Rwamagana district. From the sector, all cells were selected and considered. In those cells, targeted respondents were selected randomly and surveyed by considering headed households while also considering female and male representatives.

Data Collection Methods and Procedures

The researcher collected primary and secondary data from the sample size using questionnaires. This instrument helped respondents take their time and provide the needed information thoughtfully.

Data Collection Instrument

In collecting data for this study, questionnaire and documentary review techniques were used in order to get information in both quality and quantity.

Questionnaire

A questionnaire is a set of questions which are asked to get information from a respondent. It is a set of questions prepared by the researcher to be distributed to a particular sample. A questionnaire was designed and pre-tested before the researcher submitted it to the selected respondents. The questionnaires comprised both closed-ended and open-ended questions. The questionnaire was designed on a five-point Likert scale where (1) Strongly Disagree, (2) Disagree, (3) Neutral, (4) Agree, and (5) Strongly Agree. The researcher used information obtained via questionnaires in order to make an efficient analysis. In the present study, the researcher submitted the questionnaires to respondents in order to get the needed information.

Documentary Review

Creswell and Plano-Clark (2016) defined documents as materials which contain information about a phenomenon that the researcher wishes to study. Documentation review refers to the process of carefully reading, understanding and analysing written documents for the purpose of research . Documentary review is a data collection technique based on reading books and other existing documents, like reports and brochures, so as to get background and understand information in studies on similar topics This technique enabled the researcher to obtain secondary data for the study by reviewing the existing financial statements of BRALIRWA Plc available on its website.

Validity

Validity refers to how well a specific research method measures what is supposed to be measured. In addition, validity refers to the degree to which a study accurately reflects or assesses the specific concept or constructs that the researcher is attempting to measure (Bowling, 2002). To ensure the validity of the instrument, the researchers mostly used the expertise and guidance of the university supervisor. The supervisor greatly contributed to the designing of the study instruments in line with the topic under study, specific objectives, research questions and literature so that the instrument could measure what it is supposed to measure or could collect the right data.

Data Analysis Techniques

In this study, various data analysis techniques were applied to examine the relationship between

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stock management practices and financial performance in manufacturing companies, with a focus on Bralirwa Plc. The analysis incorporated both quantitative and qualitative methods to ensure accurate and reliable findings. Statistical Package for the Social Sciences (SPSS) was used as the primary tool for data analysis, given its efficiency in handling large datasets, performing statistical tests, and generating comprehensive reports.

Reliability

Prior to the study, the researcher conducted a pilot study test in the study area to ascertain the questionnaire's dependability. This study, which only included 30 households from Mwurire Sector, was conducted to determine whether the data instruments could establish the necessary data. The researcher provided information that was anticipated from these individuals, who regarded the data instruments as legitimate.

The sample data obtained was entered into the Statistical Package for Social Science (SPSS) and used to determine the reliability of Cronbach's Alpha Coefficient. The questionnaire was considered reliable because the calculated alpha (0.774) is greater than 0.70 **(**Amin, 2009).

The Cronbach's Alpha coefficient was used to test the reliability of the data collection tool, and the results showed that the score was 0.774, within the acceptable range. Measurement error arises from random influences that tend to make measurements different from one occasion or situation to another. Measurements are only considered dependable to the extent that they are credible.

Table 1: Cronbach's Alpha

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionnable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Source: *Cronbach (2004)*

Analysis of Data

Both descriptive and correlational statistics were applied in this investigation. The researcher employed descriptive statistics, such as frequency, mean, and standard deviation, for the first and second study objectives. Spearman correlation was used for the third objective's analysis.

A statistical indicator of the strength of a monotonic relationship between paired data is Spearman's correlation coefficient. In a sample, it is indicated by and subject to the following design constraints:

$-1 \leq r_s \leq 1$

And its interpretation is similar to that of Pearson, e.g. the closer is to the stronger the monotonic relationship. Correlation is an effect size, and so it helps to describe the strength of the correlation using the following guide for the absolute value of:r_s:

- $r_s = 1$: Perfect correlation,
- $0.9 \leq r_s < 1$: Strong correlation (very high)
- $0.7 \leq r_s < 0.9$: High correlation,
- $0.5 \leq r_s < 0.7$: Moderate correlation,
- $r_s < 0.5$: Weak (low) correlation,
- $r_s = 0$: Absence of correlation.

Ethical Considerations

To ensure the safety, dignity, and rights of the participants, ethical rules were closely adhered to during the study's execution. Community ties, independence, and privacy were respected in the

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study, and participants were allowed to stop taking part at any time. Contact with community leaders and individuals ensured cultural knowledge and local customs. The objectives and possible consequences of the investigation were communicated clearly.

FINDINGS

Demographic and Socio-economic Characteristics of the Respondents

This sub-section emphasises demographic and socio-economic characteristics of the household that play an important role in perceptions and adoptions of forest landscape restoration, such as sectors, age, gender, household size, marital status, education level, employment status and habitat duration in the sector.

Table 2: Demographic Characteristics of the Respondents

Parameter	Valid	Frequency
Gender	Female	118
	Male	104
	Total	**222**
Marital status	Widowed	10
	Single	8
	Married	204
	Total	**222**
Education level of respondents	Not completed primary education	95
	Primary school	59
	Secondary school	54
	TVET	2
	College and university	12
	Total	**222**
Age of the respondent	23 to 30	27
	31 to 60	162
	61 and above	33
	Total	222
Occupation of the respondents	Farmer	143
	Small business	38
	Salary job	31
	Casual job	8
	Student	2
	Total	**222**
Family size	1 to 3	67
	4 to 6	145
	7 to 9	10
	Total	**222**
Period of respondents lived in Rwamagana district	Below 10 years	21
	11 to 30 years	91
	31 to 60 years	97
	Above 60 years	13
	Total	**222**

Source: *Primary Data, January 2025*

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The table **(Table 2)** presents the demographic and socio-economic characteristics of survey respondents: The gender distribution is balanced, with 118 female and 104 male respondents, ensuring a diverse range of perspectives from both genders. The study primarily consists of married individuals, with 204 respondents being married, followed by 10 widowed and 8 single. Gender significantly influences household decision-making, with male-headed households being more likely to adopt new technologies and engage in risky businesses. Studies have shown that gender also affects adoption decisions related to weather patterns and soil and water conservation measures. However, having a female head may negatively impact these decisions due to traditional social barriers, as women may have limited access to information and resources. The study conducted by Aelst and Holvoet (2016) stated that married households are more aware of and resilient to extreme weather patterns and climate change adaptation measures than single, divorced, separated, or widowed households, and that this makes the intersectionality approach to gender and climate change policy imperative.

95 of the respondents did not complete primary education; 59 completed primary education; 54 completed secondary school education; 2 pursued technical and vocational education and training (TVET), and only 12 pursued college and university education. Accordingly, the likelihood of adjusting to climate change is increased when the head of the household has more education. Additionally, studies have demonstrated that farmers who possess higher levels of knowledge are more inclined to adopt climate change adaptation measures compared to those who do not.

The age distribution of the respondents is concentrated in the 31 to 60 age group, comprising 162 of the respondents, while the age groups of more than 61 years old are 33. The family size comprises 4 to 6 members, with 145, followed by 1 to 3 members, 67. The majority of respondents are farmers, 143, followed by small business owners, 38 and salary jobs, 31. The dominant occupation of farming suggests a study population with a significant connection to the land and potentially vulnerable to poverty and to effects of climate change. It was shown that employment status has a significant role in determining decisions on how to adapt to climate change, and jobs outside the farm could boost farmers' income and help them deal with the negative effects of climate change. The majority of respondents 201 have lived in Rwamagana district for more than 10 years, providing a historical perspective on community changes and adaptations to extreme weather events.

Status of Forest Landscape Restoration in the Fumbwe Sector

The first specific objective of this study was to assess the status of forest landscape restoration in Fumbwe sector. In Fumbwe Sector, forest landscape restoration prioritises the selection of tree species based on soil type and altitude for optimal growth. Regeneration follows a structured sequence to ensure ecological balance. The government actively combats illegal forest use by issuing certificates for legal harvesting. Forest management practices like clear-cutting and continuous cover are implemented effectively. Additionally, government authorities have established efficient pathways to access government-owned forests, supporting both sustainable resource management and community engagement in conservation efforts. These measures aim to preserve and restore the forest ecosystem in the region.

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Table 3: Views of Respondents on Forest Landscape Restoration

Statement	Strongly Disagree	Disagree	Not sure	Agree	Strongly agree	Mean	SD
The tree species to plant are selected according to the type of soil and altitude	0.0	12.1%	35.4%	43.4%	9.1%	3.49	.825
Forest regeneration is done by respecting the sequence	3.0%	0.0%	39.4%	25.3%	32.3%	4.16	.416
At the government level, different activities are undertaken to limit people who use the forest illegally (Certificates are issued for harvesting the forest)	3.0%	13.1%	0.0%	35.4%	48.5%	4.11	.411
Stand management, like clear cutting and continuous cover, are done efficiently	3.0%	9.1%	26.3%	44.4%	17.2%	3.64	.974
Government authorities create efficient ways to pass through the government-owned forest	6.1%	9.1%	7.1%	37.4%	40.4%	4.14	.452
Average						**3.90**	

Source: *Primary data, 2025*

Legend: 5. Strongly Agree = [4.21-5.00] = very high, 4. Agree = [3.41-4.20] = high, 3. Not Sure = [2.61-3.40] = Moderate, 2. Disagree = [1.81-2.60] = low 1. Strongly Disagree = [1.00-1.80] = very low

Table 3 shows the opinions of participants in this study about different activities related to forest landscape restoration. Rwamagana region, where Fumbwe sector is located. To respond to that, it was necessary to choose the species of trees which could be in line with such kind of soil. To this element, respondents reported that for their side, tree species to be planted are selected according to the type of soil and altitude, with a mean of 3.49, which is interpreted as a high mean. This means that this action is being performed well by citizens in Fumbwe sector. Another activity which was reported to be performed well while forests are being managed is stand management with clear cutting and continuous cover of places without forest. This was accepted on the mean of 3.64, which is interpreted as a high mean.

In conclusion, the overall mean gives the message of saying that forest landscape restoration is being managed in a high manner since the average mean is 3.90, which is interpreted as a high mean.

In Tanzania, the findings from this study are in agreement with Mrema (2013), who showed that the local community were willing to create and control their own open spaces because of their understanding of the need and meaning of such spaces in their residence. Studies like Sewando et al. (2011) showed that residents' willingness to participate in forest conservation increases with the increased level of education in Mufindi District. Sesabo et al. (2006) found that some local residents were willing to participate in conservation initiatives such as the establishment of marine protected areas due to positive perceived benefits.

According to Kangalawe (2012), the local population in Irangi Hills, Dodoma Region, showed a desire to engage in agricultural conservation by embracing a number of conservation measures. This result suggests that, although being aware of the expenses involved, the local population in Dar es Salaam is eager to take part in open space conservation in order to

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restore the deteriorated quality of the specific locations. The next images corroborated these conclusions.

Figure 1: Before Rehabilitation

Figure 2: After Rehabilitation

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Socio-economic and Environmental Benefits from Forest Landscape Restoration in the Fumbwe Sector

The second specific objective of this study was to evaluate the socio-economic and environmental benefits from forest landscape restoration in Fumbwe sector. Forest landscape restoration in Fumbwe sector brings several socio-economic and environmental benefits. It helps combat erosion, preventing soil degradation and enhancing agricultural productivity. Restored forests also improve air quality by absorbing carbon dioxide and releasing oxygen. They generate income through sustainable timber and non-timber forest products. Additionally, restoration regulates weather patterns and stimulates rainfall, supporting local agriculture. Forest restoration aids biodiversity conservation, protecting species and ecosystems. It creates job opportunities in forest management, offering livelihoods to the community while fostering sustainable development and enhancing food security.

Table 4: Views of Respondents on Socio-economic and Environmental Benefits from Forest Landscape Restoration

Statement	Strongly disagree	Disagree	Not sure	Agree	Strongly agree	Mean	SD
Forest restoration contributes to fighting erosion	0.0%	17.2%	34.3%	34.3%	14.1%	3.43	.990
Forest restoration contributes to cleaning the air	0.0%	12.1%	40.4%	40.4%	7.1%	3.42	.797
Forest restoration contributes to generating income	0.0%	20.2%	38.4%	34.3%	7.1%	3.28	.869
Forest restoration contributes to regulating the weather	3.0%	23.2%	35.4%	28.3%	10.1%	3.19	1.007
Forest restoration contributes to conserving species	1.0%	5.1%	0.0%	64.4%	29.35	4.10	.420
The forest restoration projects created job opportunities in your community	10.1%	28.3%	37.4%	24.2%	0.0%	2.76	.938
Forest Restoration contributes to crop production	3.0%	0.0%	39.4%	25.3%	32.3%	4.16	.416
Forest Restoration contribute to stimulating the rain flow	3.0%	13.1%	0.0%	35.4%	48.5%	4.11	.411
Average						3.55	.432

Source: *Primary data, 2025*

Legend: 5. Strongly Agree = [4.21-5.00] = very high, 4. Agree = [3.41-4.20] = high, 3. Not Sure = [2.61-3.40] = Moderate, 2. Disagree = [1.81-2.60] = low 1. Strongly Disagree = [1.00-1.80] = very low

According to Table 4, the best advantage provided by respondents in this study revealed that forest restoration contributes to fighting the erosion with a mean of 3.43, which is interpreted as a high mean. For the second statement, the respondents attested that Forest restoration contributes to cleaning the air, by considering a mean of 4.42, interpreted as a high mean. For the third statement, the respondents reported that forest restoration contributes to generating income, since the mean was 3.28, interpreted as a moderate mean. For the fourth statement, the respondents reported that forest restoration contributes to regulating the weather at a moderate level, by considering a mean of 3.19, interpreted as a moderate mean. For the fifth statement, the

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respondents attested that Forest restoration contributes to conserving species by considering the mean of 4010, interpreted as a high mean. For the sixth statement, the respondents revealed that the forest restoration projects created job opportunities for the community, since the mean was 2.76, interpreted as a moderate mean.

For the seventh statement, the respondents confirmed that Forest Restoration contributes to crop production by considering the mean of 4.16, interpreted as a high mean. For the last statement, the respondents revealed that forest Restoration contributes to stimulating the rain flow since the mean was 4.11, interpreted as a high mean. In partial conclusion, factors behind forest landscape restoration play a great role in socio-economic and environmental benefits, by considering an average mean of 3.55, interpreted as a high mean. In rural areas, they consider that forest landscape restoration helps in protecting the soil in the form of an anti-erosion. The study by Sakurai et al. (2015) found that the need for social interactions and interests in forest landscape restoration activities, such as the "greening project", were among the factors influencing local community willingness to participate in forest landscape restoration in Yokohama city. Shan (2012) argues that education level was the main factor influencing Guangzhou residents' willingness to participate in urban green spaces conservation interventions, such as the decision-making process. Additionally, local community understanding, concerns and intentions to restore environmental problems can influence their willingness to participate in conservation interventions of environmental resources (Chun et al., 2010). These findings were supported by the following Figure 3.

Figure 3: Socio-economic and Environmental Benefits from Forest Landscape Restoration

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The findings from Figure 3 illustrate opportunity areas for agroforestry on flat and gently sloping land.

The agroforestry interventions focus on incorporating trees into agricultural landscapes, including lands being used for cultivating crops and pastures for raising livestock.

Relationship between Socio-economic, Environmental Benefit and Forest Landscape Restoration

The third specific objective of this study was to analyse the relationship between socio-economic factors, environmental benefits and forest landscape restoration. This was achieved by correlating the results of the independent variable and the dependent variable, meaning the results of community participation practices and environmental conservation. The correlation helps to show the relationship between variables, where its positive value explains the positive relationship. And the significance relationship should be tested, where the significance level of 0.05 was used in this study, where the p-value less than the significance level indicates the significance of the relationship.

Table 5: Correlation between Socio-economic, Environmental Benefit and Forest Landscape Restoration

			Forest landscape restoration	Socio-economic, environmental benefits
Spearman's rho	**Forest landscape restoration**	Correlation Coefficient	0.713	1.000
		Sig. (2-tailed)	0.006	-
		N	222	222
	Socio-economic, environmental benefits	Correlation Coefficient	1.000	0.713
		Sig. (2-tailed)	-	0.006.
		N	222	222

Note: $r_s = 1$*: perfect correlation,* $0.9 \leq r_s < 1$*: strong correlation (very high),* $0.7 \leq r_s < 0.9$*:high correlation,* $0.5 \leq r_s < 0.7$*:moderate correlation,* $r_s < 0.5$*:weak(low) correlation,* $r_s = 0$*: absence of correlation.*

The findings from Table 5 indicate that there is a high positive correlation, which is statistically significant since the correlation is 0.713 and its p-value is 0.006, which is less than the p-alpha of 0.05. This means that there is a high Socio-economic, environmental benefit from Forest landscape restoration

This finding is similar to other related studies. For example, Shan (2012) found that about 76% of the respondents were willing or very willing to participate in planning, management and design of urban green spaces in Guangzhou, China. Sakurai et al. (2015) found that more than half of the respondents were willing to participate in various forest landscape restoration projects in urban areas, like tree planting and nature conservation in Japan.

CONCLUSION

Assessing the effectiveness of forest landscape restoration in Socio-economic, environmental benefits requires an understanding of the political context, suitability of the decision-making process, the planning process, and community awareness of environmental issues. The overall mean from the findings of the first specific objective revealed that the forest landscape restoration is being managed in a high manner since the average mean is 3.90, which is interpreted as a high mean. The findings from the second specific objective revealed that the factors behind forest landscape restoration play a great role in socio-economic and environmental benefits, by considering an average mean of 3.55, interpreted as a high mean. In rural areas, they

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consider that forest landscape restoration helps in protecting the soil in the form of an anti-erosion. The findings from the third specific objective indicate that there is a high positive correlation between socio-economic, environmental benefit and forest landscape restoration, which is statistically significant since the correlation is 0.713 and its p-value is 0.006, which is less than the p-alpha of 0.05. This means that there is a high Socio-economic, environmental benefit from Forest landscape restoration. Therefore, we can conclude by saying that forest landscape restoration provides Socio-economic, environmental benefits to the community.

Recommendations

According to the results found the recommendations in this study the recommendations are subdivided into categories, those related to community participation and environmental conservation strategies.

In terms of effective forest landscape restoration, the following are recommended to local communities and authorities:

- Promote private sector investment in forest landscape restoration value chains, sustainable land management practices and technologies for forest protection and climate-smart agriculture with a focus on greening and securing supply chains
- Diversifying different species of trees which could be in line with the climate, altitude, and the type of soil
- Impose sanctions and fines on those who harvest the government-owned forests, and impose a rule of limitation for forest harvesting.
- There should be more participation by community members in determining their needs, prioritising and choice of the technology interventions for soil and water conservation that they find beneficial to them.
- Soil and water conservation projects should ensure that farmers acquire the right knowledge and skills. Additionally, environmental conservation projects need to ensure that their program staff receive specific skills to promote community participation.

In terms of strategies to mitigate the effects of deforestation, the following are recommended:

- Sensitisation and mobilisation on the effects of deforestation on the welfare of citizens
- Increasing methods and techniques of planning familial in order to avoid the pressure of overpopulation on forest management
- Promoting entrepreneurship strategies for ruining the essence of thinking that forests are the quick sources of income.

Recommendation for Further Research

It is recommended that further research should be done to assess the attitude of urban planning authorities and institutional arrangements in planning, designing and the location of open spaces.

Also, further research is needed to assess the appropriate modality for high involvement and empowerment of the local community towards the conservation of open spaces.

To make an assessment of the impact of community participation on soil and water conservation projects.

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