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Research Article

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Assessment of the impact of native tree species reforestation in Rwanda. A case study of Ibanda makera natural forest

Gaspard Ntabakirabose[1], Innocent Hakuzimana[2], Vital Mory Karinda[3], Jean Claude Noel Majuga[4], David Mwehia Mburu[5]

[1,2]Department of Forest Research, Rwanda Forestry Authority, Huye, Rwanda

[4]Department of Agricultural Engineering, Integrated Polytechnic Regional College (IPRC) Musanze, Rwanda.

[5]Department of Land Resources Planning and Management, College of Agriculture & Natural Resources, Jomo Kenyatta University of Agriculture and Technology (JKUAT), Nairobi, Kenya

**Corresponding author e-mail: gmutago@gmail.com*

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ABSTRACT

The study was conducted in Kirehe District, Mpanga Sector. The major objective of this study was to assess the impact of native tree species reforestation in Rwanda. A Case Study of Ibanda Makera Natural Forest. The study adopted a cross-sectional survey research design as its framework to guide the process of data collection. The target population was households living closer to the forest. The study adopted a purposive sampling approach to select four villages. Twenty (20) households were randomly selected from each village making a total sample size of 80 respondents. Descriptive analysis was done using SPSS version 20, and regression using STATA version 17. A logistic regression model was mostly adopted for this study to determine the factors influencing native tree species in the study area. The result of the regression analysis indicated that age, gender, occupation, household size, price of fuel, tree product use, and distance to the forest influenced negatively native tree species. This study revealed that the most common social-economic benefits of native tree species reforestation are community benefits, soil protection, carbon sequestration, increased research activities, habitat restoration, climate resilience, job creation, water regulation, increased tourism demand, and infrastructure development. Additionally, native tree species require less maintenance, are more tolerant of local conditions, and require fewer pesticides and fertilizers to thrive. Native tree species often require less water and can be used to create natural buffers that reduce noise and air pollution. Finally, from an economic perspective, native plants can improve property values, reduce energy costs, and create a more desirable living environment. Native tree species may also reduce the risk of invasive species, which can be costly and difficult to remove. Policymakers and planners should consider the importance of incorporating native tree species into their plans to ensure a more sustainable and resilient of native tree species for both urban and rural natural environments.

Keywords: Assessment, Impact, Native Tree Species, Reforestation, Natural Forest

INTRODUCTION

More than 94% of the Rwandan population depends on wood as a source of energy. Improved management of forests through afforestation and reforestation helps to diversify income-generating activities. Rwanda remains a predominantly agrarian society and much of the energy use consists of firewood and charcoal (MININFRA,2008a). 86% of overall energy use is biomass-based in the form of firewood (57%), charcoal (23%) or agriculture residues (6%). The remaining 14% of non-biomass energy is derived from petroleum products GE Baseline Survey Report - Rwanda 2016 12 (11%) and electricity (3%) (GoR, 2016). The increase in the frequency of natural disasters due to climate change observed in the environment in recent years has led people to understand the importance of tree. With an intent to combat climate change, the Rwandan government has been pursuing reforestation and afforestation through many programs across the country to increase forest cover (MININFRA,2008a).

One of the major issues associated with the afforestation and reforestation activities in natural and urban habitats is the introduction of exotic species especially Eucalyptus species which were introduced for greening the area(Charles and Dukes,2007). These species sometimes become potential threats as they become invasive, outcasting the natural vegetation and further negatively affecting ecosystem services upon which human societies depend (Charles and Dukes,2007). The invasive species becoming a potential threat can pose several other ill effects such as causing toxicity and allergic reactions (Nentwig *et al.,* 2018), and homogenizing biotic communities by replacing native species (Ku¨hn and Klotz, 2006).

Reforestation involves the replanting of trees in areas that have been previously deforested. It is a crucial strategy to mitigate the impacts of deforestation (Akpan-be, Isidore Nelson, 2017), and (Ngounou Boris,2021). Reforestation involves the deliberate planting of trees and restoring forested areas that have been depleted or destroyed. It involves a planned forest restocking to ensure a sustainable supply of timber and other forest products (Akpan-be, Isidore Nelson, 2017), and (Ngounou Boris,2021). Reforestation, in essence, involves replenishing forests to guarantee a consistent and sustainable supply of timber and various other forest resources. This objective can be accomplished through either natural regeneration techniques or artificial regeneration methods (Akpan-be, Isidore Nelson, 2017).

Reforestation generally has many advantages of supporting various flora and fauna and promoting ecological balance. Forests play a crucial role in absorbing carbon dioxide from the atmosphere and act as carbon sinks. Sequestering carbon reduces greenhouse gas emissions. Reforestation helps prevent erosion by stabilizing soil, reducing runoff, and promoting humus production from organic matter *in situ* (Park Chris *et al.*,2017). Forests play a vital role in regulating water cycles and maintaining healthy watersheds. Reforestation helps protect water sources, improves water quality, and reduces the risk of flooding, benefiting both urban and rural communities (Park Chris *et al.*,2017). Reforestation and afforestation promote the sustainable management of forest resources, including timber, non-timber forest products, and medicinal plants(Park Chris *et al.*,2017).

Reforestation can help reverse some of the more severe impacts of forest loss and degradation on rural communities in the tropics by providing secure access for local people to a range of forest products, including fuelwood and non-timber forest products; improved hydrological regulation and nutrient cycling; providing more diverse and better-connected habitats, thus supporting more biological diversity; and options to increase the resilience and adaptability of existing agricultural systems (Maginnis and Jackson, 2002).

For reforestation to be attractive to local communities, it needs to provide socio-economic benefits. As a pre-requisite for achieving long-term reforestation success, local people must receive benefits exceeding those from alternative land uses, otherwise reforested areas will continue to be cleared (Ramakrishnan *et al.*, 1994).

One of the major problems facing Worldwide forests including Rwandan forests is the shifting cultivation of farming, which reduce forests. Shifting cultivation is a method of farming in which a farmer relocates his farm to another place after about three years, as a result of the decline in crop yield. The row cropping system may be an alternative to shifting cultivation. The row-cropping method involves a compromise between row-cropping and forestry. It involves the growing of food crops and forest crops together, as long as the forest crops allow sunlight to penetrate and reach the food crops. Through this system, the land will be in continuous production, providing income to farmers and at the same time preserving the ecosystem (Etuk, and Collins, 1976).

According to the CIFOR Rehab Team (2003), the objectives of reforestation projects are to enhance productivity, livelihood, and environmental service benefits. In general, the objectives of reforestation projects are divided into physical and non-physical. Physical objectives are usually aimed at increasing forest and land cover, increasing timber production, protecting watersheds, and conserving biodiversity; while the non-physical objectives are usually to increase community incomes, create livelihood opportunities, empower local communities, secure community access to land, and to raise environmental awareness and education (Chokkalingam *et al.*, 2006a; Nawir *et al.*, 2007).

The socio-economic benefits of reforestation do not necessarily have to be direct and can include ‘avoided negative impacts’ (e.g. landslide prevention or preservation of timber reserves) (Akindele, S.O, 2012). The most common indicators used for measuring the socioeconomic success of reforestation are local income, local employment opportunities, other livelihood opportunities, provision of food and fiber, stability of market prices of locally produced commodities, and local empowerment and capacity building (Akindele, S.O, 2012).

However, reforestation initiatives in Rwanda face many obstacles. Among these challenges is the inability of the country to maintain a basic standard of acquiring regular and up-to-date information on its forest reserves. Most of the information used in making decisions on Rwandan forests is based on obsolete information and extrapolation from very old data (Akindele, S.O, 2012).

In Rwanda especially in the Eastern province, several species of native trees are found there. One such trees are *Erythrina abyssinica* (Umuko), *Ozoroa reticulate* (Umukerenke), *Zanthoxylum chalybeum* (Intareyirungu), *Albizia Amara* (Umunaniranzovu), *Euclea schimperi* (Umushikiri), *Combretum molle* (Umurama), Dombea sp (Umuhanga), (*Acacia polyacantha (*Umuharata), etc. are known for their medicinal properties and ability to purify the air. The global objective of this study was to assess the impact of native tree species reforestation in Rwanda. A Case Study of Makera Natural Forest. By planting and conserving native trees in Rwanda, we can help create a more sustainable and healthier environment for future generations.

The species of tree selected for reforestation can have a large influence on both the benefits derived from tree products and the ecological benefits of the forest (Montagnini, 2005). The most important socio-economic requirements for reforestation success appear to be enhanced livelihood planning, active participation and involvement of local people, payment for environmental services provided by forests, socio-economic incentives, financial and economic viability, degree of dependency on traditional forest products, social equality, absence of corruption, marketing prospects, and addressing underlying causes of forest loss and degradation (Dudley *et al*., 2005).

The native species, which are well acclimatized to the local environment, on the other hand, help in providing undisrupted ecosystem services. All the lower and higher level of animal species depends on the native tree species of the region for their food requirements, shelter, etc. Most importantly the native plant species does not require additional needs of resources for its growth and maintenance. In short, native species not only support ecosystem services but also support the native fauna of the region. Therefore, to keep the ecological balance of an area it is very important for planners to safeguard the existence of native plants and should promote less of the exotic plants for the plantation in the natural and urban landscapes. However, the promotion of native tree species in the long run, with mixed plantations can lead to the development of a healthy natural ecosystem (Andrew David Almas; Tenley M. Conway, 2017). As native trees are an essential part of our ecosystem and play a critical role in maintaining the ecological balance of our planet. They provide numerous benefits, such as improving air quality, reducing soil erosion, and providing habitat for wildlife. These trees are particularly important because they are well adapted to the local environment, and therefore require less maintenance and resources to grow and thrive (Andrew David Almas; Tenley M. Conway, 2017).

Few studies have been conducted on native tree species identification, benefits, breeding, methods of harvesting, dissemination, propagation, and other factors as well as challenges of adoption in many countries including Rwanda. Therefore, the main aim of this study was to assess the impact of native tree species reforestation in Rwanda. A Case Study of Ibanda Makera Natural Forest to encourage the planting of native trees. Specific objectives of the study were to classify the native tree species threatened in the study area; to identify the factors influencing native tree species threatening in the study area; and to determine the social-economic impact of native tree species reforestation in the study area. By planting and conserving native trees in Rwanda, we can help create a more sustainable and healthier environment for future generations.

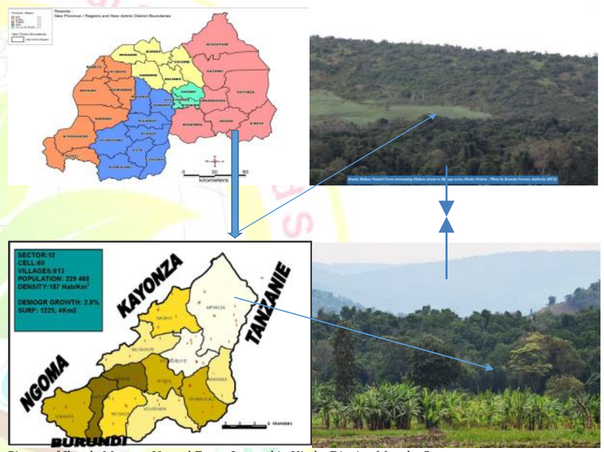
MATERIALS AND METHODS

Study Area:

Description of the Study Area

The Rwanda Population and Housing Census 2022 revealed that the total population of Rwanda is spatially distributed in rural areas representing 72.1% and urban areas representing 27.9%. The Eastern Province is predominantly the urban area (86.9%) and rural area (13.1%). Kirehe District population is predominantly by rural area 93.7% while urban represents 6.3%. Kirehe district has a current population density of 398 inhabitants/km2. It is made up of twelve administrative sectors, which are: Gahara, Gatore, Kigarama, Kigina, Kirehe, Mahama, Mpanga, Musaza, Mushikiri, Nasho, Nyamugali and Nyarubuye, 60 cells and 612 administrative villages (NISR,2022).

Kirehe Flora, a shrubby savannah dominates the natural vegetation of the district of Kirehe. The fauna of Kirehe district is diverse with several birds, reptiles, amphibians, insects, and aquatic animals including fish, crocodiles, and hippos. A large part of the fauna of Kirehe is located in the inhabited places. Kirehe District has forest plantation estimated to be 2,634 Ha of woodlots, planted by the local gaovernement and those belonging to private individuals. The Forestry sector plays a key role in supporting the livelihood of all Rwandans, especially by providing most of the energy consumed by the bulk population, controlling soil erosion protecting water catchments, and supplying other goods and ecological services (REMA, 2015).



Picture of Ibanda Macyera Natural Forest Located in Kirehe District, Mpanka Sector.

Research Design

Research design provides a logical structure for research data gathering and analysis. The study adopted a cross-sectional survey research design as its framework to guide the process of data collection.

Target Population, Data Collection, and Sampling Procedure

The target population was households living closer to the forest. The study adopted a purposive sampling approach to select four villages (Nyawera I, Nyawera II, Pirote, Busasamana I) of Nasho cell of Mpanga sector in Kirehe district of Eastern Province. These villages were purposively selected based on the proximity to the Macyera forest which was the study area. The respondents were stratified into one category namely forest communities. Twenty (20) households were randomly selected from each village making a total sample size of 80 respondents. Data was collected between October-November 2023 through personal interviews, and structured questionnaires.

Table 1. Sample Size Distribution.

Location/ District	Village	Sample size
KIREHE	NyaweraI	20
	Nyawera II	20
	Pirote	20
	Busasamana I	20
TOTAL		80

Data Analysis

The study used structured questionnaires to obtain information from the respondents. The data was coded and entered in the Statistical Package for Social Scientists (SPSS). Descriptive analysis was done using SPSS version 20, and regression using STATA version 17. The analysis included assembling of tables, and a logistic regression analysis to identify the factors influencing native tree species threatening in the study area

Model Specification

To determine the factors influencing native tree species threatening in the study area, a logistic regression model was mostly adopted for this study. The study regressed the factors influencing native tree species threatening in the study area as the dependent variable as a function of the independent variables which are socioeconomic and demographic. The choice of the logistic regression model is premised on the specification of the dependent variable as binary in nature and outcome.

Logistic Regression

Following Maddala (1983, 2001), the probability, *p*, that a household uses native tree is given by:

$$P = \frac{e^{z}}{1+e^{z}}$$

Central to the use of logistic regression is the logit transformation of p given by Z

$$Z = \ln\left(\frac{p}{1-p}\right)^{2}$$

Where;

$$Z = Z\left(f, d, a\right) + \varepsilon$$

Z is a latent variable that takes the value of 1 if the household used native tree and 0 otherwise, f is a vector of farmer characteristics, d is a vector of farm level variables, a is a vector of asset endowment variables, and ε is the stochastic term assumed to have a logistic distribution. Based on the above equation, the logistic regression model was estimated using multiple regression analysis.

Estimated Logistic Model

Specifications of the Empirical Model used for the native tree (Z) = f (age, household size, educational level, major occupation, medicinal use experience, gender, marital status, distance forest) + e

Specifically, the empirical model is specified as:

Y = β0 + β1 X1 + β2 X2 + β3 X3 + β4 X4 + β5 X5 + β6 X6 + β7 X7 + β8 X8 + β9 X9 + e

Where:

Y represents the total native tree products demanded in stere (st)

X1= Age (years)

X2 = Household size (number of persons in the household)

X3 = Educational level (years spent in school)

X4 = Major occupation (Dummy, farmer = 1, off-farming = 0)

X5 = Medicinal use experience (years)

X7 = Gender (Dummy, male = 1, female = 0)

X8 = Marital status (Dummy, married = 1, other = 0)

X9 = Distance to forest (km)

e = Error term

β0 = Intercept

RESULTS AND DISCUSSIONS

This study discussed the results and findings as well as linkage to the previous parts. The first results relate to the sociodemographic characteristics of households surveyed within the selected sectors/communities under study as shown in Table 1.

3.1 Socio-economic Characteristics of the surveyed Respondents

The data collected from the respondents were used to run regression analysis as well as to find out the relationship between inputs and the output. The results obtained are shown in the table 2 below.

Table 2. Socio-economic characteristics of surveyed respondents.

	Frequency	Percentage
Gender		
Male	46	57.5
Female	34	42.5
Age		
21-30	11	13.75
31-40	20	25
41-50	35	43.75
>50	14	17.5
Family size		
1-3	20	25
4-7	47	58.75
8 and above	13	16.25
Education		
Illiterate	17	21.25
Primary	32	40
Secondary school	20	25
University	11	13.75

The study indicated that 57.5% of the respondents were male and 42.5% were female. This implies that most of those who participated were male head of household and are most likely to be participating in forest product use especially in building, charcoal preparation, hunting as well as medicinal practices. However, 42.5% were female participating in cooking using firewood form the nearest forest even in said one. The findings displayed that 43.75% of the respondents are between 41-50 years followed by 25% whore are in the range between 31-40 years. The third class is 50 years and above with 17.5%. The last class was that is between 21-30 years with 13.7%. The findings showed that 58.7% of the respondents are between 4-7 members of household followed by 25% who are between 1-3 members while the last class was occupied by eight and above members per household with 16.2%. The results indicated that 40% attended primary school, followed by 25% of those who attended secondary school and the who attended university. The results showed that the illiterate class was occupied by 21.2% which is less compared with those in attended school. However, this percentage of the illiterate class will have a negative impact on forest conservation through household food preparation using firewood and lack of capacity building for tree harvesting and forest conservation and management.

The native tree species threatened in the study area

When a forest is cut down, the humidity levels come down and cause the remaining plants to dry out. Forest loss and degradation are both cause and effect of our changing climate. Additionally, loss of trees leads to flooding, soil erosion, desertification, loss of biodiversity, food insecurity in the future, and an increase in global warming and higher temperatures to occur more rapidly and exponentially. This also contributes to social economic conflict and population migration. This investaigation, the native tree species threats were categorized into six main classes such as firewood, animal grazing, medicine, buildings, food, and others. The findings of this study revealed the first class for native tree species threats was the firewood (96.75%) followed by animal grazing with (72.5%), medicine (53.45%), building (27.8%), food (8.7%), and others with (15.9%). Human activities have been viewed as one of the major sources of the environmental degradation. Ibimilua(2012) supported that deforestation is caused by human induced activities. Forest encroachment through various human activities are a threat to Rwandan forests. These activities include illegal logging, charcoal production, and bushfires. A national forest inventory in 2007 identified illegal tree cutting (78.3 %), charcoal making (4.9 %), livestock grazing (2.5 %), farming activities (1.9 %), bushfires (1.9 %), stem debarking (0.6 %), mining (0.5 %) and beekeeping (0.4 %) as the main threats (MINITERE-ISAR 2007).

In the study area, respondents indicated that the firewood (96.75%) for example *Dryptes gerrardi* (Umunyagahira), *Coffea eugonioides* (Umushangura), *Pterygota mildbraedii* (Umuguruka), *Acacia polyacantha* (Umuharata), *Pittosporum spathicalyx* (Umunyerezankende), *Markhamia obstifolia* (Nyiragasave), *Vachellia sieberiana* (Umunyinya) etc are in the first class. This is because the local community are mainly dependent on forest products particularly firewood for cooking. The result of this study is in line with GE Baseline Survey Report of Rwanda in 2016 indicated that Biomass Energy consumption is estimated at 86% as national average but at the district level, it is estimated at 96.3%. Fuel wood consumption is estimated at 3.2 million tons per year (GoR, 2016).

The results showed animal grazing with (72.5%) as the second main class for native tree species threats in the study area. This is because the local community did not yet adopt the system of zero grazing. This was supported by Hassan and Hertzler (2012) postulated that overgrazing, the extensive removal of tree cover for dry-land farming (both mechanized and traditional), and the excessive cutting of wood resources for fuel purposes are the main causes of deforestation in arid and semiarid environments.

The use of forest products as medicine occupies the third class which increased native tree species threats in the study area because main species for instance *Osylis lanceolate* (Kabaruka), *Comretum sp* (Umumuna), *Zanthoxylum chalybeum* (Intareyirungu), *Securidaca longepedunculata* (Umunyagasozi), *Grewia similis* (Umukomagore), *Albizia amara* (Umunaniranzovu), etc. are used to cure different human and animal diseases. The class of others with (15.9%) also cause native tree species threats in study area because they are used in Rwandan natural tools/instruments such as *Ficus thonningii* (Umuvumu), *Cordia Africana* (Umuvugangoma), *Albizia gummifera* (Umusebeya), *Markhamia lutea* (Umusave), *Olea europea var Africana* (Umunzenze), *Teclea nobilis* (Umuzo), and *Polyscias fulva* (Umwungo) are used to make chairs, spatula, wooden ladle, mortar for pounding, walking stick, milk pot, trough, bowl, drums, pipe, dugout, paddle, and other ornamental handcrafts materials.

Figure 1. Classification of native tree species threats in the study area

The factors influencing native tree species threatening in the study area

The data collected from the respondents were analysed using a multiple regression model to determine factors influencing native tree species threats in the study area. R-square value (R^2) of 0.7245 means that 72.45% of the total variation in factors influencing native tree species threatening explained the dependent variable. The result of the regression analysis in (Table 3) revealed that seven variables out of ten negatively influenced native tree species threatening in the study area. Age, gender, occupation, household size, price of fuel, tree product use, and distance to the forest influenced negatively native tree species threatening.

Meanwhile, household size, price of fuel, and distance from the forest were negatively significant at the $P \leq 0.01$ level. This implies that a unit increase in household size, and price of fuel will lead to increased native tree species threatening by 1.4 and 3.7 units respectively. However, a 1 km distance decrease to forest will lead to increased native tree species threats by 1.8. This was supported by

Belete Limani Kerse (2016) in his study on factors affecting local People participation in forest managed for carbon sequestration a Case of Mount Damota, Southern Ethiopia which indicated that distance from forest should negatively increase forest degradation because further a household is from the forest resource, the less it will interact with forest.

However, age, gender, occupation, and tree product use were negatively statistically significant at $P \leq 0.05$ level. Moreover, only three variables such as education level, off-farm income, and land size influenced positively native tree species threatening. This for instance implies that a 1-year increase in the level of education of the respondent will lead to reduce native tree species threatening by 0.85%. This study is in the same line with that of Faham *et al.*, (2008) concluded that the level of forest dweller participation in forest management activities increase as their level of formal education increases.

The results of the study showed that a unit increase in the off-farm income generation, and land size will lead to reduced native tree species threatening by 0.56 and 0.36% respectively. The finding is consistent with Chhetri (2005) indicated that the households head with larger land size have low intensity of participation in natural forest activities rather than being concentrated in their own farm activities. This could be due to the fact that the large land enabled them to have enough fodder, ground grass and other forest related benefits they could have got.

This could be because education helps the rural communities to understand better the innovation introduced to them as regard forest conservation and management as well as both direct and indirect tree production help them to make sound and useful economic and managerial decisions.

The level of education also determine the quality of skills of local communities, their allocative abilities, and how well-informed they are about the innovations and technologies around them. This is because people with higher educational qualification are usually faster adopters of innovation in different domains. This was supported by Nawir *et al.*, (2007) indicated that agriculture leads to around 80% of deforestation. Due to the over rowing demand for food products, a huge number of trees is clear felled to grow crops, and 33% of agriculture-caused deforestation is because of subsistence agriculture. This was also supported by Nawir *et al.*, (2007) which notes that industrial activities are the principal driver of deforestation and degradation worldwide, but subsistence agriculture and fuelwood consumption remain an important direct driver of deforestation, especially in Africa. Drivers vary on a regional scale. For example, cattle ranching and large-scale agriculture are major drivers of deforestation in Latin America, whereas palm oil development, intensive agriculture, and pulp and paper plantations are principal drivers in Indonesia.

The results showed that there is a negative influence of tree product use and native tree species threats in the study area at ($p < 0.05$). This implies that a unit increase in tree product use would increase native tree species threatening by 0.97 units. This is for example the construction of family houses, animal shade, bridges, firewood, charcoal, timber, medicine, and fodders are undertaken to increase the rate of native tree species threatening. Therefore, forestland is reclaimed. The results also pointed out that there is a significant association between household size and native tree species threats in the study area at ($p < 0.01$). This implies that a unit increase in the household size would increase native tree species threatening by 1.4 units. This is because household size requires more forest products for construction of house, firewood for cooking, etc. This was supported by Mfon, *et al.*, [25] in their study in Nigeria who have identified population growth and its resultant effect on deforestation. This is because as the population grows, it increases the pressure on the available forest resources for sustenance and survival. In addition, population growth also increases the demand for housing and construction, which results in a general forest decline.

Increases in human population are likely to increase household size and this could lead to an increase in fuel wood dependence in developing countries. Kapinga [22] argued that the majority of these households who depend on the forest for their livelihood are from the rural periphery of the developing countries and this has led to deforestation as a common feature.

Table 3. Regression analysis of factors influencing native tree species threats

Explanatory variables	Coefficient	Standard deviation	p-value
Age	-0.159	0.103	0.012
Gender	-0.287	0.262	0.043
Education level	0.854	0.105	0.000
Land size	0.367	0.679	0.075
Occupation	-0.448	0.113	0.035
Off family income	0.568	0.318	0.019
Households size	-1.431	0.362	0.000
Price of fuel	-3.66	0.020	0.003
Tree product use	-0.975	0.082	0.015
Distance to forest	-1.828	0.624	0.008
constant	3.097	3.766	0.000
Number of observations = 80, Prob > Chi2 = 0.000 Log likelihood = -43.75, Pseudo R2 = 0.7245			

Social-economic impact of native tree species reforestation in the study area

Forests fulfill far more functions than simply the production of wood and non-timber forest products. Indeed, they are vital in achieving global sustainable development. They provide solutions to challenges including poverty eradication, environmental sustainability, food security and agriculture, energy, clean water and watershed protection, biodiversity conservation, mitigation of and adaptation to climate change, combating desertification and land degradation, and disaster risk reduction (Kühn, 2006).

However, the findings of this study revealed that the most common social economic benefits of native tree species reforestation were the Community benefits (100%), Soil protection (97.5%), Carbon sequestration (93.7%), increase research activities (73.75%), Habitat restoration (71.25%), Climate resilience (63.75%), jobs creation (53.75%), Water regulation (43.25%), Increase tourism demand (37.5%), and infrastructure development (23.75%).

In the study area, all respondents (100%) reported that the native tree species reforestation provide the community benefits. This is because the native tree species reforestation provides community benefit in different domain as listed in figure 2. For example, jobs creation, soil protection, infrastructure development, research activities etc. This is because native tree species reforestation can provide economic opportunities for communities through sustainable forestry practices, as well as supporting ecotourism.

The native tree species reforestation is very important because it helps to sequester carbon from the atmosphere, reducing greenhouse gas concentrations and the results showed that (93.7%) respondents were agreeing with this benefit. Furthermore, native tree species reforestation provides habitats for a wide range of species, helping to restore biodiversity. The native tree species reforestation is very crucial because trees help stabilize soil, prevent erosion and maintain soil fertility as well as increase agricultural and forest productivity. The results of the study showed that native tree species reforestation facilitate water regulation as forests play a vital role in regulating water flow in rivers and streams, reducing the risk of floods and ensuring a steady water supply. The results of the study revealed that native tree species reforestation is incomparable reason and important forest management activity because a well-planned reforestation effort can enhance the resilience of ecosystems and communities to the impacts of climate change.

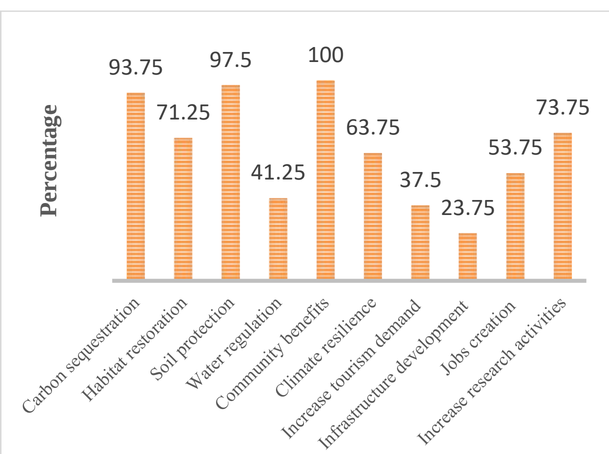


Figure 2. Social-economic impact of native tree species reforestation

CONCLUSIONS AND RECOMMENDATIONS:

The majority of the trees found in Rwanda belong to the exotic species. As the native tree species are the basis of the urban and natural landscape, further efforts should be made to encourage the planting of these native tree species to increase the proportion of these species in both urban and rural areas and promote sustainable biodiversity. The study indicated that the majority of the respondents were male with 57.5%. The findings of this study revealed the first class for native tree species threats was the firewood followed by animal grazing, medicine, building, others, and food respectively. The result of the regression analysis revealed age, gender, occupation, household size, price of fuel, tree product use, and distance to the forest influenced negatively native tree species threatening.

This study revealed that the most common social economic benefits of native tree species reforestation are community benefits, soil protection, carbon sequestration, increase research activities, habitat restoration, climate resilience, jobs creation, water regulation, increase tourism demand, and infrastructure development. If properly planned and implemented, native tree species can provide a host of environmental, economic, religious, and aesthetic benefits. From a purely aesthetic perspective, native plants are often more attractive, colourful, and fragrant than exotic plants.

Additionally, native tree species require less maintenance, are more tolerant of local conditions, and require fewer pesticides and fertilizers to thrive. Native tree species often require less water and can be used to create natural buffers that reduce noise and air pollution. Finally, from an economic perspective, native plants can improve property values, reduce energy costs, and create a more desirable living environment. Native tree species can also reduce the risk of invasive species, which might be costly and difficult to remove. Policymakers and planners should consider the importance of incorporating native tree species into their plans to ensure a more sustainable and resilient for both urban and rural natural environments.

CONFLICT OF INTEREST

The author here declares that there is no conflict of interest in the publication of this article.

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