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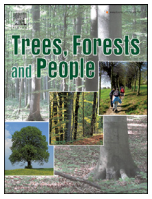

Original paper

Evaluating the potential of introducing multipurpose tree species in the rural landscapes of Weza, Ugu District municipality, KwaZulu-Natal, South Africa

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ABSTRACT

In many African countries, trees are often a source of security for poor rural communities in providing food and energy. This study evaluated the potential of introducing multipurpose tree species in the rural landscapes of Weza, Ugu district municipality, KwaZulu-Natal, South Africa. Structured questionnaire and focus group discussion interviews were used to collect data. Descriptive analysis including chi-square and Friedman tests were used to analyze the data. The study results showed that over 90% of the household respondents from Mkhoba and Ngubelanga have recognized that trees play an important role in their livelihoods compared to 88.9% from KwaBasa. In this case, the employment, collection of foods and fruits, fuel wood and grazing for livestock were benefits greatly received by household members from the surrounding forests. On average, 99.2% of household were also found to be interested in growing fruit trees with *Citrus sinensis* (4.96), *Prunus persica* (4.12), *Persea americana* (3.97) and *Malus pumila* (3.95) being the most preferred. However, giving the people their preferred tree species should be coupled with capacity building and extension support programmes in order to encourage them to effectively participate in tree planting and management. On this note, the government authorities and private sector would have to prioritize collaborative efforts in promoting or encouraging the growing of multipurpose trees and adoption of agroforestry practice strategy through development of tailor-made capacity building and awareness creation programmes.

1. Introduction

In many African countries, trees are often a source of security for poor rural communities in providing food, energy (Koffi *et al.*, 2016) and source of income for the people (Garrity *et al.*, 2010). Rural households often collect tree products for their own use and/or for selling (Powell *et al.*, 2011; Arnold *et al.*, 2011). Some trees can be intercropped with household crops for the purposes of soil amelioration (Akinnifesi *et al.*, 2010). Trees are also beneficial through their provision of food, medicine, windbreaks, firewood. Moreover, trees also play an important role in small-scale farmers and rural households' livelihood as they provide a safety net function as well as a means for poverty alleviation (Leakey *et al.*, 2005; Shackleton *et al.*, 2005). In fact, rural individuals are both mindful of and reliant on the products and services provided by trees (Shackleton *et al.*, 2008). In the study conducted by Li *et al.* (2020) in central mountainous region of Hainan Island in China, the major source of household income (74%) was derived from tree plantation activities providing 46% of the total income.

People also have gardens where they grow vegetables and other trees and shrubs, crops as a means of alleviating poverty. The home-garden has been recognized as an imperative social and economic unit of rural family units (Azeez *et al.*, 2007; Li *et al.*, 2020). These have been described as areas where a variety of crops, trees, shrubs, herbs, and livestock are managed to provide food, shade, fuel, income, medicines, construction materials, and socio-cultural purposes (Sahoo, 2009). Moreover, home gardening and agroforestry are identified as a means to lessen the pressure that increasing population densities usually have on natural forests (Dewia *et al.*, 2013).

Agroforestry is severely underdeveloped in South Africa as compared to other southern African countries (Zerihun *et al.*, 2014). In South Africa, there is limited amount of arable land, which counts for only 22% of the total surface area. Major land use on the arable land is agriculture, accounting for 81%, while natural resources only comprise of 9%. Of the agricultural land, 83% is used for grazing, and 17% is used to cultivate crops, forestry only takes up 2% of the land (DALA, 2007). Most importantly, both Agriculture and Forestry are critical and contribute significantly in the country's Gross Domestic Product (GDP), contributing

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24.2% in the first quarter of 2018 (Statistics South Africa, 2018). This necessitates the need to explore agroforestry and take advantage of its benefits, especially for rural areas that mainly depend on these resources for their livelihoods. Agroforestry has the potential to address many of the issues associated with land use competition as arable land in South Africa is relatively limited. According to DAFF (2017) the agroforestry systems has the potential to contribute to sustainable agriculture. It is capable of increasing productivity, improves income, promotes environmental sustainability, reduces impacts of climate change, and promote stable biodiversity. It can also help reduce the challenges of soil degradation and soil erosion (DEA, 2015a, 2015b). For instance, Agroforestry practice in Columbia have been widely promoted to reverse the environmental impact of livestock farming such as deforestation, land degradation, loss of biodiversity and emission of greenhouse gases (Jara-Rajos *et al.*, 2020).

Although still not well established, many rural areas in South Africa do practice agroforestry (DAFF, 2017). For example, in the Eastern Cape, people usually plant crop combinations; in summer, maize is usually intercropped with sugar beans, pumpkins, and potatoes. In the Limpopo province, people usually have fruit trees in the homesteads while at the same time keeping a home garden. Many crop combinations are usually practiced in many rural areas in the country. DAFF (2017) further notes that information on agroforestry in South Africa is difficult to access and outdated. Agroforestry has the potential to improve the livelihoods of rural farmers by increasing their crop yields because it consistently restores the fertility status of the soil by recycling the litter that is deposited, thus increasing soil organic matter. It is also very important for rural homesteads as it provides tree products like fodder, firewood, woodcraft, medicinal herbs and food for livestock and man, without them having to go to forests to collect them (Alao and Shuaibu, 2013). According to Alao and Shuaibu (2013), the trees used in the practice of agroforestry have the ability to fix nitrogen which also helps improve soil fertility (Lott *et al.*, 2009). Furthermore, the system is capable of improving the water holding capacity of the soil (Siriri *et al.*, 2013) and other ecosystem services (Schroth *et al.*, 2004). As suggested by Nair and Nair (2014), the agroforestry practice also has the potential of mitigating climate change by increasing carbon sequestration.

The comparison of past and present assessments of natural forests in South Africa reveal a trend of decreasing natural forest cover (Watts, 2006). This means more plantations are necessary to buffer the pressure put on these natural forests and prevent them from being destroyed. The DAFF (2015) strategic plan enlists the application of the agroforestry policy as the tool to ensure food security for small growers, while they wait for their harvest. DAFF is also developing policies and strategies on conservation, food security and nutrition, and land care. Agroforestry can support all these three initiatives. DAFF (2017), on its Agroforestry Strategy Framework (ASF) for South Africa, states that agroforestry has the potential to contribute to sustainable development. The Intergovernmental Panel on Climate Change (IPCC, 1999) also acknowledges agroforestry as an essential component of climate-smart-agriculture. Furthermore, the Agroforestry Strategy Framework for South Africa acknowledges that agroforestry also includes community forestry and sustainable forest management (DAFF, 2017).

In many rural communities, the households keep small gardens where several crops are grown, including maize, potatoes, wheat, cabbage, spinach, and many other crops. The surrounding landscapes are covered with natural and plantation forests. Considering the high unemployment in rural communities, the natural resources from the surrounding forests and subsistence farming practices become the livelihood safety net (Schakleton *et al.*, 2005). Consequently, the objective of this study was to assess the potential of introducing multipurpose trees into people's homesteads as well as associated benefits on households' livelihoods. This study was commissioned by community forestry component of Merensky Forest Company (MFC). The plan was to introduce *Persea americana* tree planting with free seedlings provided to individual households for planting in their homesteads with the market for the fruit during maturity guaranteed. Furthermore, MFC highlighted the reasons for pursuing this approach or initiatives being to strengthen the unstable community relations while presenting individual household with opportunities to generate income as well as address food security issues upon first harvest into the future. At the same time, this approach was envisaged to provide the much needed land resource for the company to increase their *Persea americana* production to complement yield from their Orchards operations in Tzaneen, Limpopo. Hence, conducting this study was significant to understand the household perception about their willingness to grow trees and type of tree species preferred. Similarly, Azeez *et al.* (2007) have argued that adoption of any system cannot be realized unless appropriate attention is given to the end-users' or target group perceptions on limiting factors.

It is thus important for forest companies interested in improving the livelihoods of rural households in the KwaZulu-Natal region to understand the importance of trees and tree products to people and how the livelihoods of rural residents depend on these trees. This understanding will help to ensure that the tree species that are chosen to be grown in these areas meet the needs of the rural dwellers. Moreover, it will ensure that the tree species are integrated well with their already existing agricultural practices, thereby promoting long term sustainability of these trees in the households or the community (Azeez *et al.*, 2007). The outcomes of the study will provide useful information on how to integrate forestry with already existing agricultural practices in rural areas, with information on how to use agroforestry to alleviate poverty in rural areas and how to achieve sustainable human development.

2. Methodology

2.1. Description of study areas

The study was conducted at Weza, (30° 36′ 0" South, 29° 43′ 0" East) which is a settlement in Ugu district municipality in the Kwazulu-Natal (KZN) province in South Africa. Weza is 20 km west of Harding and 50 km east of Kokstad (Ugu District Municipality, 2015). The names of the communities under study were KwaBasa, Mkhoba, and Ngubelanga. These settlements are close to the forest plantations owned and managed by Merensky Forestry Company (MFC) situated in Weza. Furthermore, these communities are in the close proximity of compacted closed-canopy indigenous forest as well as woodlands. These communities were purposefully selected as the study communities on the basis that MFC's community forestry section needed to understand whether households would be interested in receiving donation of *Persea americana* seedlings to grow in the homesteads. Most of the members from these communities are employed by MFC to work in the timber processing plant and also in the plantation to perform silvicultural operations.

2.1.1. Socioeconomic profile of KwaBasa

KwaBasa is a small community under the uMzimkhulu local municipality. This community consists of only 63 households with majority of them sharing the same family name. The respondent's gender distribution was 36.4% males and 63.6% females. The households (63.2%) in this community are headed by females who are unemployed and unmarried, (40% married and 60% unmarried). The average household size in this community is 4.8 individuals per household. Furthermore, this community is characterized by a very high unemployment rate. This community high unemployment rate can be linked to 46.6% uMzimkhulu local municipality unemployment rate of which 56.6% of that account for youth unemployment rate (Statistics South Africa, 2011). The youth have secondary education as their highest level of education. Most of the land surrounding the community is covered with plantation forests and natural forests. The village chief claims that even though the land with the exotic forest plantation trees is currently under the ownership and management of MFC, the land rightfully belong to the community and as such, the land claim is submitted and currently being processed.

The employment opportunities for household members in this community are presented by MFC in Weza. In addition to employment at MFC, majority also support themselves with the production of crops and the keeping of livestock. They also have access to the surrounding forests, to collect foods and fruits, poles, firewood for cooking, medicinal plants. The community has access to piped water and electricity.

2.1.2. Socioeconomic profile of Mkhoba and Ngubelanga

Mkhoba and Ngubelanga are communities under Umuziwabantu local municipality. This municipality has about 98 157 total population. Mkhoba has 1265 households, while Ngubelanga has 350 households. In these study communities, the households are mostly run by unmarried females. In Mkhoba respondent's distribution were 20.1% males and 74.9% females, with 41.4% married and 58.6% unmarried. In Ngubelanga, there were 28.4% males and 71.6% females, with 38.8% married and 60.7% unmarried. The household size in this local municipality was reported to be 4.5 individuals per household (Ugu District Municipality, 2015). The unemployment rate in Umuziwabantu local municipality was reported to be 33%. In Mkhoba and Ngubelanga study communities, the unemployment is very high; people survive by practicing livelihood strategies such as the production of crops, which include maize, potatoes, sweet potatoes, cabbages, spinach, etc., as well as livestock production especially cattle and sheep. They also derive benefits from the surrounding natural and plantation forests to support their livelihoods. The primary source of employment is Merensky Forestry Company that owns the forest plantations close to these communities. The level of education in these communities is relatively low (which is primary and secondary education level), which makes it difficult for them to receive decent employment.

2.2. Research design and sample size

A mixed-mode research design approach was used in this study to ensure unbiased representation across respondents' groups (Martin, 2011). Most importantly, mixed research design approach presents an opportunity for the researcher to gather both quantitative and qualitative data through the use of various tools (Wilkinson and McTiernan, 2020). According to Mathers *et al.* (2007), a sampling frame "is the pool of potential participants which share similar criteria for entry into a study"; this can also be known as a population. Consequently, the three rural communities in KwaZulu-Natal province were purposefully selected since they were targeted by MFC for the project to introduce *Persea americana* (Avocado) tree planting in the homesteads of individual households. The total number from the lists of households were used to determine the sample sizes required for the survey at Kwabasa (55), Mkhoba (295) and Ngubelanga (183) (Krejcie and Morgan, 1970).

$$S = \frac{X^2 N P(1-P)}{d^2(N-1) + X^2 P(1-P)}$$

Where:

S = Required Sample size
X = the table value of chi-square for 1 degree of freedom at 95% confidence level (3.841)
N = Population Size
P = Population proportion (expressed as decimal) (assumed to be 0.5 (50%) d = Degree of accuracy (5%), expressed as a proportion (.05), It is margin of error

2.3. Data collection

This research involved human participation in the data collection process. Therefore, before the data was collected, the ethical clearance application was prepared and submitted in line with the research ethics committee' guidelines for approval. In this study, data were collected using a structured household questionnaire, which was administered to heads of selected households. Before data collection, research assistants in all three communities (KwaBasa, Mkhoba, and Ngubelanga) were trained on data collection methods and tools, respectively (Fig. 2). The process of data collection took five days in each village for questionnaire distribution. The household survey focused on the following questions:1) *What are the benefits your household get from the surrounding forests? 2) What is your level of agreement in that trees play an important role in your household livelihood? 3) Do you have any knowledge about agroforestry land use practices? 4) Are you willing to plant or grow trees in your homestead? 5) Which type of trees do you prefer for planting in you homesteads?* and *6) What are organizations in your knowledge participated in tree planting project in your community?*

Additional to the household survey, the focus group discussion was conducted to understand people's views concerning the idea of MFC introducing tree planting initiative in their households' livelihood. Specifically, the FGDs participants were asked a question about whether they would be willing to accept and grow *Persea americana* in their homesteads that MFC intend to donate or not. Another question was whether the introduction of multipurpose trees in the agroforestry system is perceived as bringing about any positive change in their livelihoods. The participants of the FGD's were selected from the households visited. Each research assistant was tasked to invite the respondent at the household for a focus group discussion interviews session. Additionally, the FGD's had 20, 50, and 30 participants for KwaBasa, Mkhoba, and Ngubelanga, respectively. Furthermore, the focus group was to discuss whether poor socio-economic status of the households in the communities could be improved by the introduction of trees and agroforestry practices. The structured questionnaire used for the household survey was divided into four sections. The biographic information of the household respondents was covered in section A. Secondly, section B captured the involvement of the Weza rural settlements in community forestry. While section C and D covered multipurpose trees and agroforestry, respectively.

2.4. Data analysis

In this study, the household data were analyzed using the Statistical Package for Social Sciences (SPSS) version 20. In this case, the descriptive statistics, including frequency and percentage, were used to compare the characteristics of the sampled household respondents across the three communities. The Chi-square test of independence was performed to determine whether responses of the respondents from the three study communities were related or not. Considering that the preference of fruit trees were ordinally measured, the non-parametric Friedman's test analysis to determine the differences in the responses of the household respondents on the type of fruit trees they preferred to plant in their homestead was used (Hoffman, 2019; Smallheiser, 2017).

3. Results

3.1. The demographics of the respondents

Table 1 presents the characteristics of the household respondents results in the study communities. In terms of gender, there were more females (64.0% at KwaBasa, 72.0% at Ngubelanga, 75.0% at Mkhoba) than males in all villages (Table 1). The age distribution showed that the youth (18–35 years) were the lowest class ranging from 25.0% to 27.0%, followed by the above 55 years (30.0%–40.0%). Except for KwaBasa, the dominant age class was the 36–55 years (40.0%). Over 80.0% respondents in KwaBasa and Mkhoba community acquired basic education level qualification (primary and secondary) compared to 78.7% from Ngubelanga community. However, Mkhoba community is the highest with 4.7% of respondents holding tertiary qualifications compared to those from KwaBasa and Ngubelanga with 1.8% and 0.5%, respectively. The majority of respondents in the three communities were not married with those from Mkhoba accounting 58.6% compared to 60.0% and 60.7% from KwaBasa and Ngubelanga, respectively.

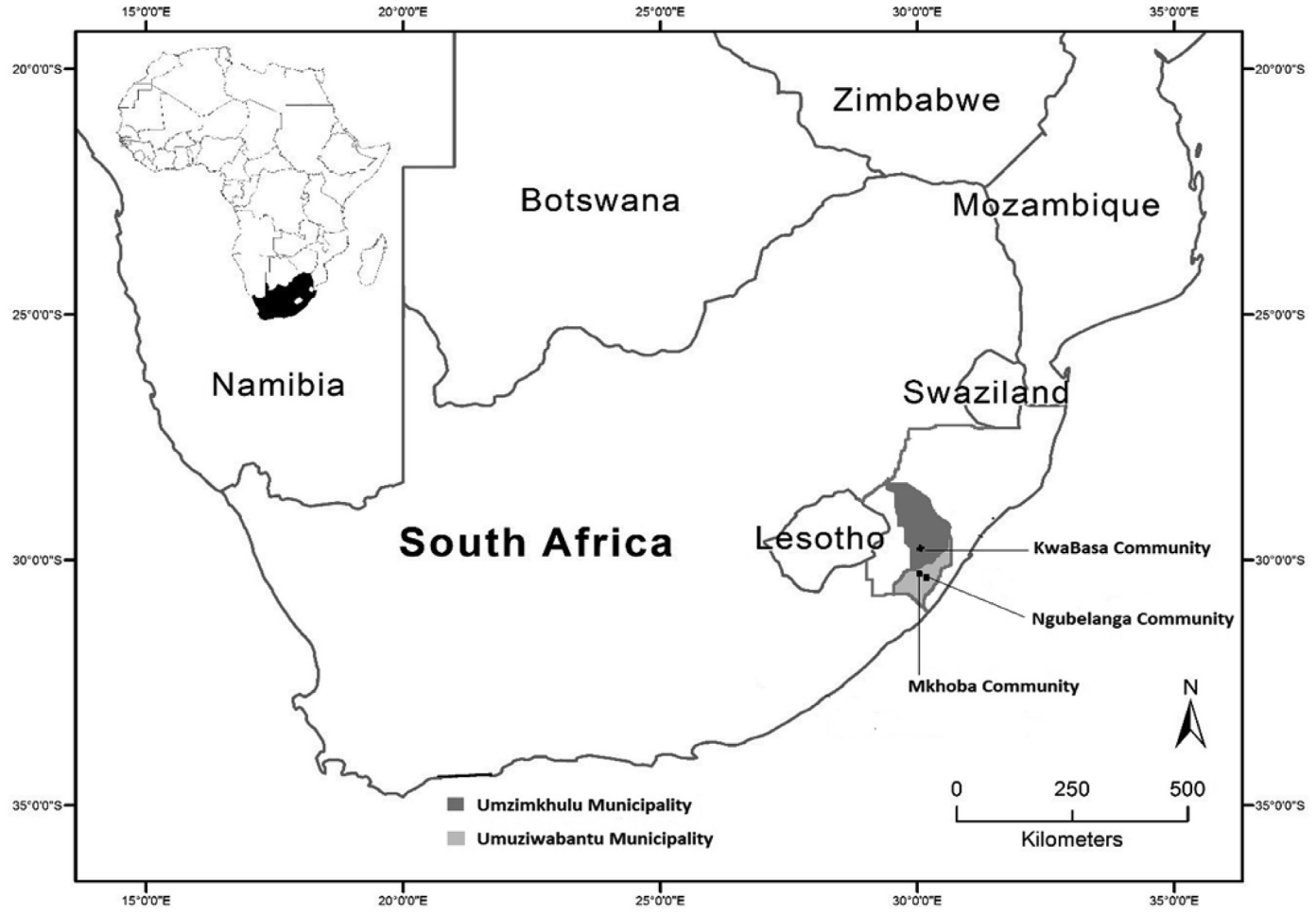

Fig. 1. Map showing the study areas of Mkhoba, Ngubelanga, and KwaBasa within their municipalities in KwaZulu-Natal Province.

Fig. 2. Photo showing training of research assistants on how to collect data using questionnaire.

Table 1
Characteristics of household respondents in study communities

Household respondents profile	Proportion of respondents in each community (%)		
	KwaBasa (n = 55)	Mkhoba (n = 295)	Ngubelanga (n = 183)
Gender			
Female	64.0	75.0	72.0
Male	36.0	25.0	28.0
Age category			
18–35	25.0	25.0	27.0
36–55	35.0	45.0	41.0
Over-55	40.0	30.0	32.0
Highest level of education			
Not Educated	14.5	8.1	20.8
Primary	47.3	37.3	36.6
Secondary	36.4	49.8	42.1
Tertiary	1.8	4.7	0.5
Marital status			
Single	60.0	58.6	60.7
Married	40.0	41.4	38.8

Table 2
Household responses on the importance of trees, knowledge of agroforestry practice, growing trees in homesteads and type of preferred trees

Questions	Responses	Proportion of respondents' responses in study communities (%)			Inferential Statistics		
		KwaBasa (N = 55)	Mkhoba (N = 295)	Ngubelanga (N = 183)	X^2	df	P-value
What is your level of agreement that trees play an important role in your household livelihood?	Strongly agree	70.4	87.4	93.3	26.808	8	0.001
	Agree	18.5	9.9	5.6			
	Not sure	9.3	1.7	1.1			
	Disagree	1.9	0.7	0.0			
	Strongly disagree	0.0	0.3	0.0			
Do you have any knowledge about agroforestry practice?	Yes	60.0	37.6	27.1	19.128	2	0.001
	No	40.0	62.4	72.1			
Are you willing to grow trees in homesteads?	Yes	90.6	97.3	100	15.302	2	0.001
	No	9.4	2.7	0.0			
Which type of trees do you prefer for planting in you homesteads?	Fruit	98.1	100.0	99.4	4.437	2	0.109
	Medicinal	1.9	0.0	0.6			

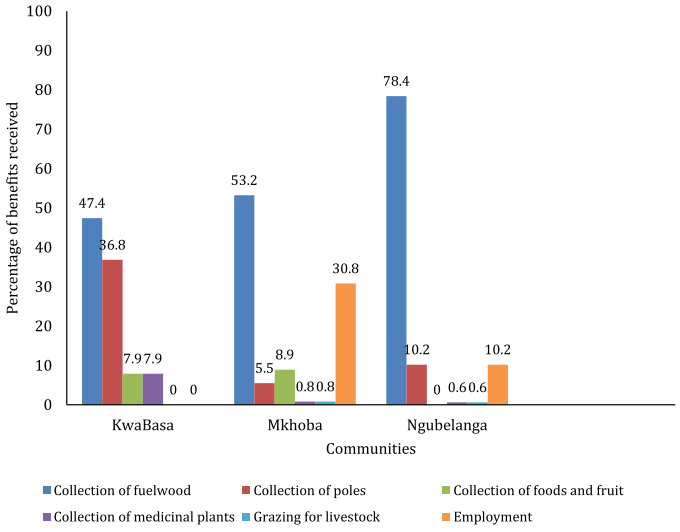

Fig. 3. Percentage of benefits received from forests

3.2. Forest benefits accrued to respondents

Majority of household respondents in the study communities indicated they received benefits from the surrounding forests. Fig. 3 below shows the results of forest benefits options, which include collection of fuelwood, poles, food and fruits, medicinal plants, grazing for livestock and employment. They were further requested to indicate on the given options which benefits they accrued. The households in Kwabasa community indicated that from the listed benefits they mostly accrued collection of poles (47.4%), followed by employment (36.8%), collection of food and fruits and collection of medicinal plants accounted for (7.9%). At Mkhoba and Ngubelanga collection of fuelwood was the most accrued benefit with 53.2% and 78.4% respectively. Employment benefit accounted 30.8% for Mkhoba and 10.2% for Ngubelanga. Collection of poles counted at 5.5% for Mkhoba and 10.2 for Ngubelanga. The collection of medicinal plants and grazing for livestock both counted for 0.8% for Mkhoba, while at Ngubelanga they both counted at 0.6%. The results showed a statistically significant relationship ($p < 0.001$) in the types of benefits accrued by respondents from the surrounding forests.

3.3. Perception of importance of trees, growing interest and knowledge of agroforestry

Table 2 shows the importance of trees, knowledge of agroforestry practice, tree growing or planting interest and type of tree preference results in the study communities. Over 90% of the respondents from Mkhoba and Ngubelanga communities indicated that trees are important in their household livelihood compared to only 88.9% from KwaBasa. Regarding growing of trees in the homesteads, the majority of respondents showed that they are highly interested accounting 90% in KwaBasa (n = 55) compared to 97.3% and 100% from Mkhoba (n = 295) and Ngubelanga (n = 183), respectively. Similarly, more than 90% of the respondents in the three study communities indicated that they would prefer fruit trees in their homesteads instead of medicinal trees. About 60% respondents in KwaBasa (n = 55) (60%) revealed that they were familiar with the practice of agroforestry compared to 27.1% and 37.6% in Ngubelanga (n = 183) and Mkhoba (n = 295), respectively. In this case, there was a statistically significant relationship ($p < 0.001$) between the respondents' responses regarding their knowledge of agroforestry practice. Regarding the involvement of organizations in tree planting or growing projects in the communities (Table 3), about 98.1% of respondents in KwaBasa indicated that MFC was the most involved compared to those from Mkhoba (88.8%) and Ngubelanga (62.3%). However, fewer respondents from Mkhoba (5.4%), Ngubelanga (2.7%) and KwaBasa (1.9%) revealed that the local municipality was involved in the tree planting activities in their communities. On the other hand, over 30% of the respondents from Ngubelanga indicated that there was no involvement of any organization in terms promoting tree growing activities in their locality compared to only 2.0% from Mkhoba. The involvement of DEFF in promoting tree planting in the communities was recognized by a fraction of the respondents in Mkhoba (3.7%) and Ngubelanga (0.5%).

3.4. Fruit tree preference ranking

Table 4 shows the ranking of fruit tree preference by household respondents. The majority of the respondents ranked *Citrus sinensis* (4.96) as their first preferred tree species they are willing to plant or grow in the homesteads. The second household preferred tree species is *Prunus persica* with mean ranking value of 4.12 followed by *Persea americana* (3.97) and *Malus pumila* (3.85), respectively. Furthermore, they revealed that the least household preferred fruit tree species in the study communities are *Macadamia integrifolia* (3.55) and *Carya illinoinensis* (3.52). Also, the results showed significant difference between fruit tree preference ranking at $p \leq 0.001$.

3.5. Factors limiting household tree planting activities

Table 5 shows the results of the main challenges or factors affecting tree planting activities in the three communities. Majority of the respondents from KwaBasa (69.1%), Mkhoba (70.8%) and Ngubelanga (67.2%) have indicated that lack of seedlings is the limiting factor for them to participate in tree planting. Most importantly, all respondents from KwaBasa have not regarded availability of land as a factor limiting tree planting activities in their community, while in the same vein 13.2% from Mkhoba and 3.3% from Ngubelanga indicated land availability as a serious issue limiting them to participate in tree planting activities. About 25.5%, 31.2% and 37.7% of the respondents have indicated lack

Table 3
Organizations involved in tree planting projects in the communities

Question	Organizations	Proportion of respondents' responses in study communities (%) KwaBasa (N = 55)	Mkhoba (N = 295)	Ngubelanga (N = 183)	Inferential Statistics X^2	df	P-value
Which organization in your knowledge has approached your community regarding the tree planting project?	Local municipality	1.9	5.4	2.7	120.459	6	0.001
	MFC	98.1	88.8	62.3			
	DEFF	0.0	3.7	0.5			
	None of the above	0.0	2.0	34.4			

Table 4
Household respondents' fruit tree preference ranking

Fruit	Preference ranking	Inferential statistics Chi-square	df	p-value
Citrus sinensis (Orange)	4.96	423.464	6	0.001
Prunus persica (Peach)	4.12			
Persea americana (Avocado)	3.97			
Malus pumila (Apple)	3.95			
Musa acuminata (Banana)	3.87			
Macadamia integrifolia (Macadamia nuts)	3.57			
Carya illinoinensis (Pecan nuts)	3.55			

Ranking range
1 – Lowest preference - 7- Highest preference

Table 5
Main challenges limiting household tree planting

Factors limiting tree planting	Proportion of respondents' responses main challenges (%) KwaBasa (n = 55) Yes	No	Mkhoba (n = 295) Yes	No	Ngubelanga (n = 183) Yes	No	P-value
Lack of seedlings	69.1	30.9	70.8	29.2	67.2	32.8	0.703
Availability of land	0.0	100	13.2	86.8	3.3	96.7	0.000
Pest and diseases	5.5	94.5	16.6	83.4	38.8	61.2	0.000
Vandalism of trees	1.8	92.8	7.5	92.5	2.7	93.7	0.038
Livestock problems	23.6	76.4	23.4	76.6	37.7	62.3	0.002
Lack of knowledge in tree growing	25.5	74.5	31.2	68.8	23.5	76.5	0.173

of knowledge in tree growing and livestock problem as factors limiting their participation in tree planting activities in KwaBasa, Mkhoba and Ngubelanga, respectively. More than 90% respondents in all the communities did not regard vandalism of trees as problem. In the contrary, pest and diseases was regarded by few (5.5%) in KwaBasa as a limiting factor for them plant trees compared to those from Mkhoba (16.6%) and Ngubelanga (38.8%).

4. Discussion

4.1. Significance of household socio-economic status on tree planting adoption

The results revealed that most respondents had primary and secondary education with few of them possessing tertiary education level. At the same time, there were more female headed households and few youth available in rural areas which could be attributed to labour migration. As noted by Nwosu and Ndinda (2018), the cities have lucrative industries and well-paying departments and companies that attract the educated youth. According to Okorio *et al.* (2004) it is paramount to balance the involvement of males and females in tree growing activities. This is mainly because preferences of which specific tree species to grow vary between the two gender categories. Moreover, the household tree growing activity may substantially be affected by the age of the head of household factor (Kulindwa, 2016). Considering the low level of tertiary education within the communities and the lack of knowledge identified as the limiting factor for household to engage in tree planting activities, it may be significant to pursue tree growing awareness programmes (Kulindwa, 2016) and capacity building programmes with the incorporation of extension services (Obiri *et al.*, 2011). In this case, the efforts of tree growing initiatives may be more easily promoted and acceptable to the households in the rural communities. According to Makhubele *et al.* (2020) and Li *et al.* (2020), the socioeconomic factors of the households are closely linked to the potential land use options. Therefore, it is important for community members' socioeconomic status to be improved in order to ensure more participation in various activities including tree planting as well as adoption of agroforestry practice (Jara-Rajos *et al.*, 2020).

4.2. Importance of trees and forest benefits accrued to respondents

The findings showed that majority of the respondents in all communities recognized the importance of trees for their livelihoods. Furthermore, the results showed a statistically significant relationship ($p < 0.001$) between the household respondents' reactions regarding the importance of trees in their livelihoods. Regmi and Garforth (2010) posited that trees grown outside forests are a strategy to meet the demands of a growing population. These include trees grown in urban and rural landscapes in homesteads, farmlands, orchards, along roads, and in cities (Seth, 2003). These planted trees contribute to the economic, environmental and social wellbeing of the people in the respective area (Regmi, 2003; Li *et al.*, 2020).

In a study conducted by Regmi and Garforth (2010) in Chitwan District Nepal, it was observed that people with access to the surrounding forests, tree planting in that region was non-existent. However, after 1970 the management regime of the forests changed and community forest management restricted open access to the forests. The changes of the management regime caused households to gradually implement tree planting as a way for them to meet wood demand for their daily needs. In case of the study areas, there is limited collection of medicinal

plants, fuelwood and poles from the surrounding forests. According to MFC owning the plantations, it is reported that people are destroying some trees during collection of the forest products and as such, measures are put to restrict them. In the FGDs, participants recognized the importance of trees for their livelihoods. Therefore, it is most likely that they would be interested in a tree planting initiative to ensure a continuous supply of tree products and services. However, the challenge limiting household to engage in tree planting is the lack of seedlings. During the FGD participants indicated that they had challenges sourcing tree seedlings. In addition, the participants emphasized that they would require assistance with capital as well as with knowledge and skills to implement tree planting. According to Okorio *et al.* (2004) and Obiri *et al.* (2011), provision of free seedlings to rural community household could significantly influence the level of participation in tree planting.

4.3. Involvement of organization in community tree planting

The involvement of private forestry companies, government forestry department, and in some instances local municipalities in promoting or encouraging tree planting activities in rural communities is vital. This helps to sustain forests while ensuring improved livelihoods for rural people (Li *et al.*, 2020). According to Hlaing *et al.* (2017), majority of the low-income households possessing low education and small agriculture land were found to be depending more on the forests. Therefore, it is important to come up with appropriate strategies that local people themselves can adopt in order to sustain forests (Galabuzi *et al.*, 2014). These may include tree planting in order to sustain forests and livelihoods as well as to avoid forest degradation (Chen *et al.*, 2010). Marie *et al.* (2009) suggested that local people need encouragement to be part of tree planting initiatives in their landscapes. In this case, the MFC is already playing a significant role in the study communities in ensuring that communities are part of the initiatives through provisions of free seedlings. As Ruseva *et al.* (2015) suggests, household or private landowners may be encouraged to participate in tree planting activities if they are presented with opportunities to access low cost or free seedlings. Moreover, MFC provided members from local communities with employment opportunities through its commercial forest and timber processing sections. Notably, the involvement of DEFF and the local municipalities in tree planting activities and community forestry as provided for in the forest policy and other related government policies is critical (DAFF, 2017). The White paper on Sustainable Forest Development and National Forest Act of 1997 recognizes that community forestry can lead to an improved environment and resource use sustainability as well as providing income and employment opportunities to previously disadvantaged communities in rural, peri-urban and urban areas (DAFF, 2017). These legislative frameworks encourages the government to motivate people to plant trees, especially indigenous trees in gardens, parks, fields, along the roads and managed plantations in order to improve the living environment.

4.4. Understanding of agroforestry practice

Familiarity or lack of understanding of agroforestry practice was prominent amongst household respondents in KwaBasa unlike those from the other two communities. Although, households in the study areas participated in agricultural activities, such as growing of crops and the keeping of livestock, majority of them lack understanding of the system and its benefits. Noticeably, tree growing in the homestead gardens was minimal and random. This simply means that the agroforestry practice was a fraction of the land-use system in the area. In order to overcome the status quo on limited agroforestry understanding and adoption in the study areas, Hlaing *et al.* (2017) suggests that training and extension programmes focusing on tree-based intercropping practice should be prioritized taking into account local people's preference of multipurpose trees species in order to influence understanding and adoption of agroforestry. While Kalaba *et al.* (2010) highlight the significance of adopting participatory approach in achieving successful high rate of agroforestry understanding and adoption within society. On the same note, the respondents revealed that they were not familiar with this practice. In addition, communities in the study area were not familiar with benefits of agroforestry practices. During the FGDs, participants were informed on the benefits of agroforestry. However, they raised concerns that there is competition between trees and crops for sunlight, nutrients, space, and water, which would negatively affect crop growth when grown in the same land with trees. In the end, FGDs participants realized that the benefits outweigh the disadvantages and indicated that they are interested in initiating this practice. On this note, the findings of the study by Li *et al.* (2020) showed that accrual of high households' income in Hainan Island community in China was associated with planting diverse tree species and intercropping activities. On the same note, Makhubele *et al.* (2020) emphasized that diversification of land use systems in the rural communities landscape is important for the improvement of household socioeconomic status.

According to Jose (2009), agroforestry has several benefits that could improve the livelihood of rural people in several ways, which include enhancing long-term productivity and sustainability of the soil. Jose9~ *et al.* (2014) stated that the physical, chemical and biological characteristics of the soil are enhanced by adding significant amounts of above and below ground organic matter, releasing and recycling nutrients in agroforestry systems. Some trees with deep roots also improve groundwater quality. According to Allen *et al.* (2004), tree roots can absorb excess nutrients that are leached below the root-zone making sure they do not go to waste. Some agroforestry practices such as windbreaks and shelterbelts have several benefits including protecting buildings from unfavorable weather conditions, protecting livestock from wind chills, protecting crops, providing wildlife habitat, reducing the wind velocity and noise pollution, as well as mitigating odor (Tyndall and Colletti, 2007).

4.5. Tree growing interest and preference

It is important to note that respondents in the study communities showed interest and preference for fruit trees compared to indigenous forest trees. The preference for fruit trees could be linked to food security (Okorio *et al.*, 2004) and potential income benefits to households through sales of fruits (Li *et al.*, 2020; Makhubele *et al.*, 2020). Akinnifesi (2006) emphasized that homesteads grown fruits could be sold at local and urban markets thereby potentially providing substantial income for the household. Besides, these trees also play a central role as a source of nutrition for humans, as they are rich in sugars, vitamins, minerals, oils and protein, which people in rural areas often lack (Muok *et al.*, 2001). Additionally, although being a source of food, fruit trees serve an essential role in the environment by creating clean air, controlling erosion and carbon sequestration (Angelsen and Wunder, 2003). As noted in Okorio *et al.* (2004), it is also important to understand the type of fruit tree the community prefers in order to stimulate interest for households to nurture and manage the trees. In line with findings by Azeez *et al.* (2007), the interest shown towards planting of trees in the homesteads by household in the study communities could promote what is called the mixed home garden system which has an influence on multipurpose trees and may be beneficial for the household that keeps livestock.

The majority of households showed a preference for *Citrus sinensis, Prunus persica, Persea americana* and *Malus pumila* (apple) trees. Furthermore, the findings of the study revealed that the *Persea americana* tree (promoted by MFC) was not on the top list of preferred fruit trees. Although the majority in the study communities did not prefer the *Persea americana* tree planting in the homesteads, they had an interest to plant it only if land could be allocated outside their homesteads. Li *et al.* (2020) argues that reallocation of land by family size could significantly increase the proportion of household above the poverty line in the plan-

tation group. On the same note, Kulindwa (2016) suggested family size have a significant negative tree planting behaviour.

Moreover, plausible reasons for not planting the *Persea americana* trees included the aggressive rooting of the plant that would ultimately cause cracks on the structures of the house. Unfavorable weather conditions in the study area were perceived as another limiting factor for not preferring to plant *Persea americana*. These communities are in a very cold area of KwaZulu-Natal province and Avocados often grow well in temperatures between 20-25 °C and can only tolerate light frost, which should not be experienced during flowering and fruit set (DAFF, 2012). Moreover, participants during FGD linked *Persea americana* tree to bringing bad luck in terms of death of a male family member and lighting to the household when planted in the homestead. In line with this finding, Kulindwa (2016) suggested that "household attitudes towards tree planting have significant negative effects on household's tree planting behaviour". On this note, Anuga *et al.* (2019) emphasized that it would be vital for the government and other relevant authorities to prioritize putting together training programmes at the local level in order to influence personal attitudes towards pro-environmental behaviour. In the same vein, the provision of extension services as well as capacity building support at a community level need to be prioritized in order to stimulate effective and sustainable tree planting development programmes (Obiri *et al,*. 2011). According to Azeez *et al.* (2007) the income generated from agroforestry practices and availability of extension services support have a positive influence in the adoption of tree planting behaviour.

On the contrary, in the FGD participants in the Ngubelanga community had no issue with growing *Persea americana* tree seedlings in their homesteads. This is because people in this community do not believe that growing of *Persea americana* tree species in the homestead is associated with the death of a male family member and/or bad luck in the household as it is case in the other communities. This might be due to few households in the Ngubelanga community growing *Persea americana* tree species. It is important to note though that cultural beliefs play a dominant role over plant preference and use in rural communities. Moreover, human preferences are highly promoted by cultural institutions and social norms. Often, this is done to encourage the behavior of individuals towards a certain species. The assumption is that individuals in a society select their species preference based on efficiency and rationale of its various utilities (Araia and Chirwa, 2019). Moreover, participants in KwaBasa and Mkhoba, which are the communities with this belief, went on to give examples of a few households in the community with *Persea americana* tree species, where men had died and they believe it was because of the planting of *Persea americana* tree. Most African countries carry similar beliefs, in Nigeria, there are forested areas and trees that are seen as deity, shrines or sacred groves and therefore community members esteem them for two reasons; the benefits they accrue from them, and the consequences when not adhered to (Aneliefo *et al.*, 2015).

5. Conclusions

This study found that households in the study communities are recognizing the importance and the benefits of trees in their livelihood. Moreover, the households have also shown interest to grow trees in their homesteads. In particular, fruit trees are the ones that household preferred more than the medicinal trees. Nevertheless, the households in Mkhoba and KwaBasa characterized planting or growing of *Persea amaricana* tree species in the homesteads with a belief that it causes deaths of the male members in the household. This simply suggests that the MFC initiative to supply free *Persea americana* tree species seedlings for the household to plant in the homesteads may be futile. Therefore, it may be necessary for MFC to engage with these communities in quest to identify or allocate communal land where community owned *Persea americana* orchard can be established. On the other hand, considering the household interest for growing or planting trees in the study communities, it suggests that there is a potential for the successful introduction of multipurpose trees in the landscapes of KwaBasa, Mkhoba and Ngubelanga. However, giving the people their preferred tree species should be coupled with capacity building and extension support programmes to encourage them to effectively participate in tree planting and management. On this note, the government authorities and private sector would have to prioritize collaborative efforts in promoting or encouraging the growing of multipurpose trees and adoption of agroforestry practice strategy through development of tailor-made capacity building and awareness creation programmes. Most importantly, this study recommends more similar research in other provinces to assess the factors that affect the adoption of tree planting and agroforestry practice in South Africa.

Declaration of Competing Interest

None

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