

Agroforestry and Tree management in Kivuuvu Parish, Maanyi Subcounty, Mityana District. Uganda

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Research Article

Keywords: Agroforestry, Woodlots, Silviculture, Thinning, Species

Posted Date: September 6th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-2013869/v1>

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Abstract

Agroforestry is an important alternative in land management systems to improve rural livelihoods. Timber and Non-timber Forest Products (NTFPs) have been the most important components in the agroforestry system, and to rural villagers' household income portfolio including in Kivuuvu Parish, Maanyi Subcounty in Mityana District. However, the management strategies for tree components at household level has been quite inadequate resulting in low benefit margins for the farmers. These are eventually perceived by the small scale tree farmers as poor and unattractive incentives that has led many to abandon the practice of tree growing on farm. The study helps the farmers to identify the key action points to emphasize in on-farm tree management where efforts can be directed and tangible benefits realized and livelihoods impacted positively. Direct farmer interviews of 12 tree farmers were conducted covering the villages of Buyobe, Gulejja, Kabayenga, Kivuvuu, Kyetuuzo, Maanyi, and Nakulamudde. These were purposively selected from both large scale and small scale categories as well as hilly and gentle slopping landscapes. Results indicated that tree growth was very slow with tree rotation exceeding 20 years for common tree varieties such as *Eucalyptus grandis* grown for timber. A wide variety of tree species were also incorporated into farmlands for food, fuel, fodder, medicine and aesthetic values. The study uncovered the indiscretions in tree species selection for different cropping systems as well as landscapes. Important tree management practices such as pruning, fertilizer application and thinning were also not done resulting into poor tree performance. This significantly reduces the farmer's income and economic livelihood. The study recommended the intervention of the District Forestry Services and other NGOs to increase the community's access to improved tree varieties such as eucalyptus clones and also disseminate the knowledge appropriate tree management practices as per the SPGS tree growing standards.

1. Introduction

The term Agroforestry refers to the collective name for land use systems and technologies where woody perennials are deliberately used on the same land management units as agriculture crops and/or animals, in some form of spatial arrangement or temporal sequence (Lundgren and Raintree, 1982). Trees and forests play important functions in the ecosystem categorized as productive and protective functions. Productive functions encompass the production of fuel, food, fodder and timber while the protective functions include the conservation of soil water, fertility restoration, protection from erosion, and climate modification (Milewski 2017).

The ever increasing community demands for the named tree products seem impossible to satisfy from the existing naturally forested areas, hence the incorporation of trees in crop and livestock management fields seems the way to go. The World Bank estimates that over 1.2 billion people globally derive their livelihoods from agroforestry practices (ICRAF, 2008). It is also estimated that Uganda has lost about one third of forests cover over the last 30 years. The Country is therefore making great efforts to reduce deforestation through encouraging the satisfaction of household demands for tree products on farm. Between the year 2000 and 2015, it is estimated that about 50,000 hectares of forest was disappearing

per year compared to the period between per year (NFA State of Uganda's Forestry Report, 2016). The continuous disappearance of tree cover is a threat to the climatic condition of the country. Additionally, the loss of trees and shrubs threatens the livelihoods of people that are dependent on those resources. Both peasant and elite populations, globally, depend very much either directly or indirectly on plant resources for their livelihood (FAO 2009). Therefore, the rate of loss of forest cover must be kept as minimal as possible in Uganda through diversification of the sources of tree products.

Recently, Uganda has been making important progress in tree planting on private lands outside protected areas through a number of interventions for establishment of well managed tree plantations. These efforts have been mainly through the NFA and SPGS supported by external funders such as FAO. Obua et al (2010) however established that the interventions such as the SPGS targeted large plantation farmers ignoring small holder farmers who make the largest proportion of the population. It is clear that successful increase in tree/shrub cover cannot be achieved without the participation of small holder farmers who own approximately 70% of all land in Uganda. In order to involve the farmers, it is pertinent to appreciate their attitudes and perceptions concerning the managing of trees on their farms by finding out how they are doing it currently, the challenges and opportunities prevailing for tree growing. The choices farmers make on whether or not to engage in tree growing are normally based upon their judgement of the potential of the intervention to maximise their welfare and uplift their livelihoods (Scherr 1995, Miller et al 2014, Meijer et al 2015). Miller et al (2014) identifies the analysis of farmer's decisions and very key in designing workable and sustainable interventions for the people. Agroforestry research has also been conducted in Uganda aimed at identifying appropriate tree for inclusion on agricultural land without interfering with food crops/pastures. A number of Agroforestry practices have therefore been introduced and promoted in different parts of the country by various Agroforestry bodies, notably, the International Center for Research in Agroforestry (ICRAF) and the Uganda Forestry Resources Research Institute (FORRI) working together with a number of other non-governmental Organizations (NGOs) Such as Vi Agroforestry in Masaka District Kakuru and Okia, 2005) though the rates of adoption of modern agroforestry technologies are still generally lower than expected (Mwase 2015).

This study was undertaken in Mityana District, Maanyi subcounty and specifically Kivuuvu Parish to analyse the status of the tree systems in the area and make practical recommendations for maximising the contribution of the tree systems to livelihood. Specifically, the study determined (1) the most preferred tree species and reasons for their preference, and (2) existing tree management practices and challenges associated with these practices.

2. Methodology

The study was conducted in Kivuuvu Parish, Maanyi Subcounty in Mityana District. Mityana District lies in Central Uganda on Geo-coordinates; Latitude: 0° 25' 3.00" N and Longitude: 32° 01' 22.01" E approximately 60km west of Kampala, Uganda.

Field work for this study was done between 19th June and 1st July, 2022. The study employed two main methodologies for data Collection; Field observation and direct farmer interviews. Field observation involved two transect walks in the parish covering all the villages of Buyobe, Gulejja, Kabayenga, Kivuvuu, Kyetuuzo, Maanyi, and Nakulamudde. Additionally, 46 farmers were selected purposively considering the scale of production (commercial vs subsistence) and the landscape (hilly vs gengle sloping) at a ratio of 1:1 for direct in depth interviews. The transect walks availed to the study information regarding the common tree species in the area and the preferred landscape selected for tree growing while the farmer interviews were meant to provide the reasons behind choice of certain species of trees and the tree management practices employed by the people in the area. The interview method was seleted because of its robustness in uncovering hidden information through probing (Blaxter et al 2006: 172), which would remain inaccessible while using other methods. Burns (1999, p. 118) also contends that “Interviews are a popular and widely used means of collecting qualitative data” which allows the researcher to connect with the respondent’s mind. Each of the transect walks lasted aproximately five hours while the interviews were designed with a few open questions each lasting approximately one hour.

“A transect walk is a tour through the study sites guided by local informants, allowing researchers to observe, ask, listen and discuss” (DPI & QNRDP, 2007). Transect walks are described by researchers as simple, effective and easy-to-adopt methods as a means of guiding decisions or sampling at the local level (Pérez-Foguet and Giné-Garriga, 2018). It helped the researcher to obtain a geographical, landscape and social over view of the area making it very easy to identify and contact the respondents for the proceeding interviews.

3. Results

3.1 Agroforestry systems, landscape matching and values

Five important tree systems were identified as well as their most preferred landscapes as summarized in Table 3.1 below.

Table 3.1
Common tree farming systems in Kivuuvu Parish

No.	Tree system	Preferred landscapes	Values
1	Scattered trees on cropping/grazing land	Gentle slopes	Fuelwood, livestock feeds, building materials,
2	Home gardens	Gentle slopes	Shade, shelter belts, food
3	Shade trees in coffee gardens	Gentle slopes	Shade for coffee, livestock fodder
5			
4	Trees as boundary markers	Gentle slopes, hill tops	Timber, boundary marking
5	Wood lots	Gentle slope/hill topes	Timber, fuelwood, income

Trees in Kivuuvu Parish are grown in 5 main farming systems as shown in Table 3.1 above. As far as landscape differentiation is concerned, three of the tree farming systems: scattered trees on farm, home gardens and shade trees in coffee gardens, are practiced majorly in gentle slopes; while boundary planting of trees as well as woodlot establishment and management is practiced both in the valley bottoms (gentle slopes) and the hill tops. Small scale farmers are mostly involved in tree management along the boundaries, shade trees in coffee gardens, home gardens and scattered trees on farm. Woodlots are only managed by medium to large scale farmers.

When asked to give the main values for their trees, fuelwood production, livestock feeds, shade, food, shelter protection, timber and income were all mentioned which makes the first line of evidence of the role played by trees in livelihood improvement.

3.2 Species of trees/shrubs and values attached

The study identified seven fruit trees and fourteen other trees as the most common tree/shrub species in the research area as represented in Table 3.2a and 3.2b.

Table 3.2
a Fruit species of trees

English Name	Local Name (Luganda)	Main Value	Secondary value
Mangoes	Muyembe	Food	Shade
Avocado	Ovakedo	Food	Shade
Jack fruit	Ffenne	Food	Shade
Guava	Mapeera	Food	Shade
Pawpaw	Papari	Food	Shade
Soursoup	Kitafeli	Medicinal	Shade
Pomegranate	Enkomamawanga	Medicinal	Beauty

Trees grown in the home gardens were majorly fruit trees valued for food. Two rare fruits were found in two different home gardens valued for their medicinal values. These were Pomegranate and Soursoup. Respective respondents were able to identify the specific medicinal values of the shrubs as prevention and treatment of cancer for Pomegranate and boosting immunity against diseases for Soursoup. All the other fruit plants had been grown in the area since the early 1990s and their roles in nutrition are widely appreciated by the local people.

Table 3.2
b Other tree species

Botanical/scientific name	Local Name (Luganda)	Main Value	Secondary value
<i>Canarium schwinfurthii</i>	Muwafu	Medicinal	Shade
<i>Grevillea robusta</i>	Gireveria	Timber	Shade
<i>Pinus patula</i>	Payani (Patula)	Timber	Firewood
<i>Eucalyptus grandis</i>	Kalitunsi (local and clonal)	Poles	Firewood
<i>Maesopsis emini</i>	Musizi	Timber	Shade
<i>Ficus natalensis</i>	Mutuba	Shade	Charcoal
<i>Albizia chinensis</i>	Mugavu musini	Shade	Fodder
<i>Khaya anthotheca</i>	Mukusu	Timber	Shade
<i>Melcia excelsa</i>	Muvule	Timber	Shade
<i>Markhamia lutea</i>	Omusambya	Timber	Tool handles
<i>Calliandra calothyrsus</i>	Kaliisa Mbuzi	Fodder	Firewood
<i>Gliricidia sepium</i>	Mutamese	Firewood	Stakes
<i>Sesbania sesban</i>	Muzimba-ndegeya	Soil fertility	Fodder
<i>Vernonia amygdalina</i>	Mululuuza	Medicinal	firewood

There was good knowledge of the usability of a number of tree/shrub species for timber, medicine, firewood, fodder, poles and soil fertility. Respondents showed good knowledge of the steps followed when harvesting say; herbal medicine from the trees including the growth stage, the parts to collect, how to process the herb, herb administration and the associated illnesses against which it is used. However, the collection of fodder for livestock was seldom reported given the common grazing systems in the area being field/rough grazing where animals are tethered outside in the un-attended-to pasture lands.

3.3 Management of tree components

By way of observation complimented by interviews, the study investigated the degree of practice of five major silvicultural practices in tree growing: weeding, pruning, thinning, and pest control. The results are summarized in Table 3.3 below.

Table 3.3
Management practices of tree components in the system

Management practice	Practiced/not practiced	Method/materials	Reason for practice/no practice
Weeding	Practiced	Slashing with slashers	Cheaper, convenient
Pruning	Not practiced	-	Lack technical knowledge
Thinning	Not practiced	-	Lack technical knowledge
Pest management	Practiced	Chemical using Termidol against termites	Termite is very rampant in tree gardens
Fertilizer application	Not practiced	-	Soil supports tree growing without fertilizers

Ignorance concerning the application of special forestry management practices was widespread. None of the respondents acknowledged having interacted with technical forestry personnel for any advice. Respondents were relying on knowledge picked from fellow farmers for forest management. However, access to certain inputs such as termite killers was possible from the farm supply shops in Maanyi trading center. None of the forest woodlots was thinned, pruned or had received fertilizers (see appendix 1).

4. Discussion

4.1 Tree species preference in Kivuuvu Parish

Tree species preference was highly linked to the associated crops in the area. This was due to the fact that the majority of the farmers grow their trees in association with crops on the same field. Very few farmers have land available for exclusive woodlot establishment. The trees in Table 3.2a are highly preferred due to their contribution towards household food as well as their associated benefits to the crops in association in form of shade plus their medicinal values. The sale of fruit products for income was however not acknowledged at all since almost every other person in the community had access to the same products from their own farms. This finding justifies the role played by agroforestry trees and shrubs in food security and nutrition (FAO 2013). The interpretation of this is that the study area engages in tree management on their farms with the main aim of achieving regular access to a number of products which are very important in ensuring household food and nutrition security. This is in-line with Scherr's welfare maximization theory (1995) that asserts that "rural people manage trees with the aim of having regular access to products that satisfy their household needs and not for income generation".

Other tree species that are hard and woody (Table 3.2b) are planted for their timber, firewood, fodder, medicine, shade and charcoal. This represents a combination of social and economic attributes of Agroforestry. Trees such as Eucalyptus and Pine are grown in woodlots for timber production. While woodlots were most situated on the hill tops, some farmers still maintained them in the gentle slopes and

valley bottoms and there were no significant differences in growth vigour. On the hill tops, the people were growing trees as a means of reducing the rate of runoff and its consequences on the soil while in the valleys, trees such as eucalyptus were grown as a means of draining the valleys and making the formally water logged valley bottoms usable for farming. Unlike Eucalyptus which was growing in all landscapes, Pine was particularly preferred for the hill tops. These areas are characterised by very stony, shallow soils. *Pinus patula* is specifically well adapted to such soils. This is inline with the SPGS tree planting guidelines (2011) where it is on record that *P. patula* requires cool climatic conditions that are only found in raised altitude areas.

The local varieties of trees were grown in the area more predominantly than the exotic improved varieties. Only two out of the twelve tree farmers had adopted improved varieties of Eucalyptus, - GU 07 in their plantations. The tree farmers who are growing these GU 07 varieties are large scale farmers who picked the planting materials from other districts. There is no tree nursery in the community capable of supplying these new tree varieties. Clonal varieties are encouraged due to their fast growth ability and short rotation. Tree farmers in Kivuuvu take long to access the economic gains from their Eucalyptus crop, being predominantly a local variety. The SPGS community tree planting guidelines (2011) assert that while clonal Eucalyptus reaches timber maturity at 12–13 years, the local varieties would do so at close to 20 years.

4.2 Shaded coffee farming systems

The use of trees for provision of shade in coffee plantations is very common with the major species used being *Ficus natalensis* and *Albizia chinensis*. These are planted as scattered trees in coffee plantations during initial coffee establishment stages. Growing coffee under tree shade is a very prominent traditional agronomic practice in Kivuuvu parish. Shade trees are well appreciated for providing ideal microclimate for good growth and production of coffee. Various authors have indicated an increase in coffee production with increase in intensity of shade up to a given level beyond which it begins to decline (Soto-Pinto et al., 2000; Staveret et al., 2001). Damatta (2004) in a review paper also provides strong emphasis on shading in coffee gardens calling the performance of shaded gardens as being “much superior” compared to those under full sun. Trees are well recognized as key in improvement of soil fertility through nutrient cycling as their roots go deep in the soil and reach nutrients that are otherwise not accessible to the coffee plants (Pincho et al 2012). Tree shade in coffee plantations also protects the coffee crop against drought effects. Tree canopy provides cool temperature above the coffee plants which reduces the loss of soil moisture by evaporation and transpiration. Organic matter accumulation from the shade plants after leaf fall helps to retain soil moisture for longer periods especially during dry spell that ensures coffee plants survival better than the open plantations (Alemu, 2015). Robusta coffee raised from seed, commonly known as elite coffee was the most commonly grown coffee with shade trees.

Some of the coffee farmers had contradicting information that shade provided by *Ficus natalensis* and *Albizia chinensis* provides a conducive environment for development of Black Coffee Twig Borers (BCTB), which cause drying of coffee twigs and reduce coffee yields. There was evidence of cutting down some

of these shade trees in some coffee farms as a means of reducing shade and controlling the BCTB. In a study by Kagezi et al. in 2013 in 26 Districts in Uganda, it was established that 69% of the coffee gardens were infested by BCTB. The same study however could not independently verify whether *Ficus* and *Albizia* species as common shade plants are not associated with the increase in BCTB infestation. The most used effective though uneconomical cultural control method used by farmers against BCTB is pruning and burning of infested twigs. Continuous pruning of the twigs reduces the number of available berry bearing branches on the coffee plant and which reduces coffee yields. Practices that promote tree vigour and health will aid recovery from BCTB damage.

4.3 Tree management practices

The most ignored but yet very important silvicultural practices included pruning, fertilizer application and thinning. Thinning is a vital silvicultural practice that helps to maximize the production of large sawlogs for various uses in the shortest time possible.

SPGS defines thinning as “the removal of a proportion of individual living trees from a stand before the final harvest” (SPGS 2004). It is a routine forestry operation beginning immediately when the woodlot closes the canopy. The procedure is to remove the weaker trees from the stand which gives the best trees relief and space to grow and reach the useful sizes early. Not a single woodlot in Kivuuvu had undergone thinning and therefore the tree sizes were generally far below the would be size at that age. The size of the tree is the most desired tree characteristic yet trees need special conditions to accumulate the size. Despite the soil factors, space is very vital for trees to expand and this must be provided by thinning. At any one time, trees in a stand are always competing with each other for growth requirements and therefore the more densely populated they are, the more stiff the competition. SPGS emphasizes thinning operations to be done by technical personnel because bad thinning may cause financial losses to the farmer (SPGS 2004). Short of thinning operations, the stand ceases to be a forest stand but a stand of “sticks” (see appendix 1) with very minimal contribution to make on the income of the tree farmer. It is clear that at times, the market for thinnings is not readily available. In such situations, the SPGS encourages thinning to waste especially if it is the first thinning because the losses can well be covered by the gain in size after thinning. The recommended thinning densities for *Eucalyptus* and *Pine* at different stages are shown in appendix 2.

Pruning and fertilizer application were the two other management practices not practiced in the tree growing systems in Kivuuvu parish. Stoeckeler and Arneman (1960) recommend Fertilizer application in tree management at two stages: during nursery stage to boost early seedling growth and catch up with planting season and during seedling planting to encourage fast establishment. Pruning is also very important to enhance timber quality and economic value by increasing the proportion of the tree stem that is clearwood. It leads to production of Knot-free timber which attracts a premium price in timber grade markets for pine and eucalyptus (Rowan 2002).

5 Conclusions

The importance of shade trees in coffee and other crop gardens out-weigh their perceived risks. The only talked about potential risk being creation of conducive environment for BCTB multiplication, the other soil enhancing attributes such as soil structure stabilization, runoff control, soil cover provision, organic matter accumulation, soil nitrogen fixation, as well as other productive roles cannot be traded for any other un foreseen potential hazards. Tree farmers should however keep the vigilance of removing certain tree species from the system and replacing them with others should they see them as suspicious hosts for certain pests. The most vulnerable stage of coffee to BCTB was under 3 years. After 3 years of growth, Robusta coffee gains resistance against the pest and it is no longer a threat. Generally, coffee yields have reduced due to the increase in BCTB infestation.

Other than food, fuel, timber and fodder, the medicinal values of certain tree species are highly valued. There is good knowledge of the various medicinal trees and their medicinal values. This is a good gesture considering the current emergency of misterious diseases such as covid 19, Hepatitis B, Merburg and others. This knowledge is passedon from generation to another through informal institutions.

The people in the area have a long lived cultural/traditional relationship with certain trees. For instance, coffee has always been grown with trees, fruit trees have always grown in people's home gardens and species such as Ficus natalensis were used for bark cloth making.

Communities in Kivuuvu have not enjoyed the economic benefits from tree growing. Most of them have little space for tree growing, others have woodlots where the guidelines applied in tree plantations have not been adhered to. Planted trees grow very slowly and poorly, which is largely attributed to poor tree management practices.

6. Applications

The individual farmers take the first opportunity to understand their strength and weaknesses as regards tree management on their farms which gives them a benefit to improve. A knowledge empowered farmer is with no doubt a change agent.

The District Local Government, forestry and Agriculture sections will better appreciate the missing link among their farmers and plan their interventions better.

NGOs dealing in Agroforestry, Agriculture and/or livelihood will find this information very important as a baseline for planning their interventions to uplift the standards of people in the area.

Declarations

Conflicts of Interest

The author declares no conflict of interest in the data or its publication what so ever.

Acknowledgements

I acknowledge Makerere University for funding the field exercise. The Entire PARI X class who were part of the Mityana field visit: Andrew, Joshua, Moses, Diana are highly acknowledged. Secondly, the Staff team including Drs. Miir Richard and Sarah Akello plus Mr. Kasujja Geoffrey- the IT personnel are acknowledged. Mityana DLG staff who made our access to the community possible and the participants in Kivuuvu whose data makes up this publication. Lastly, all the Authors cited in this work.

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