

ISSN 2305-2678 (Print); ISSN 2305-5944 (Online)

DOI: <http://dx.doi.org/10.4314/rj.v28i1.5>

Agroforestry practice in villages surrounding Nyamure former refugee camp, Nyanza District: tree species and purpose

Nduwamungu Jean and Munyanziza Hesron
National University of Rwanda
Corresponding author –Email : jnduwamungu@nur.ac.rw

Abstract

*An assessment of fuel wood situation and the contribution of agroforestry and woodlot resources to the supply of household fuel wood requirements were carried out in ten villages surrounding Nyamure former refugee camp, Nyanza District in the Southern Province. A total of 158 households were surveyed in February 2008. Surveyed households were selected randomly from village registries or lists of existing households. Semi-structured questionnaires and participant observation methods were used to collect primary data. The Statistical Package for Social Sciences (SPSS) was used to analyze the data. Out of the 158 households surveyed, 94% of respondents were farmers. Ninety six percent of respondents used primarily firewood and 68% had improved firewood stoves. Thirty six percent owned small woodlots whereas 70% had either planted or retained trees on their farms. The dominant agroforestry tree species was **Grevillea robusta** (69%) whereas **Eucalyptus** sp. dominated woodlots (100%). The major purposes of planting or retaining trees were: fuel wood supply (49%), building material (48.1%), food (31.7%) and soil conservation (35.6%). Despite all reforestation efforts, there was shortage of wood products and farmers often switched to crop residues for fuel (almost 47% of respondents) and often walked long distances (almost 13% of respondents walked more than 2 hours in search of fuel wood) to the remnant pockets of public woodlands. Therefore, there is need for joint management of public forest lands. Furthermore, given the land shortage, efforts should be directed to agroforestry and more efficient agricultural technologies.*

Key words: Agroforestry, fuel wood, tree products, woodlot, forest plantation

INTRODUCTION

Trees and forests play vital role in the livelihoods of rural communities. Trees indeed constitute the largest single source of energy in rural areas; they are used for

construction, for soil conservation, for windbreak, boundary demarcation or animal feed or even security to the land (Nair et al., 1984; Fortmann, 1985; Suyanto et al., 2001). The vital role of wood in people's livelihood has made trees and forests very vulnerable. According to Nwafor (1979), Gatera (1980) and Runyinya (1980), the country forest cover has steadily shrunk during the last century. MINIPLAN (2001) estimated that forests or woodland cover regressed by 67% in a period spanning over 35 years. The impact of forest depletion is dominated by people who primarily derive their living from farming on steep terrain and their energy from wood cannot be overemphasized. Nevertheless, from the 1970s a reforestation campaign has been launched throughout the country. Thus, while the above authors reported a decline in forest cover, others (Balasubramanian and Eggi, 1986; Pinner, 1988; Nduwamungu, 2011) estimated that during recent decades, tree population generally increased in plantations and on farms. In other words, trees were removed from their natural habitat and domesticated in artificial environments. The reforestation campaign got a new impetus from the current government which takes people's livelihood and environmental conservation as inseparable twins. Every year, the Government of Rwanda sponsors most tree planting activities from seed purchase to seedling planting in the field. As most Rwandan households possess tiny pieces of land (Biggelaar and Gold, 1995) and as wood is as much needed as food, the practice of agroforestry has been in some cases a matter of survival.

Nyamure (Muyira Sector, Nyanza District) has been one of the Rwandan areas which have received an influx of refugees from Burundi. As a result natural ecosystems have seen a rapid breakdown and cultivated land has seen a growing number of introduced trees in the form of agroforestry. The question is whether the practice of agroforestry has relieved natural woodlands or even contributed significantly to people's livelihoods. The objective of this study was to investigate the practice of agroforestry life in villages surrounding Nyamure former refugee camp, Nyanza District.

METHODOLOGY

Study area

The study area included three administrative cells in the surroundings of Nyamure former refugee camp currently under the Muyira sector. This administrative sector is part of the former Nyamure District which is now Nyanza District in the new administrative structure of the country. The Nyamure refugee camp was

established in 2004 and hosted about 5000 refugees from Burundi. According to local authorities, these people needed about 300 steres (1 stere = 1m x 1m x 1m or 1m³ of piled logs) of fuel wood every month to meet their needs. This sudden increase in fuel wood demand brought about extra pressure on the forest resources around the camp. Fortunately, in the mid of 2006, most of the refugees either returned back to their country of origin (Burundi) or moved to Kigeme refugee camp (Nyamagabe District) about 100 km away from Nyamure. However, they left behind a degraded environment and hence the need for rehabilitation/restoration. This study was part of the baseline survey conducted prior to launching the project “*Conservation and Restoration of Degraded Environment Surrounding Nyamure Refugee Camp*”.

Surveys

Household surveys were conducted in the three administrative cells surrounding Nyamure refugee camp, namely Gati, Nyamiyaga and Nyundo cells in February 2008 using structured questionnaires with both open-ended and closed-end questions. In closed or forced questions, a number of alternative answers were provided whereas in open-ended questions respondents were required to give their own answers. Prior to questionnaire administration, pre-testing was done to check consistency, reliability and validity of the questionnaire. The method of participant observation was used to cross check responses from the household survey and formulate a holistic understanding of the issues related to tree planting and agroforestry practices.

In order to be more concise, only those villages (settlements) within 5-10 km radius from the refugee camp were included in the survey. In total, ten villages were included in the survey (Table 1). The household was the sampling unit and its head was the target respondent often assisted by any other adult in the household. Surveyed households were selected randomly from village registries or lists of existing households. A household was considered in the Rwandese context and comprised people living under the same compound, using the same kitchen and sharing meals, cultivating the same land and recognizing the authority of one person, the head of the household. In total 158 households were surveyed which is about 15% of all households in the study area.

Statistical analyses

The Statistical Package for Social Sciences (SPSS) was used to process the data. Cross tabulation of descriptive statistics and graphics were used to present the results from data analysis.

RESULTS AND DISCUSSION

Characteristics of surveyed respondents

The results (Table 1) indicated that majority of the respondents were male (66.5%). Women involved in the survey were only 33.5%. In most African countries and Rwanda in particular, an increasing number of households are headed by females, a result of genocide or wars or deaths of multiple causes which take away men or socio-economic factors which refrain males from getting married. Thus any rural intervention to be successful must recognize females as important actors and involve them equitably at all stages. Majority of the respondents had ages ranging from 25 to 45 years (Table 1).

Table 1: Characteristics of the households surveyed in the cells surrounding Nyamure refugee camp.

Cells	Villages	No. of Households	Sex		Age groups (years)		
			Male	Female	<25	25-45	>45
Gati	Ruyenzi	11	6	5	4	4	3
Nyamiyaga	Gihama	8	5	3	0	6	2
Nyamiyaga	Kabuye	21	12	9	1	12	8
Nyamiyaga	Nzovi	26	19	7	2	16	8
Nyamiyaga	Rugese	25	14	11	3	16	6
Nyundo	Jari	27	21	6	6	11	10
Nyundo	Kiniga	13	7	6	0	9	4
Nyundo	Mugari	12	11	1	1	5	6
Nyundo	Muyira	7	4	3	1	2	4
Nyundo	Nyundo	8	6	2	1	6	1
Total	10	158	105	53	19	87	52
Percent (%)		100.0	66.5	33.5	12.0	55.1	32.9

Farming was the major activity of the respondents and employed 94.3%. This is an indication that this sector must be improved. Poor productivity in a large proportion of the population is probably the major single cause of poverty in developing countries. A sector that employs the bulk of the population must be made very rewarding if any development is to be attained. Otherwise alternatives to farming must be sought.

Like in most of African countries, households were large with an average of 5 people living upon tiny pieces of land. Majority of the households had land pieces (farm size) with area ranging from 0.5 – 2.0 ha (Fig. 1). Large households constitute a risk factor for poverty and heavily tax natural resources. This is true especially in rural areas where there are limited viable alternatives to farming.

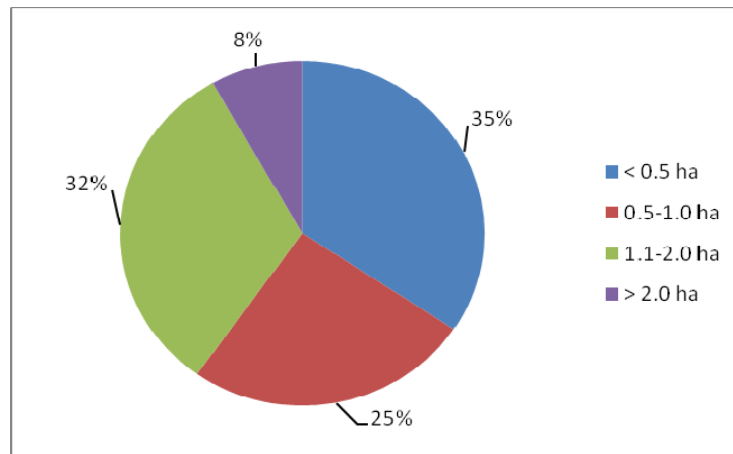


Fig. 1: Farm size in the surveyed households

Tree planting and its multiple functions in the study area

Wood intervened in many vital areas especially construction, energy and food production. According to the present results, almost 75% of the houses were made of wood and mud (walls) and even all the rest of the houses had a wood component (Table 2).

Table 2: Materials used for construction of walls and roofs

Responses	Walls				Roof		
	Cement bricks	Wood and mud	Mud bricks	Burnt bricks	Corrugated sheets	Tiles	Thatch
Frequency	4	118	28	8	75	71	10
Percent (%)	2.5	74.7	17.7	5.1	47.5	44.9	6.3

The use of wood in many sensitive areas made it very valuable and very vulnerable at the same time. In recognition of this, farmers planted or retained trees in their farms (Table 3, 4). According to early studies (Sirois et al., 1998; Harvey and Haber, 1999) retained trees have a socio-economic and a conservation values.

As source of domestic energy, firewood was dominant in 96.2% of the surveyed households while charcoal was used by only 0.6% of surveyed households. Wood is a renewable energy source and it is so widely used. Campaign for tree planting has to continue and emphasis should be placed on high energy value species. The species planted in the study area are listed in Table 3. The most frequent species were *Grevillea robusta* and those belonging to the genus *Eucalyptus*.

Eucalyptus is very popular in rural areas and has a long tradition in Rwanda (Burren, 1995). It is multipurpose and a good source of energy and it coppices readily and almost indefinitely (Nduwamungu et al., 2007). Unfortunately as it has been reported, a good number of *Eucalyptus* species degrade the sites as a result of their fast growth and heavy feeding (Nissen et al., 1999). *Grevillea robusta* was the most dominant tree species on farm. Unlike *Eucalyptus* species, it has no major negative effects on the site. In fact, it is one of the most dominant agroforestry species in the country (Harwood, 1992). *Grevillea robusta* yields timber and its branches repeatedly coppice once pruned, thus providing a steady supply of stakes and firewood. Fruit trees represented also a good proportion of woody perennials in the system. According to Musvoto and Campbell (1995), fruit trees are valued by farmers in agroforestry systems.

Table 3: Frequency of tree species planted on farms in the surveyed households

Tree species	Frequency	Percent (%)
<i>Grevillea robusta</i>	72	69.2
Fruit trees	31	29.8
<i>Eucalyptus sp.</i>	23	22.1
<i>Calliandra calothyrsus</i>	10	9.6
<i>Senna sp.</i>	8	7.7
<i>Cedrela odorata</i>	7	6.7
<i>Cupressus lusitanica</i>	6	5.8
<i>Moringa oleifera</i>	5	4.8
<i>Leucaena sp.</i>	4	3.8
<i>Euphorbia tirucallii</i>	3	2.9
<i>Maesopsis eminii</i>	2	1.9
Others	19	18.3

According to uses reported (Table 4), trees were established for four main purposes: firewood, building, soil conservation and fruit production. This is in agreement with findings from other studies (Nair *et al.*, 1984; Rugalema *et al.*, 1994).

Table 4: The major purposes of planted or retained trees on household farm

Purpose	Frequency	Percent (%)
Fuel wood	51	49.0
Building	50	48.1
Soil protection	37	35.6
Fruits	33	31.7
Timber	25	24.0
Fodder	11	10.6
Boundary	9	8.7
Windbreak	8	7.7
Selling	2	1.9
Ornamental	2	1.9
Others	12	11.5

Despite the alarming decline of natural vegetation in the study area, a few indigenous species were retained in farms. They included *Ficus* species, *Acacia* species, *Markhamia lutea*, *Vernonia amygdalina* and *Erythrina abyssinica*. In a number of cases, trees were planted in woodlots. Only about 38% of respondents reported to own woodlots, but most of the woodlots were

very small (less than 0.5 ha) which make them considered rather as agroforestry than forests. Respondents (66%) who had woodlots confirmed to own less than 0.5 ha (Fig. 2).

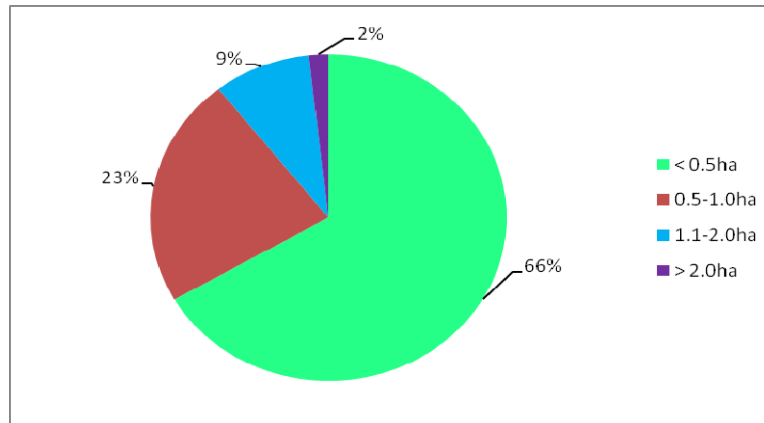


Fig. 2: Woodlot size distribution among households who had woodlots / forest plantations

Despite all efforts to increase the population of trees, there was still wood shortage in the region and often farmers shifted to alternative sources of energy such as crop residues (Fig. 3). The use of crop residues as a source of energy has a negative implication on soil fertility. It deprives it from organic matter and nutrients.

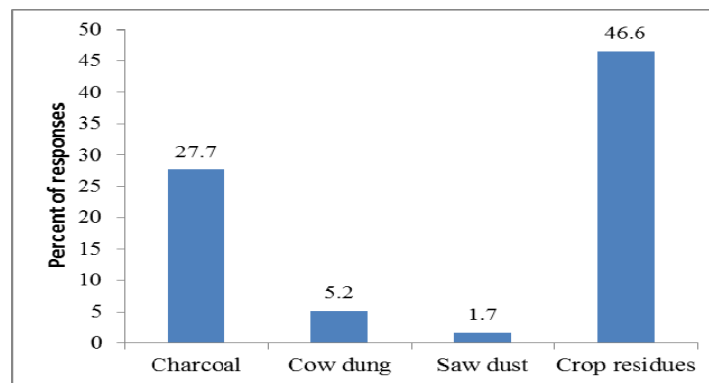


Fig. 3: Energy switch against firewood (Percent of respondents)

One of the strategies for efficiency in energy use was the adoption of energy saving stoves. Improved stoves were observed in 68.4% of the households. Efforts and facilitation need to be made to provide all farmers with energy saving stoves.

As regards to the share of public land in energy supply (Table 5), over 60% of the households reported that public land (both plantation and remnant natural vegetation) was their major source of fuel wood. Public land has always been a vital source of many forest products including firewood (Gakou et al., 1994) in areas where the land is in dire shortage or, strangely, in areas where the land is very abundant. Where local people rely on public forests or woodlands, joint forest management between government forest professionals and local community has been an effective and cheap strategy for forest conservation. Joint management of natural resources needs to be promoted in Rwanda in areas surrounding national parks, forests reserves or woodlands (Nduwamungu et al., 2007).

Table 5: Source of fuel wood used in the surveyed households

Source	Frequency	Percent (%)
Public land (both plantations and remnant natural vegetation)	65	41.8
Own farm	44	27.8
Remnant natural vegetation	32	20.3
Own woodlot	13	8.2
Market	3	1.9

Firewood collection from public land consumed a lot of time from women and children, who have to walk kilometers (Table 6) to the forest, gather wood and carry it back on the head (Fig. 4).



Fig. 4: A woman carrying a bundle of small pieces of firewood and a baby!(1 bundle =10-20 Kg).

The bundle of firewood can be used for about half a week in average households). More than 50% of the households interviewed reported that they walked 1 km or more to the site of firewood collection (Table 6).

Table 6: Distance and time spent on firewood collection

	Distance to source of fuel wood			Time spent collecting fuel wood		
	< 1km	1-2 km	> 2 km	< 1hours	1-2 hours	> 2 hours
Frequency	71	66	21	45	93	20
Percent	45.0	41.7	13.2	28.4	58.7	12.9

CONCLUSION AND RECOMMENDATIONS

This study covered an area where over 95% of households lived on farming on tiny pieces of land. High value crops and good agricultural practices need to be extended to these people as an effort to increase land productivity and food security. Wood remains the largest single energy source in Rwanda and in particular in Nyamure area.

In the study area, farmers have deployed some efforts in tree planting to meet a variety of needs, of which energy was among the most important. However, there was still a sharp wood shortage and farmers switched often to the use of

crop residues. This certainly has a negative impact on soil fertility due to the removal of the organic matter that would otherwise contribute to replenishing fertility. Public woodlands and forests remain a source of fuel wood for a large proportion of the community and this is where joint management becomes a useful necessity.

Given the land shortage, efforts should be directed towards promoting agroforestry, high yielding crops and efficient agricultural technologies. Joint forest management should be initiated in order to ensure sustainable management of public forest resources in the study area in particular and the whole country in general. Finally, this study should be undertaken also in other parts of the country in order to assess the extent of agroforestry practice so as to guide in planning further interventions to improve adoption and practice of agroforestry technologies.

REFERENCES

1. Balasubramanian V. and Eggli, A. 1986. The role of agroforestry in the farming systems in Rwanda with special reference to the BGM region. *Agroforestry Systems* 4: 271-280.
2. Biggelaar, C.D. and Gold, MA. 1995. The use and value of multiple methods to capture the diversity of endogenous agroforestry knowledge: an example from Rwanda. *Agroforestry Systems* 30: 263-275.
3. Burren, C. 1995. Les Eucalyptus au Rwanda. Analyse de 60 ans d'expérience avec référence particulière à l'arboretum de Ruhunde. Intercooperation, Organisation Suisse pour le Développement et la Coopération, Berne Suisse.
4. Fortmann, L. 1985. The tree tenure factor in agroforestry with particular reference to Africa. *Agroforestry Systems* 2. 229-251.
5. Gakou, M., Force, G.E. and Maclaughlin, M.J. 1994. Non-timber forest products in rural Mali: a study of village user. *Agroforestry Systems* 28: 213-226.
6. Gatera, F. 1980. Accroissement démographique et déforestation au Rwanda. *Bulletin Agricole du Rwanda* 13: 28-32
7. Harwood, C.C. 1999. *Grevillea robusta in agroforestry and forestry*. Proceedings of an international workshop. ICRAF. Nairobi, Kenya.
8. Nair, P.K.R., Fernandes, E.C.M. and Wambugu, P.N. 1984. Multipurpose leguminous trees and shrubs for agroforestry. *Agroforestry Systems* 2: 145-163.

9. Nduwamungu, J., Munyanziza, E., Ndayambaje, J. D., Ntirugulirwa, B., Gapusi, J. R., Ndizeye, G., Ntabana, D., Bambe, J. C. 2007. Eucalyptus in Rwanda: Are the blames true or false? A review. *Proceedings of a National Conference on Agricultural Research Outputs on Sustainable Agriculture productivity for improved food security and livelihoods*. 26-27th March 2007, Serena Hotel, Kigali, Rwanda. Pp 289-301
10. Nduwamungu, J., Munyanziza, E., Mukuralinda, A., Ndayambaje, J. D., Gapusi, J.R., Ntirugulirwa B., Mutaganda, A., Bambe, J. C., Gakwerere, N. E., Bizeye, B., Ndizeye, G. et Ntabana, D. 2008. *Inventaire des ressources ligneuses du Rwanda. Rapport Final, Vol. 2&3*. ISAR - CGIS - MINI FERE, Kigali, Rwanda
11. Nduwamungu, J. 2011. Forest plantations and woodlots in Rwanda. *African Forest Forum (AFF) Working Paper Series, Vol. 1, Issue 14, 2011*, Nairobi.
12. Nissen, T.M., Midmore, D.I. and Cabrera, M.E. 1999. Aboveground and belowground competition between intercropped cabbage and young *Eucalyptus torelliana*. *Agroforestry Systems* 44: 37-68.
13. Nwafor, J.C. 1979. Agricultural land use and associated problems in Rwanda. *The Journal of Tropical Geography* 48: 58-65.
14. Pinner, E. 1988. Enquête sur l'agroforesterie dans la région BGM. Wageningen Agricultural University. Department of Silviculture and Forest Ecology, Wageningen, the Netherlands.
15. Rugalema, G.H., Okting'ati, A. and Johnsen, F.H. 1994. The homegarden agroforestry systems of Bukoba district, North-Western Tanzania. I. Farming system analysis. *Agroforestry Systems* 26: 53-64.
16. Runyinya, B. 1980. Impact de l'homme sur les formations forestières des zones marginales au Rwanda. *Bulletin Agricole du Rwanda* 13: 14-23.
17. Musvoto, C. and Campbell, 15.M. 1995. Mango trees as components of agroforestry systems in Mangwene, Zimbabwe. *Agroforestry Systems* 37: 247-260.
18. Sirois, M.C., Margolis, H.A. and Camire, C. 1998. Influence of remnant trees on nutrient and fallow biomass in slash and burn agroecosystems in Guinea. *Agroforestry systems* 40: 227-246.
19. Suyanto, S., Tomich, T.P. and Otsuka, K. 2001. Land tenure and farm management efficiency: the case of smallholder rubber production in customary land areas of Sumatra. *Agroforestry Systems* 52: 145-160.