# POTENTIALS OF LESSER KNOWN AND LESSER UTILIZED INDIGENOUS AGROFORESTRY TIMBERS IN KILOSA DISTRICT, MOROGORO TANZANIA

Makonda, F.B.S.[1*], S. Augustino[1], P.R. Gillah[1], R.C. Ishengoma[1], D.H. Kitojo[1], C. Ruffo[3], S. Eriksen[2] and H.P. Msanga[3]

[1]Sokoine University of Agriculture, P.O. Box 3014 Chuo Kikuu Morogoro Tanzania
[2]University of Life Sciences, Norway, P.O. Box 5003, 1432 Ås
[3]Tanzania Tree Seed Agency, P.O. Box 373 Morogoro Tanzania

*Corresponding author: Tel. +255 784 55 99 47, E-mail:bulabo.makonda@gmail.com

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**ABSTRACT**

The paper presents baseline results of gathered important information for inference in establishing optimal production and utilization of Lesser-known (LK) and Lesser-utilized (LU) indigenous agro-forestry timber species (IAGTS) in improving incomes of rural communities in Kilosa District. The main key questions were: what are the characteristics of the sites for establishing LK and LU IAGTS; who are the main actors in establishing LK and LU IAGTS; what are LK and LU IAGTS and other species for establishment in the study area and what are the strengths, weaknesses, opportunities and threats for establishing LK and LU IAGTS in the study area. Data collection was participatory, involving key stakeholders, participants' observations and literature surveys. A total of eight villages were identified as potential sites for nursery establishment with seven main actors' mostly local communities engaged in tree planting activities under associations. Five priority LK and LU IAGTS were identified and selected for nursery establishment. These were: *Lonchocarpus capassa* (Mfumbili), *Sclerocarya birrea* (Mng'ongo), *Vitex doniana* (Mfudu), *Pseudolachnostylis maprouneifolia* (Msolo) and *Combretum zeyheri* (Mlama mweupe). The strengths and opportunities favouring the establishment of LK and LU IAGTS nurseries were identified, with a few weaknesses and threats which needed to be worked upon.

**Keywords**: Lesser-known agroforestry timber, Actors, Kilosa District

## 1.0 INTRODUCTION

### 1.1 Background

Tanzania with a size of 945,000 km$^2$ has remarkable arrays of vegetation types, ranging from humid tropical forests, where average annual precipitation exceeds 3,500 mm, to arid semi-deserts that receive less than 350 mm of rainfall per year. These sorts of vegetation provide sources of timber for both local and international markets. The country is estimated to contain more than 700 indigenous wood species, ranging from low to high densities. The Tanzanian timber market is however, dominated by a small number of commercially well-known timber species that are often used for purposes which other equally suitable and cheaper timber species could be used (Ishengoma *et al*., 1998). The commercially well-known timber species include *Pterocarpus angolensis* (Mninga), *Milicia excelsa* (Mvule), *Dalbergia melanoxylon* (Mpingo), *Ocotea usambarensis* (East African camphorwood) and *Khaya anthotheca* (Mahogany). The bulk of the timber species in the country are lesser known to users and therefore lesser utilized and are mainly used by traditional timber users, locally. Since properties of these lesser-known and lesser-utilized timber species are not known, it is difficult to promote them in national and international markets.

The term lesser-known timber species refers to a mixture of large number of timber species that are currently lesser known by users and therefore not easily acceptable in national and export markets. In most cases such species remain in the forest after the well-known timber species have been harvested (Bethel, 1984; Ishengoma *et al*, 1998; Youngs and Hammett, 2001; Ishengoma *et al*., 2004). Bryce (1967 revised by Chihongo, 1999) and Ishengoma *et al*. (2000) noted that in some cases, the well-known and expensive species are presently being utilized for purposes which other potentially suitable but far cheaper timbers could be utilized. A similar situation has also been reported to exist in other countries (Barany *et al*., 2003).

Conversely, the increased rate of deforestation in the natural forests in Tanzania (Burgess and Clarke, 2000), mainly contributed by cutting trees for provision of timber, wood fuel, agricultural land and building materials without efforts of re-forestation has exacerbated the demand-supply situation. Between 1990 and 2000 for example, FAO (2005) estimated the annual loss in the country's forest cover at 2 %. Following over exploitation, younger trees with inferior properties are now being cut to temporarily meet the market demand (Ishengoma *et al*., 1997).

Intervention is needed to limit the rampant destruction of the forests and at the same time improving the livelihood of the people. The timber stakeholders need alternatives and the national economies need better ways to derive value from the remaining forests in order to maintain their many useful but under-valued functions. One option to this is increasing utilization and market promotion of lesser-known and lesser-utilized timber species which are still plenty and available, but need proper sustainable management practice. Some of these species have the potential to be incorporated into agricultural systems with multiple benefits. These are the indigenous agro-forestry tree species (IAGTS), which from their biomass and ecological requirements, they have potential for carbon sequestration, hence climate change mitigation.

Agro-forestry is widely practiced in Tanzania, mixing up agricultural crops with trees. Nonetheless, in most cases, exotic tree species are used in the agro-forestry establishment. Vi Agro-forestry Programme (2007) reported that there is a serious problem of species selection and tree management which contributes to poor benefits. Mac Dicken and Vergara (1990), Nair (1993), Schroeder (1993) and The Woodland Trust (2002) documented the desirable characteristics of agro-forestry species and pinpointed out that it is important to select the most suitable trees since it is not easy to replace them once they have been planted. It is evident that a great number of indigenous timber species of Tanzania have potential contribution as agro-forestry trees with

multiple benefits (Hines and Eckman, 1993), yet they are not studied and promoted to serve the purpose.

### 1.2 Objectives

This study aimed at gathering important information for inference in establishing optimal production and utilization of lesser known and lesser utilized IAGTS in improving incomes of rural communities in Kilosa District. The specific objectives were:

a) To identify and characterize the sites within the study area for establishing lesser known and lesser utilized IAGTS
b) To identify and characterize the main actors in establishing lesser known and lesser utilized IAGTS
c) To identify the available and other suitable lesser known and lesser utilized IAGTS for establishing in the study area
d) To identify and assess strengths, weaknesses, opportunities and threats for establishing lesser known and lesser utilized IAGTS in the study area

## 2.0 METHODOLOGY

### 2.1 Description of the study area

Kilosa District is located between latitudes 5°55' and 7°53' S and longitudes 36°30' and 37°30 E, in Morogoro Region. All the study villages are found lying between 400 to 600 metres above sea level and experiencing a mean bi-annual rainfall of between 800 and 1,400 mm. The short rains come in October to December and long rains in February to May. The overall mean annual temperatures range between 25°C and 30°C. The soils are poorly drained black clay and loamy, suitable for maize, paddy, sisal, sugarcane and onion cultivation. According to KDC (2012), the district covers a total area of 14,245 $km^2$, of which only 801.5 $km^2$ (5.6%) is under forest cover.

As per 2012 Population and Housing Census, the district recorded 438,175 people at an average household size of 4.2. According to MPEE (2007), the dominant indigenous tribes are Wakaguru, Wasagara and Wavidunda. Administratively, the district is divided into seven divisions namely; Magole, Kimamba, Masanze, Mikumi, Ulaya, Rudewa and Kilosa.

### 2.2 Sampling, data collection and analysis

The implementation of the activities was participatory, conducted with help from key stakeholders, participants' observations and literature surveys. Interviews were conducted in the communities. The approach was gender sensitive so as to capture a wider representation, employing 27 males and 29 females. Stakeholders' meeting were also conducted by including district and local leaders, natural resources officers, farmers, timber stakeholders and the researchers, making a total of 65 people. The timber stakeholders included carpenters, traders, sawyers, potters, beekeepers, charcoal and firewood extractors, nursery operators and tree farmers. As noted by FARM-Africa and SOS Sahel (2007) in Ethiopia and Headley (2003) in Jamaica, wide involvement of all sectors of the community is essential for successful participatory forest management.

The collected information was authenticated through content analysis and then analyzed using the Statistical Package for Social Sciences (SPSS) computer programme.

## RESULTS AND DISCUSSION

### 3.1 Sites for establishing lesser known and lesser utilized IAGTS

A total of eight villages in four divisions were identified as potential sites to establish forest nurseries for lesser known and lesser utilized IAGTS (Table 1).

Table 1: Identified villages for establishing lesser-known and lesser utilized indigenous agro-forestry timber species nurseries in Kilosa District, Tanzania

| Division | Village | Number of Households | No. of Beneficiaries | | Total |
|---|---|---|---|---|---|
| | | | Males | Females | |
| Ulaya | Ulaya Kibaoni | 1,265 | 2,465 | 2,455 | 4,920 |
| | Nyameni | 898 | 1,033 | 2,633 | 3,666 |
| Kimamba | Peapea | 564 | 1,072 | 939 | 2,011 |
| | Rudewa Gongoni | 950 | 1,980 | 2,026 | 4,106 |
| Dumila | Madudu | 354 | 883 | 880 | 1,763 |
| | Kitete | 700 | 1,901 | 2,045 | 3,946 |
| Msowero | Msowero | 4,650 | 6,556 | 8,944 | 15,500 |
| Kilosa | Behewa | 568 | 885 | 1,092 | 1,977 |
| | Total | 9,949 | 16,775 | 21,014 | 37,889 |

Among the main features which made these villages suitable for inclusion in the study as advocated by Krasowski (2012) and Woodland Trust (2002) were:

- On-going tree nursery activities and existence of main actors for tree planting (Table 2), except in Msowero and Peapea where nevertheless, it was easy for the project to be accepted
- Accessibility by road all year round
- Relative availability of water
- Location along main roads, providing public access for other villages and individuals to learn

Working in these areas would directly and indirectly involve 16,775 males and 21,014 females, in 9,949 households.

### 3.2 Main actors in establishing lesser known and lesser utilized IAGTS

The study identified a total of seven stakeholders who could be actors in establishing nurseries for lesser known and lesser utilized IAGTS. These actors were tree planting groups established and working in specific areas. In addition to the stakeholders identified, the study managed to establish two groups, Kambarage and TUTUMA for Peapea and Msowero village, respectively. The distribution of beneficiaries for the Project is as shown in Table 2.

Table 2: Distribution of main actors for establishing lesser-known and lesser utilized indigenous agro-forestry timber species in Kilosa District, Tanzania

| Name of group | Location | Beneficiaries | | |
|---|---|---|---|---|
| | | Males | Females | Total |
| WAMAJUKUU | Behewa, Kilosa Township | 3 | 5 | 8 |
| WAMAJUKUU | Rudewa Gongoni Village | 12 | 7 | 19 |
| Tupendane A | Madudu Village | 5 | 7 | 12 |
| EMASHA | Ulaya Kibaoni | 7 | 3 | 10 |
| STETIANA | Nyameni Village | 12 | 8 | 20 |

| | | | | |
|---|---|---|---|---|
| Tupendane B | Kitete Village | 5 | 4 | 9 |
| Kambarage | Peapea Village | 8 | 6 | 14 |
| TUTUMA | Msowero Village | 18 | 7 | 25 |
| | Total | 70 | 47 | 117 |

### 3.3 Identified lesser-known and lesser utilized IAGTS

A total of five priority lesser known and lesser utilized IAGTS were identified and selected for nursery establishment in the study site (Table 3). The identified tree species had multiple uses with *Lonchocarpus capassa* scoring the first position after ranking, followed by *Sclerocarya birrea, Vitex doniana, Pseudolachnostylis maprouneifolia* and *Combretum zeyheri* being the last in the list (Table 3).

All the identified priority species are capable of providing timber, woodfuel and shade. In addition, whereas Mfumbili and Msolo have medicinal values and Nitrogen fixing ability and potential use as fodder respectively, Mng'ongo and Mfudu provide edible fruits. Mfudu is also a potential tree for fodder.

Other species which were preferred for planting, but not qualifying the name lesser-known and lesser utilized IAGTS are: *Gmelina arborea, Tectona grandis, Afzelia quanzensis, Acacia nilotica* and *Faidherbia albida*. Others were *Khaya anthotheca*, *Cedrela odorata* and *Senna siamea.*

According to Rulangaranga (1989), *Lonchocarpus capassa* (apple-leaf in English) is found naturally in Miombo woodlands including Morogoro, Dodoma, Mikumi National Park, Selous Game Reserve, and Ruaha National Park. The tree can be easily raised from seed and grows fairly fast (Hines and Eckman, 1993). The current use of the wood in Kilosa District is for woodfuel, making grain mortars and tool handles. Medicinally, it is used for the treatment of stomach disorders and coughs.

Table 3: List of five priority lesser-known and lesser-utilized indigenous agro-forestry timber species in Kilosa District, Tanzania

| Botanical name | Local name | Family name | Potential uses | Rank |
|---|---|---|---|---|
| *Combretum zeyheri* Sonder | Mlama mweupe | Combretaceae | Timber, Woodfuel, Shade | 5 |
| *Lonchocarpus capassa* Rolfe | Mfumbili | Fabaceaee | Timber, Woodfuel, Shade, Medicine, Soil Nitrogen fixing | 1 |
| *Pseudolachnostylis maprouneifolia* Pax. | Msolo | Euphorbiaceae | Timber, Woodfuel, Shade, Medicine, Fodder | 4 |
| *Sclerocarya birrea* (A. rich.) Hochst. | Mng'ongo | Anarcadiaceae | Timber, Woodfuel, Shade, Edible fruits | 2 |
| *Vitex doniana* Sweet | Mfudu | Combretaceae | Timber, Woodfuel, Shade, Edible fruits, Fodder | 3 |

*Sclerocarya birrea* (jelly plum/marula in English) is indigenous to the miombo woodlands of sub-Saharan Africa and is one of the most valued trees (Nerd and Mizrahi, 1993; Wickens and FAO, 1995; NRC, 2008; Ojewole *et al.*, 2010). The same authors documented that the species is a traditional fruit plant with potential to improve nutrition, boost food security, foster rural development and support sustainable land care. Kiptot and Franzel (2011) and Bille *et al.* (2013) noted that the tree is among the common indigenous fruit resources in southern Africa. The fruit is eaten fresh, or used to prepare juices and alcoholic beverages. It is very rich in vitamin C, about 3 times the amount found in an orange (Ojewole *et al.*, 2010; Dube *et al*., 2012). Reports in biomedical literature have indicated the presence of medicinally-important chemical constituents in the plant (Ojewole *et al.*, 2010).

Due to the immense importance of *S. birrea*, Dube *et al.* (2012) advocated growing it for industrial purposes. In their attempt to domesticate the species, Nerd and Mizrahi (1993) concluded that it can be established well at various sites with differing in environmental conditions.

Orwa *et al.* (2009) noted that *Vitex doniana* (black plum in English) is a 8 - 18 m high tree with a medium-growth rate. The species is a deciduous forest tree that requires a high water table and it is widespread in tropical Africa. The tree is indeed multipurpose as it bears edible fruits that are highly nutritious (Eseigbe and Bankole, 1996; Nnamani *et al*., 2009) and can be made into a jam and the leaves are also edible as sauce. The different parts of the tree are used for traditional medicine. Also, the fallen leaves produce a useful mulch of litter, improving the soil. Although this species is not threatened by genetic erosion, locally populations may be under pressure due to habitat loss. Orwa *et al.* (2009) documented that the species is occasionally cultivated in plantations in such countries as Nigeria, Mauritius, Ivory Coast, Burkina Faso and Seychelles. Ky (2008), Dadjo *et al.* (2012) and Sanoussi *et al.* (2012) observed *Vitex doniana* as a highly valued tree throughout Africa for various purposes and recommended it for protection and domestication as well.

*Pseudolachnostylis maprouneifolia* (duiker-berry/kudu-berry in English) is a fairly slow growing species but in its initial stages of establishment, the plant grows much faster. Non-timber use of the species revealed that the extracts from its bark is medicinally used for treating diarrhea and also pneumonia. The tree is deciduous and its leaves and fruits are used as animal feed by cattle, goats and wild animals. These uses have also been reported by Venter and Venter (1996) and Palgrave (2002) in South Africa.

On *Combretum zeyheri* (African bushwillow in English), Orwa *et al.* (2009) documented that the tree is regenerated using wildings and seedlings in pots but noted that it is slow in growing. However, the tree responds well to coppicing, lopping and pollarding. Currently, the people in Kilosa District and as noted elewhere (Malimbwi *et al*., 2000; Monela *et al.,* 2000 and Manjate, 2007) prefer *C. zeyheri* as source of firewood and makes very good charcoal. The timber is mainly used for tool handles.

### 3.4 Strengths, weaknesses, opportunities and threats

#### 3.4.1 Strengths

Several strengths were identified to favour the implementation of the study in Kilosa District and the selected villages. Results from household survey indicated 46% of household involvement in tree planting scheme mostly for fuelwood, followed by 35% for charcoal and 12% for timber. About 43% of households owned trees mostly around homestead and farm boundaries, 24% in farms and 20% were scattered in fields. Headley (2003) pinpointed that involvement of rural folk in forest management must provide real benefits, based on local and national needs.

The majority of respondents (67%) were aware of the existence of community forests in the study areas. Also, the majority of them (65%) were aware of the existence of organizations involved in conserving natural resources, mostly the Government departments followed by Community Based Organizations (20%) and Non-Governmental Organizations mentioned by 15%.

The existence of 117 nursery operators in the number of 70 males and 47 females is an indication that the community was slightly gender mainstreamed. Molnar (1987), Williams (1992), Rocheleau and Edmunds (1997), Martin (2003) and Kiptot and Franzel (2011) commented that gender relations influence many aspects of forest management and governance. In Tanzania, it was noted that over 60% of women are responsible for managing tree species planted on farms (Epaphra, 2001) while in Zimbabwe it was over 80% (Gerhardt and Nemarundwe, 2006). It was from this experience in Bangladesh rural areas, that village forest nursery for agro-forestry demonstration farms, fuelwood plantations and homestead woodlots were established with participatory concepts during mid-1980s to mid-1990s (Hossain, 1998).

The involvement of the different stakeholders in the selection process of the priority species, particularly on gender is another strong point for consideration of the project's success. Analysis by Kiptot and Franzel (2011) showed that women's rights to tree products are usually limited to products that are considered to have little or no commercial value. These products are mainly indigenous fruits, fodder and firewood and soil improvement services. Most of the Kilosa's priority species meet these qualifications.

The nursery operators in Kilosa were organized in seven tree planting groups (Table 2) providing strength to the implementation of the nursery activities. It was observed during field survey that 10% of the nursery operators had started earning incomes from the undertaking i.e. TShs 1,500 – 100,000 (4.6%) and TShs 100,000 – 400,000 (5.4%). These observations provide an incentive for other people to embark on this business (Molnar, 1987).

As it was also documented for Rwanda (Republic of Rwanda, 2010), the curiosity for tree planting in Kilosa District could mainly be due to the increasing global interest on forests as carbon sink. Several Non-Governmental Organizations had attempted to work in the area with varying successes.

### 3.4.2 Weaknesses

The study revealed a few weaknesses which could be mitigated for ensuring success of the nursery activities. The weaknesses included lack of knowledge about agro-forestry by the majority of stakeholders (75%). This weakness was nevertheless, subjugated by a one week training of trainers course.

About 49% of the stakeholders were unaware of existence of by-laws to safeguard resources at village level. Most of the actors were unaware of the rules and regulations governing exploitation and conservation of forest resources. Those who were aware perceived that the by-laws were pioneered by the government departments (52%), by government officers at local level (27%), by Community Based Organizations (10%) and by Non-Governmental Organizations (4%). A study by Moore *et al.* (2001) on access to technical information on natural resource management showed that contact with extension staff increases farmers' knowledge of the respective information.

During the stakeholders meeting, the Kilosa District Officer had an opportunity to provide education concerning the rules and regulations. It was also agreed with Kilosa District Council

that its radio station, *Radio Jamii FM* be used for broadcasting educative environment management programmes.

Elsewhere, report by Moshi (undated) in Milawilila and Mangala forest reserves, Morogoro Tanzania showed that normal villagers had perception that forest resources belonged to village leaders and those at higher levels. This could be from the fact that, as it was experienced in Kilosa District, Moshi (undated) also recorded illegal forest activities taking place and being cushioned by village or ward executive leaders for their own benefits. Although by-laws had been formulated in the villages still the experience indicated that they were not being fully put in practice.

### 3.4.3 Opportunities

The majority of respondents (54%) perceived that the forest resource base in Kilosa District was decreasing, whereas 46% provided uncertain answers. The perceived concept by the majority provides a good opportunity to allow effective implementation of the project in Kilosa District. Experience by Molnar (1987) in Nepal showed that people would support a project when they could see tangible results. Since it takes a long time for trees to mature, early positive results such as village nurseries stocked with tree species of known value for farm planting would help elicit people's support.

### 3.4.4 Threats

A few threats to the implementation of nursery activities in the study site were noted. Of utmost importance are the Maasai pastoral and a variety of ethnic groups farming practices which have been causing everlasting conflicts over crop damages particularly in Kimamba and Dumila divisions. Benjaminsen *et al.* (2009) and Butler and Gates (2010) conducted studies on these conflicts in the problem area of Kilosa. General conclusions drawn by these researchers indicated that the conflicts were occurring mainly as a result of resource competition. Another notable threat was from external individuals who were buying ample land, particularly in Kimamba, Msowero and Dumila divisions (80% responses). This was a threat as it could reduce the available land for agriculture and bring problems among key actors and stakeholders in the selected villages.

Early on, Feldman (1974) warned that gross inequalities in land ownership were growing without controls in Tanzania because government policy had caused customary law to be retained for most rural land. The author noted further that the customary land tenure rules in the country were incompatible with conditions of land shortage. Barrows and Roth (1990) concluded that these land tenure systems were inefficient when land has scarcity value and recommended individualised tenure which was viewed as superior since owners are given incentives to use land most efficiently.

## 3.0 CONCLUSIONS AND RECOMMENDATIONS

The preference for forest products in Kilosa District is woodfuel and timber and hence the selection of the five priority species for establishment and domestication is appropriate. These species can be well established and domesticated and Kilosa District is a potential site for their production. However, the noted weaknesses and threats including lack of knowledge on agro-forestry, rules and regulations governing natural resources management, conflicts between farmers and pastoral communities and land grabbing by "investors" need to be worked upon in collaboration with other stakeholders.

## REFERENCES

Barany, M., Hammett, A.L. & Araman, P. (2003). Lesser used species of Bolivia and their relevance to sustainable forest management. *Forest Products Journa*l 53 (7/8): 28 – 33.

Barrows, R. & Roth, M. (1990). Land Tenure and Investment in African Agriculture: Theory and Evidence. *The Journal of Modern African Studies* 28(2): 265 - 297

Benjaminsen, T. A., Maganga, F. P. & Abdallah, J. M. (2009). The Kilosa Killings: Political ecology of a farmer-herder conflict in Tanzania. *Devl. and Change* 40 (3): 423 - 445.

Bethel, J.S. (1984). Sometimes the word is "weed": A critical look at lesser-known species. *Unasylva* 36(145): 17-22.

Bille, P.G., Shikongo-Nambabi, M. & Cheikhyoussef, A. (2013). Value Addition and Processed Products of Three Indigenous Fruits In Namibia. *African Journal of Food Agriculture, Nutrition and Development* 13(1): 7192 – 7212.

Bryce, J.M. (1967) revised by Chihongo, A.W. (1999). *The Commercial timbers of Tanzania, Tanzania*. Forestry Research Institute, Morogoro 292 pp.

Burgess, N.D. & Clarke, G.P. (eds) (2000). *The Coastal forests of Eastern Africa.* IUCN Forest Conservation Programme. Gland, Switzerl. and Cambridge, England, 443 pp.

Butler, C.K. & Gates, S. (2010). Communal Violence and Property Rights. *Working papers,* University of New Mexico

Dadjo, C., Assogbadjo, A.E., Fandohan, B., Kakai, R.G., Chakeredza, S., Houehanou, T.D., van Damme, P. & Sinsin, B. (2012). Uses and management of black plum (*Vitex doniana* Sweet) in Southern Benin. *Fruits* 67(4): 239 – 248.

Dube, S., Dlamini, N.R., Shereni, I. & Sibanda, T. (2012). Extending the Shelf Life of Fresh Marula (*Sclerocarya birrea*) Juice by Altering Its Physico-Chemical Parameters p. 181 - 196 In: Jimenez-Lopez, J.C. (ed.) *Biochemical Testing* 216 pp.

Epaphra, E. (2001). Assessment of the role of women in agroforestry systems: a case study of Marangu and Mamba in Kilimanjaro region, Tanzania. World Agroforestry Centre. Nairobi, Kenya 107pp.

Eseigbe, D. A. & Bankole, S. A. (1996). Fungi associated with post-harvest rot of black plum (*Vitex doniana*) in Nigeria. *Mycopathologia* 136(2): 109 – 114.

FAO (2005). *Deforestation rates in Tanzania*. State of the World's forests. Federal Statistical Office, Rome Italy.

FARM-Africa & SOS Sahel (2007). *The Key Steps in Establishing Participatory Forest Management: A field manual to guide practitioners in Ethiopia.* Oromiya Bureau of Agriculture and Rural Development Southern Nations and Nationalities Peoples' Region Bureau of Agriculture and Rural Development, 28 pp.

Feldman, R. (1974). Custom and capitalism: Changes in the basis of land tenure in Ismani, Tanzania. *The Journal of Development Studies* 10(3-4): 305 - 320

Gerhardt, K. & Nemarundwe, N. (2006). Participatory planting and management of indigenous trees: Lessons from Chivi District, Zimbabwe. *Agriculture and Human Values* 23: 231-243.

Headley, M. (2003). Participatory Forest Management: The Jamaica Forestry Department Experience. In: Perlis (ed.) Forest Management at the XII World Forestry Congress held on 21 - 28 September 2003 in Quebec City, Canada *Unasylva* 54(3-4):

Hines, D. A. & Eckman, K. (1993). *Indigenous multipurpose trees of Tanzania: Uses and economic benefits for people*. FAO Forestry Department, Ottawa Canada

Hossain, S. (1998) Participatory forest management in Bangladesh. In: Isozaki, H. & Inoue, M. (Eds.) Proc. of the 2nd IGES International Workshop on Forest Conservation Strategies for the Asia and Pacific Region, Institute of Global Environmental Strategies (IGES), Hayama, Japan, p.22–32.

Ishengoma, R.C., Gillah, P.R. & Chihongo, A.W. (1997). Properties of lesser utilized *Trichilia emetica rocka*) and *Pterocarpus stolzii* timber species of Tanzania, *Annals* of F*orestry 5 (1): 10 – 15.*

Ishengoma, R.C., P.R. Gillah & Andalwise, M.O. (1998). Some Physical and Strength Properties of lesser known *Milletia oblata* sub spp *stolzii* from Tanzania. Faculty of Forestry, Sokoine University of Agriculture, Record No. 67:54-59.

Ishengoma, R. C., Gillah, P.R., Amartey, S.A., Makonda, F. B. S. & Hamza, K. F. S. (2000). Important physical and mechanical properties of *Albizia amara*: A lesser utilized species in Tanzania. *Tanzania journal of Forestry and Nature Conservation.Vol. 73:. 94 – 98.*

Ishengoma, R.C., Gillah, P.R., Amartey, S.A. & Kitojo, D.H. (2004)**.** Physical, mechanical and natural decay resistance properties of lesser known and lesser utilized *Faurea saligna* and *Bridelia micrantha* timber species from Tanzania. *Hols als Roh-und Werkstoff, 62 (5): 387-389.*

Kilosa District Council (2012). Kilosa District Social Economic Profile. Unpublished.

Kiptot, E. & Franzel, S. (2011). Gender and agroforestry in Africa: are women participating? ICRAF Occasional Paper No. 13. Nairobi: World Agroforestry Centre

Krasowski, M.J. (2012). Forests and forest plants - Vol. III: Producing planting stocks in forest nurseries

Ky, K.J.M. (2008). *Vitex doniana* Sweet. Record from PROTA 4U. Louppe, D., Oteng-Amoako, A.A. & Brink, M. (Editors). PROTA (Plant Resources of Tropical Africa), Wageningen, Netherlands.

Mac Dicken, K.G. & Vergara, N.T. (1990). *Agroforestry: classification and management.* John Wiley and Sons, New York.

Malimbwi, R.E., Misana, S., Monela, G.C., Jambiya, G. & Zahabu, E. (2000). Impact of charcoal extraction to the forest resources of Tanzania: The Case of Kitulangalo area, Tanzania.

Manjate, N.B. (2007). The impact of charcoal production on populations of selected savanna tree species on clay soils in Catuane, Southern Mozambique. MSc. Report, Faculty of Science, University of the Witwatersrand South Africa.

Martin, A. (2003). In : Lara, S., Campbell, C., Rajas, M.H, Aguilar, L. & Siles, J. (eds). Forestry: Gender makes the difference

Ministry of Planning, Economy and Empowerment (2007). Morogoro Regional Socio-economic Profile 2nd Edition. The National Bureau of Statistics/Morogoro Regional Commissioner's Office.

Molnar, A. (1987). Forest Conservation in Nepal: Encouraging Women's Participation Story. *Seeds* No. 10 ISSN 073-6833

Monela, G. C., Zahabu, E., Malimbwi, R.E., Jambiya, G. & Misana, S. (2000). Socio-Economics of Charcoal Extration in Tanzania: A Case of Eastern Part of Tanzania.

Moore, K., Hamilton, S., Sarr, P. & Thiongane, S. (2001). Access to technical information and gendered NRM practices: men and women in rural Senegal. *Agriculture and Human Values* 18: 95-105.

Moshi, E. R. (undated). Participatory Forest Management (PFM) initiatives in Milawilila and Mangala forest reserves: Achievements, Problems/Conflicts and Lessons learnt

Nair, P. K. R. (1993). *An Introduction to Agroforestry.* Kluwer Academic Publishers, 520 pp.

National Research Council (2008). *Marula. Lost Crops of Africa*: Volume III: Fruits. Washington, D.C.: National Academies Press

Nnamani, C. V., Oselebe, H. O. & Agbatutu, A. (2009). Assessment of nutritional values of three underutilized indigenous leafy vegetables of Ebonyi State, Nigeria. *African Journal of Biotechnology* 8(9): 2321 – 2324.

Nerd, A. & Mizrahi, Y. (1993). *Domestication and introduction of marula (Sclerocarya birrea subsp. caffra) as a new crop for the Negev desert of Israel*. p. 496 - 499. In: Janick, J. & Simon, J.E. (eds.), New crops. Wiley, New York.

Ojewole, J.A., Mawoza, T., Chiwororo, W.D. & Owira, P.M. (2010). *Sclerocarya birrea* (A. Rich) Hochst. (Marula) (Anacardiaceae): A review of its Phytochemistry, Pharmacology and Toxicology and its Ethnomedicinal uses. *Phytotherapy Research* 24(5): 633 -639.

Orwa, C., Mutua, A. Kindt, R., Jamnadass, R. & Anthony, S. (2009). Agroforestry Database: A Tree Reference and Selection Guide version 4.0 (http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp)

Palgrave, C.M. (2002). *Trees of Southern Africa*, edn 3. Struik, Cape Town.

Republic of Rwanda (2010). Strategic Plan for the Forest Sector 2009 – 2012. National Forestry Authority (NAFA) Ministry of Forestry and Mines, 50 pp.

Rocheleau, D. & Edmunds, D. (1997). Women, men and trees: Gender, power and property in forest and agrarian landscapes. *World Development* 25(8): 1351 – 1371.

Rulangaranga, Z.K. (1989). Some Important Indigenous Medicinal and Aromatic Plants in the Wild Flora of Tanzania Mainland. Tropical Forestry Action Plan, Working Paper 24. Tanzania Ministry of Lands, Natural Resources and Tourism, Dar es Saalam.

Sanoussi, A., Ahoton, L.E & Odjo, T. (2012). Propagation of Black Plum (*Vitex donania* Sweet) Using Stem and Root Cuttings in the Ecological Conditions of South Benin. *Tropicultura 30(2): 107 – 112.*

Schroeder, P. (1993). Agroforestry systems: integrated land use to store and conserve carbon. *Climate Research* 3: 53 – 60.

Venter, F. & Venter, J.A. (1996). *Making the most of indigenous trees*. Briza Publications, Pretoria, p. 20 – 21.

Vi Agro-forestry Programme (2007). Plan Vivo Project Idea Note (PIN)

Wickens, G. E. & Food and Agriculture Organization (1995). *Potential Edible Nuts*. Non-Wood Forest Products. 5. Rome: Food and Agriculture Organization.

Williams, P.J. (1992). NGOs, Women and forestry activities in Africa. *Unasylva* - No. 171

Woodland Trust (2002). *Urban Woodland Management Guide 4: Tree planting and woodland creation* 25 pp.

Youngs, R.L. & Hammett, A.L. (2001). Diversity, productivity, profitability, sustainability, and the Tao of underutilized species. *Forest Products Journal* 51(1): 29 - 35.