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Studies on the influence of tree tenure on the adoption of agroforestry practices in Uluguru Mountains, Tanzania

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On-farm tree retention formed the basis for the present day agroforestry systems in many traditions. In the present study, we assessed the influence of tree tenure on the adoption of agroforestry practices in Uluguru Mountains, Tanzania. Results showed that most of the farmers (92%) were involved in activities related to tree planting and/or tree retaining with the number of trees planted in existing farmlands ranging between 150 to more than 300. Young respondents planted more trees compared to middle and old age groups. Household labour unit level had an influence on the number and species of plant trees planted. The study revealed that men were significantly more involved in tree planting than women. It was also found by this study that most of the respondents (82.2%) were planting trees in their farms mainly for economic gains through timber production, while 13.3% and only 4.5% of the respondents were planting trees for soil conservation and for moisture conservation respectively. Therefore, more efforts need to be directed to planting tree species that have economic benefits to farmers in order to speed up the rate of agroforestry adoption. Perceived benefits of agroforestry practices in the study areas were for its easiness in the management of trees with other crops (59%), conservation of moisture (28%) and (13%) of the respondents said see no benefit of agroforestry system.

Keywords: Adoption, trees, agroforestry, Uluguru Mountains.

INTRODUCTION

Traditionally, the Waluguru practice both matrilineal and matriarchal systems, however in Mkuyuni division, the maternal system is the most dominant. The maternal uncle wields great authority in the family such as management and distribution of land. For example, in his study Young *et al,* (1960) found that land in most parts of the Uluguru was traditionally acquired through matrilineal inheritance, and land is passed on to children, more often to the son by the head of the clan (Uncles). The author further reported that an individual being allocated a piece of land has no absolute rights on that land, and he/she is restricted from planting trees or any perennial crops such as trees as the land that is planted with trees and other perennial crops is considered as an individual property and other members of the clan cannot access it. Along the same view, Nair (1993) argued that the relationship between a farmer and his land determines the type of crops to be grown and in instances when and individual is renting a land, he/she is not permitted to plant trees and other perennial crops on that land.

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Agroforestry (AF) is defined as a collective name for land use systems and practices where woody perennial are deliberately integrated with crops and/or animals in the same management unit (ICRAF, 1990). The integration can be either in a spatial or in temporal sequence. There must be both ecological and economical interactions between the wood and non wood components to qualify as agroforestry (Rocheleau *et al*., 1988). Farmers, particularly in developing countries have been incorporating trees in their farmlands as a means to buffer environmental conditions and decreases in agricultural production. Trees, particularly, fruit trees have been used to supplement household source of income and shortage of other food crops.

Arnold and Dewees (1997) pointed out that, trees like it is for other resources at farmer's disposal are managed depending on the requirements of the person in question or household. These requirements vary within, between, from one farm to another and from one region to another and are influenced by several socio-economic and cultural factors. However, by providing a supply of fuel wood from farm, AF can help to reduce pressure on forests and communal woodlands (Ramadhani *et al*., 2002). It should be noted that as tree planting is regarded as a mark of ownership right, customary tenure does not allow non-owners to plant trees, which is an important constraint for introduction of AF systems (Neef, 2001 Following slow adoption of AF practices in Tanzania, Mgoja (1992) argued that, despite the contribution of AF to soil conservation and improvement of soil fertility, supply of fuel wood, building poles, timber and increased household income, these were not enough to contribute to adoption of AF.). It was the objective of this study to assess the influence of tree tenure as it affects the rate of adoption of AF practices in Uluguru Mountains.

MATERIALS AND METHODS

The study was carried out at Tandai village in Kinole Ward, Mkuyuni division in the year 2006. Tandai village is in Mkuyuni division in Morogoro rural district, Tanzania. The division lies on the Eastern part of Uluguru Mountains at altitude between 400 meter above sea level (m. a. s. l) and approximately 1000 m. a. s. l.

Experimental Design

A cross-sectional research design involving collection of information from representative population sample in one time duration at a single point (De Vaus, 2002). A cross sectional research design was used in this study due to its associated advantages (Babbie, 1990), such as it high degree of flexibility in consideration of different aspects of a problem understudy (Kothari, 2004), such as socio-economic and political factors influencing adoption of land conservation methods and practices.

Sampling Procedure

The study involved smallholder farmers in Tandai village who grew agricultural crops and/or trees. According to URT (2003) a smallholder farmers (peasants) is the one who is cultivating a farmlands of an average size ranging between 0.9 to 3 hectare (2.25 acres) to 3.0 (7.5 acres) respectively. Therefore most of the study respondents are smallholder farmers (69%) having a farmland ranging between less than 1 and 3.5 hectares. The sampling unit was the head of a household. The simple random sampling technique was applied to select respondents for the study. A sample size of 50 heads of households which was about 15% of smallholder farmers in the study area were selected using a table of random numbers from the list of heads of households prepared during the 2002 national census (URT, 2003).

Data Instrumentation

A preliminary survey was done to familiarize the researchers with the study area by pre-testing the questionnaire. The questionnaire was administered to 20 respondents who were excluded in the actual study which involved 50 farmers.

Data Collected

Primary data collection was done by administering a structured questionnaire to the 50 respondents. The questionnaire was composed of close and open-ended questions to capture the respondents' belief and aspirations on unbiased basis. Secondary data was collected from Sokoine National Agricultural Library (SNAL), University College of Dublin (UCD), the Uluguru Mountains Biodiversity Conservation Project (UMBCP), the Uluguru Mountains Agricultural Development Project (UMADEP) and from Tanzania national website.

Data Analysis

Both qualitative and quantitative data were summarized and analyzed using Statistical Package for Social Sciences (SPSS) computer software. Construction of cross tabulations was used to compare relationships between number of tree planted and age group of the respondents, household level of income and gender labour units. The relationships between number of tree planted and household farm size and education level

Table 1. Socio-economic characteristics of the respondents

Category	Number	Percentage (%)
Age categories		
18 - 45	34	68
46 - 55	11	22
> 56	5	20
Type of household		
Male	48	96
Female	2	4
Education level		
Primary Education	33	66
No - formal education	17	34
Income categories (000 Tzshs)		
< 100	3	6
100 - 300	20	40
> 300	27	54
Household labour unit		
Small (2.0-4 units)	20	40
Medium (4.5- 6 units)	19	38
Large (6.5- 9 units)	11	22
Farm size		
Small (> 2 – 5 acres)	34	70
Medium (6-9 acres)	7	14
Large (10-15 acres)	8	16

were also determined. Chi square tests were done to test for levels of significant differences among the variables studied. The household labour units (HLU) were calculated using the formula: HLU = Number of members of household aged above 18 years + (Number of members of household aged below 18 years x 0.5).

RESULTS AND DISCUSSION

The distribution of the respondents by their socio-economic characteristics is shown in Table 1. The socio-economic characteristics of the study population were described in terms of age, type of household and education level. Others include household labour unit; income and farm size. These independent variables were considered to be very important for the study area and they provide the socio-economic characteristics of the study population that might be influencing tree tenure and ultimately the adoption of agroforestry practices in the study area.

Results show that most of the respondents (68%) were relatively younger aged between 18 – 45 years, while 22% and 10% of the respondents were aged between 46-55 years and above 56 years respectively. The relationship between age and adoption of land conservation methods and practices such as agroforestry, age influence risk aversion with the traditional view that older farmers are more risk averse and hence less adoptive to new innovation. These observations as in agreement with the one reported by Shiferaw and Holden (1998).

Results also show that most of the households (96%) were male headed while only 4 % of households were female headed. The level of basic education in the study area, most of the respondents (66%) had primary education and 34% of the respondents had no formal education. However, there was no respondent with a post primary level of education in the study area. This implies that, despite the influence of other factors in the innovation- decision process, formal education also might have greater influences in the adoption process. However, according to Yaron et al. *(*1992) the relationship between adoption and education is positive up to a certain level and becomes a negative.

The study further revealed that most of the respondents (54%) had annual income greater than 300,000.00 Tanzanian shillings (TZS) while 40% and 6% of the respondents earned between 100,000.00 and 300,000.00 (TZS) respectively, Although poverty cannot be simply be measured and is difficult to define, but based on the economic measures of poverty, one can

Table 2. Distribution of respondents by the activities related with tree planting and/or tree retaining

Activities	Frequency	Percentage
Planting and retaining trees	28	56
Planting	12	24
Retain	6	12
Neither planting nor retaining	4	8
Total	**50**	**100**

say that, most of the household were living below the poverty line of less than one USD per day (World Bank, 2000). Poverty might compel people to over-exploit the natural resources, particularly land and forest products, hence perpetuating the problem of land degradation in the study area. This implies that, there might be a relationship between poverty and land degradation in the study area Also, farmers with relatively high level of income can invest more in long-term income generating activities compared to the resource-poor farmers as they have to compromise for any risk that might be involved in the practice and therefore could not withstand the long investment needed (Luoga et al., 2000). Further, resource poor farmers can adopt long-term income generating activities so long as they have other alternative sources of income to ensure their livelihood. This will promote other income generating activities within and outside their farmlands might enable smallholder farmers to adopt long-term conservation and income generating practices such as agroforestry. Alavalapati *et al.* (1995) reported that higher income farmers are the main beneficiaries of agroforestry if only farm forestry is considered.

Results show that Household Labour Units (HLU) range between 2 and 9 units with an average of 4.76 HLU. Of the respondents, 40% had small labour units, while 38% and 22% of the respondents had medium and large labour units respectively. It can therefore be argued that low labour units, interventions that require significant labour inputs might not be appropriate to the majority of smallholder farmers with shortage of man labour, as such innovation may suit those with large household labour unit and whose who are able to hire extra labour. This suggest that, any agroforestry intervention should therefore, focus on the holistic livelihood strategies of the community to which is proposed and these strategies should enhance one another and not compete each other on the scarce resources such as HLU under smallholder farmers disposal. Results imply that respondents with large household labour units could easily adopt AF practices compared to households with small labour units if there will be no other disincentives to adoption. For example, in the semi-arid areas of Tanzania where by a labour peak period usually coincides with soil conservation activities, farmers have been spending most of their time on crop production rather than on soil conservation to maximize the use of the rains (Kangalawe, 1995). Cook (1997) reported the relationship between household labour unit and adoption of AF in the Western part of Nigeria, as one of the major constraint that is preventing smallholder farmers from intensifying their farming systems and this constraint has important implications for the adoption of alley farming which is agroforestry practice. The wealthier farmers whose farming and off-farm activities are already diversified, cushioning the risks entailed in adopting new farming techniques.

The study further revealed that household farm sizes ranged between less than 2 acres and 15 acres of the respondents. Most of the respondents (70%) had a farm size between 2 and 5 acres while 14 % and 16 % of the respondents had between 6 - 9 acres and 10 – 15 acres respectively. This implies that, land holdings differ significantly within and between different areas in the Uluguru Mountains.

The distribution of the respondents by the activities related to tree planting is shown in Table 2. Results show that most of the respondents (56%) planted and retained trees in their farms while 24% and 8% of the respondents were involved in planting trees only and neither planted nor retained trees in their farms respectively. It can therefore said that tree planting and/or retaining were the most common agroforestry practices among smallholder farmers in Tandai village. Along the same view, in his study Munishi *et al.* (2004) also argued that on-farm retention of trees has formed the basis for the present day agroforestry systems in many traditions.

The number of trees planted in the existing farmlands ranged from less than 150 to more than 300 (Table 3). The majority of respondents (45%) planted more than 300 trees on their farmlands. 12.5% of the respondents planted between 150 and 300 trees while 42.5% planted less than 150 trees on their farms. The whole activities of tree planting is probably constrained by among other thing by inadequate extension services, high prices of tree seedlings, lack of training on seedling production, management and utilization techniques of different trees and shrubs species that have the potential for agroforestry in the area. Mwihomeke et al. (1999) noted that extension agents and farmers were lacking know-

Table 3. Distribution of respondents who planted trees by the number of trees planted on farm

Number of trees planted	Frequency*	Percentage
< 150	17	42.5
150-300	5	12.5
>300	18	45
Total	40	100

*10 respondents were not involved in tree planting nor retaining trees in their farm lands

Table 4. The relationship between age group and the number of trees planted on farms

Number of trees planted	Age groups of respondents		
	Young (18-45)	Middle (46-55)	Old (>56)
<150	20 (59%)	7 (64%)	4 (80%)
>150	14 (41%)	4 (36%)	1 (20%)
Total	34 (100%)	11 (100%)	5 (100)

Chi-square = 0.84; P>0.089

Table 5. The relationship between the number of trees planted and categories of the respondents

Number of trees planted	Income categories of the respondents ('000.00 Tshs)	
	<300.00	>300.00
<1500	17 (74%)	10 (37%)
>150	6 (26%)	17 (64%)
Total	23 (100%)	27 (100%)

Chi-square = 6.80; P< 0.012

ledge of the most appropriate exotic and indigenous species that can be sufficiently utilized for agroforestry practices in the Uluguru Mountains. Kabwe *et al*., 2004 observed that some government extension services and traditional leaders are also not effective in the dissemination of agroforestry technologies.

An examination of the association between age group and the number of trees planted on the farmlands and age category of respondents is shown on Table 4. Results show that, 59% of the young respondents planted less than 150 trees compared with 64% and 80 % of the middle and old aged respondents who planted less than 150 trees respectively. While only 20% of the old respondents planted more than 150 trees, 36% and 41% of the middle aged and young respondents planted more than 150 trees respectively. The results show that, there is curvilinear relationship between the number of trees planted and age group of the respondents as most of the middle aged respondents planted more than 150 trees. Probably old people were not interested with tree planting as the practice has long-term economic returns. However, results show there is no significant association between age categories of the respondents and the number of trees (P>0.089).

Results presented on Table 5 show that there is strong association between household level of income and the number of trees a particular household planted on their farms (P< 0.012). Many farmers with a relatively high level of income, planted more trees than those with small level of income. The level of income was important for the household to meet the costs of buying and transporting seedling to their farms. Probably the farmers with relatively high levels of income can invest more in long term economic activities compared to the resource poor farmers as they have to buffer for any risk that might be involved in the practice and therefore could withstand the long term investment needed. This is important because considering the long waiting period needed for trees to mature in order to realize the benefits, the poor farmers may not be able to afford waiting for long periods. As such it may be necessary to introduce shorter term agroforestry options that complement immediate income sources of the farmers. This is supported by Alavalapati et al. (1995; FAO, 1995) who argue that Agroforestry should contribute towards an increase in household income.

Table 6 The association between gender labour units and number of trees planted

Number of trees planted	Labour units					
	Small (1-2 units)		Medium (2.5-3 units)		Large (3.5-6.0 units)	
	Women	Men	Women	Men	Women	Men
<150	9 (53%)	12 (60%)	4 (50%)	5 (56%)	3 (27%)	1 (11%)
>150	8 (47 %)	8 (40%)	4 (50%)	4 (44%)	8 (73%)	8 (89%)
Total	17 (100%)	20 (100%)	8 (100%)	9 (100%)	11 (100%)	9 (100%)

Chi-square (Women) =1.91, P> 0.385; Chi-square (Men) = 6.27, P<0.044

Table 7. The association between farm size and the numbers of tree planted

Number of trees planted	Farm size (acres)		
	Small(<5 acres)	Medium(6–9 acres)	Large (10- 15 acres)
< 150	15 (54 %)	4 (67 %)	7 (47 %)
> 150	13 (46 %)	2 (33 %)	8 (53 %)
Total	28 (100 %)	6 (100)	15 (100)

Chi-square = 0. 695; P> 93

The association between gender labour units and the number of trees planted is shown on Table 6. Results show that 53% of the household with small units of women's labour planted less than 150 trees compared to 50% and 27% of households with medium and large units of women's labour planted less than 150 trees respectively. Furthermore, the results showed that 47% of household with small units of women's labour planted more than 150 trees compared to 50% and 73% of the households with medium and larger units of women's labour who planted more than 150 trees respectively. However, there is no significant association between women's labour units and the number of trees planted (P> 0.385). Further, the results show that, 60% of households with small men's labour units planted less than 150 trees compared to 56% and 11% of households with medium and larger labour units who planted less than 150 trees respectively. Also, only 40% of households with small men labour units planted more than 150 trees compared to 44% and 89% of the households with medium and large men's labour units respectively, who planted more than 150 trees. There is a strong association between men labour units and the number of trees planted (P<0.044). Other researchers' findings in the study area also suggest that tree planting is mainly men's activities as women are usually not interested in the practices as it a long –term investment and with existence of high divorce rates, women think that they might not benefit from their labour that they would invest in tree planting (Mwihomeke et al., 1999).

The distribution of respondents by the association between farm size and the number of trees planted is shown on Table 7. Results show that most of the respondents (54 %) with small farm size planted less than 150 trees compared to 67 % and 47 % of the respondents with medium and large farm size who planted less than 150 trees respectively. Results also shows that 53 % of the respondents with large farm size planted more than 150 trees compared to 33 % and 46 % of the respondents with medium and small farm size respectively. Results further show that there is a trend between the numbers of trees planted and farm size. However, there is no significant association between farm size and the number of trees planted (P>0.093). Similar results were observed by (Rocheleau, 1998) who pointed out that, farmers with larger farms were able to adopt long-term conservation practices on their farm when compared with small farms.

The distribution of respondents by the association of level of respondents' education and the number of trees planted is shown in Table 8. Results show that most of the respondents (53 %) of the respondents who had no formal education planted less than 150 trees compared to 54 % of the respondents who had a primary education. The results also show that 47 % of the respondents who had no formal education planted more than 150 trees compared to 46 % of the respondents who had primary. There is no association between education and number of trees planted (P> 0.91). Arguing of the relationship between education level and adoption of innovation Rogers (1983) found that innovators had larger farm size, higher incomes and more years of formal education. This implies that, despite the influence of other factors in the innovation- decision process, formal education has greater influences in the adoption process. Furthermore, Yaron et al. (1992) pointed out that the relationship be-

Table 8. The association between education level of the respondents and number of tree planted

Number of trees planted	Education level of the respondents	
	No formal education	Primary education
<150	9 (53%)	18 (54 %)
>150	8 (47%)	15 (46%)
Total	**17 (100%)**	**33 (100%)**

Chi – square = 0. 012; P >0.91

Table 9. Distribution of respondents who planted and/or trees by their reasons for planting and/or retaining trees on their farmland

Reason for planting and/or retaining trees	Frequency*	Percentage
Timber production	22	48
Soil conservation	14	30
For fuel wood	6	13
Forced by extension agents	2	4
For food purpose	2	4
Total	46	100

*4 respondents were not involved in trees planting and retaining

Table 10. Distribution of respondents who planted and/or retained trees by their pattern of planting and/or retaining trees

Trees planting patterns	Frequency*	Percentage
Mixed with other crops	30	65
Not mixed with other crops	16	35
Total	46	100

*4 respondents were neither planting nor retaining trees in their farms

tween adoption and education is positive up to a certain level and then becomes a negative. A higher level of experience may diminish the likelihood to adopt since the farmers involvement in farm work may be important as well.

Table 9 depicts the respondents' reasons for planting trees. Results show that, 48% of the respondents planted and/or retained trees for timber production while 30% of the respondents planted and/or retained trees for soil conservation while 13% of the respondents planted and/or retained trees to meet their household's fuel wood demand and only 4% planted and/or retained trees because extension agents forced them. An equal percentage planted and/or retained trees for food purposes mainly as fruit crops. It was found that, those who claimed to be forced by extension agents were those farmers who recently opened up new farms near or in the public forest slopes and/or cultivated on very steep slopes. Results also revealed that many respondents were interested in planting trees in their farms for economic benefits by producing timber rather than for environmental conservation. This implies that more efforts should be directed to planting tree species that have economic benefits to farmers in order to speed up the rate of agroforestry adoption. In farmlands, trees slow down rainfall run-off thus protecting the soil and increasing the infiltration of water so that ground water stores are replenished (Young, 1997). They also act as nutrient pumps, drawing essential minerals from the subsoil and depositing them through their leaf fall in surface layer where they are made accessible to other plants (HDRA, 2001).

The distribution of respondents who planted and/or retained trees by pattern of trees planting and/or retaining is presented on Table 10. Results show that majority of the respondents (65%) were intercropping trees with other crops on their farms. Only 35% of the respondents were planting trees around their farms. This suggests that farmers have been practicing different AF practices depending on their own perception and need.

Table 11. Distribution of respondents by their perceived benefits of agroforestry

Farm size (ha)	Frequency*	Percentage
Easy management of trees and other crops	19	41.3
Moisture conservation	13	28.3
Availability of fuel wood	8	17.4
No benefit	6	13.0
Total	**46**	**100**

*4 respondents did not either plant or retain trees in their farms

Furthermore, the finding implies that, development practitioners should promote different agroforestry practices that suit individual farmers based on their own situation (Franzel *et al*., 2001).

Perceived benefits of agroforestry practices are shown on Table 11. Results show that, easy management of trees with other crops was the most perceived benefit reported by the majority of the respondents (41.3%). Of the 46 respondents 28.3% said that, moisture conservation was the benefit of agroforestry and 17.4% of the respondents said that, the easy availability of fuel wood was the benefit gained from agroforestry; whereas 13% of the respondents said that they had no benefits from agroforestry practices**.** This implies that, most of the respondents were appreciating the different benefits of agroforestry practices and their decision to adopt or reject the adoption of agroforestry might only be influenced by other socio–economic factors rather than lack of benefits from practices. Kyomo (1994) noted that, despite the fact that many agroforestry technologies have given positive results in terms of increased productivity, increased food security and ultimate poverty alleviation, it is not well adopted. It is hypothesized that many farmers are either not aware or lack knowledge of agroforestry. For example, Mwihomeke *et al*. (1999) in his study in Uluguru Mountains noted that extension agents and farmers were lacking knowledge of the most appropriate exotic and indigenous species that can be sufficiently utilized for agroforestry practices in Mountains. Argueing in favour of Mwihomeke *et al* (1999) view, Kabwe *et al*. (2004) also reported that some government extension services and traditional leaders are not effective in the dissemination of agroforestry technologies, which might also being affecting their effectiveness.

CONCLUSION

In this study, it has been observed that most of the farmers were interested in planting trees as a component of the agroforestry system. Trees were planted mainly for timber production and soil conservation. Several constraints were identified that limit tree planting in the study area; these included poor extension services especially lack of training ion seedlings production, and management and utilization of different tree species. Other problems were land scarcity, low level of household incomes and low labour units. It was perceived that if the issue of insecurity on land ownership and also the extension services were improved, there was more likelihood of the farmers integrating trees in their present cropping systems so as to achieve agroforestry. Women should be encouraged to participate in tree planting and/or retaining activities.

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REFERENCES

Alavalapati JRR, Luckert MK, Gill DS (1995). Adoption of agroforestry practices: a case study from Andhra Practice, India. *Agroforestry Systems,* 32(1): 1-14.

Anold JEM, Dewees PA (1997). Farms Trees and farmers: Responses to agricultural intensification. Earthscan, London. 186.

Babbie ER (1990). Survey Research Methods. Wordsworth Publishing Co. Belmount, California. 163

Bakengesa SS, Otsyina R, O'kting'ati A (2004). Influence of National Policies on Tree Planting and Conservation: The Case of Agroforestry Technologies in Shinyanga Tanzania. In: Rao MR, Kwesiga FR, (Eds.), Proceedings of the Regional Agroforestry Conference on Agroforestry Impacts on Livelihoods in South Africa: Putting Research into Practice. 301--306.

De Vaus (2002). Surveys in Social Research (5th eds). Allen and Unwin, Australia.

Franzel S, Coe R, Cooper P, Place F, Scherr S (2001). Assessing the adoption of Potential of agroforestry practices in Sub Sahara Africa. Agricultural Systems. 69: 37-62

ICRAF (1990). Strategy for year 2000. ICRAF, Nairobi.

Kabwe GR, Katanga PL, Maforgonya IM, Grundy D, Phiri K, Kwesiga F (2004). Dissemination pathways for scaling up agroforestry optains in Eastern Zambia. In: Rao MR, Kwesiga FR, (Eds). Proceeding of the Regional Agroforestry Conference on Agroforestry impacts on Livelihoods in Southern Africa: Putting Research into Practice. Pp.275-278.

Kothari CR (2003). *Research Methodology: Methods and Techniques* (2 Eds). New Age International Publisher, Delhi, India.

Kyomo ML (1994). Agroforestry Development for Environmental Quality. Presentation, Sustainable Development and Biodiversity Maintenance in Southern Africa. In Proceedings of the First Tanzania National Agroforestry and Environment Workshop. Ministry of Agriculture and Ministry of Tourism, Natural Resources and Envi-

ronment, 71pp
Mgoja A (1992). Problems of Technology Adoption and Sustainability in Agroforestry. (Unpublished).
Mwihomeke ST, Zilihona JEI, Hamisy WC, Mwaseba D (1999). Assessment of forest users group and their relationship to the condition of the natural forests in the Uluguru Mountains (unpublished).
Munishi PKT, Philipina F, Temu RPC (2006). On-farm tree resources and farmer motives for on-farm tree retention and management in Bumbuli Ward, Lushoto District, North Western Tanzania. In: Chamshama SAO, Nshubemuki L, Iddi S, Swai RE, Mhando ML, Sabas E, Balama C, Mbwambo L,Mndolwa MA, (Eds). Proceedings of Second National Agroforestry and Environmental Awareness: Partnership and Linkages for Greater Impact in Agroforestry and Environmental Awareness. pp188-198.
Mndolwa MA (Eds). Proceedings of Second National Agroforestry and Environmental Awareness: Partnership and Linkages for Greater Impact in Agroforestry and Environmental Awareness. Pp 188-198.
Nair PK (1993). An introduction to Agroforestry. Kluwer Academic Publishers.
URT (2003). Country profile: The National website (www.tanzania.go.tz)
Ohymas O (2000). Assessment of the remaining forests on the Uluguru and the pressure that they face (Unpublished).
Neef A (2001). Land Tenure and Soil Conservation Practices-Evidence from West Africa and Southeast Asia. In: D.E.Stott, R.H. Mohtar and G.C. Steinhardt (Eds). Sustaining the Global Farm. Selected Papers from the 10th International Soil Conservation Organization Meeting at Padue University and the USDA-ARS National Soil Erosion Research Laboratory, 24-29 May, 125-130.
Ramadhani T, Otsyina R, Franzel S (2002). Improving households incomes and reducing deforestation using rotational woodlots in Tabora Districts, Tanzania. *Agric., Ecosystem and Environ.* 89: 229 – 239.
Rocheleau D, Weber F, Field-Juma A (1998). Agroforestry in dryland Africa. International Council for Research in Agroforestry (ICRAF) Nairobi, Kenya. 15
Young A (1997). Agroforestry for soil management. CAB international. UK.
Rogers EM (1983). *Diffusion of innovations.* Third edition, the Free Press, New York, pp. 213-232.
World Bank (2000).
Shiferaw B, Holden ST (1998). Resource Degradation and Adoption of Land Conservation Technologies in the Ethiopian Highlands: A Case Study in Andit Tid, North Shewa. *Agric. Econ.* 18: 233-247
Luoga EJ, Witkowski ETF, Balkwill K (2005). Land Cover And Use Changes In Relation To The Institutional Framework And Tenure Of Land And Resources In Eastern Tanzania Miombo Woodlands Environment, Development And Sustainability 7:71–93
Yaron G, Janssen G, Maamberua U (1992). Rural Development in the Okavango Region of Namibia: an assessment of needs, opportunities and constraints. Gamsberg Macmillan Publishers, Windhoek.