African Journal of Agricultural Research Vol. 4 (5), pp. 427-437, May, 2009
Available online at http://www.academicjournals.org/AJAR
ISSN 1991-637X © 2009 Academic Journals

Full Length Research Paper

Influence of property rights on farmers' willingness to plant indigenous fruit trees in Malawi and Zambia

G. German[1,3], F. K. Akinnifesi[2]*, A. K. Edriss[3], G. Sileshi[2], C. Masangano[3] and O. C. Ajayi[2]

[1]World Relief, P. O. Box 30717, Lilongwe 3, Malawi.
[2]World Agroforestry Centre, Southern Africa Regional Programme, Chitedze Agricultural Research Station, P. O. Box 30798, Lilongwe, Malawi.
[3]University of Malawi, Bunda College of Agriculture, P. O. Box 219, Lilongwe, Malawi.

Accepted 15 February, 2009

Despite the important role that indigenous fruit trees play in the food security and livelihood of households in southern Africa, investments in the cultivation and conservation of indigenous fruit trees (IFTs) by farm communities is very low. Through the use of reconnaissance surveys, household surveys and focus group discussions, this study assessed the effects of land and tree tenures and household characteristics on farmers' willingness to plant and domesticate IFTs in Malawi and Zambia. Results revealed that 98% of land cultivated by smallholder farmers in Malawi and Zambia were under customary land tenure system, and were conducive for tree cultivation as opposed to leasehold land tenure systems. The existing land user-rights of customary land were of private property regime, and provided smallholder farmers much freedom in land utilization. Household tree tenure was observed to account for 96% of tree tenure types, and is favourable to IFTs' cultivation. Farmers' resource endowment, cultural practices and socio-economic characteristics had overriding effects on fruit tree planting. The weak extension capacity, lack of knowledge in IFT cultivation, seedling scarcity, cultural norms such as matrilineal inheritance system were identified as major disincentives to fruit tree planting. Household size and formal education increased the probability of farmers to plant fruit trees in the study area. Contrary to popular notion, the existing land and tree tenure systems do not impose constrains on the cultivation of IFT by households.

Key words: Conservation, domestication, investment decision, land tenures, tree tenure.

INTRODUCTION

Wild fruit collection is one of the ways smallholder farmers and rural people have traditionally been addressing their livelihood needs in the tropics (Akinnifesi et al., 2008 a, b). The domestication and commercialization of indigenous fruit and nut trees have been a topic of interest in many scientific and development forums as an important avenue for increasing nutrition, diversified cash income and asset building opportunities for smallholder farmers in the developing world (Akinnifesi et al., 2006, 2007; Leakey et al., 2005). Research on indigenous fruit and nuts has accumulated considerably in Sub-Saharan Africa, and their role in poverty reduction is increasingly being recognized (Schreckenberg et al., 2006; Mithofer et al., 2006).

In addition, several studies have indicated that access to indigenous fruit trees (IFTs) reduces impact of food shortage during the hunger periods of the year (Mithofer, 2005; Akinnifesi et al., 2004). An *ex ante* impact analysis in southern Africa indicates that indigenous fruits can reduce vulnerability of rural households to income poverty by 33% (Mithofer et al., 2006). IFT conservation and commercialization constitute a safety-net during the periods of famine, and provide income to women and children (Ramadhani, 2002). White and Robinson (2000) indicated that most HIV/AIDS-affected female headed households tend to seek small-scale income generating activities opportunities like selling indigenous fruits for raising cash. As a result, research has been intensified on domestication strategies: selection of priority species,

*Corresponding author. E-mail: fakinnifesi@africa-online.net.

germplasm collection and tree genetic improvement, propagation systems and field management, harvesting and post-harvest technology, economic analysis and market research (Akinnifesi et al., 2006, 2008).

But despite the important role that IFTs play in the food security and livelihood of households, investments in the cultivation and conservation of the trees by farm communities is quite low. In the literature, this has been attributed to several reasons particularly, the insecure tenure rights on trees and land. Few studies have been done on the role of land and tree tenures, family household power structure-matrilineal and patrilineal systems and other socioeconomic characteristics and their implications on the willingness of farmers to cultivate indigenous fruit trees. According to Ramadhani (2002), tree tenure is a form of tree ownership belonging to the state while communal tenure was defined as trees owned by the community as opposed to group tree tenure defined as trees owned by a group of individuals having common interest, such as fruit processing groups or tobacco growing farmers. Individual tree tenure was defined as the sole or exclusive user rights on those trees that an individual household have planted, inherited or managed. Under private user rights, farmers are expected to be more willing to invest in the cultivation of fruit trees because they retain exclusive rights to the benefits of such investments. They may however be less willing to invest in the development of common property resources. This study was therefore, undertaken in order to investigate factors affecting farmer's willingness to plant and domesticate indigenous fruit trees.

We hypothesized that land characteristics such as land and tree tenure, as well as tenure rights; social economic and demographic characteristics; and cultural norms affect farmers' decisions or willingness to cultivate indigenous fruit trees. Issues of particular interest in this study were land and tree tenure systems, socio-economic and cultural factors relating to local policies are for the purpose of this study defined as statements of purposes that have acts meant to accomplish a particular goal and are informally formulated, community based and undocumented policy reforms that may affect indigenous fruit tree cultivation. The study also traced the trend of land tenure in Malawi and Zambia from the colonial era to present and reported that the initial appropriation of customary land both in Malawi and Zambia was undertaken through treaties with local chiefs who believed that they were allocating usufructuary rights alone as per customary law. [Customary land is defined as land held, occupied and used under customary law and is declared as the lawful and undoubted property of the people (Cap. 50:01 Laws of Malawi)].

Trends in land and tree tenures

The land tenure system is one of the most important components of any land use or farming system. The institutional arrangements under which a person gain access to land largely determines, among other things, what crops he can grow, how long he can till a particular piece of land, his rights over the fruits of his labour and his ability to undertake long-term improvements on the land (Benneh, 1987; Camilla et al., 2000). A land tenure system is the body of rights and duties which regulates the use and control of land. It is the terms and conditions under which land is held, used and transacted (Adams et al., 2000). These customary property systems often distinguish between tree and the land on which they grow, and may vary between regions and countries, and areas within the country (Lawry et al., 1995).

Land tenure, which refers to land user rights and security are among the cited land related factors affecting IFTs domestication. Tchale and Lunduka (2000) observed that land user rights, which are temporal, create insecurity and therefore a disincentive to farmers to domesticate or plant fruit trees. Following the initial appropriation of customary land which was then under the control of local chiefs and traditional authorities, many people lost all the original rights they had to their land and subsequently moved on to European farm estates. African land rights were left in great ambiguity, which made their position insecure and created difficulties for the future (Phiri, 1991). Estate owners were allowed to charge rent to all Africans on the estate. The estate owners preferred tenants who worked in lieu of cash rent. Paying "rent" for land that Africans believed was theirs but "bought" for so little by Europeans led to conflicts between tenants and settlers (Minde et al., 1997). Under the provisions of the African Order in Council and the Foreign Jurisdiction Acts, the first governor was given the authority to issue certificate of claim as freehold land aimed at claiming land for the crown. Subsequently, leasehold land was also conferred to individual and private organization in order to resolve the conflicts (Leasehold land is that land, which is rented out and ownership is for a given period of time mostly 99 years).

As the number of settlers increased, the pressure on land became greater, because settlers acquired land mainly from fairly fertile and often high densely populated areas. The displaced natives were confined to small and marginal lands and on the settler estates as tenants. Due to land conflicts, the land given to settlers was gradually returned to natives and by independence in 1964, most of the land had been returned to traditional customary control. In Malawi alone, in 1948 the land under European freehold amounted to 490,000 hectares, about 4.1% of the total land area of Malawi. This percentage was reduced to 3.7 by 1954 and less than 2% by 1964. Therefore at independence in 1964 about 87% of the land in Malawi was under customary ownership (Kachule et al., 1999). The 1962 "African Private Estates Bill" and the 1964 "Malawi Land Bill" suggested that future land policies would centre on customary law (Minde et al., 1997).

As a result, after political independence, the development of agriculture has been carried out at two levels: estate and smallholder farming. Government policy encouraged estate development which saw a number of customary farmers succeeding in leasing their land thus resulting in voluntary conversion of customary land into estate land (Place and Hazell, 1993). The estate sector now takes up more than 9% of the total land on leasehold or freehold tenure (Freehold is a form of land tenure in which the owner is legally taken as the sole owner of the land for his lifetime) mostly for growing cash crops (Ng'ong'ola, 1987). Further, the customary land tenure system discouraged the development of the rural credit market for individual smallholder farmers because the land could not be held as collateral for loans. This was because customary land was communally owned and the chief, in consultation with community elders, allocated it to individuals. The estate sector also encouraged tenants. This was also influenced by landlessness on the part of the displaced customary smallholder and the desire to employ cheap labour on the part of the estate owners (Nankumba, 1988).

Kundhlande and Luckert (2000) identified a conceptual framework for assessing land rights (Land rights are an indication of levels of powers, freedom and use of land that characterize the land tenure). These land rights are termed as land tenure user rights and are eleven in number namely: comprehensiveness, exclusivity, allotment type, use designation, duration, size, operational requirements, operational control, security, transferability and fees. Matrilineal (Matrilineal is a form of marriage and residency practice whereby the husband leaves his homeland and get settled at his wife's homeland. Land transfer usually follows mother to daughter lineage) and patrilineal (Patrilineal is a form of marriage and residency practice whereby the wife leaves her home land and get settled at her husband's homeland. Land transfer usually follows father to son lineage) systems of marriage were reviewed following the "individual-blame" hypothesis (Van den Ban and Hawkins, 1996), which stipulates that slow adoption (Defined as the process of implementing an innovation after a farmer has made a conscious decision and this decision depend on different factors (Gondwe, 1999)] of technology (in this case cultivation of IFTs) is as a result of tradition or conservative attitude towards life. In addition to land rights, research findings also indicate that there are a number of household characteristics, which affect fruit tree cultivation. This myth needs correction if the advantage of tree cultivation is to be fully harnessed. Van den Ban and Hawkins (1996) in the 'system-blame approach' posited that farmers rarely adopt technologies should resources meant for its adoption become insufficient. To this, Gondwe (1999) reported that education, literacy level, higher social status, social participation, urban contacts, mass media exposure and knowledge of innovation are vital in the adoption index of a household. A recent review of adoption studies indica-ted that beyond technological characteristic of the innovations, farmers' uptake of agricultural innovations are based on several other considerations which include household-specific factors (e.g. farmer perceptions, resource endowment, household size), policy and institutions context (inputs and output prices, land tenure and property rights) among others (Ajayi et al., 2007).

MATERIALS AND METHODS

Pre-survey arrangements

The study involved three main approaches: first, reconnaissance survey was conducted by visiting the Rural Development Projects (RDPs) (Rural Development are Government administered projects scattered in Malawi) and districts in Malawi and Zambia respecttively. Key persons like extension staff from Ministry of Agriculture, horticulturalists and several institutions working in the study areas were interviewed. The data collected also involved meeting project officers and the Provincial Agricultural Coordinator, District Agricultural Coordinators as well as Camp Officers in Eastern Zambia who responded by filling checklist. Existing indigenous fruit trees on farmers' land were taken as being the result of partial domesticcation. It was further conceptualized that differences in demographic, biophysical and land and tree tenure, cultural norms and socio-economic characteristics affect farmers' way of cultivating IFTs. Three groups of farmers were identified: planters, conservators and planter cum conservator, all of who were collectively referred to as IFT farmers. Planters were defined as farmers who have IFTs through planting as opposed to conservators who have IFTs through adopting voluntarily growing trees by retaining and managing them. Planters *cum* conservators were defined as farmers having IFTs through both planting and adoption of voluntarily grown trees.

Study area and inheritance systems

Based on the outcome of the pre-study reconnaissance survey, five sites were selected for the study that is three sites from the southern, central and central regions of Malawi and two sites in Eastern Zambia. The study sites in Malawi are Ntchenachena Extension Planning Areas (EPAs) in Rumphi district (northern region), Thembwe EPA in Salima District (Central region) and Thondwe in Zomba districts (southern region). In Zambia, the survey was done in the eastern province: Kalunga agricultural extension camp in Chipata district and Mwanaphangwe agricultural extension camp in Katete districts (Figure 1).

Ntchenachena EPA is mainly occupied by the Tumbuka ethnic group who practice patrilineal marriage. Tembwe EPA is one of the frequently drought-prone areas in Malawi and the temperatures are always on the higher side while rainfalls are very low. Zomba is relatively cool and experiences high rainfall of about 1000–1100 mm per annum. The Eastern province of Zambia has 30,000 farm families and has eight districts. Chipata district is mainly populated by the Ngoni ethnic group.

The Ngoni practice patrilineal marriage where inheritance is by paternal lineage. Katete district is predominantly inhabited by the Chewas ethic group who practice matrilineal marriage. The majority of the population in Mwanaphangwe Camp in Katete – Zambia, Tembwe EPA in central Malawi and Thondwe EPA in southern Malawi were all matrilineal societies while Ntchenachena EPA in northern Malawi and Karunga Camp in Chipata – Zambia were patrilineal societies.

Sampling technique

A multi-stage sampling technique was used to select the respon-

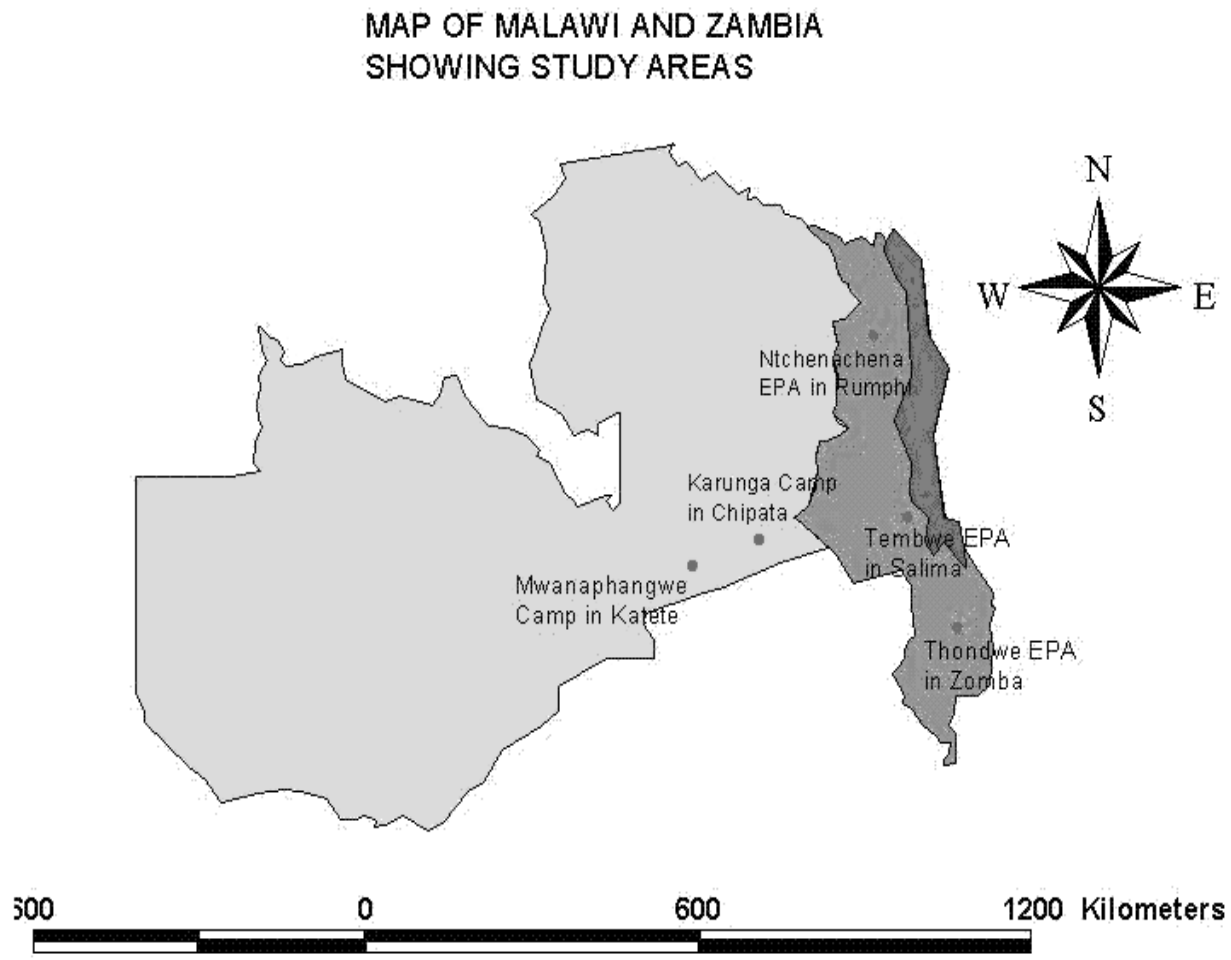

Figure 1. Map of Malawi and Zambia showing the study sites.

dents that participated in this study. This approach was chosen in order to get a representation of farmers having indigenous fruit trees. A purposive selection of three RDPs in Malawi and two districts in Zambia was done. The second stage was selection of EPAs in Malawi and camps in Zambia. One EPA (Malawi) and one camp (Zambia) from each RDP and district respectively were purposively selected for the same reason of wanting to get representation of farmers managing and using indigenous fruit trees. A sampling frame consisting of all the EPAs and camps within the respective RDPs (Malawi) and districts (Zambia) were obtained from the RDP project officers in Malawi and the District Agricultural Coordinating Officers in Zambia. These were written on papers and ranked in terms of prevalence of matrilineal/patrilineal marriage systems. The ranking was basically an exercise of choosing an RDP with highest percentage of farm families practicing a particular marriage system (matrilineal or patrilineal), while at the same time having a higher percentage of farmers in close contacts with World Agroforestry Centre offices located in the respective countries.

The process led to selection of Ntchenachena EPA, Tembwe EPA and Thondwe EPA (in Malawi) and Karunga camp and Mwanaphangwe camp in Zambia. In each of the selected EPAs (Malawi) and camps (Zambia), a final selection stage was done. A list of household names was obtained from the EPA Development Officer in Malawi and Camp Officer responsible for the agricultural camps in Zambia. From this list, a sample of 50 households in each EPA in Malawi and camps in Zambia were drawn using a Table of random numbers. In Malawi, 150 households were selected from Ntchenachena, Tembwe and Thondwe. Out of these, 61 were IFT farmers, while 89 were non-IFT farmers. In Eastern Zambia 100 households were selected from Chipata and Katete camps. Out of the 100 households, 19 were IFT farmers, while 81 were non-IFT farmers.

Data collection

A semi-structured questionnaire was used to collect data, which in its initial stage of development was discussed with the key persons involved in this study. The final questionnaire comprised of three major components, which were: land and tree ownership, socio-cultural issues and household characteristics. Like focus group discussions, these household interviews were also done in the vernacular language but translated for purposes of documentation. Primary data was collected from the farmers through the aid of focus group discussions (FGD) and individual household interviews. In focus group discussions, villagers sat in a group to discuss the situation when need arose. During focus group discussions, a checklist was used to facilitate the discussions and a questionnaire was used during household interviews.

Data analytical framework

Data were tabulated and logistic regression analysis using the CATMOD procedure of the SAS system was used to relate farmers'

Table 1. Average age, education level and extension extent of IFT and non-IFT farmers in Malawi and Zambia.

	Malawi			Zambia		
	IFT farmers	Non-IFT farmers	Mean	IFT farmers	Non-IFT farmers	Mean
Land (ha)	2.9	2.4	2.6	4.3	3.17	3.4
Age	47.3	47.1	47.2	41.0	42.3	42.0
Education	7.5	6.5	6.9	5.7	5.7	5.7
HH Size	6.5	5.6	6.0	6.7	6.4	6.4
Extension	26.9	17.2	21.2	39.7	33.9	35.0

age, education, household size, size of landholding and extension contact with farmers IFT ownership. For this purpose, farmers were categorized in to IFT-farmers and non-IFT farmers. For ease of understanding continuous farmer characteristics such as age, education level, land holding size, extension contact were coded into discrete categories. Farmers' age was made discrete by coding ages as follows: <30 years of age (young), 30-40 years of age (middle-aged) and >40 years (old). Farmers' education level was also coded as illiterate, elementary school (grades 1-7) and secondary and above (>grade 7). Household size was coded as small (<4 people per household), medium (4-7 people), and large (>7 people). Extension contact was coded as low (<11 contacts per annum), medium (11-15 contacts) and high (>15 contacts). A categorical models procedure using the CATMOD of SAS was used to analyze these data. Inference was based on the of the 95% confidence intervals of the predicted probabilities. If the 95% confidence intervals of two categories do not overlap, they are judged significantly different.

In the second step of the analysis, farmers were grouped into three categories based on the extent to which they invested in and cultivated IFTs as: planters, planter cum conservators and non-IFT. Given the multiple levels of groupings, a simple binary canonical analytical approach such as binary logit regression will be inappropriate to analyze the data. Therefore, a multinomial logit model via the logistic procedure of SAS was applied for the analysis. The multinomial logit model explains the relationship between a dependent variable and vector of independent variables. If we let p_1, p_2 and p_3 be the probabilities associated with the four categories of farmers (the probability of choosing to be a planters, planter cum conservators or Non-IFT), then the idea is to express these probabilities in relation to the explanatory variables (gender, age, inheritance, education level, household size, land holding size, and extension contact).

RESULTS AND DISCUSSION

Socioeconomic characteristics of respondents

The majority of the sample households in the study areas (81% in Malawi and 80% in Zambia) were male-headed. In Zambia 100% of sample households had customary land tenure. In Malawi, 96% had customary and 4% had lease-holding. Households in Zambia owned bigger lands (mean 3.4 ha) than those in Malawi, which had smaller holdings (mean 3.4 ha). Farmers in Zambia also had greater access to agricultural extension services than their counterparts in Malawi (Table 1). A larger proportion of the farmer in the study sites in Malawi had gone to formal school compared with the farmers in Zambia. The average age, education level and frequency of extension contact of IFT and non-IFT farmers in Malawi and Zambia is presented in Table 1.

Categorical models analysis revealed that whether a farmer will be an IFT farmer or not depend on gender (χ^2 =80.1; P<0.001), age (χ^2 = 24.0; P<0.001), inheritance (χ^2 = 9.5; P = 0.021), education level (χ^2 = 45.6; P<0.001), household size (χ^2 = 59.0; P<0.001), landholding (χ^2 = 20.1; P<0.001) and extension service (χ^2 = 23.2; P<0.001). Examination of the 95% confidence intervals in Table 2 reveals the following trend:

1) The probability of males owning IFTs is greater than females.
2) Middle-aged and older (>30 years) farmers are also more likely to have IFTs than younger (<30 years) farmers.
3) Matrilineal communities are more likely to have IFTs than patrilineal ones.
4) Educated farmers are more likely to have IFTs than illiterate farmers.
5) Farmers with medium land holding sizes (4-8 ha) are more likely to own IFTs than those with smaller land holdings (<4 ha).
6) Farmers with frequent extension contact are more likely to own IFTs than those with less frequent contact.

Further analyses using a multinomial logit model relating the probability of choosing to be a planter, planter cum conservators or non-IFT with farmer characteristics (gender, age, education, inheritance, household size, land holding and extension contact) shows that the frequency of extension contact is the only factor that had significant effect on IFT ownership (Table 3). The effects of extension contact on the log odds of planting cum conserving versus not planting were significant (P = 0.016). On the other hand the log odds of planting versus not planting were not significant (P = 0.962).

Cultural norms

Socio-cultural issues affecting cultivation of fruit trees such as how land is inherited or passed on and cultural perception of man as planter of trees were observed to centre more on differences between matrilineal and patri-

Table 2. Predicted probability (and 95% confidence interval) of IFT planting as affected by farmer gender, age, marriage system, education level, household size and land holding size.

Explanatory variable	Variable category	IFT farmer	Predicted* probability	95% confidence	
				Lower	Upper
Gender	Female	Yes	0.06	0.04	0.08
	Female	No	0.13	0.10	0.17
	Male	Yes	0.26	0.21	0.31
	Male	No	0.55	0.49	0.61
Age	Young (<30 years)	Yes	0.07	0.05	0.09
	Young (<30 years)	No	0.11	0.08	0.15
	Middle (30-40 years)	Yes	0.13	0.10	0.17
	Middle (30-40 years)	No	0.22	0.17	0.27
	Old (>40 years)	Yes	0.18	0.14	0.22
	Old (>40 years)	No	0.29	0.24	0.35
Inheritance	Matrilineal	Yes	0.20	0.16	0.24
	Matrilineal	No	0.42	0.36	0.48
	Patrilineal	Yes	0.12	0.09	0.15
	Patrilineal	No	0.26	0.21	0.31
Education	Illiterate	Yes	0.04	0.02	0.05
	Illiterate	No	0.08	0.05	0.11
	Elementary (<Grade 8)	Yes	0.15	0.12	0.18
	Elementary (<Grade 8)	No	0.32	0.27	0.37
	Secondary and above	Yes	0.16	0.10	0.16
	Secondary and above	No	0.28	0.23	0.33
Household size	Small (< 4 people)	Yes	0.05	0.03	0.07
	Small (< 4 people)	No	0.11	0.08	0.14
	Medium (4-7 people)	Yes	0.18	0.14	0.22
	Medium (4-7 people)	No	0.38	0.33	0.44
	Large (>7 people)	Yes	0.09	0.06	0.11
	Large (>7 people)	No	0.19	0.15	0.23
Land holding size	Small (< 4 ha)	Yes	0.08	0.06	0.11
	Small (< 4 ha)	No	0.17	0.13	0.21
	Medium (4-8 ha)	Yes	0.15	0.12	0.18
	Medium (4-7 ha)	No	0.32	0.27	0.37
	Large (>8 ha)	Yes	0.09	0.07	0.11
	Large (>8 ha)	No	0.19	0.15	0.23
Extension services (visits)	Low (< 11 per year)	Yes	0.06	0.04	0.08
	Low (< 11 per year)	No	0.13	0.09	0.17
	Medium(11-15 per year)	Yes	0.14	0.11	0.18
	Medium (11-15 per year)	No	0.30	0.25	0.35
	High (>15 per year)	Yes	0.12	0.09	0.15
	High (>15 per year)	No	0.25	0.20	0.30

*The predicted probability was obtained using the maximum likelihood method of categorical models.

lineal societies (Table 4). Different study sites were categorized following the prevalence of marriage system in the given site. The number of interviewed farmers who belong to matrilineal and patrilineal societies is presented in Table 4.

Within customary land tenure, freedom of land transfer differs principally according to marriage practices namely matrilineal or patrilineal (Place, 2000). The probability of owning IFTs was greater among matrilineal societies than patrilineal ones (Table 2). The system practiced by the Ngoni and Tumbuka in northern Malawi is patrilineal under which land is passed on from father to son and when the son marries, he continues to reside on and own that land. The Chewa ethnic group of central Malawi and the Chewas of Zambia traditionally practice matrilineal system (Place, 2000) whereby inheritance is through

Table 3. Parameters of the multinomial logit model relating the probability of being a planter, planter cum conservators or non-IFT with farmers' gender, age, education, inheritance, household size, land holding and extension contact.

Parameter	IFT farmer	Estimate	SError	ChiSqua	Pr>ChiSq
Intercept	1	2.32	0.70	11.1	0.001
	2	-1.42	2.21	0.4	0.519
Gender	1	0.28	0.21	1.8	0.183
	2	0.19	0.62	0.1	0.764
Inheritance	1	-0.12	0.16	0.6	0.430
	2	-1.05	0.58	3.3	0.068
Household size	1	-0.03	0.05	0.4	0.519
	2	-0.04	0.19	0.0	0.841
Education	1	-0.05	0.04	1.3	0.251
	2	-0.01	0.15	0.0	0.926
Extension contact	1	0.00	0.00	0.0	0.962
	2	0.01	0.01	5.8	0.016
Age	1	-0.01	0.01	1.1	0.291
	2	0.01	0.04	0.1	0.791
Landholding size	1	-0.03	0.02	1.5	0.217
	2	-0.31	0.20	2.4	0.120

IFT farmer 1 = planter, 2 = planter cum domesticator. The non-IFT farmers were held as the reference category.

Table 4. Cultural systems of land inheritance in Malawi and Zambia.

Country	Study Site	Patrilineal (Frequency)	Matrilineal (Frequency)
Malawi	Ntchenachena	47	3
	Tembwe	3	47
	Thondwe	0	50
Zambia	Karunga	50	0
	Mwanaphangwe	0	50
	Total	100	150

maternal lineage. Since the husband is the main decision maker in most households regardless of practice, the patrilineal system tends to provide more land security to the husband in a patrilineal than in a matrilineal society. As a result, long-term land investments are more prevalent in patrilineal societies. This is not the same with matrilineal societies since although the husband may be the decision maker in the household; he is limited in terms of decisions over the land, the principal factor of cultivation and management of trees as long-term farm assets.

In patrilineal societies as was observed in Ntchenachachena EPA, the man is perceived as the main tree planter though the wife and children do help at times. Women are responsible for gathering or harvesting the fruits, and tree cultivation is rarely women's function. Since husbands are the main decision makers in households, and under patrilineal system they feel secure about the land they own, and are more motivated to conserve, manage, cultivate or plant more trees in the patrilineal societies. This agrees with findings by Place (2000), who reported that there are more investments on tree conservation and management in patrilineal than in matrilineal societies. Patrilineal societies like Karunga (Chipata in Zambia) and Ntchenachena (northern Malawi) follow "father to son" lineage in inheritance of land. In the matrilineal societies such as Thondwe (southern Malawi) and Mwanaphangwe (Katete in Zambia) land inheritance follows "mother to daughter" lineage.

The study also reveals that the settlement pattern was slightly different in the two types of societies. In terms of settlement, culturally, the Phoka ethnic group common in the hill areas of Ntchenachena EPA where patrilineal marriage is prevalent prefer scattered settlement because they earn their living through hunting and this has been passed on to present generations though some are now drifting to modern farming. Similar findings were also observed among the Ngoni ethnic group of Karunga Camp

in Zambia. There were more fruit trees under scattered settlement than in nuclear settlement. This is probably because farmers prefer having fruit trees on their homestead land than any other form of land for purposes of protecting them from thieves. Under nuclear settlement, homestead land is too small for land to be set aside for fruit tree cultivation due to congestion of dwelling units. The other reason is probably that under nuclear settlement the planted fruit trees end up being appropriated by the whole community because households are too close and can hardly demarcate homestead land boundaries from one household to the other. However, the trend in fruit tree cultivation arising as a result of settlement pattern could not be traced to equally affect cultivation of indigenous fruit trees because these IFT trees were found mostly in natural woodlands other than on homestead land.

Further analysis also revealed an location-specific cultural norm in Mwanaphangwe Camp (Zambia) where for a newly married couple, the first two to three years of their marriage is termed as 'Nthawi yodziwa khalidwe la nkamwini' (time when the son-in law is assessed of his behaviour). The couple is asked to stay at the woman's homeland and is given land, which is temporal to cultivate and build a dwelling unit. After the "probation period" is over, the bride's parents recommend the son-in law as well behaved or not. In an event of observed good behaviour, the parents finally announce land given to the new couple as permanently theirs. The effect of this cultural norm is that during the probation, the new couple especially the man has limited user rights on the land provided by his parent-in-law. Planting of fruit trees in this case is delayed since surety of ownership remains not fully granted to the newly married couple. Farmers with less security on lands and tree tenure have been associated with less incentive for adoption of tree based systems, such as agroforestry (Kang and Akinnifesi, 2000).

Customary land tenure is the most prevalent tenure arrangements in the study sites (Table 5 and 6). These results prompted an in-depth exploration of customary land in terms of land ownership and tenure rights that farmers have. Customary land system was common compared with other systems of land tenure because farmers do not have enough capital to lease land nor are they aware of the legal processes involved in order to hold freehold land. In both countries, households owned a larger proportion of customary land as opposed to other forms of land ownerships such as land owned by relatives; village mates or chiefs (Table 5 and 6). Once the chief assigns land to a particular household, it turns out to be solely owned by that particular household (land owned by household). The chief distributes customary land to his subordinates without any segregation and These observations show that customary land that is owned by households enhance cultivation of IFTs because farmers feel a sense of ownership and security over their land and the resources there in. As a result usually rights attached to it are equally the same; such as land being sorely owned by the household. As such, all farmers are endowed with the same tenure rights. However, some households who do not have enough land for cultivation may borrow from relatives, the chief or relatives. IFT farmers mostly use household owned land and because of that, they rarely participated in other forms of local land tenure as opposed to non-IFT farmers. They are prompted to cultivate more IFTs. This fact was evidenced by the response given by the farmers when asked which tree tenure they prefer for enhanced fruit tree cultivation. Many farmers (both IFT farmers and Non-IFT farmers) supported individual tree tenure (fruit trees owned by the households) as opposed to communal tree tenure (Table 7).

The community or the state have no rights to impose conditions to regulate operations in lands owned by households unlike the case of estate farms where owners are required to set aside 10% for forestry woodlot. While the absence of operational regulations in households owned by households allow for freedom and flexibility in management, it was observed that naturally growing IFTs were being exploited with minimal rates of replacement. Some farmers do not notice that with time, these trees are decreasing in number and do not realize possible law government can play in such a state. Usually, when a sufficient proportion of community members is unhappy about the decline and non-sustainability of IFTs and perceive this as a problem, they seek solutions by calling upon the government to intervene and regulate the sustainability of these trees (Folmer et al., 1995).

Community-based regulatory issues

As a way of promoting tree cultivation, communities have regulations that are meant to protect young fruit trees and agricultural produce. They are mostly regulations on controlling livestock from browsing and destroying trees especially when they are just transplanted. Similarly, there are also regulations that control harmful bush fires, which if left unchecked can destroy trees (Ajayi and Kwesiga, 2003). Being undocumented regulations that are verbally passed on, it was noted that awareness of these regulations differed across the interviewed households (Table 8 and 9).

Conclusions

We have clarified the generalized myths that the existing land tenure systems are a general disincentive to tree conservation, cultivation and management by smallholder farmers. Although land tenures differ in different regions predominantly categorised as either patrilineal or matrilineal, their effects on long-term tree investment vary by gender. Rather, the land and tree tenure systems prevailing in Malawi and Zambia are not the primary reasons for the low levels of IFTs cultivation and conservation. The existing land tenure system is potentially good for the

Table 5. Land Ownership within customary tenure system in different extension planning areas in Malawi.

Land	Ntchenachena (%)		Tembwe (%)		Thondwe (%)	
	IFT Farmers	Non-IFT farmers	IFT Farmers	Non-IFT farmers	IFT Farmers	Non-IFT farmers
Owned by the household	31.8	43.4	40.0	20.6	25.2	31.5
Owned by relative of the household	0	1.9	0	0	0	0.2
Borrowed from the chief	2.2	0	0.5	0	0	0
Borrowed from village mate	0	0.2	0	1.2	1.1	1.0
Borrowed from other sources	0	0.2	0	0	0	0
Total	34.0	45.0	40.0	22.3	26.3	32.7

Table 6. Land ownership within customary tenure system in Zambia.

Land	Karunga camp (%)		M/phangwe camp (%)	
	IFT Farmers	Non-IFT farmers	IFT Farmers	Non-IFT farmers
Owned by the household	33.3	51.5	61.3	44.4
Owned by relative of the household	4.8	1.9	0	0.2
Borrowed from the chief	0	1.1	0.6	0
Borrowed from village mate	0	0	0	0
Borrowed from other sources	0	0.9	0	0
Total	38.1	55.4	19.3	44.6

Table 7. Tree tenure by land ownership type in Malawi and Zambia

Country		Household (%)	Relative (%)	Chief (%)	Village mate (%)	Others (%)
Malawi	State	0.3	0.0	0.0	0.0	0.2
	Communal	0.5	0.0	1.0	0.0	0.0
	Individual	93.2	0.0	0.2	0.2	0.0
	Institutional	0.3	0.0	0.3	0.0	0.0
	Other tenure*	1.7	0.5	0.2	1.2	0.0
Zambia	State	0.0	0.0	0.0	0.0	0.0
	Communal	0.0	0.0	0.0	0.0	0.0
	Individual	94.8	0.8	0.0	0.0	0.0
	Institutional	0.0	0.0	1.5	0.0	0.0
	Other tenure*	0.8	0.8	0.0	0.0	1.3

* Other tree tenure refers to those tree tenure types that had small proportions to be included in the table.

Table 8. Community-based bush fire regulations in Malawi and Zambia.

Regulation	Malawi (Percentage)			Zambia (Percentage)		
	IFT	Non-IFT	Total	IFT	Non-IFT	Total
n = Do not set community grass ablaze	60	90	150	20	80	100
	1.3	1.3	2.7	.0	10.9	11.9
Fields not to be set ablaze during dry season	0.7	0.7	1.3	2.0	3.0	5.0
No bush fire to be seen in the community	26.2	29.5	55.7	4.0	16.8	20.8
Land anticipated not to be used or rented out	0.0	0.7	0.7	0.0	0.0	0.0
Unaware of bush fire existing regulations	12.1	27.5	39.6	12.9	49.5	62.4
Total	40.3	59.7	100	19.8	80.2	100

Totals of IFT vs. non-IFT: Malawi, $z_c = 3.360 > z_t = 1.645$; Zambia, $z_c = 8.542 > z_t = 1.645$

Table 9. Proportion of community-based livestock regulations in Malawi and Zambia.

Regulation	Aware farmers	Non-aware farmers	Total (%)
Livestock to be grazed in natural woodland land or strictly looked after	30.8	0.0	30.8
No livestock should be seen in the field	3.6	0.0	3.6
No over-grazing of livestock in community grass land	3.6	0.0	3.6
Aware of the regulations but not followed	2.0	0.0	2.0
Do not know existence of any livestock regulation	0.0	60.0	60.0
Total	40.0	60.0	100

Proportional difference test for the totals between aware and not aware: $z_c = -14.20 < z_t = 1.645$.

cultivation of IFTs. Customary land tenure system was the predominant land tenure systems constituting up to 96% of the tenure systems in Malawi and 100% in Zambia. As suggested by farmers, land owned by an individual or within customary land tenure system was conducive for IFT cultivation since it does not give any restriction on how and what to use the land for. As for leasehold and freehold systems of land tenure, no effects were observed to affect farmers' willingness in cultivation of indigenous fruit trees. This implied that other factors, apart from land tenure systems are responsible for the low levels of IFTs cultivation in the study locations. Within customary land, households own 94% of land parcels in Malawi and 96% in Zambia, and it follows that they are under private property regime. Being under such a regime, these land parcels are not subject to guidelines and operational requirements and this restricts the state, IFT promoting institutions and organizations from implementing some regulations that could otherwise promote cultivation of IFTs as a way forward towards formulation of IFTs promotion policy.

There is a general weak capacity on IFT extension services in both Malawi and Zambia. Some household demographic structure and characteristics affect the cultivation of IF trees. Of particular importance is household size, which increases probability of farmers who cultivate IF trees through both planting and domestication. Since the underlying reason behind this is labour availability, alternative means of overcoming labour constraint without actually raising household size could be developing labour serving indigenous fruit tree technologies.

There are basically three broad recommendations that have been drawn from this study: Firstly, there is need for increased awareness of IF tree cultivation in both Malawi and Zambia, especially by sensitizing farmers on the potential economic gains of IF trees. Secondly, efforts to promote IFTs domestication should aim at addressing key areas that are disincentive to IFT cultivation such as some cultural norms, services of extension modalities, access to improved germplasm, and tree cultivation and management skills of farmers. Thirdly, studies are needed on the economic profitability of IFTs cultivation and an *ex ante* impact assessment in terms of their contributions to food security, nutrition and cash income.

AKNOWLEDGEMENTS

We would like to acknowledge the financial assistance received from the German Ministry of Economic Cooperation (BMZ) through the project; "Domestication and marketing of indigenous Fruit Trees of the Miombo for Improved Household Nutrition and Incomes in Southern Africa," implemented by the World Agroforestry Centre (ICRAF), Southern Africa Regional Programme. In addition, we would like to thank the Canadian CIDA, and the government of Ireland through the Irish-Aid for financing supporting fruit projects in Malawi. Also deep thanks go to Prof. George Yobe Kanyama-Phiri for the administrative support provided to the first author.

REFERENCES

Ajayi OC, Akinnifesi FK, Gudeta S, Chakeredza S (2007). Adoption of Renewable Soil Fertility Replenishment Technologies in Southern African Region: Lessons Learnt and the Way Forward. Nat. Res. Forum 31: 306-317.

Ajayi OC, Kwesiga F (2003). Implications of local policies and institutions on the adoption of improved fallows in eastern Zambia. Agrofor. Syst. 59: 327-336.

Akinnifesi FK, Kwesiga F, Mhango J, Chilanga T, Mkonda A, Kadu CAC, Kadzere I, Mithofer D, Saka JDK, Sileshi G, Ramadhani T, Dhliwayo P (2006). Towards the development of miombo fruit trees as commercial tree crops in southern Africa. For. Trees Livelihood 16: 103-121.

Akinnifesi FK, Leakey RRB, Ajayi OC, Sileshi G, Tchoundjeu Z, Matakala P, Kwesiga FR (2008). Indigenous Fruit Trees in the Tropics: Domestication, Utilization and Commercialization. World Agroforestry Centre: Nairobi. CAB International Publishing, Walling-ford, UK. p. 438.

Akinnifesi FK, Sileshi G, Ajayi OC, Tchoundjeu Z (2008). Accelerated domestication and commercialization of indigenous fruit and nut trees to enhance better livelihoods in the tropics: Lessons and way forward. In: Akinnifesi FK, Leakey RRB, Ajayi OC, Sileshi G, Tchoundjeu Z, Matakala P, Kwesiga FR (eds.) Indigenous Fruit Trees in the Tropics: Domestication, Utilization and Commercialization. World Agroforestry Centre: Nairobi. CAB International Publishing, Wallingford, UK. pp. 392-428.

Benneh G (1987). Land tenure and agroforestry land use systems in Ghana. In: Raintree, JB (ed) Trees and tenure. Proc. Int. Workshop

on Tenure Issues in Agroforestry, Land Tenure Centre, Wisconsin, USA.
Folmer H, Landis H, Opschoor H (1995). Principals of Environmental and Resource Economics. Edward Elgar Publishing Ltd. Cheltenham, UK.
Gondwe FMT (1999). Factors Influencing the Adoption of Land Conservation Technologies in Malawi: The Blantyre/Shire Highlands Rural Development Project. In: Ritchie JM (ed.), Integrated Crop Management in Malawi: Developing Technologies with Farmers pp. 263-272.
Kang BT, Akinnifesi FK (2000). Agroforestry as alternative land-use production systems for the tropics. Nat. Res. Forum 24: 137-151.
Kundhlande G, Luckert MK (2000). Towards an Analytical Framework for Assessing Property Rights to Natural Resources: A Case Study in The Communal Areas of Zimbabwe. University of Alberta, Edmonton, Canada.
Lawry S, Stienbarger D, Jabbar MA (1995). Land tenure and the adoption of alley farming in West Africa. In: Alley Farming Research and Development. AFNETA/IITA, Ibadan, Nigeria pp. 464-471.
Leakey RRB, Tchoundjeu Z, Schreckenberg K, Shackleton SE, Shackleton CM (2005) Agroforestry Tree Products (AFTPs): Targeting poverty reduction and enhanced livelihoods. Int. J. Agr. Sust. 3: 1-23.
Mithofer D, Waibel H, Akinnifesi FK (2006). The role of food from natural resources in reducing vulnerability to poverty: a case study from Zimbabwe Proc. 26th Conf. Int. Assoc. Agr. Economists (IAAE), Queensland, Australia.
Minde I, Kachule R, Luhanga J (1997). Macroeconomic and Sect oral Policies and Their Influence on the Livelihood Strategies of Households in The Miombo woodlands: the case of Malawi. Report Bunda College, University of Malawi, Lilongwe.
Ramadhani T (2002). Marketing of indigenous fruits in Zimbabwe. Socio-economic Studies on Rural Dev Wissenschaftsverlag Vauk. Kiel, Germany Vol.129, 212 pp.
Nankumba JS (1988). Dynamics of Land Tenure and Agrarian Systems in Africa: The Case of Malawi. University of Malawi.
Ng'ong'ola DH, Jumbe CBL, Shawa M (1997). Estate Food Security and Nutrition in Malawi: Land Utilization Stud, University of Malawi.
Phiri CD (1991). Agricultural Policy in Malawi, 1971 – 1987. University of Cambridge. PhD Dissertation.
Place F (2000). Population, tree tenure and natural resource management; The case of customary land area in Malawi. J. Environ. Econ. Manag. 41:13 – 32.
Place F, Hazell P (1993). Productivity effects of indigenous land tenure system in sub-Saharan Africa In: Am. J. Agr. Econ. 75: 10-19.
Schreckenberg K, Awono A, Degrande A, Mbosso C, Ndoye O, Tchoundjeu Z (2006). Domesticating indigenous fruit trees as a contribution to poverty reduction Forest, Trees Livelihood. 16: 35-52.
Tchale H, Lunduka R (2000). The Impact of Policy and Tenure on Agro forestry Adoption and Development. A Paper Prepared for The Regional Training of Trainers Course in Southern Africa Bunda College of Agriculture, Lilongwe, Malawi.
Van den Ban AW, Hawkins HS (1996). Agricultural Extension. Second Edition. London: Blackwell Science.
White J, Robinson E (2000). HIV/AIDS and rural livelihoods in Sub-Saharan Africa. Policy Series No. 6, Natural Resource Institute. University of Greenwich p.63.