International Scholars Journals

African Journal of Wood Science and Forestry ISSN 2375-0979 Vol. 7 (2), pp. 001-006, February, 2019. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

The contribution of indigenous fruit trees in sustaining rural livelihoods and conservation of natural resources

Felix K. Kalaba[1*], Paxie W. Chirwa[2] and Heidi Prozesky[2]

[1]Copperbelt University, School of Natural Resources, P. O. Box 21692, Kitwe, Zambia.
[2]Stellenbosch University, Department of Forest and Wood Science, Stellenbosch 7602, South Africa.

Accepted 22 September, 2018

The dependency of many African rural households on natural resources for sustenance is widely acknowledged. The utilization and commercialization of indigenous fruit trees (IFTs) has in the past been overlooked by extension agencies due to the misconception that they do not play a major role in contributing to the rural livelihoods. There is new and increasing emphasis on the contribution of indigenous fruit trees (IFTs) on improving rural livelihoods in the *Miombo* woodlands. A study was conducted in Mwekera area in Zambia using participatory rural appraisal techniques to ascertain the significance of IFTs in the livelihoods. The study revealed that 97 per cent of the respondents collect indigenous fruits and ranked in order of importance *Uapaca kirkiana*, *Anisophyllea boehmii* and *Parinari curatellifolia.* The study has revealed that 46% of households process the fruit into juices and/or porridges. Furthermore IFTs are also used as traditional medicine. Sixty three percent (63%) of the households used IFTs for medicinal purposes with two-thirds of the respondents citing *A. boehmii* as an important medicinal tree species. The study also showed that 85% of the respondents have seen a change in the forest cover resulting into loss of biodiversity with the respondents indicating that the change is with respect to reduction in forest size and scarcity of some species. Fewer trees mean less forest derived foods and medicine for the local people. It is concluded that IFTs have both food and non-food value to the local communities and are hence significant in sustaining households.

Key words: Indigenous fruit trees (IFTs), rural livelihoods, processing, food security, biodiversity, miombo woodlands.

INTRODUCTION

Most of the rural people in southern and eastern Africa are food insecure and chronically malnourished (Tiisekwa et al., 2004). Natural resource based livelihood strategies and migration are therefore common in rural areas as hunger escaping opportunities. Rural people therefore use various products from their environment in order to sustain their livelihood. According to Scherr (1995), rural households' survival strategies encompass multiple objectives in maximization of utility, like provision of food and subsistence goods, cash for purchase of goods and services and saving for future needs. Households therefore depend on various activities to sustain their livelihoods. In southern Africa, the fruits play an important role especially during times of famine (Akinnifesi et al., 2008) providing an alternative source of nutrition (Muok et al., 2001) and as a source of cash income (Akinnifesi et al., 2006). Despite this significance of IFTs in livelihoods as highlighted by various authors (Akinnifesi et al., 2008, 2006; Tiisekwa et al., 2004). Muok et al. (2001) reports that there is however little information available on specific communities' actual use, management and preferences in this regard. The study's aim was to fill this gap by investigating the utilization of IFTs in Mwekera rural livelihoods.

MATERIALS AND METHODS

The purpose of the research involved both exploration and descrip-

*Corresponding author. E-mail: kanungwe@cbu.ac.zm, kanungwekalaba@yahoo.co.uk or kanungwe@gmail.com

Table 1. The seasonality of forest product use

Forest Products	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fuel wood												
Charcoal												
Building poles												
Fibre												
Wild fruits												
Medicines												
Thatching grass												
Fodder												
Mushroom												
Wild roots												
Wild vegetables												

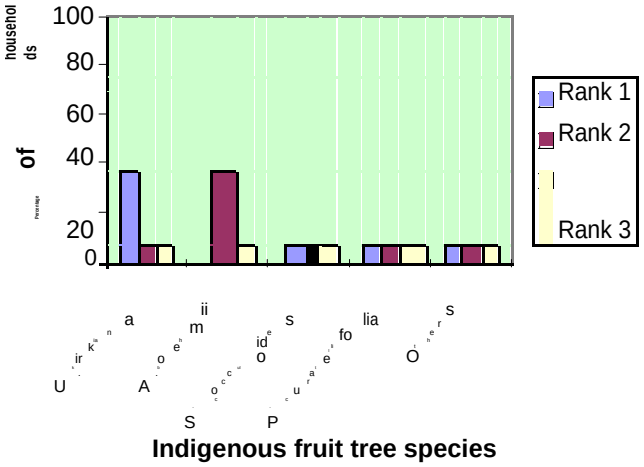

Figure 1. Preference ranking of IFTs (n = 70).

tion. The explorative part of the research was addressed by using participatory rural appraisal techniques which comprised of group meetings, transect walks, seasonal calendar of activities. This was complemented by descriptive research, in the form of individual in-depth interviews, and a household survey. Semi- structured questionnaire were administered to the household heads in Mwekera area in the Copperbelt province of Zambia to collect qualitative and quantitative data. Data was collected from 19th November to 19th December 2006. Data was analysed using Statistica 7.1 statistical package to generate descriptive statistics. The generated statistics tables and associated graphs were used in the interpretation of the results. Information obtained from the group interviews was analyzed at the spot by recording consensus conclusions from the participants.

RESULTS AND DISCUSSIONS

Woodland use and seasonality

From the participatory rural appraisal it became clear that the woodlands in the study area are important to the rural households. They are a source of energy, that is, as fuel wood, as well as a source of medicine, building poles, thatching grass, fibre, wild vegetables, grazing grass, mushrooms and wild fruits (Table 1). These woodland products can be classified as either seasonal or perennial. Products are classified as seasonal if they are gathered from the woodlands only during some months of the year, while perennial products are those that are gathered throughout the year. Among the seasonal products are wild fruits, wild vegetables, mushrooms and thatching grass. The other products from the woodlands, that is, fuel wood, medicines, fodder, building poles and fibre, are perennial (Table 1).

Food security of households

The levels of food insecurity are high in rural areas. According to the survey, 99% of the households suffer from food insecurity. The months with the least food reserves are between November and April. This period has therefore been termed 'hunger period'. Akinnifesi et al. (2004) reported that between 60 and 85% of rural households in southern Africa lacked access to food for three to four months each year. The situation is worsening due to erratic rainfalls (Akinnifesi et al., 2008) which results in poor harvests which lasts only for a few months.

Fruit collection and processing

The people in the study area have access to various indigenous fruit trees. The IFTs were not only found in the woodland, but some households retained fruit trees on their fields, by leaving trees standing in agricultural land. Almost all of the respondents (97%) in the household survey indicated that their households collect fruit. The preference ranking revealed that *Uapaca kirkiana, Anisophyllea boehmii and Strychnos cocculoides* as the top ranked species respectively (Figure 1)

A breakdown of the kinds of fruit collected showed that 74% of the households collected *U. kirkiana*, 71% collected *A. boehmii*, 50% collected *S. cocculoides*, while 33% collected *Parinari curatellifolia*. In addition to these

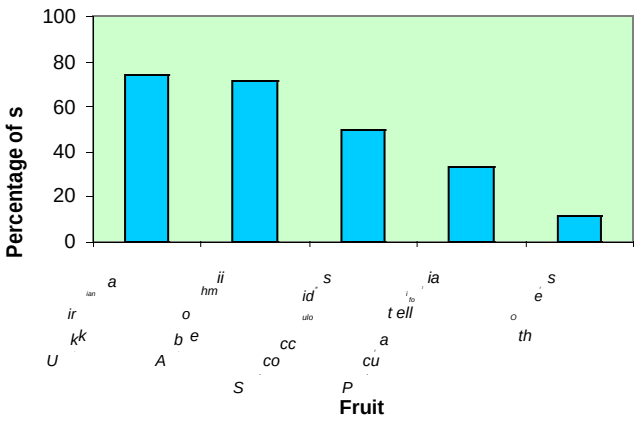

Figure 2. Fruit collected by households (n = 70).

fruit that were collected by a large proportion of the households, 11% of them also reported collection of *L. kirki*, *Suillus pungens*, *Syzygium guineense*, *Garcinia huillensis* and *Diospyros mespiliformis* (Figure 2). It's evident that indigenous fruits are an important source of food to the households, and therefore help to provide food security to rural households. The findings of this study are in agreement with various studies (Muok et al. 2001; Maghembe et al. 1994; FAO, 1983; Fashawe, 1972) that have reported the importance of indigenous fruit as a dietary supplement. Akinnifesi et al. (2006) reported that indigenous fruits are important in the Southern Africa development community (SADC) especially for marginalised groups in society. It has further been reported that indigenous fruits contribute on average about 42% of the natural food basket that rural households rely on in southern Africa (Akinnifesi et al., 2006; Campbell et al., 1997).

Rural household process fruit, with 46% of the households reporting processing fruit into juices and/or porridges. Processing of fruit is limited to a few fruit tree species such as *U. kirkiana, A. boehmii* and *P. curatellifolia*. The proportions of households that process each of these species in descending order are: *A. boehmii* (36%), *P. curatellifolia* (33%), and *U. kirkiana* (31%). There was no evidence of commercial processing of any fruit. The household survey results reveal that all the households in the study area that process fruit do so for home consumption. The essence of processing is to add value to, and increase the palatability of the fruit. Processing of fresh fruits is necessary, as the fruits' perishability rate is very high, due to lack of cold storage facilities in the rural areas.

It may be argued that the local people are also unaware of the processing technologies that may be appropriate to their needs, despite the fact that technologies are being used elsewhere in Zambia and southern Africa. Several studies (Leakey, 1999; Packham, 1993; Kwesiga and Mwanza, 1995; Mateke et al. 1995; Akinnifesi et al. 2006; Saka et al. 2004) have highlighted the processing of IFTs into wine and jams by various groups, communities and small-scale enterprises, yet the information regarding this processing, which is very valuable to communities that utilise IFTs, is lacking in many communities. For example, Leakey (1999) reported that in Zambia, *U. kirkiana* was processed into local potent spirit *kachasu,* jams and cakes. Similarly, Akinnefisi et al. (2006) highlighted the processing of *U. kirkiana* into *masuku* wine and jam in Zambia while Parinari nuts were processed into oil in Zimbabwe and Strychnos fruits into juice in Tanzania. These fruits that are processed are available in the study area. This provides some evidence that in the area studied, the people probably have limited knowledge on the processing of indigenous fruit. Ham (2003) argued that the development of improved indigenous fruit processing technologies owed its effectiveness to the information being disseminated to communities who can use it in their everyday lives.

Tiisekwa et al. (2004) stressed that if farmers in areas of fruit tree availability are trained, they can easily process the fruit during the fruiting season for home consumption during the off-season and for sale to earn cash. Thus the IFTs can contribute to improving the food and nutritional security of rural people.

Indigenous fruit harvesting

The study showed that rural people use various fruit harvesting methods. Fruit harvesting is done by knocking the fruit down with sticks, throwing objects to dislodge fruit, shaking the stem or branches, climbing the trees, and picking fruit up from the ground following abscission. Poor harvesting methods cause some fruits to sustain bruises, thereby reducing the fruit's shelf life. These results are similar to those of an earlier study by Kadzere et al. (2004), who reported that some harvesting methods can cause damage to the fruit trees and excessive bruising of the fruit. The main injuries that the fruits sustain are abrasion injuries, impact injuries and compression inju-ries. The group interviews revealed that the indigenous fruits that are affected mostly are *U.* kirkiana and *A.* boehmii, due to their delicate outer covering when the fruit is fully ripe. In an attempt to reduce post-harvest los-ses of fruit, the local people use baskets called *museke* to transport *U. kirkiana* and *A. boehmii.*

The *museke* allows the air to circulate through thereby avoiding fruit rot. The fruit that are very ripe are more susceptible to damage than those that are less ripe. To avoid these damages, some rural people prefer harvesting fruit that are not yet fully ripe.

In the study area, it's evident that the harvesting methods currently practiced lead to some fruit losses. These considerable losses of fruits reduce the quantity and quality of fruit available for consumption and sale. These findings correspond to that by Saka et al. (2004) who reported that fresh fruit incur direct or indirect nutrient and general quality loss from the field to the consumer. In quantifying the amount of fruits lost (Wilson, 2002;

Hughes and Haq, 2003) reported post-harvest losses of fruit to be between 40 and 60%. Kordylas (1990) estimated post- harvest fruit loss to be 5 - 25% in developed countries compared to as much as 20 - 50% in developing countries. These losses are attributed to a lack of knowledge in fruit handling and marketing.

Constraints to sustainable harvesting

The absence of rules regarding the harvesting of IFTs is a constraint to sustainable usage. This study has revealed that there are no norms, either community-based or traditional, on harvesting of IFTs in the study area. In open areas, the forest resource is viewed as a common property. The free access and consequent exploitation of common resources has been termed by Hardin (1968) as the 'tragedy of common'. This is because unrestricted demand for a finite resources causes exploitation of the resources (Bromley and Cernea, 1989) as each individual's aim is to maximise his/her own benefits. This might be attributed to the fact that there are no incentives to act in a socially altruistic way (Hardin, 1968). It is therefore necessary to come up with IFTs policies that will empower community groups to manage the IFTs in open areas.

Fruit collection responsibilities

Collection of fruit is predominantly conducted by women and children. They account for over 80% of fruit collectors. Women combine fruit collection with other daily activities such as collecting fuelwood, cooking and daily chores. This study confirms what other studies have reported on women as being the primary fruit collectors (Schreckenberg, 2004; Ruiz-Pérez et al., 1997). In Benin, the shea tree (*Vitellaria paradoxa*) is considered 'a gift from God to enable women to survive' (Schreckenberg, 2004) because of its importance with respect to providing income to women through trading. Similarly, Ruiz-Pérez et al. (1997) reported that women were the major collectors and decision-makers with regard to the selling of indigenous fruits.

Medicinal value of IFTs

It has been reported by Mander and Le Breton (2006) that up to 80% of the world's population (mostly in developing countries) rely on traditional medicine for primary health care. The survey on the value of IFTs specifically for medicine showed that 63% of the households use IFTs for medicinal purposes. *A. boehmii* was the most used IFT (67 %) followed by *U. kirkiana* (44 %) and *P. curatellifolia* (36%). The tree parts that are used are usually the roots, leaves and bark. Tree barks are harvested using axes, while roots are harvested using hand hoes. Extraction of the active drugs from barks and roots is usually done by means of the processes of infusion and decoction. The use of indigenous trees for medicine is widespread probably due to poor health services which are often not stocked with drugs. Traditional medicine is preferred as the local people consider it to be effective. The knowledge about the medicinal use is passed through generations.

Deforestation

It was found that 85% of the respondents have seen a change in the forest cover in the past 10 years. According to the respondents, the forest cover is diminishing, and it is becoming difficult to find certain species of trees in the forest. The loss of forests cover is attributed to charcoal production and expansion of land for agriculture. Seventy- four per cent (74%) of the respondents cited charcoal production and clearing of forest for agriculture as the main causes of forest loss.

Impact of forest loss on availability of IFTs

The loss of forest cover also entails a reduction in the forest tree species distribution. By far the majority (93%) of the respondents in the household survey indicated that indigenous fruit trees are under threat, as they report a reduction in their availability. Respondents also mentioned that the distance that people have to cover to collect fruit has increased over time. The fruits have become scarce, particularly in the nearby forest and open areas. A breakdown of the threatened IFTs species as indicated by the respondents is *U. kirkiana* (38%), *A. boehmii* (38%), *P .curatellifolia* (21%), while only a small proportion of respondents (3%) reported *S. cocculoides* as being threatened. These finding are supported by Hyde and Seve (1993), who reported that *U. kirkiana* is under threat of extinction in the *Miombo* due to high rates of deforestation, which has been compounded by little domestication (Ngulube et al., 1995). It is important to note that the IFTs that are highly preferred by the households are the ones that were identified as being under threat of extinction. The change in the forest cover as reflected in the reduction in forest size and scarcity of some species has repercussions on rural households which are highly dependant on forests. Fewer trees means less forest derived foods and medicine for the local people whose livelihoods significantly depend on forests. The people are forced to migrate to new areas, causing further deforestation and land degradation in the new areas.

Agricultural expansion or the practice of shifting cultivation is known to contribute to huge annual losses of forest cover (Chidumayo, 1997; PFAP, 1998) . People clear the forest to make way for agriculturally based land use systems, which rely on the forest as a source of nutrients. The practice of slash- and-burn agriculture helps to release nutrients that are held in the plant components of

the ecosystem. The released nutrients improve the soil for a short while. Once the nutrients are exhausted, people shift their clearing practices to a new forest area, in search of fertile soil. The increase in human population poses a challenge to this form of cultivation.

Charcoal production also contributes to loss of biodiversity. The problem of charcoal production is prevalent in areas closer to urban centres (SNR, 2005). The high deforestation in the vicinity of urban areas is attributable to the high energy demand in these areas. Rural areas in the vicinity of urban areas meet this high demand by supplying charcoal. Due to the high electricity tariffs, most urban households use charcoal to meet part or all of their domestic energy demands, making charcoal a major household fuel in urban Zambia (Chidumayo, 1997). With regard to the study area, the demand for charcoal in Kitwe is also high, providing a ready market for charcoal.

Domestication of IFTs

In order to improve the contribution of the IFTs to the rural household livelihoods, it is vital to domesticate IFTs. Local planting, product development and market expansion are the first steps in domesticating wild fruits in fields, homesteads and communal areas (Maghembe et al., 1998; Leakey et al., 1994; Akinnifesi et al., 2006). The choice of which trees to domesticate follows a priority setting which identifies the most highly valued species. Domestication is likely to be effective when local people are involved in the process of priority setting of the tree species (Franzel et al., 1996). There is therefore need to promote domestication of IFTs in the study area, and the trees that should take preference are those that are highly ranked by households, and were reported to be under threat. It is cardinal to consider domesticating the IFTs that are scarce, so as to maintain and broaden biodiversity. It is worth observing that the trees that are under threat are actually the same fruit trees that are ranked highly, that is, *U. kirkiana* and *A. boehmii*. Domestication of IFTs is important as the indigenous fruit trees are vital for the survival of rural households as they provide food, medicines and are source of income.

Conclusions and Recommendations

Indigenous fruits are important sources of food, income and medicines, which are vital in sustaining rural communities. *U. kirkiana, A. boehmii* and *P. curatellifolia* are the most preferred species, due to their contribution as a food supplement to the households, and because of their marketability. The rates of deforestation in the area are high and have caused a reduction in the availability of IFTs. As regards to processing, most of the processed fruits are for household consumption. Although there was knowledge on the processing of some indigenous fruit, there was an obvious lack of information on processing of fruit into commercially viable products such as wines and oils. The following recommendations are drawn from this study.

I.) Domestication of indigenous fruit trees and restocking of natural forests with IFTs.
II.) In order to improve the processing and marketing of IFTs, the rural community must be provided with information on harvesting, use and processing as well as regular marketing information on the potential fruit markets. The government and stakeholders must link the rural fruit producers with possible markets including international markets.
III.) The reproductive biology and ecology of *Anisophyllea boehmii* must be investigated in order for its domestication to be initiated.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the national research foundation (South Africa) and Copperbelt University for providing funds for this study.

REFERENCES

Akinnifesi FK, Sileshi G, Ajayi OC, Chirwa PW, Kwesiga F, Harawa R (2008). Contributions of agroforestry research and development to livelihood of smallholder farmers in Southern Africa: 2. Fruit, medicinal, fuelwood and fodder tree systems. Agric. J. 3(1): 76-88.

Akinnifesi FK, Kwesiga FR, Mhango J, Chilanga T, Mkonda A, Kadu CAC, Kadzere

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. Forests, Trees and Livelihoods 16: 103-121.

Akinnifesi FK, Kwesiga FR, Mhango J, Mkonda A, Chilanga T, Swai R (2004). Domesticating priority miombo indigenous fruit trees as a promising livelihood option for smallholder farmers in southern Africa. Acta Horticulturae 632:15-30.

Bromley DW, Cernea MM (1989). The management of common property resource. Some conceptional and operational fallacies, World Bank Discussion Paper Washington, D.C. World Bank. No. 57,

Campbell B, Luckert M, Scoones I (1997). Local level valuation of Savannah resources: A case study from Zimbabwe. Econ. Bot. 51:57-77.

Chidumayo EN (1997). Miombo ecology and management: An introduction. IT Publications, Lodon, UK, p.166.

Fanshawe DB (1972). Useful trees of Zambia for the agriculturist, Lusaka, Zambia: Government Printer.

FAO (1983). Food and fruit bearing forest species: examples from Eastern Africa. FAO Forestry Paper 44/1 Rome.

Franzel S, Jacnicke H, Janssen W (1996). Choosing the right trees. setting priorities for multipurpose tree improvement. The Hague: International Service for National Agricultural Research. Research Report 8.

Hardin G (1968). The tragedy of commons. Science 162: 1243-1248.

Ham C (2003). Background report on indigenous fruit commercialisation activities in selected SADC countries. Commercial Products from the Wild Consortium, Department of Forest Science, University of Stellenbosch, South Africa.

Hughes A, Haq N (2003). Promotion of indigenous fruit trees through improved processing and marketing in Asia. International Forestry Review, 5, (2 special issue: NTFPs revisited), pp. 176-181.

Hyde WE, Seve JE (1993). The economic role of wood productsin tropical deforestation; the severe example of Malawi. For. Ecol. Manage. 57:283-300.

Kadzere I, Hove L, Gatsi T, Masarirambi MT, Tapfumaneyi L, Maforimbo E, Magumise I (2004). Current status of post-harvest

handling and traditional processing of indigenous fruits in Zimbabwe. In: Rao M.R. and Kwesiga F.R. (eds) Agroforestry impacts on livelyhoods in southern Africa: Putting research into practice. Proceedings of the regional agroforestry conference held on 20-24 May, 2002, Warmbaths, South Africa. World Agroforestry centre (ICRAF), Nairobi, Kenya, pp. 353-363.

Kordylas JM (1990). Processing and preservation of tropical and subtropical foods. Macmillan, London, UK, p.414.

Kwesiga F, Mwanza S (1995). Underestimated wild genetic resources: the case of indigenous fruit trees in eastern Zambia. In: Maghembe J.A, Ntupanyama Y, Chirwa PW (eds) Improvement of indigenous fruit trees of the miombo woodland of Southern Africa. Proceedings of a conference held 23-27 January 1994, Mangochi, Malawi. ICRAF, Nairobi, Kenya, pp.100-112.

Leakey RRB (1994). Les arbres au bois dormant. Agroforestry Today ICRAF, Nairobi, Kenya. 6(2):3-4.

Leakey RRB (1999). Farmers' top priority fruit trees. Agroforestry Today ICRAF, Nairobi, Kenya. 11: 11-12.

Maghembe JA, Kwesiga F, Ngulube M, Prins H, Malaya FM (1994). Domestication potential of indigenous fruit trees of the Miombo woodlands of southern Africa. In: Leakey R.R.B. and Newton A.C. (eds). Tropical trees: the potential for domestication and the rebuilding of forest resources. London: HMSO, pp. 220-229.

Maghembe JA, Simons AJ, Kwesiga F, Rarieya M (1998). Selecting indigenous fruit trees for domestication in southern Africa: Priority setting with farmers in Malawi, Tanzania, Zambia and Zimbabwe. International Centre for Research in Agroforestry, Nairobi, Kenya. p. 94.

Mander M, Le Breton G (2006). Overview of the medicinal plants industry in southern Africa. In: Diederichs, N (ed)., Commercialising medicinal plants A southern African guide. Sun press South Africa, pp. 3-8.

Mateke SM, Kamara CS, Chikasa P (1995). Ripening periods of edible indigenous fruits in Zambia: implications for utilization and domestication In: Maghembe, J.A, Ntupanyama, Y. and Chirwa PW (eds) Improvement of indigenous fruit trees of the miombo woodland

of Southern Africa. Proceedings of a conference held 23-27 January 1994, Mangochi, Malawi, ICRAF, Nairobi, Kenya, pp. 58-65.

Muok BO, Owuor B, Dawson I, Were J (2001). The potential of indigenous fruit trees; result of a study in Kitui District, Kenya. Agroforestry today 12: 13-15.

Ngulube MR, Hall JB, Maghembe JA (1995). Ecology of a Miombo fruit tree Uapaca kirkiana (Euphorbia). For. Ecol. Manage. 77: 105-117.

Packham J (1993). The value of indigenous fruit- bearing trees in miombo woodland areas of South Central Africa. Rural Development Forest Network Paper, Overseas Development Institute, London. Available at: http://www.odi.org.uk/fpeg/publications/rdfn/15/rdfn-15c-ii.pdf .

PFAP (1998). Copperbelt action plan. 1998-2018, PFAP. Ndola, Zambia.

Ruiz-perez M, Broekhoven AJ, Aluma JRW, Iddi S, Lowroe JD, Mutemwa SM, Odera JA (1997). Research on non-timber forest products in selected in southern and east Africa: themes, research issues, priorities and constraints. *CIFOR* Working Paper Bongor, Indonesia No. 15.

Saka JDK, Swai R, Mkonda A, Schomburg A, Kwesiga F, Akinnifesi FK (2004). Processing and utilisation of indigenous fruits of the miombo in southern Africa. In: Rao M.R. and Kwesiga F.R. (eds) Agroforestry impacts on livelihoods in southern Africa: Putting research into practice. Proceedings of the regional agroforestry conference held in Warmbaths, South Africa 20-24 May, 2002. World Agroforestry centre (ICRAF), Nairobi, Kenya, pp. 343-352.

Scherr S (1995). Economic analysis of agroforestry systems: the farmers' perspective In: Scherr S. (ed.) Costs, Benefits and adoption of agroforestry project experience in Central America and the Carribean. World Bank working paper 14, CATIE–IFPR – World Bank projects. Washington, USA, pp. 28-44.

Schreckenberg K (2004). The contribution of shea butter (*Vitellaria paradoxa* C.F. Gaertner) to local livelihoods in Benin. In. Sunderland T. and Ndoye O. (eds). Forest products, livelihoods and conservation. Case studies of non-timber forest product systems. Africa. CIFOR, Indonesia. 2

SNR (2005). Impact of biodiversity loss and desertification on women, youth and children. Report prepared by the School of Natural Resources at the Copperbelt University, Zambia for UNDP, MTNER and UNICEF.

Tiisekwa BPM, Ndabikunze BK, Samson G, Juma M (2004). Suitability of some indigenous tree fruits for manufacturing juices and jams in Tanzania. In: Rao M.R. and Kwesiga F.R. (eds) Agroforestry impacts on livelihoods in southern Africa: Putting research into practice. Proceedings of the regional agroforestry conference held in Warmbaths, South Africa 20-24 May, 2002. World Agroforestry centre (ICRAF), Nairobi, Kenya, pp. 331-335.