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Full Length Research Paper

Quantities and values of selected forest foods harvested by eight villages adjacent to natural woodlands in the four ecological zones of rural Swaziland

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Edible non-timber forest products (NTFPs) like other environmental resources play a crucial role on the provision of subsistence and income to people's livelihoods, especially the poor and marginalized communities. The objective of the study was to undertake user surveys to determine the actual quantities of harvested edible NTFPs, and to do an economic analysis of their direct use values. The methods used include literature research, community consultations, household visits and interviews, household profiles and economic valuation models. The findings indicated that there were significant differences between sites in annual quantities harvested per household for edible NTFPs, in annual quantities harvested per household between communities, between sites in annual value per household, and in annual values per household between communities. Edible species were harvested in spring and summer over 4, 8, 12, 16, 20 and 24 weeks. Only 57 species were reported as highly preferred species, across the four study sites. The key factors determining the variability in harvested quantities and values per household are: the wealth status, variability of species per site, season and duration of harvesting, commercialization, number of accessible natural woodlands within a site, need and demand, the household profile with regard to gender and age, and farm gate price differences.

Key words: Non-timber forest products (NTFPs), economic value, natural forest, natural woodland, sustainable, economic valuation, user surveys.

INTRODUCTION

Research has shown that in Africa, non-timber forest products (NTFPs) are in common use and their utilisation as a secondary land use occurs alongside small-scale agriculture and extensive communal grazing. NTFPs contribute to increased rural household incomes, and cash flow into rural areas and from abroad into the continent (Dlamini, 2010a). Furthermore, NTFPs can lead to improved management of indigenous forest resources, while maintaining traditional and cultural knowledge and practices. The NTFP subsector plays a vital role in improving rural food security and nutritional status. This is why NTFPs form a critical basis for the sustainable management and utilization of indigenous resources (Dlamini and Geldenhuys, 2009). For example NTFPs such as multi-purpose trees like Marula (*Sclerocarya birrea* subsp. *caffra*) forms an integral part of the diet, tradition and culture of rural communities in southern Africa. In addition such NTFPs and others contribute to economic, social and environmental stability of many rural communities (Dlamini, 2010a).

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Abbreviations: NTFPs, Non-timber forest products; **CSO,** Central statistics office.

However valuation of environmental products including NTFPs for their total direct, indirect and intermediate use values still remains a major challenge nationally, regionally and internationally. The importance of this phenomenon of valuation of environmental goods and services is manifested in two ways. Firstly, it helps policy makers in designing and implementing effective poverty reduction strategies. Secondly, the size and nature of environmental values has implications for issues of conservation and sustainable resource use (Peters et al., 1989; Chopra, 1993; Campbell et al., 1997; Dlamini, 1997; Dovie et al., 2001; Vedeld et al., 2004; Willis, 2004; Dlamini, 2007).

The ultimate aim of natural resource surveys and accounting is to promote sustainable use of the resources and prevent degradation (Hedge et al., 1996; Dovie et al., 2001; Geldenhuys, 2002; Dlamini, 2007). The economic valuation of NTFPs, is faced with numerous challenges starting with their inventory. The underlying reasons for the difficulty in the valuation of NTFPs are attributed to the complex nature of the products leading to most having non-wood values. Non-wood values have been described as those goods and services produced by the forestland which enter an individual's preference (or utility) function and for which individuals are willing to sacrifice their scarce resources (McKenney and Sarker, 1994; Dlamini, 2007) and these products may not have a defined market price. The local factors that influence land-use priorities, such as lack of secure land tenure, the low level of price stability for NTFPs, the non-economic preferences, and the traditional taboos and norms regarding extraction of these products need to be integrated into the economic valuation (Gram, 2001; Dlamini, 2007). Although, present-day knowledge about the economic value of NTFPs is based on a doubtful foundation because the different methods used by scholars have led to different results and conclusions (High and Shackeleton, 2000; Dovie et al., 2001; Gram, 2001; Godoy et al., 2000).

The specific objective of the study to undertake user surveys to determine the actual quantities of edible NTFPs harvested and to conduct economic valuation for their direct use values. The hypotheses to be tested were as follows:

1. The quantities and values of edible NTFPs extracted and utilized vary amongst households in response to a myriad of local and external contextual conditions (Shackleton and Shackleton, 2004) and;
2. Edible NTFPs make a significant contribution to rural household income (Lawes et al., 2004; Chipeta and Kowero, 2004).

MATERIALS AND METHODS

Study area

The four study sites were distributed in the four ecological zones of Swaziland where two villages were studied per site in order to fully capture variability in climatic and socio-economic conditions between these regions of the country. See Box 1 for a brief description of the ecological zones.

A letter of request for permission to engage local communities was written and a human ethics permit was sought and granted by the local and traditional authorities in the various study sites.

The selection procedure ensured that all the villages selected within study sites were those that harvest, extract or collect and utilize NTFPs from the neighbouring natural forests and woodlands. Only rural villages were included in the study due to the low dependence of urban populations on direct harvesting of NTFPs from natural forests and woodlands (Hassan et al., 2002). Two villages were sampled per ecological zones. A maximum of seventeen households per village were selected in line with criteria set out in Campbell et al. (1997), Gram (2001), Hassan et al. (2002) and Shackleton et al. (2002). It was worthwhile to study at least two villages adjacent to a community forest reserve (Shewula Nature Reserve), where harvesting is monitored and under control. Over and above that it was important to have at least two villages surrounding a protection-worthy area (Grand Valley), amongst those selected during a study on the identification of protection-worthy areas in Swaziland undertaken by DANCED (2000a). This was a means to assess the degree of product flow from a protection-worthy area to confirm its protection worthiness.

In addition, household profiles were sought as research has shown that within any given community there is significant socio-economic differentiation arising from a multitude of factors such as levels of employment, education, gender, age, human population, wealth status, farming opportunities, and other factors (Shackleton and Shackleton, 2000, 2004; Dlamini, 2007). See household profiles for this study in Table 1.

Sampling design and data collection

Literature search

Technical reports from the Central Statistics Office (CSO) were reviewed to ascertain the average number of individuals per household in the various study sites. This aided in determining the sample size (that is, the number of households to be selected for interviews per village for precision purposes).

Community meetings

Three community consultation meetings were held to brief the people about the relevance of the user surveys and economic analysis of the actual harvested quantities of their preferred edible products to the resources inventory and sustainability of NTFPs. The full cooperation of the people was sought following the same trend like during the National Forest Policy development process in 2001/2002 and a slight modification of the work of Balick and Mendelson (1992), Hall and Bawa (1993), Peters (1996), Campbell et al. (1997), Gram (2001) and Dlamini (2007, 2010a).

Sampling design and procedure

A nested analysis of variance (ANOVA) approach was followed, where eight villages are nested on four sites and in turn seventeen households are nested in eight villages (Ott, 1998).

A brief analysis of the employment status of all the selected households in all the study sites was carried out through interviewing households for the number of employed versus unemployed members. This was to have an idea of the financial status of the households besides subsistence farming and its effects on NTFPs harvesting.

Table 1. Household profiles .

Factors	Ecological Zone	Ecological Zone	Ecological Zone	Ecological Zone
	Highveld	Middleveld	Lubombo	Lowveld
	Site: Hhelehhele North	Site: Grand Valley	Site: Shewula	Site: Siphofaneni
	Villages/Enumeration Number:	Villages/Enumeration Number:	Villages/Enumeration Number:	Villages/Enumeration Number:
	Mlumati/ 12104	Emoti/22249	Jamehlungwini/44122	Hlutse/43138
	Hhelehhele/12108	Kundodemnyama/22 250	Mangwenya/44125	Madvuma/43139
Availability of wage employment	Migrant labour in towns	Migrant labour in towns	Available in the sugar industry, but seasonal	Available in the sugar industry, but seasonal
Crop farming	Maize, ground nuts, sweet potatoes, vegetables, paw-paw, banana, oranges, other.	Maize, water melons, pumpkins, ground nuts, potatoes, cassava, beans, other.	Cotton, maize, some legumes, other.	Maize, ground nuts, cassava, sorghum, sweet potatoes, other.
Livestock farming	6 goats, 7 cattle and 30 chickens.	11 goats, 8 cattle and 23 chickens.	9 goats, 8 cattle and 21 chickens.	8 goats, 7 cattle and 31 chickens.
Human population densities	7 people per household	7 people per household	10 people per household	7 people per household
Age profiles	20 to 60 years	20 to 74 years	19 to 68 years	25 to 72 years
Gender profiles	60% women	50% women	55% women	55% women
Availability of food aid	Not reliable	Not reliable	Reliable	Not reliable
Availability and proximity to health care centres	Easy access	Access difficult due to long distances	Access difficult due to long distances	Easy access

Data recording

Special recording sheets were printed for each household per study site (Godoy et al., 1993; Gram, 2001; Wong et al., 2001; Hassan et al., 2002; Shackeleton et al., 2002) to collect and record the following data where possible:

1. Specific extracted/collected/harvested products;
2. Site of collection (e.g. on trees, shrubs, herbs, under-story, on the ground, water courses, etc.);
3. Product collector (men, women, children etc.);
4. Quantities of products extracted (for consumption in forest/veld/along the way home);
5. Quantities of products collected for domestic use; quantities of products harvested for trade (bartering or sale);
6. Time spent going to the source/forest;
7. Time spent extracting product;
8. Distance between homestead and product source;
9. Processing and end-use of products; value of products (preferably at farm gate);
10. Tools used for extraction;
11. Transport means to convey products to the village;
12. Marginal costs of extraction (in terms of time, labour, processing etc.);
13. Farming activities (yields and economic value);
14. Other income; and time used in different activities; and
15. Farm gate prices were being collected monthly over the entire survey period from local sources.2.4 Data analysis.

Economic valuation

The equation for calculating values of harvested NTFPs per household was:

$AVe = AQe \times P_i$

Where AVe is annual value extracted, AQe is annual quantity extracted for either domestic use or trade, and P_i is the mean farm gate price.

This equation was adopted with slight modifications from Shackleton and Shackleton (2000) and Shackleton et al. (2002).

Table 2. The mean number of unemployed members per household in the different sites in Swaziland.

Members unemployed per household			
Level of Site	**Number of households studied**	**Mean number of unemployed members per household**	**SD**
Hhelehhele North	34	4.1 (ab)	1.8
Grand Valley	34	4.3 (a)	1.7
Siphofaneni	34	3.5 (b)	1.9
Shewula	34	1.9 (c)	1.0

The underlying reasons being as follows:

1. Extraction costs are largely very low, as none of the resources harvested require specialist tools, usually just an axe, sickle or a bushknife and such tools are used for a multitude of uses within the household. Transport used for conveying edible NTFPs was mainly 'walking'. Thus, once the capital cost is spread over a number of different uses and then subject to a discount factor over the life of such a tool, then the annual cost or cost per unit harvested is negligible. Furthermore, the collecting containers for the NTFPs were old sacks and used plastic bags.
2. The impact of opportunity cost of labour were also very small, firstly because the daily rates paid for labour collecting NTFPs does not exist within the rural areas, as these products are collected by women and children as well as unemployed men, and there is a large surplus of unskilled labour. So the application of opportunity cost of labour under such circumstances would be unrealistic.

Statistical analyses

The data sets collected for household profiles, annual quantities of edible NTFPs harvested per household, and the annual value per household for harvested NTFPs were analysed and results were interpreted. Analyses were carried out at the following levels:

1. Between Sites
2. Between Villages within Sites
3. Between Households within Villages
4. Between Species within Sites
5. Between Species within Villages

This was not an experimental study, but a nested sampling design and procedure with continuous data. Therefore appropriate analyses of variance (Proc GLM with SAS version 8.2) were used to analyse the data (SAS, 1999). Student's t-test was calculated at the 5% confidence level to compare treatment means (Ott, 1998).

In Household Profiles, Nested GLM was used with employment as the main effect in the model.

$$Y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$$

Where μ is the population mean, α_i is the main effect (employment) and ε_{ij} is the error.
(ANOVA for a one-way classification)

In Annual Quantities and Values, Nested GLM was used with either site or species or village as the main effects in the model.

$$Y_{ijk} = \mu + \alpha_i + \beta_j + \alpha\beta_{ij} + \varepsilon_{ijk}$$

Where μ is the population mean, α_i is the main effect (site or species or village), β_j is the duration effect, $\alpha\beta_{ij}$ is the interaction effect of duration with main effect (site or species or community) and ε_{ij} is the error.

The Shapiro-Wilk test was performed to test for non-normality (Shapiro and Wilk, 1965). In some cases where evidence of non-normality was found, it was due to high kurtosis and not skewness. A magnitude of similar values was responsible for the kurtosis. According to Glass et al. (1972) these analyses are valid.

RESULTS

Employment status of households

A one way ANOVA shows that Grand Valley had the highest mean number of people (5) and Shewula had the lowest mean (2), meaning that there are more unemployed members per household in the Grand Valley than in the Shewula site. There were no significant differences in the number of unemployed members per household between villages (p=0.7208). Refer to Table 2 and Table 3 for means of unemployed members of the various households.

Species utilized and their quantities and values

Edible species used

This study found that there is a total of 57 species eaten and each household consumed between 5 and 15 species. The Emoti and Kundodemnyama villages reported the highest number of harvested and consumed edible species (25 and 28), followed by the Hlutse and Magwenya villages (26 and 20). There was variation in the number of edible NTFPs species reported per household, per village and per ecological zone (study site), and in the harvesting periods between villages (Table 4).

Annual quantities and values harvested per household

The summary statistics for the mean quantities and values per year of edible goods harvested per household in the four ecological zones show large variations (Table 4). The findings of the study show that there are

Table 3. The mean number of unemployed members per household in the different villages in Swaziland.

Members unemployed per household			
Level of Village	**Number of households**	**Mean**	**SD**
Hhelehhele North	17	4.3	1.7
Mlumati	17	3.9	1.9
Kundodemnyama	17	4.3	1.7
Emoti	17	4.3	1.7
Madvuma	17	3.1	1.8
Hlutse	17	3.2	2.0
Mangwenya	17	2.1	1.3
Jamehlungwini	17	1.7	0.5

Table 4. Number of edible NTFPs species used per village and harvesting duration (that is, length of harvesting period per year) according to the user surveys undertaken in the eight villages over the four ecological zones.

Ecological zone (Study site)	Village	No. of edible species	Length of harvesting period per year (weeks)
Highveld	Mlumati	12	3 durations (8, 12, 16)
(Hhelehhele North)	Hhelehhele	12	3 durations (8, 12, 16)
Middleveld	Emoti	25	4 durations (8, 12, 16, 20)
(Grand Valley)	Kundodemnyama	28	6 durations (4, 8, 12, 16, 20, 24)
Lubombo	Jamehlungwini	12	4 durations (4, 8, 12, 16)
(Shewula)	Mangwenya	9	3 durations (4, 8, 12)
Lowveld	Hlutse	26	5 durations (4, 8, 12, 16, 20)
(Siphofaneni)	Madvuma	20	2 durations (8, 20)

significant differences between villages within sites in the annual quantities harvested per household in edible NTFPs in all the various study sites. However, for Hhelehhele North and Shewula there are significant differences in annual quantities harvested per household over harvesting durations. The same applies for harvesting duration.

The extraction rate of edible NTFPs is higher at Siphofaneni area (Table 5). Similarly, there are significant differences in annual values per household between villages within sites. The same trend as in high extraction rates was obtained in annual values, most probably because prices are constant across the study sites.

The highest extraction rate of edible NTFPs occurred over 8 weeks. It was alluded to that there are species that are harvested any time of the year, but it should be noted that these are not harvested continuously but fall within the given harvesting durations as well. The annual values for edible NTFPs followed the trend of the annual values since unit prices were constant.

The study further gave details of individual villages in quantities and values per household for the user surveys (Table 5). The Madvuma and Hlutse villages under the Siphofaneni are the highest in harvested quantities of edible NTFPs.

The statistical significance of the quantities harvested, the duration of the harvests and the interaction between the quantities and duration are shown in Table 5. The annual quantities harvested per household in edible NTFPs are significantly different between the study sites ($p=0.0038$). However, the differences between harvesting duration ($p=0.7001$) and in interaction between sites and duration are not significant ($p=0.9972$). The differences between sites in annual value per household are not significant for edible NTFPs ($p=0.013$). These results support, in part, the hypothesis that there are variations in quantities of NTFPs harvested between sites.

As mentioned before there were 6 classes of harvesting duration or length of harvesting periods (in weeks) for edible NTFPs and 9 classes for harvesting duration (in months) for medicinal NTFPs (Table 6). The highest extraction rate of edible NTFPs occurred over 8 weeks, while the highest for medicinal NTFPs was over 5 months. It was alluded to that there are species that are harvested any time of the year (for medicine), but it should be noted that these are not harvested

Table 5. Summary statistics of mean annual quantities and values per household in the four study sites and across villages.

Ecological zone (study site)	Village	Number of households	Mean annual quantities (Kg)	Mean annual values (US$)
Highveld	Mlumati	97	93.7b	44.3b
(Hhelehhele North)	Hhelehhele	96	138.0b	63.7b
Middleveld	Emoti	127	360.1b	444.1ab
(Grand Valley)	Kundodemnyama	112	467.4b	636.0ab
Lubombo	Jamehlungwini	59	152.7b	76.5b
(Shewula)	Mangwenya	37	188.3b	87.9b
Lowveld	Hlutse	95	908.4b	432.2b
(Siphofaneni)	Madvuma	122	3107.6a	1434.3a

Means with same letters are not statistically significantly different, Exchange rate: 1US$ is equivalent to R6.50 as at 2004 (Times of Swaziland, 2nd March 2004).

Table 6. Summary statistics of mean annual quantities (kg) and values (US$) per household over the respective harvesting durations.

Harvesting duration (weeks)	N	Mean annual quantities (kg)	Mean annual values (US$)
4	29	15.9	7.4
8	256	1804.3	834.8
12	255	106.9	54.3
16	157	644.9	808.1
20	45	239.3	155.3
24	3	64.0	78.8

Exchange rate: 1US$ is equivalent to R6.50 as at 2004 (Times of Swaziland, 2nd March 2004).

Table 7. Mean annual quantities of the most commonly harvested edible species across the study sites.

Species/product name	Mean annual quantities harvested (kg)
Sclerocarya birrea	755
Strychnos spinosa	204
Strychnos madagascariensis	186
Aloe saponaria	180
Caterpillars	180
Psidium guajava	170
Umbhindolo (SiSwati name)	160
Pollichia campestris(Mushrooms)	128
Syzygium cordatum	124
Englerophytum natalense	123

continuously but fall within the given harvesting durations as well. The annual values for both edible and medicinal NTFPs followed the trend of the annual values since unit prices were constant.

Out of interest the twenty most harvested species of edible NTFPs were selected based on harvesting frequency and quantities over the entire spectrum of the study sites. *Sclerocarya birrea* was the most highly ranked species in the user surveys. The matrix of common NTFPs in Swaziland also revealed that *S. birrea* was the most multi-purpose species in Swaziland (Table 7). Currently, there is a national project initiative on the collection and processing of indigenous fruit and berries, where *S. birrea* is the top priority species.

The ten most preferred indigenous edible species that are harvested in large quantities include the one type of caterpillar (*Imbrasia belina*) and mushrooms (*Pollichia campestris*), and the following fruits: *S. birrea*, *Strychnos spinosa, Strychnos madagascariensis, Aloe saponaria, Psidium guajava*, Umbhindolo (the scientific name is not known), *Pollichia campestris*, *Syzygium cordatum* and *Englerophytum natalense*.

The prioritised multi-purpose species harvested for both edible and medicinal purposes include the following: *Sclerocarya birrea, Psidium guajava, Momordica involucrate, Momordica clematidea, Aloe saponaria* and *Berchemia zeyheri*.

DISCUSSION

The results of this study confirm that natural forests and woodlands contribute to all aspects of rural life, in particular by providing foods and medicines to the rural communities as highlighted (Dlamini, 2007, 2010a; Dlamini and Geldenhuys, 2009, 2011a, 2011b). However, and in accordance with other studies (Falconer, 1992; Shackleton et al., 2002 and Hassan et al., 2002), there is a great variation within and between sites and within and between villages, as noted, in the annual quantities and values harvested per household derived from various forest foods.

Forest foods still contribute significantly to the diet of many rural households. All households studied consume wild edible plants and plant products on a seasonal basis. The results show that most forest foods are mainly harvested in spring and summer (the research was carried out during this time of the year when forest foods are collected in the rural areas). Predominant forest foods include wild edible leaves, fruits and berries (Falconer, 1992; Shackleton et al., 2002; Hassan et al., 2002). This study indicates that all households in all communities sampled, harvested and consumed wild edible NTFPs and similar results were found in South Africa (Shackleton and Shackleton, 1997). The harvesting season is mainly between December and April, and this tallies with findings of Shackleton and Shackleton (1997). Indigenous edible plants and animals are widely used in most parts of eastern and southern Africa (Crafter et al., 1997; Dlamini, 1999, 1998, 2007, 2010a, b). In addition to NTFPs, rural inhabitants make considerable use of wild resources from communal areas around settlements, including fallow lands and residential plots (Ogle, 1982; High and Shackleton, 2000; Dlamini and Geldenhuys, 2009, 2011a, 2011b). These resources include wild edible leaves, berries, and other edible portions that supplement the diet of the rural people.

Siphofaneni harvested significantly higher quantities of fiorest foods compared to other sites. However, villages or communities from the Grand Valley also sites consumed a substantial amount of forest foods. This may be attributed to the high rate of unemployment that leads to people spending more time foraging and more time in harvesting and extracting forestry resources for their livelihoods. Communities from Hhelehhele North and Shewula sites are engaged in extensive agriculture and the climate is highly favourable and as such they spend less time foraging and more time in non-forestry occupations and use more agricultural and industrial products. The other reason why Shewula site extracts fewer wild products may be the reliable National Food Aid Programme in the area that provided people with alternative sources of food, which is rare in the other study sites. Similar results were found in Zimbabwe (Campbell, 1987).

Wild edible plants account for a larger share of household income among households with unemployed members in the communities from Grand valley and Siphofaneni sites than among households with employed members from the Hhelehhele North and Shewula sites.

All the species harvested for forest foods have a vibrant local and national market all over the country. That means that they are of high commercial value and thus preferred by collectors for household cash income. Most of the plant species listed above are multi-purpose as they are also medicinal. This list differs slightly from the priority list of candidate edible trees for immediate domestication developed by the Swaziland National Tree Seed Centre (Dlamini, 1998). The main reason could be that the SNTSC did not consult the communities while developing their list, but relied on existing literature and other regional priority lists.

The indigenous and naturalized species that are harvested for both food and medicine are *S. birrea, Psidium guajava, Momordica involucrata, Momordica clematidea, Aloe saponaria* and *Berchemia zeyheri.* As a result these multi-purpose species are the most highly valued plant species in all the villages where they exist. The notable thing is that these species are almost always readily available within short distances from the village. Furthermore, it was observed that *S. birrea* occurs in all the eight villages sampled, but due to altitude it is relatively scarce or sparsely distributed in the Highveld region of the country.

The most valuable indigenous edible species listed is almost the same as the most preferred, excluding Umbhindolo and *S. cordatum.* Informal enquiry revealed that the farm gate price of bee honey (which was not part of this study) is the highest at US$3.10 per kg. The prices of the other species are almost the same at an average of US$0.46 per kg. The variation in the rankings for annual values may be attributed to the fact that the annual harvested quantities and actual farm gate prices of the species differ between and within villages. These prices are expected to rise at the urban markets and also vary from species to species depending on the price elasticity of demand and supply. This means that the indicated values of the preferred edible NTFPs reflected

in this study are conservative figures on the lower estimate. These prices are however in line with those in DANCED (2000b) except that the prices of indigenous vegetables have risen over the last four years from US$0.77 to 3.10 per kg while the prices of indigenous edible fruits and berries have not changed much since then. The steady increase in the demand for indigenous vegetables for health reasons may be responsible for the hike in their prices.

The annual values per household for edible NTFPs ranged between US$44 and 1434.. These figures are higher than the mean gross direct use value for utilization of plant resources of US$159 in the Eastern Cape Province of South Africa reported by Cocks and Wiersum (2003). These figures are higher than those of Shackleton et al. (2002) of a mean total gross annual direct use value per household of between US$211 and 324 found in Kat River Valley of South Africa. These figures are extremely high in view of the fact that this study only covered edible products and excluded other NTFPs such as fuelwood and bushmeat, which the South African study included. The range in this study is higher than a combination of wild and domestic plants that were valued at US$206.00 per household per year in a South African rural village by High and Shackleton (2000), considering that this study excluded domestic plants. The annual values per household in this study are higher than those of the annual value of woodland resources (mainly NTFPs), in all sectors in South Africa, of an annual value of US$193 per household for edibles (Dovie et al., 2001). The annual values in this study are comparable with those total direct use values of 11 secondary resources in the Bushbuckridge area in the Lowveld of South Africa where US$368 per household is for domestic use and US$767 is for trading (Shackleton and Shackleton, 2000).

Based on the resource assessment and economic analysis of preferred NTFPs and other wild resources from communal lands, Shackleton (1996), in the Central Transvaal of South Africa, noted that the broad-scale harvesting and commercialisation of such natural resources in such areas could be a vehicle towards meaningful development, rather than to simply support a subsistence livelihood. The same could be said about Swaziland in view of the economic values of the preferred NTFPs in the four ecological zones.

The ultimate concern of the user surveys is ecological rather than economic sustainability. This is in consideration of the fact that extraction of NTFPs may be economically sustainable if the value, adjusted for inflation, increases or remains constant, but economic sustainability is not always consistent with ecological sustainability (Hall and Bawa, 1993). In this case over-harvesting of the preferred NTFPs may lead to continuing decline of populations while persistent demand keeps the market value constant.

The populations of the highly sought species of forest foods become depleted and the products become scarce, and there may be an increase in economic return if the demand remains the same while the resources are dwindling. Furthermore, scarcity may increase the marginal costs of extraction, pushing the prices upwards thus reducing the demand.

Consequently, with complete resource depletion, there will be neither economic nor ecological sustainability, but only local extinction of the economically viable species. In economic terms, the effects of unsustainable extraction take a long time to be detected, especially with long-lived trees (Hall and Bawa, 1993).

CONCLUSIONS AND RECOMMENDATIONS

The study has shown that the rural communities of the four ecological zones of rural Swaziland make good use of the NTFPs from the surrounding natural forests and woodlands, and that the financial value of such direct provisioning was significant. In addition, the input costs associated with harvesting of natural resources were extremely low, making it a viable strategy for poor households, both for domestic consumption and trade. It is worth noting that about 75% of the entire population resides in the rural areas where poverty is very high and the vast majority of these people depend on and derive many direct and indirect use and non-use benefits from natural forests and woodland resources (DANCED, 2000b; GOS, 2001a; Hassan et al., 2002).The idea that quantities and values of edible NTFPs extracted and utilized vary amongst households and that Edible NTFPs make a significant contribution in rural household income) are supported by the findings of the results of this study.

The preferred species of edible NTFPs have been captured and they need immediate attention as they may be threatened with extinction if left unchecked. An immediate action programme for participatory research into the ecology of the affected species and the domestication and commercialization of all the priority species is recommended alongside other conservation strategies such as integrated local-level sustainable forest management approaches.

Harvesting and marketing commercial quantities of any NTFPs produces a measurable impact on the structure and dynamics of plant and animal populations, as well as the genetic composition of the harvested populations (Peters, 1996). In this case the most highly sought and extracted species may be in danger in the near future as long as there are no local-level strategies and practices towards sustainable use of the concerned NTFPs. It is clear that the harvesting rates of different species differ from ecological zone to ecological zone and between and within villages. Unfortunately both the flow of benefits and asset values of natural forests and woodland resources are not captured in the system of national Accounts in Swaziland (Hassan et al., 2002).

Most of the direct benefits derived from natural forests

and woodlands, such as indigenous edible vegetables, fruit and berries, are not commercially supplied and traded in the formal markets (Hassan et al., 2002). Lately indigenous medicines are flooding the modern town markets though.

Economic growth and development have taken place primarily through degradation of the natural environment as stock of renewable and non-renewable resources are depleted, and as such the National Accounting System purposefully disguises this depreciation. While depreciation of man-made capital appears as a cost GNP, the exploitation of natural resources appears a positive entry in the form of high economic activity (GOS, 1997).

Governments should recognize the importance of the following ecosystem goods and services when doing policy reforms for sustainable forest resource use in future: the role of the forests in providing raw materials; acting as a sink/dumping ground for waste generated by life supporting activities; providing life-sustaining services such as climate stability and soil and water supplies; and supporting human beings, their cultures and livelihoods along with animal and plant habitats.

Considering the array of benefits and functions of the forest environment the National Accounting System should include or reflect these. This will be a milestone in the recognition of the contribution of the natural forests and woodlands to life on earth. Consequently, the sustainable development slogan will be practically realized.

A policy recommendation is that there is an urgent need to provide economic incentives for communities to become involved in sustainable forest management. There is need to develop and test economic incentive measures within the context of on-going attempts at community-based sustainable forest management, which generate tangible benefits in forms and at levels that are at least equal to compensate for the economic costs that accrue to communities.

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Box 1. Brief description of the four ecological zones of Swaziland.

Ecological zone and characteristics
Highveld:
The Swaziland Highveld (altitude: 900-1400 m) is the upper part of an overall escarpment, comprising complex steep slopes between low and high levels, dissected plateaux, plateau remnants, and associated hills, valleys and basins. Mean annual rainfall is 850-1400 mm. Characterized by Short grassland with evergreen forest patches.
Middleveld:
The Upper Middleveld (altitude: 600-800 m) consists of strongly eroded plateau remnants and hills at intermediate level of the overall escarpment. It also has structurally defined basins in relatively protected positions, which are only weakly eroded. The Lower Middleveld (altitude: 400-600 m) is a piedmont zone of the escarpment, with generally strongly eroded foot slopes. The slopes are mostly moderate and the zone classifies at the first level as a plain. Mean annual rainfall is 650-1000 mm. Dominated by Tall grassland with scattered trees and shrubs and Broad-leaved savanna.
Lowveld:
The Lowveld plain comprises sedimentary and volcanic Karroo beds as opposed to the igneous and metamorphic rocks of the Highveld and Middleveld. The Lowveld is subdivided into the higher Western Lowveld (altitude: 250-400 m) on sandstone or claystone and the lower Eastern Lowveld (altitude: 200-400 m) on basalt. Mean annual rainfall is 550-725 mm. There is a combination of Mixed savanna and Acacia savanna.
Lubombo:
The Lubombo Range (altitude: 250-600m) is a cuesta with a steep escarpment bordering the Eastern Lowveld and a gradual dip slope of about 5% descending east. As a major landform the Lubombo qualifies as a plateau. Mean annual rainfall is 700-825 mm. Usually has Hillside bush and plateau savanna.

Source: Dlamini (2007).