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Mopane worm utilisation and rural livelihoods in Southern Africa

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INTRODUCTION

In recent years there has been growing interest in the roles of non timber forest products (NTFPs) in the livelihoods of poor rural people, and in the potential for expanding returns to NTFP activities. Initiatives to expand these returns commonly look for technical and institutional innovations in the management and utilization of forest resources, and in the processing and marketing of forest products. However, it is important that in such initiatives researchers and development workers understand the roles that NTFPs play in rural livelihoods, and then match innovation development to the resources, aspirations and constraints of current livelihood strategies. In this paper, we analyse the roles of mopane worm harvesting in rural livelihoods against a categorisation of different types of rural livelihood strategy. This analysis suggests different types of technical and institutional innovation that will pose opportunities and threats to different classes of household who participate in mopane harvesting.

The paper is structured into six sections. Following this introduction we describe the principal features of rural livelihoods and of mopane worm harvesting in the 'mopane belt' in Zimbabwe and Botswana. Section a categorization of livelihood strategies then introduces the categorization of livelihood activities to allow, in the following section, an analysis of the roles of mopane worm harvesting in rural livelihoods in the region. This analysis then allows us to investigate the potential for different types of technical and institutional innovations in the management and utilization of mopane woodland, and in the processing and marketing of mopane worms.

RURAL LIVELIHOODS AND MOPANE WORM HARVESTING IN ZIMBABWE AND BOTSWANA

The mopane worm (MW), the edible larvae of the Saturnid moth *Imbrasis beilina* is one of the best – known and most economically important forestry resource products of the mopane woodland in southern Zimbabwe, Botswana and the northern Transvaal (Timberlake, 1996; Bradley and Dewes 1993). Styles (1994) data estimated an annual population of 9,500m mopane worms in South Africa's 20,000 km² of mopane veld worth £57m, of which approximately 40% goes to producers who are primarily poor rural women. Originally, the mopane worm used to be an important food source for the rural communities occurring within the range of mopane woodland, but it is now widely eaten across southern Africa where it has become an important trading commodity. MWs have a high protein content and are considered a traditional delicacy. Women and children are usually involved in MW collection but in recent years men and youth have participated in the gathering of this product, attracted by the income earning opportunities from the supply and trading of MWs. Peaks in abundance of this species are between November and January (major) and March – May (minor), though population numbers and location of outbreaks vary from year to year. Outbreaks of MW although seasonal, are very timely in that they occur during the early months of the rainy season, when most rural households are in need of cash for food and school fees. However, the high inter annual variability in production means that these products are not a very reliable income source.

Rural Livelihoods in the Mopane belt

The large outbreak populations of mopane worm in southern Africa largely follow that of the host plant (*colophospermum Mopane*), which occurs in a broad band extending from the northern parts of South Africa into Zimbabwe, Botswana and west into Northern Namibia. The majority of these areas lie in regions of low natural resource potential, where cultivation is risky and extensive livestock production is the most suitable form of agriculture. Unreliable climate causes regular failure of staple grains and a

High level of vulnerability to food insecurity.¹ Smallholders in these areas have a long history of involvement in a diverse portfolio of farm and non farm activities although the intensity of involvement in these activities varies in response to outside factors such as natural calamities, shifts in economic policy, conflict, health and disease (e.g. HIV) and overall trends (in for instance resource stocks, population density, migrant labour opportunities and prices).²

Smallholders in the mopane belt in Botswana also pursue a diverse portfolio of farm and non farm activities but poverty levels are generally much lower than in Zimbabwe due to the better developed public safety nets afforded by the strong Botswana economy.

Overview of study areas and research methodology

Some studies have looked at the collection, processing and marketing of mopane worms (Hobane, 1994, 1995 Gondo, 2001), but little is known on the contribution of these activities to rural household livelihoods and the variability of involvement in MW activities between different communities or between different socio-economic groups. Much of the work done to date on MWs is vulnerable to the criticism that the results are 'just case studies' that do very little to provide knowledge rather than hearsay about the wider population of users of this forestry resource. This study reviews a cross section of surveys and case studies from a variety of communities across southern Zimbabwe and Botswana to gain an overall picture of both similarities and variability in MW utilisation among communities and different groups of households that harvest this forest resource.

This report reviews findings from research carried out between April–July 2002 in several communities in southern Zimbabwe where households harvest mopane worms.³ Formal questionnaires, with randomly selected households, were used

¹ . In Zimbabwe, for instance, the main areas of mopane worm outbreaks are in districts in the south of the country that lie in natural region IV and V (in the Zimbabwe classification). Since 1990, these districts have been struck by six serious food crises (1991, 1992 1997, 2000, 2002, 2003).

² Reliable data on income sources are scant but remittances and non farm sources probably account for 40-50% of rural incomes of rural people in provinces in which the mopane belt is located (ICES, 1995).

³ Most of the material presented here arises from a collection of studies undertaken as part of a collaborative research effort, for the 'Mopane woodlands and Mopane Worm project' (DFID project Z1042) between University of Zimbabwe, Veld Products Institute, Botswana; Southern Alliance for Indigenous Resource Use (SAFIRE) and Imperial College London. Although separate individuals worked on each study, common themes were explored and household surveys and data analysis were a collaborative effort. The following data sources are acknowledged - Gondo and Frost, 2003; Gwavuya, 2003 Musitini, 2003; Rutumaba, 2003 and Zhou, 2003

together with key informant interviews, focus groups discussions and observations. Data were collected on the demographic and socio economic characteristics of households, and involvement in mopane worm activities (harvesting, processing, consumption and marketing). Information on mopane harvesting and utilization referred largely to the December 2001 –January 2002 harvesting season since the March/April harvest did not materialise due to intense drought in southern Zimbabwe at the time. Views were also elicited about problems and constraints collectors experienced undertaking MWs activities, the contribution of mopane worms to peoples livelihoods and conflict issues relating to access and use of mopane resources. Formal survey data is also complimented with qualitative data from participatory livelihood analysis (PLA) undertaken in Gwanda, Chiredzi and Mwenezi (SAFIRE, 2002)

Figure 1 shows the location of the five districts in Zimbabwe for which detailed survey results and/or PLA data are available. All of these areas lie in marginal rainfall regions characterised as too dry for successful crop production without irrigation. Smallholder farmers grow crops in these areas despite the low rainfall. Sorghum and millets are common crops but many farmers grow maize, which is the preferred staple. Some households in study communities in Masvingo and Midlands grow cash crops, such as cotton, but overall cash cropping is not a major feature of dry land farming in rural communities located in the mopane belt. As in most rural communities, access to social and commercial services is constrained by the highly dispersed nature of settlements, the poor state of roads and the high cost of transport. Generally, study communities in Masvingo province face better market access due to their proximity to the Masvingo –Beitbridge trunk road linking Zimbabwe with South Africa. The communities in other areas faced greater difficulties and problems are most severe in the remote Kapeni village.

In Botswana, key informant interviews and community workshops were held with mopane harvesters in the villages of Lerala and Maunatlala of East Central Botswana during the 2001/2002 MW season. In addition, field surveys were conducted at four MW outbreak sites (Lechana, Tshokana River, Matopi village and Kutamgore) and over 107 people, including children were interviewed during December 2002. Information on harvesting activities was collected through interviews with individual harvesters and focus group discussions at campsites and while groups were harvesting. The project's MW cleaning drum was used to clean and, more importantly remove the spines of the group's ready dried MWs. Involving people in discussions and interviews while they were actively engaged in harvesting and processing, proved a good way of engaging peoples interest in project activities and information flowed freely (Taylor, 2003).

The demographic and socio economic characteristics of households surveyed in the study areas are given in Table 1. Average household size is around seven, with some variation between study areas. Women head or manage more than 50% of households, except in Ndiweni. Children under 18 years account for 52-63% of survey population, emphasising the significance of children in the domestic group. Land holdings varied both within and between study areas. Average land holding was above 5 acres (2.25 hectares) but cultivated area in 2001/2002 was generally only 70-75% of holding. Prevailing drought conditions and inadequate resources (particularly loss of draft power due to recurrent drought in the 90s) account for this. 26-39% of respondents

had no cattle, which is in line with prevailing situation in other communal areas.⁴ Donkey ownership is widespread and these animals supplement draft power. Almost all study households in Masvingo and Matabeleland South own goats, illustrating the importance of smallstock in drier rainfall areas. A plough is the most frequently owned asset and the proportion of respondents owning ploughs is generally higher than proportion whom own cattle, supporting the assertion that cattle ownership has fallen due to successive droughts. The widespread ownership of solar panels and radios among study communities in Masvingo and Matabeleland South underlines the prevalence of wage employment across the border. It has become the habit for youths to bring home at least a solar panel and a radio after a long period of work outside the country (Musitini, 2003).

Synthesis of findings

Who harvests MWs?

Key questions in the analysis of NTFPs relate to the typology of households that participate in collection, processing, consumption and marketing of NTFPs. Within the household it is of interest to understand the pattern of gender roles for different activities related to NTFPs. Within communities it is of interest to establish whether poorer households are more likely to participate in NTFP activities than wealthier households and whether households that receive larger sums of employment income are more or less likely to participate (Mutamba, Chirara and Frost, 2002).

In all the Zimbabwean study areas, there was widespread involvement in Mopane worm collection by all categories of households. In most communities, more than 80 % percent of households interviewed collected MWs during the 2001/2002 season. (Table 2). Some households not involved in collecting mopane worms belong to religious groups that forbid collecting of such products⁵. Widespread collection of MWs suggests that utilisation of this forestry resource is not limited to the poorest households but is an activity undertaken by all social classes. Limited income earning opportunities and low income levels throughout these communities encourage almost all households to take advantage of a 'free forest resource', particularly one that is available at a time of year when stored supplies of staples are finished and the new crop is only just planted.⁶ In PLAs in Gwanda, Chiredzi and Mwenezi, communities indicated that the poor form the largest groups of mopane worms harvesters and rich families hardly harvest MWs at all, since they are too busy making money from other means such as own shops and grinding mills (Safire, 2002). It was noted however, that such households often buy MWs from local collectors as part of their business. Better off households, who do not necessarily participate in MW collection, thus still participate in MW related activities.

⁴ Fewer households from one study area (Chilonga) were without cattle but this lower percentage may be due to selection bias that purposefully included some households who bought MWs from other collectors

⁵ For example, four households from Ndiweni not collecting belong to the Seventh Day Adventist Church. (Gondo and Frost, 2002). However, in one study area (Bangwe), people belonging to the Zionist church, which forbids the consumption of MWs, still participate in collection for the sole purpose of selling (Zhou, 2003).

⁶ A national income and expenditure survey estimated that 80% of the rural population in natural regions IV and V were poor and over 55% very poor (ICES, 1995).

Table 1. Demographic and socio economic characteristics of study communities in Zimbabwe

| | Matabeleland S. | | Masvingo | | | Midlands |
|----------------------------|-----------------|---------|------------------|----------------|-------------------|--------------------|
| | Matobo District | | Mwenezi District | Chivi District | Chiredzi District | Mberengwa District |
| | Kapeni | Ndiweni | Wards | Gwerima | Chilonga | Bangwe |
| No. of households Surveyed | 35 | 25 | 51 | 42 | 30 | 41 |
| Mean Household size | 7.2 | 6.1 | 7.0 (2.0) | 9.7 (3.6) | 7.5 (2.4) | 7.5 |
| Household Composition | | | | | | |
| Adult male (%) | 11 | 18 | 24 | 22 | 30 | 20 |
| Adult female (%) | 26 | 27 | 24 | 26 | 34 | 22 |
| Children under 18yrs (%) | 63 | 55 | 52 | 52 | 36 | 58 |
| Male headed (%) | 45 | 76 | 43 | 41 | 50 | 43 |
| Female managed (%) | 37 | 16 | 33 | 21 | 30 | 49 |
| Female headed (%) | 18 | 8 | 24 | 38 | 20 | 8 |
| Land holding (acres) | ? | ? | 6.5 | 7.4 | 5.0 | na |
| land cultivated 2002 | ? | ? | 4.2 (1.45) | 5.7 (2.1) | 3.5 (1.46) | na |
| mean (std dev) | | | | | | n |
| Mean cattle numbers | ? | ? | 4.7 (3.6) | 4.0 (3.9) | 4.8 (3.4) | ? ? |
| Mean goat holding | | | 4.6 (3.5) | ? ? | 13.6 (5) | ? ? |
| Non cattle owners (%) | ? | ? | 26 | 31 | 13 | 39 |
| Donkey owners (%) | ? | ? | 63 | 88 | 72 | 53 |
| Goat and sheep owners (%) | ? | ? | 84 | 100 | 97 | 63 |
| Households with no lvstk | ? | ? | 12 | 0 | 3 | na |
| Plough ownership (%) | ? | ? | 69 | 79 | 83 | 73 |
| Scotch cart ownership (%) | ? | ? | 35 | 60 | 60 | 27 |
| Wheel barrow ownership (%) | ? | ? | 57 | 32 | 83 | 51 |
| Bicycle ownership[(%) | ? | ? | ? | 59 | 67 | 22 |
| Solar panel ownership (%) | ? | ? | ? | 48 | 77 | 5 |
| Radio ownership | ? | ? | ? | 62 | 100 | 54 |

The level of involvement of different categories of people in harvesting, processing and marketing by gender and age is shown for four study areas in Tables 3-5. Some interesting facts emerge. Collection and processing of MWs are traditionally regarded as women's tasks.⁷ Although women and children still predominate, participation by men and particularly youth is extensive. For instance, in Mwenezi, more than 90% of male respondents between the ages of 12-17yrs and about 30% male adults were involved in collecting MWs (Table 2). In Chilonga 59 % of adult males aged 18-33yrs collected MWs in the 2001/2002 season and about two thirds of the youth. Not all males collecting MWs participated in the processing (Tables 2 and 3). Evidently this task is still regarded as women's' work by some men! In both Kapeni and Ndiweni nearly three quarters of men were engaged in mopane worm activities (Table 4).

Table 2. Involvement in Mopane worm harvesting and utilization, 2001/2002

| | | Matabeleland South | | Masvingo | | | Midlands |
|------------------------------|---|--------------------|-----------------|------------------|-----------------|-------------------|--------------------|
| | | Matobo District | | Mwenezi District | Chivi District | Chiredzi District | Mberengwa District |
| | | Kapeni N=35 | Ndiweni N=25 | Mwenezi N=51 | Gwerima N=42 | Chilonga N=30 | Bangwe N=41 |
| Collecting | % | 100 | 84 | 96 | 100 | 80 | 76 |
| Collecting but not consuming | % | 0 | 0 | 10 | 7 | 0 | 22 |

Table 1. Proportion of residents involved in MW activities by gender and age composition, Mwenezi study area, Zimbabwe, 2001/2002

| MW activity | Adults Over 33yrs | | Adults 18-33yrs | | Youth 12-17yrs | | Youth 5-11yrs | |
|---------------------------|-------------------|-----------|-----------------|-----------|----------------|-----------|---------------|-----------|
| | M N=22 | F N=39 | M N=21 | F N=28 | M N=39 | F N=40 | M N=17 | F N=17 |
| Collection only | 27.3 | 5.1 | 4.7 | 3.5 | 30.7 | 2.5 | 29.4 | 0 |
| Collection and processing | 4.5 | 89.7 | 28.6 | 92.9 | 66.7 | 92.5 | 23.5 | 70.6 |
| Selling | 4.5 | 76.9 | 33.3 | 75.0 | 64.1 | 70.0 | 17.6 | 35.3 |
| Buying | 0 | 25.6 | 14.3 | 25.0 | 12.8 | 12.5 | 5.9 | 5.9 |
| Consuming | 95 | 94.9 | 76.2 | 85.7 | 92.3 | 87.5 | 82.4 | 70.6 |

⁷ Hobane (1995) established that collectors of mopane worms are mostly women and children. Results from her survey revealed that 91% of the collectors are women.

Figure 1. Map of Zimbabwe study areas

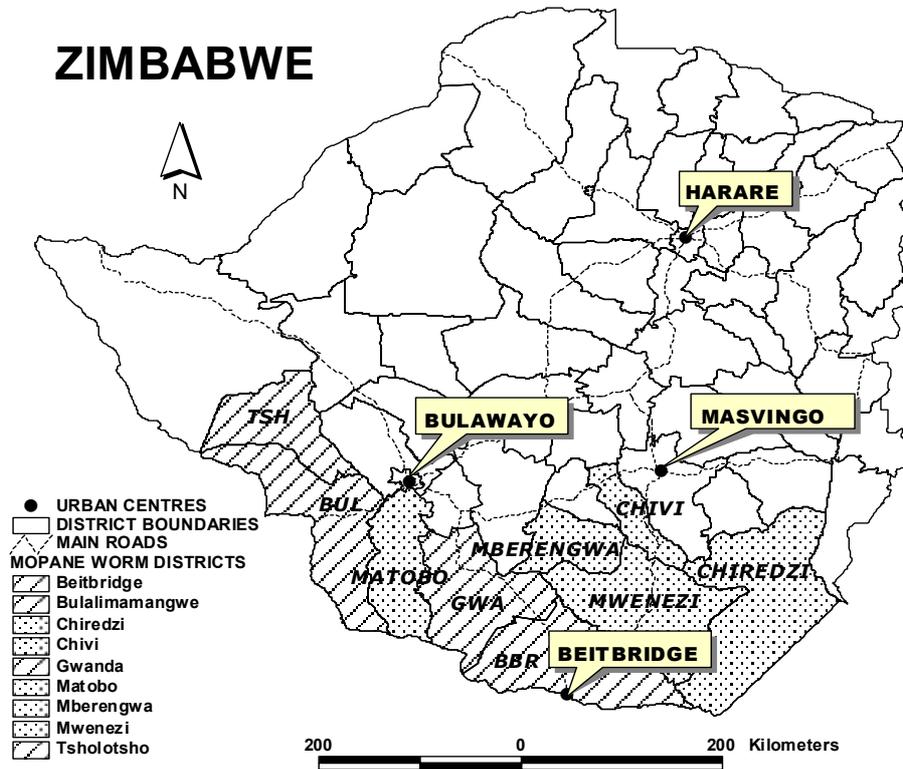


Table 2. Involvement of residents in MW activities by gender and age composition, Chiredzi, study area, Zimbabwe, 2001/2002

| MW activity | Adults Over 55yrs | | Adults 33-54yrs | | Adults 18-33yrs | | Youth | |
|-------------------------------------|-------------------|------|-----------------|------|-----------------|------|-----------|----------|
| | M | F | M | F | M | F | 12-17 yrs | 6-11 yrs |
| | N=8 | N=10 | N=20 | N=27 | N=41 | N=40 | N=47 | N=25 |
| Collection and processing only | 4 | 10 | 10 | 13 | 5 | 37.5 | 64 | 40 |
| Collection processing and Marketing | 10 | 50 | 25 | 74 | 59 | 42.5 | 5 | 0 |
| Marketing only | 13 | 10 | 40 | 13 | 37 | 2.5 | 0 | 0 |
| Buying | 33 | 30 | 60 | 57 | 62 | 40.0 | 0 | 0 |
| Consumption | 61 | 70 | ?? | 91 | 70 | 77.5 | 61 | 63 |

In the harsh economic climate of Zimbabwe, rural families are coming under increasing economic strain. Recurrent drought, widespread unemployment and rapid inflation have undermined households' ability to meet basic needs. Income from selling mopane worms is seen by an increasing number of men and youth in addition to women as an available way of alleviating financial problems. Often youth collect and sell MWs to raise essential cash for school fees and stationary. The high level of involvement of children in mopane worm collection illustrates the pervasive role of children in the labour force. In rural areas it is common for children to 'help' their parents with routine chores and 'productive' activities from an early age (Mangoma and Bourdillon, 2001). The December MW harvest occurs at a time favourable to parents for receiving help from their children because the harvest coincides with the school holidays. The same is often true for the April harvest. The involvement of young children in MW collection, in contrast to youth, is seldom an individual strategy, rather it occurs within the framework of the household.

In the Botswana field survey 96% of harvesters were women. 74% percent of people involved were adults between the ages of twenty one and sixty, 8% were over 61 years, and fourteen percent were young people between the ages eleven and twenty. About 10 percent of the people involved were children less than 10 years who were brought primarily to assist with campsite based activities while mothers were out collecting mopane worms. These activities included looking after babies and raking over the MWs that were spread out to dry, as well as guarding them against hungry cows and the possibility of rain. (Taylor, 2003). That MW collection in Botswana has remained the preserve of women is probably because Botswana men, in contrast to their Zimbabwean counterparts have more attractive income earning opportunities due to the strength of the economy.

Zimbabwean data disaggregated by wealth group and status of household head show that in some areas (Kapeni, Ndiweni, Chivi, and Mberengwa) the extent of

involvement in MW collection, measured by quantity collected, was higher for poorer than better off households (see Tables 5 and 6) and also tended to be lower for female managed households, (presumably because they have relatively secure incomes from husbands working elsewhere) than either male headed or female managed households (Table 7). But, these differences were not significant and no firm conclusions could be drawn on the typology of households that participate in collection.

Table 3. Extent of involvement of different categories of people in the use of mopane worms, in two villages in Matabeleland South, Zimbabwe, 2001/2002

| | Kapeni | | | Ndiweni | | |
|-------------------------------|--------|-------|------|---------|-------|------|
| | Youth | Women | Men | Youth | Women | Men |
| Individuals interviewed | 160 | 66 | 27 | 80 | 45 | 27 |
| Involvement in use of MWs (%) | 54.4 | 98.5 | 74.1 | 46.3 | 60 | 74.1 |

Table 4. Quantity of MW harvested by category of household in Matobo District, 2001/2002, Kg per household

| Social Class | Kapeni N=35 | Ndiweni N=21 |
|-----------------------|----------------|-----------------|
| All households | 65.5 | 49.4 |
| Better Off households | 48.7 | 28.5 |
| Poor households | 74.3 | 52.9 |

Table 5. Collection of MWs by wealth category, 2001/2002, mean Kg per household

| Wealth Category | Masvingo | | | Midlands |
|-----------------|------------------|------------------|------------------------------|--------------------|
| | Mwenezi District | Chivi District | Chiredzi District | Mberengwa District |
| | Mwenezi N=51 | Gwerima N=42 | Chilonga N=30 | Bangwe? N=41 |
| Bottom 25% | 53.8 (47.5) | 228.5 (58.6) | 65.4 80.4 85.8 | 36.5 |
| Next 25% | 37.0 (44.0) | 224.1 (90.4) | | 37.9 |
| Next 25 % | 48.9 (39.6) | 172.2 (103.9) | | 27.6 |
| Top 25% | 56.3 (53.6) | 222.0 (103.9) | | 14.4 |

Standard deviation in parenthesis

Note: Wealth groups in Chilonga were defined in thirds

Where are mopane worms harvested?

Mopane worms are collected from mopane woodlands under a variety of land tenure and access arrangements. In Zimbabwe, mopane trees are located around homesteads (individual and open access), in communal grazing areas (open or managed access), on large-scale commercial farms (private managed access) and on state farms (public managed access). It is generally assumed that in Zimbabwe the bulk of MWS are harvested from communal woodlands but survey data casts serious doubts on this assertion indicating instead that mopane woodland on formerly large scale commercial farms is a very important source of the product (Figure 2). In Botswana, much of the mopane belt is located in tribal areas where customary law allows anyone to harvest.

Information was gathered from households on where they collected mopane worms. Although some households collected from more than one source each study community generally had a dominant source from which the bulk of production was harvested (Table 8). In both villages in Matobo, mopane worms are abundant locally during outbreaks. Nevertheless in the 2001/2002 season, more than half the residents of Ndiweni village, to satisfy their requirements, harvested on adjacent commercial farms and state land, where mopane tree cover is more extensive. Only 13% harvested around their homesteads, while 30% collected mopane worms from the communal grazing area. In contrast, residents of Kapeni village harvested mopane worms solely from around their homesteads (92%) or in the communal grazing area (8%) (Gondo and Frost, 2003). Thriving mopane woodlands on commercial farms in Mwenezi and Chivi and Mberengwa districts favour widespread outbreaks that attract villagers from surrounding communal areas and outsiders.⁸ A high proportion of villagers in these districts identify commercial farms as their main source of MWs although MWs were also collected from around homesteads and the communal grazing area (Table 8). In contrast, people in Chilonga relied on mopane worms from state forest woodland (Epungeni Forest) for nearly three quarters of the total harvest (Table 9). In this community commercial farms accounted for less than 15% of MWs collected.

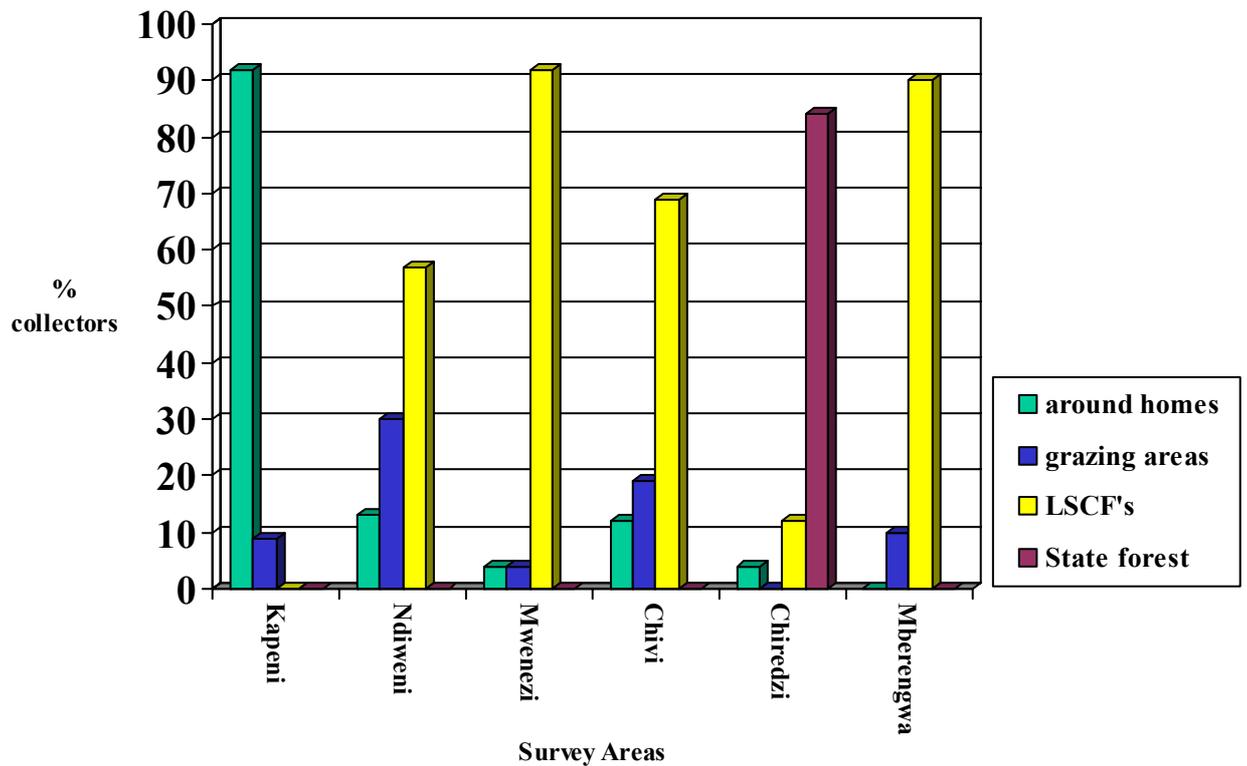
The need for some communities to collect MWs on land controlled either by private landowners or the State, adds considerably to the cost of harvesting mopane worms (Gondo and Frost, 2002). People sometimes travel considerable distances to these sites and often camp for several days in the collection area while harvesting. Collectors are also often required to pay a harvesting fee to the owner of the land.

Since the MW outbreaks coincide with busy periods in the agricultural season, households face conflicts between MW collection and agricultural activities and have to make choices in allocating labour.⁹ The problem is most severe for households travelling to collection sites outside the community. In recent seasons priority has been given by many households to mopane worm collection. Where feasible a few family members remain at home to take care of planting and weeding whilst others collect MWs. In extreme cases however, planting is delayed (Gwavuya, 2003). A common strategy, when collection areas can be visited within a single day is to collect

⁸ For example, in Chivi District, outside collectors (relatives of locals and unknown people) come from towns such as Beitbridge, Masvingo and Chirdezi and other rural areas (Ngundu, Nyilkavanhu and Rutengwa (Musitini, 2002).

on traditional non working days. In Mwenenzi district these are Thursdays and Sundays. (Gwavuya, 2003). In addition where MWs are abundant locally harvesting around homesteads and from the grazing area takes place in the afternoon once agricultural tasks are complete.

Figure2. Main sources of Mopane Worms by Survey Area, Zimbabwe



⁹ In some seasons, due to the sporadic nature of outbreaks, the MW harvest does not begin until after planting which lessens activity clashes. But, generally labour is a constraint and households have to make choices about prioritising activities

Table 6. Collection of MWs by type of household head, 2001/2002, mean Kg per household

| Status of Head | Matabeleland South Matobo District | | Masvingo | | |
|----------------|---------------------------------------|-----------------|------------------|------------------|-------------------|
| | | | Mwenezi District | Chivi District | Chiredzi District |
| | Kapeni N=35 | Ndiweni N=25 | Mwenezi N=49 | Gwerima N=42 | Chilonga N=30 |
| Male headed | na | 13.1 | 54.7 (48.2) | 208.2 (77.4) | 82.0 (53.36) |
| Female managed | na | 16.8 | 34.5 (47.2) | 269.7 (88.3) | 35.3 (57.3) |
| Female headed | na | 25.7 | 58.5 (49.2) | 184.5 (103.6) | 128.0 (43.04) |
| Sample mean | na | | 49 (48.3) | 217 (96.4) | 77.2 (60.7) |

Standard deviation in parenthesis

Table 7. Collection of MWs from different sources and share of collectors who identify specific area of MW as main source of harvest, Zimbabwe, 2001/2002

| Source of Mopane worms | Matabeleland South Matobo District | | | | Masvingo | | | | | | Midlands | |
|------------------------|---------------------------------------|-----------|---------|-----------|------------------|-----------|----------------|-----------|-------------------|-----------|--------------------|-----------|
| | Kapeni | | Ndiweni | | Mwenezi District | | Chivi District | | Chiredzi District | | Mberengwa District | |
| | % | % main | % | % main | % | % main | % | % main | % | % main | % | % main |
| Around Homes | Na | 92 | Na | 13 | 59 | 4 | Na | 12 | 25 | Na | 19 | 0 |
| Grazing Areas | Na | 9 | Na | 30 | 37 | 4 | Na | 19 | 8 | Na | 16 | 10 |
| LSCF's | 0 | - | Na | 57 | 96 | 92 | 88 | 69 | 27 | Na | 90 | 90 |
| State forest | 0 | - | 0 | - | 18 | 0 | 0 | 0 | 91 | Na | 0 | 0 |

In Botswana, collectors of mopane worms include people living in villages and cattle posts near outbreaks and outsiders who travel to outbreak sites. Distances traveled vary greatly. The longest distance traveled to the outbreak site was 120kms. The shortest was within a hundred metres of one harvester's back yard (Taylor, 2003).

The variety of sources of MWs and variability in their importance between communities adds to the complexity of the issues that need to be addressed when

considering innovation development. Resource management options and livelihood constraints.

How are MW harvested and processed?

Mopane worms are collected from both the ground and from trees, usually the 5th instar stage, and the last stage before pupation. Mopane worms collected from the ground, immediately prior to pupating generally have little digested food in their guts and are easier to process. However, most MWs are collected from the trees while still feeding and so have to be processed thoroughly to remove all undigested material from their gut (Gondo and Frost, 2002). People usually check for waste products below trees to identify the caterpillar's presence. Harvesting and processing of MWs throughout the mopane belt is still pretty much traditional but widespread destruction of trees in order to speed up the collection process is increasingly identified as a problem (SAFIRE, 2002). No improved technological devices were identified during fieldwork beside the use of gloves to protect hands from the sharp spines during collection and degutting. The MW is removed from the tree by holding it at one end (either by the head or by the rear end) and pulling it to peel it off the branch. This way the suction force exerted by the suction pads on its legs is easily broken (Taylor, 2003).

The bulk of MWs are disemboweled by squeezing them by hand to expel the guts while walking around harvesting. Fifty percent of the harvesters in the Botswana survey used gloves during harvesting whilst a further 20% of the collectors wrapped their fingers (especially thumbs) with pieces of cloth (Taylor, 2003). In Zimbabwe, few collectors use gloves since these are expensive locally relative to people's income. People try to avoid the discomfort of sharp spines by using home made protection (strips of plastic or cloth) or using bottles as rollers or crushing the MWs with sticks (Table 10). The latter methods are common among those who collect in bulk some of whom are also reported to degut by starving MWs for about 2-3 days in a large sack (Musitini, 2002). A recent practice adopted by some collectors is to place MWs in a pit, cover with hot coals and allow the build up of heat to expel the gut contents. (Gwavuya, 2002).

Table 8. Quantity of MW collected in Kgs from each source, Chiredzi rural area, Zimbabwe 2002

| Source of mopane worm | Total Quantity collected | | % share |
|-----------------------------|--------------------------|---------|---------|
| | 20l tins | Est Kgs | |
| Around homesteads | 29 | 173 | 17.6 |
| Grazing area | 18 | 108 | 4.6 |
| Large scale commercial farm | 56 | 336 | 14.5 |
| State Forest (Epungeni) | 283 | 1698 | 73.3 |
| Total | 386 | 2316 | 100.0 |

After degutting MWs are preferably rinsed with water before cooking. Where there is a shortage of water MWs are cooked without washing. Among Botswana harvesters about 10 % of MWs were cooked without washing (Taylor, 2003). In the Zimbabwean studies the proportion of unwashed MWs was slightly higher (Table 10).

People have various ways of cooking MWs but the most common are either boiling in salt water and then sun drying or roasting over a bed of hot coals then sun drying. The latter method is faster, uses less firewood and saves labour which is an advantage in the rainy season when a common problem is delays in drying due to wet and overcast days and shortage of firewood. Collectors participating at a community workshop in Masvingo indicated that MWs that are boiled and sun dried are preferred, particularly by women for storing for home use (SAFIRE, 2002). At the same workshop, people involved in roasting complained of the danger of burns from tending MWs over hot coals.

Processing is often done in the collection areas, especially in Botswana where collectors travel to outbreak sites and among Zimbabwean villagers who camp in collection areas. If people live close to the collection areas MWs are normally carried home for processing. The widespread practice of processing in collection areas has implications for the nature of technical innovations that are likely to be adopted by collectors. Equipment that is bulky and heavy to transport is less attractive than lightweight innovations.¹⁰

How much is harvested?

Variability in the extent of harvests both within and between communities and from year to year is clearly demonstrated from available survey data (Figure 3 and Tables 11-12). Among six Zimbabwean communities average MW production ranged from 36kg– 217kgs per household in the 2001/2002 season.¹¹ The community with the highest average (Gwerima, Chivi District) is well known locally for good MW outbreaks on adjacent commercial farms. In addition, there is considerable variation in output between households as demonstrated by high standard deviations about the mean (Table 12). An additional source of unpredictability is the episodic and unreliable nature of MW outbreaks which leads to variations in both the location of outbreak sites and extent of MWs from season to season. This is well exemplified with harvest data for four seasons from two villages in Matobo (Table 12).

Harvesters in Botswana, in a good season, reported harvesting between two – four 20L containers a day of degutted worms per person and ended up with up to seven 25kg bags (350kgs) of dried worms at the end of the harvesting season. In a bad harvest such as the current one (2002/2003), an individual may fill only one bucket a day and end up with two or at the most, three bags (75kgs) at the end of the harvesting period (Taylor, 2003). The extent of MW harvesting by individual households in Botswana is considerably above that of most households in Zimbabwean study communities. Whatever the explanation (likely relative abundance of MWs and/ or less competition for collection in Botswana) these differences in operating scale present challenges when considering potential innovations to enhance the livelihood contribution of this forest resource. Further, variations in level of harvesting indicate that the contribution of Mopane Worms to rural livelihoods is likely to vary both between communities and from year to year.

¹⁰ Field trials and community workshops in Botswana confirm this finding as producers showed a greater interest in lightweight drying racks than bulky cooking equipment (Taylor, 2002).

¹¹ 20Litre buckets are the most common local measures for MWs. Data has been converted into kgs based on an estimate of 6kgs per 20 litre buckets.

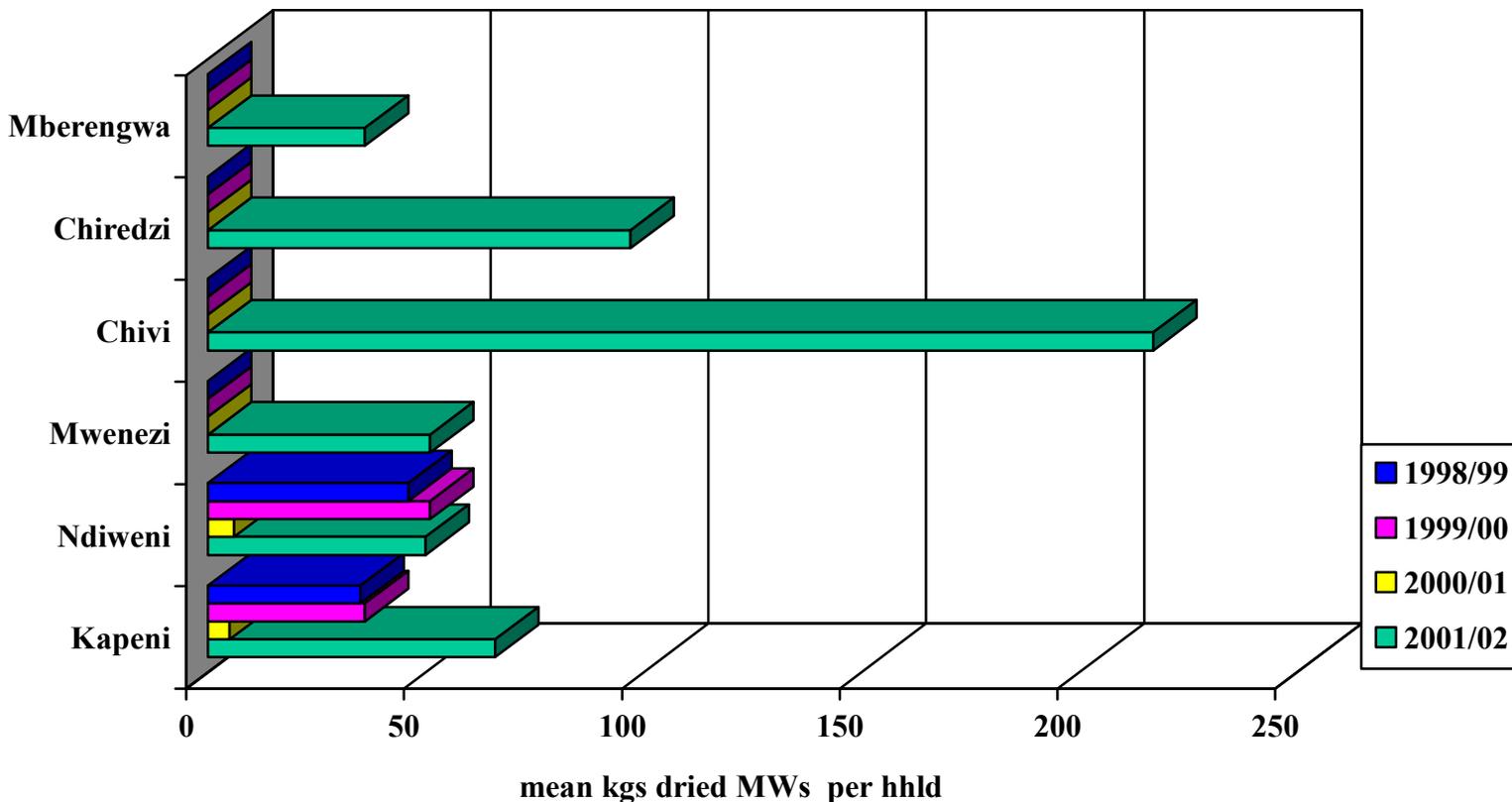
Table 9. MW Processing methods, in two survey areas 2001/2002

| Processing methods | Masvingo | |
|--------------------------|------------------|----------------|
| | Mwenezi District | Chivi District |
| | Mwenezi | Gwerima |
| Degutting (% collectors) | | |
| Hand | 74 | 29 |
| Bottles | 14 | 42 |
| Sticks/stones | 4 | 24 |
| Starving MW | 0 | 5 |
| Charcoal heat | 18 | 0 |
| Washing (%collectors) | | |
| River water | 17 | 33 |
| Boiled water | 65 | 48 |
| No washing | 18 | 19 |
| Cooking (% collectors) | | |
| Boil then sun dry | 65 | 64 |
| Roasting | 33 | 36 |
| Clay pot on fire | 2 | 0 |

Table 102. Average quantity of MWs harvested in study areas (Kgs per household), Zimbabwe 2001/2002

| | Matabeleland South | | Masvingo | | | Midlands |
|--------------------------|--------------------|---------|------------------|----------------|-------------------|--------------------|
| | Matobo District | | Mwenezi District | Chivi District | Chiredzi District | Mberengwa District |
| | Kapeni | Ndiweni | Mwenezi | Gwerima | Chilonga | Bangwe |
| Average all hhlds | 69 | ? | 49 (48.3) | 217 (96) | 77 (60.1) | 27 |
| Average collecting hhlds | 69 | 52 | 50.8 (48.3) | 217 (96) | 97 (52.0) | 36 |

Figure 2. Quantity of Mopane Worms Harvested by Survey Area



Why are mopane worms harvested?

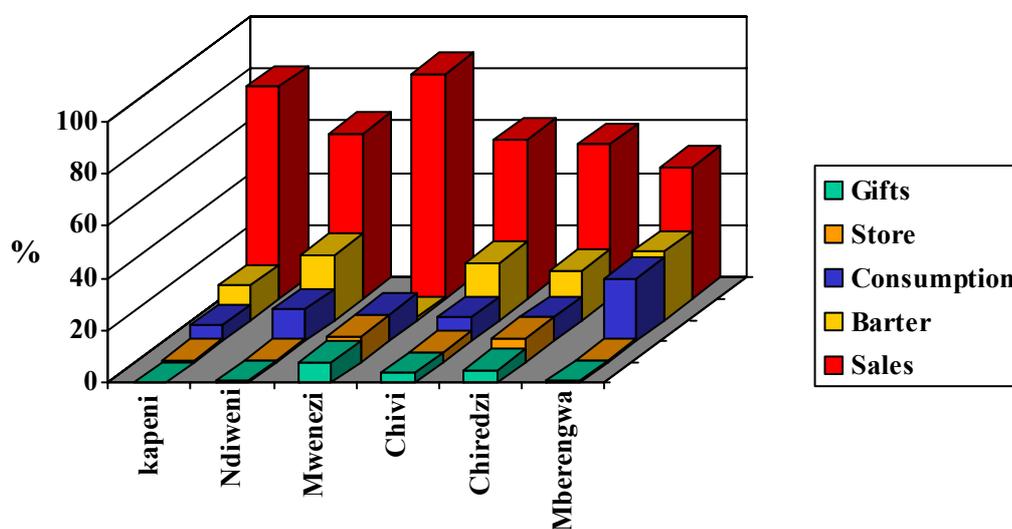
Whereas harvesting of mopane worms was traditionally a subsistence livelihood activity, undertaken largely for nutritional purposes, increasing commercialisation of the resource has been taking place throughout the mopane belt in recent years (Hobane, 1994, 1995; Rebe, 1999 quoted in Kozaniya and Frost, 2002). Trading (cash sales and barter exchange) accounted for a large proportion (between 76- 94%) of MWs collected in communities studied in Zimbabwe (Figure 4 and Table 13). The distribution of MW output in Chilonga, Chiredzi district typifies the pattern of utilization. Following the 2001/2002 harvests, 59% of MW stocks were sold for cash and a further 19% were exchanged for goods, 9% were consumed at home , 5% were given as gifts and at the time of the survey (July 2002), 10% were held in store for own use or sale (Rutamba, 2003). These results contrast with those obtained by Hobane in the early 90s who found that over three successive years (1990-1992), only 30-38 % of stocks were sold, 24-36% exchanged, 28-39% consumed and 2-10% given to others (Hobane, 1994, quoted in Gondo and Frost, 2002).

Table 113. Average quantity of MWs harvested over four years in Kapeni and Ndiweni villages, Matobo District, Zimbabwe, Kgs per household

| Harvesting Season | Kapeni | Ndiweni |
|-------------------|--------|---------|
| 1998/99 | 35 | 46 |
| 1999/00 | 36 | 51 |
| 2000/01 | 5 | 6 |
| 2001/02 | 66 | 50 |

Source: Calculated from Tables 6 and 7, Gondo and Frost (2002)

Figure 3. Utilisation of Mopane Worms, by Survey Area



Increased commercialisation of mopane worms in Zimbabwe may be a consequence of the economic hardship that followed economic structural adjustment and the contraction of economic growth, especially in the rural areas, compounded by the severe droughts of the late 1980s and early 1990s. These events adversely affected the poorer families, particularly in areas of low agricultural potential, leading those with limited resources to seek other sources of income, such as from the harvesting, processing and sale of NTFPs (Cavendish, 1999, quoted in Mutamba, Chirara and Frost, 2002). Further, in urban areas, poverty levels have increased in recent years. This has resulted in a strong demand for relatively low cost protein as relish ingredients to accompany the traditional staple (Stack and Poole, 2003).¹² Surveys of formal and informal retail outlets selling MWs indicate strong urban demand for MWs and that the business is profitable: the main problem in the market is within and between season variations in supply.

How do rural collectors market MWs?

Dried MWs from the rural areas increasingly find their way into both the formal and informal national distribution network via a wide variety of marketing chains (Kotsanyi and Frost, 2002 and Stack, 2002). Mopane worms reach urban markets via a number of pathways (Collectors, rural traders urban based middlemen) and are marketed in a wide variety of places including urban bus termini, open markets, roadside vendors, wholesalers, supermarkets, and tuck shops. In some instances the marketing chain is quite long. Generally, rural collectors play a limited role in upstream marketing activities and wait for traders and middlemen to purchase the dried mopane worms and move the product from the collection areas to the point of sale (predominantly urban areas but also cross border markets). As MWs move up the marketing chain the product changes little in form, except that some vendors and wholesalers pack loose MWs in plastic bags for resale. Most intermediaries simply move the product around in space and time.

Sales from home or at local centres account for the bulk of MW trading by rural producers. Only a small proportion of collectors market the product outside of their local community (Figure 5 and Table 14). For example in Mwenezi, in the 2001/2002 season, 24 % of cash sales took place at the homestead, 59% at a local centre and only 17% at an urban location. The participation of collectors in up stream marketing activities appears to vary with market access. In Kapeni, which is located in a remote area of southern Zimbabwe, all sales were local and no collector in the survey had marketed MWs outside the community. In contrast, in Chiredzi which is accessible to the main trunk road to the border town of Beitbridge, 55% of cash sales of MWs were transacted in an urban centre and 19% across the border. Clearly market access determines how close collectors get to the final point of sale. In turn, this often effects net returns. Price data indicate that the average net price (after allowing for marketing costs) varies by location of sale and is significantly higher for sales across the border and generally (but not always) higher in urban centres than local centres.¹³

¹² MWs together with beans and kapenta (small dried fish) are favoured cheaper alternatives to meat for low income urban consumers. In, Mbare Musika (open air urban market in a high density area in Harare) these three foods are often displayed side by side on the same stall, where they can be purchased by the cup (< 100grams) for a similar price. (In January 2003, the prevailing price was Z\$300 per cup).

¹³ For instance, it has been noted that collectors who travel by bus and sell their MWs on arrival at an urban bus termini often realize no more and sometimes less than if they had sold MWs locally. So it is

For instance, in the 2002 season Chiredzi collectors selling MWs realised on average Z\$97 per kg at the collection area, Z\$132 per kg MWs for sales at a local centre, Z\$ 205 per kg for urban market sales and Z\$409 per kg for MWs sold across the border in South Africa (Rutamba, 2002).

Figure 4. Quantity of Mopane Worms Sold by Producers in Different Markets by Survey Area

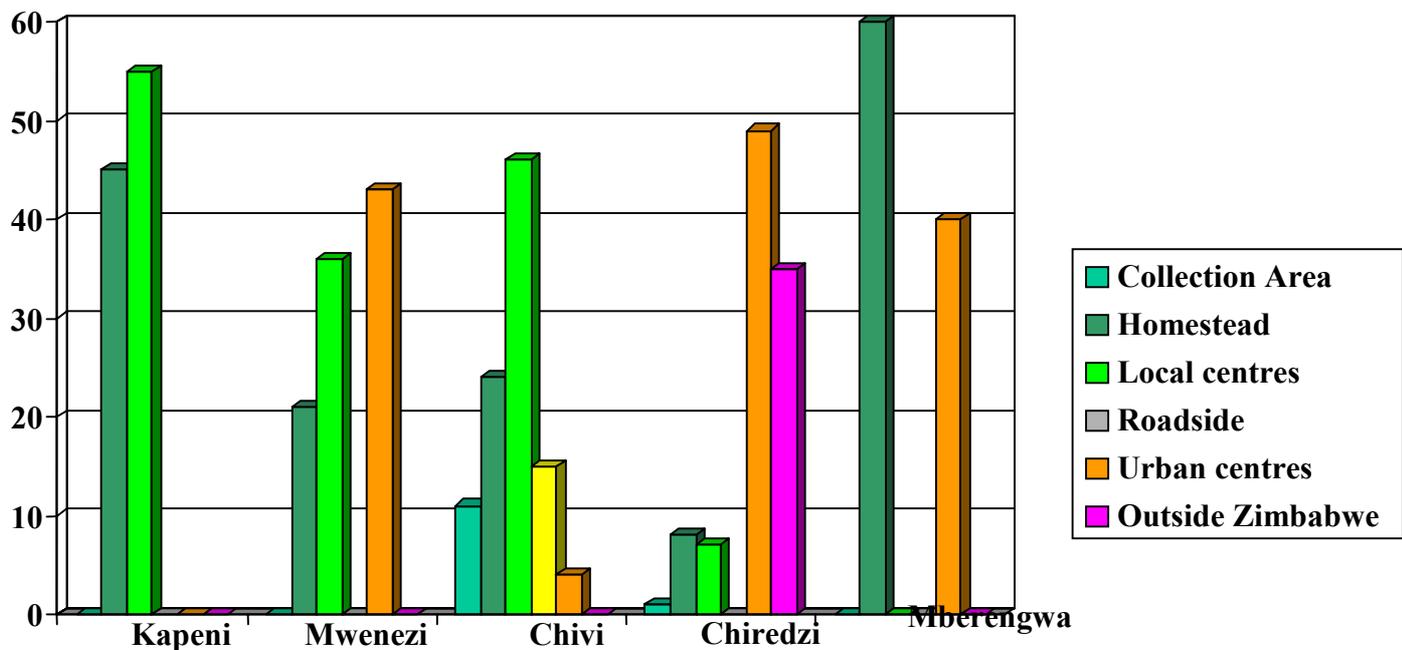


Table 12. Mopane worms utilization, study areas, Zimbabwe, 2001/2002

| Use of MWs | | Matabeleland South | | Masvingo | | | Midlands |
|------------|---|--------------------|---------|------------------|----------------|-------------------|--------------------|
| | | Matobo District | | Mwenezi District | Chivi District | Chiredzi District | Mberengwa District |
| | | Kapeni | Ndiweni | Mwenezi | Gwerima | Chilonga | Bangwe |
| Sales | % | 81 | 63 | 86 | 61 | 59 | 50 |
| Barter | % | 13 | 25 | 1 | 22 | 19 | 26 |
| Gifts | % | 0 | Neg | 8 | 4 | 5 | Neg |
| Consumed | % | 6 | 12 | 10 | 9 | 9 | 24 |
| In storage | % | Neg | Neg | 10 | 4 | 9 | Neg |

not always the case that urban markets are more lucrative than local ones. Some collectors come to town to sell MWs because there is no trader in their community at the time they want to sell. Having expended a bus fare they do not want to return home without selling their produce and therefore accept whatever price, the buyers at the bus termini are offering.

Households who bartered MWs for other goods (such as maize grain, clothing, kitchen utensils) generally undertook these transactions within the local community with the bulk of barter deals occurring at the homestead. For example, in Chiredzi, 65% of barter transactions took place at the homestead, 24% at local centres and 10% in the Mopane woodland (Musitini, 2002). Bartering is not a common form of exchange in urban centres.

Most collectors dispose of MWs destined for the market as soon as possible after harvest. Few collectors store MWs for sale out of season despite the considerable financial attraction of doing so. A study of off-season marketing of MWs indicates prices for MWs rise considerably later in the year and that collectors could enhance their returns from MWs by retaining some in storage for marketing off-season.¹⁴ Currently the storage function is undertaken much further up the marketing chain, primarily by wholesalers and traders at the final point of sale (Rutamba and Stack, forthcoming).

For MW producers to capture a greater share of the market value of the worms they need to be more involved in adding value by, for instance, moving MWs closer to the point of sale or by storing MWs in anticipation of profitable off season prices.

How important are MW to rural livelihoods?

Mopane worms are harvested for both home consumption and sale (including barter). When asked to rank their motives for collecting MWs the vast majority of Zimbabwean households identify the opportunity to earn cash income as their prime motive and food uses as secondary (Table 15). However, it is the timing of this income earning opportunity, during the early months of the rainy season which is traditionally the hungry period, which is a key factor in understanding the role MWs play in rural livelihoods. Survey data confirm that MWs are seldom the most important source of household income, particularly among livestock owning households, but that the prime motivation for MW collection is the opportunity they provide to earn cash or obtain exchange good to fill seasonal cash flow gaps, especially for those households with limited remittance income (SAFIRE, 2002). This is supported by survey information on how households use income from MW sales and the importance of MW income in funding those purchases. Table 16 shows the percentage of households using MW income for different purposes and the percentage of households who identified MW income as the main (1st) source of income for such expenses. MW income was the main source of funds primarily for purchasing grain, other foodstuffs, paying school fees and obtaining (buying or bartering) kitchen utensils. Although a large number of households indicated that some MW income was spent on agricultural inputs, medical expenses, travel, buying clothes or invested in livestock, MW income is rarely the most important source of funding for these expenditures. The type of goods that MW income is spent on also reflects the high level of participation of women and youths in MW collection.¹⁵ For the women, MWs provide an opportunity to earn money for family provisioning and for children

¹⁴ Poor rural dwellers reasons for not storing MWs are often very rational, such as a pressing cash need to cope with seasonal food shortages and to pay for things like school fees.

¹⁵ In a ranking of livelihood activities, people in Gwanda, Chiredzi and Mwenezi identified livestock sales as the most important livelihood sources. However they also mentioned that crops are key to subsistence in the area but there is hardly any surplus to sell. Particularly women rank Sale of MWs above crafts and small scale businesses as a source of cash. (SAFIRE, 2002).

and youths; participation in MW activities (either as an individualised economic activity or as part of the family group) provides an opportunity to earn cash to meet schooling and stationary needs.

The contribution of mopane sales to household livelihoods is difficult to assess without comprehensive data on the contribution (in cash or kind) of all livelihood activities. However, an indication of their contribution can be assessed by estimating the cash income derived from the sale of such products relative to other income sources. The widely observed phenomenon that income from forestry products tends to be of greater importance to poorer socio economic groups is confirmed by survey data. In Mwenezi District for instance, mopane sales accounted for nearly forty percent of reported cash income for the bottom 25% of households, twenty percent of income for the middle 50% of households and less than 4% of cash income received by the top quartile.¹⁶

Table 13. The number and proportion of sales made at different locations, in study areas, Zimbabwe, 2001/2002

| | Matabeleland South Matobo District | | Masvingo | | | | | | Midlands | |
|-----------------|---------------------------------------|----------|------------------|----------|----------------|----------|-------------------|----------|--------------------|----------|
| | | | Mwenezi District | | Chivi District | | Chiredzi District | | Mberengwa District | |
| | Kapeni | Ndiweni | Mwenezi | | Gwerima | | Chilonga | | Bangwe | |
| Place of sale | % no. | % no. | % no. | % qty | % no. | % qty | % no. | % qty | % no. | % qty |
| Collection Area | 0 | Na | 0 | - | 10 | 11 | 2 | 1 | 0 | - |
| Homestead | 45 | Na | 24 | 21 | 38 | 24 | 6 | 8 | 85 | 60 |
| Local centres | 55 | Na | 59 | 36 | 38 | 46 | 11 | 7 | 0 | - |
| Main roadside | 0 | Na | 0 | - | 13 | 15 | 0 | 0 | 0 | - |
| Urban centre | 0 | Na | 17 | 43 | 10 | 4 | 55 | 49 | 15 | 40 |
| Outside country | 0 | Na | 0 | 0 | 0 | 0 | 19 | 35 | | |

Table 14. Main reason for collecting MWs , three study areas, Zimbabwe, 2001/2002

| Main Reason for collecting MWs (% collectors) | Masvingo | | Midlands |
|---|------------------|----------------|--------------------|
| | Mwenezi District | Chivi District | Mberengwa District |
| | Mwenezi | Gwerima | Bangwe |
| Food in season | | 7 | 7 |
| Food out of season | 16 | 0 | 0 |
| Sell for cash | 84 | 67 | 93 |
| Exchange for goods | 0 | 24 | |
| Gifts to relatives | 0 | 2 | Na |

¹⁶ Households were placed into wealth categories using information on livestock ownership (cattle and smallstock) which are recognized by local communities as an indicator of wealth status.

Harvesters in the Botswana study identified collection of MWs to be a vital source of income despite outcry over low buying prices. Nevertheless, all harvesters are involved in other forms of livelihood including cropping, rearing livestock, selling traditional beer and working for the Drought Relief programme. Harvesters in Botswana also use the proceeds of MW sales for various household supplies including food, school uniforms and fees, buying household utensils, reinvestment in livestock, vending and property paying medical expenses (Taylor, 2003).

What are the differences in involvement in MW activities among various types of households within communities and between different study areas?

In absolute and value terms, poorer socio-economic groups in some communities (Kapeni, Ndiweni, Mwenezi) harvested more MWs than better off households in 2001/2002. However there is evidence that some of the value of the higher harvest is lost through lower prices achieved by MW sellers from poorer households compared to those from better off households. (Stack et al forthcoming). The factors accounting for this include, among others, the greater likelihood that poorer households engage in barter transactions, the lower involvement of poorer households in MW markets outside the community and therefore higher dependency on market intermediaries, and the pressing cash needs of poorer households which provide little scope for storing MWs to take advantage of anticipated upward seasonal price movements.

Although most MW abundant areas are found in environments of low agro ecological, potential significant variation in mopane worm production and market systems and environments is apparent, both between and within countries.

- *Botswana* has a growing economy and (in some areas at least) declining interest in mopane worm collection as other more lucrative income generating opportunities and jobs become more widely available. The devaluation of the Rand against the Pula has depressed export prices, while there is only a small domestic market.
- *Zimbabwe* has a contracting economy and growing interest in mopane worm collection as other more lucrative income generating opportunities and jobs become more difficult. The devaluation of the Zimbabwe dollar against the Rand (in the parallel market) at least maintains export prices, but there is in any case a large domestic market that is probably growing as mopane worm presents a cheap protein source for urban dwellers.

Differences within countries – between areas/ communities and within areas/ communities:

- In *Botswana*, poorer people in less accessible villages are more dependent on mopane worm as a cash source (and are likely to remain more dependent for longer) as compared with those in villages that are more accessible.
- In *Zimbabwe*, there are large differences in access to other sources of cash, in access to markets, in pressure on mopane woodland and on mopane worm outbreaks, and in the nature of access to mopane resources (communal lands, commercial farms, state farms, with differing systems and costs for gaining access

Variation between households and communities (as described above) has important implications for the range of technical, institutional and market innovations that are appropriate to different MW users.

A CATEGORIZATION OF LIVELIHOOD STRATEGIES

Rural livelihoods may be considered as dynamic strategies by which rural people seek first to survive and then to improve their well being over time. Dorward and Anderson (2002) have suggested that livelihood activities may play different roles in these strategies, and categorise these roles in terms of 'hanging on', 'stepping up' and 'stepping out'. 'Hanging on' describes activities that enable households to maintain their current livelihood (to survive) while the latter two roles represent different pathways for livelihood improvement, the first involving accumulation of productive resources to expand current activities and income, the second the accumulation of resources that can be used as a base from which to shift to different, more desirable livelihood strategies.

Dorward and Anderson develop their conceptual framework in examining the role of livestock in the livelihoods of poor livestock keepers. They argue that for the poorer livestock keepers livestock are likely to be important in helping them to 'hang on', providing important buffering and insurance roles as they struggle to maintain precarious and vulnerable livelihoods at the margins of survival. In some situations they will also play important productive roles, providing for subsistence (through home consumption of meat, milk, eggs or fibre) and/or supporting complementary (commonly cropping) activities (providing draft power or manure). Beyond the minimal maintenance roles, livestock keeping may enable advancement through accumulation either of more productive animals (the 'stepping up' strategy) or of a set of assets that can be used as a base to 'buy in' to assets needed to gain entry to other livelihood activities (the 'stepping out' strategy). Within a livestock based 'stepping up' strategy, accumulation of productive animals is critical, whereas in a 'stepping out' strategy the productivity of the animals is less important than their ability to hold value as savings. For 'stepping out' livestock may be accumulated to fund investments in alternative means of increasing income, for example, education (human capital), social and political contacts and advancement (social and political capital), physical capital (such as shops, vehicles and other items used for different businesses), or migration.

In each case livestock based strategies have to be evaluated against alternative means of 'hanging on', 'Stepping up' and 'stepping out'. For hanging on, unskilled labour markets and crop production may be the principle alternative means of subsistence, and social relations, formal safety nets, informal financial markets and micro finance the principle alternative means of buffering and insurance. Most households will seek to spread risk and take advantage of niche opportunities by diversifying across these. For both 'Stepping up' and 'stepping out', alternative means of accumulation may again be investment in social relations, informal financial markets and micro finance institutions. For 'stepping out' there may be any number of alternative means of increasing income, ranging from cropping activities to a variety of non-farm activities.

The 'stepping up' and 'stepping out' strategy of accumulation can be viewed as alternative livelihood paths. The former has parallels with the notion of poverty

reduction through increasing agricultural productivity whilst the latter is more closely aligned with the concept of poverty reduction through decreasing dependence of rural households on agriculture through providing non-farm income earning opportunities. Since it is widely acknowledged that rural households, especially in low rainfall areas, depend on a multiplicity of farm and non-farm income sources to sustain livelihoods the two poverty reduction strategies need not be seen as alternatives. However, households or individuals within households are likely to favour one of these alternatives as they become better off even if they continue to keep a foot in both farm and non farm income activities. This pattern is compatible with observations that poorer households often have more difficulty in engaging in higher return non-farm activities¹⁷

We now apply this type of analysis to examine current and potential roles of MW (and environmental resources in general) in enabling vulnerable households in precarious environments to hang on and/or to promote or support advancement out of poverty. We also need to ask how MW or natural resource based strategies compare against alternative means (farm and non farm) of ‘hanging on’, ‘stepping up’ and ‘stepping out’.

CURRENT AND POTENTIAL ROLES OF MOPANE WORM HARVESTING IN RURAL LIVELIHOODS IN THE REGION.

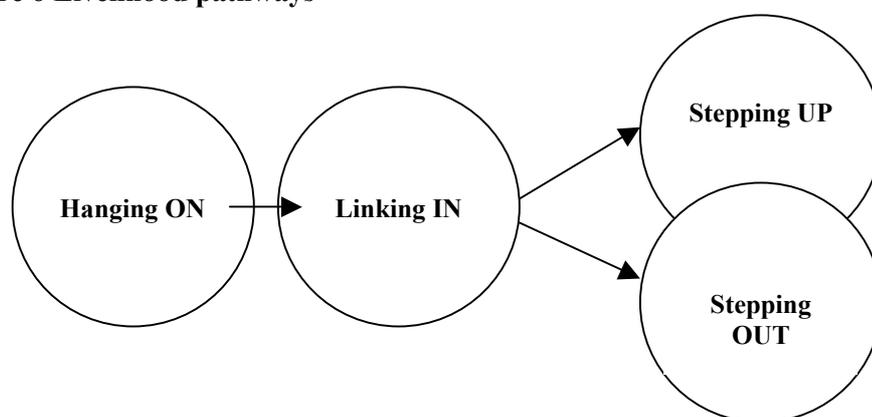
We begin by adding a fourth role for livelihood activities, to acknowledge the role natural resource based strategies may play in maintaining and improving standards of living (more than just ‘hanging on’) without resource accumulation or productivity investments (as is assumed in the ‘stepping up’ livelihood path) and without use of income to fund investments in alternative activities (as is implied in the ‘stepping out’ strategy). We have termed this fourth livelihood strategy ‘linking in’. Table 17 and Figure 6 illustrate the relationships between these different activity roles:

¹⁷ Reardon *et al.*, 2000 summarising evidence from a number of studies in Africa suggest ‘a rough pattern’ (with exceptions) of ‘a positive relationship between non-farm income share (and level) and total household income and/or landholding in much of Africa’ (p272). Barrett *et al.*, 2000 and Toulmin *et al.*, 2000 note a common (but not universal) ‘U shaped’ relationship between the proportion of income earned and total income, with poorer and better off households with a higher proportion of off-farm income, but with very different returns to these activities, while intermediate households often have lower proportions of earning from off farm activities, as they are able to gain more from farm activities than the poorest households, but are not able to engage in the highest return off farm activities open to the better off households.

Table 17. Principal Activity Roles of Income component by livelihood strategy

| Livelihood strategy | Principle MW roles |
|----------------------------|--|
| 'Hanging in' | Subsistence Buffering |
| 'Linking in' | Subsistence Market production/ income for small cash purchases Income to initiate some lower order 'stepping up' activities Income to initiate some lower order 'stepping out' activities Accumulation of primarily social capital |
| 'Stepping up' | Accumulation of all types of capital assets Complementary production Market production / income |
| 'Stepping out' | Accumulation of capital assets |

Figure 6 Livelihood pathways



Studies that have looked at NTFPs in the context of rural livelihoods have noted that NTFPs are generally most extensively used to supplement household incomes during particular seasons in the year and help meet dietary shortfalls. . In particular, these resources are widely important as a substitute and economic buffer (or safety nets) in hard times (Luckert, 2001; Campbell et al, 2001, Arnold and Townson, 1998; Hobane, 1995; Mukwekwerere, 1996, quoted in Mutamba and Frost, 2002). The importance of forest income usually lies more in its timing than in its magnitude and although it seldom accounts for a large share of a household's total income, but is often important in filling seasonal or other cash flow gaps, and in helping households to cope with particular expenses, or to respond to unusual opportunities. Such activities may thus play 'hanging on' and 'linking in' roles.

A number of pointers from the survey data suggest that MW's livelihood contribution, particularly for poorer rural households in Zimbabwe, may also be most commonly characterised in terms of a 'hanging on' strategy. Mopane worm outbreaks coincide with the 'hungry season' (when the previous year's food stocks are depleted, particularly for households farming in low rainfall areas and when newly planted crops are still too young to harvest which coincides with a time of high seasonal cash needs (the Christmas period and the start of the new school year). For the poorest

households MW are likely to be important in helping them ‘hang on’ at the margins of survival through this difficult time. These households, who often have limited non-farm income sources, may identify mopane as their most important source of income. Further, the main use of this income is to fund seasonal consumption needs.

For other households who are not so badly off (generally due to higher livestock holdings, larger cultivated area, or a regular source of non farm income or remittances) the mopane worm business generates subsistence and cash income that funds not only essential consumption goods but also small purchases (kitchen utensils, clothing), investment in education (human capital), visits to relatives (social capital) and small-scale farm and non farm activities (petty trading, vegetable gardens, membership of informal credit groups etc). Information on how collectors used mopane income from the 2001/2002 harvest suggests that quite a few collectors were able to fund ‘linking in’ type of activities’. Its role here, however, is likely to be limited. For most collectors the income earned from mopane sales is not sufficient to fund investments in other livelihoods. Although some households mention using income from mopane to invest in agricultural inputs and small livestock purchases those that mention such investments generally acknowledge that mopane worm income is not the most important source of income used for these investments (Table 18).

Table 18. Use of income from Mopane sales, Zimbabwe study areas, 2002

| Income Use | Masvingo | | | | | | Midlands | |
|------------------------|-----------------|----------|-----------------|----------|------------------|----------|----------------|----------|
| | Mwenezi N=45 | | Gwerima N=42 | | Chilonga N=30 | | Bangwe N=31 | |
| | % hhld | % 1st | % hhld | % 1st | % hhld | % 1st | % hhld | % 1st |
| Buy food grains | 82 | 40 | 90 | 35 | 53 | na | 36 | 16 |
| Buy other food | 84 | 36 | 93 | 39 | 67 | na | 68 | 28 |
| Buy agric Inputs | 73 | 11 | 73 | 12 | 60 | na | 48 | 16 |
| Buy agric implements | 36 | 7 | 39 | 7 | 3 | na | na | na |
| Buy cattle | 7 | 0 | 7 | 0 | 0 | na | na | na |
| Buy goats | 22 | 2 | 24 | 0 | 3 | na | na | na |
| Medical expenses | 71 | 2 | 78 | 2 | na | na | 32 | 0 |
| Funeral expenses | na | na | na | na | 0 | na | 68 | 0 |
| School fees/stationary | 78 | 38 | 85 | 41 | 60 | na | 48 | 12 |
| Travel | 73 | 4 | 81 | 5 | 40 | na | 12 | 0 |
| Buy clothes | 71 | 11 | 78 | 2 | 23 | na | 88 | 36 |
| Buy household utensils | 80 | 64 | 88 | 70 | na | na | 56 | 12 |
| Buy durables | na | na | na | na | 3 | na | 68 | 8 |

Note: 1st means the share of households who indicated that income from MW sales was the main source of cash for this expenditure. For example, 82% households in Mwenezi used income from MW sales to purchase food grains, and 40% of households indicated that this income source was the most important source of income for purchasing food grains.

There are, however, a few better off households for whom trading MW (buying from other collectors and trading locally or in outside markets) may provide opportunities to earn sufficient income to invest further in the MW trading business, (e.g. holding

stocks, increasing size of business, value added processing etc). Here MW trading (rather than harvesting and processing) plays a ‘stepping up’ role, or a ‘stepping out’ role if income from mopane trading is invested in, for instance, livestock, cash cropping, non-farm activities, post school training (human capital), and assets for other business such as shops or vehicles (physical capital). Generally it was more common for income from mopane worm trading to play a ‘stepping out’ role funding investments in alternative means if increasing income rather than a ‘stepping up’ role. This is consistent with the observation that income from mopane worm activities is both seasonal and variable from year to year and therefore not a very reliable business activity. Levels of mopane worm harvesting and reported use on MW income also indicate that currently more harvesters in Botswana than Zimbabwe use mopane worm activities in a ‘stepping out’ and/or ‘stepping up’ role.

This discussion of the different roles that MW harvesting and processing and MW trading may play in the livelihoods of different people is, we suggest, helpful as we turn to consider the potential for livelihood improvement through technical and institutional innovations. We need primarily to look for innovations that support the ‘hanging in’ roles of MW harvesting and processing. We also need to look for innovations that may facilitate their role in ‘linking in’ with other activities, perhaps catalysing a shift towards ‘stepping up’ or ‘stepping out’ through other livelihood activities. However, this is likely to require, among other things, improvements in marketing systems, and here we need to understand the roles of MW trading in the livelihoods and business of rural and urban based traders. Table 19 therefore presents in more detail the principle roles of MW by livelihood strategy, together with problems and constraints identified from the research findings (described in section a categorization of livelihood strategies). The final column, suggesting possible development opportunities, anticipates to some extent issues raised in the next section, where we discuss priorities for technical and institutional innovation.

PRINCIPLE ROLES OF MOPANE WORMS BY LIVELIHOOD STRATEGY, PROBLEMS, CONSTRAINTS AND OPPORTUNITIES

The principle roles of mopane by livelihood strategy, problems and constraints identified from the research findings (described in section a categorization of livelihood strategies) together with potential development opportunities are summarised in Table 19.

For households where mopane worms play primarily a ‘hanging on’ role problems such as variable and unreliable outbreaks and low market returns dominate. These households are cash constrained and unlikely to be able to afford even low cost technology for improving productivity of MW harvesting or processing. In addition, the small quantities of MWs offered for sale and economies of scale associated with selling in alternative markets limit their ability to access outside markets. Improved returns for such households are likely best achieved through group or cooperative efforts to undertake some of the market functions currently provided by middlemen and traders. Organised collective action to manage and protect mopane resources is also of vital importance.

Table 19. Contribution of mopane worms to livelihood strategy, problems, constraints and opportunities

| Contribution of MWs | Identified Problems | Constraints | Development Opportunities |
|--|---|---|---|
| ‘Hanging on’ strategy | | | |
| <p>Harvest for food and cash.</p> | <p>Variable and unreliable outbreaks.</p> <p>Local abundance insufficient to satisfy needs and competition from outside collectors.</p> <p>Long distances to other al sources of MWs.</p> <p>Labour intensive and uncomfortable processing, shortage of firewood for cooking and delays in drying due to rain.</p> | <p>Deforestation of local Mopane woodlands in some areas.</p> <p>Episodic nature of MW outbreaks.</p> <p>MW outbreaks coincide with busy agricultural period.</p> <p>Unaffordability of protective clothing.</p> <p>No improved technology for processing.</p> | <p>Organised collective action to manage and protect resource.</p> <p>Negotiated access to state and private MW resources.</p> <p>Household scale MW breeding facilities.</p> <p>Low cost improvements in processing (e.g. protective clothing, training in handling hygiene).</p> |
| <p>Sell or exchange bulk of harvest.</p> <p>Sales to provide income for seasonal consumption needs.</p> <p>Barter for basic consumption goods (grains) and small households goods (kitchen utensils) and clothing.</p> | <p>Sell at low prices in post harvest period.</p> <p>Involvement in barter trade on unfavourable terms.</p> <p>Limited market power, buyers dictate prices.</p> <p>Sell in local markets, often from home, resulting in lowers than average net value.</p> <p>Very limited participation in value adding activities except post harvest drying.</p> | <p>High seasonal food and cash demand increases perceived value of post harvest sales and reduces benefits of delaying trade for better prices.</p> <p>High marketing and transaction costs limit access to alternative markets, especially in remote areas and for sellers of small amounts.</p> | <p>Empower sellers by providing appropriate skills training in negotiating, price searching and marketing.</p> <p>Reduce marketing costs through group marketing (informal or formal).</p> <p>Increase market power of sellers through local institutions.</p> <p>Develop niche markets that provide fair trade price and/ or enhance net value to collector.</p> |
| ‘Linking in’ strategy | | | |
| <p>Harvest for food and cash.</p> <p>Sell or exchange bulk of harvest to fund:</p> <ul style="list-style-type: none"> - seasonal needs (e.g. food and school fees) - acquisition of small items (e.g. kitchen utensils and clothing) - lower order ‘stepping up’ MW activities (e.g. move own MW to urban mkts (add space value)) | <p>Processing problems ‘as above’</p> | <p>Opportunity constraints ‘as above’</p> <p>Financial constraints not as critical but individual output and/or financial resources insufficient for technology requiring medium/high capital.</p> | <p>Potential resource management opportunities ‘as above’</p> <p>Low cost innovations (e.g. roller, drying racks) to increase efficiency.</p> <p>Producer groups formed to share lumpy capital investments (cleaning drum, improved cooker, solar drier, improved storage facilities).</p> |

| | | | |
|---|---|--|--|
| <p>- lower order 'stepping out' investment activities (e.g. cash crops, small stock, vending, secondary education, off farm migration)</p> <p>- investment in social capital (e.g. visits and gifts to extended family)</p> <p>On-farm storage for sale and consumption out of season.</p> | <p>Low prices due to any combination of the following - poor market access, little competition among MW buyers, poor negotiating skills, absence of market information, small quantity offered for sale by individual collector.</p> <p>Unreliable income source due to uncertainty and sporadic nature of MW outbreaks</p> | <p>High marketing and transaction costs limit access to alternative markets, particularly for collectors in remote areas.</p> <p>Opportunity cost of allocating family labour to collecting and marketing MW may be high, particularly during the first harvest period and if dependency ratio high.</p> | <p>Economic opportunities 'as above'</p> <p>Micro finance for specific MW activities.</p> |
| 'Stepping up' strategy | | | |
| <p>Harvest for food and cash.</p> <p>Buy MWs from other collectors.</p> | <p>Processing problems 'as above'</p> <p>Competition from outside traders.</p> | <p>Opportunity constraints 'as above'</p> <p>Unregulated open access resource & no way of protecting investments.</p> | <p>Potential resource management opportunities 'as above'</p> |
| <p>Sell or exchange bulk of harvest to fund:</p> <p>- seasonal needs (e.g. food and school fees)</p> <p>- acquisition of small items (e.g. kitchen utensils and clothing)</p> <p>- lower order 'stepping up' MW activities (e.g. move own MW to urban mkts (add space value))</p> <p>- higher order 'stepping up' MW activities (e.g. local trader, trade in bulk in outside markets; buy to store for selling out of season)</p> <p>- accumulate assets for MW business (e.g. protective clothing, processing technology, vehicle)</p> | <p>Price uncertainty, working capital requirements, availability of transport and storage.</p> <p>Seasonal of business</p> | <p>Minimum level of trade required to share overhead marketing and transaction costs associated with accessing higher value markets. Imperfect knowledge of prices in alternative markets.</p> <p>Generating sufficient turnover to warrant specialisation and investment.</p> <p>High cost of dedicated storage structures</p> <p>Variability in supplies from year to year discourage MW specific capital investments</p> <p>Lack of tried and tested processing innovations</p> | <p>Economic opportunities 'as above'</p> <p>Skills training in small business management.</p> <p>Development of appropriate processing technologies to enhance product value.</p> <p>Micro finance for trade and value adding processing activities.</p> |
| 'Stepping out' strategy | | | |
| <p>Harvest for food and cash.</p> <p>Buy MWs to trade.</p> | | | <p>Potential resource management opportunities 'as above'</p> |

| | | | |
|---|--|--|--|
| <p>Market income used to finance working finance and capital investment for other income generating activities (e.g. diversify traded commodities, cash crops, rearing livestock, buying property to let, capital assets)</p> | <p>Availability of MW supplies.</p> <p>Competition from outside traders.</p> <p>Slow seasonal and unreliable accumulation.</p> | <p>Potential to generate market income constrained by reliability and availability of MW supplies.</p> <p>Market income tends to be invested outside of community due to absence of effective local demand for goods and services due to poverty.</p> <p>Slow, seasonal and unreliable accumulation.</p> | <p>Economic opportunities 'as above'</p> <p>Largely outside scope of an individual project but success in efforts to enhance income from MWs will create greater local demand for good and services.</p> <p>Development of micro – finance institutions.</p> |
|---|--|--|--|

Households for whom mopane activities play a 'linking in' role, demonstrated by the fact that some income from mopane worm activities is used to fund some lower order 'stepping up' and 'stepping out' investments, face similar problems and constraints as those households for whom mopane activities play a 'hanging on' role. However, financial constraints are not so limiting for these households. They will benefit from economic opportunities offered by group action and the protection and management of mopane resources but in addition they are likely to be able to participate in both process upgrading (low cost technology to increase efficiency) and product upgrading (improving existing MW products and introducing new MW products).

For MW collectors involved in the 'stepping up' strategy development opportunities lie mainly in the area of providing skills training in business management, tried and tested innovations and access to micro finance to support valued added processing activities (process upgrading), adding value by assuming new functional roles and responsibilities (function upgrading) and product upgrading.

Where market income from mopane worms is used by households to fund investments in other income generating activities ('stepping out') development initiatives can play a dual role. On the one hand, the MW market income of such households is directly enhanced by initiatives that improve resource management and output value but, in addition, success in improving the livelihoods of all collectors will create local demand for goods and services and provide investment opportunities for new businesses.

RESEARCH IMPLICATIONS

Priorities for technical and institutional innovation

In discussing the role of NTFPs in general and MWs in particular in poverty reduction, it is important not to over generalize – different narratives will be appropriate in different areas since the natural and socio economic environments in which the rural poor are located vary. In addition, as this paper has shown, the same forest resource may play varying roles in different types of livelihood strategies. But,

development initiatives need to be consistent with three important areas that directly address the needs of poor people (World Bank, 2000).

- Promoting opportunity
- Facilitating empowerment
- Enhancing security

Development opportunities for MWs have the potential to contribute to all three areas. Technical innovations and development of market opportunities promote income growth. Organized collective action to manage and protect community mopane resources enhances the security and sustainability of the natural resource base on which rural households rely. Providing sellers with appropriate skills training in negotiating and marketing strengthens the ability of poor people to shape decisions that affect their livelihoods. Different types of technical and institutional innovations must however be matched to the resources, aspirations and constraints of current livelihood strategies of the resource users. Resource management options need to take into account the opportunities and constraints offered by mopane resources under different tenure arrangements and training has to provide skills that address practical needs in current activities.

Households involved primarily in the ‘hanging on’ strategy are likely to be looking for greater security (less risk) and improved returns on MW sales. They are unlikely to be able to afford even low cost technology to improve productivity. These goals are best achieved perhaps through institutional and organisation initiatives to both manage mopane resources in a sustainable manner and improve market value. Skills training in handling hygiene and price negotiating are likely to meet felt needs.

Other households, who are not so badly off, may be looking for increased productivity and ways of generating increased market income to act as a catalyst or spring board for households to link in to the ‘stepping up’ and /or ‘stepping out’ strategies. These households are more likely to be interested in technical developments and skills training to increase efficiency particularly if producer groups are formed to share the cost of lumpy capital investments and to benefit from economies of scale in marketing or value added processing.

For better off households, already involved in ‘stepping up’ and/or ‘stepping out’ strategies opportunity to generate additional market income from MWs may require particular managerial or technical skills, or access to capital or credit, that are generally not available to the majority of rural producers. Micro finance and business skills training provides entry points for enhancing the activities of these households.

Concluding comments

If profitability and productivity of MW activities increase (e.g. through new technologies, or improving prices realized by collectors), then there are dangers of

- Capture of the resource by the better off, with exclusion of the poor
- Over exploitation of the resource

The difficulty of achieving a balance between improving livelihoods of the poor rural households and sustainable use of forestry resources can be addressed by improving the framework conditions (property rights, institutional arrangements) that govern the use of common property resources and by supporting communities to establish indigenous natural resource management systems.

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