

Research Highlights from the Mopane Worm and Mopane woodland Project

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The **Mopane Worm and Mopane Woodland Project** is an interdisciplinary and collaborative research initiative involving eight organisations from Zimbabwe, South Africa, Botswana and the UK. The project purpose is to identify the principal factors that limit MW production and to determine how MW and mopane woodland can be managed to enhance rural livelihoods and resource sustainability. The project is exploring opportunities for:

- Enhancing local returns by improved mopane worm harvesting and marketing
- Developing semi domesticated system for breeding and rearing mopane worms to improve security of production;
- Improving mopane woodland management to favour continued production of mopane worms and other woodland products; and,
- Low-cost processing and storage technologies.

The research group's second annual report back workshop was held from the 28 April – May 2nd at the ^{Ilala} Lodge, Musina, South Africa. During the workshop a series of presentations were given by each collaborator describing the key results and developments from the fieldwork undertaken to date. These are briefly summarised below under six main themes:

1. Fieldwork to fill gaps in the knowledge on role of MW in rural livelihoods.

A cross section of surveys and case studies from a variety of communities across southern Zimbabwe were undertaken 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.

- In all the 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
- Although women and children still predominate in the collection and harvesting of MWs, participation by men and particularly youth is extensive
- In some areas the extent of involvement in MW collection, measured by quantity collected, was higher for poorer than better off household but differences were not significant. In the harsh economic climate of Zimbabwe, rural families are coming under increasing economic strain so almost everyone is looking for additional ways of alleviating financial problems
- 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 for many collectors.
- 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 (No improved technological devices were identified during fieldwork. A minority of collectors use of gloves to protect hands from the sharp spines during collection and degutting.
- The bulk of MWs are disemboweled by squeezing them by hand to expel the guts but an increasing number of collectors are resorting to using bottles as rollers or crushing the MWs with sticks to avoid the discomfort of sharp spines and save time
- Variability in the extent of harvests both within and between communities and from year to year is clearly demonstrated. Among six Zimbabwean communities average MW production ranged from 36kg– 217kgs per household in the 2001/2002 season

- Whilst MWs are valued as a source of protein the main reason for collecting MWs is to earn cash. Level of commercialisation is high with 75-85 % of harvest sold or bartered.
- Income earned seldom contributes a large share to a household's total income, but can be crucial, particularly for poorer households, in filling seasonal or other cash flow gaps.
- 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. Generally, rural collectors 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).
- The majority of MWs are sold for cash but bartering is still common, particularly in more remote areas.
- 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.
- 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.
- Issues that communities felt most strongly, but powerless, about were aired. Namely the questions of who should have access to the resource, how access should be regulated and by whom

A Field Survey of harvesters at four MW outbreak sites was carried out in Botswana. It was found that

- 96 % of harvesters were women.
- Whilst most harvesters are locals some are outsiders who specialise in MW collection and travel to outbreak sites.
- In the 2002/2003 drought season harvesters were forced to travel long distances to locate outbreak sites.
- MW processing and collection methods are still traditional. No technological devices are employed except for gloves to protect the hands while harvesting and degutting.
- The harvest is primarily for sale.
- Traders visit collectors at camping sites during harvesting time or at their villages after harvest.
- Although harvesters complained of low prices, collectors rate MWs as a vital source of livelihood. All harvesters, however, were involved in other activities (growing crops, rearing livestock, selling traditional beer and working for the Drought Relief Program).
- Due to the importance of MW harvesting cropping may be abandoned if no one is available to stand in for the harvesters at home.
- The proceeds from MW sales are used to acquire necessities such as food and clothing, pay school fees, invest in livestock and finance small scale business activities.
- Customary law allows anyone to harvest anywhere in tribal areas but people living in villages and cattle posts near outbreak sites are generally resentful of 'outsiders' harvesting in 'their' areas.
- No single harvester considered that the resource was under threat due to over harvesting.
- In Botswana there is probably a 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

2. **C Mopane management trials continue at Messina experimental station, South Africa.** Data monitored include tree characteristics, coppice outgrowth, leaf characteristics. Against all expectations, coppice outgrowth continued throughout the year including the dry winter months when all tree species on the Messina Experimental Farm (including *C. Mopane*)

were leafless. These observations have far reaching implications for commercial game farmers and small-scale rural farmers. Compared to other interventions, pollarding seems to be the most effective way of stimulating leaf production. Analysis of leaf quality as a food source (tannins, polyphenols and minerals monitored) to *I. belina* larvae showed that *C. Mopane* leaves do not contain any hydrolysable tannins which are widely accepted as being the primary defence compounds against insects. This explains the close association between MWs and *C. Mopane* trees. This finding is new to science

3. **Maintenance of *I. Belina* breeding population for third year at facility in Maunatlala in east central Botswana.** Five generations of *I. belina* have been bred at the facility. Although most pupae hatch within one season experiments have shown some pupae remain viable for at least two years. Survival of pupae can be influenced by both soil type and depth of pupation. Pupae are best stored in well sealed containers where they can be protected from attack by chalcids. Stored pupae, from the previous season were used for this seasons breeding. There was a good start to the season with many adult *Imbrasia belina* hatching and a large number of eggs were produced from captive stock. Due to dry conditions few trees flushed naturally in the early part of the season. Pruning, manuring and watering experiments have been carried out to see if we can decrease mortality by better management of the Mopane trees. Mortality of larvae has been measured in and out of shade houses. We have also measured mortality of larvae enclosed in chiffon bags. Virus attack is one of the major problems in the breeding of mopane worms, the highest mortality being due to this factor. The mortality appears to increase with an increase in the stocking density. Once any batch, irrespective of density, is infected with virus mortality is high. The farm produced a larger quantity of pupae in outside pits with protective covering that will provide breeding stock for pilot household MW farming systems proposed for 2003/2004 season. The breeding facility at Maunatala ceased operation at end of 2003 when the funding for this component of the project ceased. About 1000 Pupae have been retained and a proposal to develop and test the feasibility of a household scale MW farming systems has been submitted for funding.

4. **Mopane worm processing and storage techniques**

Various harvesting and processing technologies have been developed and pilot tested with target communities in Botswana. To date, few technologies have shown any real potential but considerable experienced has been gained. and some equipment (e.g. drying frames and a rotating cleaning drum justify promotion.

- **Hand held rollers** for degutting were generally seen by Botswana collectors as being less efficient than degutting by hand using protective gloves. The rollers may be more attractive in areas such as Zimbabwe where gloves are not readily available.
- **A dry roasting oven** was developed to semi dry the worms so that final sun drying is quicker. MWs roasted in this way retained their original colour (an advantage) but had the disadvantage of being smaller with the result that the harvester loses out if the MWs are sold by volume. In addition, wood consumption using the roaster was higher than conventional cooking. An experimental triple roaster was developed in an attempt to make better use of surplus heat. Although this proved effective considerable effort was required to hand crank the drums when loaded and the capital cost of the roaster is too high for most harvesters. It was concluded that the dry roasting oven is not worth pursuing.
- **Innovative drying.** Various types of drying frames were developed to improve the efficiency of the drying process and to overcome the problems associated with traditional drying practices (sun drying worms on sand and on fabric). Drying trays made from shade cloth, stretched over a wooden frame, and supported by stones or bits of wood to keep them off the ground, received much interest from harvesters. The trays promoted quicker drying of MWs by improving airflow, reduced contamination and could be easily stacked under shelter when it starts to rain.
- **Cleaning methods** The rotary drum from the dry roaster proved to be highly efficient in cleaning dried MWs, not only from dust but also those with stomach leaf matter stuck on their bodies. In addition, all the brittle spines were knocked off in the

cleaning process. Although possibly too capital intensive for individual harvesters the rotating cleaning drum should be promoted for use by enterprise groups

- **Storage technologies:** Alternative household level storage methods are being tested on MWs harvested in December 2002 . It is too early to draw any conclusions. Cellophane packaging of MWs is being tested for supermarkets. Currently MWs in retail outlets are often generally sold in plastic packing which looks unattractive since it dulls easily and tears as it is rubbed by the angular, spikey MWs.

5. MW Consumption Patterns

Consumer surveys and focus group interviews were conducted in Bulawayo and Harare and several rural locations to investigate MW consumption, market segmentation and perceptions of product quality. Consumption of MWs as a relish with the local staple is widespread in rural producing areas and among low-income urban households for whom it is an affordable protein. MW is also consumed as snacks outside the home especially at beer halls in urban areas. Due to storability, MW is usually available in the market all year and consumption continues out of season. In 2002, drought resulted in lower than normal stored quantities and by September there was very limited amounts of MW on sale in either the formal or informal sector. The main competing protein rich foods are beans and kapenta (dried fish), which are similarly priced in the market. Better off households substitute meat and dairy products whilst poorer households prepare relish from vegetables only. In Zimbabwe there is a large domestic MW market that is probably growing as mopane worm presents a cheap protein source for urban dwellers.

It is planned to extend the MW consumption work to Botswana and South Africa. The project would be interested in hearing about any existing work on this topic or from students interested in undertaking small projects on this topic.

6. Lessons from the experience of Kgetsi ya Tsie (KyT) women's group in Botswana?

KyT began in 1997 from an initiative to assist rural women to empower themselves by more effectively organising their entrepreneurial activities, based on sustainable management of natural resources. After some six years of operation, members of KyT have increased their annual cash income by 500%, from an average P440 in 1996 to over P2, 500. While members have inevitably increased production, increases in income have come about mainly by more effective storage, quality control and marketing - decreasing wastage and getting better prices for their produce. Whereas the project began as primarily a mopane project, the women are now harvesting and marketing a range of natural resource products including marula oil and soap, food products and traditional herbal remedies and cosmetics. In 2003 KyT recruited its 1000th member, operates 30 village centres and is moving towards financial self-sufficiency. The successes of KyT and the lessons learned in the process can be repeated in other poor rural communities:

- Build from the bottom up. KyT started with small 5-person resource user groups in nine villages, they moved on to federate their groups into local Village Centres. Finally, these Centres formed an Association, registering as a grassroots Community Trust in 1999.
- Importance of diversifying portfolio. Most NTFPs are highly seasonal and several are required to compliment each other and provide all year round activity. In addition, high value NTFPs such as Marula Oil are better able to contribute to overheads compared to bulky, relatively low value food products such as MWs.
- Recognise that the economic and social empowerment of rural women can be enhanced through a variety of activities and not just those related to the core business of the Trust (NTFPs). To this end, KyT provides micro loans for investment in small enterprise activities and business skills training. The default rate on loans is very low, attributable largely to the strong social structure of the groups, who take collective responsibility for individual loans.

- Include members in the management of the Trust. Experience in the representative structures of KyT, has led many members into active roles in their village communities and given them a new found confidence.

Some of the implications of current work for policy and socio-economic development are summarized below.

1. Problems with disease in MW breeding facility.

MW is likely to be more successfully managed at the household level with several satellite systems, which could provide insurance against disease or parasitism that once introduced, quickly destroys a single farmed unit.

2. Mopane veld management

The finding that coppice outgrowth at Messina Experimental Farm continued throughout the year, including the dry winter months, has important implications for mopane veld management, as such a regime could lead to:

- The availability of young *C. mopane* leaves throughout the year.
- A reduction in browse height availability, which is of importance to the domestic herds of communal and small scale farmers. High browse lines are frequently observed around rural villages, forcing an ever-wider movement of herds around the villages. By following a proper coppice management strategy, the availability of browse can be ensured.
- A possible income from the sale of logs arising from coppiced trees as firewood, other applications and products.

3. Access and Use of Forest Resources

There are reports and observations in Zimbabwe of outsiders coming into areas to collect mopane worms. Not only does this reduce quantities available for local people to harvest, but some outsiders use destructive methods of harvesting which threaten the sustainability of the resource. These pressures are reputed to have increased in recent years because of prevailing adverse macroeconomic conditions in the country.

Mopane woodlands are currently an 'open access' resource in Zimbabwe's communal areas. Some Rural District Councils have passed a bye law to prevent outsiders from harvesting MWs but compliance is minimal. Some of the reasons for this include: ignorance of the bye law by outsiders; difficulties of enforcement, including how to decide who is an outside and difficulties in administering the system. All this points to widespread institutional failure. Effective resource management cannot be sustained in the absence of clearly laid out and widely understood institutional arrangements but there are few instances of relative success in creating such arrangements. In addition communities at various levels of organisation (principally villages, wards and the districts) have to be committed to introducing, or changing and enforcing institutional arrangements governing who has access to their areas to harvest mopane worms. Attempts to regulate who have access to MWs currently do not receive overwhelming local support. Outsiders can facilitate the process of developing resource institutions by promoting dialogue among various stakeholders at community level to facilitate change in the way mopane resources are managed and utilised. User groups need to come up with a common vision or goal and then plan how to realise the goal.

In Zimbabwe, there is also a need for policy makers and Government Institutions responsible for forest resources, to recognise the need for institutional arrangements governing the management and utilisation of mopane resources on formerly large scale commercial farms. Recent changes in land ownership in this sector affect access to mopane resources and have far reaching implications on both sustainable resource use (there are reports of widespread tree felling for the urban fuel wood market) and on poor households in neighbouring communities for whom access to MWs on large scale farms has in the past made a significant food and cash contribution to livelihoods.

4. How can Mopane worm harvesters increase the income they receive from selling their mopane worms?

The research indicates that differences in producer marketing strategies are important in accounting for variations in profitability of MW sales. The majority of collectors trade dried MWs with intermediaries at their homesteads or at local centers. Sellers often have limited market power and the buyer dictates prices. Only a minority of collectors market MWs outside their community. This affects net returns since price data indicate that average net returns are generally higher for collectors who sell their stocks in urban markets or engage in cross border trade. Further, few collectors store MWs for sale out of season, despite the considerable financial attractions of doing so. Collectors are also involved in minimal product upgrading. Market data suggest that there is a price premium for quality (size and colour) and plastic packaging (perceived by final consumers to be more hygienic). 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 final point of sale, by storing MWs in anticipation of profitable off season prices or by adding more value earlier in the marketing chain through improved processing and packaging. However, upgrading opportunities are not equally suitable for all collectors.

For poorer collectors, (the majority in Zimbabwe), MWs are an important seasonal income source that allows them to 'hang on' at the margins of survival. These households face numerous constraints (high marketing costs, inadequate market information, urgent seasonal cash demands) that limit their ability as individuals to be more involved in value adding. These sellers can benefit from the provision of information about how value can be added and appropriate skills training in negotiating and price searching but development activities most likely to succeed for the poorest collectors are those that utilise producer or enterprise groups to benefit from economies of scale in marketing and value added processing. Development agencies therefore need to focus on facilitating and supporting MW enterprise groups.

For better off households, (a small number of Zimbabwean collectors but a greater proportion of Botswana producers), who are already involved in some value adding (mainly through trading), micro finance and business skills training provides entry points for enhancing the mopane worm activities of these households.

Further project information is available from

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