Mopane woodlands and the Mopane worm: Enhancing Rural Livelihoods and Resource sustainability

DFID Project No. R7822 (Forestry Research Programme ZF 0142)

First Annual Workshop 2001/2002
Wednesday 20 – 23 March,

Kwa Nokeng Lodge, Martin's Drift, Botswana

Summary and Abstracts

June 15, 2002

Mopane Project First Annual Workshop 2001/2002

Martin's Drift, Botswana
20-23 March 2002

Compiled by Jayne Stack and Jaboury Ghazoul

FOREST RESEARCH PROGRAMME

Project Title:	**Mopane woodlands and the mopane worm**
NRI Number:	ZF0142
DFID Number:	R7822

Purpose of visit

- Report on Year 1 activities and communicate and synthesise information obtained
- Visit the mopane worm breeding facility.
- Communicate key findings to local participating women's group, Kgetsie Ya Tsie.
- Finalise research plans for Year 2.

Itinerary

20-03-02	Arrival at Martin's Drift; Initial informal discussions
21-03-02	Introduction by Jaboury Ghazoul; Presentations by workshop participants
22-03-02	Visit to Breeding facility and discussions with Kgetsi Ya Tsie representatives. Discussions about key findings and future directions.
23-03-02	Small group discussions: (1) ecology and management of mopane worm and mopane woodland and (2) livelihoods and trade of mopane worms.
24-03-02	Final discussions; return to Gabarone

Participants

United Kingdom

Andrew Dorward	Imperial College
Jaboury Ghazoul	Imperial College

Zimbabwe

Peter Frost	Institute of Environmental Studies
Manweyu Mutamba	Institute of Environmental Studies
Member Mushongahande	Forest Research Centre, Forestry Commission
Nyarai Kurebgaseka	Southern Alliance for Indigenous Resources
Jayne Stack	Imperial College/ University of Zimbabwe

Botswana

Frank Taylor	Veld Products Research and Development
Alan Gardiner	Veld Products Research and Development

South Africa

Dirk Wessels	University of the North

Summary of Discussions

A series of presentations was given by each collaborator describing the key results and developments from the fieldwork undertaken to date. These are briefly summarised below under the activity they refer to. Further details can be found later in this report and separately and in full in the internal project documents submitted separately.

Activity 1.1 Review the literature on the role of the mopane worms in rural livelihoods

Peter Frost (IES), Nyarai Kurebgaseka (SAFIRE), Jayne Stack (IC)

A comprehensive review is largely complete. The importance of mopane, in providing food for household use and opportunities to earn cash, lies in their widespread occurrence, ease of access and use, low barriers to entry in trading networks, timing of income, storability and for providing households opportunities to diversify their livelihood portfolios. Mopane also contribute to livelihoods of urban poor through their widespread consumption as a cheap protein source and by providing income opportunities through petty trading.

Activity 1.2 Fieldwork in Zimbabwe to fill gaps in knowledge on the role of mopane worms in rural livelihoods

Peter Frost (IES), Tendayi Gondo (IES) ,Nyarai Kurebgaseka (SAFIRE), Jayne Stack (IC)

Collection and sale of mopane worms is widespread among all livelihood categories. Harvesting of mopane worms coincides conflicts with agricultural priorities at a busy time in the agricultural schedule, but people are increasingly prepared to leave fields to harvest mopane. Collection of mopane worms was traditionally a womens' activity, but men and youths are now increasingly involved. This reflects the economic stress of communities in Zimbabwe's marginal rainfall areas and the perceived returns to mopane relative to crops and/or other income earning opportunities. Of all NTFPs, mopane is the highest cash earner but also the least predictable and reliable. In the 2001/2002 season there was only one harvesting period in December and January due to minimal emergence in March/April 2002 caused by regional drought.

Competition to collect mopane worm is increasing both within communities and with outsiders. Harvesters from local communities noted an increase in destructive harvesting practices. Perceived problems include time-consuming and injurious processing, low prices received by collectors, lack of market information, and lack of transport to market.

Activity 2.1 Collate and synthesise existing information on the biology and use of *I. belina*, and other edible moth species, and on the management of mopane woodlands in southern Africa

Jaboury Ghazoul (IC)

The future successful management of the mopane woodland and mopane worm resources lies in a complete understanding of the integrated ecology and utility of these resources. From the perspective of the mopane worm there remain several areas for

which further information is needed, including seasonal population dynamics, the causes of mortality of *I. belina*, density dependent factors limiting population sizes, spatial dynamics and metapopulation structure of mopane populations and mopane outbreaks, and the underlying abiotic causes of the spatial patterns.

From the perspective of mopane tree biology and management areas for which further information is needed include the impact of repeated defoliation of mopane trees by *I. belina* on growth and regeneration of mopane trees and woodlands, effects of defoliation of mopane trees by mopane worms on the production and quality of new leaves and factors that limit growth rate and leaf production of mopane trees, and management regimes that favour increased leaf and stem production

Activity 2.2 Quantify age-specific mortality for *I. belina* populations under low density outbreak conditions

Alan Gardiner (VPRD), Member Mushongohande (FC)

A trial was established in Dombodema resettlement area near Plumtree to study mortality factors affecting eggs. Of 4200 eggs obtained from wild stock only 2297 hatched. Egg mortality was due to parasitism and infertility. Hatching was not significantly related to egg density. Pupation rates and larval and pupal weights were highest for the middle density conditions and lowest for the high and low density conditions but data could not be fully analysed since the trials remain incomplete due to the failure of the usual second emergence due to lack of rain.

Discussions continued about whether the outbreaks were controlled by parasitoids loads or weather patterns. Data collected to date indicate that outbreaks may be a function of periodic release from parasitoid impact rather than from physical factors as previously thought.

Under controlled conditions a proportion of pupae were found to persist for over 18 months, contrary to previous reports.

Activity 2.3 Quantify the effect of defoliation by *I. belina* on leaf growth and quality, both within and between seasons, by means of a manipulative field experiment

Dirk Wessels (UN)

In the 2001-2002 season by drought affected larval emergence and the experiments that were started have been curtailed for this reason. They will be continued when the next outbreak of mopane worms occur.

Activity 2.4 Quantify the effect of management regimes on growth and leaf quality of *C. mopane*

Dirk Wessels (UN)

Field trials of effects of management regimes (coppicing, pollarding and pruning) on growth and leaf quality are in place in Messina. A chemical assessment of the nutritional characteristics of *C. mopane* leaves at the end of the 2001-2002 growing season is underway. Additions to the work programme include leaf area measurements and a dendrochronological study to determine age of cut coppice.

Activity 2.6 Quantify the relationship between *I. belina* larval density, growth and mortality under controlled field rearing conditions

Alan Gardiner (VPRD), Member Mushongohande (FC)

Appropriate pupating, breeding and rearing facilities have and are being developed. Two methods of rearing larvae have been used: rearing in chiffon sleeves and in moth houses. The sleeving method results in the highest survival rate particularly if the sleeves are kept within the mouth house. The main problem is the control of disease which causes death in all treatments. Mortality of larvae at different densities is being investigated together with experiments to determine the best age at which larvae can be released onto mopane trees. Experiments in 2002 were hampered by disease and dry conditions.

Activity 2.8 Develop techniques for increasing the yield of the second generation of *I. belina* larvae each season

Alan Gardiner (VPRD), Member Mushongohande (FC)

There are two successful methods of egg production: in shade house and in pupation boxes. Once the eggs hatch larvae can be moved to the shade house. Larvae can be kept outside under good conditions, i.e. adequate rainfall and moderate temperature but under severe conditions (e.g. drought) survival is much improved within a shade house. Viral attack is a major problem in breeding mopane worms, and accounted for most mortality. Eggs and pupal stock also need to be protected from parasites such as the chalcid wasp which is common in pupae collected from the wild.

Experiments on the artificial control of pupal diapause time found that adult emergence can be delayed for at least a season by subjecting the pupae to cold conditions, in a fridge.

Activity 4.2 Survey the conduct of harvesters and marketing intermediaries of mopane worms and derived products to identify within and between year variations in traded volumes, prices, quality and grading and marketing chains

Jayne Stack (IC), Witness Kozanayi and Peter Frost (IES)

Market surveys have and are being carried out at various points of sale (retail outlets, market stalls, beer halls, bus termini, roadside vendors etc) in Harare, Bulawayo, Beitbridge and Masvingo. Key informant interviews were conducted at each locality with people buying and selling mopane. It was found that the black mopane worm (from the *I. belina* moth) accounts for most harvesting for commercial purposes. Traders in rural communities trade mopane mainly for cash but also for food, utensils and clothing, particularly in the more remote areas. Dried mopane worms reach urban markets via a number of pathways (traders and collectors) and are marketed in a wide variety of places by a variety of trader categories. In some instances the marketing chain is quite long. Barriers to entry are low, both for collectors and traders. Barriers to expansion, however, depend on ability of traders to secure sufficient capital to purchase in bulk. Due to perceived favourable returns to mopane trading, new entrants are common. There is some seasonality in pricing within the mopane season, with prices higher at the start of the season. However, once the season is established remarkable consistency in mopane prices between markets is observed indicating good market integration. In the 2001 – 2002 season, selling prices climbed steeply towards the end of the season due to a poor second harvest period on account of drought. Mopane prices in urban markets in

May/June 2002 are 3-4 times that achieved in the January peak harvest period. Although the collection season is over, mopane are still on sale in urban markets but the number of sellers has fallen. Large traders are probably responsible for the bulk of storage since most stallholders and vendors restock frequently.

Mopane are consumed by people from all income groups but are especially attractive as a protein rich food to lower income groups. Demand is high although the large number of market participants leads to strong competition in the market place.

Although much of the mopane trade seems to be internal, there appears to be substantial cross-border trade to South Africa, the DRC and Botswana.

Activity 4.3 Assess margins associated with value added processes in the mopane industry from harvesting to consumption

Jayne Stack (IC), Peter Frost (IES)

Margins vary widely (6-300%, but generally below 100%) depending on type of trader, service provided and location in the marketing chain. Margin is not a good indicator of gross returns as different traders have different selling strategies. Margins are low for some types of transactions but income is secured by rapid turnover whereas other traders who buy a bucket of mopane and resell it by the cup have a larger margin but smaller volume turnover. It appears that traders who facilitate the movement of mopane in space (from collection area to market or between markets) or provide a storage function make higher profits than other types of sellers.

Activity 4.4 Identify technical options for improving the harvesting, processing (particularly drying) and storage of mopane worms to enhance product quality

Frank Taylor (VPRD)

Several prototype technologies (hand held degutting device, washing equipment, drying racks, dry roaster) were developed in Year 1 and were demonstrated to farmers at the Botswana breeding facility. The initial results have been promising. The portable drying frames covered in shade cloth proved very popular with harvesters. The hand held degutter needs further field testing as some harvesters found it slower than hand degutting. Due to strong interest in degutting technology in Zimbabwe some prototypes were also distributed there for field testing. The washing and dry roasting equipment is currently too expensive for individual harvesters and more compatible with harvesters working collectively. Further, its bulk makes it more suited to collectors who plan to process mopane cooperatively at homesteads rather than in the collection area. This is not widespread in either Botswana or Zimbabwe but is becoming more common in Zimbabwe where some District councils are discouraging processing in collection areas to control damage to the environment. An unexpected finding was that when traditionally cooked and dried worms are put in the dry-roasting drum and rotated for a few minutes then most of the spines are knocked off. This considerably improves quality of traditionally produced product. Work continues throughout 2002.

Additional work

Dirk Wessels also carried out a study on aspects of mopane worm food hygiene. It appears that there are substantial and potentially toxic levels of microorganisms in

marketed mopane worms. These include coliform bacteria, indicative of contamination by faecal material, and aflotoxins from fungi and yeasts. Cooking in water (as part of processing prior to packaging and storage) reduces the populations of bacteria by 3-4 orders of magnitude and eliminated fungi, though microbial populations increase again by several orders of magnitude during the subsequent drying and storage period. The rate of spoilage is determined by residual moisture in the worms following drying. Frank Taylor reported that in Botswana he had heard of instances of illness apparently caused by mopane worm consumption and even two deaths. This is a matter of some concern and lends further weight to the importance of improved processing and storage techniques. These results are being reported to relevant government agencies in Southern Africa.

Outputs

M. Mutamba. Commercialisation of NTFPS as part of rural livelihood portfolios: policy vs. local realities. Institute of Environmental Studies, University of Zimbabwe.

Jayne Stack. Preliminary Results of Urban Mopane Market Survey, Beitbridge, Bulawayo and Harare. Imperial College.

Institute of Environmental Studies. Mopane Woodlands and the Mopane Worm: Enhancing Rural Livelihoods and Resource Sustainability, Annual Report 2001/2002.

Jaboury Ghazoul. The Biology and Management of the Mopane Worm and Mopane Woodland. Imperial College.

Witness Kozanayi and Peter Frost. Marketing of Mopane Worm in Southern Zimbabwe. Institute of Environmental Studies, University of Zimbabwe.

Owen Shumba. Narrative Progress Report 2001-2002. Southern Alliance for Indigenous Resources.

Andrew Dorward. Mopane Woodlands and the Mopane Worm (NRI Project Number: R7822) 1st Annual Workshop, 20th - 23rd March 2002. Synthesis of discussions: Issues to be addressed and/or considered in the course of research. Imperial College.

Sessions 1 and 2

Review of progress in activities related to Output 2: Factors determining the size of *Imbrasia belina* populations investigated and demand-driven, cost-effective technologies and management options for improved mopane worm harvests developed, assessed and made available to producer groups.

The *Imbrasia belina* breeding facility at Maunatlala, Botswana and review of experiments

Alan Gardiner

Veld Products Research and Development

Abstract

Breeding and pupating facilities have been established at the mopane worm farm (Maunatlala). The adult mopane worm moths hatch from October through to March, but have two peak hatching periods at the end of October and end of January through to February. Although most pupae hatch within one season experiments have shown that some pupae remain viable for at least two years. By subjecting pupae to cold conditions (a refrigerator at an average temperature of 11^0C) for certain lengths of time, hatching can be delayed for at least a season.

There have been two successful methods of egg production. In the first the pupae are allowed to hatch in the shadehouse (Figures 1 & 2). The males and females mate within the shadehouse and the females lay their eggs on one of the following substrates: twigs, leaves, shadehouse poles and shadecloth. These eggs are gathered each morning and taken to the egghouse (Figure 3).

Figure 1. Shadehouse

Figure 2. Entrance to shadehouse

Larvae can be kept outside only under ideal conditions (good rains, moderate temperatures and low levels of disease, parasites and predators). If temperatures are not excessive the larvae can be kept in bags outside until the end of the second instar, or beginning of the third instar. Under severe conditions it is best to keep larvae within the shadehouse. Keeping larvae under shadecloth without sides is also being tested.

Figure 3. Egghouse

Figure 4. *Imbrasia* eggs stapled to leaf

Survival of pupae appears to be influenced by soil type, as demonstrated by a series of experiments. Thus careful selection of pupating substrate is necessary for mopane worm production. During the 2001/2002 season a large number of pupal deaths in all substrates was probably due to a ‘virus’ which is currently being identified. A large number of pupae collected from the wild had been parasitised by a chalcid wasp. Pupae need to be protected from this and other parasitoids as they can spread rapidly through the pupal stock. For this purpose the pupae are best kept in a box that is enclosed by fine netting.

Virus attack is one of the major problems in the breeding of mopane worms, the highest recorded mortality being due to disease. The following methods may help in decreasing the mortality due to virus attack: 1) distribute larvae across several breeding areas so that if virus load becomes heavy at one site it can be closed down to limit viral spread and without incurring loss of the entire stock; 2) keep areas of the farm free from mopane worms for two to three seasons to reduce latent viral loads in the soil or biomass; 3) coppice trees and use regrowth for the mopane worms. These methods need to be investigated and tested further but are not within the scope of the present study.

In addition to the above information other interesting social aspects have been found during the study. Most rural people know little about the biology of *I. belina*, and many feel they have benefited by learning more about the biology of this insect. For instance they believed the wasp egg parasites were ants and were needed for the eggs to hatch. Additionally, many people did not know about the adult moth being related to the pupae or the larvae.

The Biology and Management of Mopane Worm and Mopane Woodland

Jaboury Ghazoul, Imperial College

With contributions from

Alan Gardiner, Member Mushongohande, Dirk Wessels and Rob Knell

Abstract

The future successful management of the mopane woodland and mopane worm resources lies in a complete understanding of the integrated ecology and utility of these resources. From the perspective of the mopane worm there remain several areas for which further information is needed, including seasonal population dynamics, the causes of mortality of *I. belina*, density dependent factors limiting population sizes, spatial dynamics and metapopulation structure of mopane populations and mopane outbreaks, and the underlying abiotic causes of the spatial patterns.

From the perspective of mopane tree biology and management areas for which further information is needed include the impact of repeated defoliation of mopane trees by *I. belina* on growth and regeneration of mopane trees and woodlands, effects of defoliation of mopane trees by mopane worms on the production and quality of new leaves and factors that limit growth rate and leaf production of mopane trees, and management regimes that favour increased leaf and stem production

Mopane Worm Annual Project Report for 2001

Member Mushongohande

Zimbabwe Forestry Commission

Abstract

Trials on the population dynamics of the mopane worm (*Imbrasia belina)* and an assessment of the effects of different mopane tree management options on mopane growth and survival are being undertaken 18 km from Plumtree border town at village 27 of Dombodema resettlement area. The vegetation of this area is classified as mopane and Combretaceae bushveld with medium and low mopane trees. The first trial is quantifying age-specific mortality of *I. belina* under a variety of larval densities. The trial was established with four treatments: T1, 750 eggs; T2, 250 eggs; T3, 50 eggs; T4, control. Of 4200 eggs obtained from wild stock only 2297 hatched. Most eggs did not hatch due to parasitism, by hymenopteran and dipteran egg parasitoids, and infertility. Hatching was not significantly related to egg density. Pupation rates, larval and pupal weights were highest for the middle density conditions and lowest for the high and low density conditions but the data could not be fully analysed since the trials were incomplete because no second emergences occurred due to lack of rain. *I. belina* has five developmental stages (instars) and they moult four times during active growth and once just before pupation. Larval developmental time takes about 28 days (excluding time the eggs take to hatch). Pupation studies under laboratory conditions last for about 38.2 days

on average with a range of about 31 to 48 days. The effect of larval rearing densities on adult female fecundity was also investigated although results are not yet complete since not all pupae have emerged. In the field female fecundity has been found to range from 8 to 335 eggs while under laboratory conditions fecundity has been found to range from 40 to 354 eggs. Mopane worms are affected by different natural enemies but the major ones are viral diseases, predation by assassin bugs (*Reduviidae*), unidentified egg parasitoids and *Ichneumonid* parasites that affect mature larvae.

This paper also highlights technical indigenous knowledge on mopane worms from the local communities. People can recognize eggs, larvae, pupa and adults in the field. They know where to collect these and at what times they can be found. However, people were unaware that there is a female and male moth. Natural enemies are identified as birds, ants, scorpions and lizards. Pupae are also eaten by wild pigs. Processing usually involves degutting with bare hands although gloves are preferred because the spines can prick and hands are discoloured by the gut contents. The issue of access to mopane worms was briefly discussed. Outsiders used to be granted access for harvesting mopane worms but recently communities are beginning to formulate bye laws to bar outsiders. There is a growing tendency for local communities not to want to share natural resources with outsiders who are often blamed for destructive harvesting practices.

Session 3

Livelihoods work

Review of progress in activities related to Output 1: Importance of mopane woodland and mopane worms and their management and utilisation within the livelihoods of different poor rural people investigated and understood

---

Review of the Literature on the Role of Mopane worms and other Non-Timber Forest Products in Rural Livelihoods in Zimbabwe

Manyewu Mutamba, Chipangura Chirara and Peter Frost

Institute of Environmental Studies, University of Zimbabwe

Abstract

The literature review has largely been completed, though it remains to be integrated with the reviews carried out by other researchers at the Southern Alliance for Indigenous Resources and Imperial College. There have been few sufficiently comprehensive studies covering the full range of rural people's livelihood activities, including the harvesting of non-timber forest products (NTFPs) for domestic use or sale, to be able to assess the specific contribution NTFPs make to these livelihoods. There is a general consensus that NTFPs are important, particularly to the poorer households, in providing free goods (food, fibre, fuel and medicines) for household use, and in some cases opportunities to earn cash from the sale of products. Income from sales, however, is generally low and sporadic, often being seasonally dependent. More specialised activities, however, such as making handicrafts crafts, are more lucrative, though beset by marketing constraints.

Few of the livelihood studies reviewed referred specifically to mopane worms, and in those that did the references were often anecdotal. Those few studies undertaken specifically to understand the harvesting, processing and marketing of mopane worms in turn only referred in passing to other livelihood activities, so that there was no basis for comparison. Other wild foods, such as mushrooms, fruits and honey, were mentioned more commonly.

In addition to the use of edible NTFPs to help meet dietary shortfalls, NTFPs generally are used to supplement household incomes at specific times of the year, either in helping households to cope with particular expenses, or as a response to an intermittent opportunity. Their importance usually lies more in the timing of income derived from their use rather than the amount. Overall, they seldom contribute a large share to a household’s total income, though they can be crucial, in some cases, in filling seasonal or other cash flow gaps. Their importance to rural livelihoods lies in their often widespread occurrence, ease of access and use, low barriers to entry in trading networks, and in providing the opportunity for households to diversify their livelihood portfolios and spread the risk.

Although there is a paucity of comparative information on the details of people's livelihood activities, undertaking a study to fill the gap is not a trivial task. The diversity of activities and their variation in time, as well as the often opportunistic way in which some activities are undertaken, means that close monitoring of household activities is often needed to

reveal the richness and complexity in the detail. This is both costly and intrusive, with the latter perhaps being of greater concern.

In this review, a typology of the studies that have looked at NTFPs is given, together with the different methods that have been used in these studies. A synthesis of the major findings form these studies is presented within the frame work of the five household capital assests (natural, financial, human, social and physical following the Sustainable Livelihoods approach, to enhance a holistic understanding of the different aspects of NTFPs in rural livelihoods.

Household livelihood analysis in Chiredzi, Gwanda and Mwenzi Districts, Zimbabwe

Nyarai Kurengaseka

Research and Development Section
Southern Alliance For Indigenous Resources

Abstract

Rural Livelihoods throughout Southern Africa depend on multiple activities including crop production, livestock farming, harvesting of non-timber forest products and earnings from non farm activities (basket making, gold panning, brick making etc) and remittances from family members or relatives working elsewhere. In most areas, especially low rainfall areas where agricultural activities alone cannot sustain the populations, people explore other livelihood alternatives. Mopane worm harvesting and sale is one such alternative which offers the chance for the rich and poor alike to generate income as well as provide a source of food.

Community and Household Livelihood assessments have been conducted in several research sites in Zimbabwe including Gwanda, Chiredzi and Mwenezi. These assessments aim to examine the role of mopane worms in rural livelihoods. To analyse the livelihood strategies of mopane worm harvesters the field team applied the 'livelihood capitals' perspective and research framework to address physical and financial, human, and social capital mopane resource sets. Interviews with key informants and focus group discussions in the three research sites were undertaken. This was followed by a participatory community livelihood analysis constituting an environmental, economic and social analysis, and a visioning and synthesis process to access the information required.

This paper which is still being finalised reports on the findings of the livelihood assessments . The broad sources of incomes and livelihood activities are investigated together with how these vary across socioeconomic status (often called livelihood categories). In addition, the report outlines various problems associated with mopane worms. Major problems identified relate to harvesting, processing, marketing and tenure, which the community members felt could be addressed if they worked together and got help from various institutions working within their areas.

Collection and sale of mopane worms is widespread among all livelihood categories. Collection is no longer just a women's activity but men and youths are also now involved. This reflects both the economic stress of communities in Zimbabwe's marginal rainfall areas and perceived favourable returns to mopane relative to crops and/or other income

earning opportunities. Of NTFPs, mopane is the highest cash earner but it is also the least predictable and least reliable. The competition to collect mopane is increasing both from community members and outsiders. Communities note an increase in destructive harvesting practices. Perceived constraints to enhancing the contribution of mopane to rural livelihoods include time consuming and hand damaging processing, low prices received by collectors, inadequate market information and lack of transport.

It is hoped that this research will give a direction on how these rural communities can best benefit from mopane worms through the combined efforts from the community itself, different non-governmental organisation and government departments working within their area.

Livelihoods and institutions: The socio-economics of mopane worm use

Tendayi Gondo and Peter Frost

Institute of Environmental Studies, University of Zimbabwe

Abstract

This work is being carried out by Mr Tendayi Gondo and follows on from his recently completed MSc (Rural and Urban Planning) thesis research project on *Mopane Worm Utilization and Rural Livelihoods: The Case for Two Villages in Matobo District, Zimbabwe*. The study is being carried out in Kapeni and Ndiweni villages in Matobo District, Zimbabwe, using a participatory research approach. Information is being collected on the value of the tree *Colophospermum mopane* to rural households; the kinds of 'mopane worms' occurring on mopane and which of these are collected; the organisation and institutional arrangements governing the harvesting, processing and marketing of mopane worms; constraints in harvesting, processing and marketing; the relationship between buyers and sellers, in particular how mopane worms are prices and whether there are any agreements, contracts or obligations covering the collection and sale of mopane worms. A household questionnaire on livelihoods and livelihood activities has been tested and is currently being refined. Research is continuing.

Research, Poverty and Mopane Worms

Andrew Dorward

Imperial College at Wye

Abstract

A presentation was made on

- current trends and issues in DFID's research programme and on
- relationships between the more 'social' and 'technical ' aspects of the research project

DFIDs emphasis on the importance of poverty reduction impacts of research projects was highlighted.

Some of the strengths and weaknesses of the sustainable livelihoods framework were then identified. A particular weakness of the approach is that the roles and importance of both technology and markets are underplayed. Since these are important components of the Mopane project - ways of modifying the SL framework were put forward to address these.

Session 4

Institutional arrangements and conflicts

Review of progress in activities related to Output 3: Traditional and emerging institutions promoting sustainable access to and utilisation of mopane woodlands and mopane worms by the poor investigated and documented.

The Need to Revise Forest Policies to Facilitate the Access by Smallholders to Collect, Transform and Market Non-Wood Forest Projects such as Mopane Worms

Member Mushongahnade

Forestry Commission, Harare, Zimbabwe

Abstract

This paper highlights the dilemma in which local communities find themselves as they access and utilise mopane worms. In Zimbabwe, forests are recognized as rich reservoirs of many valuable non-wood forestry products (NWFPs). These consist of goods of biological origin, other than wood, as well as services derived from forests and allied land uses. NWFPs, such as mopane worms, are used by households for subsistence and traded for cash. However, most policies and legislation that have direct bearing on forest resource use and management do not recognise the commercialisation of forestry resources or promote sustainable use. In this manner they are in conflict with current practices. For example, the Communal Land Forest Produce Act restricts use of forest products in Communal areas to 'own use' and also restricts movement of such produce to other communal areas. This piece of legislation is not only old but it also does not reflect the prevailing situation where for example mopane worms are being sold not only in Zimbabwe but are also being exported to other countries (South Africa, Zambia, DRC). There is need to revise existing legislation relating to communal forestry resources if NWFPs, to promote and encourage natural resource based enterprises in an orderly and sustainable manner.

Commercialisation of NTFPs as part of Rural Livelihood portfolios: Policy versus Local Realities

Manyewu Mutamba

Institute of Environmental Studies, University of Zimbabwe

Abstract

Ensuring participatory management of Zimbabwe's communally owned forests is a daunting challenge. Effective engagement of communities in active planning and implementation of forest resources management initiatives remains elusive. The inherently low values of most forest products, especially non-timber forest products (NTFPs) have undermined the viability of most options. These low values, coupled with

the often-high transaction costs associated with communicating, meeting, negotiating and enforcing agreements have dampened enthusiasm for collective action by rural communities.

The policy environment in the country has to improve significantly if meaningful progress is to be achieved with respect to community participation in forest management. Policies should aim to provide incentives for people to make decisions that are in their ‘best interests’. Policies that fight against self interest behaviour have little chance of achieving required objectives. In sharp contrast, legislation regarding sue of forestry resources in communal areas is highly restrictive. The Communal Lands Forest Produce Act prevents commercial exploitation of forest resources. This law is clearly out of step with practice as widespread commercialization of forest products, especially NTFPs, is now an important component of household livelihood portfolios in most communities. Legislation that criminalise commercial utilisation of forestry resources if effectively enforced, has the effect of reducing the perceived value of the resource such that they are not worth investing in. Legislation needs to make provision for commercialization, albeit with appropriate safeguards to ensure sustainable use.

The challenge for development research is to identify appropriate community driven initiatives for the management and sustainable utilisation of forestry resources. At the community level technical information is needed on different management options so that communities can make informed choices between alternative solutions to their problems.

Possible interventions NTFP activities in the Zimbabwe scenario include certification and licensing.

Session 5

Harvesting, Processing and Marketing

Review of progress in activities related to Output 4: Information made available to producer communities and other stakeholders on mopane market structure, conduct and performance, enhanced worm storage and processing technologies, consumption trends, new worm product development, and appropriate marketing strategies.

Technical Options for improving the processing of mopane worms to enhance product quality : Achievements in 2001-2002

Frank Taylor

Veld Products Research and Development, Gaborone, Botswana

Abstract

Several prototype technologies were developed and tested in the field in year 1. These include, degutting, washing, and dry roasting and drying equipment. The initial results have been better than expected both in the technology and in the quality of the end product. One of the bonuses in quality is that the cooking process removes virtually all the sharp spines of the worms which make the more comfortable to eat – many people like the taste but will not eat them, or only in small quantities, because of the spines.

The important results include the development of a simple, hand held degutting device, which is low cost and can be made at village level. However, this needs further field testing to establish whether it is acceptable to the harvesters as some women find it slower than using their hands. The efficient worm washing device and the novel dry roasting cooker/dryer are more sophisticated and too costly for individual harvesters. In addition they are too bulky to transport for harvesters who process in the collection areas. The portable drying frames, covered with shade cloth, have proven very popular with harvesters.

More work needs to be done to refine/modify the equipment to improve the efficiency so as to be compatible with the conceived needs of harvesters. The efficient use of firewood is of particular concern. It would seem clear that equipment for washing and cooking and drying is more appropriate for harvesters working collectively and processing close to their homesteads.

One unexpected bonus has been the discovery that if traditionally cooked and died worms are put in the dry roasting drum and rotated in it for only one minute, most of the spines are knocked off and much of the dirt, dust and semi digested leaf matter is removed. This simple and quick exercise considerably improves the quality and acceptability of the traditional product- which possible could mean better prices.

The field testing of equipment by the harvesters themselves needs to be given more attention, especially the degutting and cooking. Initial work done in flavouring the worms with spices during the cooking process has been promising; though more work needs to be done to get better penetration of flavours.

Marketing of Mopane worm in Southern Zimbabwe

Witness Kozanayi and Peter Frost

Institute of Environmental Studies, University of Zimbabwe

Abstract

Surveys were carried out during January 2002 at various points of sale of mopane worms in southern Zimbabwe, including supermarkets, other retail outlets, market stalls, beer halls, bus termini, and informal traders. The surveys encompassed the urban areas of Beitbridge, Bulawayo, Masvingo, Mbalabala, Mwenezi, Rushinga and Zvishavane, as well as at various roadside sales points between Masvingo and Beitbridge. Key informant interviews were conducted at each locality with people buying and selling mopane worms, focusing on the following, where appropriate:

- Kinds of mopane worm and other caterpillars on sale;
- The way in which the mopane worms were being sold and in what quantities;
- The selling price and its negotiability;
- The source of the mopane worms (*i.e.* whether bought from a trader, a wholesaler, another market, or a producer community; or through a contracted supplier);
- The price at which the mopane worms were bought, where this could be determined;
- The nature of the relationship between the buyer and the seller;
- What value, if any, had been added to the product before being resold (*e.g.* repacking, roasting, adding spices); and,
- The institutional arrangements for buying and selling mopane worms, in particular what kinds of people involved, whether the seller is working for someone else, operating his or her own business (and whether working alone or with the help of others), and the nature of these relationships.

Incidental information on cross-border trade and transport costs were also obtained. The results show that the collection and marketing of mopane worms is a widespread and diverse activity carried out by many, mostly poor, people under a range of circumstances. Mopane worms are traded in both formal and informal markets. Although much of the trade seems to be internal, there is appears to be substantial cross-border trade, both south and eastwards to South Africa and Botswana, and northwards to Zambia and the Democratic Republic of the Congo. The trade seems to be characterised by a high degree of opportunism and a degree of risk.

Barriers to entry are low, both for collectors and traders. Barriers to expansion, however, depend on ability of traders to secure sufficient capital to purchase in bulk. Collectors in rural communities trade mopane worms mainly for cash but also for food, clothing and household utensils, particularly in the more remote areas. On average, collectors in the rural areas received about Z$ 161 kg (about US$ 2.9 at the official rate of exchange, but only about US$ 0.54 at the more realistic parallel market rate). Collectors who transported their stocks to town seemed to get less, on average about Z$ 96 (US$ 1.75 at the official exchange rate, US$ 0.32 at the parallel market rate). Average daily income from the collection and sale of mopane worms during the period when they are available is not known, but will be a topic for research in the coming year.

Marketing of mopane worms in Zimbabwe's main urban centers
January/February 2002

Jayne L Stack

Imperial College, University of London, and Department of Agricultural Economics and Extension, University of Zimbabwe

Abstract

This report is the second briefing on the results of market surveys investigating marketing of mopane worms in Zimbabwe's main urban centres. The first briefing covered December 2001- early January 2002 and subsequent briefings will report on periodic urban surveys and provide a picture of the seasonal dynamics of markets and mopane trade related activities. Stallholders and vendors are being interviewed about prices and sources of mopane using a short formal questionnaire. At the main selling locations (open air markets and bus termini) a near census of all those selling mopane is being achieved. Key informant interviews with traders, stallholders, wholesalers, food vendors and consumers provide further information about the structure of operations of different components of the mopane market.

Figure 1: Variable units of sale

Figure 2 Mopane containers

The black mopane worm (from the *I. belina* moth) and called *madora* in Shona and *macimbi* in Ndebele accounts for most harvesting for commercial purposes. Dry Mopane worms reach urban markets via a number of pathways (traders and collectors) but few sellers of mopane in urban areas are directly involved in the collection of mopane. Some traders have extended family links with rural collection areas that facilitate trading operations particularly through information exchange and brokerage services Mopane are marketed in a wide variety of places by a number of trader categories including stallholders, vendors, roadside sellers, food vendors. Bus termini are probably the location of the greatest volume of mopane sales in urban areas but most sales at this level are wholesale transactions. The marketing chain is sometimes quite long. For instance, some traders buy mopane at bus termini and sell to other traders and/or stallholders at the same location. They in turn sell to traders or stallholders from elsewhere whose customers include petty traders and food vendors purchasing for resale as well as consumers. Due to perceived favourable returns to mopane trading, new entrants, particularly among informal vendors, are common, especially unemployed youth

and young women. Entry at this pointing the marketing chain is easy and requires minimal capital (less than Z$ 1000 or US$5) as stocks can be brought on an almost daily basis in urban markets.

There is some seasonality in mopane pricing. Both buying and selling prices had dropped since December as plentiful supplies reached the market places Price differences are observed between markets at different locations in the same city, but remarkable consistency exists in mopane prices at urban bus termini in the main collection areas (Bulawayo and Beitbridge) indicating good market integration.

Loose, dry mopane are sold in varying size containers (cups, tins, buckets) by volume rather than weight but similar types of containers are common across all the markets. (Figures1 and 2). Mopane are also sold by the lid (8-9 dry worms) as a prepared snack outside beer halls.

Margins vary widely (6-300% but generally below 100%) depending on type of trader, service provided and location in the marketing chain. Margin is not a good indicator of gross returns as different traders have different selling strategies. Margins are low for some types of transactions where the trader is achieving a rapid turnover whereas other traders who buy a bucket of mopane and resell by the cup have a larger margin but small volume turnover. Traders who facilitate the movement of mopane in space (from collection area to market or between markets) or provide a storage function make higher profits than other types of sellers. Large traders are probably responsible for the bulk of storage since most stallholders and vendors restock frequently and collectors don’t usually store more than home consumption requirements.

Mopane are consumed by people from all income groups but are especially attractive as a protein rich food to lower income groups. Demand is high although the large number of market participants leads to strong competition in the market place.