

# Utilisation of Non Timber Forest Products in Botswana: The Case of Commercialisation of Mopane Worms (*Imbraisia belina*) in Central District, Botswana

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## Abstract

In Botswana, mopane worms are widely harvested for household consumption. They are also traded for income generation. Urban based entrepreneurs source mopane worms from rural areas to sell. The price of sourcing mopane worms from the harvesters has increased quite incredibly in villages. However, there is dearth of academic studies on the commercialisation of mopane worms in Botswana. This paper uses primary data collected from multiple sources to investigate the factors influencing the prices of mopane worms. Data collection involved administration of questionnaires to purposively selected harvesters in four campsites in the Central District, focus group discussions at each campsite and key informant interviews. The results show that there is declining population of mopane worms. The decline is attributable to such factors as over-harvesting and climate change which are the main factors influencing the price of mopane worms. In addition to physical scarcity of mopane worms, institutional weaknesses exist in the study area. The Agricultural Resources Conservation Act is ineffective and the majority of the harvesters are unaware of its existences. It is recommended that the regulations on the harvesting of mopane worms be reviewed. In order to benefit harvesters, mopane worms should be processed to add diversified economic value to rural communities.

**Key Words:** mopane worms, NTFP, commercialisation, price, harvesting, Botswana

## Introduction

Mopane worms tree or *Colophospermum mopane* is often referred to *mopani* tree in some literature and largely called *mophane* in many communities in Botswana. This tree is a host to mopane worm (*gonimbrasia belina*). Mopane worms are widespread in many drier parts of the Southern African sub-region (Makhado et al. 2014). Mopane worm derives its name from mopani trees which are found on heavier-textured and nutrients-rich soils in flat valley bottoms of lower altitude river valleys in the sub-region (Makhado et al. 2014). Historically, mopane worms were physically abundant in north-eastern Botswana, southern Zimbabwe, northern Zimbabwe, Namibia and southern Angola (Gondo et al. 2010).

In some countries within the Southern African sub-region such as Botswana, mopane worms is produced twice a year (bivoltine) making the harvesting seasons to be around

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December/January and April/May (Thomas 2013). In other countries such as Namibia, these edible mopane worms are produced once a year (univoltine) which is distinct from the Botswana production and harvesting pattern as a bivoltine mopane worm producing country (Thomas 2013). Mopane worm harvesting is useful to rural communities as it boosts their household economies and source of nutrition (Thomas 2013).

Traditionally, mopane worms were harvested by rural families for their own domestic consumption (Makhado 2008). However, in the recent past, there has been increasing demand for mopane worms in urban markets, resulting in increased commercialisation of these worms. They have grown in popularity in urban areas as an affordable substitute source of protein (Hope et al. 2009). In countries like South Africa, local supply of mopane worms is far exceeded by the demand, prompting for importation of mopane worms from Botswana (Illgner and Neil 2000). It is also exported afar overseas in countries such as the United States and Korea (Mpuchane et al. 2000). Interestingly, mopane worms is traded online on largely e-commerce platforms such as Alibaba. Consequently, this has led to over-harvesting of mopane worms in Botswana to meet both local and export demands. The increasing demand at commercial levels in the region over harvesting with collectors now collecting substantially more than a single person would have traditionally harvested for family (Gondo et al. 2010).

In a good mopane worm harvesting year in Botswana, its trade is estimated at around US\$ 3.3 million (Kwiri et al. 2014). Mopane worm trade provides short-term employment and income to more than 10,000 rural poor (Kwiri et al. 2014). Commercialisation of mopane worms is valuable to rural people in the catchment areas. The income generated from the sales of mopane worms helps alleviate poverty, improve livelihoods and allows participation of the rural communities in the cash economy (Baiyegunhi et al. 2016).

During harvesting season, mopane worms are collected, cleaned, boiled and dried, or roasted for either for household consumption or for sale (Gondo et al. 2010). These worms are eaten as source of protein and some vitamins. In Botswana, as in other countries where mopane worms are harvested, there seems to have severe lack of knowledge regarding sustainable management and harvesting of the resources (Gondo et al. 2010).

Mopane worm is an important natural economic resource to many African subsistence farmers and landless poor (Gardiner et al. 2005). Harvesting of mopane worms for both household consumption and commercial purposes is one of the most common type of utilisation of non-timber forest products (NTFPs) by households in rural Africa (Wessels et al. 2004).

The increasing consumer demands of mopane worms due to its rising levels of its consumption in urban areas and the growing export markets is coupled by the increasing prices of sourcing this delicacy from its harvesters (Gondo et al. 2010). Commercialisation of NTFP resources touch on various issues of economy including production, trade, consumption, efficiency and pricing (Neumann and Hirsch 2000). However, there is dearth of academic studies and/or literature on the commercialisation of mopane worms in Botswana and the market forces determining its price especially in rural areas. This study intends to contribute to the body of knowledge in the field of commercialisation on non-timber forest products in Botswana. The main objective of this article is to assess or investigate the commercialisation of mopane worm in rural Botswana with specific focus in the central district.

## Materials and Methods

### *Study sites*

The study draws heavily upon data collected in camping sites for mopane worm harvesters located between Mashoro and Mokobaxane, Central District, Botswana (Fig. 1). Central District is the largest district in Botswana geographically and demographically. The district borders Zimbabwe in the northeast and South Africa in the southeast. The region is conveniently located to serve as a gateway to Makgadikgadi and Nxai Pans. The District has several seasonal rivers including the Boteti River, which feeds Makgadikgadi Pans during rainy seasons. The region provides an easy access to wildlife habitats and it is characterised with arenosols soils (Morebodi 2001). The vegetation in the region is predominantly mopane woodland.

### *Research design*

The methodology employed in this study is mixed method approach. Different forms and types of literature which

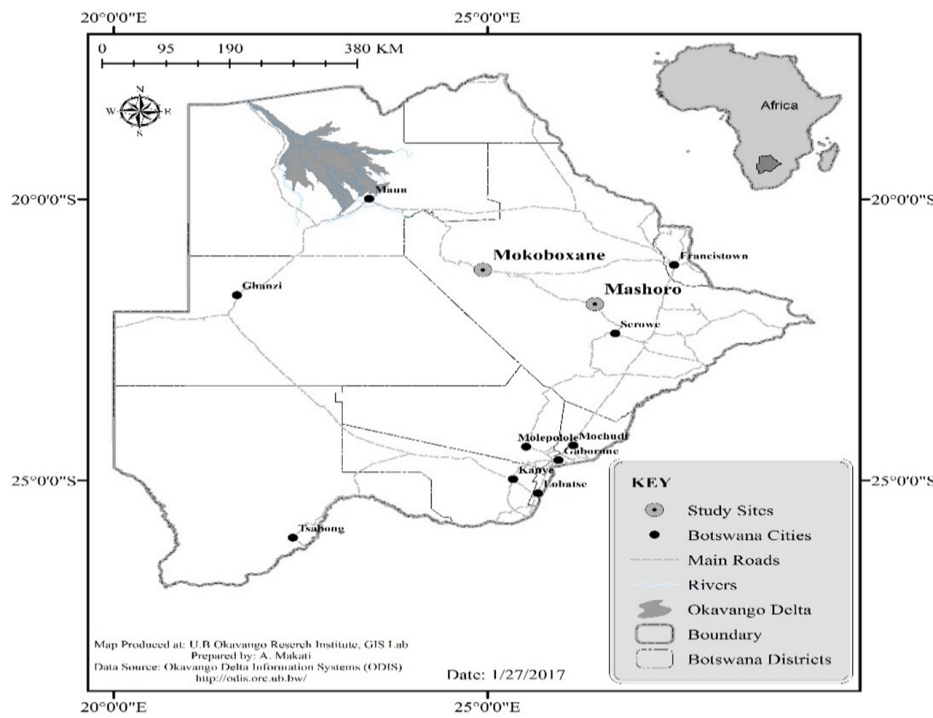


Fig. 1. Source: Okavango Research Institute GIS Lab (2017).

included books, journal articles, and newspapers were identified and reviewed. In order to achieve better results in literature search, this paper adopted backward snowballing approach of literature analysis. In addition to the document analysis, narratives from mopane worm harvesters were collected in four harvesting campsites located between Mashoro and Mokobaxane villages in two sub-districts within the Central District, Botswana. Each campsite had an average of twelve harvesters.

Primary data collection techniques used in this study were administration of structured and unstructured questionnaires and focus group discussions. Sampling of the respondents was done purposefully through convenience method. Four focus group discussions were held, one at each campsite. The focus group discussions helped in determining the perceptions, experiences and understandings of mopane worm harvesters on such issues as the declining population of mopane worms in the region. A pre-determined interview guide, which was designed to address research objectives of this study, was used to direct the discussions within focus groups.

However, in focus group discussions, the environment might influence the responses. In order to augment this, a

total of 26 questionnaires were administered to harvesters. Systematic sampling was used to select the respondents. It is a technique in which only the first respondent is selected with the assistance of a random number and subsequent respondents get selected automatically according to some pre-assigned pattern. In this study, every second respondent was selected. The study further conducted key informant interviews with such informants at sellers of mopane worms operating in different towns and transporters of the harvesters. The key informant interviews were crucial in providing various perspectives on trading and marketing of mopane worms at different chains and for different markets.

Prior to drawing analysis and extracting meaningful conclusions from the data, a coding framework was developed. The data were coded and themes were abstracted from the codes.

## Findings and Discussions

### *Geographic price variation of mopane worms*

#### **Prices at source or directly from harvesters**

This study established the steady rising of mopane worm

prices from the harvesters in the past three years. On average, there has been a 40% annual increase in the price of mopane worms per 250 ml cup. About 20% of the harvesters indicated that they do not exchange their harvest for money. They, instead, prefer in-kind benefits such as food, clothes and alcohol. Majority, over 70%, of the respondents indicated that the sale of mopane worms enhances their cash income. The harvesters sell mopane worms cooked and dried to customers.

In most cases, harvesters in respective campsites fix the price of mopane worms per cup. However, individual harvesters are free to negotiate the price with prospective buyers in order to increase their sales. It has been found that harvesters are eager to sell their products at a lower price despite having travelled long distances, sometimes in adverse weather conditions to harvest it (Jim 2015). Some traders and/or harvesters exchange their hard gathered mopane worms for a mere bottle of alcohol and/or old clothes (Jim 2015).

It is important to note that prices in most areas and cases are determined by the buyers rather than the sellers. This is largely because harvesters travel long distances to collect this delicacy and are often under pressure to sell the worms at any offered price as it is not worthwhile taking their mopane worms stocks back home (Kozanayi and Frost 2002). Consequently, buyers take advantage of the sellers' desperation by negotiating prices downwards (Kozanayi and Frost 2002). The geographical isolation of the campsites combined with low purchase frequencies at the harvesters' campsites makes the harvesters susceptible to predatory commercial buyers who want to take advantage of both buying at low prices at the beginning of the marketing chain and deriving economies of scales by buying in bulk from harvesters. This, in one way or the other, explains the decline in volume of mopane worms sold with increasing distance further away from the market because it becomes more difficult and costly for harvesters to sell large quantities of mopane worms compared to those living closer to the local markets (Ouma et al. 2010). In short, harvesters seldom participate in secondary mopane worms markets especially those in urban areas where the retailing is done by those who buy the mopane worms catch from the harvesters, selling an increased price in order to make profits.

### *Prices by sellers located in urban areas*

It was established in this study that mopane worms in urban areas are sold in informal markets with shopper traffic such as at open spaces at shopping malls. The youthful and technologically advanced sellers advertise the products through social media and offer such services as door-to-door delivery to their urban buyers. The sellers offer their products to final consumers, restaurants, tourists and others. They also export the worms to such countries as Zimbabwe and South Africa.

The inclusion of mopane worms as a traditional cuisine at upmarket restaurants has increased the popularity of and the demand for mopane worms in urban areas. The prices of a 250 ml cup of mopane worm in urban areas range from BWP10.00 to BWP30.00. Sellers located in urban areas factor in transport costs of conveying worm stock from rural areas in their prices. Others also factor packaging and advertising costs in their prices. Other factors affecting the price of selling worms include the number of buyers, the intensity of competition, taste of the worm and the time of supply. The sellers often increase the price when the worms are off seasons and there is a decline in supply. The prices urban sellers pay harvesters and/or middlemen in the supply chain range from BWP3.00 to BWP10.00 per 250 ml cup depending on the position of the actors within the retail chain, abundance of the worms, distance from the market and season. The urban sellers prefer buying in bulk to push down the prices.

Non-timber forest products are characterised by being supplied by many small producers, usually individual households, and brought to the urban ports by relatively few middlemen and even fewer producers. After these products arrive in the city, they are sold in several markets and their commercialisation is analogous to that of other small scale agricultural products. Rural-urban value-chain analysis indicates that consumers can pay four to five times the price received by a rural harvester (Hope et al. 2009). This suggest that harvesters of mopane worms need more market information to be able to profitably compete with middlemen. The resale price of mopane worms in urban areas is, to a certain extent, influenced by the buyers, the availability of the catch and the distance from the market (Thomas 2013). Given the strong influence of inter-

mediaries in the harvesting and commercialisation of natural resources such as mopane worms, these actors are key contributors in the final determination of the price both at the harvest and retail stage (Nascimento et al. 2017).

### *Institutional Weakness and physical scarcity*

All respondents i.e. 100%, indicated that over the past three years, there has been a constant decline in the availability of mopane worms in their areas. This is forcing some of the harvesters to go further into the forest and/or totally change localities to other districts such Bobirwa sub-district almost three hundred kilometres from their normal harvesting areas. To mitigate transport costs, they arrange transport in groups. The formed groups often share a campsite for easy access by the transporter.

The causes of the decline in the supply and/or availability of mopane worms are uncertain, but are arguably related to unfavourable conditions resulting from climate change (low rainfall and high temperatures) and the destruction of the mopane worms' host tree (Makhado 2008). This observation is supported by Andrew et al. (2013) who argue that the reduction in edible insect harvest can be climate-change induced. Climate change and variability have critical implications for local livelihoods and rural economies, as well as for areas and communities further afield who may be dependent on them economically or as part of their supply chain such as the urban based entrepreneurs (Naidoo 2013). Other challenges include droughts that have devastated the harvest on a regular basis and the over-exploitation that has led to local extinctions in several areas (Ghaly 2009). There have been reports of disappearance of the worms from parts of Botswana and South Africa (Illgner and Nel 2000). Furthermore, the minimal barriers to entry and/or very weak institutional arrangements regulating both the collection and trade of the worm, coupled with increasing incidence of poverty in Southern African countries where the worms are found, there is a general increasing trend of overexploitation and a decline in selective harvesting (Muchapondwa et al. 2009).

In general, mopane worms like most of the natural resources in Southern Africa, are common pool resources belonging to the community at large without any restrictions. Traditionally, as a common pool resource, the harvesting of mopane worm was neither strictly nor formally regulated.

The harvesting of the worms was largely based on local knowledge, beliefs and local institutional frameworks of control. It has been argued in literature that a tragedy of the commons occurs when common pool resources become *de facto* open access resources (DeMotts et al. 2009). This occurs in most instances when local institutions are dismantled and replaced by state institutions which then become ineffective due to the failure of the enforcement (DeMotts et al. 2009).

The absence of legislative framework regulating the harvesting of mopane worms has also increased competition for harvesting between the local people and outsiders which hampers the wealth and nutritional supplement that mopane worms can provide, and increase the vulnerability of rural people to malnutrition (Makhado 2008). Inadequate forest resource management policies in southern Africa, like in other regions of Africa, contribute to unsustainable exploitation of mopane worms (Muchapondwa et al. 2009).

Of recent, the government of Botswana has sought to regulate and license the harvesting, dealing and exportation of mopane worms. This is done in terms of the regulations made under Agricultural Resources Conservation Act [Cap 35: 06] which is administered by the Department of Forestry and Range Resources. Notwithstanding the presence of formal institutional framework, none of the respondents in this study had applied for and/or held a license to harvest and/or trade in mopane worms. Furthermore, the respondents expressed no knowledge of anyone who previously applied for a license to harvest mopane worm. According to their understanding, mopane worms are freely available in nature without any regulation on who can harvest them and the formal conditions of harvesting because they are for everyone.

### *Policy and Sustainability Issues*

In the advent of over-exploitation of mopane worms to meet increasing insatiable demand, restraining over-harvesting and striking a balance between commercialisation and conservation of the worms is necessary in order to avoid extinction are a necessity. Ostrom (2010) argues that the establishment of socially optimal solutions for the management of common pool resources such as mopane worms is dependent on both cooperation of stakeholders and individual restraint. Ninety percentage (90%) of the re-

spondents indicated that they are resisting the licensing of mopane worm harvesting because the relevant government departments responsible for issuing the licenses failed to engage them prior to the announcement of the licence requirement. They also indicated that they are not aware of the consequences for non-compliance of the new licencing requirement. The respondents alluded that they have not been sensitised or educated on the potential benefits of conservation of mopane worms to their communities.

Cooperative governance of common pool resources can be defined as the “willingness to pool resources, offsets the costs of control and increases efficiency through a cooperative atmosphere by, for example, increasing the sense of responsibility among human actors...” (Lieberherr 2009: 13). Cooperative groups can process and use information more effectively and efficiently than a centralised system as they generate customs and social conventions that fit their needs in an effort to maximise efficient resource use (Brousseau and Glachant 2002; Lieberherr 2009). The cooperative and participatory approach by the government serves as an effective path for achieving sustainable development, equitable distribution and allocation of public goods as well as internalising ecological externalities such overexploitation.

According to Ostrom (2005), communication and proper involvement of institutions that are concerned could help policymakers achieve desirable results from collective action. Similarly, the government’s failure to establish socially optimal solutions for ensuring the sustainability of mopane worms could create a disincentive to conserve by local communities through resistance to adopt top-down imposed regulations that are deemed socially unfair. The sustainability of mopane worms is therefore dependent on the development of natural resource management arrangements through cooperation of key stakeholders to protect mopane worms while providing socially just, fair and equitable outcomes.

## Conclusion and Recommendations

Rural area dwellers harvest mopane worms during the two harvesting seasons to generate income. Due to the increasing commercialisation of mopane worms, the product finds its way into urban areas of the country and end up be-

ing exported, mostly to neighbouring countries. The benefits received by harvesters from the commercialisation of mopane worm are minimal as they rarely have access or participate in secondary markets of mopane worms.

Due to the high demand of mopane worms arising from the commercialisation of what was traditionally traded at a subsistence level, there is evidence of unsustainable harvesting of this delicacy. This occurs because of weak regulatory and institutional framework. There is need to ensure that sustainable harvesting of this common pool resources is enforced and encouraged. The regulation of harvesting and trading of mopane worms, in terms of the Agricultural Resources Conservation Act and the regulations made thereunder, is ineffective and the majority of the harvesters are unaware of its existence. The requirement to obtain harvesting permit and observe certain requirements, including adherence to strict harvesting times, is unknown to the rural communities. This results in unsustainable harvesting of mopane worms.

It is recommended that other than legislating the harvesting and trade of mopane worm, the appropriate state agencies should engage rural communities by embarking on public education and awareness on the importance of the sustainable use of non-timber forest resources with specific reference to mopane worms. Having engaged in public sensitisation of the existence of the regulatory framework, it is only then when enforcement of harvesting and trading permits can be done. Further, it is recommended that efforts should be made to ensure that the rural communities benefit from the sustainable commercialisation of mopane worms by establishing rural manufacturing industries. This can be done in conjunction with already existing science and technology research and development institutions such as National Food Technology Research Centre, Director of the Center for Scientific Research, Indigenous Knowledge and Innovation (Cesrlki) of the University of Botswana among others. This will ensure that the real beneficiaries of the economic value of mopane worms are the people who harvest them.

In order to address the reducing population of mopane worms, it is recommended that the government should consider introducing restricted access in some areas like national parks and government owned land for mopane worm farming. During harvesting seasons, controlled and sus-

tainable harvesting at a small fee by rural communities could be done. This is done in the Kruger National Park in South Africa. Further, private farms with vast mopane tree forest should be encouraged to engage in mopane worm farming so as to ensure that the worm does not become extinct. The proposed recommendations above remain unexplored in the context of scholarly research. It is proposed that researchers should explore them further to inform policy formulation and implementation.

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