

**AN ETHICAL INVESTIGATION INTO THE IMPACT OF  
MOPHANE WORM DEPLETION ON THE ENVIRONMENT IN  
THE NORTH EASTERN PART OF BOTSWANA: A CASE STUDY  
OF GUNGWE AND MBALAMBI VILLAGES.**

**BY**

**FATIMA SELALEDI**

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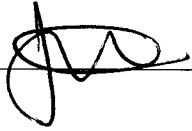


## DECLARATION

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## APPROVAL

This dissertation of Fatima Selaledi is approved as fulfilling the partial requirements for the award of the degree of Masters of Arts in Applied Ethics by the University of Zambia.

Signed: George Fallkema

Date 18/03/2011

SIGNED: Amor

DATE: 20/03/2011

SIGNED: [Signature]

DATE: 06.04.2011



## ABSTRACT

Mophane worm is a name given to caterpillars hosted by the mophane tree. The mophane worm is harvested as food supplement in most of the Southern African countries. For the past few years, there have been some reports indicating that the worm has disappeared in some parts of Botswana. Hence, the aim of this research study has been to investigate from an ethical perspective the impact of mophane worm depletion on the environment. A qualitative approach was used in this study and data was collected from the following targeted groups of people: villagers, the headmen of the stated two villages, and the Ministry of Environment, Wildlife and Tourism (MEWT) officers both at local and national level. The theoretical framework involved traditional theories (i.e., Value Theory and Utilitarianism) and environmental ethical theories (i.e., Social Ecology, Environmental and Intergenerational Justice).

The research instruments employed were individual interview schedules, focus group discussions and observation. A fourfold model of analysis was used focusing on the biological, economical, social and political dimensions. From the findings of the study, it emerged that both natural and anthropogenic factors contributed to mophane worm depletion. The natural factors were drought and predation while the anthropogenic factors included massive usage of the host tree, destructive methods of harvesting and demand for more land for agricultural and residential purposes. It also emerged that mophane worm depletion had both negative and positive impacts on the environment. These included lack of money by locals to buy their daily needs, lack of relish and poor livelihoods, loss of wildlife that fed on mophane worm, and tension between government and locals over the regulation of the resource. Ethical evaluation revealed that the dominant value for the locals was utility value to the almost total lack of explicit awareness of intrinsic and inherent value, and that on utilitarian grounds, the overall evil that depletion of the mophane worm brought about outweighed its overall good effects. With regard to justice issues, the findings revealed that unjust social structures and injustices resulting from the unequal distribution of benefits and burdens as well as from the lack of adequate participation by the local communities in decision-making had a greater negative than positive impact. Finally, recommendations were made emphasizing the utmost importance of government intervention to mitigate, if not, stop the depletion of the mophane worm.

## **DEDICATION**

I dedicate this dissertation to my two late grandfathers, Fani Nkomo James Marikwe (paternal) and Siphambe “Chooks” Kufigwa (maternal) who provided me with material and emotional support as I was growing up.

To my mother Angelinah Kwachena Fani, who raised me in an amazing way. Thank you very much for having made me the woman I am today.

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## LIST OF ACRONYMS

<b>BSAP</b>	Botswana Biodiversity Strategic Action Plan
<b>BNCS</b>	Botswana National Conservation Strategy
<b>DFRR</b>	Department of Forestry and Range Resources
<b>FAO</b>	Food and Agriculture Organization
<b>ISPAAD</b>	Intergrated Support Programme for Arable Agriculture Development
<b>MEWT</b>	Ministry of Enviroment, Wildlife and Tourism
<b>MWD</b>	Mophane Worm Depletion
<b>NAMPAAD</b>	National Master Plan for the Arable Agriculture and Dairy Development
<b>NPNR</b>	National Policy on Natural Resources
<b>P</b>	Botswana Pula exchange currency
<b>ZK</b>	Zambian Kwacha exchange currency
<b>ZNBC</b>	Zambia National Broadcasting Corporation

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## **CHAPTER ONE: BACKGROUND**

### **1.1 Introduction**

Botswana, just like the rest of the world, finds itself at a time when nature is progressively being impoverished by loss of different species from the smallest insects to the biggest animals such as the black rhino. As such, depletion impacts negatively on the entire environment. Its effects are not only being felt now but will also be felt in the distant future. There are several reasons as to why different species should not be allowed to become extinct: some are on account of their use value to humanity or the economic value derived from them; others are because of the moral consideration due to them as part of the biosphere and as having a “good-of-their-own” to flourish and reach their full potential. Different species need to be preserved for the sake of their aesthetic and intrinsic value as well as for their instrumental value. All living things form part of the ecosystem; they are the living components of the ecosystem and their extinction is likely to be disruptive to the entire ecosystem. Many people see insects like moths’ larvae or caterpillars as pests which need to be wiped out by insecticides because they just defoliate their host shrubs. But they fail to recognize the major roles that such insects play in the health of the ecosystem, or the benefits that can be derived from the same caterpillar by various dimensions of the environment, e.g., the biophysical benefit in relation to other animals. Furthermore, these insects benefit the socio-economic system by contributing to a traditional delicious meal as relish as well as to generating income.

### **1.2 Study Area**

The study was conducted in the North Eastern part of Botswana in the villages of Gungwe and Mbalambi (cf. Figure 2). Botswana is a landlocked country situated at the centre of Southern Africa. It shares borders with Zambia in the North, Namibia in the

Northern and Western part, South Africa in the Southeast as well as Zimbabwe in the Northeastern part. The country's land surface area is estimated at 582,000 square kilometres. The country's population is approximately 1.7 million with almost half living in the urban areas (United Nations Development Assistance Framework, 2000). Botswana is divided into ten districts (cf. Figure 1) and the North East District is where the study was undertaken and has Masunga as its headquarters (cf. Figure 2).

MAP OF BOTSWANA



Fig 1. Botswana Districts

Source: Maps of the world

MAP OF NORTH EAST DISTRICT



Fig 2: Map of North East District

Extracted from North East District Council Brochure

According to the North East District Council Service Guide, the North East District is situated in the North Eastern part of Botswana. The District covers an area of 5993 km<sup>2</sup> and, according to the 2001 census, it accommodates a population of 49,399. The area is comprised of 43 villages and a few settlements with Gungwe and Mbalambi lying parallel to each other along the Zimbabwean border (see Figure 2). Ethnically the North Eastern part of Botswana is inhabited by the Bakalanga, Barolong, Batalaote, Bakhurutshe and Banyai tribes (North East District Brochure).

### **1.3 Statement of the problem**

The depletion of different species is not a problem that is confined to Botswana alone or to countries in Southern Africa. It is a problem for the whole world. The world is losing different species at a rate which has been under-estimated. In Botswana, one such species which is most likely to face extinction if no proper measures are put in place is the mophane worm. The mophane worm is both an income generating natural resource as well as a food supply because of its nutritional value. According to Sekhwela (2007), the mophane worm is an important veld product for both the harvesters and their community because it constitutes more than 35 percent of nutritional value and provides about 26 percent of seasonal income. Consequently, if such a resource were to be sustained, it could reduce high levels of poverty, especially among the rural area dwellers. However, something seems to have gone wrong as this once abundant edible worm has become reduced in population. Some authors have reported the disappearance of the worm in some parts of Botswana (Akpalu, Muchapodwa and Zikhali, 2007; Maviya and Gumbo, 2005). Although many studies on mophane worm have been carried out in Botswana and elsewhere, none of these studies has tackled the problem of mophane worm depletion and its impact on



the environment. There is only scanty documentation on the disappearance of mophane worm in Botswana which is based on unconfirmed reports. Hence, there is little or no knowledge on the state of mophane worm at present in Botswana. It is for this reason that this study is being carried out to ethically investigate the impact of mophane worm depletion on the environment in the North Eastern part of Botswana.

## **1.4 AIM AND OBJECTIVES OF THE STUDY**

### **1.4.1 Aim**

The aim of the study is to investigate from an ethical perspective the impact of mophane worm depletion on the environment in the North Eastern part of Botswana.

### **1.4.2 Specific objectives of the study**

- (a) To highlight the different values related to the mophane worm.
- (b) To identify the factors that led to mophane worm depletion in Gungwe and Mbalambi villages.
- (c) To identify government policies on mophane worm sustainability.
- (d) To make an ethical evaluation of mophane worm depletion.
- (e) To come up with recommendations for protecting the mophane worm from extinction.

### **1.4.3 Research questions**

- (a) What values are associated with the mopane worm?
- (b) What factors have led to the depletion of mopane worm in Gungwe and Mbalambi villages?
- (c) What government policies are in place to ensure the sustainability of the mopane worm?
- (d) From an ethical perspective, what are the implications of mopane worm depletion?
- (e) What recommendations can be made to avoid mopane worm extinction?

### **1.5 Significance of the study**

The implications of the depletion of mopane worm on the environment are likely to be very serious if strict measures against the unsustainable harvesting and utilization of this veld product are not put in place in order to sustain it. This study is the first of its kind, hence providing a special contribution to knowledge regarding the depletion of mopane worm. An increased knowledge on the impact of mopane worm depletion on the environment is critical at a time when the whole world is fighting against species extinction. The study, therefore, will hopefully contribute towards preventing the complete extinction of a fundamental natural resource which is important as a source of food for both people and animals in addition to being an income generating veld product. Consequently, the government of Botswana will be able to use this study in the formulation of future policies towards mopane worm sustainability for the sake of future generations as well as for maintaining the balance of the ecosystem.



## **1.6 Limitations and delimitations of the study**

Being a student in Zambia while doing research in Botswana has not been easy because of the need to travel on numerous occasions by bus for a 48 hour return journey between the two countries for submissions and the collection of data. This also resulted in serious financial constraints especially in that the money awarded for the project by the government of Botswana as my sponsor was far too little to achieve the aim of the study. At the time when the research was being carried out, another financial constraint resulted from only getting the training allowance while only limited to half salary as per the government of Botswana training memorandum agreement.

A pilot study was conducted among the Botswana High Commission staff members in Zambia, but their responses had to be treated with caution because they are all intellectuals as compared to the respondents for the full project who were largely illiterate and were rural area dwellers. After the pre-test, certain changes were incorporated into the instruments to be used in the two villages in Botswana. The timing of the collection of data was also problematic because the first batch of mophane worm is usually expected around November to December and the second batch around March to April whereas the data had to be collected in September so as to be able to meet university deadlines. Nevertheless, an effort was made to travel to the two villages in April to make observations especially on the mophane trees to see if there were any that had been defoliated by the mophane worms. Due to lack of educational background in the biological sciences, especially in entomology where the worm studied is categorized under Lepidoptera insects, the study was restricted to an ethical evaluation. Hence, this means that the study was not based on any biologically

related factors such as the worm's evolutionary constraints, its anatomy or genetic variations, or the geographical factors affecting it as an insect.

### **1.7 Definitions of terms**

**Ethical investigation** refers to a systematic inquiry into the values relating to mophane worm, using a wide range of theories to assess the implications of mophane worm depletion.

**Depletion** refers to reduction of the population of mophane worm.

**Mophane worm** refers to the edible larva of a moth or caterpillar found in the Northern part of Botswana. Other names are, Mopani/miombo, phane, edible caterpillar, mophane caterpillars, caterpillars, *Gonimbrasia Belina* /*Imbrasia Belina* (Westwood) and Lepidoptera (Saturniidae).

### **Environment**

The word “environment” is quite a controversial term to define because what is termed as environment in one field of study may be totally different from what another person from another field of study will mean. The most common definition of the word is the “habitat of an organism” or the “surrounding of an animal or plant”. Different authors have defined the word environment in various ways over time. For example, MacKinnon (1998: 322) considers the word to be derived from a French word “*environs*” which means “*in circuit*” or “turning around in.” She goes on to explain that the term environment is now also used to “refer to what goes on in the space, and to climate and other factors that act on living organisms or individuals that inhabit that space” MacKinnon (1998: 322). She also quotes Sagoff (1993) who says: “The environment is what nature becomes when we view it as a life-support system and as a collection of materials” (ibid.). On the other hand, Panneerselvan and

Ramakrishnan (2005: 1) give quite a number of definitions of the term. They first state that the environment is “a system which includes all living things, viz air, water, soil, vegetation, flora and fauna”. They then say that the “environment is anything immediately surrounding an object and exerting a direct influence on it.” They conclude by classifying the term into three categories: natural environment, social environment and the cultural environment.

With so many different definitions, it is necessary for purposes of this research to adopt a single definition. Therefore, this study is based on a model developed by O'Donoghue and discussed in Roux (2001: 18-19). This model looks upon the environment as something that is based on “four related dimensions: biophysical, economic, social and political” (cf. Figure 3).

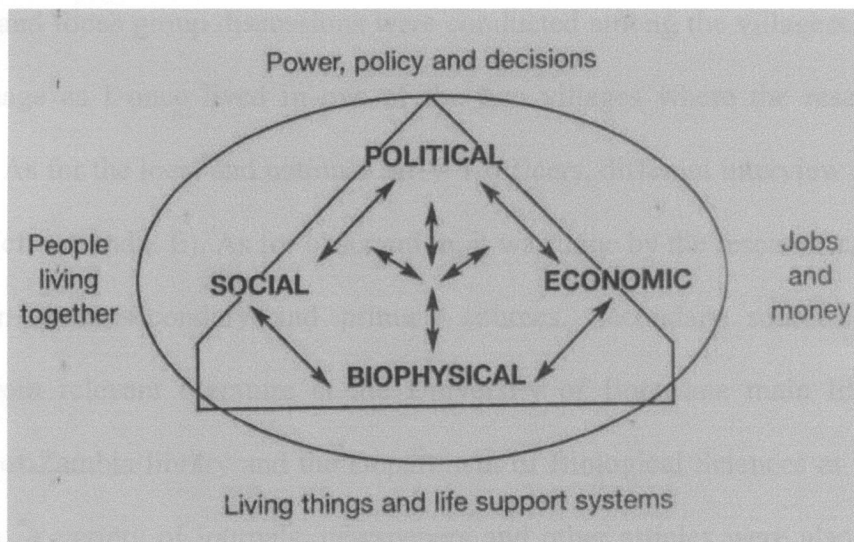


Fig 3: O' Donoghue's model of environment, taken from Roux 2001:19

As can be seen from the model, the biophysical (living things and life support systems), economic (jobs and money), social (people living together), and lastly political (power, policy and decisions) dimensions are interlinked.

## 1.8 Methodology

The methodology of the study was qualitative involving ethical evaluation. The research was based on a case study design as it is focusing on the two villages of Gungwe and Mbalambi. It is also based on purposive sampling as a non-probability sampling method. Through the use of snowball sampling as a type of purposive sampling, the villagers were interviewed, harvesters of the edible mopane worm, the Chiefs or Headmen of the two villages, and the Ministry of Environment Wildlife and Tourism (MEWT) officers at local and national level. The sample size was comprised of a total of fifty-six respondents (56), with nineteen (19) being males and thirty-seven (37) females. Data was collected through individual interviews and focus group discussions (cf. appendices C and D respectively) as well as by observation. The interviews and focus group discussions were conducted among the villagers using the local language as I once lived in one of the two villages where the research was conducted. As for the local and national MEWT officers, different interview schedules were used (cf. appendix E). As for observation, it was done by the researcher.

Data involved secondary and primary sources. Secondary source data was obtained from relevant literature at the University of Botswana main library, the University of Zambia library and the Department of Biological Sciences at these two universities. A variety of journals, newspapers and other articles were also accessed from the internet. Primary data was collected through the use of interviews and focus group discussions with different participants in Gungwe and Mbalambi villages. The findings were accordingly analyzed and subjected to a comprehensive ethical evaluation through the application of relevant traditional and environmental ethical theories.

## **1.9 Organizational structure of the study**

The dissertation has been organized into six chapters. Chapter one introduces the reader to the background of the study, the problem of mophane worm depletion, the aim of the study accompanied by its specific objectives and research questions, the significance of the study, its limitations and delimitations, and operational definitions of the basic concepts. It also describes the design, methodology and methods used in carrying out the research. Chapter two focuses on the review of literature. It gives a critical review of related work previously done by other scholars identifying a number of relevant variables. Chapter three discusses different theories that are applicable to research data collection and analysis. These include traditional ethical theories (Value Theory and Utilitarianism) and environmental theories (Social Ecology, Environmental Justice and Intergenerational Justice). Chapter four presents the data collected from the study, data analysis and discussion. Chapter five focuses on the ethical evaluation of the research findings. The last chapter is Chapter six which contains a summary of the study, conclusions drawn from the study and recommendations for policy makers and other stakeholders.

### **1.10 Summary**

The chapter began with the background of the study where it gave the reader a brief introduction on the problem of the loss of different species and also an overview of the study area. It went on to discuss the statement of the problem, the aim, objectives of the study and the research questions, the significance of the study, its limitations and delimitations, operational definitions, methodology and, lastly, the organizational structure of the whole project.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 Introduction**

This chapter presents a critical review of current studies that address the issue of mophane worm as a type of insect. It begins by giving an overview of species extinction around the world, Africa in general and then Botswana. It also looks into the importance of mophane worm. A survey of the available literature reveals that there is a vast store of information on insects and that various studies have been carried out in different fields, particularly on the mophane worm as one of the prominent types of edible insects around the world.

### **2.2 Overview of species extinction around the world**

The whole world is faced with depletion and or extinction of different species. Therefore, as it is a global issue, the whole world is at the moment concerned about the rate at which such depletion/extinction is occurring. For example, Barcalow (1998) states that more than 90 percent of the species that existed since more than more than 4 billion years ago are now facing extinction. He further reveals that some of these extinctions are more naturally occurring than anthropogenically motivated. However, Barcalow blames human activity for speeding up the rate at which extinction is happening due to the destruction of the natural habitats. It has been estimated that extinctions due to anthropogenic factors have increased the rate of species extinction by as much as 10,000 times.

Scholars have noted many causes of such extinctions around the world. They have been grouped as anthropogenic (caused by humans) and those which are naturally occurring. For example, Wenz (2001) notes loss of habitat as one of the anthropogenic factors. He says that people have destroyed areas where animals get their food, shelter

as well as mate. A second leading factor is hunting, and a third is the introduction of exotics which are said to be foreign species accidentally or deliberately brought into an area. He further asserts that:

Most estimates of the current situation are that at least 1,000 species are lost per year; an extinction rate of 100 to 1,000 times . . . human society finds itself in the midst of mass extinction . . . however, we are the reason for it (ibid.: 126).

This is an extremely unfortunate situation because the very same species, be it of animals or plants, big or small, all maintain balance in the ecosystem, especially as part of the food chain. There is, therefore, an urgent need for something to be done. As a preventative measure, the United States of America has promoted preservation of species by passing the Endangered Species Act in 1973 which was later amended for the better in 1978, 1982, and 1988 respectively. The Convention on International Trade in Endangered Species (CITES), which also has a mandate of protecting species, has at present more than a hundred and thirty countries who as signatories.

### **2.3 Overview on mophane worm in Botswana**

Botswana is also very concerned about the rate of biodiversity loss around the world which is happening at such an unprecedented rate. Some of these losses are due to long term results of natural processes like climate change, but others result from human activity. These anthropogenic factors can impact negatively on the functions of the ecosystem and, consequently, on the livelihoods of people. Due to limited knowledge of how the ecosystem operates and the future implications of species extinctions and changes in biodiversity levels, the need to take precautions as a nation is emphasized. In particular, Botswana and other Southern African countries are concerned about the loss of an important veld product called mophane worm. The

mophane worm is found and consumed in most of the Southern African countries such as Botswana, Namibia, South Africa, Zambia and Zimbabwe (Akpalu et al., 2007; Banjo et al., 2006).

In Botswana, there are only two popularly edible types of the mophane worm. One type has many colours, among them black, a bit of green, yellow, white and red, and a thorny protruding spine, technically known as *Imbrasia belina* or *Golmbrasia belina* (Akpalu et al., 2007). On the other hand, Roodt (1992: 52) gives the following description of the mophane worm, “The caterpillar is spiny hairless, about 7 cm and brightly coloured with red, yellow and black” (cf. Figure 4a below).



Fig. 4a: Mophane worm feeding on the mophane tree

Source: Toms and Thagwana (2003b)

The other type is a green worm with a faint white dotted line which, when dried, becomes yellow in colour. It is locally known as *phane e tala* and technically known as *Gynanisa maja* (cf. Figure 4b below).





Fig. 4b: Phane on the host tree

Source: Mwape (2010)

Dzimiri (2010: 17) writes that the “mophane worms have become a delicacy of choice in Botswana”. A survey carried out by FAO in 2004 has revealed that about 85% of the participants consume caterpillars, 70% of these from the Democratic Republic of Congo and 91% from Botswana. Most of the studies that have been carried out have revealed that the worm has high nutritional value as compared to most types of relish consumed in some of the Southern African countries. For example, the Department of Forestry and Range Resources (DFRR, 2009) in Botswana undertook a research on mophane worm’s nutritional value as compared to beef, bilton and chicken. The results were as follows:

**Comparison of Nutritional Quality (%)**

Sample	Protein	Fat	Carbohydrates	Calcium
Phane	56.8	16.4	13.8	0.458
Beef	22.6	8.0	0	0.016
Bilton	55.4	1.5	0	0.016
Chicken	20.5	6.5	0	0.010

Table 1: Mophane nutritional value

Source: DFRR (2009)

These figures reveal that mophane worm (phane) has far more proteins than beef and chicken which are the kinds of relish most eaten in Botswana. In terms of carbohydrates, the mophane worm has 13.8% as compared to 0% of all the three types sampled above. It is even higher in fats as well as in calcium. All this shows that the mophane worm is an important veld product that needs to be preserved. A very distinctive social aspect about mophane worm harvesting is that it is mostly done by women. Some scholars such as Moruakgomo (in Gashe Mpuchane., 1996) reveal that women constitute 95% of harvesters in Botswana and that most of them do not have reliable sources of income. In a gendered socio-economic study of phane done by Letsie (in Gashe et al., 1996), she also states that most of the veld products including mophane worms are harvested by women as it is considered a female activity. She further points out that “rural women in Botswana are among the most socio-economically marginalized groups, and a natural resource that offers the potential for improvement of their condition ought to be protected” (ibid.:118). In view of the four dimensional model of the environment chosen for analysis in this study, it will help to consider the relevant literature under each of these dimensions.

#### **2.4 Mophane worm and the biophysical aspect of the environment**

The mophane worm is part of the biophysical environment. By feeding on its host tree in one way or the other, it contributes to the health of the whole ecosystem. Still more, the worm is eaten by other animals and, at its moth stage, just like other insects, it contributes as an agent of pollination (Vantomme, Gohler and N'Deckere-Ziangba, 2004).

The mophane worm is the larva stage in the lifecycle of the *Imbrasia Belina* (Westwood) and it derives its name from its environment or host tree, *colophpermum*

*mopane* and *mophane/mpane* in Setswana and Ikalanga respectively (Akpalu et al., 2007; Banjo, 2006; DFFR, 2009; Maviya and Gumbo, 2005; Roodt, 1992; Styles, 1996). The caterpillar has been rated among the big twelve common edible insects for South Africans, Batswana, Zambians and Malawians (Akpalu et al., 2007; Mbata et al., 2002; Toms et al., 2003). The mophane tree is the host tree of the two worms. It can be termed the edible worm's environment as per the simpler definition of the word environment, i.e., "the habitat of an organism". The moth or butterfly usually lays its eggs on the lower case of the mophane leaves and branches where they incubate into small worms, feed on the same leaves, and eventually mature into the edible larvae. By feeding on the leaves of the same tree, it means that the worm contributes to the food chain. Hence, its disappearance could have an impact on the whole ecosystem. The mophane tree, technically known as *colophpermum mopane*, has got many other names like *mpani*, *balsam tree*, *black iron wood*, *butterfly tree*, *of mopane* (Setshogo and Venter, 2003; Roodt, 1992). The tree is described as having leaves shaped like the wings of a butterfly and bearing pod fruits covered with oil glands and shaped like kidneys. The fruits are not known to be edible, but when they dry and get buried in the soil, new sprouts of mophane shrubs emerge later. The species is well distributed in the Northern part of Botswana and is the most dominant kind of vegetation found in the area. Due to its deep roots, the tree is able to suck water from a great depth and, as a result, produce fresh leaves even before the rains occur (Macala in Gashe and Mpuchane, 1996). Apart from being the main habitat of the edible mophane worm, the mophane tree is used for a variety of purposes and more especially as building material in the area where it is commonly found. One of the main reasons why it is so commonly used is because it is termite-resistant and, most of the time, it has straight branches which are used for wagon shafts and fencing poles. Its ash is used as

fertilizer as it contains calcium and phosphorus (Roodt, 1992; Setshogo and Venter, 2003). Roodt (1992) states that the tree also acts as a niche for a lot of small animals like hole-nesting birds such as hornbills, woodpeckers and barbets, and for other rodents like the tree squirrel.

The mophane worm not only has a relationship with its host tree but even with the other areas in the biophysical environment as it plays an important role by being food for other animals. There is little information, however, on mophane worm as food for animals. The moths do not usually lay their eggs on a bare surface but hide them on the lower case of the leaves which suggests that they are avoiding predation. Based on an observation made in Kenya (Ditlhogo in Gashe and Mpuchane., 1996), it has been found that three species of birds similar to those found in Botswana are caterpillar predators. Ghaly (2009: 93) states that “insects make up about two-fifths of the food of our common land birds and two-fifths of the food of the adult fresh water fish”. He further explains that mealworms have been produced on a commercial scale as food for birds and reptiles. Some efforts have been made to produce flies from livestock waste for animal consumption (ibid.). Some studies carried out in Southern Africa have revealed that mophane worm is also fed to domestic animals such as cattle (Sekhwela, Ntseane, Dube, Ditlhogo, 2007; Ditlhogo in Gashe and Mpuchane, 1996). To prove the importance of an insect to the entire ecosystem, Vantomme et al. (2004: 3) write that as insects “are part of the food chain of several birds and other small animals which are hunted as bushmeat, the reduced availability of insects also affects stocks of their predators.” They also assert that such loss of biodiversity can directly affect the fructification of plant species by reducing their pollination. Chiras (1988: 82), on the other hand, asserts that “nature too is a balancing act of growth and decline, predator and prey... the secret of living systems is in achieving a balance and

maintaining it.” The health of the biophysical ecosystem environment, therefore, depends on everything that is in it, including the mophane worm. Just like any other insect, it can be seen to play a role that can bring balance to the entire environment.

## **2.5 Mophane worm and the economic aspect of the environment**

Economically, the mophane worm has always been seen as an income generating commodity especially for rural area dwellers. The mophane worm has become a booming business in most of the Southern African countries. According to Sekhwela (2007), mophane worm is an important veld product especially to the harvesters and their communities because it is a source of seasonal income. Ghaly (2009: 93) reveals that the *Isoberlina paniculata* worms provide a large portion of relish in Zambia and “are sold for good prices in urban centres including the capital Lusaka and the Copperbelt area.” This seasonal business forms the basis of a multibillion dollar trade in edible insects, especially for the harvesters, their families and those involved in trading (Ghaly, 2009; Toms et al., 2003). Mbata and Chidumayo (2003) also state that in 1999, a person could normally make up to 172,600 Zambian Kwacha (ZKW) or US\$52 and a household of at least six individuals could go slightly beyond ZKW1m, an equivalent of US\$ 309, per a harvest. Such money is far beyond what a local farmer would get from his agricultural produce. Dzimiri (2010) states that many people in Botswana are involved in the business of harvesting and selling the mophane worm as a valuable money-making venture. He also notes that the market for mophane worms is lucrative and growing fast, and that more people are getting involved as the demand is rapidly increasing. He further mentions that the “business has relieved many people from the clutches of poverty and they use their incomes to improve their ways of life” (ibid.: 17). On the other hand, Vantomme et al. (2004) mention that in Botswana,

research has revealed that the total income derived from the selling of mopane worms represents approximately 13 percent of the total household cash income per year, but that the labour input for that activity requires less than 6 percent of the overall income generating activity. Vantomme et al. (ibid.) also share the same sentiments with Ghaly when they reveal that the harvesting of edible insects is a good source of income, especially for women, because the business does not require much capital. It is also further noted that “that the sale of *Imbrasia belina* is the third biggest source of income after the sale of poles and livestock, and thus an important part of the household livelihoods” (ibid.: 2). It should be noted that this kind of business is not confined to Botswana alone as most of the yields have become one of its exports into South Africa. It has been estimated that three million Botswana Pula (the equivalent of 21 billion Zambian Kwacha) worth of mopane worm is exported to South Africa (Tefferet et al., in Gashe and Mpuchane, 1966; Moruakgomo in Gashe and Mpuchane, 1996). Whereas insects are widely bartered and sold in local village markets, some of the preferred species, like the Sapelli Caterpillars, *Gynanisa maja* and others, reach urban markets and restaurants. The sale of these worms extends beyond the borders of a single country. For example, there is a transborder trade in edible insects not only within Central African countries, but also in other countries in Africa like Sudan and Nigeria. Even though on a smaller scale, these worms are also exported beyond African borders to France and Belgium. The annual export to Belgium alone was valued at US\$41,500 at a rate of US\$13.8 per kg daily (Ghaly, 2009). This can be seen as a booming business in many countries, especially in Africa.

Of special interest is the fact that the biggest denomination among the coins of Botswana is embedded with a mopane worm feeding on the mopane leaves (cf.

Figure 5 below). This clearly indicates the importance of the mophane worm to the economy of Botswana.



Fig 5: Mophane worm embedded in a Botswana 5 pula coin

Source: Digga Dover

## 2.6 Mophane worm and the social aspect of the environment

Many reports have been produced on insects in general as food for people and several reasons have been given for the consumption of insects. The consumption of insects by humans is not something new or unheard of. Human beings have always been in the habit of eating insects as food and they have always formed part of the traditional form of foods in many cultures around the world. According to Banjo (2006: 298), “insects have played an important part in the history of human nutrition in Africa and Latin America.” They also mention that “insects are not used as emergency food during shortages, but are included as planned part of the diet throughout the year or when seasonal available.” Vantomme et al., (2004: 2) further note that “contrary to what many may think, caterpillars are not considered an emergency food but are an integral part of the diet in many regions according to seasonal availability. They are consumed as a delicacy.” In his study on *Imbrasia Belina*, Marais (in Gashe and Mpuchane, 1996) notes that “these insect resources are highly regarded by many tribes and ethnic groups and appear to have been collected



and possibly even traded since prehistoric times.” He further states that “these caterpillars were found in storage pits in Zimbabwe, which suggests that they might have been harvested as far back as the later Stone Age” (ibid: 23). In the Zambian context, Mbata and Chidumayo (2003) also point out that some Chiefs in Zambia claim that the natural resource is a God-given commodity harvested since time immemorial. On the other hand, they also note that “not all ethnic groups in Africa eat caterpillars and or other insects. The custom of harvesting insects for food is deeply rooted in the culture of specific ethnic groups on the continent that are known to exploit this renewable insect resource” (ibid.: 342).

Caterpillars are an important food supply, a source of protein as well as an alternative in increasing food security in many parts of Africa (FAO, 2004; Vantomme et al., 2004). People have different reasons for eating insects such as easy accessibility or availability and their provision of high nutritional value, especially in proteins. Vantomme et al. (ibid.: 2) note that “compared to meat or fish, caterpillars have higher protein and fat contents and provide more energy per unit.” FAO (2004) further state that “depending on the species, caterpillars are rich in minerals such as potassium, calcium, magnesium, zinc, phosphorus and iron, as well as various vitamins. Research shows that 100 grams of insects provide more than 100 percent of the daily requirements of the respective minerals and vitamins.” Vantomme et al. (ibid.: 3) issue a timely warning: “The nutritional and economic value of edible insects is often neglected, and we should further encourage their collection and commercialization, given the benefits to the environment and human health.” Ghaly (2009: 101) also alludes to the nutritional value of mopane worms, especially the protein and fat contents found in these worms, and he states that they contain “all the essential amino acids and minerals required for human growth”. With reference to Zambia, Ghaly



(2009: 93) notes that due to human population increase, a lot of people are said to have protein deficiencies. So even though there has been an increase in the production of different protein sources, there are still a large number of people who suffer from protein deficiency. Ghaly further explains that the *Isoberlinia paniculata* worms (or Miombo/Mopani worm) form quite a large fraction of the Zambian diet such that 40% of the relishes all year round come from these worms. It is also worth noting that caterpillars are not just perceived by some peoples as a source of food, but they are also held in reverence where they have attained some spiritual position in the upper realm. In some cases, shrines have been built to honour caterpillars. For instance, Mbata and Chidumayo (2003: 348-349) have written as follows about the Bisa people of Zambia with reference to two shrines dedicated to edible-caterpillar harvesting present in the area:

There was a small shrine, locally called *babanye*, at the senior chief's palace ... where the first few harvestable-size caterpillars ... were offered by the senior wife to the senior chief (*mukolo-wa-chalo*) to appease the Bisa ancestral spirits and to request for a good edible-caterpillar harvest for that year....The second shrine, locally called *chaipinda*, was located on the burial grounds of senior chiefs ... At this shrine the senior chief himself sought ancestral blessings for a good year's harvest of caterpillars for his subjects.

These authors note that the rituals done among the Bisa people with regard to reverence for caterpillars are rituals that involve everyone in the village from the Chief, the village scouts and the villagers to the male grandchildren of the Chief. They also note some taboos and beliefs associated with the harvesting of the worms among the Bisa people which, if not observed, may result in serious repercussions. Such taboos include the Chief's order as to when to begin and stop collecting. People are also forbidden to indulge in sex (whether married or not) during the harvest, especially

at the camp site, as they may be bitten by snakes or go insane (ibid.). This was also confirmed by Mwape (2010) on the different kinds of caterpillars in the same area of the Bisa people.

The medicinal value of caterpillars should not be overlooked. Mbata drew up a report based on the traditional medicinal and other uses of arthropods in Zambia. The report reveals that most of the traditional medicines are drawn from the classes of insects. The caterpillar has been listed as the edible Lepidoptera among the ten classes of insects which are said to be serving as traditional medicine in the rural areas of Zambia. Mbata (1995: 3) writes:

Caterpillars of this moth species (bag worms) together with their silk-lined bags of twigs, thorns, leaves, grass or other plant debris are roasted on an open fire and then ground into powder. This is smeared on small cuts made by razor blade into the skin around the goiter of the patient by the healer. As appetizer, the caterpillars and their bags are roasted “rare” and then eaten as snacks before a meal.

He notes that the insects are also used as charms, as good and bad omens. In this era of HIV/AIDS, “a South African entomologist, Rob Tom, has also recommended that people who are HIV-Positive should eat the caterpillars to boost their nutritional levels” (Akpai et al., 2007:1).

## **2.7 Mophane worm and the political aspect of the environment**

The regulation of the natural resources needs to be mandatory in each and every country. Presently, in Botswana, just like in many other countries, the natural resources are regulated by the government. The local communities are not so much involved in the regulation and management of the natural resources. For example, “according to Botswana law, the ownership and control of biodiversity belongs to the

State except on private, or freehold land, and customary land (tribal land)” (BSAP, 2007: 7). The tribal land areas are under the local authorities, like the land Boards in which one owns only the land but not the biodiversity in it. Similarly, the regulation on mopane worm is under the government. But traditional mopane worm just like all the other insects or veld products, are usually harvested locally or by the local people in their own communal woodlands. In the past there were regulations in place, especially on when to start the harvest and when to stop. It was also customary for the locals to seek permission to harvest (cf. Mbata et al., 2003). Similarly, Akpalu et al. (2007) allude to the fact that due to poverty and heavy dependence on the harvesting and selling of the mopane worm, policies towards sustainable management are helpful as the worm contributes to alleviation of poverty and increases food security especially among the rural poor. So there is need for regulations on the harvesting and utilisation of mopane worm as they can be helpful in sustaining the worm.

In relation to the above, the Botswana National Conservation Strategy (NCS) in 1990, drew up a National Policy on Natural Resources (NPNR) which outlines a number of strategic goals and measures on individual issues like pressure on water resources, rangeland pasture degradation and overuse of veld products among others. On the regulation of natural resources, the most interesting thing is that, subject to all the strategies, the government has come up with certain enforcement measures on the existing laws/regulations, and they deem it necessary that they have the liberty to introduce a new legislation. Such includes “improving the penal sanctions for law breakers, so that the punishments fit the offenses, and encouraging the participation of the local NGOs in enforcement activities. The laws and items for amendments include the Forest Act, the National Parks Act, the Fauna Act ...” (NCS 1990: 8). And as a solution to the overuse of veld products, the NCS (ibid.: 11) further states that:

As part of its programme encouraging economic diversification, the Government intends to foster the sustained development of a veld products industry. Effort will be made to concentrate commercial production in specific farm or plantation areas, specially licensed for the purpose by the Land Boards. The selective introduction of price incentives and capital grants will be investigated for the commercialization of new products. Strenuous efforts will continue to be made to ensure that under the Agricultural Resources Conservation Act, veld product communities are both restored and protected against exploitation. A major public educational campaign is proposed as an important component of the package, covering all aspects of veld products: values, availability, harvesting techniques, storage and processing.

There is need for nations to take precautions regarding individual species extinctions because to generalise or prioritise threats to biodiversity would vary according to species, as well by location or area. In Botswana, the species inventory does not have any details on other species like insects (BSAP, 2007). On the other hand, there has never been a clear demarcation between the commercialisation of the natural resources and their traditional usage such that “there is a perception, rightly or wrongly, that the profits generated from Botswana’s biological resources do not benefit the majority of Botswana currently” (BSAP, 2007: 8).

## **2.8 Summary**

This chapter has reviewed the available literature which is relevant to this study. It began by giving an overview of the issue of species extinction around the world and its causes which include, among others, the destruction of the habitats of different species, hunting and the introduction of exotics. The discussion was narrowed down to

Southern Africa with specific reference to the mophane worm, and lastly to Botswana where the study is based. The chapter identified the four-dimensional model of the environment by focusing on the biophysical, economic, social and political aspects.

## CHAPTER THREE: THEORETICAL FRAMEWORK

### 3.1 Introduction

The theoretical framework for this research will avail of a number of relevant ethical theories, both traditional and environmental. Ethics has traditionally been confined to human beings only, but discussions on what is right or wrong have now been extended to the non-human environment. The traditional ethical theories which will be discussed are Value Theory and Utilitarianism and the environmental ethical theories are Social Ecology, Environmental Justice and Intergenerational Justice.

### 3.2 TRADITIONAL ETHICAL THEORIES

#### 3.2.1 Value Theory

As ethics is rooted in values, it is therefore important to examine different kinds of values that are central to this study. Values can be identified in three forms: utility value, intrinsic value and inherent value. *Utility value* is the use or instrumental benefit that something brings to someone or something else. *Intrinsic value* refers to the value that something has in itself. With regard to life forms, plant or animal, they can be said to have a “good-of-their-own” and to be “morally considerable” (Goodpaster, 1999). In other words, they should not be prevented from flourishing without good reason. According to Beauchamp (1982: 81), “an intrinsic value is one that we wish to possess and enjoy for its own sake and not for something it leads to”. It is the worth or value that can be judged to already exist in something; its existence in itself does not require a valuer although a valuer can acknowledge its presence. For example, the life of a human being is valuable in itself. The third kind of value is *inherent value* which is that kind of value that can be aesthetically appreciated by someone such as, for instance, the value of a rainbow.

### **3.2.2 Utilitarianism**

Utilitarianism is one of the prominent consequentialist theories that hold that the rightness or wrongness of actions depends on their outcomes or results. Utilitarians are not interested in the motives or intentions of the actor but rather in the maximization of the good resulting from the action. Beauchamp (1982: 73) says that for utilitarianism, “the rightness and wrongness of actions and practices are determined solely by consequences produced for the well-being of all parties affected by the actions or practices”. In other words, for one to declare an action as right or wrong, he/she should have taken into account the overall good or the overall evil that are as a result of the very act, and not merely look at the act itself or the actor. Hence, for both act-utilitarianism and rule-utilitarianism, “an act or rule is right in so far as it produces or leads to the maximization of good consequences” (Beauchamp 1982: 109).

## **3.3 ENVIRONMENTAL ETHICAL THEORIES**

### **3.3.1 Social Ecology**

Social Ecology is a theory associated with a dialectical thinker, Murray Bookchin, who believes that the exploitation of the environment is due to the inequalities that exist in the structure of human society. Social ecology is defined as “the study of human systems in interaction with environmental systems” (Boff, 1994: 106). Whereas human systems include individuals, societies and social systems put in place by society, environmental systems include the natural environment as well as the human environment. Bookchin sees human beings as part of the eco-community that he refers to as “unity-in-diversity” in so far as the good of the whole is achieved through the complex interrelationships of parts to the whole. Thus, the cooperation of the complex parts is crucial in the evolutionary process. However, he believes that

interactions that take place in society are characterized by hierarchical dualisms which is “the pattern of thought and action that divides reality into two separate and opposing spheres and assigns a higher value to one of them” (ibid.). Examples of such dualisms include, male/female, powerful/powerless, rich/poor, urban/rural. Bookchin blames these dualisms for the divisions that exist in different societies. As a result, the unequal structure between the powerful and the powerless in society has resulted not only in one group dominating and exploiting the other but in their structural inequality impacting negatively on the natural environment. The net outcome is that the natural environment ends up being exploited by both the powerful and the powerless in different ways. The solution to environmental degradation, therefore, according to Bookchin, is first and foremost to dissolve the exploitative hierarchical structure of society. As Boff (ibid: 105) puts it, we need to “urgently seek to develop a new paradigm for society which does not repeat the mistakes of the old but integrates all human beings in a more humane way and establishes more benevolent relationships with the environment”.

### **3.3.2 Environmental Justice**

The concept of justice in its traditional sense is about equality or fairness among human beings. John Rawl’s *Theory of Justice* is most commonly referred to. To illustrate the concept of justice, Rawls used an imaginary device called the “original position”. He says that for us to judge whether an action is just or unjust, we need to enter into this hypothetical situation behind a “veil of ignorance” for the sake of eliminating all bias while making a decision. In such a situation, according to Rawls, decisions would be fair because people would not know who they were or what position of wealth or social standing they were in (MacKinnon, 1998). Although not



explicitly considered by Rawls, this theory has now been extended to the natural environment and to future generations under the headings of Environmental Justice and Intergenerational Justice.

According to Figueroa and Mills (2003: 427), “environmental justice refers to the conceptual connections and causal relationships between environmental issues and social justice”. Environmental justice is said to be of two forms, “domestic” which is concerned with the policies, laws and practices within the boundaries of a country, and “global” which widens the scope of environmental justice to a global perspective. Environmental justice also includes two dimensions of justice, namely, participatory and distributive. Distributive justice is concerned with how environmental benefits and burdens are distributed whereas participatory justice is interested in how these distributive decisions are made and who participate in their making. The distributive dimension is interested in disadvantaged groups like the poor and indigenous tribes faced with environmental burdens. There is seen to be a lack of equity in the way environmental problems are distributed and these include “the exploitation and loss of traditional environmental practices and depletion of local natural resources” (ibid.). While the participatory dimension of environmental justice is also interested in the same disadvantaged groups, it is more concerned with their involvement in being assigned environmental burdens and benefits. For instance, it focuses on how much the marginalized groups are involved in the drawing up of policies regarding their immediate environment as well as the extent to which they have decision-making power because, most of the time, decision-making is biased, top-down and neglects the democratic rights of such groups.

### 3.3.3 Intergenerational Justice

Intergenerational justice is a theory explaining “how we could possibly have obligations of justice towards members of distant future generations” (Wolf in Frey and Wellman., 2005: 279). It explains that the existence of future citizens depends very much on the kind of choices we make today. There are some people who are not in favour of intergenerational justice because they believe that the future generations do not exist so we cannot have any obligations towards them. On the other hand, there are those who are in favour of intergenerational justice who argue that although future persons are in no position to claim any injustice today, it is our responsibility as the present generation to claim justice on their behalf. They also note that “our choice to consume (or our failure to conserve) non-renewable resources will make these resources forever inaccessible to future generations who might have used them” (ibid.: 280). They further assert that our present actions may not only deprive future generations of the benefits they would have deserved but may even impose on them more burdens that they do not deserve. Therefore, our actions now can determine the advantages or disadvantages, the suffering or well-being of others in the future. It is also argued that the “unsustainable exploitation of natural resources now, the gratuitous damage to the earth’s environmental ecosystems, and the human-caused decrease in global biodiversity are likely to be much worse for people who will live in the distant future, and that these actions are therefore unjust” (ibid.: 281). He also states that, because we have moral obligations towards future generations, we should be able to situate such kinds of obligations in a theory like intergenerational justice which will help us to understand the content and weight of such obligations that we have towards them.

### **3.4 Summary**

The chapter has discussed different theories which are applicable to this research study. It started by discussing traditional ethical theories, Value Theory and Utilitarianism. Value Theory is based on three kinds of values: utility, intrinsic and inherent, while utilitarianism focuses on the results or outcomes of actions rather than on the actor or the act as the basis for judging the wrongness or rightness of an action. The chapter also discussed different environmental ethical theories: Social Ecology, Environmental Justice and Intergenerational Justice.

## **CHAPTER FOUR: RESEARCH FINDINGS, DISCUSSION AND ANALYSIS**

### **4.1 Introduction**

This chapter presents the research findings of the study along with discussion and analysis of the data. The focus of the study was to collect data with regard to the depletion of the mopane worm in Gungwe and Mbalambi villages. The model used in the study focused its attention on the way in which such depletion could have impacted on the different dimensions of the environment: biophysical, social, economic and political. What follows in this chapter is based on personal observation and the information obtained from in-depth interviews and focus group discussions (FGDs). Those in in-depth interviews will be referred to as “interviewees” whereas those in FGDs will be referred to as “participants”. While the headmen and MEWT officers were at ease with in-depth interviews, villagers were more at ease in FGDs. In general, as a triangulation method, the information coming from individual in-depth interviews was supported during FGDs. The sample size was fifty-six (56) comprising of forty-eight (48) villagers and eight (8) officers from MEWT. For interview schedules, see appendices C and E. For the breakdown of those interviewed, see Tables 2 and 3 below:

PLACE	HEADMEN	ASSISTANT	VILLAGERS	MEWT	TOTAL
Gungwe	1	-	19	-	20
Mbalambi	1	1	26	-	28
Masunga	-	-	-	1	1
Gaborone	-	-	-	7	7
				<b>TOTAL</b>	56

Table 2: Breakdown of interviewees

PLACE	MALE	FEMALE	TOTAL
Gungwe	5	15	20
Mbalambi	10	18	28
Masunga	1	-	1
Gaborone	3	4	7
		<b>TOTAL</b>	56

Table 3: Breakdown of interviewees according to gender

The focus group discussions (FGDs) were carried out in the two villages in two groups. In Gungwe, the first group was comprised of ten females only and the second group was comprised of seven males only. In Mbalambi village, the first group had six females and five males, hence a total of eleven participants. The second group had ten participants, four of which were male and six were female. For the breakdown of the FGD participants, see Table 4 below:

GROUP	PLACE	FEMALE	MALE	TOTAL
1	Gungwe village	10	-	10
2		-	7	7
1	Mbalambi village	6	5	11
2		6	4	10
			TOTAL	38

Table 4: Breakdown of FGD participants

## 4.2 DATA COLLECTION

### 4.2.1 Observation

No mophane trees were defoliated during April, the time when there is usually defoliation due to the second batch of mophane worm being harvested. The vegetation looked green and thickened. The mophane trees also had fruits hanging from their twigs (cf. Figure 6).



Fig. 6: Seeds/fruits of the mophane tree

Photo by Fatima Selaledi, Gungwe, 03/09/2010

In September, both the leaves and seeds were falling off the trees and being blown by the winds. The seeds were also split open due to the heat and being buried by the blowing winds. It was also observed that the domestic animals browsing on the green mophane leaves in April, and in September the animals were now picking the falling dried leaves from the ground. There were no birds or wild animals seen during my stay in the two villages. There were a lot of brownish ants in the two villages which gave me a hard time by climbing on the bed and biting me on the ears and on the head. They got into the food and were nearly everywhere. In all the households visited, none of the residents had mophane worm as relish but only the village chicken, garden vegetables, goat meat and beef sold from the vehicles passing through the two villages. In the households, it was also observed that there were more women than men in both villages. According to my observation, there was significant evidence that the mophane worm has gone through a serious depletion in the two villages.

#### **4.2.2 Knowledge on Mophane worm**

Participants in FGDs agreed in general that the mophane worm is an edible-delicious worm of which two varieties exist. They described them as follows: the green variety, which they refer to as *phane ya mengwe* in Ikalanga, and the black variety with many other colours known as *shonja le mmiwa*. According to the participants in Gungwe village, *phane ya mengwe* is said to have been named after Chief Mengwe of Maitenngwe or Ka Menngwe village in the central district of Botswana where it used to be in abundance. The *shonja le mmiwa* is known as such because of its thorny (*mmiwa*) spine (cf. Figures 4a and 4b). All the forty-eight (48) interviewees from both villages said that both of these worms used to be found in abundance in Gungwe and Mbalambi villages, though the green one was not as

plentiful as the thorny one. They also stated that these worms come from a very big butterfly that lays eggs on the mophane tree. The worms then grow from tiny little worms to very big edible worms. The ones not harvested burrow themselves (*kuyenda nsumbe*) and turn into what they call *zwigogoro* (pupae) which, if not disturbed, will emerge after rainfall as big butterflies to lay eggs again.

#### **4.2.3 Harvesting of the mophane worm**

All the fifty-six interviewees said that they or their family members were once involved in the harvesting of the mophane worms. All four FGDs acknowledged that almost every household in the two villages was once involved in this seasonal activity year in and year out. There were only two exceptional cases, one in Gungwe and the other in Mbalambi, where both women admitted to having a phobia about the worms. However, they stated that their families had been involved in the harvesting of this veld product.

#### **4.2.4 Common harvesters of the mophane worm**

All the interviewees were unanimous in stating that the common harvesters have always been the women. One of the reasons given by the villagers, both male and female, is that it is the traditional role of a woman, and of a girl child especially to do this work that they have to provide their families with relished *shadza* (porridge) (see Figure 7). In emphasizing this, one male villager in a focus group discussion in Gungwe said that it has always been a woman's task and that, as men go out hunting, women go out gathering wild vegetables and wild berries. The women were also expected to gather different insects like the mophane worm.



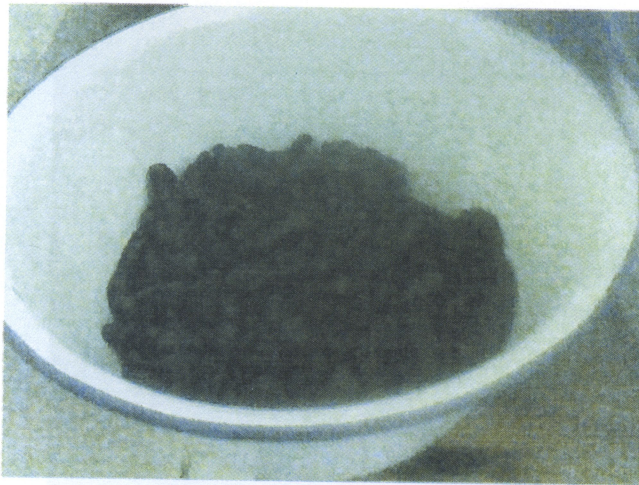


Fig. 7: Mophane worm served as relish

Photo by Fatima Selaledi, 28/08/2010

David Mabalane (cf. Figure 8) one of the male respondents in Gungwe village asserted that women had to be the ones to harvest the worms because, in more recent times, men have always been the ones going to work in the mines or towns. He also said that women have time to sit down and remove thorns in each other's hands, and even nurse their lacerated hands, whereas it would be quite embarrassing for a man to be seen doing the same (see Figure 9 below).

Fig. 9: Women negotiating the mophane worms

Source: Selaledi (2010)

### 4.3.3 Benefits of the mophane worm

Participants in the FGDs from the two villages gave several reasons for their harvesting the worms and for the roles played by the mophane worm. Firstly, as part of relish, it was stated that it was a nutritious kind of relish and that even the health



Fig. 8: Men gathered at Gungwe village. David Mabalani is seen at the far end and the researcher is seen squatting.

Photo by Joseph Selaledi, Gungwe, 03/09/2010.



Fig. 9: Woman degutting the mophane worms

Source: Mwape (2010)

#### 4.2.5 Benefits of the mophane worm

Participants in the FGDs from the two villages gave several reasons for their harvesting the worms and for the roles played by the mophane worm. Firstly, as part of relish, it was stated that it was a nutritious kind of relish and that even the health



workers had recommended it for boosting their immune systems, especially in this era of HIV/AIDS. All agreed also that they benefited economically through the selling of the worm which generated income to buy household resources. Items mentioned were school uniforms for their children, school fees, food stuffs such as meal mealie, utensils and garden tools. Bandi Jackson from Mbalambi village stated that the first time she sold her harvest, she managed to buy a bed and a chair. She even indicated that the mophane worm is one of the things that she used to sell in her kiosk.

Mrs. Kakale Bafi and Mrs. Angelinah Fani, who were once members of the Village Development Committee in Mbalambi and Gungwe villages respectively, had observed that harvesting the mophane worm was very helpful to the government in the alleviation of poverty in their area. They also revealed that, at that time, there were few destitutes as compared with today. During an FGD in Mbalambi, participants also revealed that the mophane worms are also food for some animals like the chameleon, different birds, snakes and big lizards. Even some domestic animals are said to like them when cooked. During one of the FGDs at Gungwe, it was stated that by the worm defoliating the mophane tree, it helped them to get firewood because some of the branches would have completely dried.

#### **4.2.6 The challenges associated with the mophane worm**

During an FGD at Gungwe, it was mentioned that the issue of harvesting and processing of the mophane worm entails a lot of work in terms of the harvesting and their processing. Now that the worms are no longer there in their area, Mrs. Chisina Mphengula said:

We need to relocate to far places where the mophane worms are still found in abundance during harvesting. We are forced to abandon our fields and children. This is referred to as *chilala che mashondza*. Life in the bush is not easy. We do not only fear the dangerous animals like snakes but we also encounter lacerations from degutting the thorny worms.



Fig. 10: Women gathered at Gungwe. In front is Mrs. Esther Maphuru

Photo by Fatima Selaledi, Gungwe, 03/09/2010.

#### 4.2.7 Mophane worm depletion

Most of the interviewees in the two villages, including the MEWT officers, are acutely aware of the depletion of the mophane worm in their areas. Some said that the worms are now sparingly found while others even said there are no longer any mophane worms found in their area at all. This was confirmed by the Chiefs of both villages, Mr. Bernard Mbalambi of Mbalambi village and Mr. Moses Mangole of Gungwe village, as well as by the MEWT officer Mr. Matswerere M. Olatotse at the Headquarters of the North East District in Masunga. He clearly stated that the worms have become seriously depleted in the past few years in that area. Forty-nine of the fifty-six interviewees mentioned a time frame of between two to ten years. Six MEWT officers at national level were not sure of the state of the mophane worm in the North

Eastern part of Botswana. Mr. Zimmermann, also a MEWT officer at (DFRR), said that the mophane worm is still in abundance but is likely to be endangered in the future due to commercialization. Some of the villagers were of the view that the mophane worm had gone for good or has faced total extinction whereas the local MEWT officer stated that a decline had been observed since 2008. Mr. Bernard Mbalambi, the Chief of Mbalambi village, was more specific:

The worms have been disappearing since 1970. I remember very well. There were some intruders who invaded our forests at the far corner of the village at that time. Due to the way they harvested, our forests never recovered. I observed that since that time, the worms have been reducing in number until lately when they have completely disappeared.

It should be noted that all of those interviewed had lived in the area for over fifteen years and that many of them were old people who had lived in the two villages since birth or for most of their lives.

#### **4.2.8 Anthropogenic factors**

The anthropogenic factors that emerged from the in-depth interviews and FGDs were as follows: unsustainable methods of harvesting, overharvesting or overexploitation, commercialization, cultural beliefs on mophane worms, demand for land, and extensive usage of the host tree.

##### **(a) Unsustainable methods of harvesting**

Unsustainable harvesting was said to be in the form of excessive harvesting due to commercialization and the digging up of the burrowing worms which determined the next harvest. Villagers interviewed stated that what they call *sumbe* (big mophane worms burrowing into the grounds) is nicer and fattier and does not have a thorny spine. They said that some people were so destructive that they would cut the infested

branches of the host tree in order to harvest as much as they could. Nearly all blamed what they referred to as *ku gora/fuga* (to roast in hot ashes) as having been one of the leading factors of depletion of the mophane worm (cf. Figures 11a and 11b). They stated that by setting large areas on fire, they ended up not only burning the mophane worms they had harvested but even the stray ones. This also included the veld fires that spread due to the roasting.



Figure 11a: Woman roasting caterpillars

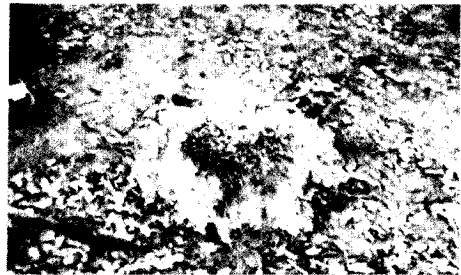


Figure 11b: Fire for roasting  
caterpillars

Source: Mwape (2010)

#### **(b) Overharvesting/Overexploitation**

The participants were of the view that the harvesting of the small mophane worms was a form of exploitation as they are not easy to degut. They also stated that when harvesting, some people would pick every worm from every tree such that there would be none left for the next yield. They further believed that some “intruders” such as Zimbabweans (as the two villages share the borders with Zimbabwe) were sneaking into their area and were harvesting what they referred to as *libiro* (very small mophane worms). They also felt that these intruders were reckless in digging the burrowing worms which resulted in low yields.

### **(c) Commercialization**

Due to the ready market in South Africa for the mophane worm, interviewees said that there was a need for an increase in the harvest so as to meet the demand. This resulted in many more people, especially the intruders, harvesting as much as they could. They later discovered that the South African farmers were using the worms as animal feeds and not for human consumption. The selling of worms in large quantities had resulted in the intruders harvesting a lot more, whereas the villagers used to sell very small quantities within their area, not going to the markets, and certainly not exporting to foreign countries. One of the villagers, Mr. Nyarenda David, was very annoyed that Botswana had allowed such freedom to intruders. Three interviewees, however, admitted that they later on joined in the commercialization of the worm locally, although only on a smaller scale. They also admitted moving to other areas when their forests got depleted.

### **(d) Cultural beliefs on mophane worms**

There is a shrine to *Mwali* in Gungwe village and the Mbalambi Chief is one of the messengers/intermediaries known as *wosana*. He said:

*Mwali* was not happy to see his animals dying in that manner, wriggling in the hot ashes until they die. That is why he had to withdraw his animals. *Mwali* had given us those things as relish but we started commercializing them and even feeding cattle, so he was hurt and felt we did not need them anymore.

Another factor that emerged is the change of roles. The activity of mophane worm harvesting had always been done by women but, due to commercialization, men realized that women were making money so they decided to join them. The women blame the men for being more reckless in harvesting these worms. They believe that

due to their impatience and laziness, they are the ones who harvest destructively by cutting trees and digging the burrowing worms. They even stated that in order to avoid lacerations, the men and some women have now turned to wearing gloves when harvesting the worms which means that the harvesters are not as gentle as those who use their bare hands. They believe that the worms also feel pain and that the gods are watching, hence the withdrawal of the worm in their area. Two old women (Banesemu and Banepakala) of Gungwe believe that the people who came to harvest in their villages cursed them by taking the long sticks (*makombo ano gora mashondza*) used for roasting (cf. Figure 11a) with them to their villages and that by so doing, the mophane worm followed them to their area. The traditional belief is that the mophane worms will follow to where the long sticks have been taken. Furthermore, they expressed the belief that when cooking the mophane worm, one is not supposed to cover the pot, for there is a belief that this action drives other mophane worms away.

#### **(e) Demand for land**

Villagers stated that due to the increase in population, there has been a greater demand for land for housing and agricultural purposes. This was confirmed by a MEWT officer who also indicated that there was a higher demand for land due to government agricultural policies like Young Farmers Fund, NAMPAAD and ISPAAD which rewarded farmers who are engaged in agricultural activities. Consequently, the clearing of the land for agricultural purposes led to the destruction of some of the host trees.

#### **(f) Usage of the host tree**

Interviewees mentioned a number of areas where the mophane tree is useful: both men and women collect firewood for selling and daily cooking respectively, and men use the logs for building kraals, droppers for the field and a lot more (cf. Figure 12).





Fig. 12: A goat kraal constructed from mophane logs

Photo taken by Fatima Selaledi, Gungwe, 04/09/2010

In a traditional hut, the wood is used as rafters (*thunngo* and *mbalilo*), supports (*phanda*, *makoko*) as well as doors (*makwasaile*), traditional rope (*lutshe*) to tie/bind the grass and the rafters together (cf. Figure 13). The bricks used for building the huts are sometimes burned using big mophane logs to make them durable.



Figure 13: A traditional hut with supports from mophane tree and the burned mud bricks

Photo taken by Fatima Selaledi, Gungwe, 05/09/2010

The mophane tree is also used in crafting household utensils, wooden dishes and cooking sticks (*ndilo*, *njigo ne mepushuko*), mortars, pestles, handles for axes and hoes and walking sticks, (*matuni*, *mese*, *mepene ye mashathu ne mapadza ne ndozo*), (cf. Figure 14), building storage for agricultural harvests and thrashing sticks (*matula, matala/zwirara ne mapanngo a no pula*).





Figure 14: Traditional wooden utensils made from mophane tree

Photo taken by Fatima Selaledi, 18/09/2010

One of the most interesting things that the villages mentioned is that one of the best sticks used for corporal punishment by the parents, teachers and Chiefs is from the mophane tree (*shamu/gamu*). The tree is also said to be medicine for the liver.

Views differed with regard to the extent to which treatment of the host tree has led to the depletion of the mophane worm. Fifty of the fifty-six (56) participants saw the excessive use of the host tree in the area as having impacted negatively on the population of the mophane worm. However, the other six (four villagers and two MEWT officers at national level) denied the correlation on the basis that the trees are still found in abundance in both villages. Among the fifty who said there was a link, they noted that the trees that are left are small shrubs and that the worms seem to prefer bigger trees. They believed that the mophane worms preferred certain types of the host tree and that the disappearance of these trees could have resulted in the depletion of the mophane worm. One of the villagers in Mbalambi even stated that he once observed a massive movement of the worms from their area to a different area in search of preferred trees even though the tree in his area were not completely defoliated. Consequently they got scorched by the sun and died without having burrowed themselves in order to pupate.

#### 4.2.9 Natural factors

Apart from the anthropogenic factors stated above, the villagers also blamed the following natural factors: (a) predation and (b) drought.

##### (a) Predation

Twenty-five participants reported that different species or animals had a great impact on the depletion of the mophane worm. One old man who had retired from the mines in Mbalambi indicated that, after discovering the rate at which the mophane worm was disappearing, he got worried and decided to go into the veld to do his own investigations. He said he discovered a big lizard-like animal, often mistaken for an iguana (*khwathe*), digging the burrowing mophane worm and the pupae (*zwigogoro*) and, in some cases, eating them or even leaving them scattered all over. They left open gullies such that the worms would never be able to emerge as butterflies to lay eggs. He also noticed small brown ants (*lemenyu*) that were eating the pupae from the open gullies. He said the ants were also pulling some of the scales left by a big lizard-like animal, often mistaken for an iguana (*khwathe*). One of the villagers in Gungwe, Angelinah Fani, shared the same sentiments regarding the small brown ants (*lemenyu*) saying that there was an outbreak of the same ant in their village, something that the researcher also observed. The ants were everywhere, including in the villagers' huts, and I myself was warned well in advance to bring my own blue death (a popular white powder they smear on the floors) to prevent the ants from getting into the food and climbing on to the beds. The villagers explained that these kinds of ants are not eaten by anything and they can kill an animal as big as an elephant by getting into its nostrils. The local MWET officer said there was a high possibility that the ants have contributed to mophane worm depletion in the area.

An old man in Mbalambi said that he saw big birds like guinea fowls, vultures, crows and others digging the burrowing mophane worms and the pupae with their beaks. He explained that the worms cannot burrow very deeply into the soil, and that in order to make it easier for them to emerge as butterflies, the soil is raised a bit above the level of the rest of the ground (*sunda/kukumuka*) and sometimes cracked.

#### **(b) Drought**

One villager, both Headmen and the local MWET officer Mr. M. Olatotse blamed the change in the rainfall patterns for the depletion of the mophane worm. They all said that the rains no longer come during the same months as they used to, and that even the quantity of rain has lessened. Mr. M. Olatotse explained that the soil found in the North East of Botswana is clay, so it tends to be logged. Hence, there is need for the rains to enable the soft furred butterfly to be able to emerge easily. He further said that for the worms to grow fast, they need rainfall as they are nourished by the leaves of the mophane trees which also need water to grow. The two Chiefs also said that the lack of rainfall had resulted in drought so that the little worms that hatched get scorched by the hot sun. This resulted in only a few maturing to burrow into the soil in preparation for the following harvest. The MWET officer also shared the same sentiments:

The amount of rainfall in the area has contributed to mophane worm depletion because, when the region experiences less rainfall, the abundance of mophane worm drops due to the lower availability of leaves that they feed on. The mophane tree will also be affected by the heat stress thus reducing foliage production.

On the other hand, one of the villagers in Gungwe said that too much rain had led to the decay of the pupae under the ground, and that some would also be washed away into the rivers.

### **4.3 DISCUSSION**

#### **4.3.1 The phenomenon of the mophane worm depletion**

According to Gungwe and Mbalambi villagers, they have not had any mophane worm harvest for a period exceeding three years. Their opinions and views on mophane worm depletion were based on over ten years of residence in the study area and many of those interviewed were elderly people who had stayed in the village from childhood. The results of this study clearly indicate that the problem of mophane worm depletion does exist in Gungwe and Mbalambi villages in the North Eastern part of Botswana. Hence, the findings of this study have confirmed the reports on mophane worm depletion as noted by authors like Akpalu, Muchapodwa and Zikhali (2007) and Maviya and Gumbo (2005). Akpalu et al. (2007: 2) had already stated that, “there have been reports of disappearance of the worms from parts of Botswana and South Africa.” Toms and Nonaka (2005) have also noted that there are some areas where the harvest appears to be very low and, in some cases, local extinctions have occurred. Furthermore, Ghaly (2009: 94) has made a similar observation stating that “these worms are facing mass extinction due to drought and overharvesting.” Banjo et al., (2006: 299) also stated that, due to the popularity of the worm, “it is eaten into extinction by people in Southern Africa.”

Several factors, both natural and anthropogenic, emerged as the causes of mophane worm depletion. The findings are in line with those of Ghaly (2009) in

Zambia that both natural and anthropogenic factors have contributed to such a situation.

### **(i) Natural factors**

Research has revealed that lack of rainfall resulting in drought is one contributing factor to mopane worm depletion. This is in line with the comment of Ghaly (ibid.: 102) that “the industry is faced with several problems including droughts that have devastated the harvest on a regular basis.” Similarly, the BSAP report done in Botswana has also reported that a lot of biodiversity loss is due to natural factors like climate change. Toms and Thagwana (2003c) noted the dried out remains of dead caterpillars and concluded that natural factors like lack of rainfall, hot sun accompanied by hot temperatures killed the hatched little worms.

The local community said that apart from rainfall and drought, there were some animal species that invaded their region. One such animal is small brown ant known as (*lemenyu*) in Ikalanga. The ants are brownish, wingless and like moving in a trail. The so-called ant has greatly increased in the area and is everywhere, even in houses or huts, and there seems to be no other species that can consume this ant in order to keep the balance in the environment. This confirms the findings of Wootton (1984: 126) that “even those ants that nest on the ground, such as the mound-building wood-ants (*formica*), restlessly forage high up in trees in search of caterpillar larvae which they milk.” He also states that “most animals, small and large, avoid these fierce hunters as they advance in vast spreading columns” (ibid.: 127). He further asserts that “these carnivorous ant colonies may run into millions ... as many as 20 million, and the availability of insects and other small animals prey must be quickly exhausted by their demands” (ibid.). This is a clear indication that these ants are one of the major contributing natural factors leading to the depletion of mopane worm in Gungwe and

Mbalambi. Some villagers reported that, since the outbreak of the same ants, the mophane worm population in their region has drastically dropped. On a more general level, Wenz (2001: 126) has noted that one of the main factors that cause species extinction is the introduction of exotics. He explains:

Exotics are species brought into an area by human beings, either deliberately or accidentally. Exotics can cause species extinction because ecological competition is a bit like commercial competition among companies trying to use the same raw materials, employ the same workers, and/or attract the same customers. Exotics, which often have no natural predators in their new home, often out-compete native species, reducing their fitness and possibly, leading to their extinction.

Wenz's explanation about exotics best suits the situation of the ants (*lemenyu*) which have invaded the villages of Gungwe and Mbalambi, especially as the villagers mentioned that there is no animal that eats these ants.

## **(ii) Anthropogenic factors**

With reference to the commercialization of the worm as one of the contributing factors to mophane worm depletion, Ghaly writes that "over exploitation has led to local extinctions in several areas" (2009: 102). This is, in fact, an indication that these worms are highly endangered and are likely to face extinction in the near future. Some people harvest in a most destructive way by cutting down the trees or branches infested by the worms. A similar observation was made by Mbata and Chidumayo (2003) who noted that some people in Zambia would clear the land by cutting down up to two hectares trees especially at a time when caterpillars are in abundance. Akpalu et al. (2007) have also alluded to the fact that the worms have declined due to overexploitation and lack of selective harvesting.



### **(a) Demand for land and usage of the host tree**

The research findings have revealed that the high demand for land for agricultural purposes and residential plots has had an impact on the loss of habitat for the mophane worm. The villagers stated that there is massive usage of the host tree in their area, especially for household purposes. Similarly, Toms and Thagwana (2003b) have identified other factors due to human activity like the loss of habitat as one of the main threats to biodiversity. Such habitat destruction is mostly due to the construction of houses, roads and other forms of infrastructure. A similar instance is reported by Marais (in Gashe et al., 1996) who says that, in Namibia, the trunk bark and branches of trees are commonly used in the construction of villages, stock and crop enclosures. Furthermore, according to Mogotsi (2009), the mophane tree is used for fuel, as fodder for livestock, as timber for traditional huts or making utensils and, due to its wide spreading canopy, for providing shade. Hence, the cutting down of trees could have an enormous impact on the population of insects found in an area. For example, Vantomme et al., (2004) noted that bush fires may also lead to deforestation which may, in turn, result in destruction of the insects and, hence, lead to population decline. Hara (2006) has also mentioned that the *chitemene* “shifting cultivation” land use practice, which results in loss of desirable tree species and on which caterpillars feed on, also results in depletion of the mophane worm.

### **(b) Knowledge on the lifecycle of the mophane worm**

The local people in Gungwe are clearly very much aware of the different stages of the mophane worm’s life cycle. However, it is worth noting that Toms et al., (2003b) had attributed one of the reasons for the depletion of mophane worms to the fact that some people do not know how the life cycle of the moths operates. In their study in the Limpopo Province in South Africa, they established that there were many people,



including teachers of biology, who did not know about the mophane lifecycle. Indeed, according to Toms and Thagwana (2005), people do not believe that there is anything like a life cycle. Knowledge of the life cycle of the mophane worm is very important, therefore, especially for the harvesters because, if the cycle is broken at any point by excessive harvesting or overexploitation, it will not be possible to maintain a sustainable harvest. The four stages of the mophane worm lifecycle as can be seen in Figure 15 are as follows:

1. The eggs are laid on the leaves of mophane tree by a large and attractive female moth.
2. Small worms hatch from the eggs and molt a few times before they reach maturity
3. The worms that are not harvested leave the trees (and) move down the ground where they excavate a burrow in which they pupate or turn into pupae.
4. The life-cycle is completed when the adult moths emerge from the pupae, mate and lay eggs. Ghaly (2009), DFRR (2009).

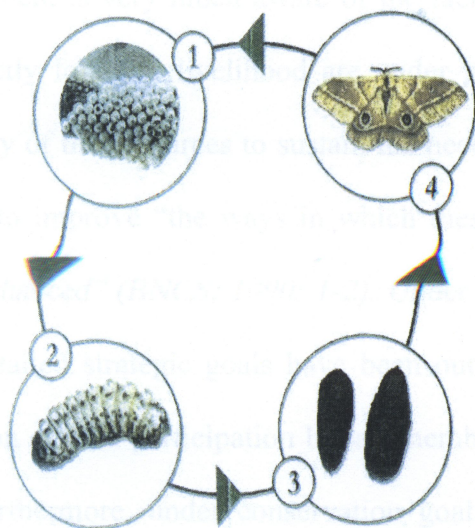


Fig. 15: Life cycle of Mophane worm

Source: The Department of Forestry and Range Resources (DFRR)

### 4.3.2 Regulation of natural resources

The findings of the research have revealed an inconsistency in the regulation of the natural resources as per the government's recommendations. On 28<sup>th</sup> December 2007, the government withdrew the clause on mopane worm after having included it among the regulated veld products on 1<sup>st</sup> December 2006. This is contrary to BSAP and NCS expectations. In the year 2000, the Ministry of Environment, Wildlife and Tourism (MEWT), as per the recommendations of BNCS, drew up a biodiversity action plan which was later revised in 2007. However, due to red tape or bureaucracy, the Biodiversity Strategic Action Plan (BSAP) was only implemented in April 2010. The BSAP identified eleven strategic objectives among which are the following:

Better understanding of biodiversity and ecological processes; long-term conservation and management of Botswana's biodiversity and genetic resources; efficient and sustainable utilisation of all components of biodiversity in Botswana through appropriate land and resource use and management.

The government is very much aware of the fact that resources that many people depend on directly for their livelihood are under pressure. Hence, there is concern "about the ability of the resources to sustain the needs of the future generations" and about the need to improve "the ways in which these resources are used so that the environment is enhanced" (BNCS, 1990: 1-2). Under the two main strategic goals, a series of more detailed strategic goals have been outlined, and one of them is "the increased education of, and participation by, all members of society in improving the environment." Furthermore, under conservation goals, emphasis is placed on "the conservation of all main ecosystems, wildlife and cultural resources the protection of endangered species and the distribution of incomes and rewards more equitably, in the interests of conserving natural resources" (BNCS 1990: 3). This shows that the

government is very much aware of the need to conserve natural resources for future generations and for the sake of the ecosystem. Akpalu et al. (2007: 2) have significantly observed that “with the poor heavily dependent on the collection and marketing of the worm, policies towards sustainable management will contribute to alleviation of poverty and increase food security especially among the poor.”

### **4.3.3 Property Rights**

Even though the local people had suggested that their user rights should be reinstated, the current situation on property rights does not favour the local community as their immediate environment is open to all. Presently, the land and natural resources do not belong to the local communities but to the government of Botswana. Legally “according to Botswana law, the ownership and control of biodiversity belong to the State...” (BSAP, 2007: 7). The tribal land areas are under the local authorities which means that one owns the land only but not the biodiversity in it. There has never been a clear demarcation between the commercialisation of the natural resources and their traditional usage such that “there is a perception, rightly or wrongly, that the profits generated from Botswana’s biological resources do not benefit the majority of Botswana currently” (ibid.).

## **4.4 DATA ANALYSIS**

### **4.4.1 Impact of mopane worm depletion**

The depletion of the mopane worm in Gungwe and Mbalambi villages has resulted in both negative and positive outcomes. The impacts have been felt in the four dimensions of the environment, (a) the biophysical, (b) economic, (c) social, and (d) political.

## **(a) The biophysical environment**

### **(i) Negative impact**

Due to the depletion of the mophane worm, the natural environment has been affected both negatively and positively. The negative impact is felt in the loss of certain types of wildlife, the loss of manure and the scarcity of firewood. All the forty-eight villagers stated that, in the past, there were a lot of different kinds of small animal species which fed on the worm. Such animals include different kinds of birds, such as the vultures, crows and guinea fowls, chameleons, snakes, different forms of lizards and squirrels. Now, they have become few. Different kinds of livestock are said to be feeding on the mophane worm and, although most of the domestic animals prefer it boiled in salty water as do humans, they still eat them.

The loss of manure was also identified as a negative effect. The villagers explained that the droppings of the mophane worm acted as manure for the soil and for the growth of different kind of plants. Mr. Olatotse, the local MWET officer, confirmed that the droppings have nitrogen which is needed by the soil, and that these droppings act as feed to small organisms in the soil as well.

The villagers further stated that the worms defoliated the mophane tree with the result that some branches became dry enabling them to get firewood easily. This was especially important because recently policies have been put in place that deny them permission to cut live trees making life difficult as they do not have any other means for cooking. Of course, it has to be noted that what the villagers perceive as impacting negatively on them by forbidding the cutting down of trees is based on an anthropogenic utilitarian ethical evaluation.

## **(ii) Positive impact**

The depletion of the mophane worm has in some ways also benefitted the biophysical environment. Two villagers, one from Mbalambi and another from Gungwe, noted that it was for the better that the worms have disappeared. Mrs. Ndzonga Emily Fani said a lot has changed as, “the worm severely reaped the forest naked and, since it disappeared, their land is green and the mophane trees are now able to bears fruits” (*Gonyana la ka be le mbula shanngo kwa ka bepa kubi, chinnga kwa la ka yenda shanngo e tala e bile mepane ena bana*). She went on to explain that with the mophane worm, the tree now has a chance to bear fruit and flourish, and that when these fruits dry, they drop off the trees, get buried and new shrubs emerge.

Another participant in Mbalambi, Mrs. Ludo Keskile, who has a phobia of the worm, said that their livestock, goats and cattle, now have something to feed on as they used to compete for the same tree as the mophane worm. What was happening is that the mophane worm would feed at night, and by dawn, the tree would be completely defoliated so that the rest of the animals would suffer. In this way, the depletion of the mophane worm was perceived to impact positively on the biophysical environment especially as the host tree was given a chance to flourish and produce seeds, and thereby to feed other animals.

## **(b) The economic environment**

All the forty-eight participants stated with disappointment that the disappearance of the worm has been a serious challenge to their finances. They revealed that, with the selling of the worms, they managed to meet some of their needs as their area has very scarce job opportunities. Mrs. Mabalane in Gungwe said that she used to sell a 50kg bag at P400.00 (ZKW 280, 000) and that a mug would sell for P5.00 (ZKW 3,500). One of the villagers in Mbalambi who runs a kiosk revealed that the depletion

of the worm has affected her business as the worm was one of the commodities that generated a lot of profit for her.

### **(c) The social environment**

Under the social dimension during a focus group discussion, the participants lamented that their way of life had been badly affected as it was part of their culture to harvest the worms and that they used to pass on this skill to their children. All the forty-eight participants stated that the worm was also a form of relish, and that its disappearance had led to problems as other forms of relish like beef and chicken are expensive and scarce in their area. One of the villagers in Gungwe said that the worms helped in boosting their immune system, especially for those who could not afford other forms of food. However, one of the male villagers in a focus group discussion complained that during the harvesting of mophane worms, some women neglected their fields and abandoned their children.

### **(d) The political environment**

According to all the eight MWET officers, there had been a policy on the regulation of some natural resources which was implemented in 2006 and included the mophane worm/*Imbrasia belina* (cf. Appendix A). In 2007, however, the regulation was amended to exclude it under category C (cf. Appendix B). This has caused much dissatisfaction and confusion as it is not clear as to why this change was made. It has resulted in tension between the villagers and their government. One villager in Gungwe, David Mabalani, complained that the government of Botswana is just imposing on them one policy after another without even consulting them on issues affecting them. All the participants, including the Headmen of both villages, said that they just heard through rumours that no one is allowed to harvest the mophane worms without a permit. One of the participants in Gungwe, Mrs. Chisina Mphengula,

revealed that she heard the news from her daughter in Palapye. Her daughter had been among a group of harvesters who were confronted by some officials from the surrounding area for harvesting the worms without a permit. None of the interviewees were even aware of the withdrawal of the regulation in 2007. However, during a focus group discussion, some male participants reported that they had recently been informed of a new regulation on the use of mopane tree. They said the Land Boards officials had informed them that whoever would be caught cutting down the mopane tree would be subjected to a sentence in prison or fined. They complained that as their lives revolved around their immediate natural environment, especially around the mopane tree, they did not know how the government was expecting them to survive when it was not even providing alternatives for them to alleviate poverty. While one MWET officer at national level thought the withdrawal of the regulation had been politically motivated as the government had later realized that it was a wrong move to have implemented it without having consulted the local inhabitants on something that involved them. Those interviewed also revealed that if they had been involved in the decision-making process, they would have come up with better decisions as they had better knowledge about their environment than the government officials. The MWET local officer was also of the view that the local community should be involved in issues such as the conservation and protection of the natural resources or veld products within their territory.

The Headmen suggested that a permit for harvesting should only be granted to those who are harvesting in bulk, and that permission should be obtained from the Chiefs/Headmen and not the government officials. According to them, the Chiefs/Headmen should be granted authority over their immediate environment. This would help them to be always on the lookout for intruders, especially the illegal

*immigrants who cross over to destroy their environment. They said that, if given the resource use rights as in other areas where there is wildlife, it would help to improve their lifestyle as well as manage the natural resources well. Mr. M. Olatotse suggested the implementation of Community Based Natural Resource Management (CBNRM) policies and the formation of conservation trusts by the villagers as in other areas where there is a lot of wildlife could help in empowering the local community. The Headmen of Mbalambi, and two old women (Banisemu and Banipakala) who believe in Mwali, suggested that, as villagers, it is time for them to go back to the mountain (dombo) to apologise on behalf of all who have been involved in behaviour destructive to the environment so that the mophane worms might come back.*

The general opinion, then of those interviewed was that the government must help in re-introducing the mophane worm in their area and in setting up harvesting quotas. People should be monitored when harvesting so that they would not be allowed to roast the worms in ashes. They also suggested that the government should dig some of the pupae from the area where the mophane worms are still found in abundance and bury them in their region where they will emerge as butterflies to lay eggs. They said that, if given the opportunity and taught farming technology, they could be involved in the rearing of the worms. They further stated that it is not only the elders who should be sensitized on environmental sustainability during village gathering but even children in schools. This would be in line with what Mr. M. Olatotse said of the government position:



Our Department of Forestry and Range Resources (DFRR) is involved in sensitizing or educating the community on sustainable utilization of the veld products, on the cutting down of live trees, on the handling of fires in our daily chores, on the rehabilitation of degraded areas and on methods of conservation of natural resources so as to ensure sustainable regeneration of those products.

Finally, most of those interviewed were of the view that everything that we have access to today should be conserved for future generations as they are entitled to them as much as we are. They said that we need to leave some food for them. One of the villagers in Gungwe, Mrs. Esther Maphuru (cf. Figure 10), added that that it would be very bad for their great grand-children to be able to just see the worm in pictures. Furthermore, the worm might be found in future to be more valuable in a lot of ways that we are not aware of now. The MWET officer at national level was of the same opinion in that there is need to conserve mophane worm for future generations. He said that this is why they are embarking on different studies in order to determine the level and utilization of the worm. He also said that the government is in the process of developing regulations governing harvesting and of coming up with strategies to ensure sustainable harvesting by the local communities.

#### **4.5 Summary**

This chapter has presented the research findings, along with some discussion and data analysis. The information has been obtained mainly from interviews and focus group discussions. Research findings have been presented as follows: knowledge on the mophane worm, harvesting of the mophane worm, common harvesters of the mophane worm, the benefits drawn from the mophane worm, the challenges associated with the mophane worm and mophane worm depletion. Both natural and

the anthropogenic factors that contributed towards mophane worm depletion have been considered. Lastly, analysis of the findings has been based on the four dimensions of the environment as per O'Donoghue's model of the environment: as a species in the natural environment, the mophane worm falls under the biophysical dimension; the issue of jobs and money falls under the economic dimension; under the social dimension of people living together, the worm is seen as a delicacy for consumption as well as being a source of medicine for some; policy decisions with regard to the mophane worm fall under the political dimension. What this model reveals is that it is not adequate to talk about the environment of the mophane worm by looking at only one of the four dimensions. All four are interrelated. The issue of mophane worm depletion could not be fully evaluated if we were to leave out any of these four dimensions.

## CHAPTER FIVE: ETHICAL EVALUATION

### 5.1 Introduction

This chapter, in which a number of traditional and environmental ethical theories are applied to the findings of the study, ethically evaluates the problem of mophane worm depletion in Gungwe and Mbalambi villages. A more detailed explanation of these theories has been given in chapter three.

### 5.2 Value Theory

Values are at the root of ethics. Values identify the worth of something, and that worth can be judged to have *utility value*, *intrinsic value* or *inherent value*. Of course, an object can be judged to have all three kinds of values depending on what is under consideration. For example, in the case of the mophane worm, the utility value would be identified with reference to its usefulness to humans or animals or the ecosystem. According to the findings, the villagers harvested mophane worms only for consumption and selling. This contributed to better or improved livelihoods of these rural area dwellers. Those in both villages indicated that the mophane worm was valuable to them as it improved their way of life, especially as an income generating commodity. The mophane worm, therefore, is of utility value to the local community. Some members of the local community also revealed that, due to its high nutritional value, it is very good in boosting their immune system. On the other hand, the villagers indicated that they do not harvest all the mophane worm but leave some in order to pupate. However, this action was not done for the purpose of letting it flourish or for a good-of-its-own but for utility value as they revealed that they spared them for the sake of another yield.

### 5.3 Utilitarianism

Utility value is highlighted in utilitarian theory or utilitarianism. Utilitarianism is a traditional ethical theory that states the rightness or wrongness of an action is based on the outcome of such an action. For utilitarian's, "the rightness and wrongness of actions and practices are determined solely by consequences produced for the well-being of all parties affected by the actions or practices" (Beauchamp, 1982: 73). Therefore, based on such an argument, one could say that the acts that the harvesters were involved in, which resulted in the depletion of the mophane worm, did not produce or lead to the maximization of good consequences because the results of the depletion of the mophane worm have impacted negatively on the four dimensions of the environment. Taking into account the overall consequences brought about by the depletion of the mophane worm, they are bad rather than good. In the biophysical environment, the result has been a loss of wildlife with regard to the different kinds of birds that feed the mophane worm. Furthermore the very livestock that feed on the host tree and eat the worm are being deprived of nourishment. Again, there is loss of nitrogen in the soil which the mophane worm adds by its droppings. On the economic level, people have lost the money they acquired through the selling of this veld product with its consequent negative effect on their livelihood as well as on the economy of the country. On the social sphere, the people's way of life has been affected. They are deprived of nutrition and relish, and they are prevented from extending benefits of the mophane worm to future generations. The political dimension has also been negatively affected in generating tension between the government and villagers. Although some good consequences have been identified to result from the depletion of the mophane worm, namely, in that the host tree can reach its full potential by bearing fruits for reproduction; in that defoliation by the mophane

worm is avoided, and in that wildlife and livestock have fodder to feed on, nevertheless, from the utilitarian perspective, the action that results in the depletion of the mophane worm is, on balance, an ethically wrong action because the negative effects outweigh the positive effects. Still more the depletion of the mophane worm does not improve the well being of the villagers and neither does it maximize the good of all the affected parties.

However, while the utilitarian value seems to dominate, there is also evidence of the acknowledgement of both intrinsic and inherent values as well. For example, one of the villagers in Gungwe, Angelinah Fani, narrated that her son-in-law, Joseph, once visited them in December 1998 when the worm was in abundance. She recalls seeing him holding a twig with the worm clinging on to it, looking at the worm in admiration, and then putting it back on to the mophane tree. This could suggest that even if the villagers did not explicitly express their appreciation of the beauty and complexity of the worm, the stranger who was seeing this worm alive was able to wonder at it, to appreciate its inherent value. Furthermore, putting it back on the tree, and not killing it, he seemed to accept its intrinsic right not to be harmed without good reason. Intrinsic value refers, first of all, to the worth of a living being in-itself and for-itself, a value that expresses itself in the living being striving to survive and flourish in seeking its own organic good. In this context, one type of the mophane worm found in Botswana has thorns or a spike spine which is undoubtedly an evolutionary defence mechanism that developed over the years. It should also be further noted that African cultures acknowledge the intrinsic value of things by showing respect to “spirits” living in them and giving life to them. The fact that a shrine to *Mwali* has been constructed in Gungwe in relation to the natural environment which includes the

mophane worm demonstrates the reverence and respect in which the mophane worm is held.

## **5.4 Justice**

Traditionally, the concept of justice is about fairness among the human beings only. This has now been extended to the natural environment and future generations. In this dissertation, justice will be discussed under the following three theories: Social Ecology, Environmental Justice and Intergenerational Justice.

### **5.4.1 Social Ecology**

Murray Bookchin, the founder of Social Ecology, believes that the exploitation of the environment is as a result of the inequalities that exist in the structure of human society. He notes in particular that social structural inequalities are rooted in forms of dualism. Bookchin emphasises that relationships in society are characterized by dualisms such as powerful/weak, male/female, rich/poor and urban/rural which identify one side as superior and the other as inferior. The role of mophane worm female harvesters can be seen to belong to this kind of dualism which is socially and culturally conditioned. Social Ecology blames the existence of hierarchically structured societies for the manner in which the natural environment is degraded. Due to poor educational and employment opportunities, the male villagers in Gungwe and Mbalambi have had to leave their villages to find work and the female villagers have little option other than to harvest the mophane worm for food and to pay school fees from the sale of these worms. According to Social Ecology, the solution to environmental degradation is first and foremost to dissolve the exploitative hierarchical social structures that exist in society. From this perspective, the depletion

of the mophane worms, along with other forms of environmental harm, will continue in Botswana until a more de-centralised and democratic social structure is established.

The women and the girl child are the common harvesters of the mophane worm in Gungwe and Mbalambi villages. A reason given for this is that women are less educated than men in the area and hence are not employed. By custom and tradition, they are expected to remain at home while men migrate to the towns to look for jobs. The outcome is that they feel compelled to exploit nature for survival. They turn to mophane worm harvesting as one way of surviving. In a few cases, however, men become involved in the harvesting of mophane worm because they live in an area where there are no job opportunities. Participants in FGDs in both villages indicated that, traditionally, it is the role of a woman to provide food for her family.

#### **5.4.2 Environmental Justice**

Environmental justice is of two forms: “domestic” and “global”. Domestic environmental justice, which is more relevant in this research, is concerned with the “policies, laws and practices within the boundaries of a country” (Wolf in Figueroa and Mills 2003: 427). In the case of mophane worm depletion, domestic environmental justice can be seen to relate to unsustainable harvesting methods and the use of the host tree.

##### **(a) Unsustainable harvesting methods**

Unsustainable harvesting or overharvesting is among the main human factors affecting the environment. It expresses itself in two ways: harvesting everything and not leaving any worm to burrow in preparation for the next harvest; digging up the ones that are burrowing or already buried under ground. These activities are an injustice done to the environment by the harvesters because they are disrupting the

natural balance in the ecosystem and are failing to respect both the utilitarian and intrinsic values of the mophane worm. Furthermore, as villagers do not have user rights over the produce of the land, there is no control over exploitation of the mophane worm from intruders. This has been referred to as the “tragedy of the commons”, i.e., everyone having the liberty to use the land at will without any controlling authority. As the mophane forests are regarded as common property which is open to all, there is no protection for the mophane worm. As the government has withdrawn user rights from the local people, it has resulted in contributing to depletion of the mophane worm. Hence, there is need for a policy which will entrust the people with the responsible care of their local environment. In other words, the solution would be to replace the system of the commons with a responsible system of control. The government of Botswana had come up with a policy to regulate the harvesting and utilization of the mophane worm although, regrettably, they later on reversed it due to reasons best known to themselves.

#### **(b) Use of host tree**

The women in the two villages indicated that one of the main contributing factors to mophane worm depletion is the irresponsible usage of the host tree by men. They blame men for the excessive destruction of the host tree for roofing using supports, rafters and doors made from the mophane tree. Men also sell the firewood, build kraals, poles for the field as well as crafting different household resources. Men are therefore seen to have contributed, not only to the destruction of the environment but also to the depletion of the mophane worm due to loss of habitat.



### **5.4.3. Distributive and Participatory Justice**

Environmental justice also includes two further dimensions of justice, i.e., distributive and participatory. Distributive justice is concerned with the distribution of environmental benefits and burdens. According to the findings, the disadvantaged groups like rural area dwellers, the poor and the women are the ones who are now faced with greater burdens brought about by mophane worm depletion. Such burdens are manifested in the biophysical, economic, social and political dimensions.

Participatory justice is interested in how the distributive decisions are made and who participate in their making. In 2006, the government of Botswana introduced a regulation on mophane worm harvesting and utilization as an intervention measure. The villagers denied any knowledge on the regulation and stressed the fact that they had not been consulted. In 2007, the regulation was reversed although, once again, without any consultation with the local people. The research findings revealed tensions between the villagers and the government on the mophane worm regulations and harvesting methods. Although the government of Botswana, under the Department of Forestry and Range Resources (DFRR), had come up with a regulation with regard to the harvesting and utilization of the mophane worm, in the case of Mbalambi and Gungwe, they had not involved the local people in the decision-making process. Hence, there was a lack of participatory justice relating to the environment.

### **5.4.4 Intergenerational Justice**

Based on impact of mophane worm depletion, concern expressed was that the future generation might never see the mophane worm alive, but only in pictures, most probably on the five pula coin (cf. Figure 5). They had mentioned the importance of preserving the mophane worm for future generations because they might need it more

than we do today. This view reflects the focus of Intergenerational Justice, a theory about the need to sustain resources for the sake of future generations. For example, the worm might result in medicinal breakthroughs in the future. Hence, an injustice would be done to future generations if the mophane worm was allowed to become extinct.

## **5.5 Summary**

An ethical evaluation of the problem of mophane worm depletion in Gungwe and Mbalambi villages has been carried out from the perspective of a variety of ethical theories which were discussed in chapter three. All in all, the villagers did not explicitly recognize the intrinsic and the inherent values in the mophane worm but only the utility or instrumental value. On utilitarianism grounds, actions leading to mophane worm depletion have been found to result in more bad than good consequences. As an extension on justice as restricted to human beings, environmental justice theory and intergenerational justice theory have been applied to the context of mophane worm depletion, revealing dimensions of injustice. Social Ecology theory has also been applied to the phenomenon of mophane worm depletion in Gungwe and Mbalambi villages with specific reference to the existence of social structural inequalities.

## **CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **6.1 Summary**

The study investigated the impact of mophane worm depletion on the biophysical, economic, social and political dimensions of the environment in the villages of Gungwe and Mbalambi. In chapter one, the background of the study was outlined where it gave the reader a brief introduction to the problem of species loss around the world. After presenting an overview of the study area, the statement of the problem and the aim of the research, the objectives were then identified as follows: (i) to highlight the different values related to the mophane worm, (ii) to identify the factors that led to mophane worm depletion in Gungwe and Mbalambi villages, (iii) to identify government policies on mophane worm sustainability, (iv) to make an ethical evaluation of mophane worm depletion, and (v) to come up with recommendations for protecting the mophane worm from extinction. Finally, the significance of the study, its limitations and delimitations, operational definitions, methodology and overall design were given.

Chapter two discussed the relevant literature available bringing out the threat of species extinction around the world, narrowing it down to Southern Africa with specific reference to the mophane worm, and lastly focusing on Botswana where the study was carried out. Highlighting the importance of the mophane worm, a four-dimensional model was chosen to analyse the depletion of this worm in Gungwe and Mbalambi villages in North Eastern Botswana. Chapter three discussed different ethical theories which were found to be relevant for an ethical assessment of the data. Two traditional ethical theories considered were Value theory and Utilitarianism. Environmental ethical theories considered were Social Ecology, Environmental Justice

and Intergenerational Justice. Chapter four discussed the data collected through personal observation, in-depth interviews with villagers, headmen of both villages, the MWET officers at local and national level as well as focus group discussions. The findings were then discussed and analysed. Chapter five presented an ethical evaluation of the findings by applying some traditional and environmental ethical theories.

## **6.2 Conclusion**

The study has revealed that mophane worm has become depleted in Gungwe and Mbalambi villages. Both anthropogenic and natural factors emerged as contributing factors to mophane worm depletion. Among the anthropogenic factors are unsustainable harvesting in the form of overharvesting and exploitation due to commercialization, the methods used for harvesting, cultural beliefs, the demand for more land for agricultural and residential purposes, and extensive usage of the host tree. The natural factors are invasion by foreign species and lack of rainfall resulting in drought. The government of Botswana did not involve the local people in the decision-making process regarding mophane worm as most of them were not aware of the existence of any regulation or of its later amendment. Through the application of some traditional and environmental ethical theories, an ethical evaluation was made of the findings. The study finally concluded that the impact of the depletion of the mophane worm on the four dimensions (i.e., biophysical, economic, social, and political) has, on utilitarian ethical grounds, been more negative than positive.

## **6.3 Recommendations**

In view of the findings of this study and in order to mitigate, if not stop, the depletion of mophane worm, the following recommendations are made:

- The government of Botswana should work closely with the local inhabitants in making decisions that concern natural resources like the mophane worm as they have more accurate knowledge related to their immediate environment.
- Further research is recommended to evaluate the extent of the impact of natural factors like exotic species on the environment, and how they could be dealt with or checked out in order to keep the naturally evolved balance in the ecosystem.
- The government should come up with intervention measures like the re-introduction through harvesting and the relocation of eggs of mophane worms to areas where they have become depleted or faced possible extinction.
- The engagement of monitoring systems such as harvesting quotas is needed in areas where the mophane worm is still found in abundance.
- *There should be community involvement in decision making especially by reinstating the user rights of local inhabitants, so that they can take responsibility for their use of the natural resources in their area.*
- The government should send representatives to other countries (e.g., Mpika district in Zambia) where there is still an abundance of the mophane worm for benchmarking.

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Statutory Instrument No. 89 of 2006

AGRICULTURAL RESOURCES CONSERVATION ACT  
(Cap. 35:06)

AGRICULTURAL RESOURCES CONSERVATION  
(UTILIZATION OF VELD PRODUCTS) REGULATIONS  
(Published on 1st December, 2006)

ARRANGEMENT OF REGULATIONS

REGULATION

1. Citation
2. Interpretation
3. Harvesting of veld products
4. Dealing and exporting of veld products
5. Applications for permits
6. Conditions for issue of permit
7. Commercial register
8. Validity of permits
9. Offences and penalties
10. Confiscation of veld products
11. Cancellation, suspension of permit
12. Revocation of S. I. No. 69 of 1977 and S. I. No. 28 of 2004

IN EXERCISE of the powers conferred on the Agricultural Resources Board by section 16 of the Agricultural Resources Conservation Act, the following Regulations are hereby made —

1. These Regulations may be cited as the Agricultural Resources Conservation (Utilization of Veld Products) Regulations, 2006. Citation

2. In these Regulations, unless the context otherwise requires —

Interpretation

"Commercial register" means the complete record keeping by the registered dealers and exporters of all transactions including buying, selling, making of donation, receiving of donation,

"Dealer" means a person permitted under these Regulations to carry on a business of dealing in veld products;

"Harvesting" means gathering of veld products, including picking, cutting, burning, uprooting, transplanting, digging up and collecting;

"Veld products" means a non-domesticated, vegetative biological resources that may be used for construction, medical, food, cultural activities and firewood.

"Veld products categories" means categories as set out in the schedule.

3. (1) No person shall, without a permit from the Board or from any person authorised by the Board, harvest any veld product listed in the Schedule exceeding the amount specified in subregulation (2) in relation to such veld product, except in accordance with the conditions specified in the said subregulation (2).

Harvesting of  
veld products



(2) The permissible amounts and conditions for harvesting in respect of the veld products set out in the Schedule are as follows —

- (a) veld products of category 'A' shall not be harvested without a harvesting permit, except for domestic use;
- (b) veld products of category 'B' require a harvesting permit if the amount to be harvested exceeds 2 kg per person per month;
- (c) veld products of category 'C' require a harvesting permit if the amount to be harvested exceeds 10 kg per person per month;
- (d) veld products of category 'D' may be harvested without a permit from the Board;
- (e) *veld products of category 'E' require a harvesting permit if the amount to be harvested exceeds 10 bundles (maximum diameter 20 cm) per household per month;*
- (f) veld products of category 'F' shall not be harvested from the 20th October each year to the 15th July of the coming year, if harvesting is carried out not within the stipulated period a harvesting permit shall be required if the harvest exceeds the quantity of 800 bundles (maximum diameter 20cm) per household; and
- (g) veld products of category 'G' require a harvesting permit if the amount to be harvested exceeds 1.0 tonnes per household per month. A permit for fencing or building using untreated poles (indigenous) must be obtained if the collection exceeds more than 500 poles per household per year;

Dealing and  
exporting of veld  
products

4. A person shall not deal in or export any veld product listed in the Schedule without a permit from the Board or any person authorized by the Board.

Application  
for permits

5. (1) A person who wishes to obtain a harvesting, dealer or export permit shall submit a written application to the Secretary of the Board.

(2) An application under sub-regulation (1) shall clearly specify —

- (a) the kind of veld product and the quantity which the applicant wishes to harvest, deal in or export;
- (b) the origin and the destination of the veld product; and
- (c) whether the applicant is a citizen, resident or non-resident of Botswana.

(3) The Board may require the applicant to give additional information reasonably required to enable a permit to be issued.

Conditions for  
issue of  
permit

6. (1) The Board shall issue a permit where it is satisfied that —

- (a) the area proposed to be harvested is permitted for harvesting activities; and
- (b) the proposed harvesting methods are effective and sustainable harvesting methods.

(2) The Board may, where it consider, it necessary, attach to a permit any reasonable conditions under which the permit may be used.

(3) A permit holder must, during the period of the validity of the permit, ensure that any conditions attached to a permit under sub-regulations (1) and (2) are complied with.

Commercial  
register

7. (1) Dealers and exporters are required to keep a commercial register of all transactions, and shall be registered with the Board.

(2) The Register shall always be available for inspection.



8. A harvesting, dealer or export permit issued to any person or entity shall be valid for a period stipulated in the permit and shall not be transferable.

Validity of permits

9. (1) A person who contravenes these Regulations, or who makes a false statement in order to obtain a harvesting, dealer or export permits, commits an offence and is liable to a fine not exceeding P1,000 or to imprisonment for a term not exceeding 1 year, or to both.

Offences and penalties

10. In addition to any penalty that may be imposed, the court may order that any veld product in respect of which the offence was committed shall be forfeited to the State.

Confiscation of veld products

11. Without prejudice to any criminal liability of a permit holder, the Board may cancel or suspend a permit if it considers that the provision of these Regulations, or a condition in a permit, is not being complied with.

Cancellation, suspension of permit

12. The Agricultural Resources (Grapple Plant) Regulations and the Agricultural Resources Conservation (Harvesting of Veld Products) Regulations, are hereby revoked.

Revocation of S.I. No. 69 of 1977 and S. I. No. 28 of 2004

### SCHEDULE

(regulation 3 (1))

CATEGORY	SCIENTIFIC NAME	PRODUCT VERNACULAR/ COMMON NAME
A	Hoodia Species	Thokabotshwaro/Sekopane/Seboka/Hoodia
A	Harpagophytum species	Sengaparile/Grapple Plant/Devils Claw
B	Lippia scaberrima	Mosukudu/Fever Tea
B	Lippia javanica	Mosukujane/Mosukubanye/Fever Tea
B	Artemisia afra	Lengana/Wild wormwood
B	Terfezia pfeilii	Mahupa/Truffles
B	Myrothamnus flabellifolius	Gala la tshwene/Resurrection Plant
B	Strophanthus kombe	Kombi/Poison Rope
B	Indigofera tinctoria	Mhetola/Africa Indigo (basket dyes)
B	Cassia abbreviata	Monepenepe/Long tailed cassia
C	Imbrasia belina	Phane/Caterpillar
D	Sclerocarya birrea subsp caffra	Morula
D	Adansonia digitata	Mowana/Baobab
D	Orthanthera jasminiflora	Mosata>Nama ya setlhare
D	Mimusops zeyheri	Mmupudu/Red Milkwood
D	Vangueria infausta	Mmilo/Wild medlar
D	Betchemia discolor	Motsintsila/Brown Ivory
D	Grewia species	Mogwana/Moretlwa
D	Azanza garckeana	Morojwa/Snot Apple
D	Strycnos cocculoides	Mogorogorwane/Corky monkey apple
D	Strycnos spinosa	Morutlwa/Green monkey apple
D	Phragmites australis	Letlhaka/Common reed
E	Hyphane pertesiana	Mokolwane/Mokola/Fan palm
F	Eragrostis pallens	Motshikiri/Thatching grass
F	Cymbopogon plurinoides	Mokamakama/Thatching grass
F	Cymbopogon excavatus	Mosagasolo/Thatching grass
F	Hyparrhenia hirta	Thatching grass



F	Hyparrhenia filipendula	Thatching grass
F	Hyparrhenia dissoluta	Thatching grass
F	Stipagrostis uniplumis	Tshikhithane/Thatching grass
G		Dikgong/Firewood/Fuelwood
G		Untreated poles/plant materials for building purposes

MADE this 7th day of November, 2006.

E.B. MOABI,  
Chairman,  
Agricultural Resources Board.

#### REGULATIONS

Chapter

1. Amendment of regulations 7 of L.R. No. 29 of 2006

2. Amendment of Schedule

IN EXERCISE of the powers conferred on the Agricultural Resources Board by section 14 of the Agricultural Resources Conservation Act, the following Regulations are hereby made:—

1. These Regulations may be cited as the Agricultural Resources Conservation (Amendment) Regulations, 2007.

2. Regulation 7 of the Agricultural Resources Conservation (Unloading of Wild Products) Regulations for these Regulations referred to as "the Regulations" is amended to read as follows:—

3. The Schedule to the Regulations is hereby amended by the deletion of the following words:

Category C	Hyparrhenia filipendula	Thatching grass
Category F	Hyparrhenia dissoluta	Thatching grass
Category F	Stipagrostis uniplumis	Thatching grass
Category F	Hyparrhenia filipendula	Thatching grass
Category F	Hyparrhenia dissoluta	Thatching grass
Category F	Stipagrostis uniplumis	Thatching grass

MADE this 7th day of November, 2007.

E.B. MOABI,  
Chairman,  
Agricultural Resources Board.



## Appendix B

C.1408

Statutory Instrument No. 87 of 2007

### AGRICULTURAL RESOURCES CONSERVATION ACT (Cap. 35:06)

### AGRICULTURAL RESOURCES CONSERVATION (UTILIZATION OF VELD PRODUCTS) (AMENDMENT) REGULATIONS, 2007 (Published on 28th December, 2007)

#### ARRANGEMENT OF REGULATIONS

##### REGULATION

1. Citation
2. Amendment of regulation 3 of S.I. No. 89 of 2006
3. Amendment of Schedule

IN EXERCISE of the powers conferred on the Agricultural Resources Board by section 16 of the Agricultural Resources Conservation Act, the following Regulations are hereby made —

##### Citation

1. These Regulations may be cited as the Agricultural Resources Conservation (Utilization of Veld Products) (Amendment) Regulations, 2007.

##### Amendment of regulation 3 of S.I. No. 89 of 2006

2. Regulation 3 of the Agricultural Resources Conservation (Utilization of Veld Products) Regulations (in these Regulations referred to as "the Regulations") is amended in subregulation (2) by the deletion of paragraphs (c) and (f).

##### Amendment of Schedule

3. The Schedule to the Regulations is hereby amended by the deletion of the following words:

"Category C	Imbrasia belina	Plane/Caterpillar"
"Category F	Eragrostis pallens	Motshikiri/Thatching grass
Category F	Cymbopogon plurinoides	Mokamakama/Thatching grass
Category F	Cymbopogon excavatus	Mesagasolo/Thatching grass
Category F	Hyparrhenia birta	Thatching grass
Category F	Hyparrhenia filipendula	Thatching grass
Category F	Hyparrhenia dissolute	Thatching grass
Category F	Stipagrostis uniplumis	Thikhitshane/Thatching grass".

MADE this 21st day of December, 2007.

E.B. MOABI,  
Chairman,  
Agricultural Resources Board.

L2/7/232 III (82)



## **Appendix C**

### **FOCUS GROUP DISCUSSION CHECKLIST**

#### **A. INTRODUCTION**

- **Introduce myself**
- **Ask participants to introduce themselves**
- **Explain purpose of meeting**
- **Thank them for their time**

#### **B. QUESTION GUIDE**

1. Tell me what you know about the mophane worm.
2. Do you harvest the mophane worm in your village?
3. Who are the common harvesters of the mophane worm?
4. Why do you think they are the common harvestors?
5. What is the present state of the mophane worm in your village?
6. If depleted, what do you think are the contributing factors?
7. Which trees host the mophane worm in your village?
8. What other purposes is the host tree used for in your village?
9. Do you think its usage could have contributed to the depletion of the mophane worm?
10. How is the harvesting and processing of the mophane worm done in your village?
11. Do you think the way of harvesting and processing could have contributed to mophane worm depletion in your village?
12. How has the depletion of mophane worm affected:
  - (a) The natural environment in your village (biophysical)?

- (b) The way of life in your village (social arena)?
  - (c) The finances of the villagers (economical)?
  - (d) The governance in your area (political)?
13. What cultural beliefs do you have in your village regarding the mophane worm?
  14. Are there any government policies or regulations in place to sustain the mophane worm?
  15. Does the government involve you in the decision-making regarding your immediate environment?
  16. Do the environmental officers visit your village on educational campaigns to sensitize the local community on environmental sustainability?
  17. What are your suggestions on what should be done in order to avoid a complete extinction of the mophane worm?
  18. What is your opinion on sustaining the mophane worm for the future generation?

### **C. CLOSING**

- **Ask if they have any other contributions in the form of questions or comments.**
- **Thank them once again for their participation.**

## **Appendix D**

### **IN-DEPTH SEMI-STRUCTURED INTERVIEW SCHEDULE FOR THE VILLAGERS**

1. How long have you lived in this village?
2. What do you know about the mophane worm?
3. What types of the benefits are drawn from this veld product both in abundance and in depletion?
4. What burdens are due to mophane worm both in abundance and in depletion?
5. According to your knowledge, who are the common harvesters of this worm?
6. Why do you think they are the common harvestors?
7. What is the present state of the mophane worm in your village?
8. If depleted, what do you think are the contributing factors?
9. Which trees host the mophane worm in your village?
10. What other purposes is the host tree used for in your village?
11. Do you think their usage could have contributed to the depletion of the mophane worm?
12. How is the harvesting and processing of the mophane worm done in your village?
13. Do you think the way of harvesting and processing could have contributed to mophane worm depletion in your village?
14. How has the depletion of mophane worm affected:
  - (a) The natural environment in your village (biophysical)?
  - (b) The way of life in your village (social arena)?
  - (c) The finances of the villagers (economical)?

(d) The governance in your area (political)?

15. What cultural beliefs do you have in your village regarding the mophane worm?
16. Are there any government policies or regulations in place to sustain the mophane worm?
17. Does the government involve you in decision-making regarding your immediate environment?
18. Do the environmental officers visit your village on educational campaigns to sensitize the local community on environmental sustainability?
19. What are your suggestions on what should be done in order to avoid a complete extinction of the mophane worm?
20. What is your opinion on sustaining the mophane worm for the future generation?

## **Appendix E**

### **IN-DEPTH SEMI-STRUCTURED INTERVIEW SCHEDULE FOR THE MINISTRY OF ENVIRONMENT, WILDLIFE AND TOURISM (MEWT) OFFICERS**

1. According to your knowledge, what is the present state of the mophane worm in North East District?
2. If depleted, what do you think are the contributing factors?
3. What do you think are the repercussions brought about by the depletion of the mophane worm regarding the:
  - (a) The natural environment (biophysical)?
  - (b) The people's way of life (social arena)?
  - (c) The people's finances (economical)?
  - (d) The governance (political)?
4. Are there any government policies in place to safeguard the mophane worm?
5. Does the government involve the local community in decisions-making regarding their immediate environment?
6. Do you often visit the villagers on educational campaigns to sensitize them on environmental sustainability, especially regarding the conservation of the mophane worm?
7. What measures are in place to sustain the host tree?
8. What is the government doing at this point in time regarding mophane worm depletion?
9. What is your opinion on sustaining the mophane worm for the future generation?
10. Any other contributions regarding the mophane worm?