



# **Economic Valuation of Forest and Range Resources in Botswana**

**Report by the Centre for Applied Research for  
Department of Forestry and Range Resources and the  
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## **Abbreviations**

ARCA	Agricultural Resources Conservation Act
BUAN	Botswana University of Agriculture and Natural Resources
CAR	Centre for Applied Research
CBNRM	Community-Based Natural Resource Management
CBO	Community-Based Organisation
CITES	Convention on International Trade in Endangered Species
CPI	Consumer Price Index
DEA	Department of Environmental Affairs
DFRR	Department of Forestry and Range Resources
DUV	Direct Use Value (can be gross -GEV- or net -NEV-)
FRR	Forest and Range Resources
GEV	Gross Economic Value
HH	Household
JICA	Japan International Cooperation Agency
Kg	Kilogram
KyT	Kgetsi ya Tsie Trust
L	Litre
LED	Local Economic Development
LPG	Liquid Petroleum Gas
M	Metre
MFMP	Makgadikgadi Framework Management Plan
ML	Millilitres
N\$	Namibian Dollar (equal to a Rand)
NAFTEC	National Food Technology Centre
NEV	Net Economic Value
NGO	Non-Government Organisation
ODMP	Okavango delta Management Plan
O&M	Operation and Maintenance
P	Pula
P.a	Per annum
SB	Statistics Botswana
SU	Standard Unit
T	Ton
TEV	Total Economic Value
ToR	Terms of Reference
TRG	Technical Reference Group
UB	University of Botswana
VDC	Village Development Committee
VPR&D	Veld Products Research & Development
WF	Wild Foods
WTP	Willingness To Pay
Z\$	Zimbabwean Dollar



**Botswana consumer price index (1980-2017; 2016 = 100)**

YEAR	CONSUMER PRICE INDEX OR CPI
1980	4.2
1981	4.7
1982	5.5
1983	6.1
1984	6.7
1985	7.3
1986	7.9
1987	10.2
1988	9.5
1989	10.3
1990	11.5
1991	12.8
1992	14.9
1993	17.1
1994	18.8
1995	20.9
1996	22.9
1997	25.3
1998	27.5
1999	29.3
2000	31.6
2001	34.3
2002	36.5
2003	39.5
2004	43.1
2005	47.0
2006	51.9
2007	55.4
2008	63.2
2009	66.7
2010	71.0
2011	80.3
2012	86.0
2013	88.1
2014	92.3
2015	96.8
2016	100.0
2017	102.7

Source: Statistics Botswana.

**Pula exchange rate against major currencies (1980-2017)**

YEAR	US \$/PULA	RAND/PULA	EURO/PULA	YEN/PULA
1980	1.3473	1.0057		
1981	1.1362	1.0878		
1982	0.9425	1.0128		
1983	0.8654	1.0569		
1984	0.6418	1.2737		
1985	0.476	1.2284		
1986	0.5442	1.1982		
1987	0.637	1.2297		
1988	0.5166	1.2288		
1989	0.5341	1.3576		
1990	0.5344	1.3685		
1991	0.4825	1.3241		60.41
1992	0.4431	1.3552		55.22
1993	0.3899	1.3258		43.63
1994	0.368	1.3049		36.73
1995	0.3544	1.294		36.52
1996	0.2743	1.2846		31.86
1997	0.2625	1.2775		34.09
1998	0.2243	1.3177		25.45
1999	0.21665	1.3187		22.11
2000	0.1865	1.4106		21.39
2001	0.1432	1.7188		18.8
2002	0.1829	1.5801	0.1745	21.68
2003	0.2251	1.4875	0.1791	24.06
2004	0.2336	1.3233	0.1714	23.96
2005	0.1814	1.1511	0.1527	21.27
2006	0.1658	1.1565	0.1259	19.71
2007	0.1665	1.1318	0.1129	18.63
2008	0.1330	1.2455	0.0944	12
2009	0.1499	1.1086	0.1043	13.85
2010	0.1553	1.0265	0.1162	12.64
2011	0.1329	1.0859	0.1027	10.31
2012	0.1286	1.0901	0.0975	11.07
2013	0.1147	1.1963	0.0832	12.04
2014	0.1051	1.2169	0.0865	12.58
2015	0.0890	1.3830	0.0814	10.72
2016	0.0932	1.3034	0.0866	10.95
2017	0.0823	1.3118	0.0978	10.96

Source: Bank of Botswana.

# 1 Introduction

The Japan International Cooperation Agency (JICA<sup>1</sup>) and the Department of Forest and Range Resources (DFRR), Government of Botswana, contracted the Centre for Applied Research (CAR) to carry out the study on 'Economic Valuation of Forest and Range Resources'. The objectives of the study are to:

1. Determine the direct use value of forest resources in Botswana;
2. Design an economic valuation methodology to estimate direct use value of forest resources;
3. Assess the socio-economic status of the local people in the survey areas; and
4. Assess the levels of utilisation by and availability of forest resources to local communities and distribution of benefits in and around selected localities.

The following tasks had to be carried out (Terms of Reference or ToR):

- a. Conduct a desktop study of the use and economic value of Forest and Range Resources (FRR);
- b. Collection of existing economic/socio-economic data (e.g. from DFRR, Statistics Botswana-SB, etc.);
- c. Collect information about the trade in FRR to estimate the economic value;
- d. Carry out a FRR use and value survey at village level in two zones<sup>2</sup> and assess the level of benefits the local people attain from FRR;
- e. Train research assistants including one DFRR staff involved in the survey; and
- f. Analyse the distribution of economic value and costs.

As per the ToR, the valuation focuses on the following FRR: firewood, thatching grass, phane, morula, mmilo, palm leaves, grapple, wood products and morama bean. The Setswana, English and Latin names of the listed FRR are shown in Table 1. The names in bold are used throughout the report, mostly Setswana and English names.

**Table 1: Setswana, English and Latin names of the listed FRR**

Setswana name	English name	Latin name
<b>Morula</b>	Morula	<i>Sclerocarya Birrea</i>
<b>Mmilo</b>	African Medlar	<i>Vangueria Infausta</i>
Motsintsilala	Bird Plum	<i>Berchemia Discolor</i>
<b>Morama</b>	Morama Bean	<i>Tylosema esculentum</i>
Sengaparile	Devils Claw/ <b>Grapple Plant</b>	<i>Harpagophytum procumbens</i>
Seboka/Thokabotshwaro/Sekopane	Hoodia	<i>Harpagophytum</i>
<b>Phane</b>	Mophane Worms	<i>Imbrasia Belina</i>
Mokolwane	<b>Fan Palm</b>	<i>Hyphaene petersiana Klotzsch ex Mart</i>
Motshikiri	<b>Thatching Grass</b>	<i>Eragrostis pallens</i>
Mokamana	<b>Thatching Grass</b>	<i>Cymbopogon plurinoides</i>
Mosagasolo	<b>Thatching Grass</b>	<i>Cymbopogon excavates</i>
	<b>Thatching Grass</b>	<i>Hyparrhenia hirta</i>
	<b>Thatching Grass</b>	<i>Hyparrhenia filipendula</i>
	<b>Thatching Grass</b>	<i>Hyparrhenia dissolute</i>

<sup>1</sup> JICA provided the project funding.

<sup>2</sup> Zone 1 -Central district and Zone 2 – Kweneng and Ghanzi districts.

Seloka	<b>Thatching Grass</b>	<i>Aristida congesta</i>
Tshikitsbane	<b>Thatching Grass</b>	<i>Stipagrostis uniplumis</i>
Mogonono	<b>Firewood/Wood product</b>	<i>Terminalia sericea</i>
Mokoba	<b>Firewood/Wood product</b>	<i>Acacia nigrescens</i>
Morukuru	<b>Firewood</b>	<i>Spirostchys africana</i>
Motswere	<b>Firewood</b>	<i>Combetum imberbe</i>
Rothwe	Indigenous vegetable	<i>Cleome</i>
Thepe	Indigenous vegetable	<i>Amaranthus thunbergii</i>
Delele	Indigenous vegetable	<i>Corchorus</i>
Moretlwa	Brandybush	<i>Grewia flava</i>
Mogwana	Edible berries	<i>Grewia supspatulata</i>
Moseme	Edible berries	<i>Grewia bicolor</i>
Mahupu	Truffle	<i>Terfezia</i>
Moretologa	Sour plum	<i>Ximenia americana or caffra</i>
Motsotsojane	Kalahari sand raisin	<i>Grewia retinervis</i>
Mmupudu	Common red milkwood	<i>Mimusops zeyheri</i>
Mokgomphatha	Sand raisin	<i>Grewia flavescens</i>

## 2 Approach and methodology

The project was carried out in the period July to December 2017. The different project activities were closely attuned to each other to meet the tight time schedule. The ToR ‘prescribe’ the following activities:

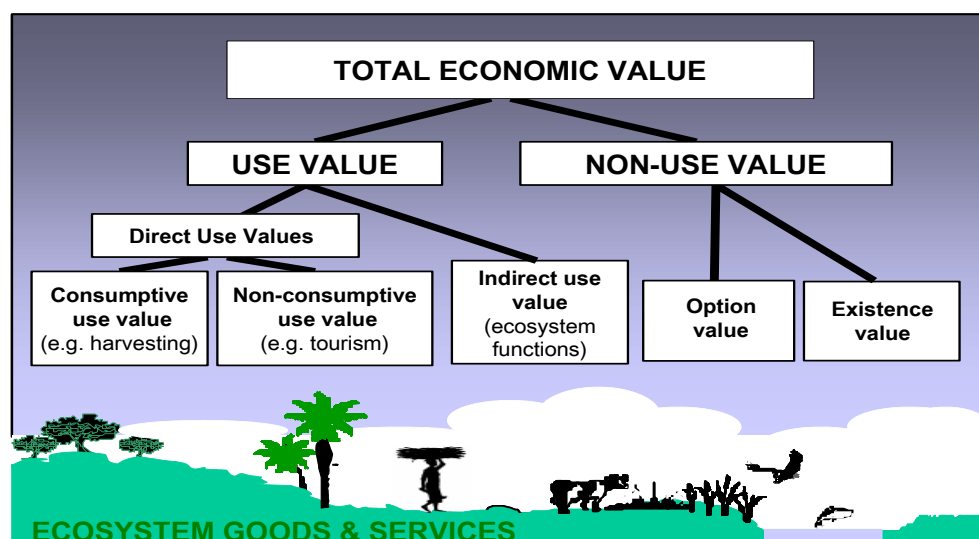
- a. Rapid desk top study of the value of FRR (section 2.2);
- b. Survey preparation, e.g. selection of villages (section 2.3);
- c. Development of survey tools; questionnaire and checklist (section 2.3);
- d. Training of DFRR staff member for the survey (section 2.3);
- e. Data entry, validation, processing and analysis (section 2.3); and
- f. Reporting: inception report, survey report, desk top study report and final report. The revised survey and desk top reports are chapters 3 and 4 of this report.

Chapter 5 offers an integrated analysis based on the rapid desk top study and the survey. As an extra activity, CAR designed a questionnaire for completion by DFRR stations. Five out of the ten stations responded.

### 2.1 Valuation method

The economic valuation of FRR was carried out within the broader framework of sustainable development and livelihoods. Consequently, the economic (value), social (livelihoods and poverty) and environmental (resource conditions) sustainability pillars were considered. Given the ToR, emphasis was given to economic and social aspects, while considering the environmental aspects. The economic valuation is restricted to the direct, consumptive, use value, of nine FRR, specified in the ToR. In reality, the value of FRR is higher, and includes the indirect use values (i.e. non-abstractive ecosystem functions), the option value (i.e. possible future uses) and the existence value (the value not linked to current or future use). The option and existence values are difficult to assess, and require a detailed willingness-to-pay (WTP) study. The direct use value is most important for people’s livelihoods. However, it is important to realise that this is ‘only’ part of the total economic value (TEV) of the FRR, albeit a very important one. The broader value context is shown in Figure 1.

Figure 1: Total economic value framework



Source: Turpie *et al*, 2006.

The collection and use of FRR is mostly seasonal with the exception of firewood that is collected throughout the year. The use of FRR also differs. Some are mostly used domestically (i.e. by households themselves such as firewood), while others are sold (e.g. phane) or mostly processed (e.g. morula for beer or jam).

The annual direct use value of each FRR has been estimated as follows:

$$DUV_{frr} = \text{Amount harvested}_{frr} * (\text{Unit Price}_{frr} - \text{Costs of harvesting}_{frr})$$

Where:

DUV: Direct use value.

Revenues: Amount harvested/ produced \* unit price

Expenditures: Labour costs and other costs

A distinction is made between the *gross* value (revenues only) and the *net* value (revenues – costs).

The amount harvested was estimated from data on the months of collection, collection frequency and the amount collected/ trip. Local prices were used; where not available prices of substitutes were used (e.g. gum poles for wood products). Local prices were obtained from the survey, local interviews, and checks in local shops. While prices of many substitutes (e.g. gas, electricity, cabbage, and corrugated iron roof sheets) were successfully obtained, few prices of substitutes had to be used as most resources could be priced. More details are provided in Appendix 3. Particularly for firewood, electricity, gas and/or paraffin tend to be used in addition to firewood, becoming complements rather than substitutes.

The expenditures on non-FRR inputs are as follows:

- a. Labour: number of days and wages. The number of days were derived from the survey questionnaires. Local consultations showed that the monthly pay for informal employment was P500/month, slightly lower than the Ipelegeng<sup>3</sup> wages. The informal employment rate was rounded off to P20/day and used in all villages; and
- b. Equipment by type and costs (purchase, operation and maintenance costs - O&M). Equipment referred mostly to transport and basic appliances (e.g. gloves, buckets, knife and crowbar). Respondents provided prices for most appliances.

Values are mostly expressed in the local currency, i.e. Pula (P). Data discussed in this report date back to the 1980s. Therefore, the trends in the Botswana consumer price index (CPI) and Pula exchange rate for major currencies are shown in the introductory pages of the report (1980-2017). This allows the reader to compare Pula values in different years and values in different currencies (Yen, Rand, United States \$ and Euro).

## 2.2 Literature review – desktop study

The project included a rapid literature review or scan. Relevant rangeland valuation case studies from Botswana (e.g. for the Okavango and Makgadikgadi wetlands), were reviewed as well as forest and rangeland management and Community-Based Natural Resource Management (CBNRM) reports from past national studies. Key statistics and some data from DFRR<sup>4</sup>, SB, etc. were reviewed, including

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<sup>3</sup> Ipelegeng is a labour-based government social protection programme.

<sup>4</sup> Half of the DFRR stations responded to a questionnaire that was sent out.

population and housing census and household survey reports. These were used to provide socio-economic baseline information about the survey villages. Additionally, relevant policies, legislation, development plans and other relevant administrative frameworks were reviewed.

## 2.3 Survey

### 2.3.1 Survey and fieldwork

The survey was carried out in six villages in the Central, Ghanzi and Kweneng districts from the 4<sup>th</sup> of September to the 13<sup>th</sup> of October, 2017. The villages were selected in consultation with the DFRR, mainly based on the distribution and availability of FRR in the village as well as on the relative importance of FRR in each village. The villages and main FRR collected in each village are shown in Table 2.

The sampling procedure was systematic, and was based on the number of households and the location of households within each ward. For the large villages, i.e. Gweta, Lerale and Kumakwane, every 18<sup>th</sup> household was considered while in the smaller ones, i.e. Tsetseng, Palla Road and Chobokwane, every 4<sup>th</sup> or 2<sup>nd</sup> household was interviewed, depending on the number of households. The specific selection was guided by an overview of field maps that were produced from Google Earth. In addition, upon arrival in each village, the survey team met with the village leadership (Chiefs and Village Development Committee chairpersons-VDC) to get an indication of the number of wards in the village and the general structure /layout of the village to support the data provided in the maps. This was followed by a brief village tour to appreciate and augment the information provided by the village leadership and maps.

**Table 2: Survey villages and FRR collected**

Zone/village	FRR
<i>Zone 1: Central district</i>	
a. Gweta	Palm leaves, thatching grass, morula, wood, firewood
b. Lerale	Morula, phane, thatching grass, morula, wood, firewood
c. Palla road	Thatching grass, wood, morula, firewood and mmilo
<i>Zone 2: Ghanzi and Kweneng districts</i>	
a. Chobokwane	Moroma, grapple, firewood, thatching grass and wood
b. Tsetseng	Moroma, grapple, firewood, wood and thatching grass
c. Kumakwane	Morula, mmilo, thatching grass and firewood

A standard replacement procedure was applied if the selected household was absent or could not be interviewed. In such cases, the next household was interviewed. In a few cases the interviewers had to go back to the household, particularly if there was an indication that the household is heavily involved in collection of a particular resource.

Guided by a detailed questionnaire, a team of six research assistants and a field supervisor carried out the survey. In total, 544 households were interviewed, exceeding the target of 495 households. For zone 1, the target was 260 households but 289 were interviewed, while the zone 2 target of 235 was also exceeded as 255 interviews were conducted. Moreover, additional data were collected from DFRR stations, selected individuals in the villages as well as from retail shops. A detailed checklist guided the data collection. Weight measurements were also taken for the various FRR where available, to provide for data conversions. Where community-based organisations (CBO) dealing with natural resource use and management were available, these entities were also interviewed.

To identify and map the distribution of FRR, coordinates were taken in each village based on the information provided during the interviews. Village guides were engaged to guide the team to the various sites of FRR collection. In each village, most of the FRR are collected in similar areas, particularly firewood, wood and thatching grass (see Appendix 4).

The most common challenge was the delay in conducting interviews because respondents had gone for lpelegeng work. However, the team would then wait until household members were done with lpelegeng and proceeded with interviews. Moreover, in some areas, FRR measurements could not be taken due to non-availability of the resources within the households<sup>5</sup>.

### 2.3.2 Data processing and analysis

The survey data were entered in Microsoft Excel spreadsheets by resource and village. The entered data were validated, and incomplete or suspect responses were removed. Moreover, households that only consumed the resource and did not harvest, were removed too as they do not add direct use value. The data from the resulting harvesters were analysed in terms of the totals, averages<sup>6</sup>, median<sup>7</sup>, mode<sup>8</sup>, maximum and minimum.

The 'average harvester' shows the overall situation in the village. Most harvesters harvest less than the average, when the survey includes large harvesters, who push up the average. In that event, the median and mode are more representative for 'resource harvesters'. The average was used for the principal valuation, as it is assumed that the large harvesters in the survey are also found in the village.

Next, the results were up-scaled to the village, assuming that the proportion of household participation of resource collection in the survey also applies to the village. For example, if 40% of the survey households collected morula, the same is assumed in the village. If the village has 1 000 households, 400 households collected morula in the village (40% of 1 000).

Further to earlier information, the economic valuation (or direct use value) was done using the following formulas:

<i>Gross Economic Value (GEV)</i>	=	<i>Amount of harvest* Unit value</i>
<i>Net Economic Value (NEV)</i>	=	<i>GEV – Labour costs – Other costs</i>
<i>Labour costs</i>	=	<i>Labour Days per annum * Labour costs/day</i>
<i>Other costs:</i>	=	<i>Costs of Equipment + Transport.</i>

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<sup>5</sup> Resource availability and harvesting is seasonal.

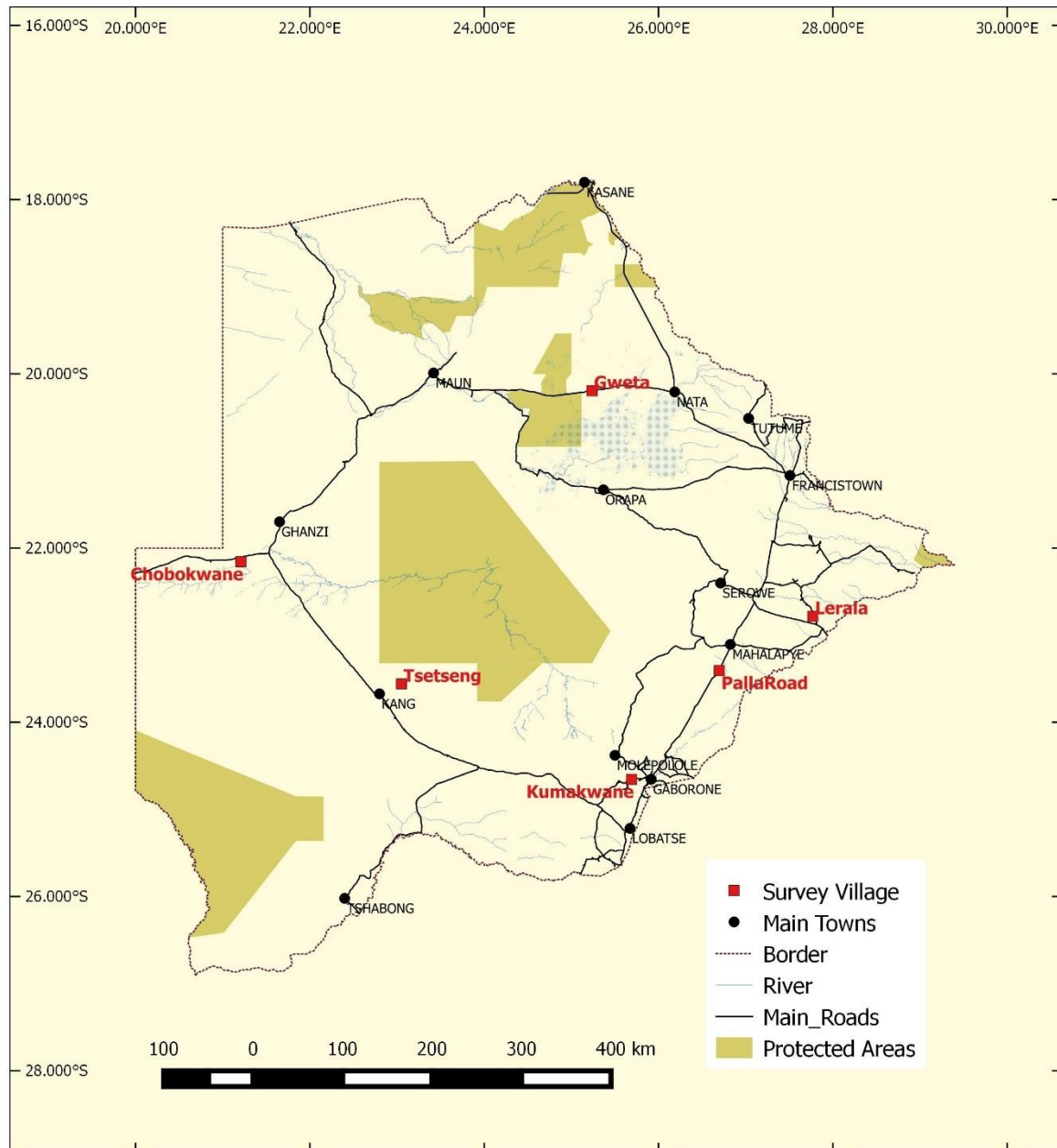
<sup>6</sup> The *average* is the summation of all values/ divided by the number of values.

<sup>7</sup> The *median* is the **middle value** of a set of data after ranking them from low to high.

<sup>8</sup> The *mode* is the **most common value** of a set of data after ranking them from low to high.



Figure 2: Location of the survey villages



For each resource, a standard unit (SU) was selected and other measurements were converted into this SU. The following SU were used:

- ✓ Kilograms (kg) for phane, morula, morama, mmilo, grapple and firewood;
- ✓ Bundles (of 0.3 and 1.3m circumference) for thatching grass and for palm leaves; and
- ✓ Kilograms (kg) for wood products.

Other measurements (e.g. headloads, bags, buckets, and cups) were converted into kg using conversion factors. The conversion factors were obtained from the questionnaires, local measures by the team and from village interviews.

Prices of resources and inputs were obtained from the completed questionnaires, interviews, prices from village shops etc. Prices of substitutes were also collected, but these were used only if no local resource price was available. The same price for labour was used in all villages (P20/day)<sup>9</sup>. This is based on village information that the price for informal employment is P500/ month and is slightly below the lpelegeng payment of P560/month. The category 'other costs' refers to equipment and transport costs. The price of equipment (knife, saw, sickle, gloves, and shovel) were obtained locally. Prices differ by village. We have assumed that the smaller equipment lasts one year; wheel barrows last four years. For transport (donkey carts, pick-ups and trucks) standard costs per trip have been assumed as follows:

- |                  |   |
|------------------|---|
| a. Donkey carts: | P10 and P20/trip for 2-wheeled and 4-wheeled donkey carts respectively; |
| b. Van:          | P15/trip; and   |
| c. Truck:        | P35/trip  |

Resource prices have been derived from the completed questionnaires and interviews. If different prices were mentioned, the average of the most frequently mentioned price was taken to value the resource. The value of cups (usually 270 ml) was obtained; cup prices are higher than bulk price in terms of SU (e.g. kg). Where households sold in cups, these values have been applied to the sold produce. For grapple, prices refer to dry weight. The harvested wet weight was converted into dry weight in Tsetseng and Chobokwane, based on information from the questionnaire.

Table 3 shows the coverage of resources by village. Firewood and thatching grass were harvested in each village; morula was harvested in 4 villages; phane in 3 (all in zone 1), while morama, grapple and mmilo were harvested in 2 villages, mostly in zone 2 but also in Palla Road. Palm leaves are only harvested in Gweta.

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<sup>9</sup> It is important to realise that these are often not costs incurred by the households. The opportunity costs of labour are low in the absence of informal and formal employment opportunities.

**Table 3: Resources covered by village**

	Gweta	Lerala	Palla Road	Tsetseng	Chobokwane	Kumakwane	TOTAL
Firewood	1	1	1	1	1	1	6
Thatching grass	1	1	1	1	1	1	6
Morula	1	1	1			1	4
Phane	1	1	1				3
Wood products	1	1	1	1	1	1	6
Morama				1	1		2
Mmilo			1			1	2
Palm leaves	1						1
Grapple				1	1		2
<b>TOTAL</b>	<b>6</b>	<b>5</b>	<b>6</b>	<b>5</b>	<b>5</b>	<b>5</b>	

## Resource specific issues:

- ✓ Thatching grass: two categories of thatching grass are distinguished, based on the quality and preferences. Category A covers the good quality or preferred grass species for thatching, e.g. mokamakama and motsikiri, while category B covers the poorer quality grass species such as tsikitshane. Category A is collected in bundles of 0.3 and 0.8 m circumference while category B covers bundles of 1.3, 1.7 and 1.8 m circumference.
- ✓ Morula: most of the collected morula is used for beer brewing and households generate most income from brewing, not collection. The price of morula in bags of 12.5 kg is low. Where it is used for beer brewing, the amount of morula used in beer brewing is an input in the brewing process and included under other costs (valued at the unit price of morula);
- ✓ Firewood: the unit price of firewood was derived from local measurements and data. The price/kg varies by village ranging from P0.70/kg in Gweta to P1.10 in Tsetseng. The price in Kumakwane is the lowest at (P0.25/kg), based on the reported price of a donkey cart load;
- ✓ Grapple: grapple is only sold after it has been dried. Drying reduces the weight significantly. The conversion factors from wet to dry weight are 0.49 in Chokokwane and 0.33 in Tsetseng. These figures were averages derived from the village surveys<sup>10</sup>.
- ✓ Morama: morama is collected in two villages, mostly in Chobokwane for household and commercial use;
- ✓ Palm leaves: harvesting of palm leaves was confined to Gweta, where six households collected palm leaves and made baskets;
- ✓ Mmilo: Mmilo is only collected in two villages in small amounts;
- ✓ Phane: Phane was collected in the three villages in zone 1. It is mostly sold; and
- ✓ Wood products: The unit price of wood was derived from local measurements and where unavailable, the local price of gum poles was used. Wood products were mostly used for fencing.

<sup>10</sup> Households remember dry weight best as they are paid based on the dry weight.

### 3 Rapid literature review

The rapid literature assessment covered documents accessed in August through an internet scan, documents in the CAR library and documents availed by DFRR and members of the Technical Reference Group (TRG).

#### 3.1 Natural environment

Botswana's climate is semi-arid, with seasonal rainfall from November to March. Seasonal temperatures are high, where the highest mean monthly temperatures range from 32-35 Degree Celsius (recorded mostly between October and January). The high temperatures occur throughout the entire country, but are most extreme in the Kalahari Desert. Rainfall is low, unreliable, unevenly distributed and highly variable and the mean rainfall is about 650 mm/annum in the north and 250 mm/annum in the extreme south-western part of the country. Since the climate is dry and semi-arid, most streams and rivers are ephemeral and therefore most valleys are usually dry except after the rains. Climate change is expected to lead to even higher temperatures and greater rainfall variability, leading to more frequent droughts and floods.

Much of the country is covered by Kalahari xeric savanna or Kalahari Acacia-Baikiaea savanna (Department of Environmental Affairs-DEA, 2016). However, the areas of greatest biodiversity are found in the north of the country: the Zambezian flooded grasslands, the Zambezian and mopane woodlands, and the Zambezian Baikiaea woodlands. Soils and vegetation varieties create geographical differences in flora and fauna due to climatic conditions. More than half of the country is covered by sandy soils on the Kalahari Desert covering mostly the south-western and part of the central regions. Also known as the sandveld, the soils are largely infertile limiting crop production. These arid lands have fewer palatable plants and nurture plants like grapple, truffle and tree species such as *Terminalia sericea* and other acacia trees.

The well wooded areas, e.g. mopane woodlands, are found in the hardveld and are relatively rich in plant and animal life due to the better climatic conditions. These areas provide good fuelwood and wood species and are also home to the succulent mopane worms. In the wetlands of Makgadikgadi and Okavango, palms or mokolwane trees occur that are used in the basketry industry. Grass species occur throughout the country, but the good species for thatching are mostly found in the northern/central regions due to the good soil conditions and rainfall.

#### 3.2 Policy environment

The Department of Forestry and Range Resources (DFRR) is responsible for the management of FRR.

Several Non-Government Organisations (NGOs) such as Thusano Lefatsheng are active in promoting, collecting, and processing of veld products. The private sector is particularly active as middlemen and exporters of phane and grapple. In addition, WildFoods (Pty) Ltd (WF) has processed morula, as well as other products such as mmilo, wild cucumbers and desert truffles. Several cosmetic oil processors have recently started to produce morula oil.

Concerning research, the University of Botswana (UB), Botswana University for Agriculture and Natural Resources (BUAN) and the National Food Technology Research Centre (NAFTEC) have done research on the propagation, sustainable harvesting and processing and marketing of veld products such as grapple, phane and morula. Furthermore, Veld Products Research and Development (VPR&D) has undertaken a wide range of research, development and training in all aspects of veld products

including marketing of several types of veld products. It has also identified over 40 species with economic potential around 80 villages and settlements spread around Botswana.

The use of veld products or FRR is controlled under the *Agricultural Resources Conservation Act* (ARCA) and international trade in threatened plant and fauna species under the Convention for International Trade in Endangered Species (CITES), which has schedules for (nationally) endangered species with trade limitations and prohibitions. The ARCA lists for which veld products permits are required for harvesting, trade and exports (Table 4). Of the nine species, grapple can only be harvested with a permit; collection of phane, thatching grass, firewood and poles are exempted for subsistence use<sup>11</sup>. No permit is required for morula collection. The harvesting fees are low (P2 for individuals and P5 for CBOs)<sup>12</sup>. Enforcement and compliance pose serious challenges. No Botswana trade in CITES listed plant species is recorded for listed plant species in the CITES trade data base.

**Table 4: Harvesting regulations for Forest and Range Resources (veld products)**

Category	Harvesting conditions	No. of species	Type of species
A	Need permit	2	Hoodia, grapple
B	Need permit if harvest exceeds 2kg/month	7	Teas, truffles and basket dyes
C	Need permit if harvest exceeds 10kg/month	1	Phane
D	No permit needed	11	Morula and reed
E	Permit needed if harvest exceeds 10 bundles/month/ household	1	Basket palm
F	No harvest allowed between 20th Oct and 15th July.	4	Thatching grass
	Outside harvesting period permit needed for over 800 bundles/household		
G	Permit need if harvest exceeds 1 Ton/month/household	2	Firewood and poles

Source: ARCA 2006 regulations.

DFRR does not keep a data base for harvested, traded and exported amounts. In the period 2010-13, on average 788 harvesting permits were issued, 216 dealers' permits and 23 export permits (Ecosurv and CAR, 2013).

### 3.3 Importance of veld products for livelihoods

#### 3.3.1 Veld products and livelihoods

Rural households derive in kind and cash income from a range of livelihood sources, including wage employment, crop and livestock production, harvesting of FRR, government support and gifts/remittances. In general, formal employment is most sought after, but opportunities are limited. Crop production yields low and uncertain revenues, related to climatic conditions, but it is very common because of good access to arable land. Government support (subsidies and social welfare) are common and attractive. Some support programmes are more attractive than harvesting of veld products. For example, the Ipelegeng labour programme pays P560/month, excluding lunch, and is an easier and more rewarding option than harvesting most veld products as will be shown later. Poor

<sup>11</sup> Table 4 specifies the exempted amount per species. The amounts vary by species.

<sup>12</sup> Trade and export permits are P50 and P 500 for citizens and higher for non-citizens. The charge is not related to the amount harvested, traded and/or exported.

households rely on harvesting of veld products for subsistence in the absence of better livelihood alternatives and affordable substitutes. The livelihood importance of veld products is therefore high, although poorly documented as it is not a formally 'recognised' economic sector<sup>13</sup>. For example, Statistics Botswana (SB) does not compile statistics on veld products.

Poverty levels have significantly decreased over the last three decades and the national poverty figure is now just under 20% (World Bank, 2015). However, rural poverty is above the national average and poverty levels have not or hardly decreased in western and northern Botswana. According to 2009/10 Botswana Core Welfare Indicator Survey (SB, 2013), the average disposable monthly income is P6 120 nationally but much lower in rural villages (P3 799 or 62% of the national average). Table 5 shows this average rural monthly household income in comparison with household income<sup>14</sup> from various veld products. It clearly shows that veld products are a supplementary livelihood source rather than the primary source. The monthly household incomes from most individual veld products are low in the Okavango area and the Makgadikgadi wetland; however, the total value of FRR for all households is significant as shown in section 3.3.2 and 3.3.3.

**Table 5: Monthly household income from veld products in the Okavango and Makgadikgadi regions**

Product	Indicator and details	Monthly household income
	Average national monthly household income (2009/10)	P3 046
	Average rural monthly household income (2009/10)	
	Average monthly household income in urban villages (2009/10)	P1 724
		P3 241
<b>All veld products together</b>	Okavango Delta: net private value/household	Ramsar: P119 - 227 Wetland: P 34 - 151
<b>Fuelwood</b>	Makgadikgadi wetland (2010) Gross Net	Zone 1: P37 Zone 2: P42 Zone 1; P21 Zone 2: P24
	Okavango Delta (2005): value per collecting household	Ramsar: P120 - 228 Wetland: P34 - 152
<b>Palm leaves</b>	Okavango Delta (2005): value per collecting household	Gross: P13 -146 Net: P13 -146
<b>Timber (poles)</b>	Okavango Delta (2005): value per collecting household	Gross: P17- 81 Net: P15- 79
<b>Phane</b>	Makgadikgadi wetland (2010)	P3 000
	DFRR country wide survey	P 667
<b>Thatching grass</b>	Makgadikgadi wetland (2010)	Zone 1: P2 625 Zone 2: P420
	Okavango Delta (2005)	P15-124

Sources: CAR and DEA, 2010 and Turpie *et. al.*, 2006; SB, 2013.

### 3.3.2 Okavango Delta

An economic valuation of the Okavango Delta and Ramsar site was carried out as part of the Okavango Delta Management Plan or ODMP (Turpie *et.al.*, 2006). Veld products<sup>15</sup> and fish contributed P 27.8 million to household livelihoods in 2005; roughly half of this figure is attributed to dry veld products

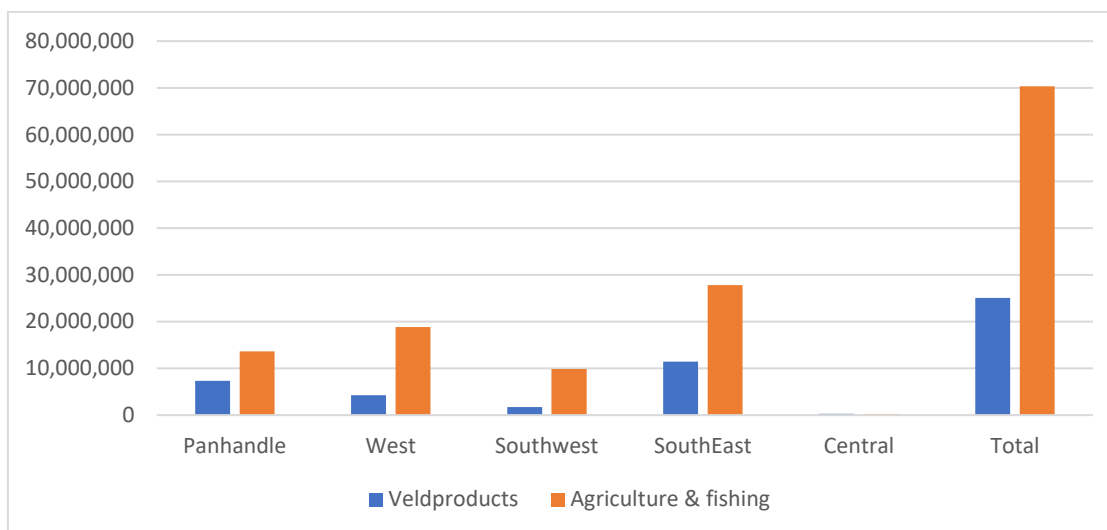
<sup>13</sup> From an economic perspective, harvesting of veld products is part of the agricultural sector. In the absence of good data, the value increase of the sector is linked to population growth, not to real changes in production.

<sup>14</sup> Measured as net private value for households. This is the estimated revenues (in kind and cash) minus the operational costs (e.g. labour and basic implements).

<sup>15</sup> The terms veld products and FRR are used interchangeably in this report.

and products derived from processing of veld products. Veld products are an important livelihood source (Figure 3): almost four times more important than crop production and contributing 40% of the livestock value.

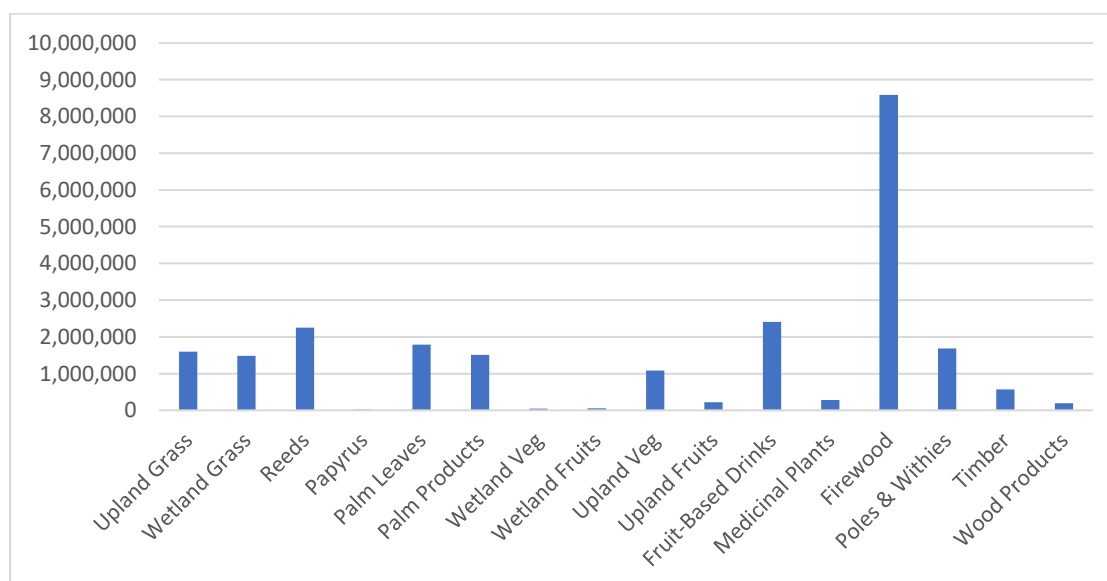
**Figure 3: Contribution to household value and cash income from veld products and agriculture in the Okavango Ramsar site (Pula, 2005).**



Source: adapted from Turpie *et.al.*, 2006, p.53.

A wide range of veld products are being harvested for food, medicines, building, and beverages; veld products are also sold for cash. Most households engage in the harvesting, especially of firewood. The average household income from veld products is estimated to be around P2 000 per annum, half of which is attributed to veld products away from the wet Delta. Firewood, palm leaves and products, grass, fruit-based drinks and reeds are the most valuable veld products, accounting for over P 2 million p.a. for households (see Figure 4).

**Figure 4: Net private value to households of major veld products (Pula, 2005)**

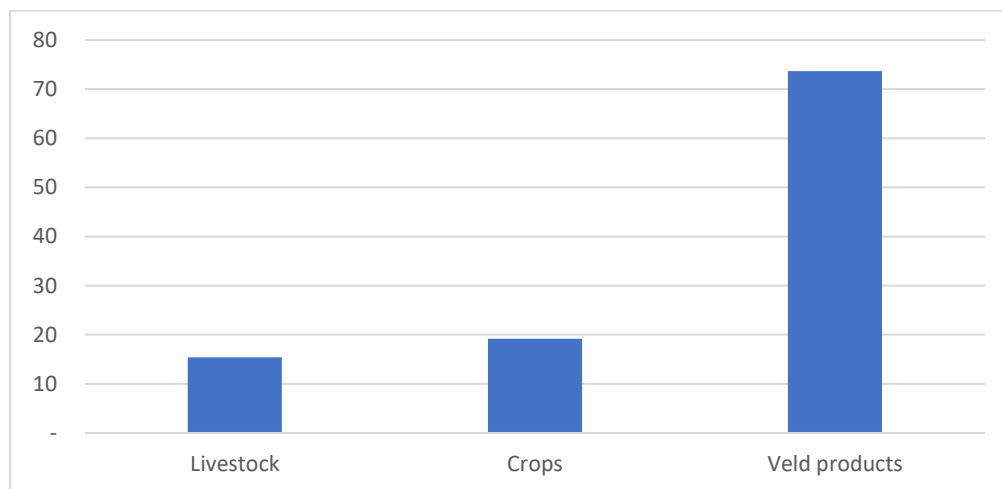


Source: adapted from Turpie *et.al.*, 2006, p. 52

### 3.3.3 Makgadikgadi Wetlands

An economic valuation was also carried out for the Makgadikgadi Framework Management Plan (MFMP; DEA and CAR, 2010). A wide range of veld products is collected for food, medicines, beverages and construction material, including phane worms, grass, firewood, palm leaves, timber, poles and medicinal plants. Morama bean and mmilo were not explicitly mentioned in the report. The value to households of agriculture and veld products is estimated to be P 108.2 million (2009), 73.6% of which is attributed to veld products. The harvesting of grass and wild foods generate more livelihood value than livestock and crop production combined (Figure 5). This is different from the Okavango area (cf. Figure 4).

**Figure 5: Household value of veld products and agriculture (Pula million; 2009)**



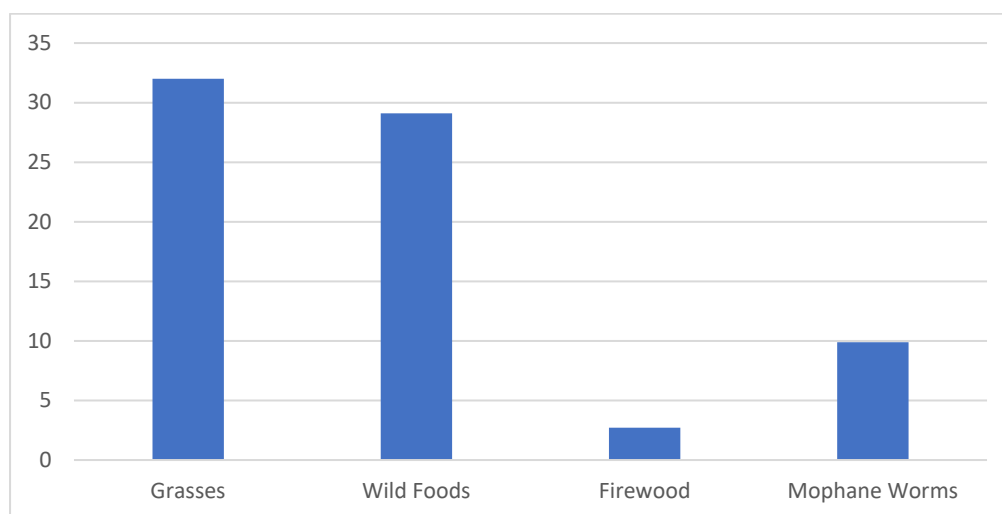
Source: adapted from DEA and CAR, 2010.

Harvesting of grass and wild foods are most important for livelihoods (valued at over P 30 million p.a.). Phane worms accounted for around P10 million while firewood is most commonly collected but less valuable (Figure 6). Wild foods are mostly fruits<sup>16</sup> and indigenous leave vegetables (*delele*, *thepe* and *rothwe*). Wild foods are mostly for own consumption.

<sup>16</sup> Abundant fruits are brandy bush, *Grewia supspatulata* and *Grewia bicolor*. Scarce and rainfall dependent include sour plums and various types of sand raisins (DEA & CAR, 2010 vol.2, p.24)



**Figure 6: Economic value generated by different types of veld products (Pula million; 2009)**



Source: adapted from DEA and CAR, 2010.

### 3.4 Economic value of the focal veld products

#### 3.4.1 Morama

Morاما occurs largely in the Kalahari Desert. The resource is not regulated under 2006 ARCA. The morama bean is currently primarily used for subsistence purposes as a snack or main food, sometimes eaten fresh (when boiled), but generally roasted when mature. Morama beans are considered to have the same nutritional value as soya beans, but it is not yet commercially exploited in Botswana. However, the bean is considered to have commercial potential:

- a. Mpotokwane (2017) lists morama products (oil, milk and roasted nuts) as one of the 25 best commercial opportunities for veld products; and
- b. Commercial use could include beverages, oil, butter, milk and biscuit. It is a crop earmarked for poverty alleviation (Morama engaged, 2013).

Botswana Agricultural College (now BUAN) has identified a potential for cultivation at a community demonstration plot in Tsetseng and a plot at the college. Communities collected seeds in Tsetseng (one of the six surveyed villages; see chapter 4) and Maokane village. The Tsetseng community had to travel far to collect seeds; saline water posed another challenge for cultivation.

Information from DFRR stations shows that morama is common in Southern, Central and Kweneng districts. In Central District, a cup of 250 ml fetches P5-10. No prices were given for the other districts. In Kweneng, morama is used for making flour and as a snack.

At present, little information exists about the harvesting and use of morama beans and its economic value for households and the economy at large. These plants live to be over 100 years old, but the yield per plant is generally low, so genetic selection and breeding is essential if it is to be made into a commercial crop.

### 3.4.2 Phane

Phane worm is harvested on a large scale in northern and eastern Botswana, mostly for commercial purposes. While information is sketchy, harvesting dates back for at least three decades.

Phane is currently not processed in Botswana. Dried phane and phane-onion-tomato canning are among the 25 products with a high commercial potential (Mpotokwane, 2017). According to Arntzen and Veenendaal (1986) in good years such as 1979, 750 tonnes were harvested in north-eastern Botswana with an average harvest of 300-450 tonnes per annum in the 1980s. Prices were around P0.25 to P1/kg (in 1979 and 1982 respectively).

Export of phane is significant. Moruakgomo (1996) found that 55 out of 60 harvesters sold more than 85% of their harvest to traders. Traders export to South Africa, mostly through Martins Drift and Zanzibar borders.

Various data for phane trading prices exist:

- a. Business in phane trade (mid 1990s?): bucket of 12.5kg for P 50; bag of 25 kg for P100; 1 cup for P1;
- b. Moruakgomo (1996): bags of 32 kg sold for P 140-168 with an average of P 150/bag;
- c. Mars (1996): P1/cup; price of bucket, presumably 12.5 kg, P20-50, depending on the time of selling;
- d. Zimmermann and Maribe (2010a) found that the price of phane had increased to around P45/kg in buckets (mean per bucket of 4.25 kg of P191) and P78/kg in cups (mean per cup of P5.5). The price increase was attributed to a rapid increase in demand;
- e. The 2017 street vendor price is currently P10 per cup.

The unit export value in the 1990s was estimated at P 4-6/ kg. This is similar to the trading price<sup>17</sup>.

Information from the Serowe DFRR station suggests that phane is widely collected in Central District, and that many traders buy phane and sell it locally and in South Africa. The only price mentioned was P10/cup of 250 ml.

Phane is collected and traded in neighbouring countries too. Marcis (1996) found a price range of Namibian Dollar (N\$) 15-25/ kg of phane in Namibia. Hobane (1994) studied urban phane markets in Harare and concluded that buying prices were 6-10Z\$/kg, selling prices 12-17 Z\$/kg. Phane was also sold in retail outlets at slightly higher prices.

Phane is collected around the Makgadikgadi Pans, mostly on the northern side (DEA & CAR, 2010). On the northern side, 48% of the households collect phane, while on the southern side only around 20% collect phane. Phane collection is valued at around P10 million, much of which is in the form of cash to households. Around 80% of the phane is sold in the village and to traders from outside. Most phane is collected in April as the December harvest conflicts with the ploughing season. Households harvest on average 260 kg per annum, 200 kg in April and another 60 kg in December (average year). Households earn around P3 000 p.a. or P250/month from phane. This is around 7% of the average rural household income. The price is P12/kg (2005). Phane contributes some P9.9 million to rural livelihoods (P8.6 million in cash income).

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<sup>17</sup> Phane is likely to fetch a higher price in the South African market.

Mars (1996) found that in Ratholo village, the collection of phane was more common than arable farming: 87% of the households collected phane and 71% sold their produce. The average household earning was P121. The value to households is estimated to be around P10 million, mostly in cash.

Zimmermann and Maribe (2010a) describe the socio-economic aspects of phane collection. Phane harvesting is typically done by low-income groups, mostly women between 20 and 50 years of age. For almost half, phane is the only source of cash income and they harvest on average 3.9 dry gutted phane/ha or a total of 172 dry kg (covering 44 ha). There are two harvests per year in April and December, lasting 21 days on average. Harvesters are estimated to make P3 800 to 4 100 per season; making earnings of more than seven times the minimum wage (Zimmermann and Maribe, 2010a, p.13). Prices are highest in areas with limited supply. Some harvesters argue that they are underpaid as transport costs provided by traders are high. The economic value for the surveyed harvesters was estimated at P8 million or around P8 000/ harvester; this translates into an average income of P667/month; or around 20% of the average rural monthly income (2009/10 Botswana Core Welfare Indicator Survey). Clearly, phane harvesting is attractive as a livelihood source (though seasonal). Zimmermann and Maribe (2010a) concluded that there was no threat of phane depletion in 2010.

In brief, phane is an important veld product that provides mostly poor households with cash income; the bulk of the harvest is exported without being processed or packed. The price of phane appears to have increased significantly. Harvesters travel far and during the peak season, this has led to conflicts between communities<sup>18</sup>.

### 3.4.3 Morula

Morula products are used for subsistence and commercial purposes. Unlike for grapple plant and phane, there is no documented trade in morula. No permit is required for harvesting morula. The economic value of morula has long been recognised (e.g. Taylor and Moss, 1982; Arntzen & Veenendaal, 1986). Morula can be processed into a variety of products such as beverage (juice, tea and beer), cosmetics (oil and soap) and food (sweets, jam, nuts, etc.). The National Food Technology Centre (NAFTEC) identified morula drink as one of the 25 promising food products for commercialisation.

Morula is widespread, but is not found everywhere in the country. For example, morula is not common around the Okavango Delta (Turpie *et.al.*, 2006). Where it occurs, morula is commonly collected although in urban areas and large villages, morula fruits often remain uncollected and unused. Mars (1996) found that in Ratholo and Mokoboxane villages, 32% and 4% of the households collected morula.

There have been several morula processing projects in Gweta, Lerale and Gabane. In the Makgadikgadi wetlands, morula is mostly found in and around Gweta, where a morula project was established in the 1990s. The idea was to produce morula pulp for juice. While there was sufficient supply, the occurrence was scattered over a large area, leading to high collection costs (GNRT, 1997).

Based in Lerale, Kgetsi ya Tsie (KyT) is a CBO that collects morula through women groups in four centres in the Tswapong hills and produces morula oil and soap. KyT appears to be struggling with very modest revenues from sales recently (e.g. P12 000 in 2015; CAR, 2016).

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<sup>18</sup> Personal communication Mr. F. Taylor.

Kgetsi ya Tsie started 20 years ago as a CBO in the Tswapong Hills in eastern Botswana. It is involved in harvesting and processing of veld products, in particular morula. Morula oil and soap generate most income from sales; morula jelly was also produced in the early days. Other products include phane, dicheru for oil extraction with the “waste” oilcake for chicken feed and for cattle, leafy vegetables and herbal products. Plans to can phane never materialised. Phane collection was unsuccessful as KyT offered low prices (P4.25/kg in 2002). In 2003, KyT covered 26 villages and had 980 members. The income for member is very small (e.g. P100 / member in 2003).

The headquarters and factory are located in Lerala. The harvesting is done by women who are organised in groups in nine villages. KyT grew rapidly in the late 1990s until around 2005; it appears to be struggling with limited very low reported revenues in recent years.

Challenges:

- Financial viability: KyT has never been able to meet its full costs from sales;
- Decreased external financial assistance: this has affected the scope and level of activities
- Markets: KyT has not managed to export its high-quality morula oil and is struggles to develop the local market (e.g. outlets in Gaborone are limited and some have closed).

Sources: CAR, 2003 and 2016; Buzwani *et.al.*, 2007.

Dibapalwa Nageng Trust (veld products) in Gabane village<sup>19</sup> produces morula jam and sweets. They buy the pulp from WF in Gabane, which annually processes about 55 tons of morula to produce jam and snacks for local and export markets and beverages made from mmilo and morula (pers. comm. F. Taylor). The Trust recently stopped production. Divine Morula (Pty) Ltd, from Gaborone, produces a range of morula products including beverages, cosmetics and soap. Recently several small to medium size morula oil industries have started up. DLG-Naturals, based in Gabane, produces morula oil, and intends to produce oil on a large scale. The company also collect dicheru from various communities’ country-wide.

In brief, morula products have a good commercial potential, and can be collected, processed and sold locally and abroad. However, the resource is currently underutilised for commercial purposes as processing has stagnated. As a result, morula oil, soap and other products are difficult to find domestically, and exports<sup>20</sup> are low. Hopefully, the new morula processing initiatives will be successful, sustained and increase the commercial utilisation of morula. Data on harvesting and the associated values are fragmented and inadequate.

### 3.4.4 Grapple plant

Information on grapple has been collected since the 1980s but data remain fragmented and sketchy. Harvesting, trade and export permits are required. DFRR does not have a data base on harvesting, trade and export of grapple and other FRR.

Grapple is mostly harvested in Kgalagadi and Ghanzi Districts. Kgathi (1987) found that people use dried grapple tubers for domestic and commercial use. Grapple is used as traditional medicine for people and livestock (dissolved in water), but also sold for manufacturing of ‘modern’ medicines

Arntzen and Veenendaal (1986) state that 25 tons (T) of dry grapple tubers were harvested in 1984 in Kgalagadi District. Harvesters collected 13 tubers per day or 0.65 kg/day. This would earn a harvester around P0.6 - 2/day; traders offer between P1 to P3/kg. The harvest is closely related to rainfall, with better harvests in years with better rainfall. Kgathi (1987) documented grapple plant trade in two villages in the Kgalagadi (Makopong and Kokong). He found that there was only one trader in the

<sup>19</sup> Gabane is close to Kumakwane, one of the 6 survey villages.

<sup>20</sup> At one point, Air Botswana offered morula snacks on its flights. This practice has stopped.

district and the recorded exported amount was much higher than the transferred amount, suggesting that the harvest is underreported. During the period 1979-1984, on average 12 T of dried grapple was transferred annually while 20 T was exported. The transferred volume generated on average P22 600 per annum. In 2006, around 20 T of dried grapple was harvested. Sales in the Kgalagadi were estimated at 5-10 T/a with a value of around US\$24 000 (Ecosurv and CAR, 2013).

A social enterprise (Kamela Holdings (Pty) Ltd) started grapple collection in Ghanzi and Kgalagadi District in 2014 for export to Namibia. They buy grapple tubers in Chobokwane, one of the 6 surveyed villages. The company commissioned a resource inventory, which indicated that Ghanzi District alone had a potential yield of 300 T of dried tubers; the grade of grapple is very good and attractive for export markets. The company trained communities in collection, established Buying Point Managers in each village and supplied over 500 collectors with basic equipment such as a knife and canvas for grapple drying. The harvests have been below expectations, but the company is optimistic that 2017 will be better as the company has increased the price to P21/kg. The company bought 3 520 kg (dried) in 2014, but saw reduced purchases in 2015 and 2016 (3 229 and 750 kg dry weight). They bought from 64 harvesters in 2016. These amounts are small compared to the volumes documented by Kgathi in 1987, and a fraction of the sustainable harvest potential. The following challenges have led to the modest results: delays in issuing of permits; sometimes lack of cooperation of DFRR staff, poor history of past grapple collection and pay-outs by other companies, lack of cooperation of the Kgosi.

In brief, harvesting of the grapple plant has an economic potential that remains underutilised. The harvest is low, and no processing takes place other than the grapple tea by Thusano Lefatsheng.

There is no documented evidence that the sector has expanded since 1987<sup>21</sup>. There is no direct threat of resource depletion provided sustainable harvesting techniques are utilised. The returns are modest but have improved. Harvesters may earn P10 to 20/day due to the significant price increase, but it is less than for example, the Ipelegeng programme (P560/month plus lunch). The economic value of grapple to the country is currently small, but can be increased through value additions and expansion of sustainable harvests and improved digging tools.

### 3.4.5 Mokola palm

Botswana has a long, proud basketry tradition, which uses young palm leaves, natural dyes, and skills from basket makers. Baskets are sold locally and in Gaborone (Botswana Craft) and some are exported. The industry is mostly located in the north, especially around the Okavango Delta. Arntzen and Veenendaal (1986) reported that households earn P360-370/ annum with basket making. The basket market in Etsha was worth P100 000, most of it bought by Botswana Craft and 20% sold locally to tourists.

When severe competition occurred for palm leaves by basket weavers, leaves were cut before they had fully emerged. To mitigate the unsustainable resource situation, small plantations of palms were planted. It is not known what the current situation of these plantations is, and to what extent small-scale palm plantations can secure the sustainable supply of palm leaves.

The MFMP found that collection of palm leaves and basketry is not common around the Makgadikgadi due to lack of a market; most baskets are made for domestic use. In the Okavango Delta, over 9 000 bundles of palm leaves are collected to produce some 36 500 baskets<sup>22</sup>. The palm leaves and basketry contribute some P3.3 million to households' livelihoods and gross benefits of around P1 500 p.a. are realised (Turpie *et al.*, 2006).

<sup>21</sup> Thusano Lefatsheng used to collect around 20 T annually until 2006 (pers. Communication Mr. F Taylor).

<sup>22</sup> Grass is another ingredient for baskets with natural dyes.

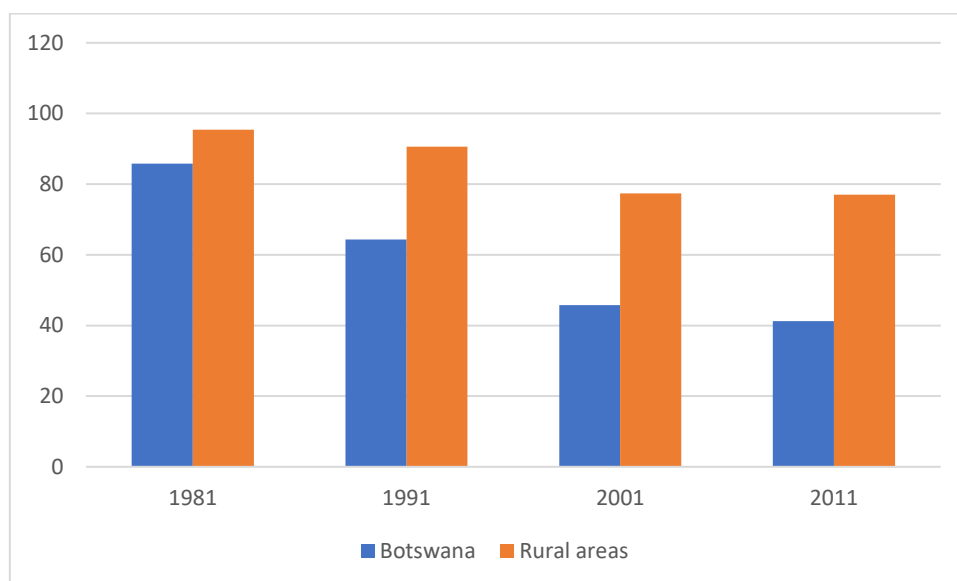
### 3.4.6 Mmilo

There is little information about the use of mmilo, which is mostly found in eastern Botswana. There are two species, one of which is less common and has a larger fruit with soft skins. The fruit is unusual in that it never rots; instead, it just dries up and can be stored, and later be reconstituted by soaking in water. No permit is required for harvesting, trade or export. It is one of those indigenous fruits that are picked as a snack, but not purposely collected for subsistence or sold on a large scale. Vendors sell the fruit on a small scale at P10 per cup. It is an important veld product with a commercial potential, which is not yet utilised (Millar, undated quoted in Arntzen and Veenendaal, 1986). Mmilo can be processed to produce a beverage and jam and can be packed for snacking. WF is planning to process mmilo into various end products such as beverage. Generally, mmilo has not been studied in detail, probably because it is not collected in large amounts and/or traded.

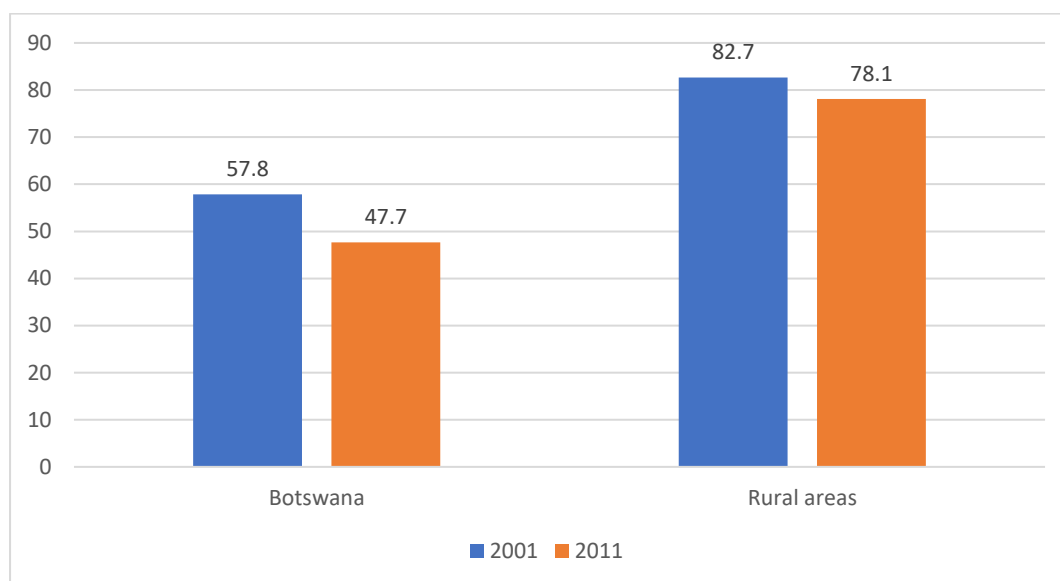
### 3.4.7 Firewood

Firewood is commonly used for cooking and heating. Its importance for cooking is slowly decreasing (Figure 7), but remains high in rural areas where almost 80% of the households still use wood for cooking (47% of all households in Botswana). Around 80% of the rural households still use wood for heating (Figure 8). The dependency on wood for lighting has significantly reduced: fewer than one in ten rural households use wood for lighting.

**Figure 7: Households using wood for cooking (1981-2011; % of households)**



Source: Population Censuses 1981-2011.

**Figure 8: Wood as principal source of heating (% of households)**

Source: Population Censuses 2001-2011

Turpie *et al.* (2006) found that over 80% of the households in the Okavango Delta collect firewood, mostly for own use; only 9% of the harvested bundles are sold at P5/bundle. An estimated 1.8 million bundles are annually collected in the Okavango. The net value of the harvest is estimated to P8.6 million; the gross value is only slightly higher, which indicates that harvesting is done with minimal inputs.

The same situation was found in the Makgadikgadi wetlands. DEA and CAR (2010) found that over 80% of the household collect firewood. A head load last 4-5 days and therefore households make 5-6 trips per month or 90 to 100 per year. It is estimated that around 950 000 head loads of firewood are annually collected. The net value to households is estimated to be P2.7 million. The gross value is much higher, indicating that significant efforts are required for collection (e.g. hiring transport, travelling far). Less than 1% of the collected wood is sold; the average monthly cash income of trade is P833 or around 20% of the average disposable rural income. Most species are still 'enough' or plenty, but some species are decreasing (e.g. *Combretum imberbe*, *Spirostchys africana*, *Acacia nigrescens* and *Terminalia sericea*). The species that are decreasing are used both for firewood and for timber (e.g. poles).

### 3.4.8 Wood products

Wood is also used for poles in the Okavango delta. An estimated 276 000 kg are collected annually for fencing and building (Turpie *et al.*, 2006). Few households make wooden products such as handles for equipment, food preparation, chairs and walking sticks. Prices vary but are generally low. In the Makgadikgadi, wood is also important for fencing and building, but there is no information on the amounts harvested and the number of households involved (DEA & CAR, 2010). A few households also manufacture furniture items, various items used in production, such as hoe, axe and chisel handles, as well as items such as instruments.

### 3.4.9 Thatching grass

Thatching grass is widely used for domestic purpose and for sale. It is a country-wide activity, which involves most rural households. For example, in Ratholo and Mokoboxane villages, over 80% of the households collect thatching grass (Mars, 1996). Commercial harvesting is mostly found in Central District (Zimmermann and Maribe, 2010b). Domestic use is more common than selling. Grass is also used for making brooms etc. There are nine major thatching grass species of different qualities (see Table 1). Free harvesting without a permit is allowed in the dry season (mid-July to mid-October). However, harvesting outside this period for commercial purposes requires a permit. Thatching grass is rarely collected inside the Forest Reserves (Lepetu *et.al.*, 2009).

Grass is widely collected in the Makgadikgadi area: 68% of the households in the northern side and 88% in the south (CAR and DEA, 2010). Households in the north collect on average 525 bundles p.a., selling 80% of it. In contrast, in the south, households collect on average 275 bundles annually, and only 10% is sold. The price per bundle is P6 in the north and P15 in the south, possibly due to greater scarcity. The annual cash household income is estimated to be P420 in the south and P2 625 in the north. The value to households (net private value) is estimated to be P29 million p.a.

In the Okavango area (Turpie *et.al.*, 2006), 174 000 bundles of grass are collected annually, mostly used for own use; trade is minimal (P0.2 million per annum). The net value for households is P3.1 million (2006), collected with minimal inputs (e.g. labour and sickle); the gross value is P3.2 million. Household incomes are in the range of P570-1 200 p.a.

A DFRR survey of thatching grass collection (Zimmermann and Maribe, 2010b) found that the collection is typically an activity for the underprivileged, often middle aged, single women, to sustain their livelihoods. The daily revenues of women (P103) are lower than that of men (154), as men cut more grass and realise higher prices; the average daily earning is P116, which compares favourably to lpelegeng wages. Prices vary according to species. Prices range from P1 to 7.40/0.5 kg with a mean of P5.9. The expectations are that prices will rise in future. The harvesting season lasts 69 days (August-September) with large variations between districts. The average cutter can therefore make P8 000 p.a. or P667 per month in gross revenues (the costs are not indicated). There is a trade-off between high prices and daily income. Those who get the highest prices make the lowest daily income because of lower volumes. Sales are mostly local; only 9.8% sell thatching grass through middlemen.



## **4 Survey findings**

### **4.1 Introduction**

This chapter presents the results of the household survey in six villages in Botswana: Gweta, Lerala and Palla Road in zone 1 and Tsetseng, Chobokwane and Kumakwane in zone 2.

### **4.2 Gweta**

#### **4.2.1 The village and livelihoods**

Gweta has a population of 5 304 people (2011 Population and Housing Census); 45% of these are males while 55% are females. Gweta's population was 4 689 in 2001, implying an increase of 12% between 2001 and 2011. If this trend has continued to 2017, the current population is around 5 700. The village had 1 950 households in 2011 and today there may be about 2 060 households, assuming the same household size. The village is approximately 205 km away from Maun and about 100 km from Nata and is adjacent to the Makgadikgadi Pans and Nxai Pan National Park (Figure 2).

**Livelihoods options** include arable farming, livestock farming, government welfare, formal employment, sale of veld products, and income from brewing. The overall official unemployment rate was 10% of the adult population. According to the MFMP (DEA and CAR, 2010), 70% of all households depend on livestock farming and of these households, 79% use livestock for subsistence purposes and only 21% use it to earn cash for the household. While livestock and arable farming are important for livelihoods, predation and crop raiding by wild animals are a major problem to the Gweta farmers.

#### **Household characteristics**

The literacy rate in Gweta is estimated at about 74% for the population aged 10 years and above, who had completed standard four and above. The rate is similar for men and women (74 and 73% respectively). With regards to education, about 491 inhabitants of Gweta have undergone some form of training, especially vocational training.

Overall, 58% of the households had access to sanitation facilities. Pit latrines are commonly used (about 39% of the households) while 9.5% have access to flush toilets. It is estimated that 81% of the households had access to potable water. Paraffin and electricity are the main sources of energy for lighting (51% and 24% of households respectively) followed by candles with 12%. Firewood is the most used source of energy for household cooking and is used by 83% of households. This is followed by use of Liquid Petroleum Gas (LPG) at 9% and electricity at 7%.

Through CBOs, communities aim to augment their livelihoods and develop their villages. Although inactive, there is a local CBO (Gwezotshaa Trust) that covers Gweta, Tsokotsaa and Zoroga villages. Villagers complain that many resources are found inside the nearby National Park where harvesting is not allowed. Mokolwane palm leaves are among the harvested natural resources and are used for basket weaving. Morula, firewood, and thatching grass are also collected for subsistence and commercial purposes.

#### **The Gweta survey**

During the household survey, 103 households were interviewed in Gweta, representing 670 household members. This is approximately 5% of all households, but represents 12% of the population due to the survey's large average household size of 6.5. Most household heads (67%) were female, middle-aged or older, poorly educated (only 23% more than primary school) and unemployed (71%).

The most common household size was 4 and only 40% of households had one or more formally employed member.

FRR are important for the livelihoods in the village. Table 6 shows the most important livelihood source for households in Gweta as recorded in the household survey<sup>23</sup>.

**Table 6: Most important livelihood sources for Gweta households**

<b>MOST important Livelihood</b>	<b>No. of households (103)</b>	<b>% of household</b>
1.FRR collection	24	23
2.Livestock husbandry	14	14
<b>3.Arable farming</b>	<b>27</b>	<b>26</b>
4.Informal employment	18	17
5.Formal employment	15	15
6.Welfare programmes	5	5
7.Other	0	0

Note: Ipelegeng is included under informal employment.

Arable farming is most often stated as the most important livelihood (26% of all households). Forest and Range Resources (FRR) collection is most important for 23% of households and informal employment is most important for 17% of households. FRR collection is the second and third most important livelihood source<sup>24</sup>. Most households have two to five livelihood sources, increasing their resilience. All households are involved in FRR collection, but for 24 households, FRR collection is the most important livelihood resource; for nine of these it is the only household livelihood. These households are in majority female-headed (17).

Among the 103 surveyed households, the FRR collected by most (about 68%) households are firewood, followed by thatching grass (67%) and, thirdly, morula fruits (23%). Palm leaves for basketry are only collected by 6% of the households. The phane season was bad around Gweta, so only few households collected phane. Other resources such as brandy bush, *Grewia supspatulata* and *Grewia bicolor* are also collected by households.

#### 4.2.2 Firewood

Of the 103 surveyed households, 68 were involved in firewood collection. Respondents emphasised the importance of firewood for their households. The annual harvest for the entire village is estimated to be 5.1 million kg (Appendix A.3) with an average of 3 782 kg per collecting household; 55% of the harvest was for own use. About 42% of households buy firewood to supplement their energy needs. Electric, gas or paraffin stoves are used by 22% of the households as substitutes for or supplements to firewood; 78% do not use substitutes.

Firewood is collected throughout the year. The availability of firewood in 2016/17 is considered 'good' by 44% of households, 'bad' by 23% and average by the rest (33%). Many households collect firewood daily, but most common is one trip per month to gather a load of firewood. The average number of trips per month is 2.6. Firewood is collected as bundles or as head loads, wheel barrow loads, donkey cart loads (2- or 4- wheeled) or van load. The latter two are sometimes hired.

Households use their own labour at an average of 0.5 person-day per month; three households occasionally hire additional labour. In 32% of households, firewood is collected by women only. Men

<sup>23</sup> Figures for the second and third most important sources are given in Appendix A.2.

<sup>24</sup> Detailed figures are provided in the survey report.

account for 53% of collection, women for 47%. Basic equipment is used: axe, saw, wheel barrow and/or donkey cart.

Table 7 shows the economic value of firewood in Gweta. The gross value is over P3.6 million, while the net value is just under P3 million. The net values based on the median and mode are much lower: P390, 547 and P476, 544. This is largely due to large traders, one of which sold 28 500 kg of firewood or more than 10% of the total harvest. The net annual value is P2 200 per collecting household.

**Table 7: Economic value of firewood harvest in Gweta (Pula; 2016/17; 1 360 households)**

Gross economic value	3,600,226
Labour costs	376,338
Other costs	226,426
Net economic value	2,997,463

Note: based on the average harvester profile.

#### 4.2.3 Thatching grass

Fifty-six households collect thatching grass out of 103 surveyed households. Thatching grass is collected in bundles and various species are utilised. Forty-four households collected the preferred or category A<sup>25</sup> grass species, comprising about 96% of the total harvest, while category B was collected by 12 households. Category A grass was collected in bundles of 0.3 or 0.8 m circumference, while category B was collected in bundles of 1.3 and 1.7 m circumference. The total village harvest is estimated at 1.4 million bundles of 0.3 m (category A) and 62 400 bundles for category B.

Thatching grass is commonly collected in the dry season between June and August while some households also collected in September and October. The resource was generally available, and the harvest was considered 'average' by most of the households for both grass categories. For category A, households travel longer distances to harvest; on average they make one trip and collect over a period of 14 days while some stay out and camp for more than 30 days. Harvesters of category B grass mostly collect in the proximity of the village and take on average 3 hours per day to collect. Only four households reported to have camped to collect grass for a period of one to two weeks.

Collection of thatching grass involves mostly women (88%). Moreover, all the collecting households use own labour, while 18% reported to use both own and hired labour. Equipment used is basic: sickle and for transport donkey carts, vans or trucks. Some households collect small quantities in head loads. Transport is usually hired at varying costs, both cash and in-kind<sup>26</sup>.

The collected grass is mostly used domestically to thatch roofs, while some households sell. Of the harvesting households, 18 households sell and 83% of these sell category A grass. This grass is sold on average for P5 per bundle of 0.3 m circumference or P50 for the 0.8 m circumference. For cat. B, the selling price is P5 per 1.3 m circumference bundle. The sellers alluded that mostly tourism operators in and outside Gweta purchase the resource while a few households also buy. However, the market for thatching grass is limited, and part of the harvest is stored.

Both grass categories have been valued (Table 8 and 9). The economic value of category A harvesting in Gweta is higher. Based on the average harvester, the gross value is estimated at P8.9 million

<sup>25</sup> Category A covers the good or preferred grass species, in this case, *mokamakama* species is considered good quality.

<sup>26</sup> In-kind payments include bundles of collected grass.

(median of just over P4.3 million) while the net value generated is P7.8 million (Table 8). This indicates that a few households collect large quantities while most collect modest amounts. A large proportion of the costs is attributed to labour (66%), which is mostly due to the number of people engaged in harvesting and the time taken to harvest. The average net value per collecting households is high at P 8 870 (category A) and P4 491(category B).

**Table 8: Economic value of category A thatching grass harvest in Gweta (Pula; 2016/17; 880 households)**

Gross economic value	8,929,525
Labour costs	743,182
Other costs	380,669
Net economic value	7,805,673

Note: figures based on average harvester.

The economic value of category B is much lower than that of cat. A grass (Table 8 and 9). The estimated gross and net values are both just over a million Pula at P1.5 and 1.1 million, respectively (Table 9). This is largely due to the small amounts collected and the fewer harvesting households.

**Table 9: Economic value of category B thatching grass harvest in Gweta (Pula; 2016/17; 240 households)**

Gross economic value	1,456,000
Labour costs	235,900
Other costs	142,333
Net economic value	1,077 767

Note: figures based on average harvester.

#### 4.2.4 Palm leaves

Six of the surveyed households collect palm leaves to make baskets. The collection occurs near the village, and takes up to one hour per trip. Most households collect for 2 to 4 months; one collects every month. The collection is typically done by women through head loads. A head load has 20 small bundles, of which 2 bundles are needed for a small basket and 3 for a large basket.

All six households make baskets, but complain about the lack of market and low prices. They face serious challenges of selling their produce and getting reasonable prices. Basket making is labour intensive and requires good skills. Apart from labour, inputs include charcoal, bird plum and mulberry. No data could be obtained for the amounts required and the prices. Therefore, the valuation does not include the costs of these three inputs. Based on one survey respondent, it is assumed that 5 working days are needed for a small basket and 10 days for a large basket and a winnowing basket.

Table 10 shows the estimated gross and net economic value of the collection of palm leaves and basket making. The large difference between the gross and net value is due to the high labour requirements. The median values are similar, indicative of the fact that basket makers are evenly distributed.

**Table 10: Economic value of palm leaves and basketry in Gweta (Pula; 2016/17; 120 households)**

Gross economic value	341,100
Labour costs	282,417
Other costs	10,140
Net economic value	48,543

Note: figures based on average harvester.

#### 4.2.5 Phane

Phane is only collected by three surveyed households. The only household with sufficient data harvested 12.5kg. Phane is collected in December and March/April. Veld products are moderately important for the harvesting households. The average and median importance rank is 3 (1 being the highest).

Several households that normally collect phane did not collect this year because of poor availability. Thus, the year 2016/17 was considered bad in the Gweta area. Due to poor availability and harvest, 13 households ended up purchasing cups of phane (in total 2.4 kg). The single household in the survey with sufficient data collected phane mostly in and around the field. The household spent an estimated 3.5 days collecting 1 bag of 12.5 kg for household consumption. The estimated phane harvest for the village is 1 425kg for 2016/17. No equipment was used, and the net value is estimated to be P330 per household.

Table 11 provides the estimated gross and net economic value of phane harvesting in Gweta. The values are low because of the bad phane season.

**Table 11: Economic value of phane harvesting in Gweta (Pula; 2016/17; 57 households)**

Gross economic value	22,800
Labour costs	3,990
Other costs	0
Net economic value	18,810

Note: figures based on average harvester.

#### 4.2.6 Morula

Twenty-two of the surveyed households collected morula. The estimated harvest for 2016/17 was 398 640 kg with an average of 906 kg per harvesting household. Morula is mostly collected in February to April with some collection in December and May. The availability and harvest of morula was considered to be 'bad' by most harvesters.

Households use mostly their own labour for harvesting. Collection involves mostly women (77.8% of the response). Equipment used is basic: a bucket and when morula is collected a donkey cart or van. Interestingly, three households harvest morula within their own yard, showing the potential for back yard 'agriculture'.

Veld products are important for the harvesting households. FRR are on average the 2.3 most important sources of livelihoods (median is 2). The collected morula is mostly used for beer brewing (over 80%). The recorded beer sales are 15 148 L. and 3 066 cups (270 ml) at P5/L and P1/cup,

respectively. Selling in bags of morula is rare, and mostly involves dicheru or kernels). Beer brewing adds significant value to the morula harvest.

Morula is mostly collected as an input for beer brewing. The net economic value of harvesting is modest (Table 12), while the annual value of morula beer is high (Table 13). The economic value of morula harvesting is limited. Based on the average harvester, the net value is estimated at just under P330 000. The median value is much lower (even negative), showing that most harvesters collect modest amounts while there are a few households that collect a lot. The equipment is minimal and nearby collection keeps transport costs low. The average annual net value is P744/household.

**Table 12: Economic value of morula harvest in Gweta (Pula; 2016/17; 440 households)**

Gross economic value	398,640
Labour costs	50,900
Other costs	20,000
Net economic value	327,740

Note: figures based on average harvester.

Eighteen out of the 22 harvesting households in the survey brew beer. This is an estimated 341 households in the entire village. The processing of morula into beer generates significant value and more than triples the value of collection (P0.9 million based on the average beer brewer; P151 000 based on the median brewer). It is therefore understandable that households brew beer to enhance their livelihoods. The main 'other costs' is the costs of the morula fruits (valued at P6/bag). The average annual value of beer brewing is P2 665/household.

**Table 13: Economic value of morula beer brewing in Gweta (Pula; 2016/17; 341 households)**

Gross economic value	1,204,685
Labour costs	15,260
Other costs	280,665
Net economic value	908,760

Note: figures based on average harvester.

#### 4.2.7 Wood products

Of the 103 surveyed households, only 9 households were involved in wood collection. This is an estimated 180 households in the entire village. The estimated wood harvesting in the village is 349 860 kg in 2016/17 with an average harvest of 1 944 kg. Wood is collected throughout the year (two households), but most collection is done in the last four months of the year. On average, one trip is made per month for wood collection.

The availability of wood as well as the harvest were mostly considered average by the surveyed households. Only one household reported 'bad' harvest for 2016/17. Households use their own labour, and collection is done by males in 90% of the households. The FRR is collected for own use in all the households. Wood is mostly used for fencing yards and the fields/ cattle posts. None of the households reported the use of wood for craft or furniture making.

In terms of equipment, an axe is used to cut down the wood and transported in donkey carts and own cars. One household wishes to utilize a hack-saw to harvest, while one mentioned that they would like to have their own cart to ease transporting the wood from the area of collection to the village. Based

on the average harvester, the gross value of wood collection in Gweta is estimated at P465 314 with a net value of P377,414 (Table 14). However, the value based on the median harvester is relatively low, with an estimated gross value of P147 470 and a net value of P78 620. The net annual economic value is P2 097 per collecting household.

**Table 14: Economic value of wood collection in Gweta (Pula; 2016/17; 180 households)**

Gross economic value	465,314
Labour costs	19,950
Other costs	67,950
Net economic value	377,414

Note: figures based on average harvester.

### 4.3 Lerala

#### 4.3.1 The village and livelihoods

The village of Lerala is located at the south-eastern end of the Tswapong Hills in Central District (Figure 2). In 2011, the population of the village was estimated at 6 871, having increased 16% since 2001 when the population stood at 5 747; it had in 2011 about 1 793 households at an average of 3.8 persons per household. If we extrapolate the 2001-2011 population growth (16%) to the current year (2017), the estimated population for Lerala in 2017 amounts to 7 489 people and 1 970 households.

Lerala has a literacy rate of about 58% and an official unemployment rate of 10% for the population aged 15 years and above. Overall, 85% of the households had access to sanitation facilities with most of the households relying on pit latrines (61%), while 8% use flush toilets. It is also estimated that overall, 97% of the households have access to potable water with about 47% having indoor or outdoor piped water. The population of Lerala relies on paraffin and electricity and candles for lighting. Firewood is the main energy source for cooking for 76% of the households. LPG gas is used by 13% of the households and electricity by 10%.

The village is well known for the collection and processing of morula fruit to produce morula oil and soap products through the KyT women's Trust. KyT carries out a range of activities, but the collection, processing, and marketing of veld products and a micro-lending scheme are its core activities. The Trust has membership from various villages in the Tswapong region, where both individual members and groups collect veld products. They have the option to process the veld products themselves or sell them unprocessed to the Trust for processing, packaging, and marketing (mostly for morula), or to market and sell veld products directly to third parties, as usually happens with phane. KyT therefore encourages commercialisation of veld products and the empowerment of rural women to improve their livelihoods. It appears that in recent years there has been a 'slow-down' in the processing of morula fruits in Lerala.

#### The Lerala survey

A total of 111 households were interviewed. This represents about 5-6% of all households. Most household heads (67%) were women, middle-aged or older, poorly educated (only 17% having more than primary school education) and not employed (85%). The most common household size was 5 and only 41% of households had one or more formally employed member. While the village is quite 'traditional', only 10% of the interviewed households had houses with thatched roofs.



Table 15 shows which activities are the most important source of livelihood. Arable farming is the most important livelihood source for 33% of the households. Informal employment such as through lpelegeng, is most important for 19% of households and FRR collection for 18% of households. Formal employment is first only for 13% of households. FRR collection is the second most important livelihood source for 31% of the households and is the most important second and third livelihood source (see appendix A.2). Most households have multiple livelihood sources, reducing their vulnerability.

**Table 15: Most important livelihood sources for Lerala households (111 households)**

Most important livelihood source	No. of households (111)	% of households
1.FRR collection	20	18
2.Livestock husbandry	9	8
<b>3.Arable farming</b>	<b>37</b>	<b>33</b>
4.Informal employment	21	19
5.Formal employment	14	13
6.Welfare	7	6
7.Other	3	3

The FRR collected by most households is firewood (73%), followed by phane (64%), thatching grass (31%) and morula (22%). Other resources such as *Grewia flava*, *Grewia supspatulata* and *Grewia bicolor* are collected by 13% of the households. All households are involved in FRR collection, but there is a small number of mostly female-headed households for whom FRR collection is the most important livelihood resource (for 4 households this is the *only* livelihood source). Thus, households for whom FRR collection is a crucial livelihood, have heads of household, who are in majority women, over 45 years in age and with limited education.

#### 4.3.2 Firewood

Of the 111 surveyed households, 82 households are involved in firewood collection. Respondents commented about the importance of firewood for their household livelihood.

The average collected per year per household amounts to 4 807 kg. This generates an estimated village harvest of 7 million kg of firewood for 2016/17. Only three households in the survey sell firewood at an average of 13 250 kg per year (median 13 125 kg). Most households collect for their own use; 90% of the harvest is for own use. About 23% of households buy firewood to supplement their energy needs. Electric or gas stoves are used by 33% of the households.

Firewood is collected throughout the year. The availability of firewood is considered 'good' by 30% of households, 'bad' by 32% and 'average' by the rest (38%). Many households collect daily, but most common is one trip per month to gather a load of firewood. The average number of trips per month is 2.9. Firewood is collected as head loads, wheel barrow loads, donkey cart loads or van loads. The latter two are sometimes hired.

Households use their own labour at an average of 0.6 person-day per month; two households hire additional labour occasionally. In 31% of households, firewood is collected by women only; generally, men and women are equally involved in collection, but women do most of the head loads. Basic equipment is used: axe, saw, wheel barrow and donkey cart. The equipment highest on the wish-list is a donkey cart.



Table 16 shows the economic value of firewood in the village based on the profile of the average harvester. The gross value is P6.9 million<sup>27</sup> while the net value is P5.9 million. Economic values based on the median and mode are much lower but still significant (e.g. gross value of P1.7 million and net values of P1.5 million). The difference is caused by three large firewood traders, pushing up the average. The annual economic is P4 053 per harvesting household.

**Table 16: Economic value of firewood harvest in Lerala (Pula; 2016/17; 1 455 households)**

Gross economic value	6,906,812
labour costs	707,767
Other costs	302,513
Net economic value	5,896,533

Note: figures based on average harvester.

#### 4.3.3 Thatching grass

Twenty-seven surveyed households collected thatching grass. Of the harvest, 79% was category A. Category A was reported to be mostly *Motsikiri* species while category B is *Tshikitshane*. For the entire village, the harvested amounts are estimated to be 209 187 and 42 328 bundles for category A and B, respectively.

The resource was generally available in 2016/17, and the harvest was considered 'average' by most of the households for both grass categories. Harvesting is mostly undertaken in July during the dry season. Collection areas differ, but harvesters usually travel as far as Palla Road to harvest grass, particularly the category A species. The harvesters camp for up to 20 days but the average harvesting days per trip is 14.

Thatching grass is mainly collected by women, while only three households reported to involve men too. All collecting households use own labour, while 15% reported to use both own and hired labour. In terms of equipment used, most of the households use sickle, while some reported that no tools are used, implying the use of bare hands. The latter may compromise the sustainability of the resource since the grass is uprooted. Grass is transported in donkey carts and vans, which are either owned or hired.

The gross economic value of category A is P2.1 million, while the net value is estimated at P2 million (Tables 17 and 18). The costs involved are modest, with the labour costs amounting to P84 065. Other costs are associated with transport and purchase of harvesting equipment. For category B, the economic value is low; P1.1 million (net value) based on a price of P30 per bundle of 1.3 m circumference. The annual economic value per harvesting household is P13 802 and P3 239 for category A and B respectively.

**Table 17: Economic valuation of category A grass collection in Lerala (Pula; 2016/17; 142 households)**

Gross economic value	2,091,868
Labour costs	84,065
Other costs	47,801
Net value	1,960,002

<sup>27</sup> Local price is P5/ bundle of 5 kg; assumed price is therefore P1/kg.

**Table 18: Economic valuation of category B grass collection in Lerala (Pula; 2016/17; 355 households)**

Gross economic value	1,269,851
Labour costs	82,128
Other costs	37,803
Net economic value	1,149,921

Note: figures based on average harvester.

#### 4.3.4 Phane

Phane harvesting is a major commercial activity in Lerala: 71 of the surveyed households are involved in the harvesting of phane. Phane is collected in December and/or April. The year 2016/17 is considered a 'slightly below average' year (median is 'average'). The estimated phane harvest for the entire village is 391 739 kg. The bulk of the phane is sold (87%), mostly to traders; a small amount is sold locally in cups; the remainder is consumed within the household. If the contents of a bag is sold as cups, its value more than doubles.

More than three quarters of the phane is collected by women (78%), mostly by individuals but also by groups of up to 7 persons. Few of the harvesting households hire labour (14 households with on average 1.5 person). The equipment used is restricted to buckets and -importantly and expensive- transport of the harvest as collection is at a distance from the village. Transport charges vary, and are usually one or more 12.5 kg bag per trip. It can also be cash (e.g. P250 per trip).

FRR are very important to the harvesting households. The average and median livelihood rank of FRR for the collecting households is 1.4 and 1, respectively (1 being the most important livelihood source). Most of the harvest is sold; the remainder is used within households. The average selling price is P 400/bag of 12.5 kg with a range of selling price of P300 to 500/bag. Cups sell for P10/cup.

Phane is a multi-million business in Lerala (Table 19). Based on the average harvester the net economic value is P11.5 million, accruing to 1 260 households, while the net value based on the median harvester is P2.8 million. The much lower median value shows that a few large harvesters 'capture' most of the value. Four households harvested 54% of the harvest. The household harvests range from a minimum of 50 kg to a high of 3 050 kg. The annual economic value is P9 134 per harvesting household.

**Table 19: Estimated annual economic value of phane in Lerala (Pula; 2016/17; 1 260 households)**

Gross economic value	12,372,825
Labour costs	535,232
Other costs	328,351
Net economic value	11,509,242

Note: figures based on average harvester.

#### 4.3.5 Morula

Morula is collected by 13 of the surveyed households. This is an estimated 210 households in the entire village and the collected amount is estimated at 42 219 kg of morula fruits. Morula is collected in the period January to April with some collection done in December and May. Women do the entire

collection, mostly by individuals but sometimes in groups of 2. Only one household hires labour. Morula harvesting requires little labour, equipment and transport. Only buckets and/or plastic bags are used, and morula harvesting site is reached by walking; no transport means were recorded. Unlike in Gweta, the year 2016/17 is considered to be an average morula year.

The average and median livelihood rank of FRR for the collecting household is 2.2 (1 being the most important livelihood source; median of 2). The collected morula is mostly used for beer brewing. Eleven households harvest morula to brew beer and one household collects to make jam. One household sold morula nuts (dicheru) by cup. The jam producing household uses one bag of 12.5 kg and makes 12 jam bottles (mayonnaise bottles of 750 g) sold for P25 each. A recorded amount of 1 353 Lt of beer is produced at an average and median price of P6.7/L. No harvester in the survey sold morula to KyT for oil or soap production.

The value of the morula fruits themselves is limited (P6/12.5kg. bucket), but the value increases with jam making and beer brewing (Tables 20 and 21). As observed in Gweta, morula collection itself has marginal value, but significant value is derived from the sale of beer: more than P100 000 based on the average brewer, and P45 000 based on the median brewer.

**Table 20: Economic value of morula harvest in Lerala (Pula; 2016/17; 210 households)**

Gross economic value	54,845
Labour costs	27,125
Other costs	350
Net economic value	27,370

Note: figures based on average harvester.

**Table 21: Economic value of morula beer brewing in Lerala (Pula; 2016/17; 161 households)**

Gross economic value	120,763
Labour costs	6,507
Other costs	15,126
Net economic value	114,256

Note: figures based on average harvester.

#### 4.3.6 Wood products

Of the surveyed households in Lerala, only four collected wood for wood products in 2016/17 and this is an estimated 71 households in the whole village. The estimated wood harvest in the village is 66 554 kg with an average of 937 kg per harvesting household. Wood is available throughout the year as the respondents reported various months of resource collection. Households use own labour for harvesting wood and is an activity carried out by both males and females. The harvesters spend on average 0.6 days harvesting, and make one trip per year. All the households use an axe to harvest wood and donkey carts are used as a mode of transport.

FRR are important for the surveyed households and are mostly ranked second as important sources of livelihoods. Wood is collected mainly for household use; none of the respondents indicated that they sell the resource.

The economic value of wood harvesting in Lerala is provided in Table 22. Wood harvesting generated a modest gross economic value of P239 595 and a net value of P224 829 based on the average harvester. The annual net economic value is P3 167 per harvesting household.

**Table 22: Economic value of wood harvest in Lerala (Pula; 2016/17; 71 households)**

Gross economic value	239,595
Labour costs	887
Other costs	13,879
Net economic value	224,829

Note: figures based on average harvester.

## 4.4 Palla Road

### 4.4.1 The village and livelihoods

Palla Road is situated along the main road between Gaborone and Francistown in the Central District (Figure 2). The village had 1 229 people in 2011 (54% were women) and 408 households. The village had about the same population in 2001. It is therefore assumed that the number of households in 2017 has remained the same (408). The literacy rate for Palla Road population is about 66%. Overall, 63% of households had access to sanitation facilities; most of which uses pit latrines (45%) while 8% have access to flush toilets. It is also estimated that 99% of households had access to potable water from various sources with piped water being the most commonly used by 74% of the households. Villagers rely on paraffin (50%) and electricity (20%) for lighting. Firewood remains important and is the principal source of energy for cooking, utilised by about 81% of the households followed by use of gas at a low 11% and electricity at 6%.

### The Palla Road survey

A total of 75 households, with a total of 465 persons, were interviewed in Palla Road; this represents about 18% of all households. Most household heads (73%) were female, middle-aged or older, poorly educated (only 20% having more than primary school) and unemployed (56%). The most common household size was 5 and only 43% of households had one or more formally employed member. While the village is quite 'traditional', only 12% of the interviewed households had houses with thatched roofs.

Table 23 shows the most important livelihoods for households in Palla Road. Informal employment is stated as the most important livelihood source by 41% of all households. Formal employment is most important for 17% of households and FRR collection for 13% of households. FRR collection is the second most important livelihood source for 39% of the households. Almost all households (98%) have at least two livelihood sources, while many households (56%) have three livelihood sources.

**Table 23: Most important livelihood sources for Palla Road households (75 households)**

<b>MOST important Livelihood</b>	<b>Number of households (75)</b>	<b>% of households</b>
1.FRR collection	10	13
2.Livestock husbandry	8	11
3.Arable farming	7	9
<b>4.Informal employment</b>	<b>31</b>	<b>41</b>
5.Formal employment	13	17
6.Welfare	5	7
7.Other	1	2

Firewood is the most collected FRR by 87% of the households, followed by thatching grass (48%). Morula, phane and other resources such as *Grewia flava* and *Grewia bicolor* are also collected, but the number of households involved is small. All households are involved in FRR collection, but for a small number (10, of which 5 female-headed) of households is FRR collection the most important livelihood resource. For other households, FRR collection is the second and third most important livelihood strategy and is thus supplementary to other livelihood sources. These are mostly female-headed households: 20 of 29 and 19 of 26 respectively, making FRR collection especially important for female-headed households.

#### 4.4.2 Firewood

Firewood is collected by about 90% of the households in Palla Road. The average annual amount per collecting household is 7 521 kg, while the total village harvest is estimated at just under 3 million kg of firewood.

Most households collect for their own use. Only a few households sell firewood at an average of 5 460 kg per year. About 17% of households buy firewood to supplement their energy needs. Electric, gas stoves or paraffin stoves are used by 41% of the households as substitutes for firewood, while 59% do not use substitutes.

Firewood is collected throughout the year. The availability of firewood is considered 'good' by 40% of households, 'bad' by 33% and 'average' by the rest (37%). Many households collect firewood daily, but most common is one trip per month to gather a load of firewood. The average number of trips per month is 4.3. Firewood is collected as head loads, wheel barrow loads, donkey cart loads (2 or 4 wheeled) or van loads.

Households use their own labour at an average of 0.4 person-day per month; they do not hire additional labour. Women constitute 45% of the collectors (mostly headloads), while men make up the balance of 55% (mostly with wheel barrows and donkey carts). In 28% of households, only women collect firewood. 'Simple' equipment is used: axe, saw, wheel barrow and donkey cart. The equipment highest on the 'wish-list' is a donkey cart.

The economic value of firewood to the village<sup>28</sup> is shown in Table 24. The estimated annual gross and net economic values are P2.2 and P2.1 million, respectively. The median values are around P1 million and the mode is around P300 000. The annual net economic value is P5 885 per harvesting household.

<sup>28</sup> No local prices could be obtained. We have used the same price as in Lerale (P1/kg.)

**Table 24: Economic value of firewood harvest in Palla Road (Pula; 2016/17; 354 households)**

Gross economic value	2,188,953
Labour costs	42,758
Other costs	62,941
Net economic value	2,083,253

Note: figures based on average harvester.

#### 4.4.3 Thatching grass

Thatching grass is collected by 37 households which is almost 50% of the surveyed households. Both category A and B grass type were collected in 2016/17. Category A is more common, and was collected by 90% of the households while 10% collected category B grass type. The estimated village harvest for category A and B are 243 445 and 174 bundles, respectively. The availability of the resource was considered 'good' by 64% of the households, 'average' by 16% and 'bad' by 5%. The FRR is collected in the dry season between May and October but most commonly in July. Most harvesters make one trip per year that can last up to three months. The most common area for collection is to the west of the village, where both the inhabitants and non-inhabitants of Palla Road are allowed to harvest. However, when the harvesting season begins, all harvesters have to report to the village Chief to register for harvesting in the area.

The collecting households all use their own labour, while 19% also hired labour. Collection of grass is done by women in 84% of the households; 20 of these engage both male and females. Moreover, in terms of equipment used, most households use a sickle and transport the FRR in donkey carts and vans, which are either owned or hired. Sometimes the harvesters pay in-kind for hired labour and transport. No special wish list was made in terms of equipment they would like to use, but some alluded to using tents during camping, while others mentioned owning a mode of transport.

Thatching grass is utilised for both domestic and commercial purposes. Category B grass harvest was all used in the household. For category A, about 64% was used in the household while 36% of the harvest was sold at a local price of P5 per bundle. These are usually sold locally or to passers-by on the A1 highway from Gaborone to Francistown. While the grass is important for thatching roofs, other products are also made from it such as traditional brooms. There is no indication as to how many of these products are produced or sold during the year 2016/17.

Both category A and B grass types have been valued for Palla Road (Table 25 and 26). The former generates more economic value for the village, with an estimated gross value of P1.2 million and a net value of P0.9 million. The estimated median gross value is about P0.5 million, while the net value is P0.3 million. Due to the small quantities collected, the average harvester for category B generates a gross value of P4 352 for the village while the net value is negative due to the labour costs. The average net annual value is P5 035 per harvesting household (category A).

**Table 25: Economic value of category A thatching grass (Pula; 2016/17; 185 households)**

Gross economic value	1,217,227
Labour costs	270,191
Other costs	15,640
Net economic value	931,396

Note: based on the average harvester.

**Table 26: Economic value of category B thatching grass in Palla Road (Pula; 2016/17; 22 households)**

Gross economic value	4,352
Labour costs	4,461
Other costs	0
Net economic value	-109

Note: based on the average harvester.

#### 4.4.4 Phane

Phane is collected by five of the 75 surveyed households. Phane is only collected in December and April, three quarters by women and one quarter by men. Two households hire labour; most work is done by the household itself, sometimes in groups.

The year 2016/17 was an average to slightly below average year and the harvest in the village is estimated at 8 370 kg of phane. Most of the harvest is sold (96%). A few households sell in cups (P15/cup; 270ml or 107 gr<sup>29</sup>). Harvesters collect phane in buckets. No household records transport; presumably, the phane is collected nearby and harvesters walk to the harvesting sites.

Veld products are important to the households: the average livelihood ranking is 1.6 while the median is 1.5.

The net economic value of phane in Palla Road is estimated to be P219 928 (based on the average harvester) and P81 000 for the median harvester. The large difference is due to the two large harvesters, who account for over 90% of the annual harvest. The average net annual economic value is P8 146 per harvesting household.

**Table 27: Estimated annual economic value of phane in Palla Road (Pula; 2016/17; 27 households)**

Gross economic value	233,820
Labour costs	12,596
Other costs	1,296
Net economic value	219,928

Note: based on the average harvester.

#### 4.4.5 Morula

Morula harvesting is limited in Palla road. Only three of the 75 surveyed households collect morula. The collected amount of morula fruits for the village is estimated at 2 467 kg. Morula is mostly collected in February and March, all by women. The households use the entire harvest themselves: 2 households for brewing beer. The year 2016/17 is perceived to be an average year in terms of availability and harvest. Harvesting requires very little inputs. Only buckets are used. It appears that all households walked to the collection site as morula was collected from nearby.

Two households sold a recorded 200 L of morula beer at P3/L. Beer was not sold in cups. The economic value of harvesting in the village is negative (Table 28); that of beer brewing is positive, but small as only a few households brew beer (Table 29).

<sup>29</sup> Based on actual weighing of a phane cup purchased in Gaborone.

**Table 28: Economic value of morula harvest in Palla Road (Pula; 2016/17; 16 households)**

Gross economic value	1,184
Labour costs	2,640
Other costs	0
Net economic value	-1,456

Note: based on the average harvester.

**Table 29: Economic value of morula beer brewing in Pall Road (Pula; 2016/17; 11 households)**

Gross economic value	4,510
Labour costs	275
Other costs	138
Net economic value	4,097

Note: based on the average harvester.

#### 4.4.6 Mmilo

Mmilo was collected by three surveyed households resulting in an estimated 16 harvesting households for the entire village. The estimated village harvest is 476 kg of mmilo and 71% of the harvest is sold. Mmilo is sold locally at P5 per 270 ml cup and is consumed as a snack. The collection months for mmilo vary, but are more commonly collected in February and March, with some collection in April and December. Mmilo is available on the outskirts of the village and harvesters do not travel far to collect. Households use their own labour and collection is undertaken by women. No special equipment is utilised, and the resource is collected in buckets or sacks. None of the households recorded transport as a cost.

The economic value for Palla Road is small due to the small amount collected and the low household participation rate. The estimated gross value is P7 616 (Table 30) with a net economic value of P6 759. The median harvester generates almost a similar gross economic value at about P6 528.

**Table 30: Economic value of mmilo harvest in Palla Road (Pula; 2016/17; 16 households)**

Gross value	7,616
Labour costs	857
Other costs	0
Net value	6,759

Note: based on the average harvester.

#### 4.4.7 Wood products

Three households in the survey collected wood for wood products. The estimated village harvest is 63 240 kg of wood. Two households reported that it takes them a whole day to collect while one took only two hours per trip. About 58% of the harvest was sold, while the rest was collected for own use. Wood is mostly used for fencing and making crafts, chairs, mortars and pestles among other. One household made crafts and managed to sell a wooden chair at P700. Only one household reported to have purchased a donkey cart load of wood at P300.



The availability of the resource as well as the harvest were mostly considered ‘average’ by the surveyed households. Households use their own labour and men collect the wood in all households. An axe is used to cut down the wood and transported in wheel barrows and donkey carts. Households wish to use a saw to harvest, while one mentioned that they would like to have their own cart to ease transporting the wood from the area of collection to the village.

The gross value of wood collection in Palla Road is estimated at P50 592 while the net value is P45 375 (Table 31). The value is based on a per kg price of P0.8. The costs involved are minimal; P3 074 for labour and other costs amounting to P2 143. The latter is mostly associated with transport hire. The average annual net economic value is P2 836 per harvesting household.

**Table 31: Economic value of wood harvesting in Palla Road (Pula; 2016/17; 16 households)**

Gross value	50,592
Labour costs	3,074
Other costs	2,143
Net value	45,375

Note: based on the average harvester.

## 4.5 Tsetseng

### 4.5.1 The village and livelihoods

The village of Tsetseng is in western Kweneng District (Figure 2). It is about 40 km north-east of Kang and 300 km from Molepolole. The village is the smallest of the surveyed villages, and had a population of 397 (2011 Population and Housing Census), about the same as in 2001 (395). The village was estimated to have 129 households. The village has not grown since 2001 and therefore the number of household is assumed to be the same in 2016. Ipelegeng is the largest ‘employer’ in the village. The Ithuseng Trust has a morama plantation, but the beans were not harvested in the 2016/17 period. Tsetseng cannot expand as it is surrounded by fields on one side, cattle posts, and ranches on the other as well as the Kweneng-Kgalagadi border. The village faces a water challenge. Many households (42%) had access to a communal tap while only 29% had access to piped water in 2011. Other sources of water include bowzers/ tanker as well as boreholes. It is reported that 58% of households had access to sanitation facilities: pit latrines are utilised by 39% of the households, while 10% had access to flush toilets. In terms of energy use, paraffin is mostly used for lighting (54% of households), followed by firewood (32%) and candles (8% of households); only 0.8% of households use electricity. The community is highly reliant upon firewood for cooking and heating with an estimated 88% of households utilising the resource for both purposes.

### The Tsetseng Survey

A total of 73 households were interviewed in Tsetseng: 51% of households were male-headed and 49% female-headed. The head of household is typically middle-aged or older, poorly educated (only 34% having more than primary school) and unemployed (52%). The most common household size was 7, and only 32% of households have one or more formally employed member. Although the village is quite ‘traditional’, only 15% of the interviewed households had houses with thatched roofs.

Table 32 shows the most important sources of livelihoods. Informal employment is the most important livelihood source stated by 42% of all households, while livestock husbandry is most important for

18% of the households; formal employment is most important for 15% of households. FRR collection is most important for 11% of households.

**Table 32: Most important livelihood sources for Tsetseng households (73 households)**

<b>MOST important Livelihood</b>	<b>Number of households (73)</b>	<b>% of households</b>
1.FRR collection	8	11
2.Livestock husbandry	13	18
3.Arable farming	5	7
<b>4.Informal employment</b>	<b>31</b>	<b>42</b>
5.Formal employment	11	15
6.Welfare	4	5
7.Other	1	2
<b>TOTAL</b>	<b>73</b>	<b>100</b>

About 93% of the respondents collect firewood, followed by grapple (71%), wood (16%) and thatching grass (5%). Collection of other resources such as brandy bush, truffle, sour plum and sand raisins is undertaken by 16% of the households. All households are involved in FRR collection, but for 8 households (one female headed), FRR collection the most important livelihood source (see Appendix A.2).

#### 4.5.2 Firewood

Almost all households in the village collect firewood (97%). The average collected amount per year per collecting household is 3 654 kg while the total collected amount in the village is estimated at 456 721 kg in 2016/17. All households collect for their own use; none of the surveyed households sell firewood, while two households buy firewood to supplement their energy needs. Gas stoves are used by 21% of the households as substitutes for firewood; 79% do not use substitutes.

Firewood is collected throughout the year. The availability of firewood is considered 'good' by 41% of households, 'bad' by 47% and average by the rest (12%). Many households collect firewood daily, but most common is one trip per month to gather a load of firewood. The average number of trips per month is 10.2. Firewood is collected as head loads, wheel barrow loads, donkey cart loads or van load.

All households only use their own labour for collection. Households spend on average 7.6 days per year on firewood collection; they do not hire labour. In 26% of households, firewood is collected by women only; overall, 40% of collection is done by women and 60% by men. Basic equipment is used such as axe and saw and for transport wheel barrows and donkey carts. The equipment highest on the wish-list is the donkey cart and tents for longer trips.

Table 33 shows the estimated economic value of firewood in Tsetseng<sup>30</sup>. The gross value is around P500 000 while the net value is just over P450 000. The median values and mode are slightly higher in the absence of traders that distort the distribution.

<sup>30</sup> The local price of firewood is P1.10/kg.

**Table 33: Economic value of firewood harvest in Tsetseng (Pula; 2016/17; 125 households)**

Gross economic value	502,393
Labour costs	19,063
Other costs	26,838
Net economic value	456,492

Note: figures based on average harvester.

#### 4.5.3 Thatching grass

The survey recorded four collectors of thatching grass in 2016/17 in Tsetseng. The harvesters collect a variety of category B grasses. Category A species are not available in their area (unlike in zone 1). The estimated village harvest is 182 bundles of category B grass species. The months of collection vary, and all respondents make one trip per year to harvest grass. Own labour is used and collection is done by women in all households; in two households men also participate in the harvesting. Grass is collected in head loads and donkey cart loads.

No special equipment is used, while one respondent indicated to have used a shovel, but it is unclear as to whether it was used to dig out the grass or to cut. The lack of information for tools used may imply that households uproot the grass from the ground thereby compromising the regenerative capacity of the resource.

Almost the entire harvest (95%) is used domestically for roofing own houses, while 5% was sold at P30 per bundle. Given the small quantities collected, the estimated economic value is low: P5 460 and P2 845 in net value (Table 34).

**Table 34: Economic value of thatching grass harvest in Tsetseng (Pula; 2016/17; 7 households)**

Gross economic value	5,460
Labour costs	2,368
Other costs	247
Net economic value	2,845

Note: figures based on average harvester.

#### 4.5.4 Wood products

Eleven of the surveyed households collected wood for wood products in 2016/17. The average harvest is 934 kg per harvesting household, while the estimated village harvest is 18 159 kg of wood per year. Wood is available throughout the year as the respondents reported various months of resource collection. Households use own labour for harvesting wood, and it is a typical male activity. Only three households indicated that women were also involved in wood collection, but always accompanied by men. Households use an axe to harvest wood, and donkey carts for transport. One household reported to use a van, while another one collected head loads.

FRR are an important resource for the surveyed households and are mostly ranked second as important sources of livelihoods. Wood is important for making fences in the village and at the cattle post or field as well as to support housing structures. Wood is collected for both household use and for selling. Of the surveyed households, 85% sell the collected wood while 15% use within the households. The FRR is mostly sold in donkey cart loads for P100 to 300 per load.

Wood collection in Tsetseng generates a modest value. Based on the average harvester, wood collection generates an estimated gross value of P41 506 (the median being P10 000) and a net value of P33 409 (Table 35). The labour costs are relatively high, given that in more than 70% of the households, more than one person is involved in wood harvesting. Other costs are also high, largely due to transport hire. In general, transport costs are reported to be P200 per load.

**Table 35: Economic value of wood collection in Tsetseng (Pula; 2016/17; 19 households)**

Gross economic value	41,506
Labour costs	3,388
Other costs	4,709
Net economic value	33,409

Note: figures based on average harvester.

#### 4.5.5 Grapple

Grapple is collected by 52 of the 73 surveyed households. The total village harvest is estimated at 2 581 kg of dry grapple tubers with an average of 28 kg per harvesting household. Grapple is collected in June-August with some collecting in May. Households only use their own labour for harvesting, mostly women. Households use either a crow bar or a kepu for digging. Donkey carts are often used to transport the harvest. Women mostly collect grapple: 82% of the collection is done by women. Only 3 of the 52 households hire labour; most households use their own labour only. The year 2016/17 is considered an average grapple year.

The entire harvest is sold after drying. Buyers pay harvesters P23/dry kg. The gross value at village level is around P60 000 and a net value of P14 000 (Table 36). The net value is relatively low because of the labour intensive nature of harvesting.

**Table 36: Economic value of grapple harvest in Tsetseng (Pula; 2016/17; 92 households)**

Gross economic value	59,352
Labour costs	39,965
Other costs	5,476
Net economic value	13,911

Note: figures based on average harvester.

#### 4.5.6 Morama

Despite the cultivation of morama by the local community Trust, only 12.5 kg of morama beans was collected by one household for domestic use. Based on the single harvester, the gross value of morama in Tsetseng is P177 while the net value is P66<sup>31</sup> (Table 37).

<sup>31</sup> The value is based on a price of P100 per 12.5 kg bag of morama. Just under 2 harvesters in the village.

**Table 37: Economic value of morama harvest in Tsetseng (Pula; 2016/17; 2 households)**

Gross economic value	177
Labour costs	110
Other costs	0
Net economic value	66

Note: figures based on average harvester.

## 4.6 Chobokwane

### 4.6.1 The village and livelihoods

Chobokwane is located in the south-western part of Ghanzi District about 80 km from Ghanzi town (Figure 2). It has an estimated population in 2011 of 771 with 294 households. The village population grew by 59% during the 2001-2011 period. If this trend has continued up to now, the current population is now about 1 040 with 396 households.

Only 6% of the households had access to improved sanitation facilities. Most households (81%) had access to potable water from various sources with an estimated 60% having access to piped water. In relation to energy sources, paraffin and firewood are commonly used for lighting, constituting 38% and 23% of households; only about 5% use electricity for lighting. Firewood is most often used for cooking (88%), followed by LPG with 10%. Firewood is also important for heating: about 90% of households utilise the resource for this purpose.

### The Chobokwane Survey

A total of 83 households were interviewed, of which 53% were male-headed. The head of household is typically middle-aged or older, poorly educated (only 20% having more than primary school) and not employed (52%). The most common household size was 4 and only 11% of households had one or more formally employed members. While the village is quite 'traditional', only 24% of the interviewed households had houses with traditional thatched roofs.

Table 38 shows the most important sources of livelihoods for households. Informal employment is most important for 51% of the households, while FRR collection is most important for 15% of the households and government social welfare programmes are most important for 13% of households. FRR collection is the second most important livelihood source for 46% of the households (Appendix A.2). Almost all households (98%) have more than one livelihood source to reduce the households' vulnerability.

**Table 38: Most important livelihood sources for Chobokwane households (83 households)**

<b>MOST important Livelihood</b>	<b>No. of Households (83)</b>	<b>% of households</b>
1.FRR collection	12	15
2.Livestock husbandry	7	8
3.Arable farming	2	2
<b>4.Informal employment</b>	<b>42</b>	<b>51</b>
5.Formal employment	9	11
6.Welfare	11	13
7.Other	0	0

Firewood is the most frequently collected FRR (99% of households). Other important FRR are morama beans (29%) and grapple (24%). Other FRR such as *Grewia flava*, sour plum, truffle and the Kalahari sand raisin are collected by 16% of the households. All households are involved in FRR collection, but for 12 households it is the most important livelihood source. For other households, FRR collection is the second (46%) or third (35%) most important livelihood strategy, and is thus supplementary to other livelihoods.

#### 4.6.2 Firewood

In Chobokwane, all 83 surveyed households collect firewood. Obviously, firewood is important for households. The average collected per year per household amounts to 2 803 kg while the estimated village harvest is about 1.1 million kg of firewood. All households collect for their own use. No survey household sells firewood. However, about 11% of households buy firewood to supplement their own. Electric or gas stoves are used by 20% of the households. Firewood is collected throughout the year. The availability of firewood is considered 'good' by 41% of households, 'bad' also by 41% and 'average' by the rest (18%).

Many households collect daily, but most common is one trip per month to gather a load of firewood. The average number of trips per month is 10.5. Firewood is collected as bundles, head loads, donkey cart loads or van load.

Households use their own labour at an average of 0.5 person-day per month; they do not hire additional labour. In 43% of households, women only collect firewood; women account for 57% of the collection. Many people use no equipment or basic equipment such as axe and saw and for transport, wheel barrows and donkey carts. The equipment highest on the 'wish-list' is the donkey cart.

Table 39 shows the economic value of firewood in the village<sup>32</sup>. The gross and net value are estimated at P760 222 and P580 220 respectively. The median values are slightly lower while the mode values are higher. The average annual net value is P 1 461 per harvesting household.

**Table 39: Economic value of firewood in Chobokwane (Pula; 2016/17; 396 households)**

Gross economic value	760,222
Labour costs	48,645
Other costs	131,357
Net economic value	580,220

Note: figures based on average harvester.

#### 4.6.3 Thatching grass

Thatching grass was collected by six of the surveyed households. Grass was collected in the dry season, with most households collecting in May while one household collected in October. The availability of the resource was considered 'good' by 50% of the households while the other half considered it to be 'average'. With regards to the harvest, half of the households also reported 'good harvest' while the other half considered the harvest to be 'average'. It is estimated that a total of 105 bundles of category B grass species were harvested in the village in 2016/17.

<sup>32</sup> The local price of firewood is reported to be P0.80/kg.

Two thirds of the households made one trip to collect thatching grass in 2016/17; two households collected more than once in a month. Grass is collected for own use and harvesting involves women in all the households, while men assist in two households. At the most, five people are involved in harvesting, all household members. Only one household reported to have used a sickle to harvest grass while others reported none. It is therefore assumed that harvesters uproot the grass from the ground without due diligence for resource management. Two modes of transport are used; van and donkey cart.

The economic value of the resource is low due to the small amounts harvested and the few households that collect. The estimated gross value for 2016/17 is P 3 149 with a net value of just under P 2 000 (Table 40). The costs involved make up 41% of the gross value generated.

**Table 40: Economic value of thatching grass harvest in Chobokwane (Pula; 2016/17; 29 households)**

Gross economic value	3,149
Labour costs	895
Other costs	277
Net economic value	1,977

Note: figures based on average harvester.

#### 4.6.4 Wood products

Of the 83 surveyed households, 6% collected wood in 2016/17 and an estimated 3 206 kg of wood was harvested in the village. The main species collected are *Acacia mellifera* and *Terminalia sericea*, which are generally found in the proximity of the village. Collection months vary from one household to the other. On average, harvesters make one trip per month, while two households made two and four trips in one month. At the most, harvesters take six hours to harvest wood, but the average time taken is three hours. Collection is done by men in all the households, while two households engage both men and women.

All harvesting households collect for own use, mainly for fencing of yards and fields; some households use wood to support housing structures and to make outdoor cooking areas. The main equipment used for harvesting is an axe while donkey carts are used for transport. Households did not express any need for special equipment, but one household wishes to own safety clothing such as gloves and goggles.

The gross economic value of wood in Chobokwane is small and estimated to be P7 328 (Table 41) while the median harvester generates a gross value of P4 580. However, the costs of wood collection are relatively high, mostly due to transport and cost of equipment. This has resulted in a low net value of P2 855.

**Table 41: Total economic value of wood collection in Chobokwane (Pula; 2016/17; 24 households)**

Gross economic value	7,328
Labour costs	608
Other costs	3,865
Net economic value	2,855

Note: figures based on average harvester.

#### 4.6.5 Grapple

Grapple is collected by 21 of the 83 surveyed households. The estimated village grapple harvest is 3 647 kg of dried tubers. Grapple is collected in May-July with some collecting in August. Households only use their own labour for harvesting, mostly women. Households use either a crow bar or a kepu for digging. One household used a hoe. No means of transport are reportedly used. Harvesters walk to and from the harvesting area. The year 2016/17 is considered a 'good' grapple year in terms of resource availability and harvest.

The entire harvest is sold after drying. Buyers pay harvesters P19/dry kg. The gross value at village level is around P70 000 and the net value of around P23 000 (Table 42). The average net economic value is P234 per harvesting household.

**Table 42: Economic value of grapple harvest in Chobokwane (Pula; 2016/17; 100 households)**

Gross economic value	69,287
Labour costs	39,875
Other costs	6,000
Net economic value	23,412

Note: figures based on average harvester

#### 4.6.6 Morama

Morاما was collected by 24 surveyed households (29% of the households). The estimated village harvest in 2016/17 is 19 788 kg of morama beans, with an average of 173 kg per harvesting household. The collection months vary, but households mostly collect in January, while February and March are also the common months for collection. Households mostly use their own labour while one household reported to have hired one person to collect the FRR. Collection involves both men and women (70.8% of the households). Women are however more involved in the harvesting (87.5% of the collecting households). Only two households reported that men are the sole collectors. Equipment used is basic: bags and sacks and when collected from far, a donkey cart or van are used (reported by two households). None of the respondents expressed the need for special equipment or transport.

The median and average livelihood rank of veld products for the collecting households is 2.9 and 3 (1 being the most important livelihood source). The collected morama is mostly used as a snack and can also be used in porridge, soups and baby food as it is believed to be nutritious and a good source of appetite. About 64% of the collected volume was sold, while the rest was used within the household for domestic purposes. Morama is sold in 270 ml cup at P7.50/cup on average, while some households sell 12.5 kg bags for P100 to 150 per bag. It is reported that 12 surveyed households bought the FRR from those that sell within the village. The purchased volumes amount to 44 kg.

The economic value of morama in Chobokwane is modest (but higher than grapple), and is estimated at P162 121 in gross value while the net value is estimated at P119 000 (Table 43). These figures are based on the average resource harvester. The use of the median harvester as the basis, generates a much lower gross value for the village: P37 214. The average net annual economic value is P1 034 per harvesting household.



**Table 43: Economic value of morama in Chobokwane (Pula; 2016/17; 115 households)**

Gross economic value	162,121
labour costs	42,713
Other costs	453
Net economic value	118,955

Note: figures based on average harvester.

## 4.7 Kumakwane

### 4.7.1 The village and livelihoods

Kumakwane is located in Kweneng-East region, about 22 km from Gaborone (Figure 2). The peri-urban village had a population of 5 545 and 1 506 households in 2011. This is a substantial increase of 76% since 2001. If this urbanisation trend has continued, the current population may now be 8 095 with an estimated 2 650 households. Being a peri-urban area, the residents are mostly employed in Gaborone and commute daily.

The villagers' literacy rate is about 85%. Most of the households have access to sanitation facilities with pit latrines being the commonly used among 30% of the households, followed by flush toilets by 19% of the households. Moreover, 69% have access to piped potable water. Electricity is utilised for lighting by 58% of households, while paraffin is used by 31% and candles by 1% of the households. LPG gas is the principal source of energy for cooking, and it is utilised by 43% of households followed by firewood and electricity at 36 and 17% respectively.

### The Kumakwane Survey

A total of 99 households were interviewed; 43% of household were male-headed and 57% female-headed. The head of household is typically middle-aged or older, poorly educated (only 23% having more than primary school) and unemployed (67%). The most common household size is 5 and 64% of households have one or more formally employed member. The village is peri-urban and only 1% of the interviewed households had houses with thatched roofs.

Table 44 shows the sources of the most important livelihoods. Formal employment is stated as the most important livelihood by 49% of all households, informal employment by 18% of households and FRR collection is most important for 11% of the households. FRR collection is the second most important livelihood source for 36% of the households and is the most common second and third important livelihood source (Appendix A.2). Almost all households (99%) have at least two livelihood sources, to reduce their vulnerability and improve their standards of living.

**Table 44: Most important livelihood sources for Kumakwane (99 households)**

<b>MOST important Livelihood</b>	<b>No of Households (99)</b>	<b>% of households</b>
1.FRR collection	11	11
2.Livestock husbandry	5	5
3.Arable farming	5	5
4.Informal employment	18	18
<b>5.Formal employment</b>	<b>48</b>	<b>49</b>
6.Welfare	8	8
7.Other	4	4

Firewood is the most frequently collected FRR (98% of households; the second most important FRR is mmilo (14% of households), followed by morula (12%) and thatching grass (7%). Households also collect small amounts of red milkwood, sand raisin and brandy bush berries. All households are involved in FRR collection, but for 11 households (7 female headed) is it the most important livelihood resource. For other households, FRR collection is the second (36%) or third (32%) most important livelihood strategy and supplements other livelihood sources.

#### 4.7.2 Firewood

Despite Kumakwane's peri-urban location, almost all households collect firewood. Of the 99 survey households, 97 collect firewood. Many comments made by respondents relate to the importance of firewood for their household, the essence being that firewood is necessary to keep the household out of poverty.

The average amount of firewood collected per year per household amounts to 3 279 kg while the total village harvest is estimated at 8.5 million kg in 2016/17. Most households collect for their own use. About 15% of households buy firewood to supplement their energy requirements. Most households (87%) supplement firewood with electricity, gas, or dried cow dung.

Firewood is collected throughout the year. The availability of firewood is considered 'good' by 25% of households, 'bad' by 29% and 'average' by the rest (46%). Many households collect firewood daily, but the most common is one trip per month to gather a load of firewood. The average number of trips per month is 3.4. Firewood is collected as head loads, wheel barrow loads, donkey cart loads or van load. The latter two are sometimes hired.

Households use their own labour at an average of 0.3 person-day per month; they do not hire labour. In 39% of households, firewood is collected by women only; in the other households both men and women or men alone collect firewood. Women constitute 53% of the collectors. The following equipment is used: axe, saw, wheel barrow and donkey cart. The equipment highest on the wish-list is a donkey cart.

Table 45 shows the economic value<sup>33</sup> of firewood in Kumakwane. As the labour costs are high the net value is much lower (P0.6 million) than the gross value (P2.1 million). The high labour costs reflect the greater effort required to collect wood. The median and mode gross economic value are P1.3 million and the net values are negative, again reflecting the labour-intensive nature of collection in Kumakwane.

**Table 45: Economic value of firewood harvest in Kumakwane (Pula; 2016/17; 2 596 households)**

Gross economic value	2,127,961
Labour costs	1,120,844
Other costs	429,721
Net economic value	577,396

Note: figures based on average harvester

<sup>33</sup> Firewood is valued at P0.25/kg, which is the report local price. This is lower than in the other villages, contrary to the expectation that prices would be higher in peri-urban settings. A price of P1/kg would yield a modest but positive economic value.

### 4.7.3 Thatching grass

Thatching grass is not commonly utilised in Kumakwane. Of the 99 surveyed households, only seven collected grass in 2016/17. The collected amounts are small and the estimated harvest for the village is 3 721 bundles per year. The FRR was collected between July and October and on average five trips were made per month. Grass is collected when needed, particularly for roofing houses at the cattle posts and the fields. Households do not have to travel long distance to access the resource. Some harvest just outside the village, while some go to nearby fields.

Three households considered the availability of the FRR in 2016/17 as being both 'average' and 'good', while the harvest was mostly regarded as 'average' by 36% of the collecting households. As mentioned, grass is collected for household use, all by women from the household. Only two households utilise a sickle to harvest, while the rest reported to have used no tools thereby implying the use of bare hands to remove grass directly from the ground. Donkey carts provide transport, while some households collect head loads.

The estimated economic value of thatching grass collection is modest due to the small quantities collected and the few collecting households. This is to be expected given the location of the village and the characteristics of households in terms of the type of roofing used, livelihood sources and access to income. Based on the average harvester and P30 as the per bundle price, the gross economic value for the village is estimated at P111 621 with a net value of just under P 100 000 (Table 46).

**Table 46: Economic value of collection of thatching grass in Kumakwane (Pula; 2016/17; 187 households)**

Gross economic value	111,621
Labour costs	3,681
Other costs	8,405
Net economic value	99,536

Note: figures based on average harvester.

### 4.7.4 Wood products

Only two households reported to have harvested wood in 2016/17 and the estimated harvest for the village is 8 994 kg per year. The FRR was collected in head loads and donkey cart loads where an axe was used to cut down the wood. In terms of availability and harvest, the resource availability is considered to be average by both households. The main costs incurred are the tools used and transport hire.

The harvest was used for fencing and making wood products such as chairs, mortars and pestles among others. One of the households reported to have sold a chair at P250 in 2016/17 while the rest of the products were not sold. Wood collection involved one man in one household and three women in the other household. The women collected head loads while the man used a donkey cart. None of the households hired labour for collection. For fencing and building, it seems gum poles are commonly used and most of the households have access to this. If not purchased locally, people buy from nearby Gaborone. The economic value for the village generated by wood collection is low, and is estimated to be P 19 273 (gross) and P7 997 (net; Table 47).

**Table 47: Economic value of wood harvest in Kumakwane (Pula; 2016/17; 54 households)**

Gross economic value	19,273
Labour costs	2,443
Other costs	8,833
Net economic value	7,997

Note: figures based on average harvester.

#### 4.7.5 Morula

Morula was collected by 12 of the surveyed households<sup>34</sup>. The harvested amounts are small, and mostly the result of collection in or near the yard. The annual village harvest is estimated at 2 094 kg of morula fruits. Morula is collected in December with some collection in November, January and February. In terms of gender, two thirds of the collectors are women and one third are men. No labour is hired. The equipment used is restricted to buckets and plastic bags. Collection is within walking distance. The year 2016/17 is an 'average' year in terms of availability and harvest of morula.

The average livelihood rank of FRR for the collecting household is 2.4 (1 being the most important livelihood source) and the median is 2. The collected morula is mostly used within the household (89.5 kg); no processing takes place. One household sold a bag of 12.5 kg of morula for P20. No survey household sold to morula processing institutions in Gabane.

The economic value of morula in Kumakwane is low, as it is mostly used within the households as a snack<sup>35</sup>. No survey household was involved in morula beer brewing (Table 48).

**Table 48: Economic value of morula harvest in Kumakwane (Pula; 2016/17; 321 households)**

Gross economic value	6,700
Labour costs	3,356
Other costs	2,043
Net economic value	1,302

Note: figures based on average harvester.

#### 4.7.6 Mmilo

Mmilo is collected by 14 surveyed households, mostly in 12.5 kg bags. The FRR is mostly collected in January, but some collection occurred in March, April and December. The households reported that the resource is generally available and that the 2016/17 harvest was 'good'. Mmilo is collected mostly close to the village, while a few households travel more than 10 km to the collection sites.

Households mostly use their own labour for harvesting. Mmilo is mostly collected by women (93% of the response) while in five households, men also participate. It is typically collected in buckets, plastic bags and sacks. Only one household utilises a donkey cart for transport while no special transport is used; 43% of the households wish to acquire a donkey cart to collect more.

<sup>34</sup> Another two households included morula in the livelihood ranking but provided no data on collection. It is assumed that these household did not actually collect in 2016/17.

<sup>35</sup> The home use is valued at P3.2/kg, double that of the sold bucket as it can be used as a fruit and nut.

It is estimated that 10 366 kg of mmilo was harvested in the village and 55% of this was used domestically while 45% was sold. It is mostly sold within the village particularly at the main bus stop targeting passers-by on the A10 road (Gaborone-Kanye; Figure 2). The FRR is sold at P10 per 270ml cup and P200 per 12.5 kg bag.

The economic value of mmilo in Kumakwane is estimated at P165 852 (gross) and P161 787 (net); this is higher than morula. The difference between gross and net value is very small due to the low costs. The average annual net value is P431 per harvesting household.

**Table 49: Economic value of mmilo harvest in Kumakwane (Pula; 2016/17; 375 households)**

Gross economic value	165,852
Labour costs	1,924
Other costs	2,141
Net economic value	161,787

Note: figures based on average harvester.

## 5 Integrated analysis

The chapter discusses the findings of the survey and desk top study by resource (5.1) and by village (5.2).

### 5.1 The veld products

#### 5.1.1 Firewood

Firewood is important for rural livelihoods. It is collected in all villages by over 80% of the households. As one respondent put it: 'firewood is important to keep us out of poverty'. It is used as the only energy source or in combination with other sources such as gas, paraffin and electricity<sup>36</sup>. Over 90% of the collected wood is used within the households in all villages except for Gweta (55%). Firewood is only sold in Gweta, Lerala and Kumakwane.

It is estimated that a total 24 879 tons (T) of firewood is collected in the villages, ranging from 500 T/a in Tsetseng to 8 511 T/a in Kumakwane. The average harvest differs across the villages with a low of 2.8 T/a in Chobokwane to a high of 7.5 T/a in Palla Road.

The gross economic value is estimated to be P16.1 million/a with a range of P0.5 million in Tsetseng to P3.6 million in Gweta. The net value is estimated to be P12.6 million/a. Clearly, firewood is a valuable energy resource. For all villages together, the labour costs are around twice the 'other costs'. However, in the smaller villages, labour costs are lower than 'other costs'<sup>37</sup>, possibly because firewood can be collected nearby. The annual net value per harvesting household ranges from a low of P222 in Kumakwane to a high of P5 885 in Palla Road the average for all villages is P2 000/ harvesting household or P 167/ month. This is around 10% of the average monthly rural household income.

Appendix A.3 has the summary figures by village and for all villages together. Firewood is important throughout Botswana as reflected in the literature and survey results. While the availability of substitutes and supplements has improved (e.g. LPG, paraffin and electricity) and the use of firewood has decreased (Figures 7 and 8), firewood continues to be widely used to 'beat poverty'. Further poverty reduction is likely to reduce the direct use value of firewood in future. The differences between villages indicate that caution is required with generalisation of the values to 'rural Botswana at large'.

#### 5.1.2 Thatching grass

Collection of thatching grass is a country-wide activity and is collected in all villages. Thatching grass is important for both subsistence and commercial use where the latter occurs in zone 1 of the survey. Several grass species are collected, depending on the location and their use. Two grass categories are distinguished: category A which covers the good quality or preferred species and are often commercially harvested, e.g. *mokamakama* and *motsikiri*; and category B which comprises the poorer quality species such as *tshikitshane*. Category A species are collected in Gweta, Lerala and Palla Road while category B species are collected in all villages.

Category A grass is collected by almost 30% of the households with a high participation of households in Gweta. Category B is collected by 13% of all households that participate in collection of category B

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<sup>36</sup> Electricity is not available in Tsetseng and Chobokwane. LPG gas and paraffin are available in all villages.

<sup>37</sup> This may be due to the fact that firewood is more abundant and requires less labour to collect. However, their transport costs are higher, possibly due to fewer but far away trips. In larger village, women tend to collect wood more frequently, settling for small amount (headloads).

grasses. An estimated 1 944 862 bundles were collected in the villages in 2016/17 of which 95% of the bundles were category A grass species. Collected harvested bundles of category A grass range from 209 187 bundles in Lerela to 1 383 320 bundles in Gweta.

The gross economic value of category A grass is estimated to be P12.2 million in 2016/17 while the net value is P10.7 million. This implies generally low costs of collection, but at a village level, the costs are much higher for Gweta harvesters who travel longer distances and the collection period is longer (camping lasting up to 2 months). The gross economic value for harvesting category B grass is estimated at P2.9 million while the net economic value is P2.3 million. Around 46% of the value is generated in Gweta (category B). The costs of collection are low, and the net values are 82% of the gross values in overall, but the ratio is much higher in Kumakwane at 90%.

Thatching grass is mostly collected by women and sold at varying prices depending on the species. The price of a 0.3 m circumference bundle of category A grass ranges from P5 to P10, while the bigger bundle can be sold up to P50. Category B bundles (1.3 m circumference) are sold at P30 to P50 per bundle. Based on the desk top study and survey results, prices do not appear to have increased over time.

The summary figures by village and for all villages are provided in Appendix A.3. Thatching grass is harvested in large quantities in northern Botswana, mostly for selling. Grass species are important, and the good ones are mostly sold either locally or to middle men and business owners particularly those in the tourism industry. However, in the 2016/17 harvesting period, harvesters did not sell much of their harvest largely due to insufficient local market and competition with harvesters from outside the villages. The commercial potential is high and need further exploiting.

#### 5.1.3 Phane

Phane is typical for northern Botswana as the worm is found on mopane trees only. Phane was collected in Gweta, Lerela and Palla Road. Lerela is the 'phane hub' accounting for 93% of the harvest. Almost two thirds of the households collect phane, compared to less than 10% in Gweta and Palla Road. Unlike firewood, phane is mostly sold to raise cash: 87% of the harvest is sold to traders.

It is estimated that a total of 401 T of phane have been collected in 2016/17, of which 392 T was collected by Lerela households. Phane was badly available in Gweta in 2016/17. The average harvester collects over 311 kg/a in Lerela, while the average harvest in Gweta is 25 kg.

The gross economic value for 2016/17 is estimated to be P12.6 million while the net value is P11.7 million. The costs of phane collection are relatively low and net values are 90% of the gross value in Lerela and Palla Road. Few tools (gloves and buckets) are needed and labour costs are modest. Traders may go out to the collectors to buy.

The price of phane has increased significantly from P12/ kg in 2005 to P30/ kg in the survey. Bags of phane (12.5 kg) are sold for an average of P375 in Palla Road and P380 in Lerela. Some households sell phane locally by cup instead of bag to add significant value. A cup of 270 ml fetches P15 in Palla Road and P10 in Lerela. Households can double their income by selling in cups; however, the local market is likely to be small. The average net household income from phane is P8 741 and comparable to the finding of Zimmermann and Maribe, 2010a). It is over 40% of the average rural household income.

Appendix A.3 has the summary figures by village and for all villages together. Phane appears sensitive to local environmental conditions (e.g. Gweta). Phane collection is an attractive activity given the prevailing low rural incomes. There is potential to increase phane collection but caution is required to

avoid over-harvesting. Phane collectors are 'lucky' that a trade sector exists. It is important, however, also to consider processing of phane locally (e.g. linked to CBNRM and local economic development (LED) programmes. As the experience of Lerala has shown, this requires higher prices (KyT cannot compete with private traders).

#### 5.1.4 Grapple

Grapple is only found in the western sandveld. In the survey, only Tsetseng and Chobokwane households collected grapple. Almost three quarters of the households in Tsetseng collect grapple while 'only' a quarter in Chobokwane.

The estimated harvest for the two villages is just over 6 000 kg most of which in Chobokwane (over 3 600). The higher harvest in Chobokwane is due to a higher average collection per harvester: 36 kg in Chobokwane compared to 28 kg in Tsetseng. The difference may be due to different natural conditions in 2016/17, but may also be related to the better market outlet in Chobokwane.

The gross value of the harvest is modest at just under P130 000, around P69 000 of which was realised in Chobokwane. The annual net economic value is much lower at less than P40 000; due to the high labour requirements. The annual values per harvesting household are low at P670 (gross) and P194 (net). This is around 1% of the average rural household income. This is despite a significant increase in the price of dry grapple: from P1-3 / kg in the 1908s to around P 20/ kg now.

Appendix A.3 has the summary figures by village and for all villages together. Grapple collection is currently not very attractive, and households will only engage in it if there are no alternative livelihood sources and uses of household labour. Grapple is mostly sold so emerging trade channels, which exist in both villages, are important to improve the value for rural livelihoods. Processing opportunities could also add value (e.g. teas, medicines, etc.). The cultivation option also deserves further investigation and trials.

#### 5.1.5 Morula

Morula is collected in zone 1 (Gweta, Lerala and Palla Road) and zone 2 (Kumakwane). It is collected as a snack for dicheru (selling of the nuts) and for beer brewing. Morula is hardly sold; only a small amount is sold in Kumakwane.

The estimated harvest for the four villages is 445 T, most of it in Gweta (398 T). A total of just over 300 000 L of morula beer were brewed, most of it in Gweta (287 000 L). The average amount harvested per harvester is high in Gweta at 906 kg and 154 kg in Palla Road. On average a beer brewer sells 557 l/ annum, but close to 850 L in Gweta.

The gross value of the harvested morula is over P460 000 per annum (valued at P6/bag of 12.5 kg in Lerala and Gweta; P20/bag in Kumakwane), while the net economic value is P355 000. Around 92% of the value is generated in Gweta. The value of beer brewing is much higher at gross value of P1.3 million and net value of P1 million. Obviously, beer brewing is an effective way of increasing the value and livelihood contributions. Other ways of increasing the livelihood value are making and selling jam (P25/bottle in Lerala) and selling 'dicheru' in cups (P10/cup of 270 ml. The average net economic value per households is around P400 for collection and P2 000 for beer brewing. Only beer brewing is significant in terms of rural household income.

Appendix A.3 has the summary figures by village and for all villages together. Morula is mostly used as a snack (small amounts) and for beer brewing. A number of households collect morula in and



around the yard, which demonstrates its potential for productive backyard activities. Some households increase income by making jam (only 1 reported survey case in Lerale) and kernels. Unprocessed morula fruits are hardly sold, which shows weak links with morula processing industry in Lerale and Gabane and the survey villages.

#### 5.1.6 Wood products

Wood is collected in all surveyed villages in limited quantities. The resource is collected by about 5% of the households with more participation in Gweta. As with firewood, the resource is collected throughout the year and is used mainly for fencing and to support housing structures, making crafts and furniture as well as household utensils like mortars and pestles. Although utilised mainly for own use, some households sell wood products to buyers within the village and passers-by. For instance, in Palla Road, some households display their products along the A1-road targeting passers-by. The estimated wood harvest in the villages is modest at just over 500 T with a range of 3.2 T/a in Chobokwane to 350 T/a in Gweta.

The gross economic value for 2016/17 is estimated at P824 000, mostly contributed by Gweta at P465 000 whereas Chobokwane contributes the lowest gross value at P7 300. The input costs account for 16% of the total gross value, resulting in a net economic value of P692 000/a. Labour costs are much lower than the costs of other inputs where the latter is on average more than three times the labour costs. The difference is much bigger in Lerale and Kumakwane. The high costs of other inputs are due to transport hire as wood has to be collected in vans and donkey carts from the point of collection. The average net value per household is P1 900 p.a. However, this varies by village from as low as P120 in Chobokwane to over P3 200 in Lerale.

The summary figures for all villages collectively are provided in Appendix A.3. Wood collection is modest and not attractive as a source of income. Wood is collected largely for fencing and building with minimal processing. Where wood products are made, households struggle to sell due to limited demand. Households have adopted modern tools and utensils and therefore seems to have lost interest in wooden products. Wood processing could generate income if one targets the external market, but this could involve high transport costs especially if one is to sell in urban centres.

#### 5.1.7 Palm leaves and baskets

Mokolwane palm leaves are commonly found in northern Botswana particularly around the Okavango area. The leaves are popularly used in traditional basket weaving to generate income for the weavers and for use within the households. Palm leaves are collected in Gweta by only 6% of the households. These are collected for basketry in all the households and there is no direct selling of the actual leaves.

The estimated harvest for the village in 2016/17 is 17 600 bundles of palm leaves with an average of 147 bundles per harvester. Collection is done in head loads and a head load has on average 20 small bundles. Small baskets require two small bundles while large ones need three bundles. Collection of palm leaves is modest, largely because of the limited market; most baskets are used within the household or kept for future selling. The harvesters display their products at a central place in the village (community library which is along the main road in the village opposite the Kgotla<sup>38</sup>) to target tourists. Unfortunately, the baskets are hardly sold. The price of baskets differs from individual to individual, but ranges between P40 to P700 depending on the size of the basket.

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<sup>38</sup> A Kgotla is a traditional law court.

The gross economic value for 2016/17 is estimated to be P341 000 while the net value is P49 000. The costs of palm leaves harvesting and basket making are high and net values are 14% of the gross value. The large difference is due to the high labour costs of basket making. Other input costs could not be valued – charcoal, mulberry and use of bird plum; these are used to dye the leaves. The net annual value per household is just over P400 and consistent with figures from the desk top study (Chapter 3). This suggests that prices have not risen significantly, confirming the market problems of basketry. It is clearly difficult to make a decent livelihood from basketry.

A summary of key indicators for collection of palm leaves in Gweta is provided in Appendix A.3. Collection of palm leaves and basket weaving are not attractive as there is limited market for the products and the labour costs are also high. Traditional basket weaving is now done when one is not engaged with other important household duties. However, it has potential to generate income for the households if the market could be accessed. The weavers could perhaps make formal arrangements with tour operators in the village to allow them to market their products at their entities to facilitate easy access by tourists. They could also target those in-transit to the Okavango Delta and Makgadikgadi wetland.

#### 5.1.8 Mmilo

Mmilo is mostly found in eastern Botswana and some parts of the southern region. In the survey villages, only Palla Road and Kumakwane collected mmilo but by few households. In Palla Road, mmilo is collected by 4% of the households while in Kumakwane only 14% of the households collect. The FRR is collected for both household and commercial use at almost similar rates (50%), and is consumed as a snack.

It is estimated that a total of 11 T was collected in 2016/17 in the two villages, most of which was in Kumakwane with over 95% of the total harvest. It is often collected when household members have gone out to collect other resources such as firewood.

The aggregate gross economic value of mmilo is estimated to be P173 000 while the net economic value is P169 000. The costs of mmilo collection are relatively low and net values are more than 90% of the gross value in both villages. The values per harvesting household are low at P444 (gross) and P431 (net). No special equipment is required for mmilo collection and is collected in buckets and sacks which households normally do not have to buy. Transport costs are also low.

Mmilo is commonly sold in cups with prices ranging from P5 to P10 per cup and in some instances, it is sold in 12.5 kg bags at an average of P200/bag in Kumakwane. It is mostly sold locally in all the villages but in Kumakwane, some sellers target those who pass through the A10 road.

Appendix A.3 has the summary figures by village and for all the villages together. Mmilo is not collected in large amounts nor traded. However, it has huge commercial potential that has hardly been realised as indicated in the literature. It can be collected and sold as snacks or processed into jam and beverage to increase household income. Efforts to educate and increase awareness on the commercial potential of mmilo should be undertaken to empower communities to efficiently collect and utilise the resource for greater benefit. The initiative of WF to process mmilo can be a start for commercialisation of mmilo.

#### 5.1.9 Morama

Morama is commonly found in the Kalahari Desert and therefore only Tsetseng and Chobokwane collected morama. About 98% of the resource is collected in Chobokwane while only 2% collected in

Tsetseng. Tsetseng was among the villages that BUAN identified for morama cultivation where a community plot was allocated to plant morama. Currently about 2 ha has been planted but no harvesting took place in the past year.

The estimated harvest for the two villages is 20 T, of which 98% is attributed to Chobokwane. About 63% of the harvest is sold and the rest is used within the households. Morama bean is roasted and consumed as a snack or crushed to make flour. It is a nutritious resource and great appetizer. Morama beans can also be processed into oils, butter, milk and biscuits, but this is not yet done in the two villages.

The gross economic value of the harvest in 2016/17 is estimated at P162 000, the bulk of which was realised in Chobokwane. The net value is about P119 000. The costs of collection are generally low, and the net value is 38% of the gross value in Tsetseng and 73% in Chobokwane. Equipment used is basic; bags and sacks, and when collected from far, donkey carts and cars are used. The net annual economic value per household is around P1 500 or P125/ month. This is around 7% of the average rural household income.

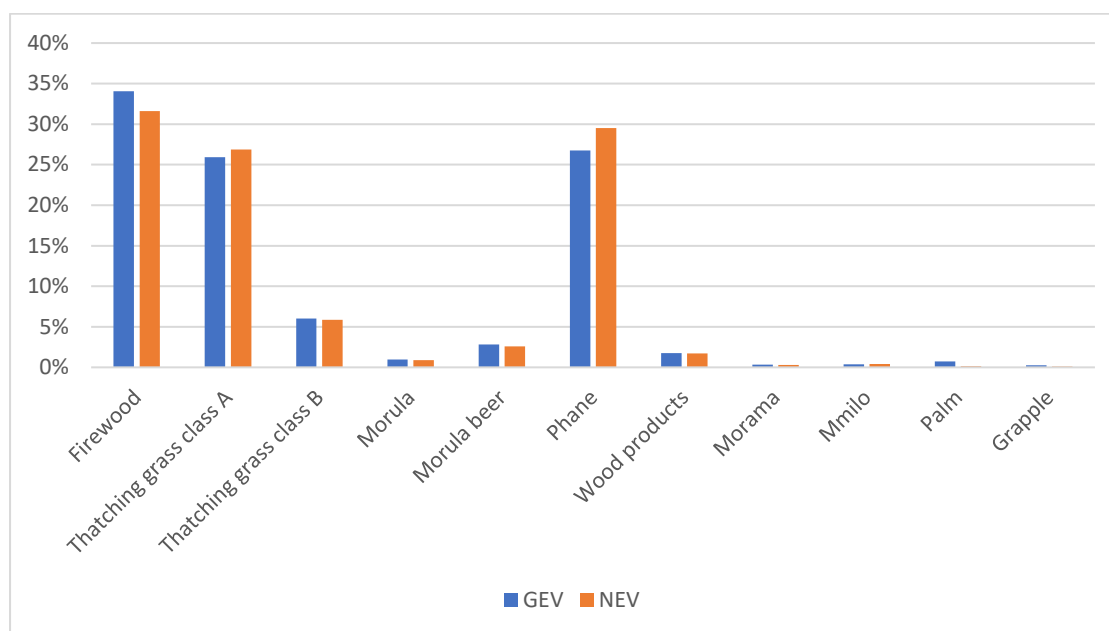
Appendix A.3 provides the summary figures by village and for all villages together. Morama collection has a good commercial potential, but the resource is not collected in large numbers or cultivated. It can be grown in the back yards (as some households do in Chobokwane). Although used traditionally at present, its processing needs to be explored, particularly in the Chobokwane area where collection is significant. This could boost LED and increase household income in the area with high poverty.

## **5.2 The villages**

This section reviews the value of the listed FRR by village. The gross and net values by village for the resources collected are given in Appendix A.4.

Figure 9 shows the value distribution among resources. The total economic value for the 6 villages is large at P47.2 million (gross) and P39.8 million (net). Firewood accounts for most of the value (around 32%), which benefits all villages. Phane is the second most valuable FRR accounting for around 30% of the net value. However, only one village (Lerala) accrues most of the value of phane: P11.5 million out of P11.7 million (net).

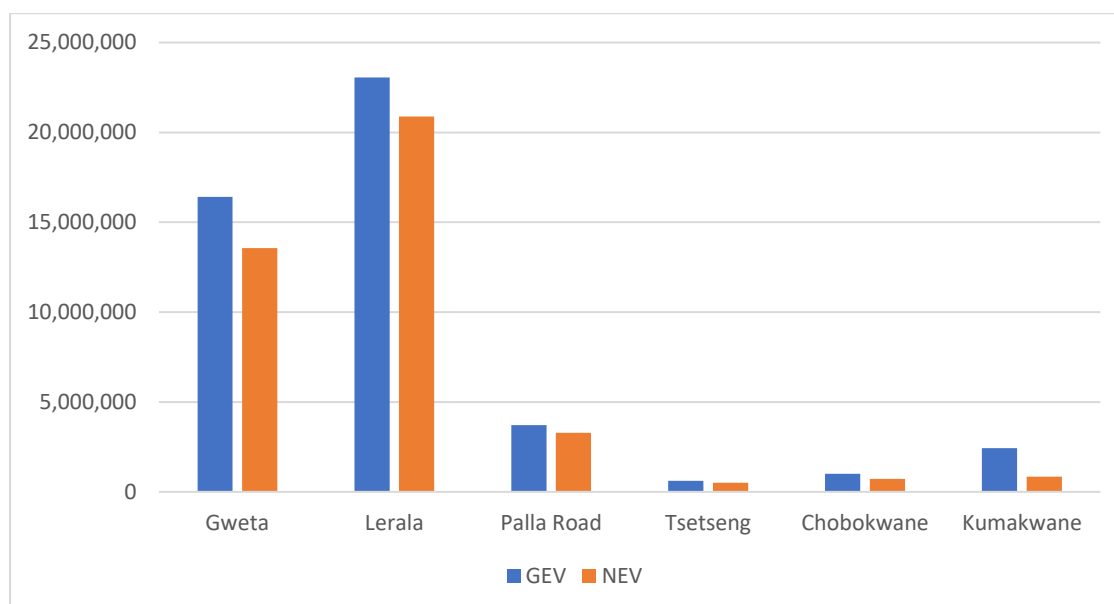
**Figure 9: Contribution to village value by resource (% of total village value)**



Note: GEV: gross economic value; NEV: net economic value.

Figure 10 shows the value distribution among villages. Due to the high value phane trade, Lerala gets around 52% of the total estimated economic value.

**Figure 10: Annual economic value by village (Pula; 2016/17)**



Note: GEV: gross economic value; NEV: net economic value.

Gweta is ranked second with about 34% of the value, while the remaining 15% is shared among the other four villages. The village value is determined by several factors:

- Resource availability (see Table 3);
- The number of collecting households, determined by the village size and participation rate;
- The amount collected by harvesting households; and

d. The resource prices and input costs.

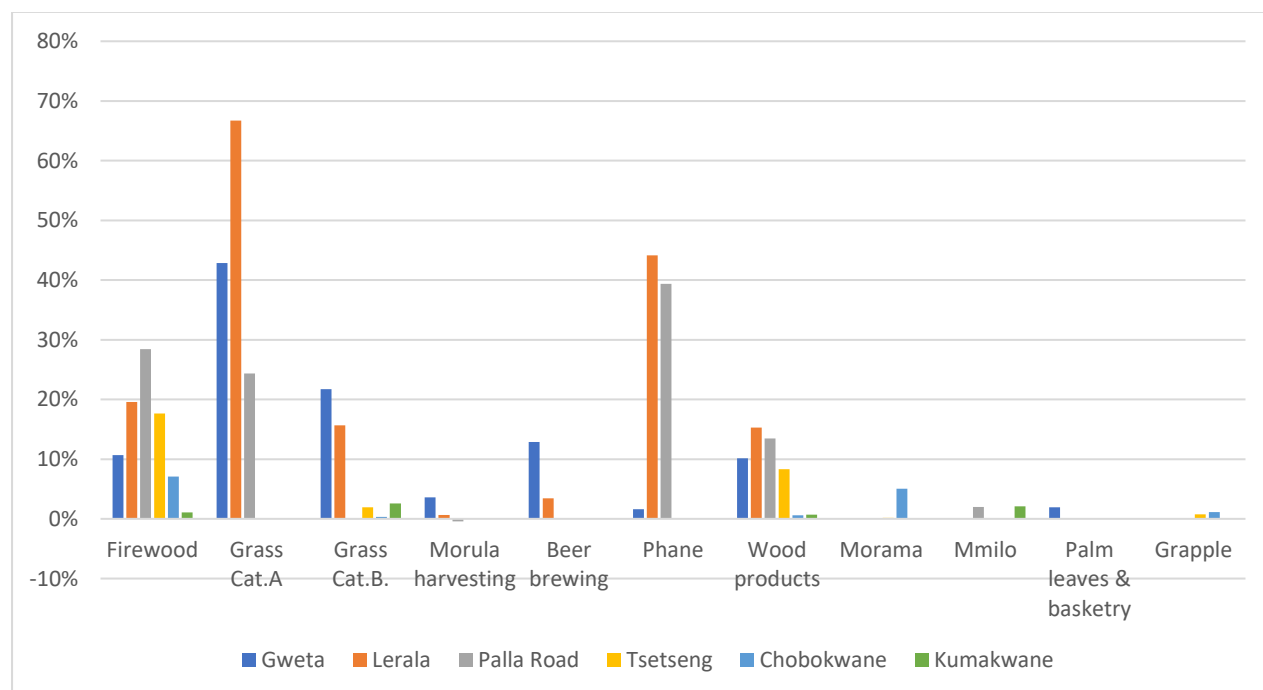
The most valuable resources for each village are:

- i. Gweta: thatching grass category A (P8.9 million) and morula beer (P1.2 million);
- ii. Lerala: phane (P12.3 million), firewood (P6.9 million) and thatching grass category A (P2.1 million);
- iii. Palla Road and Tsetseng: firewood (P2.2 million and P0.5 million respectively)
- iv. Chobokwane: firewood (P0.8 million) and morama (P0.2 million); and
- v. Kumakwane: firewood (P2.1 million).

Grapple (Tsetseng and Chokobwane) and mmilo (Kumakwane) are less valuable (e.g. third ranked) but mmilo is more valuable than grapple.

From a livelihood and poverty perspective, the value per harvesting household is more important than the aggregate village value. The economic values per harvesting household are shown in Figure 11. The average monthly net economic value per household is high for category A thatching grass and phane at P739 and P728, respectively. These high values are both generated in Lerala due to the phane and grass trade and the amounts are around 42% of the average rural household income (Table 5). The FRR income per household is lowest for grapple, morula, palm leaves and basketry as well as morama collection (they range from P16 to 36). Morula beer brewing is more valuable than harvesting (P167 per month) particularly in Gweta. The values for Kumakwane are low due to the limited number of FRR collected (firewood, morula and mmilo) and the low harvests, mostly for snacks (morula and mmilo) and to complement energy sources (firewood). FRR are less easily accessible and require higher input costs.

**Figure 11: Economic value per harvesting household (% of average rural household income)**

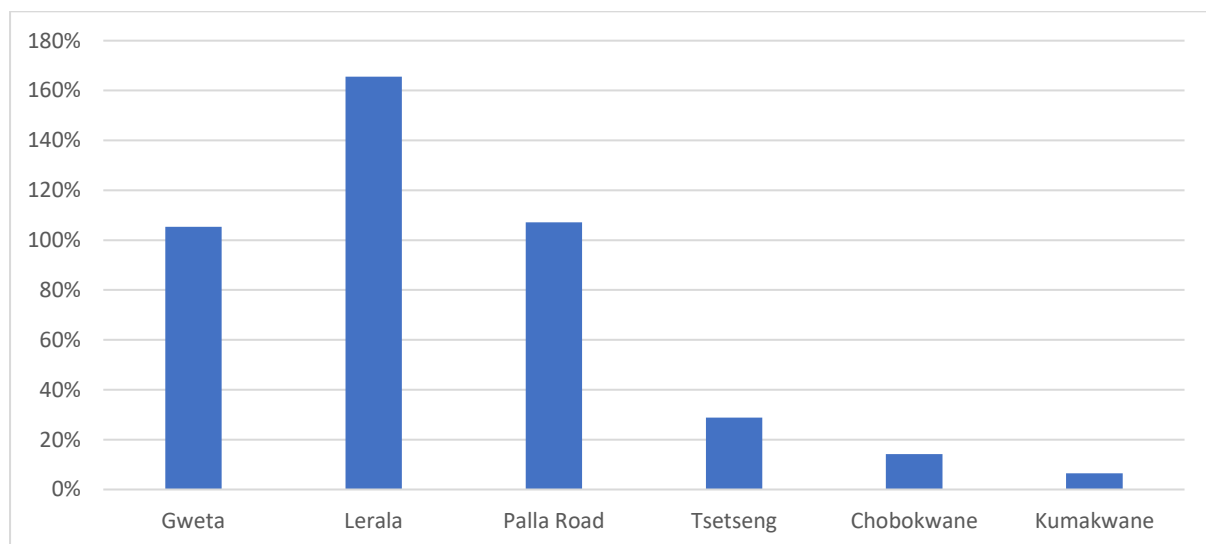


The poor are attracted to FRR collection because of the low costs and (almost) free access (sometimes subject to licenses). The production costs, including the costs of own labour<sup>39</sup> are on average 17% of the value. In the absence of alternative uses of labour, FRR collection is a vital livelihood security strategy.

The findings show that FRR are important sources of livelihoods that augment livelihood security and reduces poverty. FRR collection currently involves low-income groups that do not have more attractive livelihood options (with a few exceptions such as phane). While the returns are often not very high, the required inputs are very low, hence virtually everybody can collect FRR if necessary.

Figure 12 shows the potential income generated by aggregate FRR collection in the villages as a percentage of the updated average rural household income<sup>40</sup>. Assuming that there is active household participation in the collection of all<sup>41</sup> FRR in the village, harvesting could generate high income for the rural households. In the zone 1 survey villages, households could earn more than 100% of the average rural household income, while the potential aggregate income is much lower for zone 2 villages. The low value is due to limited 'high cash-earning' FRR in these areas but this could be enhanced through increasing access to the market, investing in processing and storage facilities and improving the rate of harvesting.

**Figure 12: Possible FRR household income (% of the average rural household income)**



<sup>39</sup> Valued at P20/day.

<sup>40</sup> The 2009/10 figure of P1 724/ month has been updated to 2016/17 using the consumer inflation index.

<sup>41</sup> Presently, households are involved in the collection of only a few.

## 6 Conclusions and recommendations

This section contains conclusions regarding the value of FRR and recommendations to increase their relevance for rural livelihoods and the national economy. Veld products or forest and range resource -FRR- have long been appreciated as important for rural livelihoods and poverty reduction. Particularly low-income groups rely on veld products for cooking, heating, food, building and health. Despite this appreciation, collection of FRR is not recognised as a form of land use and economic sector, probably because it is largely subsistence oriented and in the informal sector domain. As a result, the FRR sector tends to be overlooked in development and land use planning. The efforts towards poverty reduction and economic diversification have renewed the interest in FRR as an economic activity and sector, including for its commercial potential.

This study confirms that FRR are valuable sources of rural livelihoods and the increase rural livelihood security. FRR are usually ranked second or third in terms of frequently mentioned most important livelihood source, and in all villages as the most frequently mentioned second or third most important livelihood source. FRR are particularly important for the low-income groups, who do not have more attractive and accessible livelihood options. FRR are easily accessible and the costs are usually low, particularly if households have no better, alternative destinations for their labour. As one survey respondent put it: FRR, in that case firewood, are important to keep poverty away.

FRR are important for livelihoods as in-kind income and/ or as cash. The role of each FRR differs in this respect. The following pattern emerged:

- ✓ Almost all for cash/ sale: Phane (87%) and grapple (99%);
- ✓ Almost all for domestic use: Firewood (92%) and thatching grass (category B; 89%);
- ✓ For domestic processing and product sale: Morula (99%) and palm leaves (100%); and
- ✓ For domestic use and sale: Wood products (60% for domestic use), thatching grass (category A; 60% for domestic use) mmilo (50% for domestic use) and morama (37% for domestic use).

The availability of FRR is mostly seasonal, but firewood is collected throughout the year; wood for wood products is also collected throughout the year whenever there is a domestic need. Seasonality permits households to engage in other livelihood activities outside the FRR season, such as in arable farming. However, it leads to uneven monthly livelihood contributions. The seasonality is as follows:

- ✓ Phane: Two seasons: Mostly in December and April;
- ✓ Morama: Two less distinct seasons: December-February/ March and July – August;
- ✓ Grapple: Mostly in June-August; some in May and September.
- ✓ Palm leaves: Most months; no clear pattern.
- ✓ Thatching grass: July- September; some in October;
- ✓ Mmilo: January – March with some in December.

The aggregate direct use value (i.e. net economic value) of FRR is significant and estimated to be P40 million for the 6 surveyed villages, ranging in terms of villages from P0.5 million in the small village of Tsetseng to P20.9 million in Lerela, and in terms of FRR from P12.6 million for firewood to P37 323 for grapple. Phane generates P11.7 million in value, almost all in Lerela (P11.5 million). The economic value of FRR in villages is determined by the type of FRR available in the area, the size of the village, the participation rate of households and the costs of collection. Transport costs and labour are the biggest cost items. Households use mostly their own labour, and can 'afford' to spend labour on FRR if there is no better use of their labour. Social welfare programmes such as Ipelegeng are more

attractive than most forms of FRR collection. Transport costs are relatively high, in particular for donkey carts, vans, and trucks. Households reduce transport costs using wheelbarrows and carrying by head, but obviously limits the amounts that can be harvested.

The bulk of the current value of FRR is mostly derived from firewood (for domestic use), phane (for sale) and thatching grass (for sale, category A). In addition, good value is derived from beer brewing. The value of other FRR is relatively low, but important in specific villages with few livelihood opportunities.

Opportunities exist to increase the value of the FRR sector for households by:

- a. Increased collection of FRR such as grapple and phane. Studies have shown the potential for increased and sustainable harvesting of grapple and phane (chapter 3), and sustainability assessment for other FRR can be carried out prior to increasing the harvest;
- b. Packaging the FRR and selling in small quantities;
- c. Processing of FRR. For example, beer brewing and jam production from morula and basket making from palm leaves. KyT used to make morula soap. The recent establishment of new process facilities for morula and mmilo offer opportunities for increased sales and adding value along the value chain. The same could be done for other FRR. NAFTEC has identified several FRR based products for commercialisation (chapter 3);
- d. Storage of FRR to establish a more regular supply throughout the year (impossible for perishable FRR, unless chilled). This is likely to lead to better prices for producers and a more regular income;
- e. Cultivation of FRR. For example, BUAN established a plot for morama cultivation in Tsetseng;
- f. Creation of good market outlets and middlemen. Phane may serve as an example as it is successfully traded by the private sector;
- g. Improved marketing along the main highways for passers-by and for tourist operators in the area (e.g. thatching grass and indigenous snacks and morula snacks at Air Botswana); and
- h. Back yard FRR. A group of households collect FRR such as morula and mmilo in and around the yard or arable field. This offers low-cost opportunities for selling and processing.

FRR are included under the CBNRM policy and three of the six survey villages (Gweta, Lerala and Tsetseng) have CBOs that are involved in FRR CBNRM activities. However, the survey established that the CBOs have little visible impact on household livelihoods. There is need to strengthen CBNRM and FRR; and the survey identified several areas for CBNRM activities: storage, marketing, trade, and communal transport provision.

There is little value addition in the FRR sector and commercialisation has made little progress, despite old and new claims about the commercial potential of veld products as early as 1982 (Taylor and Moss, 1982 and Mpotokwane, 2017). Except for phane (private sector driven) and to a lesser extent grapple and morula, there is no trade sector that collects from harvesters for processing or exports. Various processing projects have stagnated or failed. Marketing and storage facilities have the potential to add value to veld products, e.g. by stabilising the prices and supply throughout the year. This would also add value.

The resources are highly under-utilised and limited progress has been made in commercialising the use of some of the veld products such as mmilo, morama and morula, among other. However, if their potential is tapped, veld products can contribute significantly to livelihoods security and poverty reduction. Moreover, given government's objectives for economic diversification and local economic development, veld products should be promoted to contribute towards these objectives. Optimal use and management of veld products would also require sustained support from academia, civil society



and extension services for research and development, marketing, education, and empowerment of harvesters.

Harvesting FRR is arduous as harvesters are exposed to unfavourable climatic conditions. Harvesting of morama, grapple and firewood (in Kumakwane) is labour intensive. It is therefore critical to make it worth it by increasing the value, either in kind or in cash. This requires a deliberate FRR support strategy and involvement of the private sector. FRR offer comparative advantages that need to be exploited for economic diversification, export diversification and growth and poverty reduction. FRR need to develop into a proper economic sector for future sustainable development of the country. As a starter, DFRR need to build a data base for the utilisation and conservation of FRR based on the permit information and monitoring efforts of the DFRR stations. FRR have been fully integrated into the 2017 technical papers for the National Strategy on Sustainable development and DFRR and the private sector need to build on the suggested actions.

Indications are that the resource sustainability of FRR like grapple, morama and phane is not under threat at the moment. This is due to the low levels of harvesting (morama and grapple) or abundance of resources. Natural fluctuations (e.g. phane in Gweta) also prevent over harvesting. Some thatching grass harvesters appear to uproot the entire plant, threatening the resource. Unsustainable harvesting practices of FRR need to be avoided through education and monitoring through CBOs, NGOs and DFRR.

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## Appendices

### A1: Household characteristics by village (% of households)

	Gweta	Lerala	Palla Road	Tsetseng	Chobokwane	Kumakwane
<b>Gender Head of Household</b>						
Female Headed	67	67	73	49	47	43
Male Headed	33	33	27	51	53	57
<b>Age Head of Household</b>						
<30	9	4	4	11	6	5
30-59	48	53	55	49	57	45
>60	43	43	41	40	37	50
<b>Education Level Head of household</b>						
No School	47	43	48	49	60	45
Primary	30	40	31	17	19	32
Junior Secondary	23	11	13	30	17	16
Senior Secondary	0	3	4	3	4	3
Higher education	0	3	3	1	0	4
<b>Employment Status(Head of Household)</b>						
Formal	7	6	8	9	6	19
Informal	22	8	28	39	42	14
Not Employed	71	85	56	52	52	67
<b>Household Size</b>						
Average	6.5	6.6	6.2	7	5.7	7.6
Mode	4	5	5	7	4	5
<b>Formally Employed HH Members</b>						
Households with	40	41	43	32	11	64
Households without	60	59	57	68	89	36
Average	0.7	0.7	0.7	0.5	0.1	1.3
Households With Thatched Roof		10	12	15	24	1

**A.2: Prioritised livelihood sources****Gweta**

<b>MOST important Livelihood</b>	<b>No. of households (103)</b>	<b>% of household</b>
1.FRR collection	24	23
2.Livestock husbandry	14	14
<b>3.Arable farming</b>	<b>27</b>	<b>26</b>
4.Informal employment	18	17
5.Formal employment	15	15
6.Welfare	5	5
7.Other	0	0
<b>SECOND MOST important Livelihood</b>	<b>No. of households</b>	<b>% of household</b>
<b>1.FRR collection</b>	<b>39</b>	<b>38</b>
2.Livestock husbandry	11	11
3.Arable farming	27	26
4.Informal employment	11	11
5.Formal employment	2	2
6.Welfare	4	4
7.Other/n.a.	9	8
<b>THIRD MOST important Livelihood</b>	<b>No. of households</b>	<b>% of household</b>
<b>1.FRR collection</b>	<b>27</b>	<b>26</b>
2.Livestock husbandry	6	6
3.Arable farming	12	12
4.Informal employment	11	11
5.Formal employment	3	3
6.Welfare	4	4
7.Other/n.a	40	38

**Lerala**

<b>Most important livelihood source</b>	<b>No. of households (111)</b>	<b>% of households</b>
1.FRR collection	20	18
2.Livestock husbandry	9	8
<b>3.Arable farming</b>	<b>37</b>	<b>33</b>
4.Informal employment	21	19
5.Formal employment	14	13
6.Welfare	7	6
7.Other	3	3
<b>SECOND MOST important Livelihood</b>	<b>No. of households</b>	<b>% of households</b>
<b>1.FRR collection</b>	<b>34</b>	<b>31</b>
2.Livestock husbandry	15	14
3.Arable farming	32	29
4.Informal employment	15	14
5.Formal employment	0	0
6.Welfare	6	5
7.Other/n.a.	9	7
<b>THIRD MOST important Livelihood</b>	<b>No. of households</b>	<b>% of households</b>
<b>1.FRR collection</b>	<b>32</b>	<b>29</b>
2.Livestock husbandry	10	9
3.Arable farming	15	14
4.Informal employment	12	11
5.Formal employment	5	5
6.Welfare	3	3
7.Other/n.a	34	29

Palla Road

<b>MOST important Livelihood</b>	<b>Number of households (75)</b>	<b>% of households</b>
1.FRR collection	10	13
2.Livestock husbandry	8	11
3.Arable farming	7	9
<b>4.Informal employment</b>	<b>31</b>	<b>41</b>
5.Formal employment	13	17
6.Welfare	5	7
7.Other	1	2
<b>SECOND MOST important Livelihood</b>	<b>Number of households</b>	<b>% of households</b>
<b>1.FRR collection</b>	<b>29</b>	<b>39</b>
2.Livestock husbandry	14	19
3.Arable farming	8	11
4.Informal employment	10	13
5.Formal employment	4	5
6.Welfare	8	11
7.Other/n.a.	2	2
<b>THIRD MOST important Livelihood</b>	<b>Number of households</b>	<b>% of households</b>
<b>1.FRR collection</b>	<b>26</b>	<b>35</b>
2.Livestock husbandry	1	1
3.Arable farming	9	12
4.Informal employment	3	4
5.Formal employment	0	0
6.Welfare	3	4
7.Other/n.a	33	44

Tsetseng

<b>MOST important Livelihood</b>	<b>Number of households (73)</b>	<b>% of households</b>
1.FRR collection	8	11
2.Livestock husbandry	13	18
3.Arable farming	5	7
<b>4.Informal employment</b>	<b>31</b>	<b>42</b>
5.Formal employment	11	15
6.Welfare	4	5
7.Other	1	2
<b>SECOND MOST important Livelihood</b>	<b>Number of households</b>	<b>% of households</b>
<b>1.FRR collection</b>	<b>22</b>	<b>31</b>
2.Livestock husbandry	17	23
3.Arable farming	14	19
4.Informal employment	12	16
5.Formal employment	3	4
6.Welfare	3	4
7.Other/n.a.	2	3
<b>THIRD MOST important Livelihood</b>	<b>Number of households</b>	<b>% of households</b>
<b>1.FRR collection</b>	<b>22</b>	<b>30</b>
2.Livestock husbandry	5	7
3.Arable farming	13	18
4.Informal employment	7	10
5.Formal employment	1	1
6.Welfare	2	3
7.Other/n.a	23	31

Chobokwane

<b>MOST important Livelihood</b>	<b>No. of Households 83)</b>	<b>% of households</b>
1.FRR collection	12	15
2.Livestock husbandry	7	8
3.Arable farming	2	2
<b>4.Informal employment</b>	<b>42</b>	<b>51</b>
5.Formal employment	9	11
6.Welfare	11	13
7.Other	0	0
<b>SECOND MOST important Livelihood</b>	<b>No. of Households</b>	<b>% of households</b>
<b>1.FRR collection</b>	<b>38</b>	<b>46</b>
2.Livestock husbandry	11	13
3.Arable farming	2	2
4.Informal employment	20	24
5.Formal employment	0	0
6.Welfare	11	13
7.Other/n.a.	1	2
<b>THIRD MOST important Livelihood</b>	<b>No. of Households</b>	<b>% of households</b>
<b>1.FRR collection</b>	<b>29</b>	<b>35</b>
2.Livestock husbandry	4	5
3.Arable farming	1	1
4.Informal employment	5	6
5.Formal employment	0	0
6.Welfare	0	0
7.Other/n.a	44	53

Kumakwane

<b>MOST important Livelihood</b>	<b>No of Households</b>	<b>% of households</b>
1.FRR collection	11	11
2.Livestock husbandry	5	5
3.Arable farming	5	5
4.Informal employment	18	18
<b>5.Formal employment</b>	<b>48</b>	<b>49</b>
6.Welfare	8	8
7.Other	4	4
<b>SECOND MOST important Livelihood</b>	<b>No of Households</b>	<b>% of households</b>
<b>1.FRR collection</b>	<b>35</b>	<b>36</b>
2.Livestock husbandry	18	18
3.Arable farming	16	16
4.Informal employment	17	17
5.Formal employment	3	3
6.Welfare	7	7
7.Other/n.a.	3	3
<b>THIRD MOST important Livelihood</b>	<b>No of Households</b>	<b>% of households</b>
<b>1.FRR collection</b>	<b>32</b>	<b>32</b>
2.Livestock husbandry	14	14
3.Arable farming	11	11
4.Informal employment	2	2
5.Formal employment	1	1
6.Welfare	0	0
7.Other/n.a	39	40

### A.3: Summary resource information across villages

#### Key indicators for firewood

	Gweta	Lerala	Palla Road	Tsetseng	Chobokwane	Kumakwane	Total
Survey households	103	111	75	73	83	99	544
Firewood harvesting hh in survey	68	82	65	71	83	97	466
HH in 2017	2060	1970	408	129	396	2650	7613
Est. firewood harvesting hh in village	1,360	1,455	354	125	396	2,596	6,286
Gross economic value	3,600,226	6,906,812	2,188,953	502,393	760,222	2,127,961	16,086,567
Net economic value	2,997,463	5,896,533	2,083,253	456,492	580,220	577,396	12,591,357
Average kg/harvester	3,781.8	4,807.0	7,521.8	3,653.8	2,802.9	3,278.8	
% own use of harvest	55.2%	89.5%	96.9%	100.0%	100.0%	96.2%	91.9%
% of firewood harvesters/ total hh	66.0%	66.0%	86.7%	97%	100%	97.98%	85.7%
Est village harvest (kg)	5,143,180	6,994,240	2,662,734	456,721	1,109,948	8,511,842	24,878,665
Net/gross value ratio	83.3%	85.4%	95.2%	90.9%	76.3%	27.1%	78.3%

#### Key indicators for thatching grass

CATEGORY A GRASS	Gweta	Lerala	Palla Road	Total
Survey households	103	111	75	289
Grass harvesting hh in survey	44	8	34	86
HH in 2017	2,060	1,970	408	4,438
Est. grass harvesting hh in village	880	142	185	1,207
Gross economic value	8,929,526	2,091,868	1,217,227	12,238,621
Net economic value	7,805,673	1,960,002	931,396	10,697,071
Average bundles/harvester	1,572.0	1,473.3	1,316.2	
% own use of harvest	90.0%	68.9%	0.0%	55.7%
% of grass harvesters/ total hh	42.7%	7.2%	45.3%	29.8%
Estimated village harvest	1,383,320	209,187	243,445	1,835,952
Net/gross ratio	87%	94%	77%	87%



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CATEGORY B GRASS	Gweta	Lerala	Palla Road	Tsetseng	Chobokwane	Kumakwane	Total
Survey households	103	111	75	73	83	99	544
Grass harvesting hh in survey	12	20	4	4	6	7	53
HH in 2017	2060	1970	408	129	396	2650	7613
Est. grass harvesting hh in village	240	355	22	7	29	187	840
Gross economic value	1,456,000	1,269,851	4,352	5,460	3,149	111,621	2,850,434
Net economic value	1,077,767	1,149,921	-109	2,845	1,978	99,536	2,331,937
Average bundles/harvester	260.0	119.3	8.0	25.8	3.7	19.9	
% own use of harvest	84.5%	93.2%	43.8%	95.1%	100.0%	100.0%	88.6%
% of grass harvesters/ total hh	11.7%	18.0%	5.3%	5.5%	7.2%	7.1%	9.7%
Estimated village harvest	62,400	42,328	174	182	105	3,721	108,910
Net/gross ratio	74%	91%	-3%	52%	63%	89%	82%

Key indicators phane

PHANE	Gweta	Lerala	Palla Road	Total
Survey households	103	111	75	289
Phane harvesting hh in survey	3	71	5	79
HH in 2017	2060	1970	408	4438
Est. phane harvesting hh in village	57	1260	27	1344
Gross economic value	22,800	12,372,825	233,820	12,629,445
Net economic value	18,810	11,509,242	219,929	11,747,981
Average harvest in kg/harvester	25.0	310.9	310.0	
% own use of harvest	33.3%	13.3%	4.0%	12.8%
% of phane harvesters/ total hh	2.9%	64.0%	6.7%	27.3%
Est. harvest in villages (kg)	1,425	391,739	8,370	401,534
Net/gross value ratio	82.5%	93.0%	94.1%	93.0%

Key indicators for grapple

GRAPPLE	Tsetseng	Chobokwane	Total
Survey households	73	83	156
Grapple harvesting hh in survey	52	21	73
HH in 2017	129	396	525
Est. grapple harvesting hh in village	92	100	192
Gross economic value (in Pula)	59,353	69,287	128,640
Net economic value (Pula)	13,911	23,412	37,323
Av. Harvest in kg/harvester	28.0	36.5	
% own use of harvest	1.2%	1.3%	1.3%
% of grapple harvesters/ total hh	71.2%	25.3%	48.3%
Est. amount harvested in villages (kg)	2,581	3,647	6,227
Net/gross value ratio	23.4%	33.8%	29.0%

Key indicators for morula

<b>MORULA &amp; MORULA BEER</b>	<b>Gweta</b>	<b>Lerala</b>	<b>Palla Road</b>	<b>Kumakwan</b>	<b>Total</b>
Survey households	103	111	75	99	388
Morula harvesting hh in survey	22	13	3	12	50
Morula beer brewing hh in survey	18	10	2	0	30
HH in 2017	2060	1970	408	2650	7088
Estimated morula beer brewing hh in village	341	161	11	0	513
Estimated morula harvesting hh in village	440	210	16	321	987
<b>Morula harvesting</b>					
Gross economic value	398,640	54,845	1,184	6,700	461,369
Net economic value	327,740	27,370	-1,456	1,302	354,956
<b>Beer brewing</b>					
Gross economic value	1,204,685	120,763	4,510	0	1,329,958
Net economic value	908,760	114,256	4,098	0	1,027,114
Total morula harvest (kg)	20,763	2,413	463	102	23,739
For own use (in kg)	20,594	2,363	463	89	23,508
Sold (kg)	169	50	0	13	231
Estimated morula embedded in beer	1,715	194	81		
Recorded beer sold (lt)	15,148	1,353	200	0	16,701
Average beer sold/brewer	842	135	100		557
Average kg/harvester	906.0	201.0	154.2	6.5	
% own use of harvest	99.2%	97.9%	100.0%	87.7%	99.0%
% of morula harvesters/ total hh	21.4%	11.7%	4.0%	12.1%	12.9%
% of morula beer brewing households	17.5%	9.0%	2.7%	0.0%	7.7%
Estimated amount harvested in village (kg)	398,640	42,219	2,467	2,094	445,419
Estimated amount of morula beer (lt)	286,970	21,783	1,100	0	309,854
Net/gross value (collection)	82.2%	49.9%	-123.0%	19.4%	76.9%
Net/gross value (brewing)	75.4%	94.6%	90.9%		77.2%
Net value collection & brewing	1,236,500	141,626	2,642	1,302	1,382,069

Key indicators for wood products

WOOD PRODUCTS	Gweta	Lerala	Palla Road	Tsetseng	Chobokwan	Kumakwane	Total
Survey households	103	111	75	73	83	99	544
Wood harvesting hh in survey	9	4	3	11	5	2	34
HH in 2017	2,060	1,970	408	129	396	2,650	7,613
Est. wood harvesting hh in village	180	71	16	19	24	54	364
Gross economic value	465,314	239,595	50,592	41,506	7,328	19,273	823,608
Net economic value	377,414	224,828	45,375	33,408	2,855	7,997	691,878
Average kg/harvester	1,944	938	3,875	934	134	168	-
% own use of harvest	100%	100%	42%	16%	100%	100%	60%
% of wood harvesters/ total hh	9%	4%	4%	15%	6%	2%	6%
Estimated village harvest	349,860	66,554	63,240	18,159	3,206	8,994	510,013
Net/gross value ratio	81%	94%	90%	80%	39%	41%	84%

Key indicators for palm leaves

PALM LEAVES AND BASKETS	Gweta
Survey households	103
Palm leaves harvesting & basket weaving hh in survey	6
HH in 2017	2,060
Estimated harvesting& basket weaving hh in village	120
Gross economic value	341,100
Net economic value	48,543
Average bundles /harvester	147
% own use of harvest	100%
% of harvesters/ total hh	6%
Average baskets sold /weaver	17
Estimated village harvest	17,600
Estimated baskets sold	2,020.00
Net/gross value ratio	14%

Key indicators for mmilo

<b>MMILO</b>	<b>Palla Road</b>	<b>Kumakwane</b>	<b>Total</b>
Survey households	75	99	174
Mmilo harvesting hh in survey	3	14	17
HH in 2017	408	2650	3058
Estimated mmilo harvesting hh in village	16	375	391
Gross economic value	7,616	165,853	173,469
Net economic value	6,759	161,787	168,546
Average kg/harvester	29	28	-
% own use of harvest	29%	55%	50%
% of mmilo harvesters/ total hh	4%	14%	10%
Estimated village harvest	476	10,366	10,842
Net/gross value ratio	89%	98%	97%

Key indicators for morama

<b>MORAMA</b>	<b>Tsetseng</b>	<b>Chobokwane</b>	<b>Total</b>
Survey households	73	83	156
Morama harvesting hh in survey	1	24	25
HH in 2017	129	396	525
Est. morama harvesting hh in village	2	115	117
			-
Gross economic value	177	162,121	162,298
Net economic value	66	118,955	119,021
Average kg/harvester	12.5	172.8	-
% own use of harvest	100%	36%	37%
% of morama harvesters/ total hh	1%	29%	16%
Estimated amount harvested in villages	22	19,788	19,810
Net/gross ratio	38%	73%	73%

#### A.4: Economic values of the listed veld products by village

Gross economic value (2016/17; in Pula)

Gross economic value	Gweta	Lerala	Palla Road	Tsetseng	Chobokwane	Kumakwane	Total
Firewood	3,600,226	<b>6,906,812</b>	2,188,953	502,393	760,222	2,127,961	<b>16,086,567</b>
Thatching grass class A	<b>8,929,526</b>	2,091,868	1,217,227	0	0	0	<b>12,238,621</b>
Thatching grass class B	<b>1,456,000</b>	1,269,851	4,352	5,460	3,149	111,621	<b>2,850,434</b>
Morula	<b>398,640</b>	54,845	1,184	0	0	6,700	<b>461,369</b>
Morula beer	<b>1,204,685</b>	120,763	4,510	0	0	0	<b>1,329,958</b>
Phane	22,800	<b>12,372,825</b>	233,820	0	0	0	<b>12,629,445</b>
Wood products	<b>465,314</b>	239,595	50,592	41,506	7,328	19,273	<b>823,608</b>
Morama	0	0	0	177	162,121	0	<b>162,298</b>
Mmilo	0	0	7,616	0	0	<b>165,853</b>	<b>173,469</b>
Palm	341,100	0	0	0	0	0	<b>341,100</b>
Grapple	0	0	0	59,353	<b>69,287</b>	0	<b>128,640</b>
<b>Total village</b>	<b>16,418,290</b>	<b>23,056,559</b>	<b>3,708,254</b>	<b>608,889</b>	<b>1,002,108</b>	<b>2,431,407</b>	<b>47,225,507</b>

Net economic value (2016/17; in Pula)

Net economic value	Gweta	Lerala	Palla Road	Tsetseng	Chobokwane	Kumakwane	Total
Firewood	2,997,463	5,896,533	2,083,253	456,492	580,220	577,396	12,591,357
Thatching grass class A	<b>7,805,673</b>	1,960,002	931,396	0	0	0	<b>10,697,071</b>
Thatching grass class B	<b>1,077,767</b>	1,149,921	-109	2,845	1,978	99,536	<b>2,331,937</b>
Morula	<b>327,740</b>	27,370	-1,456	0	0	1,302	<b>354,956</b>
Morula beer	<b>908,760</b>	114,256	4,098	0	0	0	<b>1,027,114</b>
Phane	18,810	<b>11,509,242</b>	219,929	0	0	0	<b>11,747,981</b>
Wood products	<b>377,414</b>	224,828	45,375	33,408	2,855	7,997	<b>691,878</b>
Morama	0	0	0	66	<b>118,955</b>	0	<b>119,021</b>
Mmilo	0	0	6,759	0	0	<b>161,787</b>	<b>168,546</b>
Palm	48,543	0	0	0	0	0	<b>48,543</b>
Grapple	0	0	0	13,911	<b>23,412</b>	0	<b>37,323</b>
<b>Total village</b>	<b>13,562,169</b>	<b>20,882,153</b>	<b>3,289,245</b>	<b>506,723</b>	<b>727,420</b>	<b>848,017</b>	<b>39,815,727</b>

### A.5: FRR substitutes

The analysis used substitute prices for a few resources. For firewood, LPG gas is mostly used in all the villages for cooking, and in selected households, electricity is an option especially in Kumakwane (22 households), Lerala (10 households), Palla Road (8 households). Households use gas cylinders of varying sizes – 9, 14, 19 and 48 kg. The most commonly used cylinder size across all villages is 19kg and can last up-to three months. Prices for gas refill vary from village to village and ranges between P180 for a 9 kg cylinder to P1 080 for a 48 kg cylinder. In some cases, especially in the impoverished households, there are no options for use of alternatives. In Tsetseng none of the households have an option to use electric stoves as the village is not yet connected to the national power grid. Lack of electricity has been cited as one of the major challengers for the village. Interestingly, two households in Kumakwane reported to use cow dung and two in Gweta use paraffin for cooking and heating water as alternatives for firewood. In terms of thatching grass, corrugated iron sheets are used as alternatives for roofing. Gum poles are used to substitute wood for fencing and building housing structures. However, in Lerala, Palla Road and Chobokwane none of the households mentioned alternatives for wood. Phane is used as relish or snack in many cases. As such, if not available, it is substituted with traditional bean relish, leafy vegetables such as cabbage, rape and spinach as well meat. Although grapple is well known for its medicinal importance, none of the households in Tsetseng and Chobokwane mentioned the use of other traditional or modern medicines as alternatives to grapple. Morula and mmilo alternatives are only mentioned in Kumakwane where *Grewia flava*, red milkwood and Kalahari sand raisin are harvested. These are consumed as snacks and in some cases sold by the collecting households at P5-10 per cup on average.

FRR	Gweta	Lerala	Palla Road	Tsetseng	Chobokwane	Kumakwane
Phane	Cabbage, traditional leafy vegetables, meat	Cabbage, traditional leafy vegetables, rape/spinach, meat	Cabbage, traditional vegetables			
Morula	None	None	None			<i>Grewia flava</i> and Kalahari sand raisin
Mmilo			None			Red milkwood
Grapple				None	None	
Morama				None	None	
Palm leaves	None					
Firewood	Gas, electric and paraffin stoves	Gas and electric stoves	Gas and electric stoves	Gas	Gas and electric stoves	Gas and electric stoves, dry cow dung
Grass	Corrugated iron sheets	Corrugated iron sheets	Corrugated iron sheets	Corrugated iron sheets	Corrugated iron sheets	Corrugated iron sheets
Wood products	Gum poles	None	None	Gum poles	None	Gum poles

#### A.6: Spatial distribution of FRR collection by village

##### Gweta

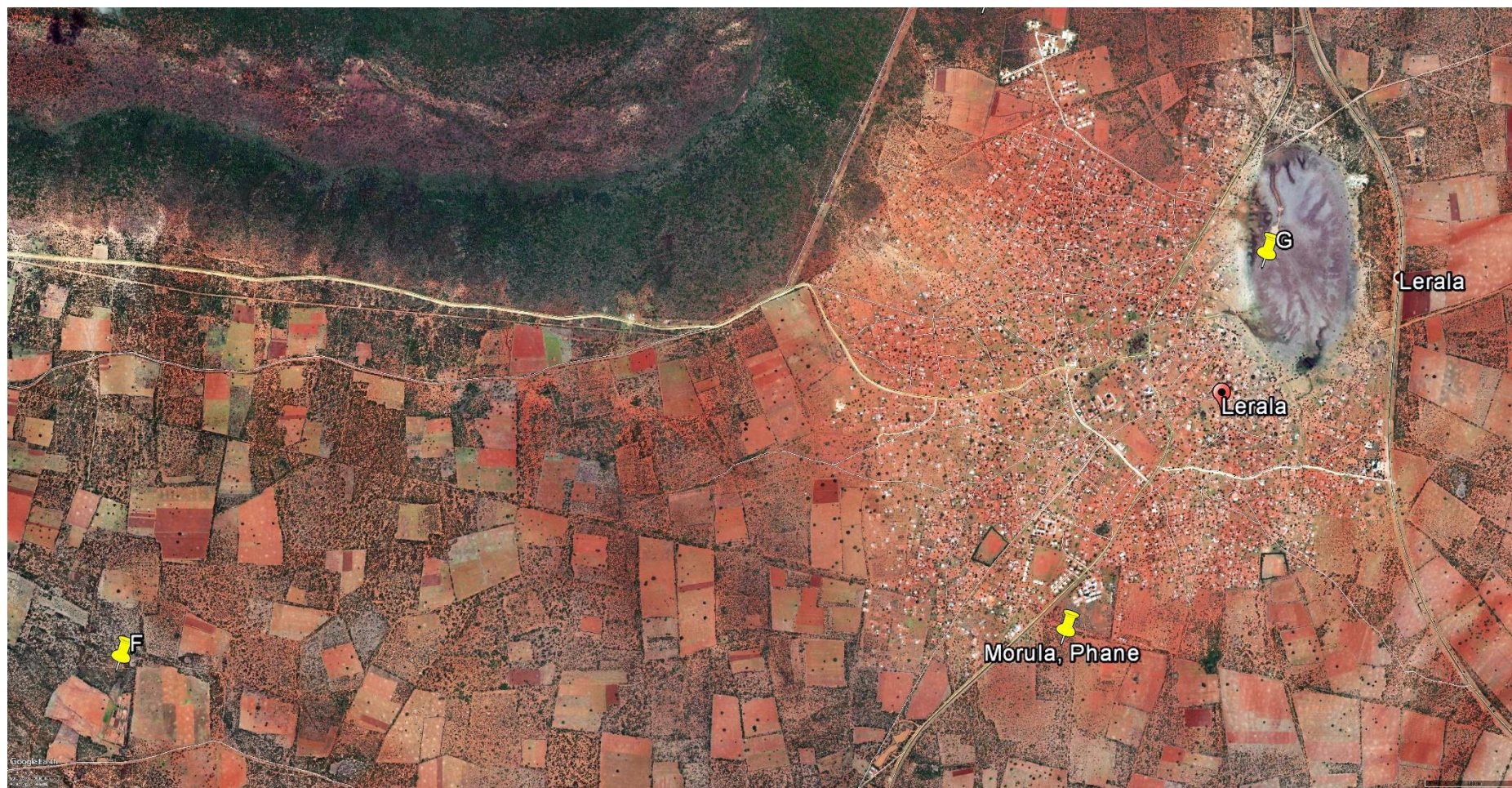
In Gweta, the special resource -Morula- is collected in limited quantities within or close to the village area, sometimes within people's yard. Firewood is also mostly collected close to the village. Wood (poles) and thatching grass are occasionally collected close to the village but more often at more distant locations to the south-east, 20 to 30 km and reportedly even 100 km away from the village.





### Lerala

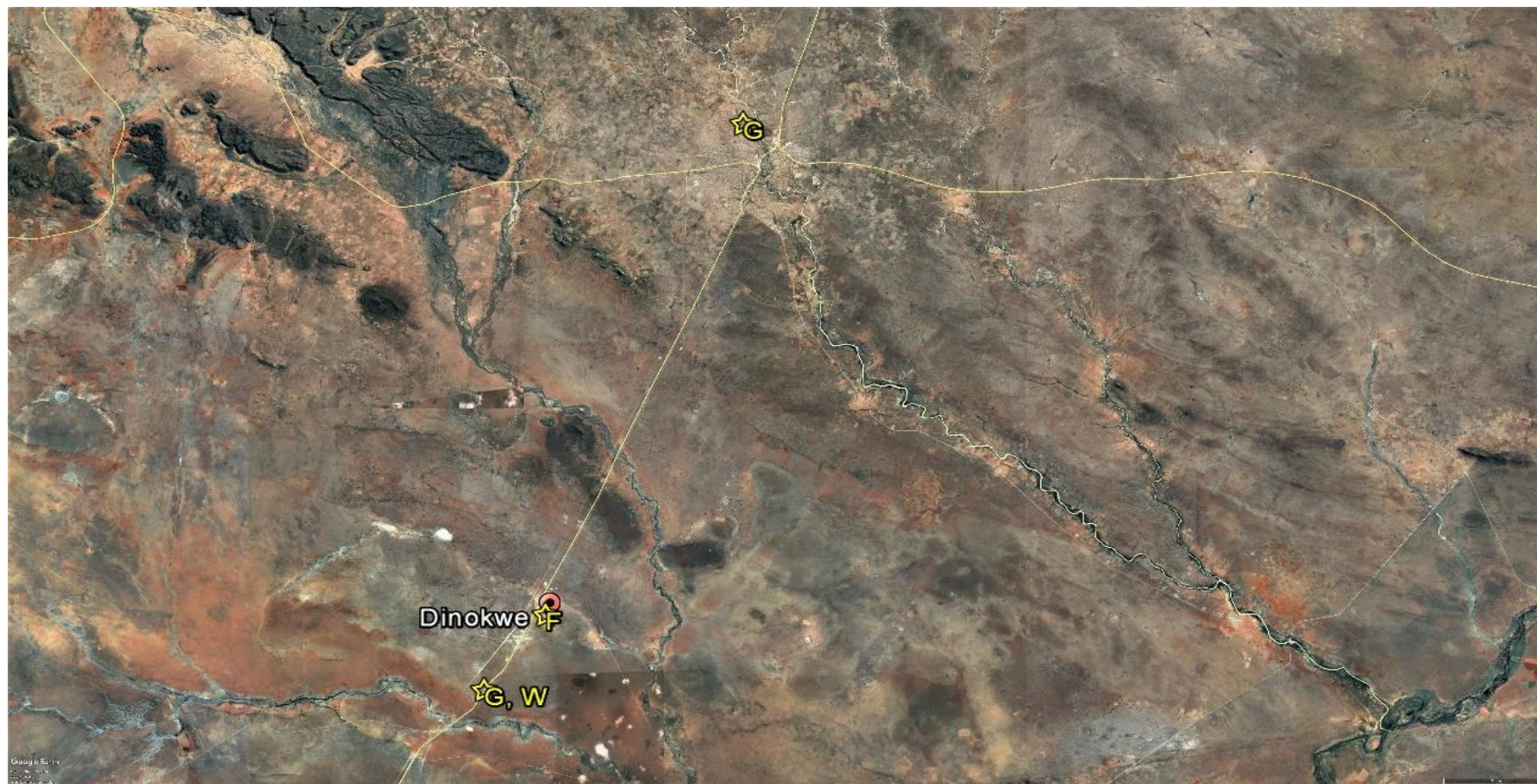
Morula and phane are collected close to the village while firewood is collected north and west of the village. Thatching grass is collected north-east of the village but also between Palla Road and Dibete, particularly the good quality grass species.





### Palla Road

In Palla Road, firewood is collected mostly within 1 – 3 km from the village. However, for large quantities of firewood or wood products such as poles, people travel up to 50 km. Thatching grass is collected mostly at locations close to the main road, but up to 40 km away from the village.





Tsetseng

Tsetseng's special resource -grapple- is collected north, south and west of the village. Firewood is gathered close to the village, but also further away to the south and east, up to 6 km from the village. Thatching grass is mostly collected at Nxhobe, 6km south of the village.





### Chobokwane

Chobokwane's special resources -grapple and morama- are mostly collected at specific locations away from the village. Morama up to 16 km away on a farm; grapple up to 11 km from the village. Grapple is also collected closer to the village. Firewood is mostly gathered close to the village, while thatching grass is collected close to the village or at a short distance, but occasionally at a remote location near distant fields, over 40 km from the village (NB. this location not shown in map).





Kumakwane

Kumakwane's special resource -Morula- is collected in limited quantities within the village area. Firewood and wood are gathered at various locations at 2-5 km from the village. The same is true for thatching grass

