The Commercial Potential Scale of the Natural Products Sector in Namibia

Assessment done by the Natural Futures Programme

November 2007

Table of Contents

1.0 INTRODUCTION

1.1. Background

The interest in Natural Products (NPs) development has been on the increase in recent years in both conservation and development circles. Natural Products are defined as 'those products derived from naturally occurring biological resources, harvested from the wild by rural producers'. These products can be supplied to the nutraceutical, phyto-medicinal, botanical flavour and fragrance, herbal remedy, dietary supplement, cosmeceutical and personal care industries.

The interest in NPs development has its origins in a number of propositions: that natural products, much more than timber, contribute in important ways to the livelihoods and welfare of rural populations, through providing them with food, medicines and as a source of income; that exploitation of natural products is less ecologically destructive than timber harvesting and therefore provides a more sound basis for sustainable forest use and management; and that the increased commercial harvest of natural products would add to the perceived value of forests by the users thereby increasing the incentive to retain the forest resource, rather than conversion of the land for use for agricultural purposes (Arnold and Pérez, 1998).

In the Southern African context, the growing interest in the use and commercialisation of natural products is also an important alternative to dryland agriculture that in most cases has low yields to sustain rural livelihoods due poor and erratic rainfall and in some regions poor soils for reliable agricultural production. Inadequate agricultural inputs are also a constraint in agricultural production, thus the high dependence on natural products by rural households for subsistence and in recent years for income generation.

PhytoTrade Africa's approach towards improving rural livelihoods through increased commercialisation of natural products in the region has been timely. Given this background it is important to understand the level and extent of resource availability of the target species for commercial purposes in the context of the development of the natural products sector in Southern Africa. An attempt to understand the level of resource availability has been done through this study, based on literature review.

This desk study was commissioned by IUCN in collaboration with PhytoTrade Africa under the Natural Futures programme. PhytoTrade Africa is the Southern Africa Natural Products Trade Association that was established in 2001 with the aim of facilitating growth in the Natural Products industry in Southern Africa. PhytoTrade Africa's product development in eight Southern African countries focuses on a limited number of species that include Marula (*Sclerocarya birrea*), Manketti/Mongongo (*Schinziophyton rautanenii*), Baobab (*Adansonia digitata*), Sausage tree (*Kigelia Africana)*, Kalahari melon (*Citrullus lanatus*), Mobola (*Parinari spp*), and Natal Mahogany (*Trichilia emetica*). In Namibia, the Natural Products industry within the context of

PhytoTrade Africa membership has been focusing on four species that include Marula, Kalahari melon, Mongongo and Ximenia

The Natural Futures Programme under which this assessment was done aims to strengthen existing initiatives in the development of the natural products industry in southern Africa and address barriers in the market by making systemic interventions that assist the development of a pro-poor Southern African natural product sector. In addition, the Natural Futures Programme recognises the potential for the growth on the natural products sector and seeks to enhance environmental sustainability and the livelihoods of the poor through the development of a vibrant pro-poor natural products sector in the region. For the natural product industry to be sustainable, it is important to have relevant information on how much NPs are available if we are to project the potential scale of commercializing the NPs.

1.2 Objectives of the country study

The objectives of the study are:

- To generate information useful for assessing the commercial potential of the PhytoTrade Africa focal species for lipid oils in Namibia.
- Produce species distribution maps for the focal species in Namibia
- Provide statistics on members' primary producers, their incomes, volumes, value of NPs and exports for 2006 (information for 2007 was not available at the time of the review as it will be collected in December 2007).
- Outline the potential scale of the NP sector in Namibia.

1.3 Methodology

Data for this assessment was gathered through a desktop review. Relevant literature was identified and located in electronic and/or hardcopy form from various sources including visits to key websites and internet searches. Both primary literature and secondary literature were reviewed. It is important to understand the broader national context within which the natural products sector is being developed. Thus the desk top study also reviewed the national context.

Densities and number of stems for three of the tree species assessed (i.e. Marula, Mongongo and Ximenia) were calculated based on estimates done by Curtis and Mannheimer (2005). The formulae used information by Curtis and Mannheimer that mapped the distribution and abundance of the three target species on grid cells of 27km X 27km which translates to grind cell sizes of 729km². For this assessment, the number of stems in a given area was calculated using the grid cells that show high abundance of the tree species. Abundance levels are categorized into four categories, namely Rare, Uncommon, Common and Abundant. Below is a description of each category:

Rare: where only one specimen (stem) in the grid cell was seen, in spite of spending some time looking;

Uncommon: more than one specimen (stem) seen but not very many e.g. 3 in a grid cell.

Common: quite a few specimens (stems) scattered between other species e.g. 6 in a grid cell.

Abundant: many specimens (stems) seen e.g. up to 32 in a grid cell (Curtis and Mannheimer 2005, page 9).

It is worth noting that this data only give a rough indication of the abundance of a particular species because no one covered entire grid cells comprehensively and the interpretation of the categories was subjective.

The following formulae were used to estimate the potential production of the tree species in Namibia:

1. Number of trees = Tree density (n stems per ha) X Size of vegetated area (ha)
2. Yield = n% X Number of trees X Average fruit yield per tree (kg). [The percentage of trees that bear fruit is assumed e.g. 20% for Marula trees]
3. Amount of oil= known percentage of seed mass that is converted to oil during oil pressing
4. Potential income per year = Amount of oil per year X current market price of oil.

The calculation on the potential scale of production in this study is based on the natural products available and therefore is not only concentrating on the PhytoTrade Africa membership. The current production levels indicated in this report however are primary figures from sales generated by PhytoTrade Africa members.

2.0 THE COUNTRY PROFILE

Namibia covers an area of some 825 000 km^2. The population of the country, estimated at 1.8 million people, of whom 68 percent live in rural areas, is growing at an annual rate of three percent. Urban populations, fed by rural-to-urban migration, are growing faster than rural populations at an annual rate of five percent compared to two percent in rural areas.

The Namibian economy has a modern market sector, which produces most of the country's wealth, and a traditional subsistence sector. Namibia's gross domestic product (GDP) per capita is relatively high among developing countries but obscures one of the most unequal income distributions on the African continent. Although the majority of the population depends on subsistence agriculture and herding, Namibia has more than 200,000 skilled workers, as well as a small, well-trained professional and managerial class. Table 1 below shows statistics for the country’s GDP, annual growth rate, per capita income, inflation rate and human population.

Table 1: Namibia GDP, annual growth rate, per capita income, inflation rate and human population statistics

Indicator	Value
GDP (2004)	US$5.5 billion
Annual growth rate (2004)	4.2%.
Per capita GNI (2004)	US$2,370
Inflation rate (2004)	3.9%.
Population (2001)	1 830 330

Source: Bureau of African Affairs (2007)

The country's sophisticated formal economy is based on capital-intensive industry and farming. However, Namibia's economy is heavily dependent on the earnings generated from primary commodity exports in a few vital sectors, including minerals, livestock, and fish. Furthermore, the Namibian economy remains integrated with the economy of South Africa, as the bulk of Namibia's imports originate there. Namibia is part of the Common Monetary Area (CMA) comprising Lesotho, Swaziland, and South Africa. Both the South African rand and the Namibian dollar are legal tender in Namibia, but the Namibian dollar is not accepted in South Africa. As a result of the CMA agreement, the scope for independent monetary policy in Namibia is limited.

Given its small domestic market but favorable location and a superb transport and communications base, Namibia is a leading advocate of regional economic integration. In addition to its membership in the Southern African Development Community (SADC), Namibia presently belongs to the Southern African Customs Union (SACU) with South Africa, Botswana, Lesotho, and Swaziland. Within SACU, no tariffs exist on goods produced in and moving among the member states. SACU is currently negotiating a Free Trade Agreement with the United States--the first of its kind in Sub-Saharan Africa. The SACU Secretariat is located in Windhoek. The integration of Namibia in these regional economic blocs creates conducive environment for the trade in natural products in southern Africa

In northern Namibia, where both human and tree populations are highest, the Ministry of Environment and Tourism carried out a major forest cover mapping exercise in 1996 on some 28 430 000 ha. The study found that 6.4 percent of the area was under extensive, subsistence cropping on woodlands and savannah; 0.3 percent was intensively cropped; 54.3 percent was open grassland and 26 percent was woodland. The remaining, treeless, 13 percent was comprised of open water, grasslands and valley bottoms (MET, 1996 cited in Kojwang H.O. and Chakanga M. 2002)

For forest inventory and management purposes, Namibia defines as forest any woody formation with at least 15 percent tree cover and mean tree height of at least 4 m. The latter figure is justified by the considerable woody biomass potential of Namibia's substantial acacia and mopane woodlands for a potentially lucrative charcoal-making industry. Trees outside forests are growing in heavily cultivated agricultural fields, villages and settlements, and

in scattered formations in savannah and arid zones and hence some of the NPs are domesticated. These systems include trees left standing on woodland converted to farmland, on-farm woodlots, living fences, ornamental hedges, natural regeneration on farmland, scattered trees in the savannah, and isolated formations in the desert. The most intensive of these systems are found on heavily cultivated farmland, where trees play a major economic role (Kojwang and Chakanga, 2002). Similar observations are made for Marula tree species by Botelle et al (2002).

2.1. Institutional and Management aspects

The main national legislation for use and management of trees outside state forests is found in the 1968 Forest Act and the 1998 New Draft Forest Bill, as well as the 1997 Nature Conservation Ordinance Amendment Act. These laws protect trees, wild flora and fauna, and their habitat. The forest rules forbid the destruction of trees and other woody vegetation, except as authorized or in the case of specific land use plans. The proposed draft forest law stipulates that no one can plant more than 5 ha of woodlots on farmland unless the new trees are fruit trees (Kojwang and Chakanga, 2002). Customary law also includes sanctions against the cutting of fruit trees.

The new forest legislation and policies acknowledge the collective ownership of forests and woodlands. This encourages good management by local communities, who are perfectly aware that usufruct is contingent upon how well they manage their tree resources. A further incentive is that rural people are heavily dependant for their livelihood on a natural resource base increasingly degraded by deforestation, overgrazing, and the lack of rain.

The potential of trees to protect ecosystems, alleviate poverty, enhance food security, and generate and diversify income has mobilized a number of institutions around a common vision of the economic benefits of specific tree species. These include: the Ministry of Environment and Tourism, whose mandate comprises forests, nature conservation and the environment; the Ministry of Agriculture, Water and Rural Development; and the ministries responsible for the advancement of women and decentralization. Two PhytoTrade Africa members namely CRIAA-SADC and Indigenous Plant Task Team (IPTT) contributes towards management and conservation of NPS in Namibia. Even agricultural policy with its traditional focus on crops and livestock now has chapters on indigenous fruits and other wood and non-wood products.

At the local level, farmers follow customary rules and standards for the use of trees on communal land, and have direct control over the trees on their own farms. Rural people are very conscious of the myriad uses of the various tree species. When new fields are prepared, trees that supply fruit, nuts, medicinal products, and trees that enhance soil fertility are not felled. Farmers leave most young or mature fruit trees such as Marula, and Mongongo standing in the fields, tend the trees and protect their seeds, watering, thinning or singling and cutting as needed at the different stages of growth.

The area in Namibia common with most commercially important natural products is the North-central Namibia. This desk study is therefore mainly centred on this part of the country, with specific review around four species for lipid oils that include Marula, Mongongo, Kalahari Melon Seed (KMS) and Ximenia. The north-central region consists of four political regions, popularly called the 'Four O's', but formally the Oshikoto, Ohangwena, Omusati and Oshana Regions. Below is a description of the 'Four O's' region.

2.2 Summary of description of the North-central region

Climate: The semi-arid climate, typical of the North-central region is characterized by rain that varies greatly in amount and timing. Almost all of the rain falls during the summer months (roughly November to April). Good agricultural yields may be had in some years, but crops often fail as a result of inadequate or badly timed rainfalls. Thus natural products are key to livelihoods in these areas. The high degree of variation in rainfall means farming is a risky business.

Water: the huge Cuvelai delta, draining part of southern Angola, brings both water and fish into the region when it flows. The availability of water had, and continues to have, a major impact on where people live, and it was access to water in the Cuvelai that allowed people to settle there permanently. More recently, an extensive network of pipelines supplying water from the Kunene River provides a large proportion of the population with water, while other people obtain it from deep boreholes. About 15% of the population lives beyond the reach of existing and planned network of pipelines and boreholes.

Vegetation and soils: The nine major types of soils are dominated by sands and clays. Their potential for crop cultivation is low in most areas for several reasons: poor water holding capacity, low nutrient content, high salt content and hard layers of clay below the surface. Thirty-five different vegetation types are recognized and described.

People, their health and education: Almost half of the people in Namibia (780 149 people) live in the region, largely in rural households. Most of the population is packed into the Cuvelai, and in small, old pan systems in the north-east. Relatively high growth rates of just less than 3 % in recent decades have produced a population dominated by young people. But the structure of the population is also skewed by high rural to urban migration rates, particularly of working age people to towns elsewhere in Namibia.

Land and governance: About 70 % of the region is used for agriculture (30% for small scale farming, 20% for communal grazing, 9% for large farms in the Tsumeb area, 11% by the Mangetti farmers and people that have fenced off large 'informal' farms in Owambo, and about 30% for conservation(largely the government controlled Etosha). Common property resources, such as grazing pastures are diminishing as a result of increasing competition and because they are being enclosed in fenced farms.

Farming: Mahangu (pearl millet and sorghum are the most important crops, while livestock numbers are dominated by cattle, goats, donkeys and poultry. Labour is the most important input to crop cultivation, especially in having adequate labour during critical periods when fields must be ploughed. Rainfall and soil fertility have a major effect on crop yields but crop and livestock production is also heavily dependent on the wealth and size of households; larger, richer families are able to contribute more labour and pay for seed, ploughs and other inputs. Farming contributes very little to the cash incomes of the majority of households.

Household economies
Diversity and vigour are the main features of the region's economy, now to be seen in the many and increasing numbers of business, entrepreneurs and trading activities. Most households now engage in a variety of economic activities, with incomes from subsistence, employment and diverse business activities contributing to most homes. Large households also have a greater diversity and incomes, more labour, more livestock, bigger fields and more access to cash than poor homes.

Environmental conditions have largely fashioned the uses of land, farming practices and social and economic circumstances that are seen today. Those conditions have also promoted a need to diversify and increase sources of income which along with a large population of people and the shortage of land on which to farm, have resulted in severe demands on natural resources.

3.0 SPECIES ASSESSMENTS

As outlined in the introduction, the focus of this review is on four PhytoTrade Africa focal species for lipid oils. These are, Marula, Mongongo, KMS and Ximenia. This section describes in detail each of the species, their distribution, relative abundance, where relevant, the population structure, regeneration capacity and the potential scale for commercialising these species.

3.1 MARULA (*Sclerocarya birrea*)

3.1.1. Botanical description

Marula (*Sclerocarya birrea*) (A.Rich.) Hochst. Subsp.cafra (Sond.) Kokwaro in the Anacardiaceae (mango) family is a medium-sized tree, 7-17m in height, with a rounded, spreading crown, which stands leafless for several months (winter) of the year. It occurs in medium to low altitude open woodland and bush. The bark is rough, flaking in patchy sections, which gives a mottled appearance. The leaves are imparipinnate, spirally arranged, and crowded near the ends of the branches, with 3-7 pairs of opposite to sub-opposite leaflets (Palgrave, 2002).

The species is primarily dioecious, with male and female flowers on different trees (Mojeremane et al., 2004). The female flower is normally single or in small groups on stalks up to 3 cm long, with an almost spherical ovary. Flowering normally starts in September and ends in November, prior to producing the fleshy, up to 3 cm diameter fruits. Insects are generally responsible for pollinating the flowers. The tree grows easily from seed sown in washed river sand in spring (Palgrave, 2002). Little is known about the silvicultural characteristics of *Sclerocarya birrea*; however, it regenerates naturally from seed, coppice, truncheons and gregarious root suckering. If the fruit operculum has been opened, germination is fast and uniform, reaching 70% after one week and 85% after two weeks from sowing (Mojeremane et al., 2004). Marula trees are frequently a community dominant and hence a keystone species in terms of community productivity.

The Marula tree has many uses. For instance, Marula fruit is an excellent source of vitamins. The Marula fruit has traditionally been used as a food supplement by the San and the Ovambo peoples. The kernel is crushed to extract a stable oil rich in unsaturated fatty acids. Marula oil is currently being promoted in the UK for pharmaceutical and cosmetic purposes. Marula juice is exported to South Africa to produce an alcoholic beverage (Ministry of Environment and Tourism, 1996).

3.1.2 Distribution of Marula

The distribution of marula in Namibia is shown in Figure 1.

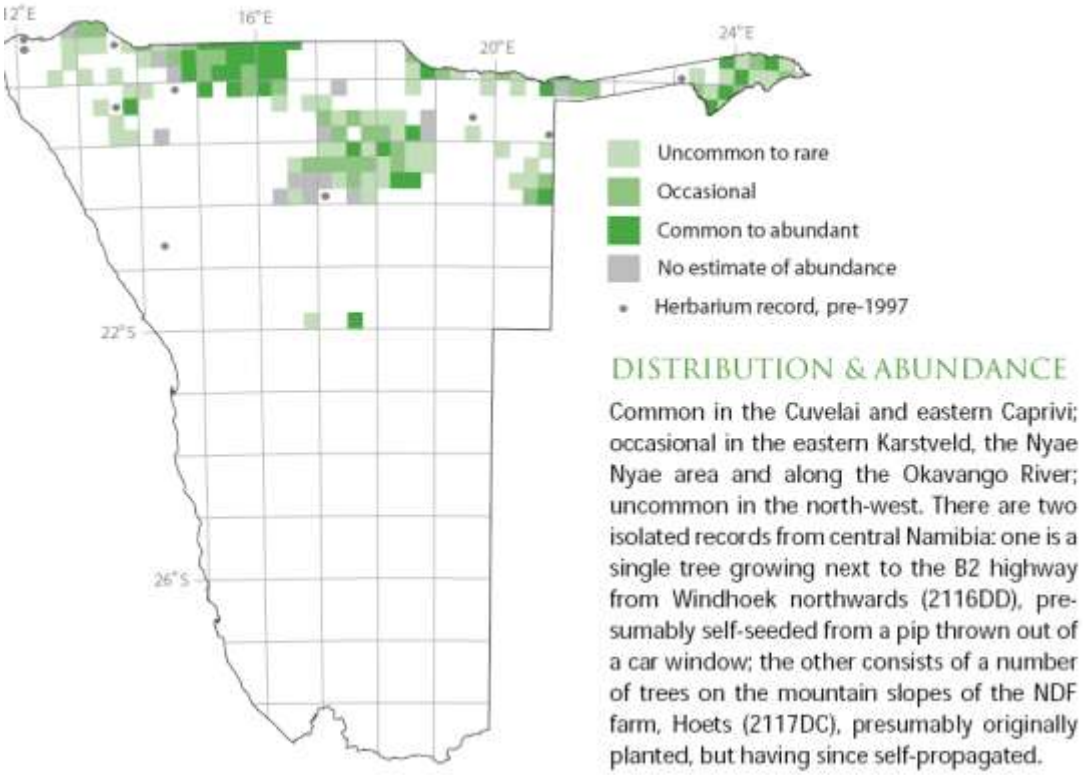

Figure 1: Distribution of Marula in Namibia (Source: http://www.biodiversity.org.na/treeatlas/SpPDFs/Sp516.pdf)

Marula has survived the expansion of the agricultural frontier because of its importance to people's livelihoods (Kojwang and Chakanga, 2002). A study done by du Plessis (2002) suggests that there is a clear correlation between Marula distribution and certain landforms, the main factor being soil depth. Marula does not grow in the very shallow saline soils and is not common on the deeper Kalahari-type sandy soils. Du Plessis (2002) also asserts that the relationship between human settlement and Marula distribution appears to be symbiotic in that people see Marula (in addition to its many other uses) as an indicator of soils suitable for crop production. The traditional practice of occasionally moving the homestead to a new location on the farm has been a key element in establishing 'groves' of Marula and other indigenous fruit trees, but this recruitment system is in decline because more people are now building permanent structures and not moving their homesteads.

3.1.3 Relative abundance

It is estimated that there are more than a million Marula trees in North-Central Namibia, more than 95% of which occur within people's fields. And eight out of every ten of these trees are female, revealing a strong preference for fruit producing trees within fields (Botelle *et al*, 2002). A stage-based population matrix model was used to estimate the sustainable yield for S. birrea fruit in the Bushbuckridge region of South Africa (Emanuel *et al*, 2005). The results of this modeling exercise show that

- Marula trees begin to bear fruit at an average size of 42.8 cm in circumference and this relates to an approximate age of 19 years.
- Using the model, it is estimated that 92% of fruit could be removed without impacting the current population profile.
- The management of other more destructive forms of S. birrea resource use (such as bark or firewood harvesting), however, do need to be monitored to limit negative impacts on the population that may reduce fruit availability for regeneration or cropping

If similar assumptions are made for the Marula trees in Namibia, high percentages of Marula fruits can be harvested without impacting on the population profile of the tree species. Statistics on the abundance of Marula trees in north-central Namibia are presented in the section 3.6, which discusses the potential scale for commercializing natural products in Namibia. The calculation on the potential scale of production in this study is based on the natural products available and therefore is not only concentrating on the PhytoTrade Africa membership. The current production levels indicated in this report however are primarily figures from sales generated by PhytoTrade Africa members.

3.2 MONGONGO (*Schinziophyton rautanenii*)

3.2.1 Botanical description

Mongongo is a member of the *Euphorbiaceae.* It is a deciduous tree, up to 25m tall with a rounded or spreading crown. The trunk is up to one metre in diameter. The bark is pale grey to light golden-brown, smooth first, later becoming reticulate and flaky. Young branchlets, leaf buds and stalks have reddish brown furry hairs. The leaves are compound with 5-7 large stalked leaflets. The flowers are yellowish, about 1 cm in diameter and gathered in loose sprays or panicled cymes, up to 12cm long. The species is dioecious, i.e. Male and female flowers are on separate trees. The fruit is eaten fresh, dried or cooked and is a staple food for the San Bushmen. The trees flower from October to November, just before the summer rain, and set fruit between February and May. Fruits are egg-shaped, velvety and contain a thin layer of edible flesh (very dry texture) around a thick, hard pitted nutshell that encloses the edible, oil-bearing kernel. Fruits will store for months without deterioration of the contents. (http://ww.sanprota.com/products/manketti.htm). The trees produce large quantities of fruits, especially after a good rain season.

3.2.2 Distribution of Mongongo

Mongongo is native to Botswana, Malawi, Namibia, Zambia and Zimbabwe, principally in a belt from East to West coast between latitudes 15 and 21 degrees South (http://www.naturalhub.com & http://polytechnic.edu.na). Its best known habitat is raised sandy plains of deep *Kalahari sands* at an elevation around 1,200 m above sea level.

The distribution of Mongongo is shown in Figure 2.

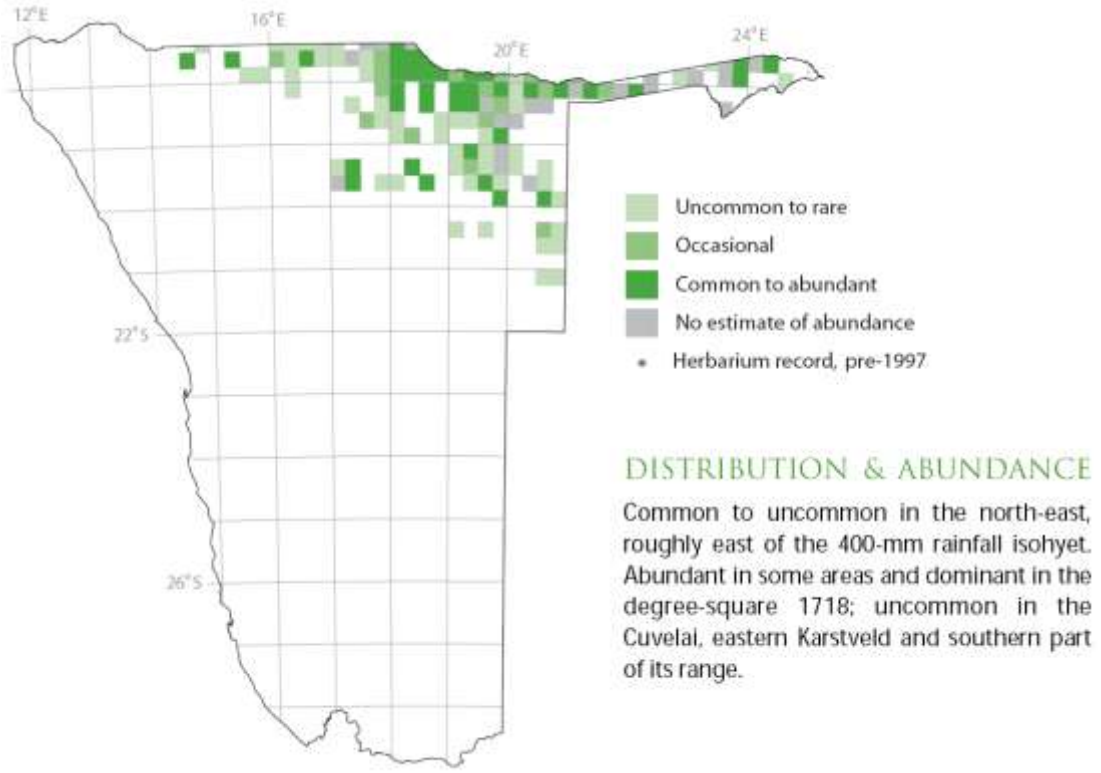

Figure 2: Distribution of Mongongo (*Schinziophyton rautanenii*) in Namibia (Source: http://www.biodiversity.org.na/treeatlas/SpPDFs/Sp513.pdf)

3.2.3 Relative abundance

Mongongo is described as being common to uncommon in north-eastern Namibia (Curtis and Mannheim, 2005 page 334). The definition of abundance levels is provided in the methodology section. Mongongo is abundant in some areas of northern Namibia. Statistics on the relative abundance of Mongongo are presented under section 3.6.

3.3. KALAHARI MELON (*Citrullus lanatus)*

3.3.1 Botanical description

There are four types of melons that are traditionally cultivated in Namibia. These are:

i) Sweet watermelons whose seeds are not eaten or used for oil production. The seeds are often kept for planting the next season.
ii) Big whitish melons that produce softer white seeds that are often roasted and eaten.
iii) Cooking melons whose seeds are not removed before cooking and are eaten with the melons. These seeds are not used for oil production.
iv) Oilseed melons – these are sometimes referred to as Tsammas – are composed of a smaller fruit size than the other types with many colour patterns, are edible but often not eaten as it is frequently

bitter. Traditionally the Tsamma melon was only used to extract seeds for oil production, as animal fodder and in some places as an emergency source of water (du Plessis, 2002). The Tsamma melon is the one currently used by PhytoTrade Africa members for oil production.

A creeping annual herb, the Tsamma melon has hairy stems, forked tendrils and three-lobed hairy leaves. Its flowers are bright yellow. The Fruits vary significantly, from small and round in the wild, to larger and more oblong-shaped under cultivation. The surface is smooth, pale green with irregular bands of mottled darker green radiating from the stalk. The flesh is a pale green or yellow, and contains numerous brown seeds. Although found all over the sub-region, the Tsamma melon is most closely associated with the Kalahari sands of Namibia, Botswana, south-western Zambia and western Zimbabwe. Traditionally a crucial water-source in the Kalahari, the Tsamma melon has always been a popular food. In addition to the flesh, which is pounded into a pulp and then eaten and drunk, the seeds are considered a delicacy. Roasted, sieved and winnowed, they are ground on a flat stone into a coarse, whitish meal, which is a nutritious and pleasantly nutty-tasting food. The seed-meal also has a long history of use as a cosmetic. After grinding, it is chewed and moistened with saliva, and then smeared over the body and rubbed in thoroughly. This is said to impart a healthy reddish colour, and blemish-free complexion, to the skin.

The use of melon seed as a source of oil can be traced to the San people but has also been incorporated into the traditional practices of other groups in the southern African region (du Plessis, 2002). Traditionally, melon seed oil was produced through boiling the crushed seeds in water and skimming off the oil that floats to the top. This has been a common practice among the Oshiwambo speaking people of northern Namibia.

The oil yield of a melon crop is determined by the combination of oil content per seed, mass of seeds per melon and melons produced per unit area cultivated (du Plessis, 2002). Melon strains analysed in Namibia showed that the one that had the highest oil content is the Tswana landrace from the Omaheke region that contained 32.1% oil compared to an average of 23.12% for all other melons strains. Identification of the strains that have the highest oil content per seed will be key if cultivation of oilseed melons is to be highly productive to meet market demands for the Kalahari melon seed oil.

3.3.2 Distribution of Kalahari Melon

The distribution of Kalahari melon is shown in Figure 3.

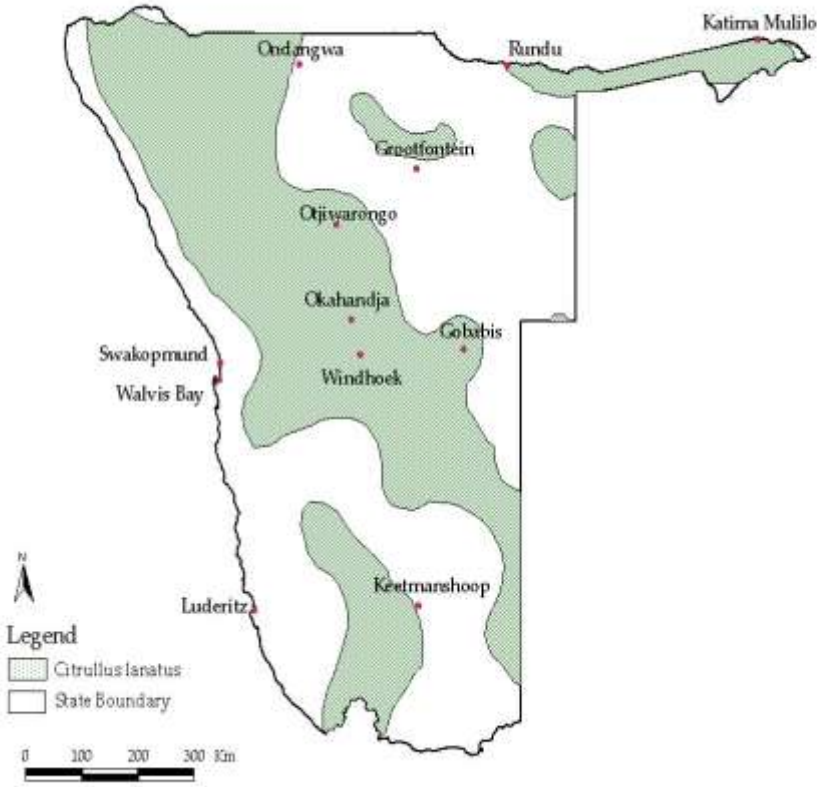

Figure 3: Distribution of Kalahari melon in Namibia (Source: PhytoTrade Africa database)

While Kalahari melons are often cultivated, they also wild in some parts of Namibia. For instance, in Omaheke and Otjozondjupa, wild melons are a crucial source of water for wildlife during the dry season. In general, there appears to be a correlation between soil type and melon seed production, with melon seed extraction much more common in the sandy areas outside the Cuvelai floodplain. This may be due to the fact that melons are susceptible to water logging and therefore grow better in these soils than in the shallower, more clayey soils of the Cuvelai, but it might also be ascribed to the fact that these areas have fewer alternative sources of edible oil because they have fewer Marula trees.

3.3.3. Relative abundance

The study done by du Plessis (2002) suggests that melon seeds can be easily produced in commercially significant quantities in Namibia and thus key to natural products development interventions aimed at increasing rural incomes through the commercialization of indigenous plants. This is because melons appear to grow almost anywhere in Namibia.

Current and potential productivity of melons as a crop and especially as a seed crop, under various climatic conditions is not known. There are bad

years when even the hardiest melon strains will not produce normally e.g. in 2002 (du Plessis, 2002). Thus keeping the Namibian market share in such years might require some building up of strategic stockpile of seeds for oil.

Because melons are an annual crop, production can be scaled rapidly as and when the market grows, if climatic conditions permit. If production is scaled up, appropriate measures have to be put in place to ensure that small-scale farmers have first access to this market so as to prevent a few large commercial farmers from over-supplying and depressing prices. Similarly, if KMS exports increase, there would be need to increase cultivation of oilseed melons and therefore the need to design cultivation guidelines, provide extension advice to boost production.

3.4 SOUR PLUM (*Ximenia Spp*)

3.4.1 Botanical description

Commonly named Sour plum and it is spiny, deciduous shrubs or small trees. The bark is dark brown to black, with textured scales. The dark green leaves are simple, alternate and smooth. The fragrant flowers are found in inflorescent clusters and bear ovoid, drupe fruits. The fruits (drupes) are similar in shape and size to a plum. They vary in colour from dark reddish-brown to bright orange-scarlet when ripe. The edible pulp clings to a brittle shelled stone, within which is contained an oil rich, soft cream coloured seed. The fruits are traditionally harvested ripe after they have fallen on the ground, but some farmers pick them right from the trees. Picking the fruits from the tree may influence the quality of kernels if some fruits are harvested not quite ripe.

Ximenia is said to contain important nutritional and medicinal properties. The fruit pulp, seed oil and bark have specific properties that are used domestically. The *Ximenia* fruits are nutritionally rich in Vitamin C and form an important component of the diet: eaten raw, made into jams, jellies and a refreshing syrup is drunk with water or added to porridge. *Ximenia* bark is used to treat toothache, mouth infections and stomach aches. The seed oil, extracted in various ways, is edible and used in cooking. However, it's principal use is as an emollient. *Ximenia* oil is used by bushmen on their bows and bow strings, whilst the women and girls use it to anoint their bodies and hair. It is a very effective hair oil, rich conditioner and skin softener. Chapped skin is often soothed by massaging *Ximenia* oil into the affected area.

3.4.2. Distribution of *Ximenia Spp.*

Ximenia species are widespread across Southern Africa, abundant in all PhytoTrade Africa's member countries, especially Botswana, Namibia, Zimbabwe and South Africa. The shrubs commonly grow in low altitude areas, in woodland and across grassy savannah landscape. The distribution of *Ximenia americana* and *Ximenia caffra* are shown in Figures 4 (a) and (b).

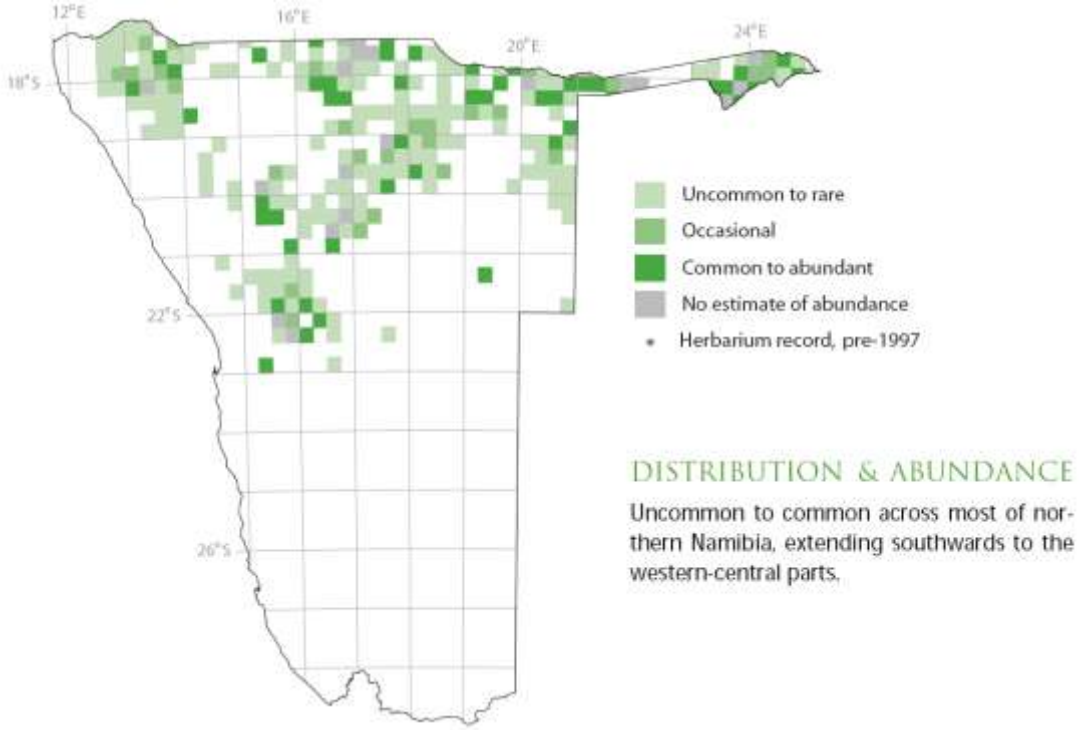

Figure 4: (a) *Ximenia americana* (Source: http://www.biodiversity.org.na/treeatlas/SpPDFs/Sp597.pdf)

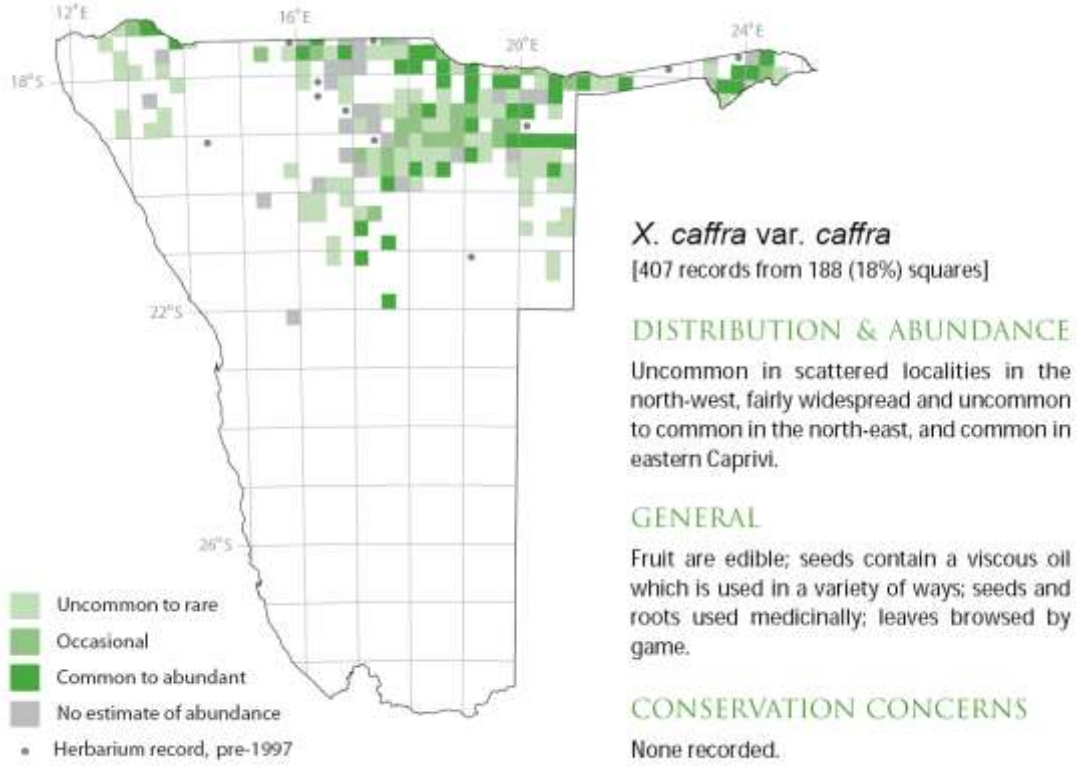

Figure 4(b) *Ximenia caffra* in Namibia (Source: http://www.biodiversity.org.na/treeatlas/SpPDFs/Sp599.pdf)

3.4.2 Relative abundance

Ximenia americana is described as being uncommon to common across most of northern Namibia, extending southwards to the western-central parts of the country (Curtis and Mannheimer, 2005). Uncommon species is defined as having more than one specimen (stem) seen but not very many e.g. three in a grid cell of 729km². Common is defined as having quite a few specimens (stems) scattered between other species e.g. six in a grid cell of the size described above. No conservation concerns were raised for *Ximenia americana* in 2005 (Curtis and Mannheimer, 2005, page 73).

In the case of *Ximenia caffra*, it is described as being uncommon and found in scattered localities in north-western Namibia and fairly widespread and uncommon to common in the north-east, and common in eastern Caprivi (Curtis and Mannheimer, 2005, p74). The definition of the abundance levels is the same as that described above under *Ximenia americana*. Statistics on the relative abundance of the *Ximenia* are presented in section 3.6.

3.4.3 Sustainability

The impacts of NPs extraction are determined by variations in site conditions over space and time. At the same time, the sustainability of the natural products requires that harvest rates do not exceed the capacity of populations to replace the individuals' extracted. Compared to other uses, fruit harvesting appears to have less impact on the persistence of the tree species than other uses that results in damage to the whole tree and hence should be promoted more than the other uses.

Natural products often have more than one possible product that can be utilized (Bennett, 2006). For instance, different parts of the tree are used for different purposes. Depending on the tree species, leaves, bark and roots can be used for medicinal purposes, while fruits are used for both consumption and oil production. Similarly, the active ingredients of commercial interest are sometimes present in several places within the plant (i.e. leaves, bark, root, and fruit), giving the potential for sustainable off-take of several different types of end product such as essential oil, juice, sap, gum, leaf meal, pulp, kernels without negatively impacting on the tree.

In general harvesting of fruits and seeds for oil production does far less damage to the tree than harvesting of other parts such as roots, bark and stems (Rønne, 2004). For example, in a stage-based population matrix model in the Bushbuckridge in South Africa it was shown that 92% of Marula fruits could be harvested without impacting the population profile (Shackleton, 2005). While this is the case, it may be argued that fruit harvesting to produce kernels has a potential impact on dispersal and establishment, but this has to be measured with regard to the quantities harvested.

In the case of the PhytoTrade Africa focal species harvested in Namibia, the seeds are primarily picked from the ground and Kalahari melons, which are harvested from the crop fields are largely a domesticated plant. Peters (1996) suggests that the intensive, annual harvesting of fruit or seeds for oil may gradually eliminate species from their habitats. Currently, there are no studies that show the impact of harvesting and processing of seed on recruitment and regeneration of the four focal species for lipid oils in Namibia. Long-term monitoring must be maintained, especially in cases where there is increased commercialisation of the baobab products.

3.5 Current statistics on the commercialization of NPs within PhytoTrade Africa membership

Current statistics on the commercialization of NPs within PhytoTrade Africa membership show significant amount of revenues generated from NPs in the region. Namibia earns the second highest income from NPs in the region (second to South Africa). This shows the key role that NPs play in people's livelihoods in Namibia. Table 1 shows the number of NPs primary producers active within PhytoTrade Africa membership, NPs income to primary producers, volumes of NPs and revenues generated by the members in the southern African countries.

Table 1: Current statistics on the commercialisation of NPs within PhytoTrade Africa membership

Country	Number of NPs primary producers engaged with members (number of persons)	NPs Income to primary producers from members (US$)	Volumes(kg) of raw natural products sourced from primary producers	Volume (kg) of value added NPs sold by members	Revenue generated by members (US$)
Zimbabwe	4,723	38,453	44,865	5,996	70,952
Botswana	6,000	13,802	9,704	9,120	41,000
Malawi	2,539	13,500	65,000	0	0
Mozambique	2,459	4,300	23,000	0	0
Zambia	2,399	4,000	4,000	560	6,135
Namibia	5,126	113,036	107,695	31,151	278,090
Swaziland	2,475	45,642	14,600	800	56,144
South Africa	3,629	151,267	220,972	13,168	393,068
Total	**29,350**	**$384,000**	**489,836kg**	**60,795 kg**	**$845,389**

(Source: PhytoTrade Africa M & E Report, 2006)

Namibia has the second highest (second to Botswana) number of natural products primary producers engaged with members in the Southern African region. The majority of rural residents who are highly dependent on natural products for their livelihoods are found in north-central Namibia. As the north-central region of Namibia is characterized by rainfall that varies greatly in amount and timing, agricultural production cannot be fully relied upon. Good agricultural yields may be had in some years, but crops often fail as a result of

inadequate and/or erratic rainfall. Thus natural products contribute significantly to the livelihoods in this region. The high degree of variation in rainfall means farming is a risky business.

At regional level, comparatively, there are relative significant amounts of lipid oils that are sold outside PhytoTrade Africa membership. Approximately 30-40% of Marula oil, 70% of trichilia oil, 50% of Kalahari Melon oil, 40% of Ximenia oil sales are outside PhytoTrade membership (Source: PhytoTrade Africa Technical Services Manager). In the case of baobab oils, the majority of the oils sold have been procured outside of PhytoTrade membership.

3.6 The potential commercial scale of the NP sector in Namibia

For all the focal species, it should be noted that there are variations in species productivity from year to year influenced by climatic changes. Resource availability and accessibility by primary producers is important to consider in assessing the potential commercial scale of the natural products sector in Namibia. The potential scale for commercializing each of the tree species that are of focus under the Natural Futures Programme is discussed below.

3.6.1 Marula

A study done by Botelle et al, (2002) calculated the fruit yield for Marula in North-central Namibia show the potential yields of Marula trees. Table 2 illustrates the analysis done during this study.

Table 2: Potential yields for Marula fruit in North-central Namibia

Tree characteristics measured	Sample size	Tree average
Total fruit yield (2002)	56	596kg (std. dev. 465kg)
Average fruit mass	49	30 grams
Canopy size (w x h)	56	45 sq metres
Trunk diameter	90	67 centimetres
Tree height	100	10.2 metres
Tree age	65	53 years

(Source: Botelle et al, 2002).

The total fruit yield of individual trees for the 2002 season varied from a few kilograms (from a tree that was fruiting for the first time) to a high 2, 860 kilograms. The results of this survey indicate that very young and old trees often net less than 100 kilograms in a season. Of the 56 trees measured for yield the average was 596 kilograms, and includes both useable and unusable fruit. The high standard deviation of 465 kilograms reveals wide variability in fruit yields between trees. Marula harvests in Namibia could range between 250 000 tons and 4.5 million tons a year. The effects of rainfall on the productivity of Marula are not well understood.

Based on the surveys done by Botelle et al, eight out of every ten Marula trees are female (compared to a ratio of 1:1 in ‘natural forests’ in the Caprivi

and in the Kavango Regions where Marula trees have not been domesticated) for the simple reason that families desire fruit-bearing trees whilst unproductive male trees are removed, as they can compete with arable crops for precious soil nutrients and moisture.

The size and quality of fruits varies considerably from tree to tree. Some trees produce exceptionally large fruit (averaging 60 grams plus) whilst others produce tiny fruits (less than 10 grams). Exceptional fruit trees are well known locally. And some male trees produce a small number of fruit each year while some female trees produce fruit intermittently and not every year. Table 3 shows the potential income that could be generated from the commercialisation of Marula through production and marketing of Marula oil.

Table 3: Potential income from Marula (*Sclerocarya birrea*)

Density (stems/ha)	4 stems/ha
Area vegetated (ha)	2, 332, 800 ha
Number of trees	9, 331, 200 trees
Annual fruit yield (kg)	905,126,400 kg
Amount of seed (kg)	144,820 kg
Amount of kernel (kernel)	36,205 kg
Amount of oil (kg)	36,205 kg
Income (US$)	US$724,101

(Data source for vegetated areas: Curtis and Mannheimer, 2005)

With the commercialisation of Marula throughout the late 1990s, local farmers are increasingly protecting and planting Marula trees. There are plans within Namibia's Directorate of Forestry to actively propagate high-yielding Marula cultivars with exceptional fruiting qualities (Botelle, *et al*, 2002). This would increase the potential income realized rural primary producers of Marula products targeted for the local, regional and international markets.

3.6.2 Mongongo

The potential income that could be realized from commercialisation of Mongongo in Namibia would be around one million United States Dollars. Based on calculations made based on tree densities reported by Curtis and Mannheimer (2005), potential oil that can be produced from Marula was calculated and resultant income also calculated using current prices for which oils are sold for to the European markets.

Table 4: Potential Income from Mongongo (*Schinziophyton rautanenii*)

Density (stems/ha)	4 stems/ha
Area vegetated (ha)	2,770,200 ha
Number of trees	11, 080, 800 trees
Annual yield (kg)	443,232,000 kg
Amount of seed (kg)	177,293 kg
Amount of oil (kg)	49,642 kg
Income from oil (US$)	US$ 1,092,124

(Data source for vegetated areas: Curtis and Mannheimer, 2005)

A conservative percentage of twenty percentage was used to estimate potential fruit bearing trees. Potential yield could be lower or higher depending on the percentage of potential fruit bearing trees used to calculate fruit yield.

3.6.3 Kalahari Melon Seed

The potential market for Kalahari Melon Seed oil in Namibia is substantial. Estimates range between 50 to 500 tonnes of oil per year, which translates to between 350 to 3500 tonnes of seed annually (du Plessis, 2002). If sold at N$2/kg this could bring between N$700,000 and N$7million additional cash income for Namibian farmers every year without profit sharing.

Labour availability is key to the development of the NP industry. In the case of the Kalahari melon seeds, in the traditional agricultural calendar, some melon seeds for oil production are processed at any time when labour and ripe melons are both available and the household needs oil. The main melon seed harvest is processed after the *mahangu* harvest has been threshed and stored. This not only due to the fact that *mahangu* is vulnerable to bird and insect damage and as a staple food has high priority, but also because it allows the melons to ripen completely, resulting in well-filled seed and a higher oil yield. Melon seed stores well for at least a year and most households keep a small stock for processing as needed.

Melon seed extraction is labour intensive and many farm families do not harvest all the melons they grow and do not grow all the melons they could (du Plessis, 2002). The unwanted melons are valuable stock feed in winter. While melons do grow wild in some parts of Namibia, they are often grazed before they can ripen.

3.6.4 *Ximenia Spp.*

Ximenia americana appears to be found in relatively more abundance than *Ximenia caffra*. Both sub-species' potential for oil production is relatively lower than the other lipid oil species in Namibia. Tables 5 and 6 below show the potential scale for commercializing Ximenia in Namibia.

Table 5: Potential Income from Ximenia *americana* (Sour plum)

Density (stems/ha)	5 stems/ha
Area vegetated (ha)	2,770,200 ha
Number of trees	13,851,000 trees
Annual fruit yield (kg)	831,060,000 kg
Amount of seed (kg)	295,857 kg
Amount of kernel (kg)	29,586 kg
Amount of oil (kg)	14,793 kg
Income from oil (US$)	US$325,443

(Data source for vegetated areas: Curtis and Mannheimer, 2005)

Table 6: Potential for Income from Ximenia caffra (Sour plum)

Density (stems/ha)	4 stems/ha
Area vegetated (ha)	2, 7770, 200 ha
Number of trees	11,080,800 trees
Annual fruit yield (kg)	664,848,000 kg
Amount of seed (kg)	236,686 kg
Amount of kernel (kg)	23669 kg
Amount of oil (kg)	11,834 kg
Income from oil (US$)	US$260,354

(Data source for vegetated areas: Curtis and Mannheimer, 2005)

Although the potential income that could be generated from Ximenia appears to be lower than for the other lipid oils species used in Namibia, the income contributes significantly towards rural livelihoods in northern Namibia.

4.0 CONCLUSION

This desk top study shows that there is a great potential for increased natural products production and commercialization in Namibia. Compared to timber related uses of trees, fruit extraction has relatively high economic returns, less negative impact on the trees and therefore should be targeted for the commercialization activities. Currently, there are no studies that show any negative impact of the utilization of seed for oil processing for commercial purposes. In the long term, it may be beneficial to commission studies that assess the impact of seed utilization on sustainability of the different trees species to ensure availability of scientific data supporting current assumptions.

The potential scale of the emerging opportunity in natural products exported from southern Africa is substantial and the study shows that the potential for wealth and job creation from the NP sector is very substantial.

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