

# **Marula Resource Survey**

*A report on the Sclerocarya birrea tree population and the availability of its fruits in Northcentral Namibia*

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## 1. Introduction

This report summarizes the results of a marula fruit resource survey that was conducted by CRIAA SA-DC in cooperation with the Eudafano Women Cooperative in a number of selected areas in the Oshana, Ohangwena, Oshikoto, and Omusati regions. It was funded by the Indigenous Plant Task Team (IPTT), through the Namibian Agronomic Board (NAB).

The main aim of the survey was to establish whether sufficient amounts of marula fruits are available to justify the development of further commercial opportunities around this resource. The development of Namibia's marula fruit industry has reached a stage where it has to show that it has enough of a resource to warrant a serious investment, and/or that it has plans to increase and improve its marula resource base. The increased propagation and cultivation of improved marula strains is being promoted by the Directorate of Forestry. The marula resource survey aims to address the question whether a commercially viable resource is available.

Without additional investments in chemical analyses and the development of processing methods, this resource survey information alone will not guarantee advancement of marula fruit commercialisation. However, just knowing with some degree of certainty how much marula is (or can be) available for processing is an essential piece of the puzzle, regardless of when the technical work is done and how it is funded.

## 2. Background

The marula tree is a drought-resistant tree that is widely distributed in sub-Saharan tropical Africa. The sub-species *S. birrea* ssp. *caffra* is indigenous to southern Africa. In Namibia it is mainly found in the northern parts of the country. The multipurpose marula tree has a long history of traditional use, especially in North-central Namibia. Here, the fruits are reported to be on average 20% bigger than in South Africa, probably the result of years of domestication by local communities. The importance of marula stretches from the social, to the cultural, the economical, and the nutritional aspects of people's lives, and its value makes a significant contribution to local livelihoods.

Cold-pressed marula oil is marketed locally and internationally as a massage / skincare oil and a cosmetic ingredient by the Eudafano Women Cooperative. In the past 10 years this has grown into a multi-million dollar community trade business, benefitting over 5'000 women in 22 communities in the North-central Regions. The commercial usage of the fruit has been limited to the local processing of *omaongo*, a fermented marula juice. This activity has also been taken up by the Eudafano processing factory in Ondangwa in recent years.

Marula fruit processing has been one of the top priorities of the IFTT/IPTT product development pipeline for the past ten years. Previous work on marula fruit processing can be roughly summarised as follows:

- ✓ In 1997 and 1998 CRIAA SA-DC successfully processed small quantities of marula fruit at the Katatura Artisans' Project (KAP) by using a different cage (larger, with fewer larger holes) on the hydraulic cage-and-plate marula oil presses. Demonstration of a similar press at the Ongwediva Trade Fair in 1999 received a very positive response, and in 2000 and 2001 different prototypes of small marula presses were manufactured at KAP and sold to producers in the NCRs. A similar-sized press of a different design was later also manufactured and sold by the Rural Development Centre (RDC) at Ongwediva. In 2001/2002 the performance of these small presses were followed up on in the field as part of the IFTT's PIF project. It was shown that well-organised producers with lots of marula fruit could produce as much as 200 litres of omaongo a day. Due to low labour and marketing costs, using one of these small presses and family labour to produce

omaongo for national informal markets has become a very lucrative micro-enterprise. There is anecdotal evidence to suggest that omaongo has become much more available nationally after the introduction of the small presses.

- ✓ In 2003 a processing technology development partnership with CIRAD was initiated, along with an effort to buy and freeze up to 300 tons of marula fruit at COSDEC in Ondangwa under the IPTT's MJP<sup>3</sup> Project Phase One. The collaboration with CIRAD eventually floundered on intellectual property rights issues. Furthermore, the project could only buy 11 tons of fruit, despite advertising on the radio and eventually upping its price to N\$1/kg. Freezing turned out not to be a viable option, at least not with the technology employed.
- ✓ In 2004 under the MJP<sup>3</sup> Project Phase 2, a semi-industrial processing package was procured and used to make pasteurised and preserved samples of juice, skin, fruit pulp and various blends of these. Some skins were also dried in the shade and sent to the South African company Afriplex, (along with other juice and skin products) for investigations into flavour extraction, with positive feedback. Investigations into anti-oxidants had been part of the work plan but due to technical problems it was not possible to define and reliably produce consistent samples. The equipment procured for this project is currently stored at either KAP or in a container at the EWC factory in Ondangwa. Some of it may be useful in future processing trials.
- ✓ After the Eudafano Women Cooperative marula factory opened in 2004, they started processing marula fruit in 2005, still using the small presses from KAP. Around 14 tons of juice was reportedly produced. This would suggest that while EWC did better than the project in procuring fruit, it was still nowhere near the estimated minimum commercially viable scale of 300 tons. A community forestry project in the Caprivi Region bought a press and produced around 3 tons of juice, before closing down.
- ✓ In 2006 marula juice processing was left to EWC, which produced less than it had the year before. Sun-dried marula skins from EWC were supplied to Afriplex and received negative feedback compared to the shade-dried skins tested in 2004.
- ✓ In 2007 the MJP<sup>3</sup> Project Phase 2 final report concluded it was unlikely that commercial quantities of marula fruit could be collated in the NCRs for processing, but that there was merit in further investigating uses for the skin (especially flavour extraction), as well as the economics of processing at a scale of 50 tons per annum.
- ✓ In 2008 further samples of marula skin, preserved in alcohol, were sent to Afriplex for flavour extraction, in collaboration with PhytoTrade Africa (PTA). The results were encouraging.
- ✓ In 2009 a senior Afriplex staff member travelled to Namibia to personally evaluate on-the-ground realities and the potential for capital investment into the upgrading of the capacity of the factory. His conclusions were that the focus should be on juice production, with flavour extraction as a by-product.
- ✓ Also in 2009, PTA engaged Vital Solutions – a German company with extensive experience and contacts in the natural products sector – as technical advisors on a number of products, including marula fruit. Vital Solutions have a potential client – one of the top companies in the sector – that is seeking “new super fruit” R&D opportunities exactly like that offered by marula. If this company decides to invest in marula research it can provide world-class mobile processing technology and commensurate market access. But before the opportunity can be pitched to this potential client, two conditions must be fulfilled:
  - a) Further laboratory analyses are required, for which funding can hopefully be raised from the soon-to-be-implemented MCA Innovation Fund.
  - b) Reliable figures on the potential scale of the opportunity must be available

The latter (b) is the issue which this resource survey aims to address.

### 3. Methodology

The marula resource survey did not aim to assess the biological resource in isolation, but rather the potential availability of the fruits, thus giving it a socio-economic orientation.

The assessment of the marula resource availability comprised of 3 different research activities:

1. Review of literature and other sources of information
2. Focus Group Discussion
3. Resource Survey

#### 3.1 Review of literature and other sources of information

Although no systematic survey of the marula resource has been previously conducted in Namibia, a great amount of research on marula has been done, both by Directorate of Forestry (DoF) within the MAWF, CRIAA SA-DC and others. A desk study of the available literature was done making sure that our current efforts would complement existing data, rather than duplicate it.

Another valuable source of information comprised of the experiences of the EWC factory with regard to the buying of marula fruits for their *omaongo* processing. Interviews were held with key staff at the factory and relevant documents were obtained.

#### 3.2 Focus Group Discussion

A one-day Focus Group Discussion was held with EWC board members, leaders of EWC associations, staff of the EWC factory, and a representative of DoF Ongwediwa. The aims of the focus groups discussion were to:

- a) Explain the purpose of a marula resource survey to the EWC leadership, ensuring their interest and cooperation
- b) "Test" and finalise the draft questionnaire
- c) Select the participating associations, ensuring that the sample included smaller and larger associations, high producing and poorly producing associations, and associations close to the factory as well as associations further from Ondangwa.
- d) Discuss and plan the practical implementation of the marula resource survey together with the association leaders and EWC factory staff
- e) Have an in-depth discussion on marula fruit availability and commercialization, thereby gaining useful insights and additional qualitative data

Specific questions addressed during the Focus Group Discussion included:

- ✓ What do they think about selling fruits, do they think the people would be interested and why?
- ✓ What do they think about the price EWC is currently paying for the fruits? What would be a good price?
- ✓ Of all the marula fruits produced in the North-central regions in a season, how much do they estimate is used and how much would in principle be available for selling?
- ✓ Do they think EWC members are more or less likely to sell the fruits than non-EWC members? Why?
- ✓ What quality of fruits do they think the people would sell? Sour/sweet, juicy/small, those with bad kernels?
- ✓ Would people only sell in the short period where there is obviously too much to process or throughout the whole marula fruit season?

- ✓ Do they think commercialisation of fruits has a negative effect on those people who don't have trees and process omaongo / get kernels from neighbours?
- ✓ Could the buying of fruits pose a possible gender conflict?
- ✓ Would it make a difference (would people sell more or less) who is the buyer? i.e. EWC vs "outside buyer"
- ✓ Would it make a difference (would people sell more) if people could pick up nuts at the factory for decortications of kernels? How could that work?
- ✓ Logistics/transport; would people/associations be willing and able to transport fruits to the factory, or would it work better to have a truck coming to the villages at certain times?
- ✓ Experiences from the 2010 EWC fruit buying season > discussion based on experiences; has it been easy to buy the required amount? How could it be improved? Price? Logistics? Did focus group members sell their fruit to EWC? If yes, how much and if no, why not?

### 3.3 Resource Survey

#### 3.3.1 Study Area

The North-central regions (NCRs) of Namibia –the Ohangwena, Oshana, Omusati, and Oshikoto regions- are by far the most important marula producing areas in the country, both with regard to the resource availability and the traditional use. Marula is however not equally distributed in these regions. It tends to be clustered in slightly higher-lying areas where it is not flooded by rising water levels in the oshanas or impeded by hardpans in the soil, but does not do very well in the highest areas or other places where the soil is too saline and dry. The resource is particularly abundant in the Cuvelai drainage system, an inland delta which is dry for most of the year, but is fed by rains falling locally and in Angola during the summer months. The elevated strips of land between the waterways have the best soils and it is here where marula thrives. In addition, because of its better soils, the cuvelai delta is more densely populated, and from previous work on marula in the NCRs it is known that there is a strong positive correlation between human settlements and the distribution of the marula resource.

The areas where EWC has its associations was an obvious starting point for the marula resource survey for a number of reasons:

- a) EWC associations are organized around the supply of marula, and are therefore found in areas where marula trees are abundant
- b) EWC and its members constitute the largest and most organised marula supply chain currently in existence in Namibia
- c) EWC factory will most likely be used for actual processing
- d) EWC members possess traditional knowledge about marula trees in their areas, which implied that the survey could be conducted outside the fruiting season
- e) Being well organized, and well-known in their areas, cooperating with EWC and its associations was both useful and practical.

Defining the study area is not an easy task since no map of EWC membership distribution currently exists. Annex 1 shows a map of the Northcentral regions indicating the Cuvelai drainage system, and annex 2 is a map of the same regions showing the constituencies where EWC has associations (highlighted in yellow and blue). Using constituencies as borders of the main marula producing areas is not ideal as some of the constituencies are quite large; only the western parts of the Epembe and Okankolo constituencies, and the northern part of the Okahao constituency have EWC members. The Omuntele constituency is not an important marula producing area, the association in this area was set up mainly around the production of KMS.

The survey also collected GPS data of all the farms surveyed, which will assist in better mapping of the EWC production area in the future.

### **3.3.2 Survey format**

The questionnaire developed for the Marula Resource Survey was kept short and simple, asking only for the most necessary information needed to answer the research questions. Short in order to limit the time taken from the respondents, thereby motivating them to provide more reliable data, and simple which allowed for more accurate capturing of the data. The draft questionnaire was finalized after it was taken to the Focus Group, who proposed a few changes and additions. The final questionnaire had very few open-ended questions, and it captured the following information;

- ✓ Code (showing which association), name of interviewer and date of interview
- ✓ Respondents' information; sex and name of respondent and household head, contact details, village, constituency, EWC membership and GPS coordinates
- ✓ Number of marula fruits trees on their farm; female fruiting trees, male trees, trees too young to fruit and trees too old to fruit
- ✓ Those respondents that did not have any fruiting marula trees on their farm were asked whether they had tried to plant marula trees and if they would like to get marula seedlings
- ✓ A subjective estimate of yield of their fruiting marula trees; high, average, or low
- ✓ A subjective indication of the different quality classes of fruits available: the taste of the fruits, the quality of the omaongo made from them, and the quality of their kernels.
- ✓ Seasonality, indicating early, mid-, and late fruiters
- ✓ Usage of fruits; sharing of fruits and usage of the total available fruits in good and bad marula fruiting years
- ✓ Selling of fruits; indication of interest in selling marula fruits, under what conditions, and how much they in principle could sell in a good and a bad marula fruiting year
- ✓ Comments (if any)

The GPS coordinates obtained in this survey will be handed over to the Research Division of the Directorate of Forestry, which will assist them in mapping the resource. The questions as to whether people have tried to plant trees, what their experiences are with planting, and whether they would be interested in getting seedlings were asked on behalf of the Directorate of Forestry as well, since this will be helpful both for their extension work and for their research on where marula trees are more or less likely to be found or successfully planted.

The questionnaire can be found in annex 3

### **3.3.3 Training and conducting the resource survey**

The EWC associations participating in the resource survey selected a coordinator and enumerators to conduct the survey. Selection criteria for the enumerators included that they live in the area where the surveys were to be conducted, could read, write and understand basic English, have a basic understanding of mathematics at grade 10 level, have a cell phone, should be at least 16 years old and healthy enough to walk reasonable distances in a day, and preferably have previous experience of doing surveys. In practice all the enumerators selected by the associations were women, not many of whom had experience in conducting surveys, and their understanding of English and mathematics was variable.

The tasks of the coordinators included collecting, checking, and returning the completed questionnaires, paying the data gatherers, and informing the local and traditional authorities

about the survey. Selection criteria for the coordinators were that they must be older, responsible people with literacy and numeracy skills and a good knowledge of the local association and area. In practice all the coordinators selected were the associations' chairwomen, who consequently knew the area and the EWC members very well, but also had varying degrees of understanding of English and mathematics.

In total 48 enumerators and 13 coordinators were selected in 13 associations. They were divided into two groups and all received one-day training either on the 14/04/2010 or 05/05/2010. Only those who attended the full day's training were allowed to conduct the surveys.

The training consisted of:

- ✓ A short introduction on the purpose of the marula resource survey
- ✓ A very thorough training on the questionnaire in English and Oshiwambo, making sure every question and the filling in of the responses was properly understood
- ✓ A practical training on the use of GPS, and the filling in of the GPS coordinates
- ✓ A practical training session on data collection, where groups of trainees interviewed members of the Shifula Association, who came to the training site for this purpose
- ✓ A short training on sampling, providing the trainees with a basic understanding of the concept and making sure that the sample surveyed by the associations would be as random as practically possible

After informing the local and traditional authorities, all the surveys were conducted by the trained enumerators between the 15/04/2010 and 20/05/2010. The coordinators assigned to the enumerators the areas to be surveyed, making sure that farms selected were spatially divided and covered only once. Upon delivery at the EWC factory, the forms were double-checked by EWC factory staff, and send back if they had obvious mistakes or omissions. The files were then sent to Windhoek for data entering.

### **3.3.4 Sampling**

The principal target population is the EWC membership. The current number of EWC members is unavailable, but the 2009 figures showed a total of 5445 members. The members are organized into 22 associations; 17 have existed for several years, and 5 have recently branched off from those. Of these 22 associations only one is not a marula producing area. There are surely some dispersed marula trees in the Omuntele area, but the association has joined the cooperative because of its KMS production, and only manages to provide small quantities of marula kernels to the EWC factory. Omuntele is furthermore not a very accessible area logistically, so it was decided to exclude Omuntele from the target population. This leaves a total of 5365 EWC members in 21 associations active in 25 constituencies in 4 regions. The number of members per association varies from 50 to 884, with an average of 255. The list of associations, with their number of 2009 paid-up members, and the constituencies where the members reside is shown in table 1 below.

It was decided to include a strong representative sample of the EWC membership in the survey, by having about 50% of the 2500 planned surveys conducted among EWC members. Furthermore, surveys were conducted in 13 of the 21 associations (62%, associations surveyed highlighted in yellow in table 1 below), and 21 of the 25 constituencies where EWC has its members.

Although the selection of participating associations was primarily determined by the attendance of association leaders at the Focus Group Discussion, the sample is representative in that



internal variances are taken into consideration; it includes both small and large associations, associations with low and high production of marula kernels, associations that are close to the factory and those that are further away.

<b>EWC membership</b>		
<b>Name of Association</b>	<b>no. of members</b>	<b>constituencies where active</b>
Ebandulo	390	Endola, Engela
Lyeendongula	300	Endola, Omulonga, Ohangwena
Meameno	256	Omulonga, Ondobe, Oshikango
Tulongeni	80	Ondobe, Oshikango
Diinina	884	Engela, Ongenga, Etayi
Kuupenda	275	Epembe, Okankolo, Onayena, Onyaanya
Pendapala	100	Anamulenge, Outapi
Okahulo	281	Onesi, Outapi
Tunetu	707	Tsandi, Outapi
Gwamiitayi	480	Tsandi, Ogongo
Nakagumbo	74	Oniipa
Nkugoyepongo	250	Okaku, Ondangwa, Ongwediwa, Olukonda
Mangundu	291	Okahao
Shifula	190	Ongwediwa
Omafa	290	Outapi
Ohole	180	Okatana, Ongwediwa, Oshakati
(Omuntele*	80	Omuntele)
Okalyohambo*	82	Onesi
Oshawapala*	77	Ondobe
Onangalo*	50	Tsandi
Omuthitugwalwani*	50	Okahao
Iihongo*	78	Onayena
<b>total members</b>	<b>5445</b>	<b>in 2009 (membership for 2010 not yet clear)</b>

\* No marula in this (KMS) area

\* former branch of Okahulo

\* former branch of Meameno

\* former branch of Gwamiitayi

\* former branch of Mangundu

\* former branch of Kuupenda

Table 1; EWC membership

The secondary target population includes all the areas in North-central Namibia where marula is abundant, which we defined as the areas where EWC is active, assuming that EWC associations have been formed in areas where the marula resource is significant, and people have easy access to the resource. The secondary target population includes farms of both EWC members and non-EWC members. Exactly how big this area is, and how many households are living in this area is not known, since EWC membership has never been mapped. In fact, this is the first proper attempt to map the EWC capture area. Currently all we could establish was the constituencies where EWC has members. These 25 constituencies consisted of a total of over 93'000 households in the population and housing census that was carried out by the National Planning Commission (NPC) in 2001. However, the population of these regions saw an enormous increase in 2001 as compared to the census done in 1991, with a 33% increase in household numbers in the Oshikoto and Oshana Regions, a 24% increase in the Omusati Region,

and a doubling of household numbers in the Ohangwena Region, and it is unknown how many households populate these constituencies in 2010. Furthermore, the borders of the constituencies are political boundaries and not the best indicators for either EWC membership or the marula resource. In particular, EWC members only populate the Northern part of the Okahao constituency, and the Western parts of the Epembe and Okankolo constituencies. Lastly, the population census does not separate rural from urban households, and especially in the Ondangwa, Ongwediwa, Oshakati East and Oshakati West constituencies, a large part of the population lives in towns with little or no access to marula trees. A table of the associations, constituencies, and number of households in these constituencies according to the 2001 population and housing census can be found in annex 4.

With an unknown population, it is impossible to take a representative sample of the secondary target group. It was however decided to include an equal amount of non-EWC members in this survey for the following reasons:

- The EWC factory has been buying a majority of the fruits used for omaongo processing from non-members, which could mean that non-members are more likely to sell the marula because they use the fruits to a lesser extent.
- It would be interesting to see whether there are significant differences between EWC members and non-EWC members, in order to see whether non-members have more or less access to the resource, use more or less of the resource, and are more or less likely to sell the resource; Did EWC members join the cooperative because they have more trees than non-members, or do they have the same amount of trees but did they become members because they either have more available labour to process the marula kernels, or because they are in greater need of cash income?

In the total survey sample, 50% was planned to be conducted among non-EWC members. Differences and commonalities found between members and non-members, will enable us to extrapolate the results, thereby making more general conclusions and providing a better overview of the resource distribution in the entire targeted area.

Within the associations participating in the marula resource survey, the number of surveys conducted was to some extent correlated to the total number of members of the association, although in practice some associations did more surveys than planned and others less, mostly as a result of the number of enumerators available and attending the training. Below is a list of the associations participating in the survey, with the number of members and the number of surveys conducted:

Association	No. of members	No. of surveys conducted
Okahulo	281	233
Meameno	256	251
Tulongeni	80	99
Diinina	884	400
Kuupenda	275	250
Nkugoyepongo	250	250
Pendapala	100	112
Tunetu	707	112
Gwamiitayi	480	168
Epandulo	390	225
Nakagumbo	74	112
Lyeendongula	300	226
Okalyohambo	82	56
total	4159	2494

*Table 2: sample associations, numbers of members and number of surveys conducted*

No maps or comprehensive lists are available of all the homesteads in the selected areas, which made it impossible to pre-determine a random spatial sampling method in the selection of the respondents. Instead it was explained to the enumerators and the coordinators that the homesteads should be randomly selected, but spatially evenly spread throughout the area where the association is active, and that selection should not in any case be based on the knowledge of either the absence or the abundance of marula trees. The coordinators were given the responsibility that the sample of homesteads selected was as random as possible, spread throughout their area, and only covered once.

### **3.3.5 Data analysis**

The data collected by the enumerators was entered by 6 data capturers in a simple excel spreadsheet database. From the database it was found useful to make comparisons between the data from members and non-members, and to separate the data from the associations close to the factory that would be more likely to be included in fruit intakes at the early stages of such an endeavor because of logistic reasons.

GPS data was also entered in the database, but has not been analysed by CRIAA SA-DC. Instead it will be handed over to the Research Division of the Directorate of Forestry and will assist them to map the marula resource distribution. The data could also be used to develop and ground-truth a GIS tool that can be used to predict where marula may be found, or where it may do well if planted.

## **4. Results**

All survey results can be found in the following annexes;

*Annex 5: Database all associations, showing all entries on sheet 1, entries of EWC members on sheet 2, entries of non-EWC members on sheet 3, and entries of respondents with unknown membership status on sheet 4*

*Annex 6: Database Nakagumbo and Nkugoyepongo Associations, which are the associations that are located near to the EWC factory*

*Annex 7: Comparison of overall data with data from EWC members and non-EWC members*

*Annex 8: Comparison of overall data with data from the Nakagumbo and Nkugoyepongo associations*

The survey results are described in the sections below, which also incorporate the information gathered from the focus group discussion and the literature review.

### **4.1 General data**

As described in the sampling section (3.3.4), data was collected from a total of 2494 households in the capture area of 13 associations, present in 21 constituencies, in the Oshana, Oshikoto, Ohangwena, and Omusati regions. Not all surveys were complete, but all 2494 surveys were used in the data analysis.

Although the aim was to get data of 1250 EWC members and 1250 non-EWC members, only 1106 respondents indicated that they or a member of their household were a member of EWC. 1294 respondents did not have an EWC member in their household, and in 94 cases the question was not answered by the enumerators.

Of the 2494 respondents, 2350 (94%) had one or more fruiting marula tree on their farm. Interestingly, even amongst the EWC membership, 7% of the respondents did not have a fruiting marula tree, as compared to 5% of the non-EWC members. This means that 7% of the EWC members interviewed solely depend on the nuts they receive after processing omaongo at the farm of their neighbours, relatives or friends for their income from sales of marula kernels to the factory.

As expected the large majority of the respondents were female, 93% overall, with 97% amongst the EWC households, and 91% of the respondents of non-member households. 47% of all households interviewed were headed by a woman, less than indicated in the population and housing census in 2001, where the percentages of female headed households were 50%, 54%, 60%, and 62% in the Oshikoto, Oshana, Ohangwena, and Omusati Regions respectively, but these percentages may have changed in the past 9 years. In our survey 51% of the EWC households comprised of female headed households, as compared to 43% of the households of the non-members.

#### 4.2 Marula population

Amongst the 2494 respondents of our survey, the number of female fruiting marula trees on their farm ranged from 0 to 50 with a total of 13 278 fruiting trees, which is an average of 5.33 per farm/household. The mode (most common value) was 3, and the median (middle value) 4. The large majority of the respondents (84%) had between 1 and 10 fruiting trees on their farm, 6% of the respondents did not have any fruiting marula trees, and 10% of the respondents had more than 10 fruiting marula trees on their farm. Figure 1 below shows the number of households on the vertical axe and their number of fruiting marula trees on the horizontal axe.

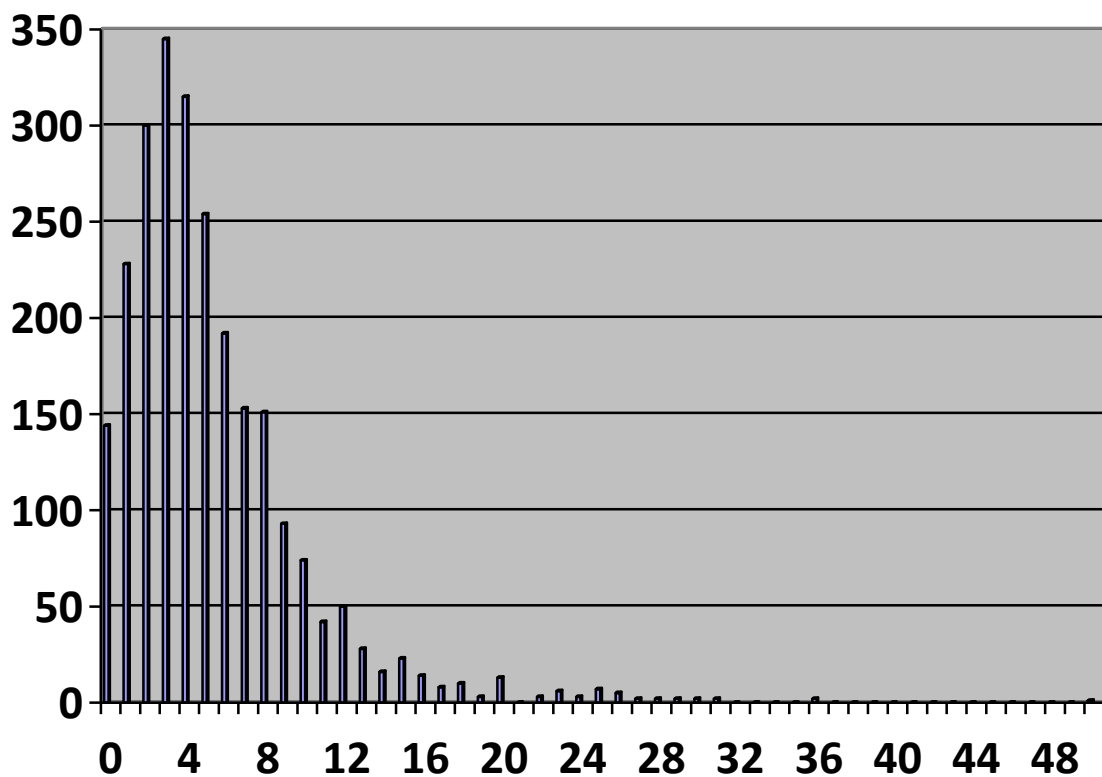


Figure 1: Distribution of fruiting marula trees per farm

There were no significant differences between the average number of trees of members and non-members of EWC, but the survey showed a smaller population of fruiting marula trees in associations closer to the EWC factory. Although as much as 98% of the people surveyed by the Nakagumbo and Nkugoyepongo Associations had 1 or more fruiting marula trees on their farm, their average number of fruiting trees per farm was 4.31, which is 1 tree less compared with the average of 5.33 over the whole survey sample. This is likely the result of the fact that areas around towns are more populated, and farms therefore smaller in size, but this should be taken into consideration when it is decided, for logistical reasons, to start with the buying of fruits in the areas surrounding the factory.

The average population of the non-fruiting male marula trees on the surveyed farms was 1.41, making the male : female ratio 1 : 3.8, slightly higher than the 1 : 4.9 ratio found by DoF in 2001, but that survey constituted a much smaller sample. The ratio was even higher in the associations located close to the EWC factory, where 3.1 female trees were found for every male tree.

The number of young and old trees was consistent over all areas and regardless of EWC membership, with an average of 1.30 young trees per farm, and 0.14 trees that were too old to fruit. Young trees were defined as trees that were close to maturity, but not (yet) fruiting, so it was unknown whether they were male or female trees. Small marula trees that are young enough to be eaten by goats or to be destroyed otherwise were not counted. With almost 10 times more young trees than old and dying trees, the marula population seems at least sustainable, although a more thorough age structure surveys would be needed to establish whether the marula tree population is increasing, decreasing, or stable.

Of the 144 respondents that did not have any fruiting marula trees, about a third reported that they had tried to plant marula trees. Interestingly less EWC members without fruiting trees had made attempts to plant than non-EWC members, but the sample of non-tree owners is too small for the difference to be significant. Where indicated, the reasons for not trying to plant were mostly that they did not have the knowledge / experience in planting marula trees, that they did not know that it was even possible, or that they did not know where to get the seeds or seedlings to plant. Only 3 respondents said that they did not desire to have any marula trees. Of those respondents that did try to plant marula trees, some said they had succeeded but the trees were either male or too young to fruit, other had attempted to plant marula but the trees had died or didn't grow well and they mentioned that the soil was not suitable for marula.

More than three quarters of the respondents without fruiting marula trees said they would like to get marula seedlings because they want to use the tree and its products. Of those that were not interested the reasons were varied, some said the soil was not good enough or they didn't have access to water, others said they were too old or didn't have the knowledge, experience or time to look after the seedlings, a few people said they had enough young trees already or were trying to plant them by themselves, and some others were simply not interested.

### **4.3 Marula Yield**

Unfortunately there are no good statistically valid data on the average annual yield of fruits per marula tree. The only study that has tried to make an attempt to establish this in Namibia was carried out by CRIAA SA-DC in 2002 (A survey of marula fruit yields in North-central Namibia). The Directorate of Forestry has agreed to make an effort to complement this data, but did not manage to do so this season. Our marula resource survey also started too late in the season to do any work on this. Preferably such work should be carried out over a number of years, because there are indications that there are strong variations in year to year fruit production.

In the above mentioned survey conducted in 2002, there was a wide variety in fruit production per tree, ranging from a few kilograms to 2860 kg. The average amount of fruit production per tree was 596 kg. The fruits of 104 marula trees were weighed by community members, but in the final analysis only 56 of the data sets seemed reliable, and the rest of the data was discarded. It was furthermore said that the results of the study were not statistically valid because the trees were not randomly selected and the survey started late in the season, which excluded many of the trees that had already started to drop their fruits. Moreover, of the data that was used in the final analysis it was said that reliability of the yield measurements was affected by a number of factors:

- The quantity of usable and unusable fruits was unknown, bad or damaged fruits were included in some measurements and excluded in others
- It is likely that unmeasured fruit fell onto piles of measured fruits, meaning the actual number of fruits was higher than recorded
- Fruit flies added strongly to the quantity of fruits which perished. Especially towards the end of the season these unusable fruits were most likely ignored by harvesters

Apart from the problems with the reliability and validity of the data, there are strong annual variations in fruit production, and it was mentioned that in 2002, when the measurements were done, the trees generally had fewer and drier fruits than the year before.

In a study by Veldproducts in Botswana an average yield of 550 kg was found, but the fruit production of only 11 trees was measured, and not much is clear about the selection of these 11 trees, and whether the year in which they were measured was regarded as a good or bad marula fruiting year.

Despite the problems with the reliability and validity of the data, an average yield of 596kg is the best we have to work with in this marula resource survey. In the formulas we used for our analysis, we set an average of 700 kg for trees that were said to have a high yield, 500 kg for trees with an average yield, and 300 kg for trees with a low yield. These figures can be modified once DoF provides us with more reliable data.

The main reason why we set the value of high yielding trees to 700 kg only, while there is evidence that some marula trees can bear thousands of kgs of fruits each year, is that the respondents in our survey rated as much as 68.5% of their trees as trees with a very high yield. A bit over a quarter of the trees were said to produce an average amount of fruits, and only 5% of the trees were rated as low yielding trees. The few trees that were not rated (non-responses) were assumed to be average fruiting trees.

Using these figures in our calculations, we came to a total estimated yield of 8'334'000 kg of fruits among our 2494 respondents, which is an average 3'342 kg of fruits per farm per year. This average includes the households that do not have any fruiting trees on their farm. There were no significant differences between the yields of members and non-members of EWC, but the average was lower (2'690 kg) for the areas close to the factory (the surveys done by the Nakagumbo and Nkugoyepongo associations), which is obviously related to the fact that the households in these areas on average have less trees on their farms.

Having no more reliable figures on fruit yield per tree, and taking into consideration the annual variabilities in fruit production, it is suggested that the average yields per farm should be interpreted with a +-25% uncertainty, which gives an estimate between 2'507 kg and 4'178 kg of fruits per farm per year.

For EWC members the average yield per year was slightly higher at 3'389 kg. Taking the 2009 membership numbers of all associations except Omuntele, the total yield of marula fruit among EWC members would be over 18'000 tonnes ( $5365 \times 3'389 = 18'181'985$  kg) + or - 25%.

Using a conservative estimate of 80'000 households in the marula producing areas in North-central Namibia, we come to a total yield of over 267'000 tonnes ( $80'000 \times 3'342 = 267'360'000$  kg) + or - 25%

#### 4.4 Availability of resource

Having established the estimated yield of marula fruits among the EWC membership and the general population in the North-central regions of Namibia, does not say much about the availability of these fruits for commercial processing:

- a) The area surveyed has a high level of competition from traditional users of the fruit, it should therefore be established how much they are using, if they would be willing to sell a portion of the available fruits and if so how much.
- b) Logistical challenges would include transport of the fruits to the processing facility. The area surveyed is large, and transport and accessible roads are not available everywhere.
- c) Fruits may in principle be available, but the majority of the fruits will ripen within a relatively short period of time, and a large part of the fruit will inevitably rot or be affected by fruit flies if not picked at exactly the right time, which is virtually impossible, especially since not all fruits from a particular tree ripen and fall off the tree at the same time.
- d) In addition to the fact that the portion of usable and unusable fruit is unknown, not all fruits in the right stage of ripening may be suitable for processing purposes, there are strong variations in the taste of fruits as there may also be in the chemical or other qualities.
- e) Peoples' willingness to sell would largely depend on the price offered for the fruits.

It is outside the scope of this survey to extensively investigate all of these issues, and we therefore mainly touched upon the traditional usage of the fruits, peoples' willingness to sell, and a quantification of the amounts of fruit available for commercial purposes in principle.

During the focus group discussion, it was confirmed by all 14 association leaders present that on average more than 50% of the marula fruits is currently unused and a large majority of the population in their areas would therefore show a keen interest and willingness to sell marula fruits. They agreed the problem would be the organisation and costs of transport rather than willingness to sell or availability of the resource.

The interest in selling fruits also became evident during the survey. In the general comments at the end of the questionnaire, although it must be noted that the majority of the respondents did not make any comment at the end of the questionnaire, more than 90% of all the comments that were made were very positive. The most common comment categories were:

- |   |       |
|---|-------|
| - Am grateful / happy / please go ahead / great idea    | 42.5% |
| - I want to sell, need money for school fees, food, etc | 24.5% |
| - I will sell, fruits are lying to rot now              | 17%   |

Only 1.5% of the comments had a very negative tone, by saying that they were not happy about the idea because it would take away their marula. Some others expressed disappointment because they did not have enough marula to be able to sell, and wanted more trees.

All owners of one or more fruiting tree were asked if they would be interested to sell some of their fruits if there were a market for the fruits. A bit more than a fifth of the respondents (18% of EWC members and 23% of non-EWC members) said they were not interested to sell their fruits, either because they did not have enough or because of other reasons. Less than 5% was not sure if they would want to sell the fruits, and a three-quarter majority of the respondents either said yes, and/or yes depending on transport /price / harvest / timing. The results are shown in table 3 below. Please note that more than one answer could be given and the added percentages therefore exceed 100%.

Yes	46.5%
Yes, but only if fruits are collected, transport is a problem	25.0%
Yes, but only in years when the harvest is good	11.5%
Yes, but only in the few weeks that there are more fruits than we can process	6.5%
Maybe, depending on the price	21.0%
No	21.0%
I don't know	3.5%
No response	1.0%

*Table 3 Responses to the question of whether the respondents would be willing to sell their fruits*

There were no significant differences in responses between members and non-members, but in the surveys done in the Nakagumbo and Nkugoyepongo areas that are located closer to the factory, the respondents expressed slightly less concern about transport, with 43.5% mentioning price as a defining factor. This is just more than twice the overall population response of 21%.

The focus group also discussed the issue of pricing. They predicted non-EWC members would be more willing to sell the fruits, because they do not perceive the commercial value of marula that strongly, and they thought EWC members would be much more sceptical about the price paid for the fruits. This, however, did not come out in the survey. Asked whether it would make a difference if EWC members would be able to get back the stones/nuts in order to decorticate and sell the kernels, this was not perceived as a good idea by the focus group, both because of quality issues, and logistical problems.

The price currently paid for the fruits at the EWC factory was perceived as low by the focus group, although there was also an understanding that in the current processing scenario additional costs and the price of the final product (omaongo) did not allow the factory to pay the producers much more for the fruits. Current pricing is N\$20 for 50kg when the fruits are brought to the factory and N\$10 per 50 kg if the factory collects the fruits. That is N\$0.20/kg for the fruits and N\$0.20/kg for transport. Especially the price for transport was perceived as problematic, which is also evident in the fact that 85% of the fruits used by the EWC factory in the 2010 season were collected and transported by factory staff, and nearly all of the fruits were coming from areas located close to the factory.

Although only mentioned by 6.5% of the respondents, the focus group also drew attention to the fact that only during peak marula season, usually somewhere during February-March, you find the fruits are too much for the people to process, and they are left to rot. In our survey, almost 70% of the trees in the overall sample fruited in the period February-March, 18% of the trees were indicated as early fruiters, and 12% of all trees were said to fruit after March. In the areas close to Ondangwa there was a slightly higher proportion of late fruiters (20%). This year the EWC factory managed to get enough marula fruits to process omaongo full-time on 3 of their presses from 27 January to 14 April, of which in the last 2 weeks they had a harder time finding fruits. During the peak of the season the supply was often higher than the demand, and they received calls from people who wanted EWC to collect their fruits, to which they could not



attend. There can be slight variations in fruiting seasons from year to year. It was said that in 2009 fruits generally fruited later than in 2010.

The 2010 season was a good year for marula fruit production, as compared to the 2009 season. In 2009 the EWC factory struggled to get enough fruits for their omaongo processing as a result of the floods. They only managed to purchase 11 tonnes of fruits from the end of February to the beginning of April, while in 2010 they purchased 37.5 tonnes, and could have easily bought more if their processing capacity was bigger. The focus group also mentioned that yield and availability of the fruits is very variable from year to year, and therefore suggested that we made a distinction in good and bad marula fruiting years in the survey to establish percentages of use and commercial availability.

Asked about the traditional usage of their marula fruits in a good marula fruiting year, either by their own household and/or by their neighbours/friends, 60% of the respondents said they used the majority or all of their fruits, 28% responded that they used about half of the fruits, and 10% claimed that only a small part of their fruits were used (2% no response). These responses were consistent amongst members and non-members of EWC, but the associations closer to Ondangwa found that slightly lower percentages of the fruits were used, despite the availability of less trees in these areas.

In our calculations we estimated 85%, 50%, and 15% usage for the 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> category respectively, and 75% for the non responses, which came to a total use of 5'689'185 kg of fruits in a good year, or 2'281 kg on average (including the respondents that do not have any fruiting trees), which constitutes 68% of the yield.

The question on usage of fruits in a bad marula fruiting year was not well understood. If people have less fruits available and they approximately use the same amount of fruits, the amount of fruits used as a proportion of the total available fruits should be higher, but in most instances it was lower. This error likely came in because many people thought of floods as the reason for a bad marula year, as this was a problem in 2009. As a result many respondents who said they used the majority of the fruits in a good marula year, said they only used a small portion of the fruits in a bad marula year, because part of the fruits were flooded/rotten and therefore not available for use. The results of this question should therefore be disregarded.

Marula use in North-central Namibia is known for its tradition of sharing. It is a cultural/traditional / social practice to ask neighbours and/or friends to come process omaongo, and they can take home most or all of the omaongo and all of the nuts of the fruits they have processed. In our survey 76% of the respondents that have one or more fruiting trees said their fruits are shared in this way with neighbours and friends. 9% of the respondents said that this does not happen on their farm, and 14% responded that their fruits are only shared sometimes. The fruits of 54% of the respondents' trees are said to be shared. The results were consistent between members and non-members of EWC, but a larger part of the trees (74%) in the associations close to Ondangwa were said to be shared.

The question whether the commercialisation of fruits would have a negative effect on this culture of sharing, especially for those women that do not have their own trees, was posed to the focus group. The focus group perceived no potential problem, and said that the culture of sharing was unlikely to change. They agreed that even while the fruits are shared, there are more fruits than can be processed traditionally, and it's the surplus fruits, those that are left to rot, that people will sell. They all predicted that the culture of sharing was strong enough to remain intact, and people would only sell what they could socially afford to sell.

The survey however suggests that the commercialisation of fruits might affect the tradition of sharing to some extent, and probably especially so if the price for the fruit becomes more attractive. Asked what portion of their fruits they would in principle be willing to sell in a good marula year, 32% responded that they would be willing to sell the majority or all of their fruits, 36% said they could sell about half of their fruits, 9% would be willing to sell a small part of their fruits, and 21% said they were not interested in selling their fruits. Using the same formulas as in the calculations of the usage of the fruits, this would add up to a total commercial availability of 4'398'790 kg amongst our respondents, which gives an average of 1'764 kg per household, including the households that do not have any trees. 1'764 kg constitutes 53% of the yield, so while an estimated 68% of the yield is currently used in good marula years, people are in principle willing to sell 53% of their total fruits in those years.

With less fruits available in bad marula fruiting years, the percentage of respondents not interested in selling their fruits increased from 21% to 26%. Generally smaller portions of the available fruit in bad marula fruiting years was said to be made available in principle for selling, with a total adding up to 2'662'945 kg amongst the respondents, or 1'068 kg on average per household per year (including those that do not have any fruiting trees).

There were no significant differences between members and non-members of EWC with regard to the commercially available amounts of fruits. The associations closer to the factory however, were willing to sell smaller amounts of fruits, which is likely to be directly related to the fact that their amount of trees and therefore fruit yield is lower than average. Table 4 below shows the estimated amounts of fruits per household that are in principle commercially available for the different groups:

Surveyed group	Average kg / household willing to sell in a good marula year	Average kg / household willing to sell in a bad marula year
All groups / overall results	1'764 kg	1'068 kg
EWC members	1'833 kg	1'105 kg
Non-EWC members	1'738 kg	1'059 kg
Membership status unknown (94)	1'316 kg	763 kg
Associations close to the EWC factory	1'356 kg	823 kg

*Table 5 Estimated average amounts available for commercial purposes per household*

Based on these averages, one can calculate the estimated amount of fruits that are in principle available for commercial purposes<sup>1</sup>;

Amongst the EWC membership that would be (5365 x 1'833=) 9'834'045 kg in good marula fruiting years and (5365 x 1'105 kg=) 5'928'325 kg in bad marula fruiting years

In the whole of the marula producing areas with the previously used conservative estimate of 80'000 households, that would add up to (80'000 x 1'764=) 141'120'000 kg in good years and (80'000 x 1'068=) 85'440'000 kg in bad years

Taking only the EWC associations that are in close proximity to the factory, there are 4 associations (Nakagumbo, Nkugoyepongo, Shifula, and Ohole) with a total membership of 694 in 2009. Their contribution could be estimated as (694 x 1'356=) 941'064 kg in good marula years, and (694 x 823 =) 571'162 kg in bad marula fruiting years.

<sup>1</sup> As with yield, these figures should be interpreted with an uncertainty of + or - 25%

In an area in the proximity of the EWC factory comprising 10'000 households, the estimated amount of marula fruits available for commercial purposes would be  $(10'000 \times 1'356=)$  13'560'000 kg in good years, and  $(10'000 \times 823=)$  8'230'000 kg in bad marula fruiting years.

The EWC factory did not indicate any problems in getting the required quantities of fruits in February and March during their 2010 marula fruit purchase season. 37'500 kg was brought by or collected from 45 people. Quantities brought / collected varied from 25 kg to 4900 kg. The average amount bought was 834 kg, with a median (middle value) of 550 kg. Leaving out the 6 people that brought quantities below 100 kg, a low quantity probably because transport proved an issue, not because people did not have more fruits to sell, the average comes to 955 kg with a median of 595 kg. Although the average sold per household in practice proved slightly less than the averages calculated, it is not at all clear that the households that EWC bought the fruits from sold all the fruits that they were willing to sell. Moreover, the EWC factory only went out to collect from each household once, and it is unlikely that all fruits were in the right state of ripeness at the day of collection.

It has been indicated that 300'000 kg of fruits would constitute a commercially attractive resource base. Even with the large degree of uncertainties especially with regard to the yield of marula trees and the number of rural households in the marula producing areas of North-central Namibia, it can be concluded that there are no problems with regard to the resource base that is estimated to be in principle available for commercial purposes. The practical availability of marula fruits for commercial purposes would mostly depend on the logistics, the price offered, and the quality of the fruits. The next section aims to provide a bit of insight in the latter.

#### **4.5 Fruit characteristics**

It has been suggested that people would be most likely to use their good fruits and only sell their dry, small, sour fruits with bad quality kernels. It is unknown at this stage which qualities and type of fruits would be preferred for commercial processing, and it was therefore not possible to focus on these unknown qualities in the survey. Instead the respondents were asked about the qualities of the fruits that are important to them: the taste of the fruits, the quality of the omaongo made from the fruits, and the quality of the kernels inside the nuts.

61% of the trees in our survey were said to have sweet fruits, 31% of the trees were indicated as having average fruits, not sweet, and not sour, and only 7.5% of the trees were said to have sour fruits. The quality of the omaongo made from the fruits, and the quality of the kernels inside the nuts indicated similar percentages; 60% was said to make very good omaongo, 32% made omaongo of average quality, and 7% of the trees had fruits that were not really used to make omaongo. With regard to the kernels 60% of the trees had fruits with very good kernels, both in size and quality, 32% of the trees produced fruits with kernels of average size and quality, and only 7% of the trees produced fruits of which the kernels were not extracted.

Asked which fruits they would prefer to sell if there would be a market for the trees, the majority of the respondents claimed they would sell any fruits (62%). 6.5% of the respondents said they would sell mostly the sour fruits, 3.5% said they would prefer to sell the fruits that have bad kernels, and 3% of the respondents would mostly want to sell the small fruits. For 21.5% of the respondents the question was not applicable because they were not interested in selling the fruits, and 3.5% indicated no response.

The results with regard to fruit qualities and which fruits they would sell were consistent among members and non-members of EWC, and associations at a close proximity to the factory and those further away.

The EWC factory inspects all of the fruits before they are bought either at the factory or in the field. The factory is not buying fruits that are half rotten, very dry or taste very bad. Still there are huge variations in taste, and although the fruits are blended to some extent, no two batches of omaongo taste exactly the same. Quality inspection would obviously prove more cumbersome if one buys larger commercial quantities in a relatively short time-span.

Apart from the taste and juiciness of the fruits, the other quality issue affecting commercial availability of the fruits concerns the different degrees of ripeness. Not all fruits ripen and fall of a tree at exactly the same time, nor can each and every fruit be visually inspected in commercial purchase efforts. Processing fruits with different degrees of ripeness will therefore be inevitable. Vital Solutions is currently investigating the effect of different ripeness levels on the chemical qualities of the fruits.

## **5. Conclusions and recommendations**

The marula resource survey set out to establish whether sufficient amounts of marula fruits are available to justify the development of further commercial opportunities around this resource in North-central Namibia. Commercially interesting quantities were indicated to be at least 300T of fruits annually.

Despite a large number of uncertainties, including the lack of reliable data on fruit yields per tree, the annual variations in yield, the borders of the marula producing areas, knowledge about what quality of fruits would be suitable for commercial processing, and the level of efficiency in logistics that could be deployed in a commercial purchase effort, it can be concluded that the survey showed that without a doubt the resource base and the socio-economic availability of the fruits are more than sufficient to warrant a commercial investment around the resource.

It was estimated that in principle, people would be willing and able to sell:

- ✓ between 570T and 940T in the EWC associations directly surrounding the factory
- ✓ between 8'000T and 13'500T in the 10'000 households surrounding the factory
- ✓ between 6'000T and 10'000T amongst the whole EWC membership, and
- ✓ between 85'000T and 141'000T in the marula producing areas in North-central Namibia

Although it is highly unlikely that any commercial enterprise would be able to collect all of this available fruit in the right state of ripeness, during the short period of time that the fruit is available, the figures are so many multiples of the indicated commercially interesting amount, that the question of logistics, price and fruit quality become much more important issues than the resource availability.

An amount of N\$250'000 for follow up work on the marula resource survey will be available through the National Forestry Programme Facility (NFPPF) later this year. It is recommended that this is used to:

- scale up the production of grafted materials
- map potential cultivation areas
- train communities

Most of this work should be done by DoF, in cooperation with EWC and CRIAA SA-DC. It is crucial that this is done in close consultation with the markets, to avoid raising false expectations and/or investing in over-production. Other recommendations include for the Directorate of Forestry in Namibia to:

- Start mapping the marula resource, based on the GPS data and the data on numbers of trees obtained in this survey
- develop GIS tools that can be used to predict where marula may be found, or where it may do well if planted.
- carry out additional work on the marula fruit yield per tree, preferably collecting data over a number of years
- conduct age structure surveys in selected areas, establishing whether the marula tree population is increasing, decreasing, or stable
- continue their work on marula tree grafting, and tree planting programs, assisting especially those households who have no or very few fruiting marula trees
- assess the supply potential of other important marula areas; in particular the Tsumeb town lands and the surrounding commercial farms in the Otavi mountain land, Kavango, and Caprivi

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## List of Acronyms

<b>CRIAA SA-DC</b>	Centre for Research, Information, and Action in Africa – Southern Africa Development and Consulting
<b>DoF</b>	Department of Forestry
<b>EWC</b>	Eudafano Women Cooperative
<b>IFTT</b>	Indigenous Fruit Task Team ( <i>predecessor of IPTT</i> )
<b>IPTT</b>	Indigenous Plant Task Team
<b>KAP</b>	Katutura Artisans Project
<b>MJP3</b>	Marula Juice & Pulp Processing Project
<b>NCRs</b>	North-central regions
<b>NFPF</b>	National Forestry Programme Facility
<b>PIF</b>	Promotion of Indigenous Fruits
<b>PTA</b>	PhytoTrade Africa
<b>RDC</b>	Rural Development Centre
<b>R&amp;D</b>	Research and Development