Western Cape Government

Guidelines for the sustainable harvesting of wild honeybush

Gillian McGregor










MARCH 2017

EADP 696: THE DEVELOPMENT OF GUIDELINES FOR THE SUSTAINABLE HARVESTING OF WILD HONEYBUSH

Western Cape: Department of Environmental Affairs and Development Planning

Service Provider: Caroline Gelderblom Consulting

GUIDELINES FOR THE SUSTAINABLE HARVESTING OF WILD HONEYBUSH

EADP 696: THE DEVELOPMENT OF GUIDELINES FOR THE SUSTAINABLE HARVESTING OF WILD HONEYBUSH

DATE: MARCH 2017

AUTHOR: GILLIAN MCGREGOR

PROJECT MANAGER: ALBERT ACKHURST, HEAD OF COMPONENT: BIODIVERSITY MANAGEMENT, DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND DEVELOPMENT PLANNING

SERVICE PROVIDER: CAROLINE GELDERBLOM CONSULTING

ACKNOWLEDGEMENTS: *Project Manager*: Albert Ackhurst, WC DEAD&DP

Consultants and Expert Advisors: Marinda du Plessis, Prof. Richard Cowling, Dr Shirley Pierce Cowling, Sam van der Merwe, Jan Vlok, Dr Wayne Vos

Student Assistants: Yondela Norman, Matt Sephton, Roxy Starkey, Wouter Van Der Walt, Mike Cohen

Workshop Facilitators: Lesley Richardson, Kirsten Retief, Rupert Koopman, Roger Bailey

Workshop participants at the Louterwater Workshop, 31 January 2017 who contributed their knowledge and experience of the wild honeybush industry

Albert Ackhurst (WC DEA & DP), Andries Gerber (Brandhoek Farm), Asanda Zulu (WC DoA), Mr Bakwa (Kransfontein Farm), Barry Jacobs (Groot-Brakrivier Council of Stakeholders), Baxolele Ngxaka (Kransfontein Farm), Chris Herselman (SAHTA, Walletjies Farm), Denny Davids (Haarlem Honeybush Trust), Dick Carr (Eden to Addo Conservation Initiative), Eric Jacobs (Khoi Gamkwa Huis, Council of Stakeholders), Eugene Smith (SAHTA, Zusterkraal Farm), Eunice Nortje (Melmont Honeybush Tea cc), Quinton Nortje (Melmont Honeybush Tea cc), Ewald Gerber (Brandhoek Farm), Gavin Barclay (Bel Wind Energy), George Ferreira (Heights Enterprises), Gerrie Ferreira (EC DEDEA), Gert September (Melmont Farm), Greg Wilmans (Mountain To Ocean), Hannes Arendse (Haarlem Honeybush Trust), Helgaard Ackermann (Honeyblossom Tea Traders), Ian Terblanche (WC DoA), Ilse Kamineth (Ouldbuch worker), Isaac Intoll (Khoi San Gounukwe Huis Council of Stakeholders), Jan Louw (Haarlem Honeybush Trust), Johannes Arendse (Haarlem Honeybush Trust), Johnson Botha (Tsitsikamma Honeybush Tea Association), Juanita Krauspe (Kransfontein Farm), Karina Brits (Brandhoek Farm), Kim van Niekerk (WC DoA), Marina Jordaan (EC Dept. of Rural Development and Agrarian Reform), Megan Bruintjies (WC DoA), Michelle Kinghorn (Herold Meander), Neil Crouch (SANBI), Nico Ferreira (Kouga Wildernis Farm), Pieter van Rensburg (Heights Enterprises), Prince Ramafalo (DEA), Quinton Willeman (Melmont Farm), Sanie Mungulwe (DEA), Tebogo Mashua (DEA), Theo Adams (Herold Meander), Thinus Viljoen (SAHTA), Willem Brits (Honeybush Natural Products), Willem

Possel (Khoi San Gounukwe Huis Council of Stakeholders), Yolande Le Roux (Tsitsikamma Honeybush Tea Association)

Field visits and interviews

***Farmers*:** Peter Norris, Nico Ferreira, Quinton Nortje, Eunice Nortje, Eugene Smith.

***Harvesters*:** Herbert Prins, Gert Prinsloo, Kobus Camphor, Ricardo Saaiers, Owen Malotodi, Gert September, Quinton Willeman

***Harvest Managers*:** Jan Haarhof, Jan Hektor, Christo Schutte

Victor Cunningham (SANParks), Dr Tieneke Kraaij (NMMU)Rhoda Malgas (Stellenbosch University), Dr Alistair Potts (NMMU), Dr Annelise Schutte Vlok (Cape Nature), Jan Vlok (Consultant)

CITATION: McGregor, G.K. (2017). Guidelines for the sustainable harvesting of wild honeybush. Department of Environmental Affairs and Development Planning, Cape Town.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS & ABBREVIATIONS

ARC	Agricultural Research Council
CD: NGI	Chief Directorate National Geospatial Information
CFR	Cape Floral Region
CoP	Community of Practice
DAFF	Department of Agriculture, Forestry and Fisheries
DEA&DP	Western Cape Department of Environmental Affairs and Development Planning
DEA	Department of Environmental Affairs
EC	Eastern Cape
ECPTA	Eastern Cape Parks and Tourism Agency
GPS	Global Positioning System (device)
GDP	Gross Domestic Product
HPAC	Honeybush Project Advisory Committee
NMMU	Nelson Mandela Metropolitan University
RU	Rhodes University
SAHTA	South African Honeybush Tea Association
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
EC DEDEAT	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism
WC	Western Cape
WC DoA	Western Cape Department of Agriculture

1. BASIS FOR THESE GUIDELINES

This is a technical document which presents existing knowledge used to develop recommendations towards Best Practice in the wild honeybush industry. The term honeybush here refers to the various plant species belonging to the genus *Cyclopia,* and covers those species which are commercially used to produce tea. The system of harvesting wild honeybush is complex and in many ways, unpredictable by nature. In developing the guidelines for the sustainable harvesting of wild honeybush, the economic, environmental and social aspects of the industry have been considered. The principle thinking behind the guidelines is the fact that renewable resources should be managed in such a way as to provide a sustainable yield, or, more directly: the rate of harvest should not exceed the rate of regeneration (Daly, 2005). The international market for herbal teas such as honeybush tea comprises sophisticated consumers who are increasingly demanding of Best Practice and sustainable methods in the production of the products they buy.

These guidelines recognize the fact that honeybush farming is part of an existing economic system, and that there will be ecological compromises in order to keep the economic system functioning. However, there are some basic ecological principles which need to be considered which will support ecological and economic sustainability. With the implementation of some simple and ecologically sound management principles, it should be possible to continue to reap the benefits of wild harvesting of honeybush.

These guidelines are a first attempt at developing a formal set of guidelines for the wild harvesting of honeybush, with a focus on *C. intermedia* as it is by far the major resource of the honeybush tea industry. The foundations on which these guidelines are based are listed below; they indicate both the strengths and weaknesses of the guidelines.

- The primary data and information on which these guidelines are based were collected methodically from interviews, field observations and measurements taken in the field with harvesters and farmers who have long experience in the wild harvesting honeybush industry;
- No long-term scientific monitoring has been carried out on wild *Cyclopia* populations (although some monitoring sites have now been set up). The best information that exists which relates to sustainability is long term historic harvest yield data from farms correlated with annual climatic conditions;
- The guidelines are based on best available secondary data (e.g. plant localities) supplemented with field data and expert information gathered during the course of the three month project. These experts are named in the Acknowledgements section. Where appropriate, these data are supplemented with other data (species distribution, threats, etc.) collected on *Cyclopia intermedia* by the project leader over a period of three years;
- The guidelines are supported by the best available ecological evidence (published material and expert knowledge);
- These guidelines are only applicable to land outside of formal protected areas; they do not address harvesting in protected areas which are considered to be sanctuaries of honeybush genetic diversity, as well as biodiversity;
- The guidelines deal only with *C. intermedia,* which makes up about 85% of the wild harvested crop. Information on the other four species is presented in a limited way in the introductory material owing to a lack of available data, while information on the fifth species, *C. plicata* is almost non-existent;

- It must be emphasized that it is risky to make generalizations owing to the high variability and complexity of the wild harvested industry. The variation lies in:
    - Environmental factors including rainfall, fire, micro-climate, seasonality, pests, genetic diversity;
    - Harvest team factors: desire to harvest, economics, accessibility, harvest day weather conditions, variation in capacity within harvest teams;
    - Landowner factors: desire to harvest, availability of harvesters, need for income, attitude to conservation;
- The scale and physical extent of the study area is substantial, crossing mountain ranges, from the coast to 100km inland, with an east/west extent of 500km, which inevitably introduces further complexities (See Figure 1);

The range of harvest sites and types of harvest teams which could be assessed during the period of this project was limited by time and a lack of commitment to appointments made by some harvest teams.

2. USE OF THE HONEYBUSH WILD RESOURCE

Honeybush has a long history of use as a tea, emerging from traditional use into a cottage industry (Joubert et., 2011). But times have changed, the demand has escalated and harvesting methods have had to adapt to the industry's requirements and no longer resemble traditional ways. This Project was initiated in response to the increase in resource use and the threats to the sustainability of the industry which is obviously reliant on the persistence of honeybush populations. The opening of trade with overseas markets has seen a significant increase in demand for many indigenous and natural products, including honeybush. The market has grown from a cottage industry to a commodity and hence demand now exceeds what the wild resource can safely yield. In only the last 20 years, the industry has moved from a position where the wild harvested crop was sustainably used, to a situation where the wild resource is under pressure in several areas across its range. One solution has been the promotion of cultivation of selected species of *Cyclopia* which is proving to be successful, though expensive to develop. The cultivated species include: *C. subternata, C. genistoides* and more recently, *C. longifolia*, while *C. intermedia*, at this stage, is used less as it tends to grow too slowly. Despite the increase in cultivation, the wild harvested crop continues to contribute about 80% (2016) of the annual harvest, as well as providing livelihoods for 100-150 harvesters, as well as income for many farms with marginal agricultural potential. This and the fact that several wild harvested species have been listed as declining (Red List of South African Plants, 2017), has prompted the need for a co-ordinated and sustainable wild harvesting approach. In order to sustain the crop as part of a natural functioning system which provides other benefits (water catchment, soil retention, pollination services etc.) we need to take cogniscance of harvesting methods that will ensure a sustainable cropping regime and which will sustain the ecosystem as well as livelihoods into the future.

While honeybush species have a natural ability to recover by resprouting or reseeding, harvesting during the wrong season or at too-young-an-age can prevent flowering and seed set, thus reducing the resilience of a population to the vagaries of drought and fire. Too frequent cropping can also weaken the plants. Therefore, there is a need for guidelines to be in place and to be enforced to ensure the sustainability of the wild harvested crop.

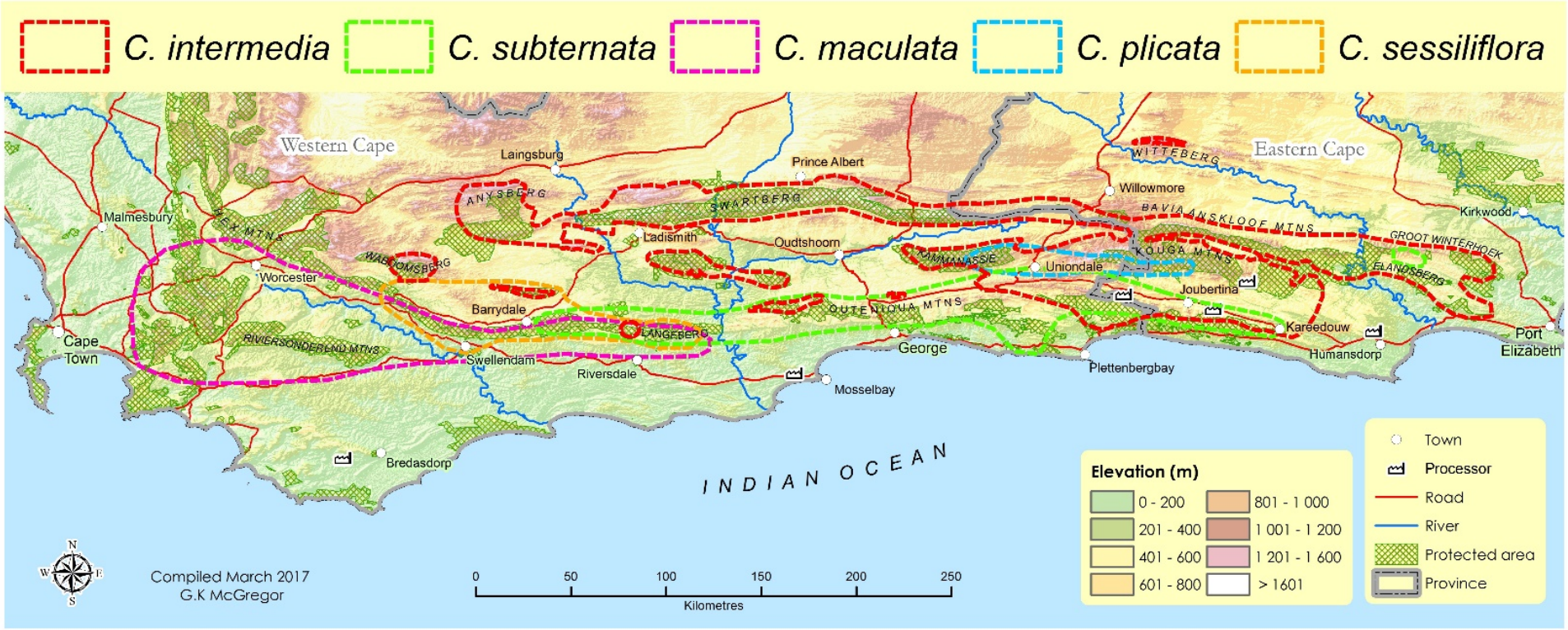


Figure 1: The distribution of the five commercially important wild harvested Cyclopia species. The map also shows the extent of protected areas in the study area.

2.1 Let the story of kustee (*Cyclopia genistoides*) be a lesson

Cyclopia genistoides or 'kustee' is seen as the 'original' honeybush, possibly because it occurs on the Cape Peninsula where early European settlement and early botanical research took place. Yet today, it is no longer wild harvested anywhere: enquiries at the time of this research project yielded no knowledge of wild harvesting. It is listed in the Red List of South African Plants (2017), as 'Near threatened,' and has lost about 25% of its former distribution extent to land transformation. However, selections of *C. genistoides* have been selectively bred for cultivation and form the basis of some substantial cultivated stands on the Agulhas Plain.

2.2 Overview of honeybush

The 23 *Cyclopia* species are members of the legume or pea family, distinguished by bright yellow, sweet smelling and characteristic pea-like flowers. The genus is endemic to the fynbos biome and the plants are well adapted to the acidic, mostly sandy, nutrient-poor soils of the coastal plains and mountainous regions of the winter and bimodal rainfall regions of the Eastern and Western Cape provinces. In common with many other fynbos groups, *Cyclopia* is fire-adapted and almost entirely dependent on fire for seed germination.

There are seven species which are important from a commercial perspective: this document will only deal with those five species that are significant in the context of wild harvested *Cyclopia* species, with a focus on *C. intermedia.*

C. intermedia (bergtee)*,* has the widest range of all honeybush species with populations distributed across the Cape Fold mountains (see Figure 1). The most western populations occur in the Waboomsberg (North west of Barrydale), the furthest inland in the Witteberg (North of Willowmore), and the most easterly in the Vanstadens mountains, west of Port Elizabeth. Other mountain areas in which *C. intermedia* occurs include the Witteberg (between Laingsberg and Touws Rivier), Anysberg, Swartberg, Touwsberg, Rooiberg, Kammanassie, Kouga, Baviaanskloof, Langeberg, Outeniqua, Tsitsikamma, Elandsberg and Langkloofberge (Schutte, 1997, Manning and Goldblatt, 2012; Vlok, J.H.J., 2017, pers. comm.)

The recent growth in demand has seen the promotion of cultivation of selected species, supported by 20 years of research by the ARC, in order to increase production and take the pressure off the wild crop. Thus far, cultivated crops cover some 147 ha (reported by SAHTA chairperson, Eugene Smith at CoP meeting, George, Nov 2016) of which about 131 ha are grown in the Western Cape. There are plans for the substantial growth of the sector in the Eastern Cape (Hobson and Joubert, 2011). Nonetheless, the wild harvested plants provide the vast bulk of production and are more than likely to continue to do so for some time into the future.

2.3 The Cape Floral Region and the Fynbos: the value of an intact biome

The Cape Floristic Region (CFR) stretches from the Northern Cape, north of Nieuwoudtville, to near Port Elizabeth in the Eastern Cape. It covers only 90 000 square kilometres, yet is home to 9600 plant species, 6500 of which are endemic. In 2015, the economic value of this remarkable vegetation was estimated at 13% of the GDP of the Western Cape. It supports the following "green" industries as part of the ecosystem services it delivers:

- The wild flower industry, with a value of R150 million per annum, 80% of which is foreign exchange (Chadwick, 2015);
- The Rooibos industry which is valued at around R500 million per annum and creates jobs for around 8000 farm labourers (DAFF, 2015);

- The Honeybush industry with an average annual export of about 390 tons with an export value of R23 million [1];
- Western Cape eco-tourism which provides 13% of the region's gross income and provides employment for 180 000 people (Chadwick, 2015);
- Water production: the mountain catchments of the CFR provide 7.2 billion cubic meters with an estimated value of R3.6 billion per annum (Chadwick, 2015).

Most of the Cape Floristic Region is covered in fynbos vegetation, and this area is known as the fynbos biome (illustrated in Figure 1). Fynbos is characterized by the presence of members of three plant families, the Proteaceae, the Ericaceae, and the Restionaceae. It is here that the various honeybush (*Cyclopia*) species occur. Six of these species are of commercial value in the wild harvested and cultivated context. A localized endemic, and seventh species, *C. longifolia* is emerging as a highly productive cultivated crop, although it is too sparse to be harvested in the wild. The distribution range of the various wild harvested species of commercial value is shown in Figure 1. (*C. genistoides* is not shown as it is no longer wild harvested).

The wild *Cyclopia* crop harvest which makes up 80% (average from 2010 to 2016) [2] of the annual harvest of around 915 tons of wet tea , is transformed into about 412 tons per year (average from 2010 to 2016) of processed tea for export. Of the wild harvested crop, about 85% is derived from populations of widely distributed *Cyclopia intermedia* ('bergtee') which grows at altitudes above 600 m, mostly on south facing slopes of the Cape Fold mountains from Port Elizabeth in the Eastern Cape to Barrydale in the Western Cape and as far inland as the Wittberg mountains, north of Willowmore. Some populations occurred on flatlands or lower slopes which are now largely transformed. The contribution from cultivated stands (*C. genistoides* and *C. subternata*, and the new crop, *C. longifolia*) is increasing by about 10% per year and is set to rise rapidly as more plantations come in to production.

2.4 Conservation and conservation status of commercial *Cyclopia* species.

In order to get some idea of the conservation of *Cyclopia* species within protected areas, herbarium records in the SANBI BODATSA (formerly PRECIS) database were interrogated (Table 1.) Although herbarium records are not an accurate reflection of populations (biased by collecting opportunities), some idea of protection can be gained. Of the commercial species listed, five give the impression that they are well represented in formally protected areas (greater than 40%). However, *C. genistoides* appears to be under-represented in protected areas, which is a matter of concern.

In the case of *C. intermedia*, which is mainly a higher altitude species, much of the species distribution range falls in mountain water catchment areas and the populations are therefore well represented in formally protected areas. These are indicated on the map (Figure 1) and include: the Baviaanskloof Nature Reserve, Kammanassie Nature Reserve, the Garden Route National Park, Formosa Provincial Nature Reserve, Gamkaberg Nature Reserve, Rooiberg Nature Reserve, Towerkop Nature Reserve, Anysberg Nature Reserve, Groot Swartberg Nature Reserve. There are

[1] Perishable Products Export Control Board (PPECB) data for the period 2010 to 2016, shows an average annual export of 390 tons per year of processed tea. If the bulk price for tea is R60/kg, then the export value of processed tea is 390txR6000, which is around R23 million.

[2] Perishable Products Export Control Board (PPECB) data for the period 2010 to 2016, shows an average annual export of 390 tons per year of processed tea. If this represents 85% of the average annual crop, then the total crop would be 459 tons. If on average, 80% of the crop is wild harvested, then 366 tons of this comes from the wild. If the loss of moisture in processing is about 55%, then the total annual average of wild harvested honeybush is 732 tons.

also some privately owned reserves, including Skilderkrantz Nature Reserve) and Kromme Riviers Hoogte Nature Reserve. Both are biodiversity stewardship sites situated near Joubertina, and conserve *C. intermedia*.

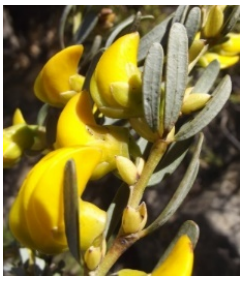
Table 1: Records of herbarium specimens of six *Cyclopia* species.

Species	Total no. of locality records in BODATSA (formerly PRECIS)	% of localities in formally protected areas
C. intermedia	60	50
C. subternata	36	41
C. genistoides	22	18
C. maculata	23	43
C. plicata	14	75
C. sessiliflora	19	65

Using a GIS based model, and data from expert mapping, locality records and field observations, *C. intermedia* is shown to be distributed across an area of approximately 13 900 km^2 (Figure 4). Of the potential honeybush-bearing land area (based on aspect elevation, vegetation type and geology) of 2520 km^2, 1395 km^2 occurs in formally protected areas while 1125 km^2 of land is privately owned. Therefore, *C. intermedia* appears to be well represented in protected areas, with extensive areas which are very remote and mostly inaccessible.

If guidelines towards sustainability are to be formalized, levels of threat to the relevant species need to be considered. This is broadly similar to the vulnerability index developed by Flower Valley Trust (Privett *et al.*, 2014) to ensure sustainable harvesting of cutflowers. Hence the conservation status of the commercial honeybush species as listed in the Red List of South African Plants is replicated in Table 2.

Table 2: Conservation status of commercial wild harvested *Cyclopia* species, replicated from the Red List of South African Plants (2017).

Cyclopia sp.	Status	Description	Image
intermedia	Declining	This is the most widespread of species in the genus *Cyclopia*. Harvesting of wild subpopulations to supply the honey bush tea industry is widespread. Overharvesting is causing declines to subpopulations particularly in the Langkloof, Tsitsikamma and Kouga mountain ranges. Proper regulation and management is needed to ensure sustainable harvesting within this trade.	*N. Barnado* 
subternata	Declining	Although still fairly common, this species is declining due to harvesting of wild subpopulations to supply the honey bush tea industry. Overharvesting is causing declines to subpopulations particularly in the Langkloof, Tsitsikamma and Kouga mountain ranges. Proper management and regulation is needed to ensure sustainable harvesting takes place within this trade.	*G.K.McGregor* 

Cyclopia sp.	Status	Description	Image
genistoides	Near Threatened A2bcd	Past harvesting of wild subpopulations to supply the tea industry has probably caused the decline of this species. Possibly more significant has been the habitat loss in lowland populations due to urban development and crop cultivation. Decline in the population over the past three generations (150 years) is suspected to be 25%.	*PLANTZAFRIKA* 
maculata	Near Threatened B1ab(iii)	This species is declining due to water abstraction and alien acacia invasion. It occurs in a habitat that is particularly prone to dense invasions. It is also harvested for the honey bush tea industry.	*SAHTA* 
plicata[3]	Endangered B1ab(iii,v)+2ab(iii,v)	Severely threatened by harvesting for honey bush tea. No regrowth has been observed in severely harvested individuals in the Kammanassie Mountains. This reseeding species is also affected by altered fire regimes and is likely to decline if fire return cycles are too frequent.	*A.L. Schutte Vlok* 
sessiliflora	Near Threatened B1ab(v)+2ab(v)	One of the species harvested for the honey bush tea industry. This species is declining due to overharvesting.	*G.K.McGregor* 

2.5 Introduction to the industry: the wild honeybush landscape

The wild honeybush industry is presented by way of a diagram (Figure 2) illustrating the various components of the industry. Each component or stakeholder is discussed here starting with the Land Base which is the foundation on which the whole system rests.

[1] Though *C. plicata* delivers poor taste, it is blended 1:1 by weight with bergtee to add bulk. Its use in secondary products such as cosmetics is likely to increase harvesting pressure.

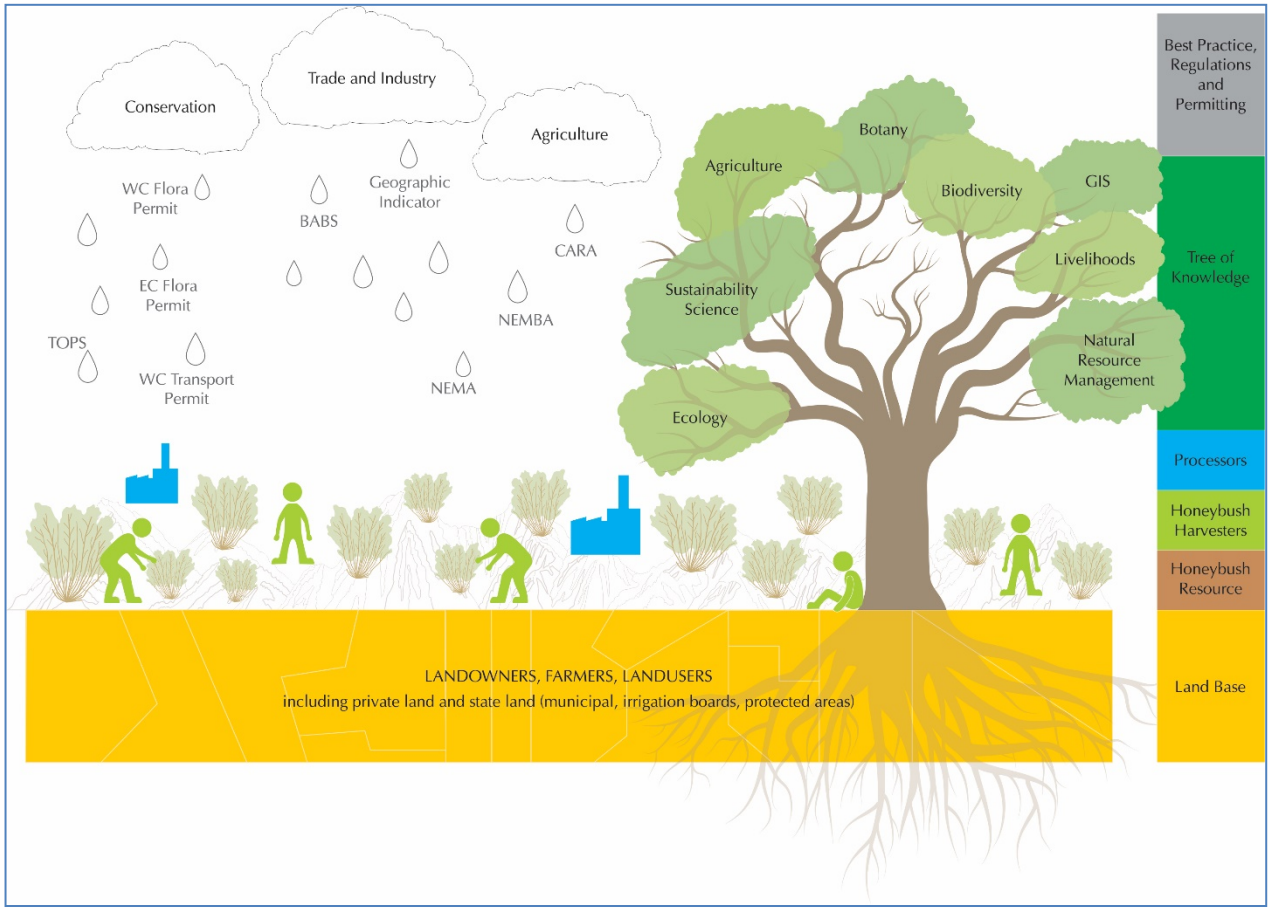


Figure 2: The wild honeybush landscape.

- ***The Land Base: landowners, farmers and landusers***

Wild honeybush-bearing lands which are harvested, occur on the slopes of the Kouga, Tsitsikamma, Outeniqua, Elandsberg, Grootwinterhoek, Kammanassie and Langkloof mountains. There appears to be no record of harvesting for commercial purposes in the wild in the western parts of the *Cyclopia* distribution range, beyond about 100km west of Uniondale. The land on which honeybush is harvested is mostly privately owned. There are about 75 permit holders in the Eastern Cape who harvest wild honeybush, and probably about 50 farmers/landowners/landusers in the Western Cape who harvest wild honeybush. There are many areas where honeybush occurs where it is not harvested, including privately owned farms, private reserves and formally protected areas under the management of ECPTA, Cape Nature and SANParks. Heavily utilized areas include 'public' land, managed by local municipalities and irrigation boards.

- ***The Honeybush Resource: wild harvested honeybush***

The commercial wild harvested honeybush crop consists of 5 species: bergtee (*C. intermedia*) makes up 85% of the harvest, while vleitee (*C. subternata*) constitutes about 10% of the wild crop. Small quantities of *C. maculata*, and *C. plicata* are harvested and processed by one of the four processing plants (about 5%) and *C. sessiliflora* is also still harvested periodically on farms in the Heidelberg area. Processors prefer bundles to comprise only one species. There is no evidence to suggest that *C. genistoides* is harvested in the wild in any quantity sufficient to process at a processing plant. There is some variation in local names for the various honeybush plants: *vleitee* may refer to *C. maculata* or *C. subternata* (used in this report), while *bergtee* may be *C. intermedia* (used in this report), *C. sessiliflora* or a variant of *C. maculata*. Sometimes *C. intermedia* is referred

to as '*die heuningbos*'. The distribution range of the commercial wild harvested species is shown in Figure 1.

- ***The Honeybush Harvesters***

Harvesting of honeybush is traditionally carried out by teams of mostly male harvesters, many of whom have a family tradition of harvesting. Harvesters usually only work a four day week because the work is physically demanding. They may cover up to five kilometres in the course of a working day in their search for honeybush, in difficult mountain terrain. An assessment of the harvest loads for a team with an average of eight harvesters over a period of 14 years, shows tremendous variation in harvest loads: from 20kg to 225kg per day, per harvester, with an average of 94kg per harvester over the 14 year period. Low harvest loads may be due to bad weather, inexperience, broken equipment, disruption by big game animals… *etc.* Harvesters earn from R1.50 per kg to R3.50 per kg (2017 rates) depending on the difficulty of access at the site. An experienced harvester may earn R1200-R1500 per week. Despite the physical demands of the job, the benefits of being a honeybush harvester as cited by all harvesters interviewed during the course of this Project include the freedom of the harvesting task, the aesthetics of the environment in which they work and the opportunity to earn more than a basic wage.

The harvest teams vary in composition, experience and the way in which they operate. Four team 'structures' have been identified:

- Contract harvest teams of around ten members with an experienced harvest manager;
- Small family teams of about four members with a senior family member as the harvest manager;
- Permanently employed farm labourers; one of their responsibilities is harvesting honeybush;
- Casual labour in loosely associated teams.

- ***The Processors***

There are only six formal processing plants who receive the harvested crop. Four of these processors receive wild harvested honeybush, and are located in the Eastern Cape. The two Western Cape processors only process cultivated harvest material. Five of the six processing plants are located on farms which produce their own honeybush harvest, from wild and /or cultivated sources.

The crop is delivered to the factory where certified organic *C. intermedia* fetches approximately R12 per kg, while other species fetch R10 per kg (price in March 2017). The tea is processed by chopping with a tobacco cutter, then sweated in heated drums, then dried to produce the tea. The process is energy intensive, particularly since sun drying has been excluded to prevent contamination from open air drying. The moisture loss from the green crop is high, on average about 55%. Mature *C. intermedia* only loses about 45% in weight (Q. Nortje, 2017, pers. Comm.), but *C. subternata* and *C. maculata* may lose up to 65% (M. Joubert, 2017, *pers.comm.*). The season may also affect the plant weight and subsequent weight loss in processing. Table 3 shows some retail prices for honeybush tea on the international and local market. The figures in the table highlight the fact that there is so little value-adding in South Africa; the major product is exported in bulk and fetches a high price once packaged.

Table 3: Retail value of honeybush tea on the overseas market and the local market. All weights are converted to a 'Rand per kilogram' value for comparison, using current exchange rate values (March 2017).

Product	Weight	Price	Rand per kilogram ($ 12.8, €13.7, £15.7)	Source
Overseas				
African Dream Honeybush Blend	50g	$ 4. 75	1216.00	Blue Teapot
Honeybush Original Organic	50g	$ 4.25	1088.00	Blue Teapot
Honeybush	85g	€ 6.50	1047.00	Adagio teas
Honeybush Tea (natural)	50g	£ 1.70	533.80	Tea story
Honeybush	100g	£ 6.00	942.00	Imperial Teas
Francis & Green, Organic Honeybush	200g	£ 8.29	650.70	Amazon
South Africa				
Honeybush Tea *(C. Intermedia)*	50g	R65.00	130.00	Medica Herbs
Numi Tea Honeybush	45g	R89.68	199.30	eVitamins
Melmont Honeybush Tea *(C. intermedia)*	300g	R38.00	114.00	Kareedouw Supermarket
Cape Honeybush (Cult. *C. subternata*)	250g	R35.00	140.00	Cape Honeybush

- ***The Tree of Knowledge and Science***

This includes all the areas of research which contribute knowledge to understanding the wild honeybush system, including agriculture, horticulture, ecology, geography, botany, economics, sociology, natural resource management, livelihoods, policy and legislation and possibly many others not illustrated here.

- ***Best Practice, Regulation and Permitting***

Of particular relevance to harvesters of honeybush are the permitting systems in the Eastern Cape for wild harvesting or cultivation which are specific to *C. intermedia* and *C. subternata*. These are dealt with in section 4.2. The Western Cape requirements for permits are general for any fynbos cropping and transport. National policy and legislation relevant to the honeybush industry is detailed in the earlier report in this Project by De Villiers and McGregor, 2017: *Review of the regulatory and policy framework relating to the harvesting of wild honeybush (*Cyclopia *sp.)*

The honeybush industry represents a complex system, in which relationships are non-linear, and often unpredictable. Understanding the system requires knowledge of all the factors which make up the system. Promoting a sustainable approach to the wild harvesting of honeybush requires an adaptive management response with regular updating.

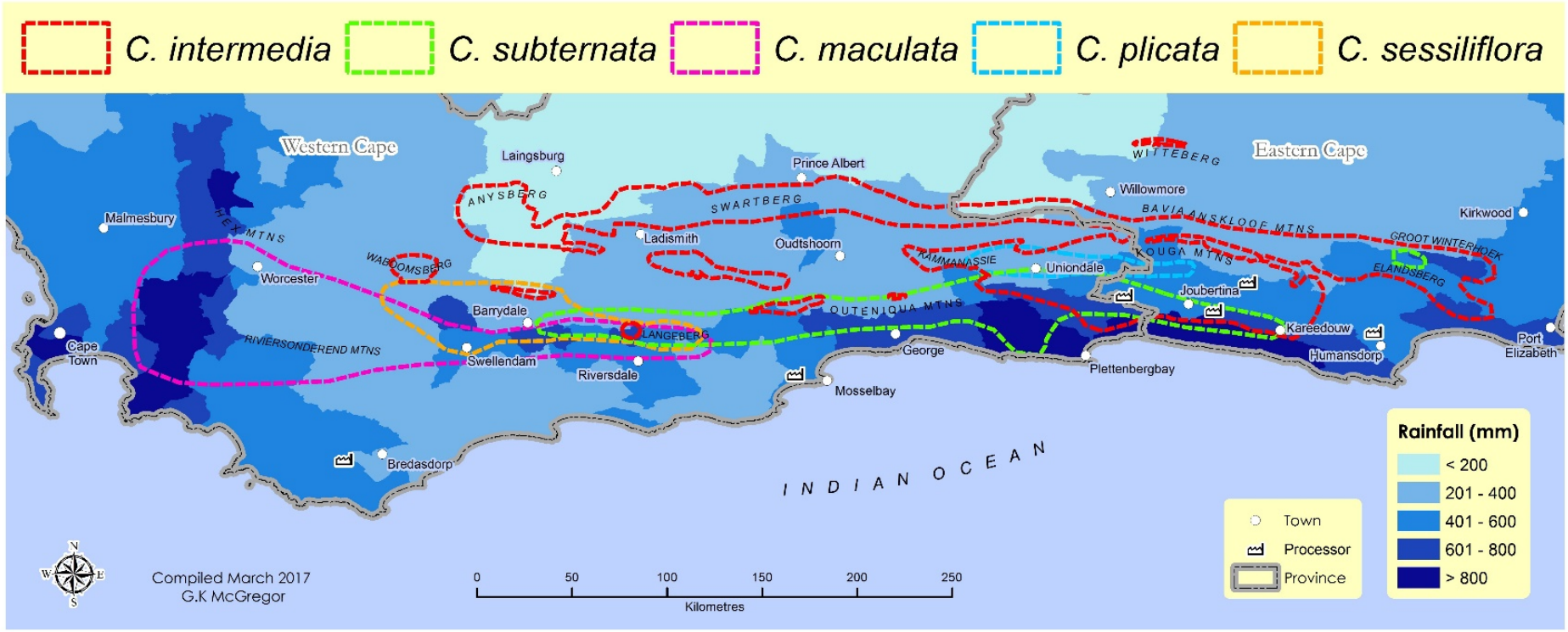


Figure 3: Rainfall across the honeybush study area.

2.6 Environmental variables

The rainfall zones across the study area are indicated in Figure 3. Most of the honeybush-bearing lands fall in a rainfall zone of 200-600 mm, where rainfall is supposedly concentrated in winter but is actually bimodal. The map is based on long-term rainfall records for South Africa over a 70 year period of record (Schulze, 2007) and represents an average rainfall figure. There may be significant variation from year to year and from one micro- or meso-climate to another.

Higher rainfall areas cause the plants to grow more quickly to reach a potentially harvestable size in a shorter time. This does not mean that the harvest interval should be aligned with plant size.

Based on observation and anecdotal evidence, there is a close relationship between the occurrence of *C. intermedia* populations and mist, which may be the only source of moisture in many areas for many months of the year.

3. SUSTAINABLE HARVESTING LIMITS AND METHODS

3.1 Understanding the honeybush plant

This section provides general information on the ecology and harvesting of the five commercial honeybush species. Thereafter, it provides the ecological background explaining the need for different approaches to harvesting in order to achieve sustainable management of the resource. The best available desktop/secondary information is given on all the wild harvested species; some detail on *C. subternata* is given in section 3.3.1 (as representative of a reseeder) while the guidelines deal in detail with *C. intermedia* (representative of a resprouter).

Table 4/...

Table 4: Wild harvested *Cyclopia* species. Summary and information collected on harvesting and state of resource from existing published materials and input from experts . (Source: own data, Joubert 2011, Schutte-Vlok 1997).

Species	Elevation range (a.s.l)	Soils	Geology	Type	Notes on current practices (sustainability unknown) GM: G. McGregor; AV:A.Schutte Vlok; MJ: M. Joubert; RM: R. Malgas; CS: C. Schutte; MonJ: Mona Joubert
C. intermedia	500-1700m	Rocky, loamy, sandy soils	TMS	Sprouter	**See main guidelines**
C. subternata	160-1000m	Well-drained, stony, loamy soils	TMS	Reseeder	**See notes under section 3.3.1**
C. sessiliflora	300-1500m	Well-drained loamy, sandy soils	TMS & Shale	Sprouter	**GM**: Cropped every 2 years, when in flower (for visibility). Commercially harvested in the Heidelberg area, one farm produces 2-3 tons every 2 years. **AV**: Harvested on the Langeberg Mtns, unsure of amount. **MJ**: *C. sessiliflora* is a sprouter and slow growing. Harvest every 3-4 years. Extent of populations limited.
C. maculata	150-830m	Wet, peaty soils	TMS	Reseeder	**RM**: Still actively being harvested at Genadendal. It seems as though there is another species/ecotype that is also harvested for tea-making. **MJ**: Some in Genadendal area and also in the Langkloof. Harvest at knee height, about 30-50 cm from the ground, with green material remaining on the plant.
C. genistoides	600-1170m	Sandy soils		Sprouter	**AV**: Used to be wild harvested, but has become scarce. Maybe at a small, local scale in western part of the WC. The species has been recorded from the Peninsula to Bredasdorp. **MonaJ**: No knowledge of wild harvesting, only cultivation. *C. genistoides* in the wild has a slightly sideways way of growth, difficult to harvest as it requires uncovering the stems under the sandy soil to harvest. **CapeNature**: 5 officials commented: no knowledge of use north of Paarl/Wellington.
C. plicata	1000-1700	Shale bands in loamy, rocky soils	TMS & Shale	Reseeder	**AV**: Harvested on private mountain catchment land on the Kammanassie Mtns for commercial purposes and in the Kouga Mtns. There has been pressure on CapeNature to allow harvesting in the Kammanassie. **GM**: commercially harvested in the Haarlem area, 10-20 tons per year

3.2 Ecological background and underlying principles for sustainability in wild honeybush harvesting

This '*information box*' describes the ecology of honeybush in relation to the guidelines presented in this report. It deals with the ecology of reseeders and resprouters, in order to present the full picture and the contrasts between the two forms. As stated elsewhere in this report, the needs of the industry are not entirely compatible with the ecological factors which determine the persistence of populations of honeybush; certain concessions are suggested.

In simple terms, the leaves of the plant are its food factories. They have to be abundant and healthy to feed the roots and to produce flowers and the subsequent seed-bearing pods. Regular damage and removal of leaves by repeated harvesting does compromise the plant's ability to produce flowers and thus seeds.

When the pods are ripe, they turn black and the seeds are dropped. Honeybush seeds have small fleshy bits attached to them which are attractive to ants who carry the seeds underground to serve as a food source. In this way, the seeds are buried in the soil, safe from small mammals such as mice. These underground stores form seed banks.

Some buried seeds may be damaged, rot and disintegrate. So to make sure that seed banks maintain a healthy stash, new seeds need to be introduced. This ongoing need for a seed source must naturally be provided by the plant which must be healthy enough to grow, produce adequate flowers, pods and seeds each year.

Reseeders (non-sprouters)

Seed banks are vital for the long term persistence of populations of reseeding plants such as *C. subternata* which are burnt to death in fire. Under natural conditions, fynbos fires occur at a frequency in the order of 10 to 50 years. However, honeybush reseeders are post-fire pioneers which are likely to become moribund (on their last legs) after about 10-20 years (though there are a few individuals which can live longer). The heat generated by a fire cracks the hard seed coats of the buried seeds, which then germinate, become seedlings and establish as young plants. In this way plants killed by fire are replaced and the population is able to persist. So from an ecological point of view, the leaves – which are the food factories – should be left alone to support flower production and seed set. However, this is not feasible for the industry – harvesters need to earn income year-round, processors cannot leave their factories idle and to meet market demand, need a steady supply. Therefore it is recommended that a reasonable percentage of plants are left entirely unharvested, so that they can continue to produce seed. This is preferable to the practice of harvesting a portion of each bush as this is likely to weaken the plants. This will in turn affect subsequent seed set, and expose plants to infections. Cut plants are disadvantaged and unlikely to cope with any unusually harsh conditions.

The question may arise – how is it that honeybush reseeder species in cultivation can be cropped at an earlier age and more frequently than the harvest regime recommended for wild plants? Cultivated reseeders are usually planted one metre apart in ploughed or cleared fields (often old abandoned fields). So the plant roots are able to establish and absorb water and nutrients without any competition from other plant species. Thus they are able to grow faster and stronger than in the wild. They are also replaced by new plants when they are no longer productive.

Research has shown a general understanding of fynbos dynamics, but the ecology of its component plant species can be unpredictable. For example, areas of dense honeybush may burn, but no new young honeybush plants emerge after the fire. There may be many reasons for this. Ants may not have been active in the area resulting in seeds lying on the soil surface and vulnerable to predations by mice or even seed-eating insects. The seed bank may have been damaged or destroyed by an unusually intense fire with very high temperatures. Seed may have suffered a debilitating fungal attack owing to particular weather conditions. Conversely, there may be fynbos areas where no honeybush plants were growing. After a fire, dense patches grow. These may be the result of previous cool fires which were not hot enough to stimulate germination. The properties of the previous fire that burnt might have been favourable for germination, and the subsequent weather conditions might have been suitable for above-average success of establishing young plants.

Resprouters

The above-ground shoots and leaves of resprouting honeybush species such as *C. intermedia*, tend to be slower growing than reseeders. This is because food manufactured in the leaves – i.e. the food factory of the plant - is fed primarily to the underground rootstocks rather than to above-ground parts. After a fire has burnt the foliage, the plant is entirely dependent on its underground nutrient reserves to resprout; hence the importance of allowing for the nourishment of the rootstock.

In their efforts to understand vegetation, scientists identified the two strategies used by plants to persist after fire – i.e. resprouting and reseeding. This classification has been useful in understanding fynbos plants but has the downside of underplaying the vital role of reseeding in the lifecycle of resprouters. The production of seed and the build-up of seed banks is just as important for resprouters as it is for plants classified as reseeders.

It may be asked – why are the seed banks of resprouters such as *C. intermedia* so important – don't resprouters just sprout again after fire? The answer is yes, but resprouters do not live forever. Monitoring of growth forms within permanent plots in fynbos over 44 years showed that the number of resprouters declined significantly. Plants that die of old age can only be replaced by young plants emerging from buried seed.

Harvesting versus burning

Because fynbos is adapted to persist after regular fires, some may argue that harvesting is mimicking the effects of fire – as both effectively eliminate shoots and leaves. But harvesting is more detrimental than fire for the following reasons:

- Fire results in adding ash which has a "fertilizing" effect on the soil.
- All aboveground plants are eliminated, so resprouters with their sturdy rootstocks are able to access soil water and nutrients without any competition from surrounding plants – this advantage can last for a couple of years.
- Heat from fire stimulates seeds in the soil to germinate and new plants are able to establish and take the place of very old or sick mature plants.

From an ecological point of view, there is concern that harvesting by removing shoots and leaves from resprouting species is likely to have long term effects even while seed banks are being replenished. By regularly removing the plant's food factories, the underground rootstocks will be undernourished and mature plants may die earlier than normal. The implications of this shorter life span are not yet known.

From the above description of the plants' ecology, the following principles can be drawn:

- After a fire, honeybush plants need sufficient rest (in years) to recover, and grow enough shoots and leaves to support flower and seed production to replenish seed banks, and in the case of resprouters – nourish the rootstocks. Seed production and replenishment of soil-stored seedbanks are absolutely essential for both resprouters and reseeders.
- Flower buds which start developing as early as April need safeguarding.
- Very dry weather conditions preceding a proposed harvest cause stress to the plants and can weaken them to a state where they should not harvested.
- Small young honeybush plants in resprouter stands should be noticed and not trampled on to allow them to continue to grow into mature individuals.

Reconciling ecological principles with industry needs

To balance the plants' need to replenish the seed banks of both resprouters and reseeders, and to nourish the rootstocks of resprouters, while meeting the industry's needs, the preferred harvest regime would be to harvest only a percentage of the honeybush plants and to leave the rest untouched.

Augmentation of honeybush stands by supplementing with honeybush seed or seedlings

Staunch conservationists may not approve of augmentation, but it may be argued that it is not much different from managed 'wild' systems of naturally occurring veld, which is managed and used sustainably for stock grazing.

Spreading honeybush seed to increase the number of plants is likely to have mixed results. As seed is expensive to buy, and time-consuming to collect, it may be worthwhile to consider the ecology of honeybush plants before augmentation with seed is trialled

Supplementing with seeds

It is essential that only locally collected seeds are used to avoid ***genetic contamination***. If seeds from elsewhere are introduced into a new habitat, it is likely that the adults will interbreed with the local plants resulting in a change in their genetic composition. This can have serious consequences down the line, such as the plants lacking the genetic diversity to adapt to new climatic conditions. Also, it is important to protect wild relatives which are often used successfully in plant breeding to improve cultivated crops.

Seeding before a fire

Based on ecology, the seed should ideally be buried below the soil surface to avoid being eaten by small mammals. Burial also insulates against excessive heat from a fire, though some heat is needed to crack the seed and stimulate germination. Smoke from the fire can also influence germination. Timing is important – seed should be put out before a controlled burn which should occur shortly before the wet season to ensure moisture for the developing seedlings. Because fire destroys all the fynbos plants, the young establishing seedlings have a chance to access soil water and nutrients successfully without competing with mature fynbos plants.

Seeding after a fire

Another approach is to supplement after a fire. Ideally the seed should first be treated; this involves treating seed with acid or hot water to crack the seed coat to stimulate germination. The seed should then be put out in a burnt site just before the first autumn rains. A risk is that the exposed seed may be eaten by small mammals. It is not known if shallow burial could prevent this.

In unburnt sites, making a small clearing for the seed may work but the rooting systems concealed underground may outcompete any tiny newcomers. Deprived of access to soil water and nutrients, the seedling is likely to perish, especially after a hot, dry period.

Supplementing using seedlings

As mentioned above, there are always individuals that don't follow the norm. So sometimes seeds germinate and seedlings establish without fire. (Seed coats may be cracked by sand or wind.) Studies on fynbos have shown that these errant seedlings inevitably die, usually in dry periods, as they are unable to compete with the surrounding mature plants for underground resources. Such seedlings are uncommon, but it may be feasible to "save" them by transplanting into a semi-cleared area (e.g. an abandoned field) for them to survive in cultivation. (This is practiced in the buchu industry.).

Other studies have shown that when seedlings were planted into an old field, a ploughed old field and mature fynbos, the best survival was in the old field, where presumably conditions were more favourable (not as exposed to heat or wind as in the ploughed field, no competition from mature plants in the fynbos).

3.3 Harvesting methods for *Cyclopia species*

It has already been acknowledged in this report that while it is desirable for biological and ecological knowledge to inform sustainable harvesting, recommendations based entirely on this information would not be feasible or practical for the industry. Harvesting cannot be carried out in one particular phase of the plant's life cycle; many harvesters need year-round work, market demands are too great, factories cannot easily stand still for most of the year *etc.*

This section presents information on various aspects of harvesting based on the best available knowledge gathered from farmers and harvesters, supported by measurements and observations in the field. The investigation in this Report focused on *Cyclopia intermedia* owing to a three month time constraint for the project (including the December 2016 holiday period). Also, this species is the by far the most widely used and the major contributor to the industry (85%), and the fact that most information is available on 'bergtee.' However, a brief section on *C. subternat*a representative of a resprouter is presented below.

3.3.1 Harvesting of a wild reseeder - *Cyclopia subternata* (vleitee).

- ***Natural habitat***

Cyclopia subternata is usually found in milder micro-climatic conditions compared to *C. intermedia*. It is widely distributed along the Tsitsikamma, Outeniqua and Langeberg mountain ranges at elevations from 160-1000 m, where it is found in found in relatively large stands along drainage lines, in kloofs and around freshwater seeps. The plants usually have only one to three long branches, and can grow up to several metres tall.

As a reseeder, the plant is dependent on efficient seedling regeneration from seeds in the soil seed bank. The adult population is killed by fire, but new plants will germinate from the seed bank. The species may appear to disappear from an area for a period (D. Hodgson, 2015 pers. com., G. Ferreira, 2017, pers. com.) but can reappear unexpectedly when conditions are right for germination. In the wild the plants flower from around July to September and they will flower in the first year of growth. Given that their means of reproduction is by seed germination it is essential that the flowers be left to set seed and replenish the seed bank.

- ***Harvesting***

According to information from harvesters (J. Louw, 2017, pers. comm.) and workshop participants (Louterwater Workshop, January 2017) the plant is harvested all year round. The recommended harvesting interval is two years (M.Joubert, 2017, pers. comm.). In practice, harvesters will revisit a site every 18 months. They select and cut mostly the young green stems, at ankle to knee height, leaving about 50% of the plant uncut. The recommended height for cutting is 30-50cm from the ground (M.Joubert, 2017, pers. comm.). Based on discussions with harvesters, where *C. intermedia* and *C. subternata* grow in close proximity, *C. subternata* is less desirable to harvest because of the lower price paid for the plant.

- ***Threats***

According to 'expert mapping' information on threats to honeybush populations, there are many areas where *C. subternata* is illegally harvested. The availability of the plant in the low lying areas of the Tsitsikammas and Outeniquas which are easily accessed by road have made it vulnerable to illegal harvesting. Declines in the population in the Elands Valley near Port Elizabeth have been reported as a result of over-harvesting.

3.3.2 Harvesting of a wild resprouter – *Cyclopia intermedia* (bergtee): The harvest cycle and amount of cropping for *Cyclopia intermedia*

Two approaches have been identified which appear to be the most sustainable, based on historic harvest yield records.

1. Harvest return interval of 2 years, harvest only 50% of plants in the stand and leave the rest of the honeybushes uncut. After a fire, rest for at least three flowering seasons (three to five years).

   OR

2. Harvest return interval of 4-5 years, harvest only 60-70% of plants in the stand and leave the rest of the honeybushes uncut. After a fire, rest for at least three flowering seasons (three to five years).

Below is an example of the results of a harvest in a surveyed transect which illustrates these two approaches (Figure 4).

- Transect A, High density of plants (3320 per ha): 60-70% harvested, 30 -40% left;
- Transect B, medium density of plants (1840 per ha): 50-60 % harvested, 40-50% left

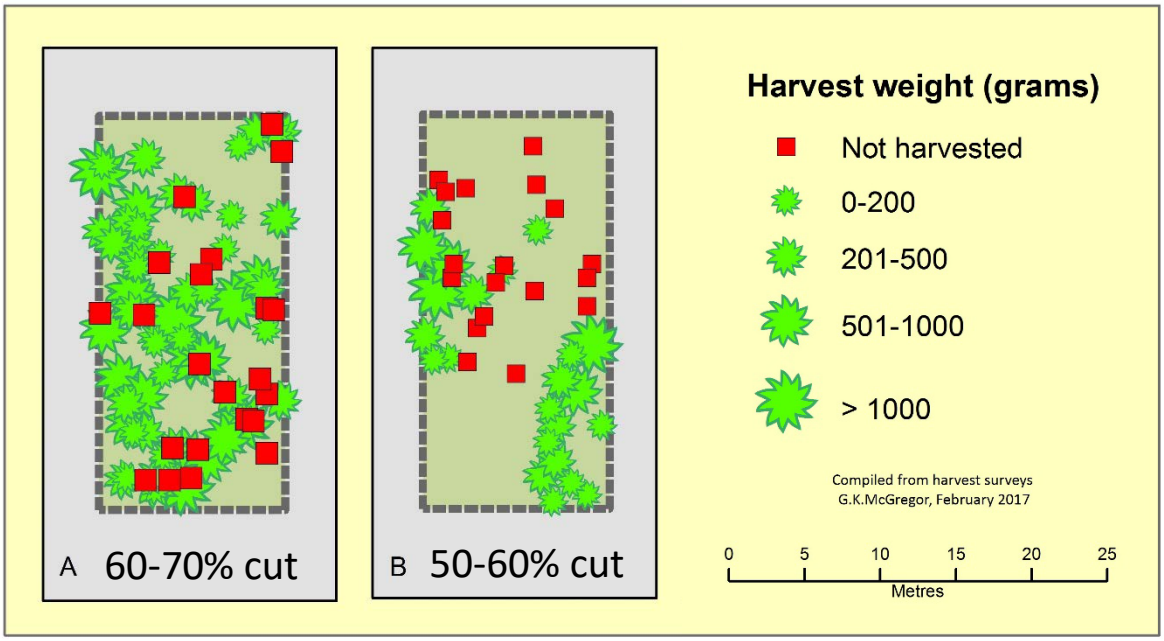


Figure 4: Harvest transects showing the size (yield weight) of plants in a transect and the percentage of harvested vs unharvested plants.

RECOMMENDATION

Based on methods used by practitioners with decades of experience, either of these approaches appear to support Best Practice for wild harvesting of bergtee. For practical reasons, the first option of more frequent harvesting is likely to be favoured, but the second option may be more ecologically sound, and in this way, potentially more sustainable. The removal of shoots and leaves weakens plants making them more vulnerable to infections and pests. Also their ability to produce seeds is reduced. By leaving untouched a significant proportion (50%) of the plants a honeybush-bearing site, these plants remain healthy and strong and able to produce an optimal seed crop. Harvested plants need to recover, show good flowering and produce as many seeds as possible. This usually takes two years depending on the time of year that the harvest is done. Usually in the first year after harvest, flowering is weak, then in the second year shows maximum seed production: thereafter flower and seed production dwindles.

3.3.3 The harvest layout for *Cyclopia intermedia*

Here follows an account of the practice of a team of experienced harvesters. In the field, team members spread out through a harvest site. Each member covers their own designated line or area; these are allocated partly according to rank within the team (i.e. less experienced workers, often youngsters, are given the more inaccessible sites to harvest). The diagram below, (Figure 5) based on tracking of a team of five harvesters shows a typical harvesting area layout. There should be enough space and sufficient quantity of honeybush to ensure that there is very little overlap of harvester tracks. This ensures that the plants deliberately left unharvested by one harvester are not harvested by a second harvester.

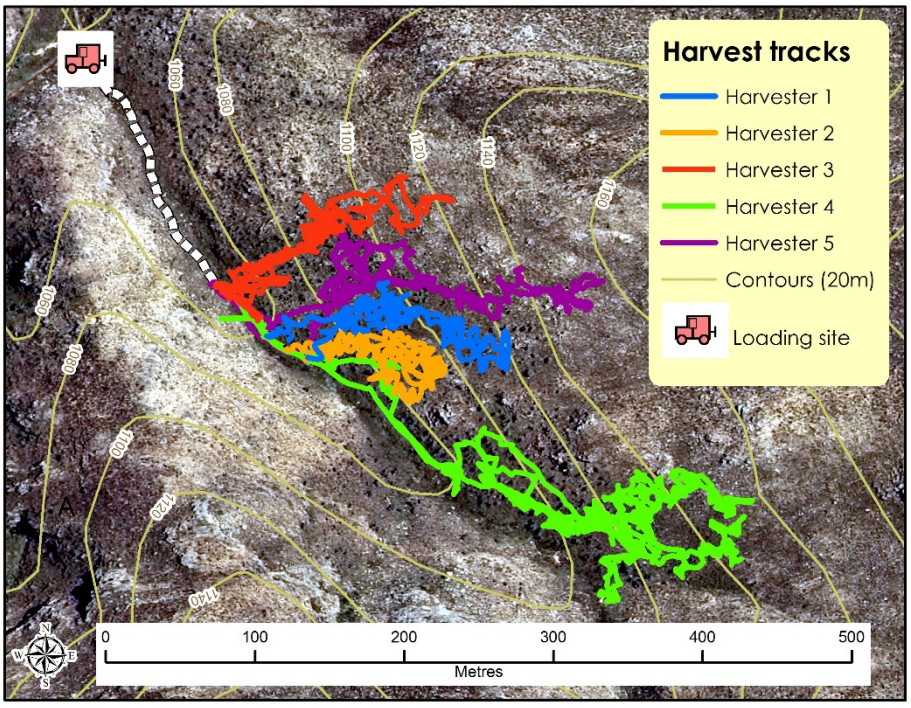


Figure 5: An example of harvester tracks, over the period of one harvest day at a harvest site. Overlap occurs only on the access path or where harvesters congregate for a break.

RECOMMENDATION

Based on methods used by experienced harvesters, it is important ensure that there is enough space at the harvest site of honeybush-bearing land per team member to ensure that harvesters crop conservatively, rather than over-harvest. For example, in veld of medium-density honeybush populations, where only 50% of the plants are harvested every two years, one harvester needs access to about 200 ha in order to earn a minimum wage for about 45 weeks in the year, over a two year period.

3.3.4 The cutting of *Cyclopia intermedia* plants

a) Choice of tools

Table 5: Choice of cutting tools.

Tool	Advantages	Disadvantage
Secateurs	Allows for selective harvesting of only the best stems thereby avoiding dead or old charred stems. Easier to avoid cutting or damaging other plant species.	Slow cropping action
Sickle	Speed of cropping	Potential for personal injury. Difficult to separate non-honeybush, or old burnt stems.

Figure 6: Use of harvest tools: A - sickle and B – secateurs.

RECOMMENDATION

Both tools are needed depending on requirement. Ideally tools should be sterilised (e.g. using jik) as often as is practicable during cropping, and also after each harvest day to avoid spreading infections.

a) Timing of day and season for Cyclopia intermedia

At very hot times of the day or season, working conditions for harvesters can be unacceptable. Also harvesting should not take place after/during especially hot, dry periods as the plants will be too stressed to endure cutting. Ideally flowering plants should be avoided.

b) Choice of Cyclopia intermedia *plants*

Stem colour: There is consensus amongst harvesters that stem colour is not significant in choice of plant for cropping because it is affected by environment as much as age of growth. Green stems (Figure 7, image D) should not be cut as this weakens plants. Also green stems are not ideal for flavour in the tea. A range of stem colours is illustrated in Figure 7.

Figure 7: Stem colours: A - yellowish, B - orangeish, C- Brown, all suitable for harvest. D - young, green stems, not suitable for harvest.

Stem length: This is not necessarily an indicator of maturity, but, there is a practical reason for only cutting plants greater than 40 cm in height; they will not fall out of the harvest bundles when carried across the rough terrain.

Stem diameter: Thick stems, greater than the diameter of a pencil are problematic for the machinery used to chop the harvest material, causing blunting of the blades. Thicker woody stems also lack flavour. Therefore, the recommended suitable stem diameter is the thickness of a pencil or less. The photographs in Figure 7 A to C all show stems which are the correct thickness. The thin green stems in image D are too young and thin for harvest.

Height of cut: The harvesters talk about a cut height of 'n' boksie hoog,' the height of the long axis of a matchbox as cutting height. In practice, they cut at about a hand width, or up to 15cm from the ground. Figure 8 illustrates a multi stem plant cropped at about 15cm. The height of the cut is

also determined by stem thickness as they will avoid a stem which is too thick at the base and therefore difficult to cut.

Plant health: Plants which appear to be sickly can be judged by indicators such as unusually small leaves, limited new leaf or stem growth, yellowing leaves, presence of brownish markings on the plant stems. Best Practise is to leave unhealthy plants alone.

Figure 8: Cut stems of a honeybush plant, cropping height about 15cm.

RECOMMENDATION

Stems of pencil thickness or thinner, which are older as indicated by their colour are desirable in terms of processing for quality tea. Shoots should be cut at least 15 cm from the ground. Sickly plants should be left untouched so as not to spread diseases.

3.3.5 Harvest estimation and monitoring the harvested proportion of *Cyclopia intermedia*

Newcomers to harvesting honeybush on their land, and those who need harvesting permits (needed in the Eastern Cape at this stage), can take the approach described here as they may not have any harvest history figures. They will need some estimation of plant density to quantify potential yield from a site. These figures will be for their own interest and will provide support for a harvest permit application. To determine yield requires an estimate of the number of plants per hectare, and the average yield per plant. This would form part of a site assessment for a farmer or harvest manager. It also allows for an assessment of the proportion of harvested versus unharvested plants. This can be done by simply walking in a line and counting the number of cropped and uncropped plants over a known distance.

Below are three methods of determining yield; the first two methods yielding more accurate figures and the third a rough estimate.

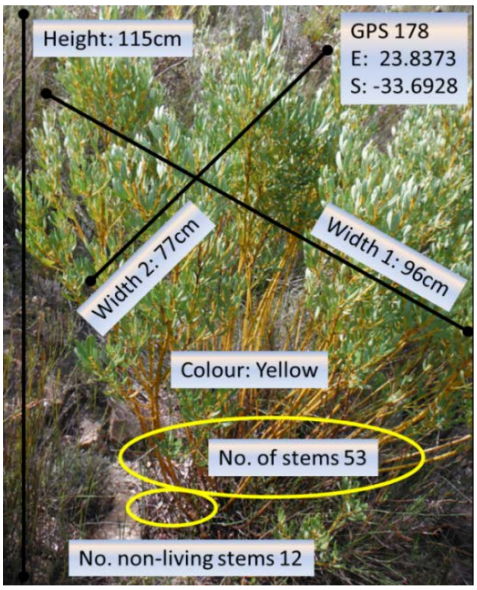


Figure 9: Measurements taken for each Honeybush plant in a survey transect.

The first method was trialled during this Project. The data collected at each farm harvest site was based on 10x25 m transects in which each honeybush plant is located with a GPS, then marked and measured as indicated in Figure 9 to get a plant density per hectare. A harvester then harvests the plot as normal, and the percentage of uncut versus cut plants is noted.

All the cut plants in the transect are weighed and summed to get a transect yield in kilograms, which is converted to yield per hectare (see results in Table 6 and 7). Figure 4 referred to in section 3. 3. 1 shows the results of the transect mapping.

As a second method of gauging the density of plants, a harvester is tracked for one hour while busy and all the plants he harvests are given a location using a GPS. The farmer then backtracks along the harvester's GPS track and records the uncut plants within 2 m either side of the track. By combining the number of harvested and unharvested plants in this harvest 'zone' and deriving an area for the 4 m wide zone, a second density figure can be calculated. The proportion of unharvested plants can also be calculated. This figure may be a more realistic measure of the actual number of plants that may be available for harvest at a site because it accounts for the variability in plant distribution. An example of the results from this kind of survey is illustrated in Figure 10.

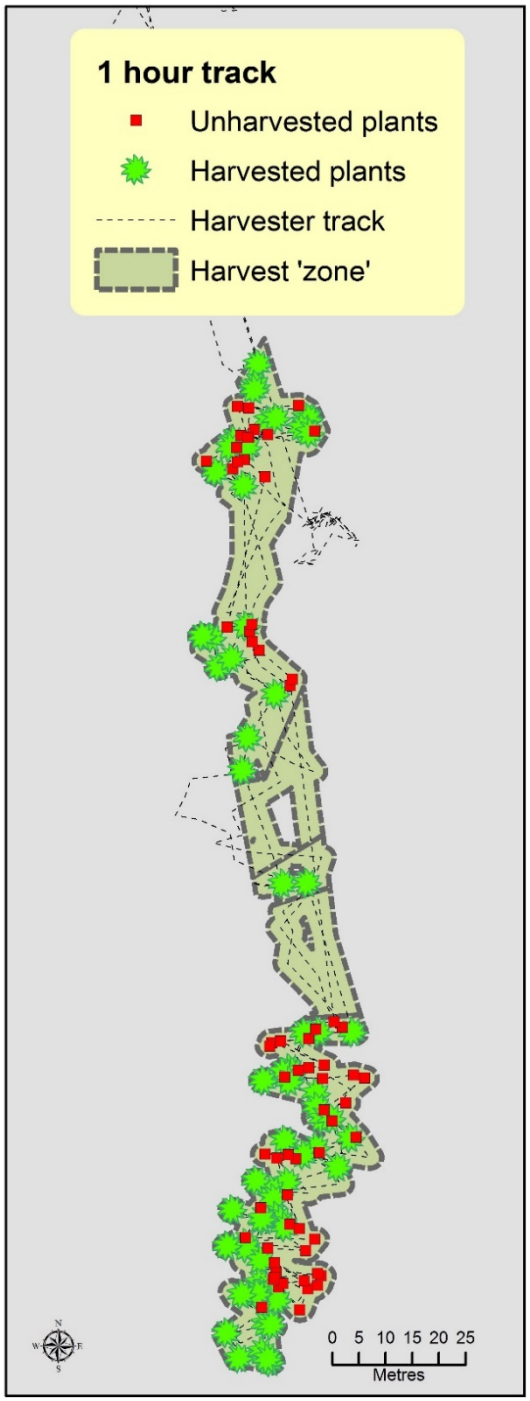


Figure 10: Harvested and unharvested plants along a one hour harvest track (49% remained unharvested).

3.3.6 Harvest yield data for *Cyclopia intermedia*

The purpose of Table 5 and Table 6 is to give an indication of potential yields and plant densities for different sites (farms) across the geographical range of the study area. The location of the sites (farms) is represented on the map (Figure 13). This type of information may form the basis for quantifying potential yield for a farm for the purposes of a farm plan or for a permit assessment. It should be noted that plant densities vary tremendously from one place to another at the local scale. (For this table to be more useful, it would require a greater range of field site data).

RECOMMENDATION

Knowing the potential yields from honeybush-bearing sites is the first step towards sustainable management. Keeping track of the proportion of plants harvested and the proportion that remain unharvested will contribute to sound management. The proportion of plants cut gives an idea of the methods used by the harvest team, and the 'rules' that they follow in harvesting.

Table 6: Harvest site statistics from four farms in the Eastern and Western Cape.

Site (Map Fig. 13)	No. of plants per ha	% unharvested plants	Yield (kg per ha)	Harvest team type	Return interval	Locality	Historic yield data
KN 1	760	57	143	Resident farm staff	4-5 yrs	East Kouga, EC	Sustained yield over 20 years plus
KN 2	1840	45	336				
KN 3	3320	27	972				
KN 4 (track)		30					
KP 1	470	20	128	Small contract team	4-5 yrs	North side of Joubertina, EC	Sustained yield over 12 years
KP 2	520	20	143				
KP 3 (track)							
MP 1	1160	17	349	Large contract team	18mnth – 2 yrs	De Hoop, WC	Sustained yield over 15 years
MP 2 (track)	629	49					
NA 1	2800	60	391	Large contract team	18mnth – 2 yrs	Bo-Kouga, WC	Sustained yield over 15 years
NA 2	1200	30	381				
NA 3 (track)	607	33					
NA 4 (track)	1218	33					

A method for farmers and harvest managers to monitor the quality of harvests was also trialled. Thus, post-harvest surveys were also conducted at two sites independently of the harvest. The results of the surveys are shown in Table 7; the location of the sites is also indicated in Figure 13.

Table 7: Post-harvest survey results from harvest sites on two farms in the Eastern and Western Cape.

Site (sites shown in Fig. 10)	No. of plants per ha	% uncut plants	Yield (kg per ha)	Harvest team type	Return interval	Locality
WK 1 WK 2	600 440	6 9	NA	Small contract team	1-2 yrs	South side of Joubertina, EC
ZK 1 ZK 2	1600 1360	66 13	NA	Large contract team	18mo – 2 yrs	Western Baviaanskloof, WC

RECOMMENDATION

Keeping track of the yield per site and per harvest event is relatively easy to achieve and worthwhile as yield is the basis of accounting in the system. Plus it is a step towards Best Practice for sustainable management: keeping track of harvest yields over time enables a farmer to notice any trends or significant changes. Thus potential problems can be identified.

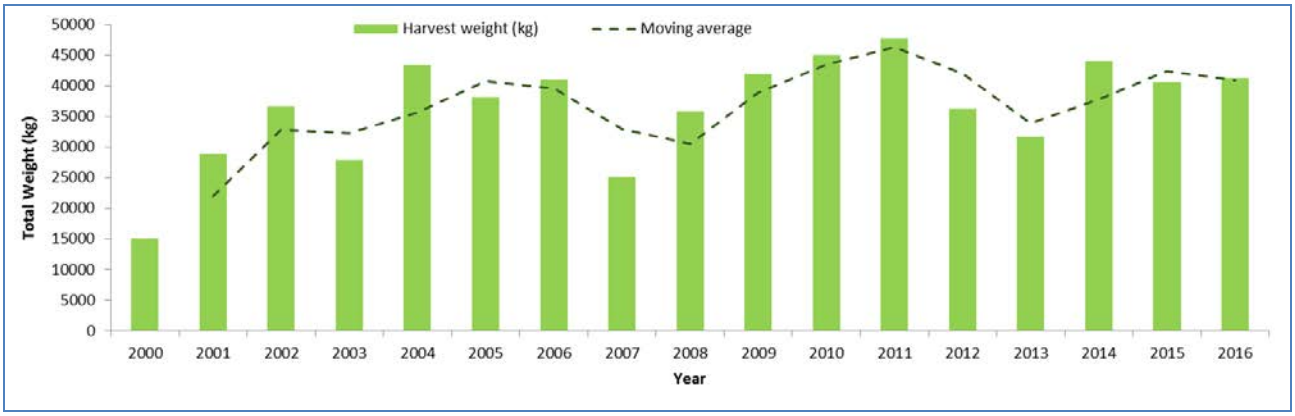


Figure 11: Historic harvest yield for an Eastern Cape honeybush farms for the years 2000 to 2016.

The graphs show historic honeybush harvest yield data for one farm in the Eastern Cape (Figure 11) and for three Western Cape farms (Figure 12). The trendlines expressed as a moving average help to visualise the change in yield. The time period for all datasets is too short to identify patterns or draw any significant conclusions about the sustainability of yield at these sites, but some of the trends can be highlighted.

For the Eastern Cape farm, the data shows a consistent harvest yield over time with a peak in 2011. There are no dramatic increases or decreases in yield. It would be useful to consider this data against climate data or fire incidence which may help explain changes in yield.

For the three Western Cape farms: NA shows a dramatic decline in yield after 2010 which can be attributed to a change of ownership and less focus on honeybush production. The farm ZK shows an increase in production in 2015, a post fire year. MP shows a high yield in 2009, and some fluctuation thereafter, for which there are no obvious explanations.

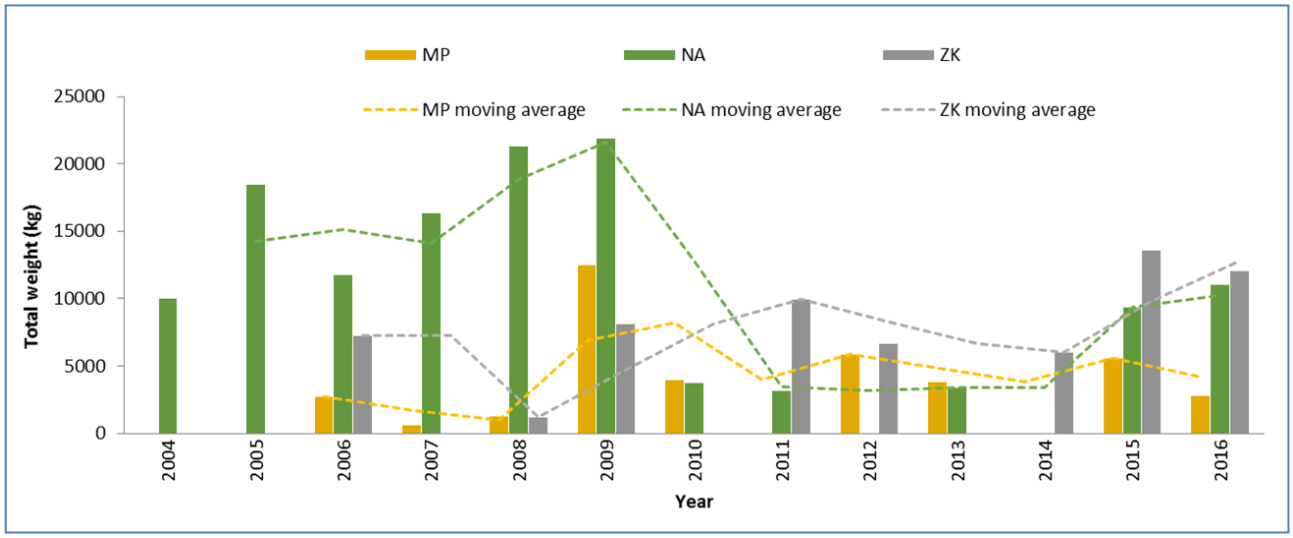


Figure 12: Historic harvest yield for three Western Cape honeybush farms for the years 2004 to 2016.

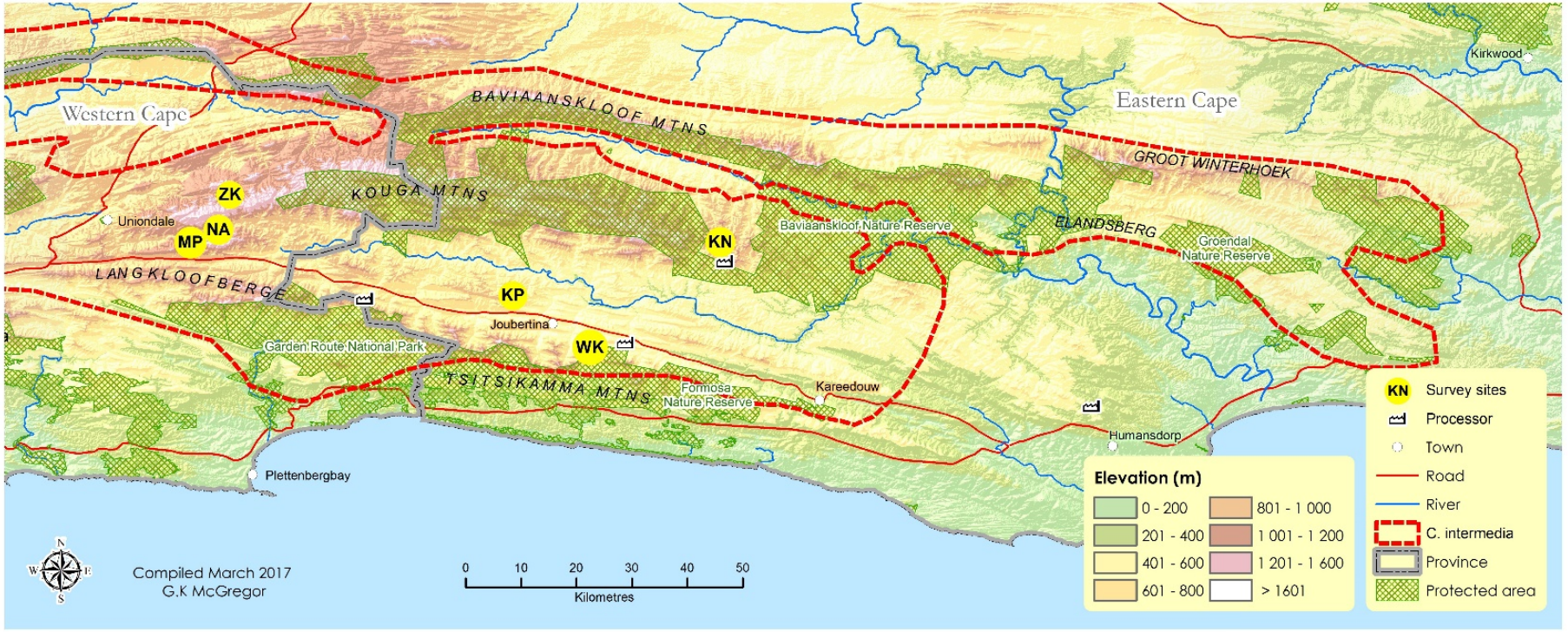


Figure 13: Map showing the location of farms surveyed (results in Tables 5 and 6)

4. MANAGEMENT

4.1 The role of fire

Although fire has an essential role in fynbos vegetation and hence in honeybush management, it is extremely risky. Costs for runaway fires are prohibitive. Fire as a management tool should probably be avoided unless a farmer has knowledge and long experience in its use. The natural fire regime of fynbos is anything from 10-50 years. Fire frequencies are increasing. This is associated with increased accidental ignitions and the use of fire for veld management - semi controlled burns are used to transform veld, usually to provide improved grazing. A detailed discussion of the impacts of fire in the fynbos is given in the Project report, *Aspects of the Ecology of* Cyclopia *sp.* Some significant points are repeated here:

- Fire is a natural feature of rejuvenation for honeybush populations;
- Without fire germination of new plants is very limited;
- The absence of fire OR too frequent fire can cause a change in honeybush shape and size and plant density.
- Recovery of plants after fire is slow (4-5 years), especially in terms of restocking of root reserves which are used to produce new growth;
- From an ecological perspective, hot fires are preferable to cool fires which fail to stimulate germination of seed banks. However, land users prefer cool fires which are easier to control.

Based on field observations and research done on different aged stands of honeybush-bearing fynbos up to 4 – 5 years after fire, honeybush-plants, being post-fire pioneers, are competitive and thrive. In the first few years of growth after a fire it can, in places, be seen to be the dominant species at some sites. Thereafter, the other fynbos species “overtake” and depending on the fynbos veld type, the honeybush plants may become tall and scraggly, with limited yield potential. As the fynbos gets older and more rank, it is increasingly difficult to access the crop. The images presented in Figure 14 illustrate some of the different aged stands of fynbos after fire, where honeybush is visible in the first three stages, but barely discernible in the older post-fire stages.

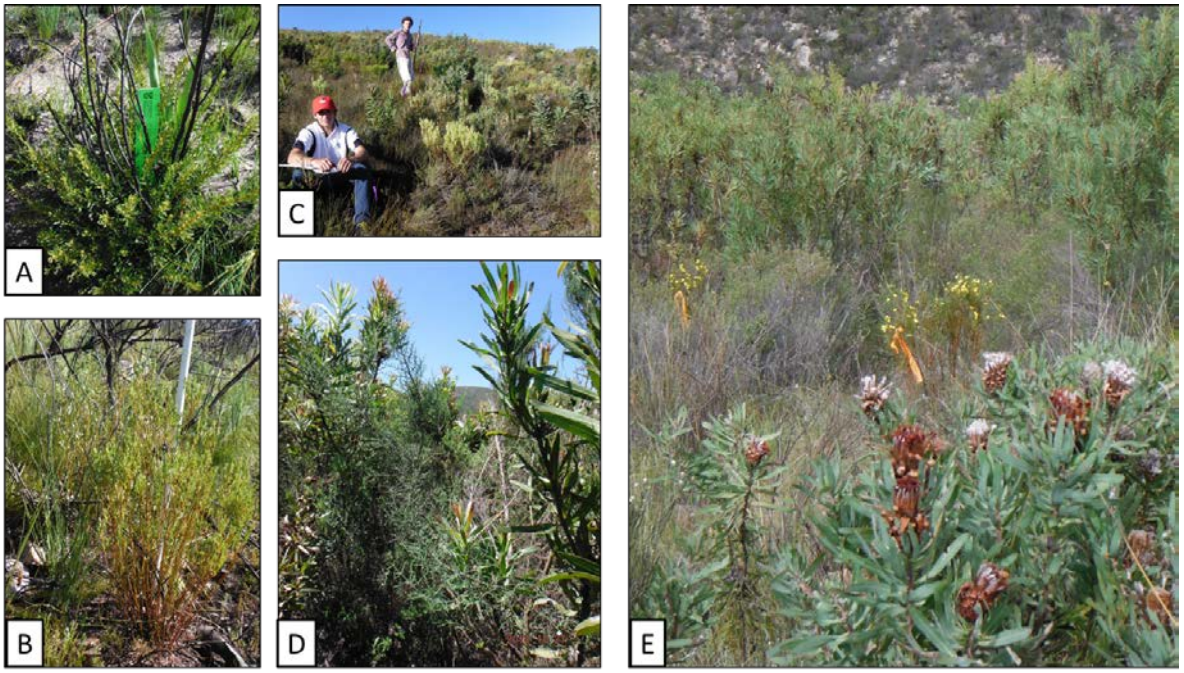


Figure 14: Examples of fynbos veld post-fire ages in which *Cyclopia intermedia* exists. A: 7 months' growth of a mature resprouting plant; B: 20 months' growth; C: 4-5 years' growth; D: 17 years' growth; E: 13-14 years' growth.

The occurrence of seedlings likely to provide new honeybush stocks (if they survive) is shown in the three images in Figure 15. It is common for seedlings to germinate under favourable conditions, and then to die off if conditions become too harsh before they have established sufficient reserves in their rootstock.

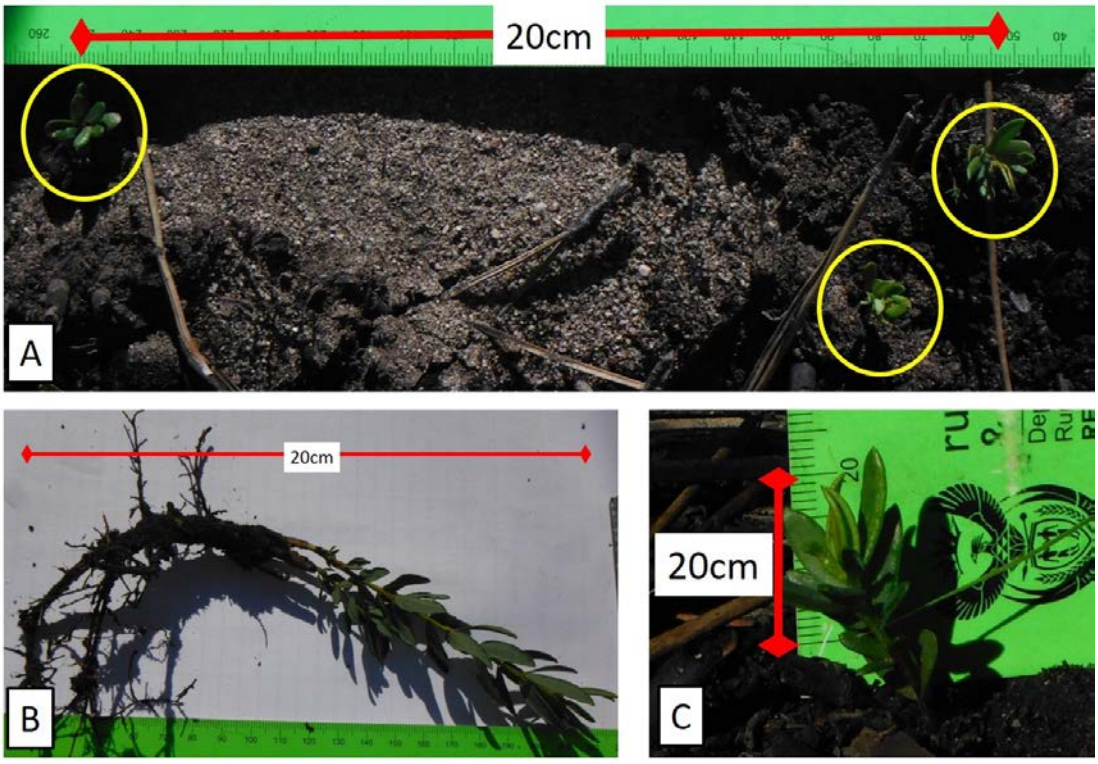


Figure 15: Stages of growth in *Cyclopia intermedia*, seven months' post-fire, A: three seedlings on a sandy substrate; B: seven months' post-fire growth on a young plant, with rootstock; C: seven month old seedling.

RECOMMENDATION

The use of fire as a management tool is NOT recommended. Liability costs for runaway fires are prohibitive. Getting the timing right for promotion of honeybush growth can be tricky.

4.2 Permitting and legislation

This guideline document presents only those regulations that are most relevant to wild harvesting as well as recommendations for Best Practice to be self-regulated within the industry. A policy specific to wild harvesting is needed for permitting systems which will assist legislation and regulation. For more information on the broader legislation and policy that relate to the wild honeybush industry, refer to the earlier report in this Project by De Villiers and McGregor, 2017: *Review of the regulatory and policy framework relating to the harvesting of wild honeybush (*Cyclopia *species).*

RECOMMENDATION

The honeybush industry should be self-regulated and should strive for Best Practice not only for sustainability but to facilitate access to discerning international markets. The Eastern Cape's permitting system should be instigated in the Western Cape to provide information on the industry's production and to enable sustainable management and Best Practice.

- ***Certification***

The need for certification of authentic harvest teams and to have a register of harvest teams has been expressed by harvesters and farmers and is strongly supported by SAHTA certification has been found to be invaluable in the cutflower industry (Privett *et al.,* 2014). Experienced and reliable team leaders and harvest managers should train new recruits in sound methods. In the absence of a certification system, it is advisable that landowners find out about experienced teams in their area and commit to using only one team on a farm to ensure consistent management of the resource. (This type of certification of labour is required for some organic certifications systems, e.g. Fair Trade, but is beyond the scope of this project).

- ***Permitting of protected species***

In order to harvest either *Cyclopia intermedia* and *C. subternata* from the wild or from cultivation in the Eastern Cape Province, the landowner or farm manager, and harvest team manager must obtain a permit from the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) official (see Table 8 for contact details). This is because in 2011 the Eastern Cape Province gazetted these two as protected species (see Table 9). Stakeholders have expressed much satisfaction with this system as it has reduced the number of irresponsible (and often illegal) harvesters, although there are issues with the inclusion of illegally harvested honeybush with legally harvested material, under existing permits. The permit system also provides a monitoring system as each processor is legally obliged to record details of all crops

delivered to their factory. These records are inspected by DEDEAT. The Western Cape Province is busy with a legal review, bringing together and revising legislation relating to a unified Biodiversity Bill, which will have implications for honeybush harvesting. There are also plans to provide protection for *C. sessiliflora* and *C. plicata* which, because of their more localised distributions, are susceptible to decline. Presently in the Western Cape, the requirement for a permit to transport honeybush brings in a measure of control: the requirement for a transport permit is regularly (and successfully) enforced by the Western Cape Department of Environment Affairs and Development Planning (DEA&DP), Cape Nature and SANParks.

Table 8: Permitting authorities.

Province	Department	Contact person	Physical address	Postal address
Eastern Cape	Department of Economic Development, Environmental Affairs and Tourism	Gerrie Ferreira Tel: 042 292 0339 e-mail Gerrie.Ferreira@cgov.za	Seekoei River Nature Reserve, Swan Road, Aston Bay, 6332	P.O. BOX 1733, Jeffrey's Bay, 6330
Western Cape	CapeNature (acting under the authority of the Western Cape Nature Conservation Board)	Danelle Kleinhans, Tel: 021 483 0121 or e-mail: dkleinhans@capenature.co.za	PGWC Shared Services Centre, cnr Bosduif & Volstruis Streets, Bridgetown, 7764	Private Bag x29, Gatesville, 7766

Table 9: Protected flora (applies only to the Eastern Cape). Includes processed honeybush tea.

Province	Activity	Regulation
Eastern Cape	Collection of seed of protected honeybush species	Any person authorised in writing by the owner of any land to pick any protected flora on such land for the purpose of gathering and propagating the seed of such flora as would be the case when harvesting wild honeybush on land owned by someone else.
Eastern Cape	Sale of protected honeybush species	Protected honeybush species may not be sold or bought at any place other than on the premises of a registered flora grower or registered flora seller or sell any protected flora without a licence issued under section 65(2) of the Ordinance.

Table 10: Unprotected flora.

Province	Activity	Regulation
Eastern Cape	Landowners must register as *flora sellers* if wild honeybush is harvested on their land. Includes processed honeybush tea.	A licence issued for a registered flora seller is valid for three years from the date of issue. The licensing authority is the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism
Eastern Cape	No person may trade with honeybush tea without a *flora licence.* Includes processed honeybush tea.	This provision applies to both sellers and buyers of honeybush: both parties must be licensed as flora sellers in order to conduct trade in the product.
Eastern Cape Western Cape	Written permission to harvest honeybush on land owned by another person	No person may pick any protected or indigenous unprotected flora on land of which s/he is not the owner, without the permission of the owner of such land or of any person authorised by such owner to grant such permission. Permission must be in writing and include the:

Province	Activity	Regulation
		• Full names and address of the owner of the land concerned or of the person authorised to grant such permission; • Full names and address of the person to whom permission is granted; and • Number and species of flora, the date or dates on which such flora may be picked and the land in respect of which permission is granted. The permission must be signed and dated by the owner or the person authorised by him/her. The permission will be invalid if it does not comply with the foregoing provisions.
Eastern Cape Western Cape	Donation or sale of honeybush tea. Includes processed honeybush tea.	No person shall donate or sell any flora to any other person unless the recipient is furnished with a written document, signed by the donor or seller, reflecting: • The full names and address of the donor/seller; • The full names and address of the recipient/purchaser; person; • The number and species of flora donated or sold; • The date on which such flora was donated or sold, and • A statement by the donor/seller that s/ he has donated or sold such flora to such other person.
Eastern Cape Western Cape	Possession of honeybush tea. Includes processed honeybush tea.	The recipient/seller of honeybush must retain the previously-mentioned documentation: • For at least two months from the date on which it was so furnished; or • While such person is in possession of the flora to which the documentation relates; • For whichever is the longer period.
Eastern Cape Western Cape	Export of honeybush tea	No flora may be exported from the Eastern Cape or Western Cape without a permit. The exporter must be in possession of the same documents that apply to the: • Donation or sale of honeybush tea; and • Possession of honeybush tea.

RECOMMENDATION

Farmers and managers must make sure they have the necessary permits for their area. They need to contact the officials of the relevant departments. They need to ensure that they employ the services of a reputable harvest team and that they retain the services of one good team.

4.3 Management plans

In order to carry out Best Practice towards sustainable wild harvesting, it is essential that a management plan is drawn up. Such a plan is being introduced in the Eastern Cape as a requirement for the permitting system. Management plans enable farmers and land managers to monitor the different sites which yield honeybush crops. These plans also allow for recording the crop sizes, and season and frequency of cropping. In addition, if the landowner is in a position to do controlled burns, plans are essential.

Farmers and land managers should be aware of the legal implications before they start to develop any new tracks to access honeybush-bearing lands, and which may disturb wetlands etc. These are considered to be Listed Activities. This means that the relevant provincial agencies DEA&DP (WC) and DEDEAT (EC), and in the case of any water-related activities, the local Department of Water Affairs should be consulted.

4.3.1 Farmer/landowner basic management plan outline

A management plan should include the following:

- A map showing farm boundaries, minor roads and access tracks, fences, adjacent land ownership, any infrastructure on the land;
- Marked on the map, approximate locations of honeybush populations suitable for harvesting (i.e. those that yield enough to make it worthwhile for the farmer and the harvester teams);
- Marked on the map: the distribution of stands of invasive alien plant species to monitor their spread which will inform any management plans for their eradication;
- A chart of harvest dates and yields used in conjunction with the map.

A map is a useful management tool: it can form a simple base for any management plan. Most farmers will have access to a 1: 50 000 topographic map showing the boundaries of their farm, or to a basic digital mapping system like Google Earth. Every farmer should know where the honeybush is located on their farm and the approximate extent of the stands of honeybush.

Examples of basic maps, provided by farmers as part of their management approach are shown in Figure 16 and Figure 17. The maps show clearly where the honeybush-bearing lands are and where farm boundaries lie so that the harvest team can be made aware of where their harvesting limits lie. These guidelines have promoted two approaches to harvesting: 1) a two year harvest interval, with 50% harvest, or 2) a four to five year interval with up to 70% of the plants harvested. The map can be used to keep track of harvest intervals, and record yields over time, for the farm as a whole or in more detail, per area of honeybush-bearing land. Keeping records in this way should be considered Best Practice for farmers who aim to use their wild honeybush resource sustainably.

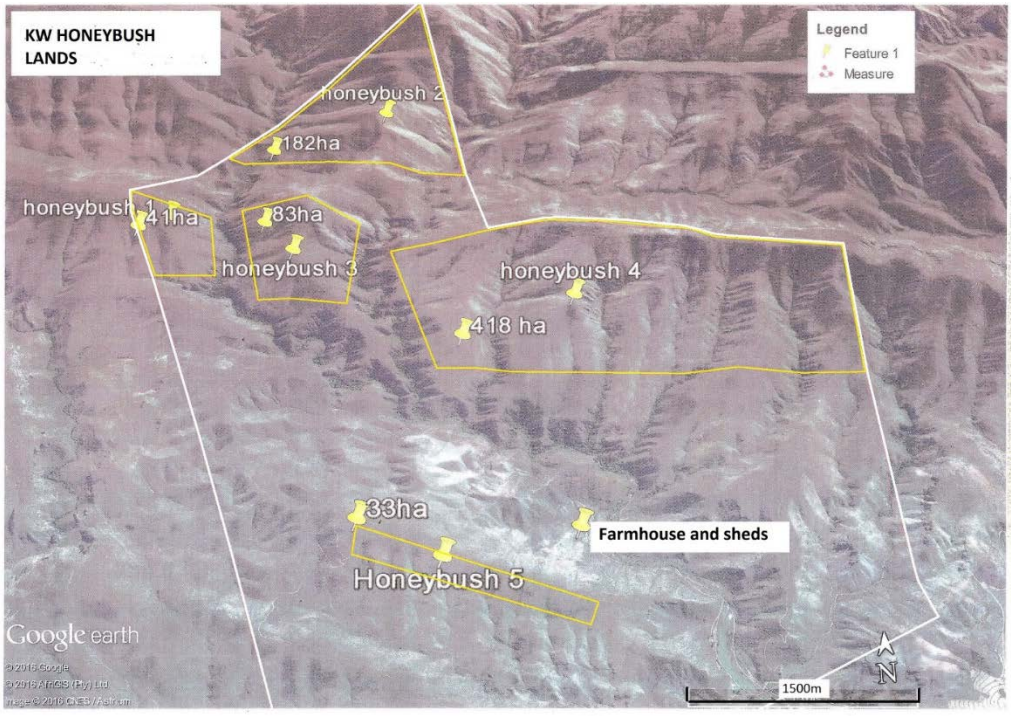
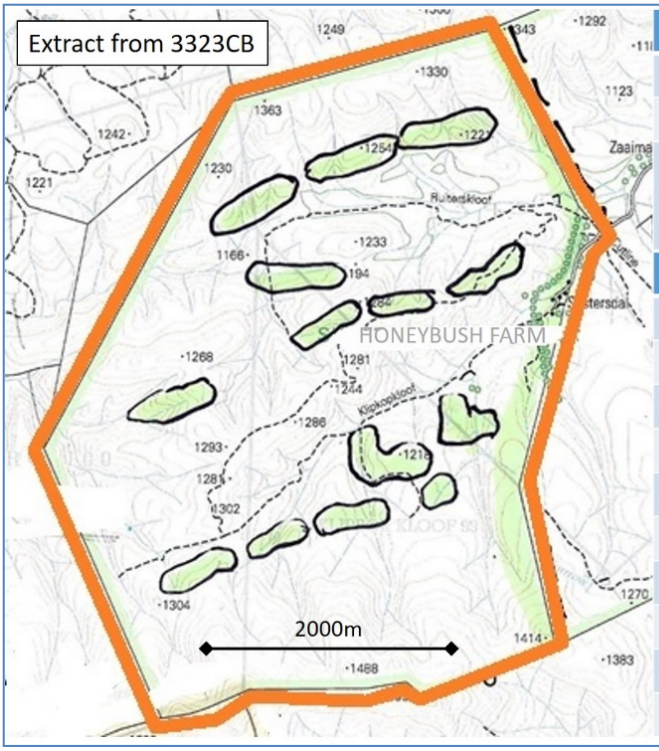


Figure 16: A farmer's sketch map of honeybush-bearing land on a farm, created using tools in the Google Earth software. The farm boundary is indicated with a white line, the yellow lines indicate the approximate extent of honeybush land, with the areas in hectares



Honeybush Lands	
Total area	199ha
Density of plants	
Low	40/ha
High	1240/ha
Average	590/ha

Year	Harvest (kgs)
2005	7272
2007	1227
2008	8169
2010	9951
2011	6677
2013	6043
2014	13601
2015	12051
2016	3270
2017	6958

Figure 17: A farmer's map of honeybush-bearing land on a farm, sketched on an extract from a 1:50 000 topographic map, with associated honeybush inventory and harvest yield records.

It is likely that at some stage in the near future a honeybush management plan will be required by the permitting authorities (as is the case already for the Eastern Case). It is in the interest of farmers to be pro-active, rather than have a plan imposed on them from elsewhere. Having a management plan will also improve alignment with international market requirements. For example, organic certification for a product requires a farm plan and a detailed record of farming practices. Honeybush from an organically certified farm fetches a higher price at the processing plant. Information that might be required in a basic management plan is outlined in Table 11 which consists of four information sections which the farmer/landowner should fill in.

4.3.2 Available resources for mapping

This section gives examples of what is available to use as base maps for preparing a resource inventory of honeybush on a farm.

Most farmers are familiar with topographic maps, 1:250 000 to 1: 50 000 and are able to use them to locate farms. Some 'tools' to assist with mapping are listed in below. Alternatively, in the case of farmers without access to such tools, SAHTA or the local Conservation Authority can download 1: 50 000 maps, increase the scale to locate individual farms and then produce a print-out map showing farm boundaries which can then be posted to the farmer. With these maps, the farmers will be able to map the location of areas of honey-bush bearing veld on the farm. This will enable records of annual yields to be kept.

Hardcopy resources
Hardcopy 1: 50 000 topographic map sheets and 1: 10 000 aerial photos of South Africa are available from the Chief Directorate National Geospatial Information (CD: NGI), in Mowbray Cape Town.

Digital resources
South Africa 1: 50 000 topographic map sheets are available online in digital format at: www.spatialreference.co.za/Maps. The website offers free images of each 1:50 000 map you need to create a logon (which is immediately available) before you can download a map.

The same maps as well as 1: 10 000 orthophotos are available freely from CD: NGI.

Google Earth mapping
Google Earth provides an easy, user-friendly platform on which to create a simple harvest site map, using the 'Add polygon' (also calculates area) or 'Add placemark' tools.

Mobile phone app for capturing harvest area extent
There are various free apps which can be used to create map data eg: *GPS Fields Area Measure*, available from : https://apkpure.com/gps-fields-area-measure/gp.joy The app allows you to map areas on a landscape using a 3D Google Earth backdrop image.

4.3.3 A plan for processors – map and delivery records

Each processor deals with a maximum of 20 teams. It is recommended that each processor generates a map (even if it is only at a scale of 1: 250 000) in conjunction with a log or worksheet in order to keep a record of harvest sites per team. The base map can be derived by following the methods described earlier (4.3.2). Using this base map, all sites can be indicated which can then correspond to a record of each delivery per site.

Table 11: Information required for a management plan for the sustainable harvesting of honeybush.

Section A. FARM DETAILS	
1) Landowners name	
2) No. of years on farm	
3) Name of person responsible for managing the harvest	
4) Name of farms / land parcels on which honeybush is harvested	
5) Size of farm/s in hectares	
6) Name of processor you normally supply	

Section B. HONEYBUSH HARVEST DETAILS					
1) Honeybush species harvested (indicate with a cross). Repeat this section for each species.					
a) C. intermedia	*b) C. subternata*	*c) C. plicata*	*d) C. maculata*		
2) Approximate area of honeybush-bearing land in hectares:					
3) Average density of plants (no. per hectare), or give range of plant densities:					
4) Harvest interval – indicate with a 'x'					
Annual	18 month–2 yrs	2-3 years	3-4 years	4-5 years	Other
5) Approximately what proportion (%) of plants are cut at each harvest?					
40%	50%	60%	70%	>70%	
6) Harvest history: record the year and the approx. harvest weight in kg or tons. In the comment column, indicate why values may vary e.g. harvest after a fire, drought conditions, shortage of harvesters or any other reasons.					
Year	Harvest weight	Explanatory comments			

Section C. HARVEST TEAM INFORMATION				
1. Name of Harvest team leader/ manager				2. No. of harvesters
3. Type of harvest team (indicate with an 'x').				
Farm staff	Casual labourers	Contract team	Other (explain)	
4. Comments on the harvest team: *Is this a regular team that harvests on the farm?* *How many years have you used the services of the team?* *Are you satisfied with their level of expertise?* *Any other comments?*				

Section D. OTHER MANAGEMENT CONSIDERATIONS	
Use this section to record how you address any other management considerations relating to the sustainable use of the wild honeybush resource.	
Fire	
Illegal harvesting	
Pests/disease	
Alien vegetation	
Infrastructure development (eg: roads, wire slides etc).	

4.3.4 A plan for harvest managers

As for the processors described above, the plan should comprise a map indicating farm boundaries and harvest sites. Each site should correspond with records of harvest size in kilograms. A system of local honeybush monitors has been suggested who would employ and mentor newcomers in the industry. Local area monitoring based on local knowledge has been noted as key to any monitoring programme.

4.3.5 Linking them all

Given the size of the industry, it should be possible to link a permit system to production. For example, each permit gets a code and a production limit. That code is allocated to harvest sites on a map, which are linked to production records.

RECOMMENDATION

A permit system like the one instituted by the Eastern Cape Province is key to improved and sustainable management of the industry. There needs to be control of harvesting in both provinces at a similar level. With a logical check point at the processor, it should be possible to ensure traceability of wild harvested honeybush. Local involvement from farmers, harvesters and the processors is key to the success of any monitoring.

At this stage there are a total of about 75 permit-holders in the Eastern Cape and probably around 50 farms in the Western Cape where honeybush is wild harvested. Therefore, it may be possible for DEDEAT (EC), the equivalent authority in the Western Cape and/or SAHTA to develop a simple system for registering and keeping records.

5. THREATS

A number of 'threats' or 'challenges' to/in the wild harvesting honeybush industry were identified in the course of this Project from participant input and through field observations. They all impact on the natural occurrence of healthy honeybush populations to varying degrees. Some information on each threat is presented below.

Lack of control of harvesting: this occurs in areas characterized by communal land ownership, absentee landlords and a lack of policing in easily accessible formally protected areas, or in the form of poaching in out-of-sight areas on farms.

Land transformation: this refers mainly to the expansion of agriculture into areas where honeybush would naturally grow, e.g.: fruit orchards and plantations, settlements and tourist resorts.

Alien plant invasion: there is widespread alien plant invasion in much of the honeybush-bearing land. On mountain slopes and drainage lines, plants such as black wattle, hakea and pine

outcompete fynbos plants such as honeybush, leading to reduced population size. Aliens occur as dense stands or individual plants; while the dense stands are extremely difficult to eradicate, their expansion should at least be held in check. Scattered individual alien plants are relatively easy to eradicate and should be targeted for removal as soon as possible to prevent spread.

Illegal harvesting and overharvesting: the harvesting of too much biomass or too often or without planned harvest intervals leads to a decline in honeybush plant abundance.

Unnatural fire regimes: fires that burn too frequently (less than 8-10 years between fires) can reduce the diversity of a fynbos system by destroying the canopy-held seed in serotinous cones (e.g. proteoids) and kills plants (e.g. honeybush) before they have matured enough to set seed. The absence of fire over many years causes honeybush populations to decline; honeybush plants are outcompeted by other fynbos plants and are reduced to a scraggly, unharvestable form.

Knowledge gaps: while our understanding of fynbos ecology has grown substantially, our knowledge of the sustainability of a wild harvested population of honeybush is still limited. For example, with regard to the vulnerability of resprouters, recent research, which has monitored populations of fynbos reseeders and resprouters over many decades, has shown that populations of resprouters have declined more significantly than reseeders (Thuiller *et al*. in press; Slingsby *et al*., 2017). Scientists are now acknowledging that resprouters have much shorter lifespans than originally thought. Consequently, it is important that harvesting regimes facilitate regeneration via seedlings, and do not reduce lifespans by removing too much plant material at high frequency intervals.

Genetic contamination: is a threat to the integrity of the genetic diversity of different natural populations of honeybush species. This entails the human-induced flow of genes from a plant/s of one population to those of another population through pollination. This results in changes in the genetic composition of the receiving plants - changes are likely irreversible. There can be serious consequences down the line, such as the plants lacking the genetic diversity to adapt to new climatic conditions. Also, it is important to protect wild relatives so that sometime in the future, their genetic diversity can be used in plant breeding to improve cultivated crops (as is done often and successfully with tomatoes, potatoes etc.).

Access tracks /roads: if tracks are not properly constructed and maintained they can cause long term damage to the environment. Dirt tracks tend to channel water and compact soil causing erosion. Tracks are also used by small stock and game which can exacerbate erosion especially on steep slopes and fragile soils. In addition, tracks can act as access points for disturbance enabling the spread of invasive alien species. The development of tracks to facilitate honeybush harvesting could also increase accessibility of previously remote areas which may increase other human impacts such as illegal harvesting of both honeybush, wildflowers and medicinal plants and illegal use of 4x4 tracks for off-road recreation. Increased human use of an area could also potentially increase fire hazard.

6. BIBLIOGRAPHY

Chadwick, P., 2015. Biodiversity Economy of the Cape Floristic Kingdom. The Table Mountain Fund. Available: http://www.thetablemountainfund.org.za/biodiversity-economy-of-the-cape-floristic-kingdom.Accessed February 2017.

Daly, H. E., 2005. Economics in a Full World. *Scientific American Special Issue*, September, 2005, 81.

Hobson, S and Joubert, M. 2011. Eastern Cape honeybush tea project: Industry overview, assessment and proposed interventions. Unpublished report to the Coega development Corporation.

Joubert, E., Joubert, M.E. , Bester, C., de Beer, J.H. and De Lange., J.H., 2011. Honeybush (*Cyclopia* spp.): From local cottage industry to global markets — The catalytic and supporting role of research. *South African Journal of Botany*. 77, 887–907.

IUCN. *Red List of SA plants*, 2017. Available : http://redlist.sanbi.org/ Accessed : 6 January 2017.

Magee, L, Scerri, A., James, P., Thom, J.A., Padgham, L., Hickmott, S., Deng, H., and Cahill, F., 2013. Reframing social sustainability reporting: Towards an engaged approach. *Environment, Development and Sustainability*. 15 (1): 225–43.

Pretorius, G., Harley, V. and Ryser, L., 2011. Handbook for implementing Rooibos sustainability standards. Available: http://www.conservation.org/global/ci_south_africa/publications/Documents/handbook-implementing-rooibos-sustainability-standards.pdf Accessed :1 February 2017

Privett, S. D. J., Raimondo, T., Euston-Brown, D., and Bailey, R., 2014. A vulnerability index for harvestable species on the Agulhas Plain, Flower Valley Conservation Trust (in prep).

Schutte, A. L., 1997. Systematics of the genus *Cyclopia* Vent (Fabaceae, Podalyrieae). *Edinburgh Journal of Botany*. 54, (2) 125-170.

Slingsby, J.A., Merow, C., Aiello-Lammens, M., Allsopp, N., Hall, S., Mollmann, H. K., Turner, R., Wilson, A. M., and Silander Jr., J. A. 2017. Intensifying post-fire weather and biological invasion drives species loss in a Mediterranean-type biodiversity hotspot. *Proceedings of the National Academy of Sciences USA* (In Press).

Thuiller, W., Slingsby, J. A., Privett, S. D., and Cowling, R. M. 2007. Stochastic species turnover and stable coexistence in a species-rich, fire-prone plant community. *PloS One*. 2(9), e938.

World Commission on Environment and Development, 1987. *Our Common Future*. Oxford University Press, Oxford.

Personal Communication

Ferreira, G., 2017. *Heights Enterprises Director*. 9 January 2017. Twee Rivieren.
Hodgson, D., 2015. *Farmer.* De Hoop, November 2015.
Joubert, M. 2017. *ARC Agronomist*. Email communication. 24 March 2017.
Joubert, M. 2017. *Agulhas Honeybush Tea*. Email communication. 14 March 2017.
Louw, J., 2017. *Honeybush Harvester*. 24 March 2017.
Nortje, Q. 2017. *Honeybush Farmer and Processor*. Nooitgedacht, August 2014.
Smith, E., 2017. *SAHTA Chairperson and Honeybush Farmer*. Email communication. 9 March 2017.