NDF Workshop Case Studies
WG 3 – Succulents and Cycads
Case Study 6
Hoodia gordonii
Country – **South Africa**
Original Language - English

HOODIA GORDONII IN SOUTHERN AFRICA

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I. Background information on the taxa

1. BIOLOGICAL DATA

1.1. Scientific and common names

Species: *Hoodia gordonii*
Genus: *Hoodia* (14 *Hoodia* species within the genus)
Family: Apocynaceae family (formerly under Asclepidaceae)
Common names: Ghaap, Bitter ghaap, Xhoba, Hoodia, lgoa.-l, lkhoba.b, lkhowa.b, lgoai-l, lhoba, lkhoba.bls, lkhobab, lgoab, otjinove, !nawa#kharab

Figure 1. *H. gordonii* in flower (and seed set) in the Northern Cape province, South Africa.

1.2. Distribution

H. gordonii has a fairly wide distribution (between 290 and 330 S), occurring predominantly in South Africa and Namibia, and to a lesser extent in Botswana and Angola. The species has a patchy spatial distribution pattern, meaning that its density varies a lot throughout its distribution range. Although its distribution is not continuous, nor uniform, it is uncertain whether it is fragmented as it has not been investigated.

The species is primarily associated with summer rainfall regions (South Africa and Namibia), but does occur in winter rainfall areas (Namibia) as well.

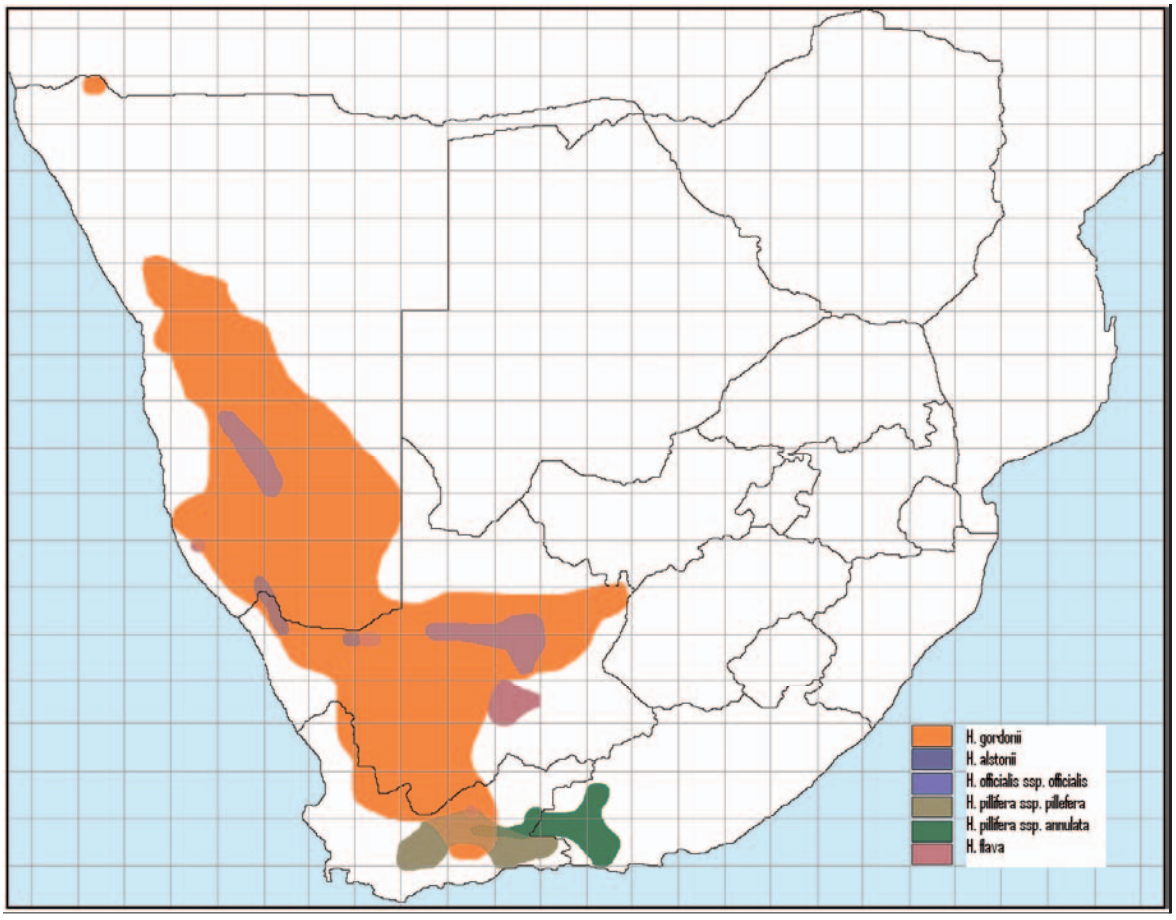

Figure 2. Schematic illustration of the known distribution ranges of six *Hoodia* species in southern Africa (PRECIS data 2005, SANBI).

Namibia is regarded as the country with the greatest richness in *Hoodia* species (11 taxa), followed by South Africa (9 taxa). However, there is disagreement amongst some taxonomists as to the species' names and classifications.

1.3. Biological characteristics

1.3.1. *Provide a summary of general biological and life history characteristics of the species.*

H. gordonii is a slow growing perennial, leafless succulent. This stem succulent forms fleshy fingerlike stems that branch near ground level. The stems are pale-green, round and covered with spiny tubercles found in rows along the length of the stems. The estimated height of an adult plant is around 60cm, while the diameter of the finger-like stems reaches more than 40cm.

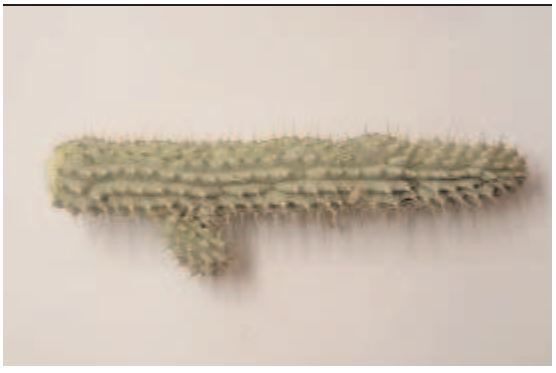

Figure 3. H. gordonii stem illustrating the spiny tubercles running along the length of stems (photo by CSIR).

The life-span and age at maturity of *H. gordonii* is unknown, but anecdotal data indicated it to be 15-20 years, with the first flowering event only occurring after three to six years. Coincidently, this is also the time (three years) it takes cultivated material to produce sufficient active ingredients to be accepted for trade.

Flowering is protracted (based on herbarium records, PRECIS records) and unsynchronised, reacting to rainfall events irrespective of the season. During good rainfall events, the plants are covered by flowers, producing masses of seed follicles after one month. Seeds ripen about two to three months after flowering.

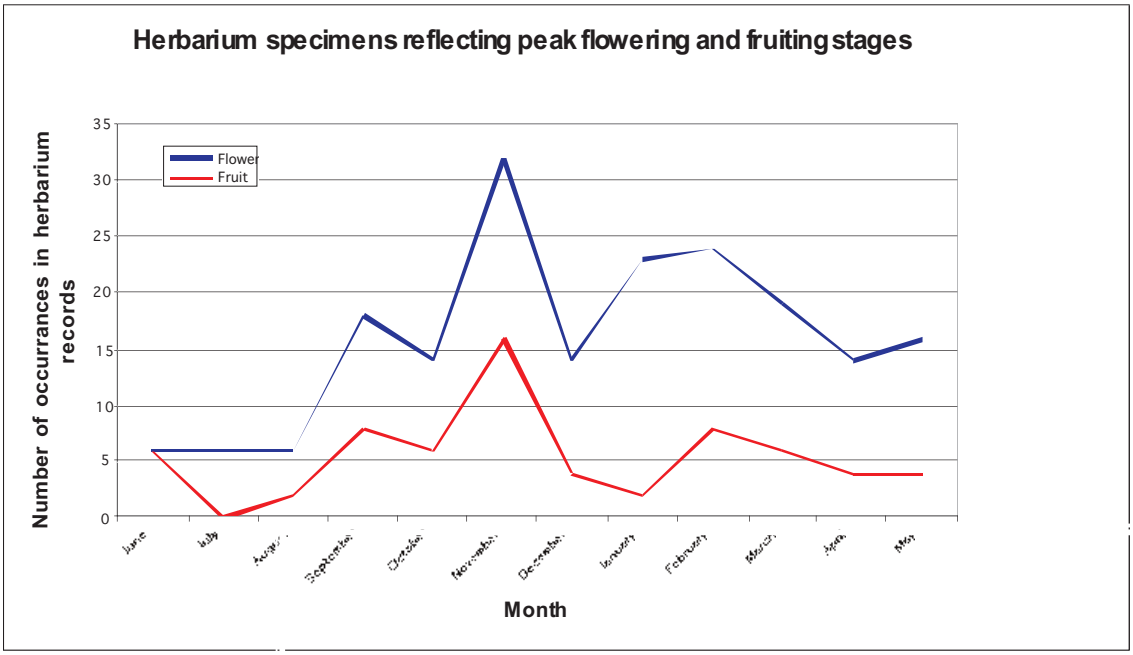

Figure 4. Illustration of the flowering cycles of *H. gordonii* (PRECIS herbarium data, 2005).

Flowers are generally dish-shaped (50-110mm in diameter), with a fleshy colour (colour does vary from red to purple to brown to mottled dark yellow). Flowers are also referred to as carrion-flowers or stapeliads and smell like decaying meat to attract pollinators, namely flies and blow-flies. Pollination occurs when the flies lay their eggs inside the flower.

Figure 5. One of the pollinators (a fly) of *H. gordonii*.

Follicles can get up to 250mm long, containing several seeds that are wind dispersed. The follicles split open along the sides, releasing the seeds which are then blown under nurse plants or other protective sites where they germinate and establish themselves. However, the potential seed production (average number of seeds per follicle) and its longevity in the veldt are unknown. According to one expert (P. Bruyns pers. Com), *H. gordonii* exhibits a weedy character and seeds germinate readily.

Figure 6. *H. gordonii* follicle releasing seed into the wind for dispersal.

Long term population trends are unknown, but drastic population declines have been observed in nature, mostly due to die-back of established plants. The reasons for these drastic die-back events are unknown, but they appear to coincide with prolonged high rainfall events when *Fusarium* (a fungus) and other pests attack the species. No studies have been undertaken to assess the survival rate and recruitment of seedlings.

Population size and density is uncertain. *H. gordonii* clusters vary a lot in density and demography. Cluster densities range between only a few plants per hectare to over 130 plants per hectare (exceptional cases reflected a few hundred plants per hectare).

Figure 7. Die-back event observed in the Northern Cape, South Africa, in the Bushmanland region. Forty percent of the population at one of the sites in the Bushmanland died within two years (2000-2002), while the above photo illustrates that it can result in more than a ninety percent decline (2005).

More information is needed on habitat requirements regarding what conditions favour germination and seedling establishment.
Natural and anthropogenic threats also need to be quantified. Some of the preliminary natural threats that have been identified include fungus infections (Figure 8, *Fausaria* sp. infestation), snout beetles (*Paramecops stapeliae*), mite infestations and fruit flies (Figure 9, *Dacus bistrigulatus*). The milkweed bug (Figure 10, *Spilostethus pandurus*) and the African Monarch butterfly caterpillar (Figure 11, *Nymphalidae*, *Danaus chrysippus*) impacts negatively on seed production. Natural die-back could result in more than ninety percent decline in clusters (refer to Figure 7). If these die-back events are followed by recruitment events (replacement), there is no immediate concern. However, should these die-back not be followed by recruitment events, then there is for urgent investigation. Another threat that still

needs to be evaluated is climate change. Some of the preliminary anthropogenic threats include commercial wild crafted harvesting (illegal harvesting) and habitat destruction (over grazing, trampling, cultivations, road construction, off road driving, urban development, mining).

Figure 8. A *H. gordonii* plant that died due to *Fausaria* sp. infestation.

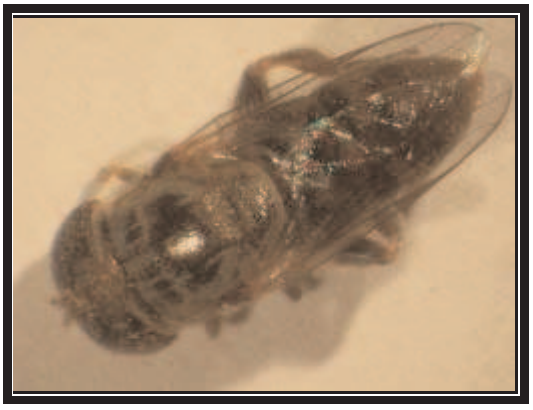

Figure 9. The fruit fly, *Dacus bistrigulatus*, which lays its eggs in *H. gordonii* stems. Here the caterpillars feed on the inner parts of the stems, causing them to fall over and die.

Figure 10. The Milkweed bug, *Spilostethus pandurus*, lays its eggs in *H. gordonii* follicles.

Figure 11. The African Monarch caterpillar, *Danaus chrysippus*, feeds on *H. gordonii* flowers.

Figure 12. Unidentified 'fly' that lays its eggs in *H. gordonii* follicles.

1.3.2. *Habitat types.*

H. gordonii occurs in a wide variety of arid habitats characterised by sparse vegetation, ranging from coastal to mountainous habitats. Generally the species do, however, prefer arid gravel or shale plains, slopes and ridges, ranging in altitudes from 250m to 1200m. However, the specific habitat requirements (niche habitat) remain unknown. In the Northern Cape Province, South Africa, the species does occur more readily (more densely populated) in some regions.

Figure 13. Examples of some of the habitats of *H. gordonii* in the Northern Cape Province, South Africa.

Habitat availability is not regarded a limiting factor to the species' distribution range and it is not expected to have a negative impact on the population status at this stage.

1.3.3. *Role of the species in its ecosystem*

H. gordonii is a minor source of food and moisture to wildlife in arid ecosystems. However, the multiple above ground stems provide shelter and breeding sites for small animals and insects, like spiders. The overall ecological function of the species is unknown.

1.4. Population:

1.4.1. *Global population size*

The global population size, or available resource, is unknown. Resource information is also not available on Provincial level in South Africa. Accordingly a Resource Assessment Report system was developed to obtain at least local basic information on population health (demography) and density (ref. permit applications for wild harvesting). From these surveys, the recorded densities ranged from less than seven plants per hectare to a few hundred plants per hectare. However, as mentioned previously, *H. gordonii* is not evenly dis-

tributed; therefore no direct population size can be calculated in reference to the total distribution range of the species.
Surveys for the Resource Assessment Report should cover at least one percent of the total distribution range of the species on the farm to make sure it is at least to some degree representative.

1.4.2. *Current global population trends:*
The global population trend is unknown, but local decline has been observed at sites where exploitation and die-back have occurred. Recruitment events have also been observed, but these were not necessarily at the sites where decline has occurred (possibly random recruitment).

1.5. Conservation status

1.5.1. *Global conservation status (according to IUCN Red List):*
Until 2002 *H. gordonii* was regarded Near Threatened. However, towards 2005 it was suggested to change it to Least Concern (unpublished). We await the most recent evaluation which is due for publication this year.
H. gordonii is listed as a CITES Appendix II species.

1.5.2. *National conservation status for the case study country*
Hoodia is protected in five on the nine Provinces in South Africa, namely the Western Cape, Free State, North West, Northern Cape and Kwazulu Natal Provinces. Legislation include, e.g., the Nature and Environment Conservation Ordinance No. 19 of 1974 in the Northern Cape Province, the TOPs Regulations, i.e. the Biodiversity Act No. 10 of 2004 (the implementation of TOPs only occurred 2006/07, as it was not finalised or delegated to provinces).
The species is protected in Namibia (Nature Conservation Ordinance No. 4 of 1975 and No. 247 of 1977), but Botswana, has no legislation specifically addressing the protection of Hoodia. The Agricultural Resources Conservation Act [CAP35:06] of Botswana addresses "harvesting from the veldt", which is used to manage *Hoodia*.
The current list of Protected Areas and Conservancies said to contain H. gordonii need to be reviewed as some of those listed do not have H. gordonii but some of the other *Hoodia* species.

1.5.3. *Main threats within the case study country*
Habitat loss/degradation (human induced), invasive alien species (directly affecting the species), harvesting (illegal gathering), accidental mortality (e.g. bycatch), natural die-back and climatic events appear to be important threats.

Of all the threats listed, illegal gathering is regarded the most important, followed by agricultural activities. It is uncertain whether the establishment of *Hoodia* cultivation sites itself are having negative impacts on its natural distribution, but needs to be investigated as these are established within its habitat.

Legal wild harvesting appears not to be a local threat at this stage as harvested sites have not died-back, and harvested plants are sprouting again.

The possibility of future commercial collection and the accidental (mistake in identity) collection of other *Hoodia* sp. is of concern. *Hoodia pillifera* was the species being investigated by the CSIR for appetite suppressant activity in 1983, and is regarded the preferred food source. The common names are indicative of the reasons for mistaken identity with H. *pilifera* being called ghaap and *H. gordonii* being called "muishondghaap" or "jakkelsghaap". It therefore makes more sense to manage the genus rather than the individual species.

Internet trade is not quantified, but is of great concern.

2. SPECIES MANAGEMENT WITHIN THE COUNTRY FOR WHICH THE CASE STUDY IS BEING PRESENTED.

2.1. Management measures

2.1.1. *Management history*

The Northern Cape Province, South Africa, issued research permits until early 2000, where after permits for commercial harvesting from the wild was put on hold to enable the department to put systems in place to handle such applications (except Patent Rights Owners of P57). Commercial applications only started after the CSIR announced their 'discovery' in the media.

However, none of the other provinces in South Africa have put *H. gordonii* permits on hold like with the Northern Cape Province did, meaning that harvesting continued in the Western Cape Province and the other Provinces transported and exported without strict cross referencing to make sure that it was legal material. Illegal material were accordingly 'legalised' due to this unsynchronised management by Provinces.

No permits for wild crafted *H. gordonii* was issued until the legal aspects of the Patent Rights contravention were resolved. A Review Report has been compiled and a Resource Assessment and Management Report (RAMR) system has been developed to manage the resource should permits be issued.

In the review process the information available on the species and the Access and Benefit Sharing aspect (the San has been acknowledged as the Indigenous Knowledge Keepers) was taken into consideration.
The RAMR include the applicant's details, resource details, harvesting management details, and trade details (trade information is not mandatory due to the free market system). Only landowners are allowed to harvest on their own properties due to illegal activities that were reported in the Western Cape Province. Harvesting methods were prescribed.
RAMR is similar to TRAFFIC's sustainable harvesting of medicinal plants document, with limitations regarding the social aspects.
No proper national and international management system is in place yet (including Range States). One of the major concerns is the cultivations occurring outside the natural distribution range of the species, thus economic benefits are not being shared with the countries of origin and Knowledge Keepers.

2.1.2. *Purpose of the management plan in place*

The purpose of the developed system is to enable economic benefits to accrue to the province, to obtain minimum baseline information to ensure that landowners harvest on their own property, to enable quota formulation for sustainable resource use (permitting), to obtain baseline information to build a database for the province on its resources and the impacts harvesting has on *H. gordonii* populations, and to acknowledge and respect the ABS/IKS.
The methodology developed was kept as simple as possible to enable non-scientists to implement the system as the department is unable to conduct all surveys (not all farmers can afford consultants). It also included prescribed guidelines as to how and when you may harvest to be able to evaluate harvesting impacts (uniform methods enable comparisons).

2.1.3. *General elements of the management plan*

Landowner confirmation (Deeds)
Available resource and general health of the resource
Harvest reporting (harvested, wet:dry ratios)
Trade information (optional)
Monitoring (harvested sites, permits)
Gap: Management efforts concentrate on *H. gordonii* though related species might also be impacted on.

2.1.4. *Restoration or alleviation measures*

No restoration is needed if prescripts are followed, only monitoring to evaluate whether adaptive management (harvesting) is needed. The only aspect of high impact is the development of cultivation sites.

2.2. Monitoring system

2.2.1. *Methods used to monitor harvesting*

Sites harvested are re-visited and visual inspections are done (no quantification). This is followed-up at a later stage (at least one year after harvest) during which time a survey is done within the harvested area, using similar methods as for the original resource assessment (an alternative is fixed point photography and making notes for interpretation).

The Permit Section has put a database system in place which can be used to monitor permits issued. However, this is a new system and not all data have been captured on it. Previously limited information could be retrieved from the database, and manual scrutiny of the ODB (investigation diaries) had to be done.

Permit monitoring is difficult as detailed recording of permits have not been done before 2006, i.e. differentiate between wild and cultivated, and wet and dry mass e.g. This has only recently been rectified.

2.2.2. *Confidence in the use of monitoring*

The confidence level is moderate – those figures indicated would always be linked to confidence levels or gaps, meaning that you would have an idea of accuracy and confidence.

Monitoring is not structured properly regarding the permits, but might be now after the new database has been implemented.

Species monitoring is not formally structured, and initially the responsibility was placed with the landowner, but it was found that it was not implemented. Accordingly the department is re-visiting the sites, with the first quantifying survey being done about one year after the harvesting took place. Due to personnel constraints the responsibility was initially placed with the client.

2.3. Legal framework and law enforcement

Refer to section 1.5.2.

The species is nationally listed as protected under NEM:BA (National Environmental Management: Biodiversity Act No. 10 of 2004, TOPs Regulations of 2007). The species is listed provincially as protected in five of the nine Provinces in South Africa. The species is also listed in CITES Appendices II.

3. UTILISATION AND TRADE FOR RANGE STATE FOR WHICH THE CASE STUDY IS BEING PRESENTED

3.1. Type of use (origin) and destinations (purposes)

Traditionally it was used by the San while hunting to suppress appetite, thirst and to maintain their energy levels. They ate portions of the fresh stems of about 180-250g per day. The commercial uses are similar, with dieting and energy boosting (cyclists) being the major consumer markets (300-400mg per day, three times per day). Interestingly, the Patent actually includes anti-diabetic and prevention of aspirin induced gastric damage characteristics.

Limited cultural and traditional use still continuous today. It has been reported by communities that the resource have become scarcer (anecdotal information). Other traditional uses (treatments) include abdominal cramps, haemorrhoids, tuberculosis, indigestion, hypertension, diabetes, peptic ulcerations and allergic reactions in eyes.

Horticulture is limited.

At this stage *H. gordonii* is commercialised as a food-source and/or -supplement, not a pharmaceutical product. The CSIR patented P57, and then licensed it out to Phytopharm (UK), who sub-licensed it to Unilever to commercialise it as a food product/supplement. Benefit sharing agreements are in place with the San (6%).

Most exports from the Northern Cape were to the UK (Phytopharm) and the Western Cape Province of South Africa. Others include the USA, US Texas and North America.

Material is exported as dry material (discs or milled), or as extracts.

Up to now, wild crafted trade was more than cultivated material. However, the number of cultivations has increased and it is anticipated that wild harvesting would not form such a large part of the trade in the future.

The collection of dead wild *H. gordonii* material was combined as wild crafted data and should be kept in mind. Nearly half of the wild harvested material (kg) was dead material that was collected.

It takes at least three years before cultivated material can be harvested, therefore it is anticipated that the pressure from wild crafted material would decrease.

Cloned / tissue culture methods have been successful but regarded unfeasible, thus no material produced via cloning / tissue culture have been exported.

(Permit figures are being double checked to eliminate double counts due to system changes, i.e. new database).

3.2. Harvest:

3.2.1. *Harvesting regime*

No harvesting prescripts are given to cultivated material collection as they mostly harvest the entire plant anyway. A register must be kept through recording all activities and weights.

General guidance (booklets) was given to applicants specifying that older plants also contain the active ingredients. Thus, plants larger than 40cm in diameter could be harvested.

Only ten of the stems may be harvested or 25% of a plant that is larger than 40 cm in diameter, only on the southern side (down wind), near ground level. Only trained harvesters may harvest *Hoodia* material, i.e. trained in the prescribed methods provided by the department. Harvesting will only be considered on sites where an excess of 2 500 plants are available that are in good health and of optimal size.

Harvesting of wet plant material may only occur if it is not in flower or seed, which is normally between April and August. Seed collection must be specified and will be evaluated in a similar manner as in wet plant material collection, except for time of year to be collected. Only every second to forth large plant (larger than 40cm in diameter) should be harvested in the wild.

Stems must be cut off at least three fingers' width (5cm) above ground level with a sharp stainless steel blade. The blade must be disinfected (3% chlorine solution, like Jik) between each plant being cut. The cut stems that remain on the plant must be dusted with lime sulphur powder. The collected stem-parts are washed and cut into disc shaped pieces. These pieces must be dried in an appropriate manner to ensure quality and prevent rotting. Plant material mass must be determined and signed off by Conservation Authorities before and after drying. Drying must occur as close as possible to the harvesting site.

The sealed dried discs are sent to accredited and endorsed Processing and Quality Assurance entities. Quality products are sealed with tamper proof Quality Labels and Logos. These products are ready for trade after quality assurance approval and labelling.

Monitoring programmes must be put in place at sites where wild crafted collections occurred / are planned.

Clients were given the opportunity to deviate from the proposed methods, IF they can provide scientifically proven data that their proposal is more effective than the prescribed method and must be reported as such in their RAMR.

Figure 14. A schematic illustration of how you should cut stems on the southern side of a plant in the veldt, using a sharp stainless steel blade.

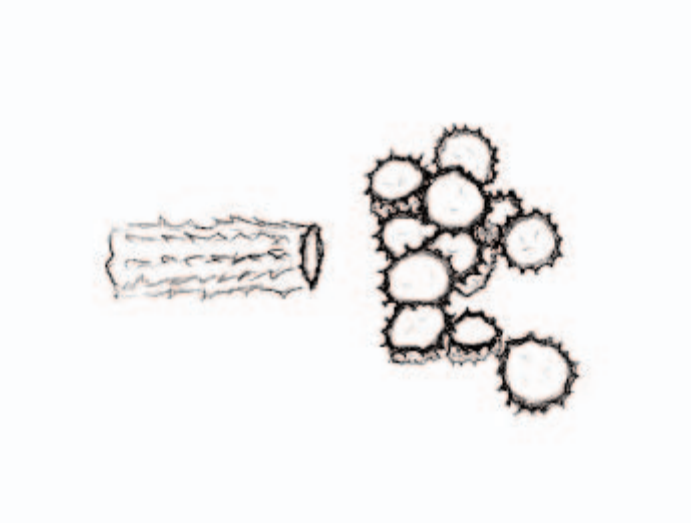

Figure 15. A representation of the cut slices of *Hoodia* stems harvested.

Mature seed pods/follicle should be collected just prior to opening of the pod, or with seed collection bags. If not done at this time, it will compromise the success rate of germination. It is recommended that seeds should be collected over two flowering seasons to minimise its impact on natural populations.

Figure 16. Example of a *H. gordonii* seed collection bag.

3.2.2. *Harvest management/ control (quotas, seasons, permits, etc.)*
Refer to section 3.2.1.

3.3. Legal and illegal trade levels

From 2005 until March 2008 a total of 15.7 tonnes of dry illegal material have been confiscated. Anecdotal data indicate that it could be more (more than 41 tonnes dry weight), but it is unconfirmed. It is suggested that only 10-15% of illegal trade is reported and/or caught.
Legal harvesting peaked in 2007 at 45-50 tonnes of dry material being collected (2005 until March 2008 adds to 70-75 tonnes dry weight).
(Exports and CITES records are being double checked).

II. Non-detrimental Finding procedure (NDFs)

1. IS THE METHODOLOGY USED BASED ON THE IUCN CHECKLIST FOR NDFs?

No, although there are various similarities. Several of the aspects to be addressed according to the IUCN checklist have been addressed through our methods being used.

2. CRITERIA, PARAMETERS AND/OR INDICATORS USED

The general health of the population is taken into consideration, the size of the population (adult plants), the total area surveyed should have covered at least 1% of distribution area to make inferences from

RAMR data, the total number of plants per site must be more than 2 500 harvestable plants, and no more than 15% of a population may be harvested (prescribed harvest methods of 25% of plant's stems, every second to fourth plant).
A precautionary principle was used, meaning that for any uncertainty in the data, the quota was reduced accordingly.
The same sites may not be harvested for the next three years, i.e. every forth year the same site might be harvested (depend on re-evaluation and site visit).
Quality control measures to secure the market and establish sustainable trade might have to be implemented. *Hoodia* differ from other Cactaceae species morphologically (e.g. grouped spines / thorns), anatomically (e.g. presence of druse crystals and hairs) and their chromatographic fingerprints (TLC, HPLC and NIR).

3. MAIN SOURCES OF DATA, INCLUDING FIELD EVALUATION OR SAMPLING METHODOLOGIES AND ANALYSIS USED

Literature, anecdotal information, Industry (who are willing to share some of their information), and the RAMR (demographic and density data, as well as habitat description) is used.
Demographic information was obtained through the following method:
The first live 100 individuals encountered in the densest part of each population must be surveyed. A plot of 1 ha (ideally 100 m x 100 m) should be documented. If a plot of 100 m x 100 m cannot be established, plot sizes should be adjusted to enable the documentation of at least 100 live individuals and a surface area of 1 ha. A template for measurements to be taken was provided.
In case of infection, or infestation / physical damage, the rating is between 0 and 3, with 0 being none and 3 being severe (rating 0 for no, 1 for presence of, 2 for moderate (60% affected), and 3 for severe infection, infestation / scarring (covered with infection or infestation / expect death).
Rating: 0 (healthy plant) Rating: 2 (infested plant) Rating: 3 (dying plant)

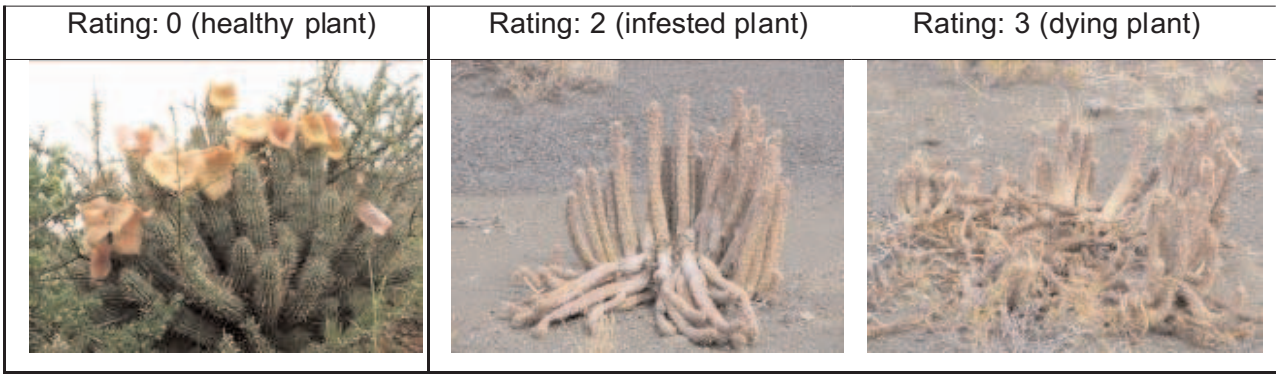

Figure 17. Examples of plants to illustrate ratings of health as per RAMR.

Dead individuals that are encountered within the same plot where the 100 live individuals are being surveyed should be documented. Also take a view photo of each plot you survey, noting the GPS coordinates and the direction in which you take the photo (north, south, east, etc.) of the photographic point. If possible, also take a photo of each individual plant respectively next to a measure rod – this will be used for future monitoring purposes to detect, e.g., growth rate.
GPS mark and note each individual Hoodia surveyed, dead and/or alive on a spreadsheet.
Site characteristics like aspect, habitat, grazing intensity (dung frequency and type), mountainous, plains, and soil type should be noted.

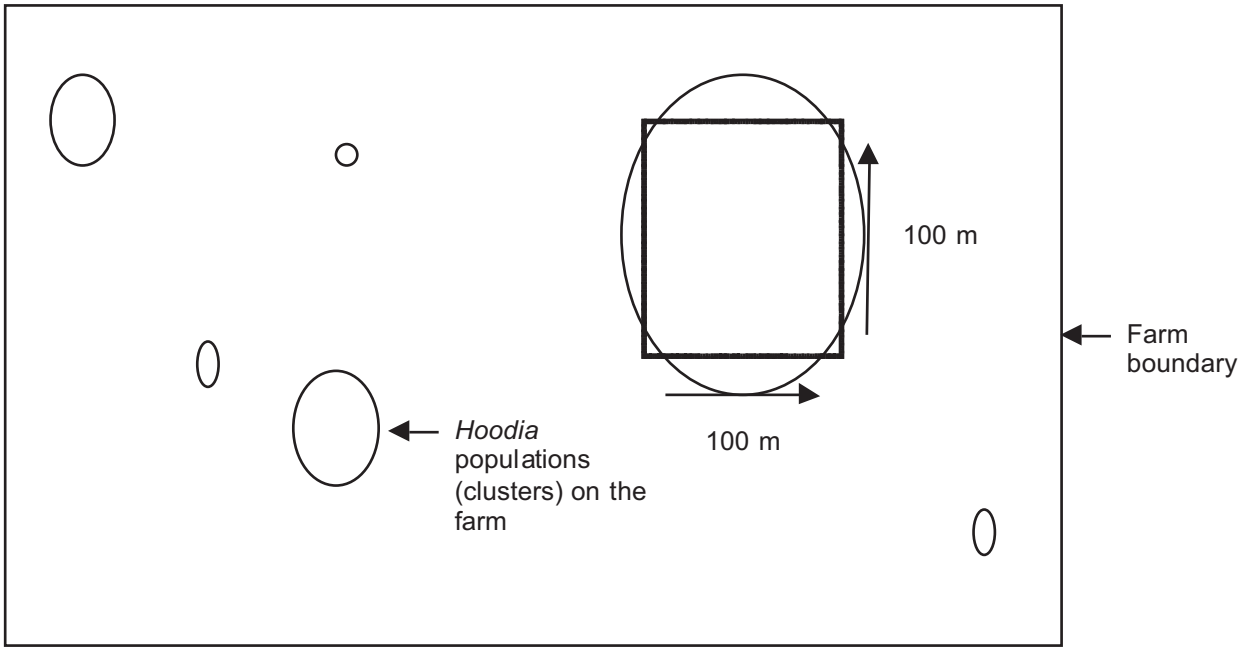

Figure 18. A schematic illustration: How to identify the site for the survey and how to place your quadrant in which you then survey individual plants.

Additional population information (density):
Population density and mortality information will be used to extrapolate your potential resource availability on the farm / site. Count live and dead individuals encountered within 4 parallel, 250m line transects that bisects the densest part of the population (and the demographic survey plot) and span its topographic gradients. Count all individuals occurring within the range of 2m on each side of the line transect (thus, total area covered is 4 000m2).
Note whether the dead individuals are standing or lying and its possible cause of death.

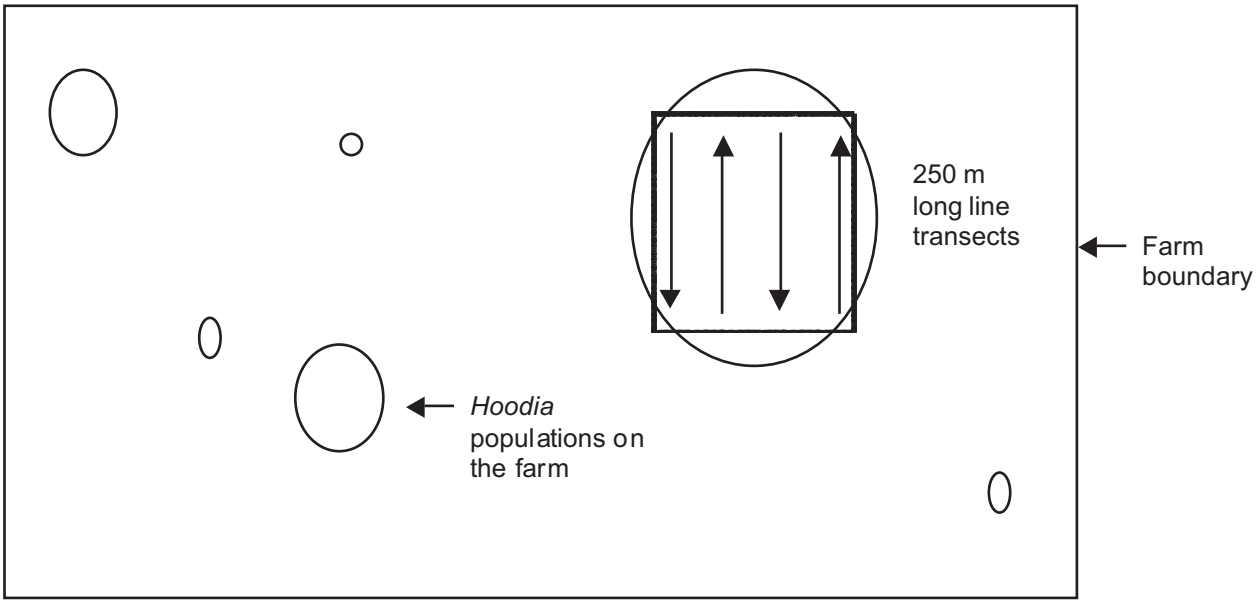

Figure 18. A schematic illustration of your line transects' layout.

This information relates to the optimum resource. An indication of part of the farm having clusters and the number of clusters on the farm is also recorded. A 1km line transect should also be walked to get a more general indication of density.

4. EVALUATION OF DATA QUANTITY AND QUALITY FOR THE ASSESSMENT

Generally most of the data could be used; however there were differences in how and what various people interpreted. This means that not all data can be lumped directly.
Data collected by departmental personnel is generally of good quality, but it was difficult to train farmers and consultants to do the surveys correctly while noting relevant information.

The line transect method is a questionable method if the department's scientist have not visited the site. Overestimation is a concern with the four parallel transects, though it provides better guidance with regard to the cluster's resource.

Preliminary information used for evaluation calculations:

Dry:wet ratios:	1:10 to 1:12 for wild material, 1:20 to 1:30 for cultivated material
Products:	each 33g serving contain 300-400mg active ingredients, that must be taken three times per day
Market:	Estimated weight needed to launch one international product is about 7 tonnes dry material (70 tonnes wet material) per month.
Resource need:	7 tonnes dry material relates to 23 333 wild plants (if 3kg wet material can be collected per plant harvested). If 30kg wet material can be collected per plant, it relates to 2 333 plants needed per month (i.e. 28 000 plants per year). When implementing harvest of every second plant, 56 000 plants are needed in the wild (if everyforth plant is harvested, 112 000 plants are needed).
Preliminary seed production:	200-250 seeds per follicle, 3mg per seed.
Cultivations:	25 000 – 50 000 plants/ha (cannot exceed 60 000 plants/ha) Ca. 4 tonnes dry material/ha (variable)

5. MAIN PROBLEMS, CHALLENGES OR DIFFICULTIES FOUND ON THE ELABORATION OF NDF

Lack of biological information is problematic (regeneration cycles, population trends, longevity of seed, seedling survival, etc.).

Lack of cooperation between provinces prevents proper management and monitoring of material/permits, enabling illegal trade via 'less-strict' provinces.

Development of the management of systems occurred within a time-frame where national legal structures (ref. Biodiversity Act) was not in place, causing uncertainties, lack of guidance and difficulties in Range State collaboration on government level.

Departmental staff shortages prevent them from being present at all harvesting activities for monitoring and recording. Although it was requested that harvesting dates should be arranged with the department beforehand to enable scheduling and their presence, it was difficult to execute.

Although it was thought to be a simple method, easy understandable guideline to be used for RAMR, most were unable to execute it properly.

6. RECOMMENDATIONS

Southern Africa should implement the same rules and methods in addressing wild crafted trade. Liaison with regard to transport and export permits is needed.

Capacity on provincial level is limited, varies in expertise and personnel turnover is of concern. It is uncertain as to how one can address these aspects, but a checklist (ticking off yes or no blocks) might be an option for evaluation (with reference to permit evaluations). However, for this more information is needed on the biology and regeneration of the species. Field experience and personal knowledge play a role in the permit evaluation processes currently, meaning that it is dependant on the person doing the evaluation (subjective to an extent).

A consultant or student should be sponsored / given a bursary to obtain the relevant biological information needed to enable the development of improved quota systems that inexperienced scientists can use to evaluate applications.

Provincial departments should be capacitated (more scientists), or provided with financial support to appoint consultants for surveys, or national departments should assist provincial departments where capacity constraints are being experienced.

Preferably the departments should do the resource assessments because it was found that the clients struggle too much with it. The time it takes to train them and assist them in getting it right, means that it is not really less time consuming as anticipated. Then you also need to either computerise their data, because they do not have computers, or you must try to unravel what applicants tried to say in their documents.

Importing countries should monitor *Hoodia* that is being imported, which should then be cross referenced with the countries of export. Any discrepancies in the data should be investigated.