NDF WORKSHOP CASE STUDIES
WG 2 – Perennials
CASE STUDY 2
Pelargonium sidoides
Country – **LESOTHO**
Original language – English

DEVELOPMENT OF A NON-DETRIMENT FINDING PROCESS FOR *PELARGONIUM SIDOIDES* IN LESOTHO

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I. Background information on the taxa

1. BIOLOGICAL DATA

1.1. Scientific and common names:

Pelargonium sidoides (DC)
Common names: Kalwerbossie, T'nami, and Khoaara e nyenyane

1.2. Distribution (Specify the currently known range of the species. If possible, provide information to indicate whether or not the distribution of the species is continuous, or to what degree it is fragmented. If possible, include a map).

P. sidoides distribution is limited to South Africa and Lesotho. In South Africa it occurs in the Eastern Cape, North West, Free State, Western Cape, Mpumalanga and Gauteng provinces. In Lesotho, it occurs predominantly in the more mountainous Southeastern and Northern parts of the country. It has been recorded at altitudes ranging from near sea-level in South Africa to 2746 metres in the mountains of Lesotho (See figure 1).

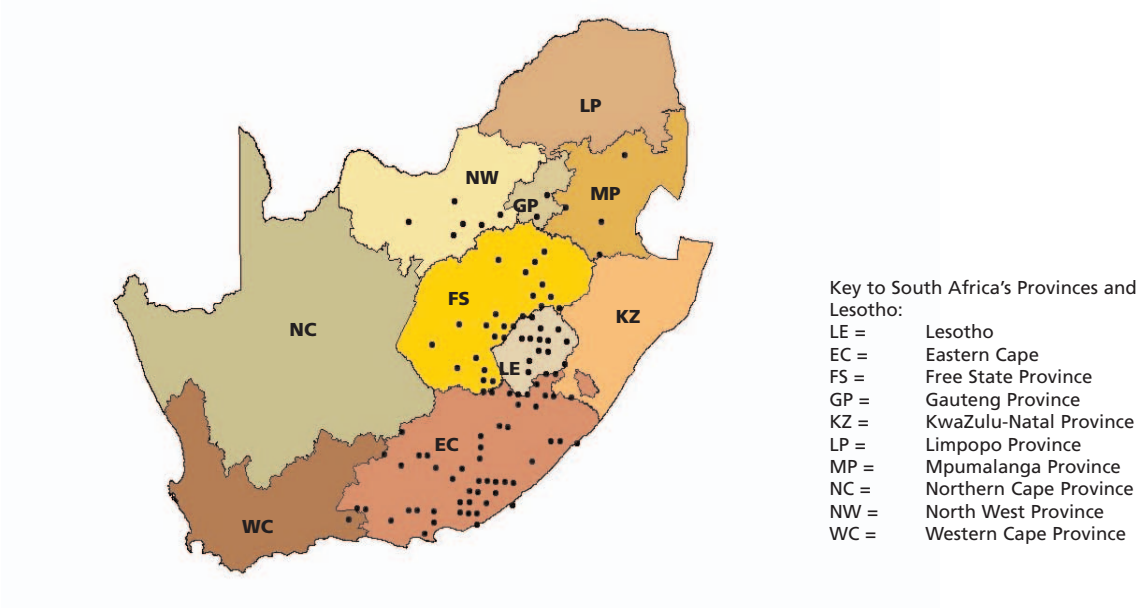

Figure 1: Distribution Map for *P. sidoides* in South Africa and Lesotho – Each solid black square represents one-quarter degree square (1 square kilometre) where the species occurs. Source: PRE (National Herbarium, SANBI, Pretoria), SAM (South African Museum Herbarium - transferred to NBG in 1956), NBG (Compton Herbarium, SANBI, Cape Town), NMB (Herbarium, National Museum, Bloemfontein), GRA (Selmar Schonland Herbarium, Albany Museum, Grahamstown), NH (KwaZulu-Natal Herbarium, SANBI, Durban), KEI (Herbarium, Walter Sisulu University, Umtata) and locality data in Lesotho identified during fieldwork for a non-detriment finding.

In Lesotho, prior to the NDF training project, distribution was limited to five PRECIS locations. This number of localities was increased substantially at 20 survey sites ranging from the South East to North West of Lesotho in the Mohale's Hoek, Quthing, Qacha's Nek, Thaba Tseka, Mokhothlong, Butha Buthe and Maseru districts. In addition, to the observed distribution, the total predicted distribution in Lesotho was determined using a GIS-based model as illustrated below in Figure 2.

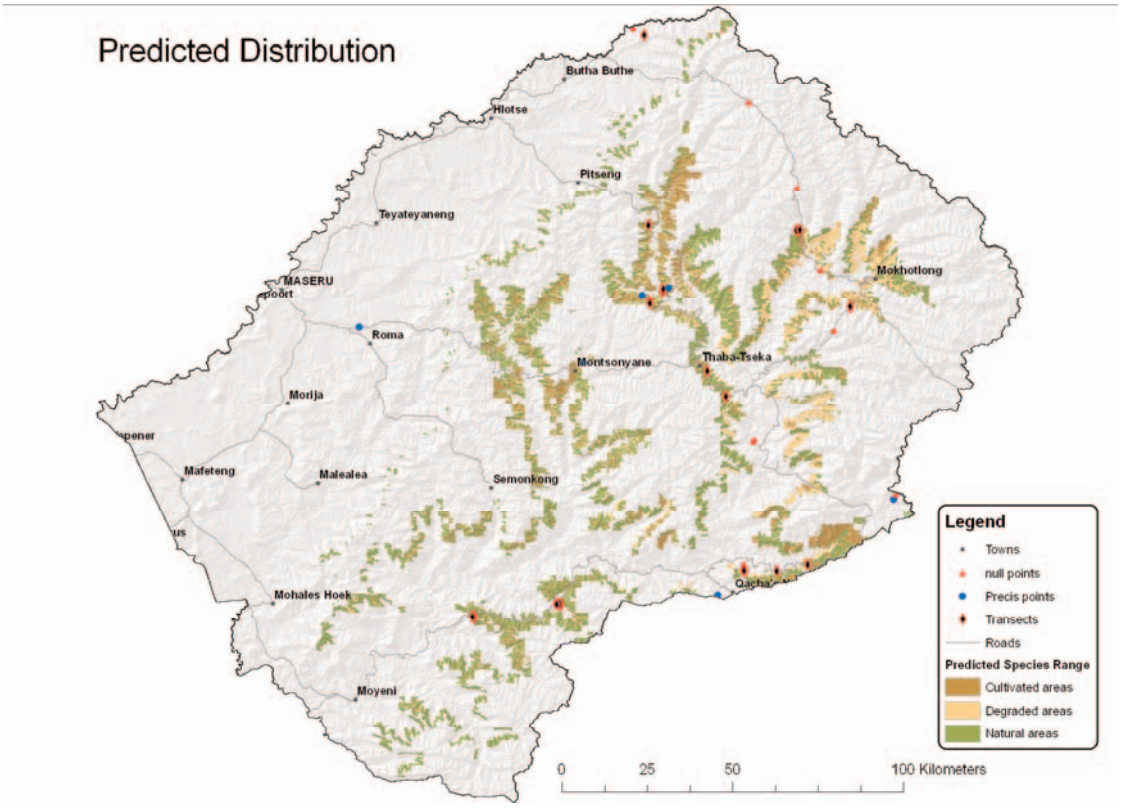

Figure 2: Distribution Map for *P. sidoides* in Lesotho. Actual distribution is based on South African National Biodiversity Institute PRECIS data and transects data gathered during fieldwork for a non-detriment finding. The GIS-predicted range is indicated by the green shading with the brown shading indicating cultivated or degraded areas. Source: Field research conducted by the Lesotho Scientific Authority and TRAFFIC East/Southern Africa, February 2008 and PRECIS database (PRE), National Botanical Institute, Pretoria, December 2003.

1.3. Biological characteristics

1.3.1. *Provide a summary of general biological and life history characteristics of the species (e.g. reproduction, recruitment, survival rate, migration, sex ratio, regeneration or reproductive strategies, tolerance toward humans).*

According to van der Walt (1988), *P. sidoides* is a somewhat aromatic rosette-like plant with crowded, velvety, heart-shaped, long-stalked leaves and a system of thickened underground root-like branches, aerial parts sparsely branched from base, evergreen in cultivation but in nature probably dying back to varying degrees during winter, two hundred to 500 mm tall when in flower. The inflorescence is a branched system of two (rarely up to four or more) pseudo-umbels, each with three to seven (occasionally up to 14) flowers. The flowers are 15 to 17 mm in diameter, the pedicel is usually very short compared to the well-developed hypanthium, and the petals are very dark reddish purple.

1.3.2. *Habitat types: Specify the types of habitats occupied by the species and, when relevant, the degree of habitat specificity***.**

Van der Walt (1998), observed that this is an environmentally tolerant species being found in short grassland, sometimes with occasional shrubs or trees, on often-stony soil varying from sand to clay-loam, shale or basalt. In Lesotho, it is found predominantly in Lesotho Highland Basalt grassland. It usually grows in direct sunlight under rather dry conditions and receives summer rain varying from 200 to 800 mm per annum. On the whole it experiences moderate rather than high summer temperatures, and over much of its range it gets winter frost or even snow. The well-developed underground parts are doubtlessly not only an adaptation to survive such unfavourable conditions, but also provide an escape from grass fires which occur almost annually over much of its range. When cut, the insides of the underground parts show bright red, a property commonly associated with *Pelargonium* species used for folk-medicinal purposes and resulting in the colloquial name "Rabassam". *P. sidoides* is easily propagated by transplanting, from seed, or from basal cuttings. It is a hardy plant that thrives in plentiful sunlight (Van der Walt, 1988). Its preferred habitat appears to be open grasslands. Field observations by Vlok (2003), revealed that bush encroachment on this habitat leads to a decline in the vigour of plants and eventually elimination. The species appears to tolerate and even thrive in partially disturbed habitats where plant competition levels are low but bush encroachment and agricultural activities are not conducive to re-growth and plants are eliminated from such areas.

1.3.3. *Role of the species in its ecosystem*

Apart from the plants use as a medicinal by humans and for treating sick livestock, the role of the species in its ecosystem has not been studied.

1.4. Population:

1.4.1. *Global Population size: (*Population size may be estimated by reference to population density, having due regard to habitat type and other methodological considerations, or simply inferred from anecdotic data*)*
In Lesotho, the predicted "very likely" distribution illustrated in Figure 2 amounts to an area of 2,100 square kilometres (210,000 hectare) out of Lesotho's total land area of 30,532 square kilometres. The average density of plants (or ramets) in this area is estimated from transect data to be approximately 5,000 plants or ramets per hectare (0.5 plants or ramets per square metre). However, given the observed patchy and localised distribution of individual populations across the landscape, a "patchiness" factor of 0.5% was applied to calculate Lesotho's total population at approximately five million plants.
In South Africa, plant densities determined by Vlok (2003) ranged from 0.2 ramets per square metres to 7.7 ramets per square metre. As insufficient survey work has been completed in South Africa it is not possible to provide an estimate of "very likely" distribution and therefore the total population is not known.

1.4.2. *Current global population trends:*
___increasing _X__decreasing ____stable ____unknown

1.5. Conservation status

1.5.1. *Global conservation status* (according to IUCN Red List):

___ Critically endangered	___ Endangered
___ Vulnerable	___ Near Threatened
X__ Least concern	___ Data deficient

1.5.2. *National conservation status for the case study country*
South Africa:
According to the South African Red Data List (2008), this species has a huge distribution range of 480,000 km2; however it is under severe harvesting pressure. Although the plants coppice after harvesting, local extirpations can occur when harvesting takes place too regularly and in the absence of adequate rainfall. The species is undergoing a continuing decline and it is therefore classified as "Least Concern – Declining".

Lesotho

Because no harvesting impact assessments have been completed to date the Red Data List status of this species is not known for Lesotho, however, small clusters of this species occur throughout a relatively large area (approximately 2,100 square kilometres) of the country. As in South Africa the species is under severe harvest pressures and its populations are estimated to be declining.

1.5.3. *Main threats within the case study country*

___No Threats
X_ Habitat Loss/Degradation (human induced)
___Invasive alien species (directly affecting the species)
X_ Harvesting [hunting/gathering]
___Accidental mortality (e.g. Bycatch)
___Persecution (e.g. Pest control)
___Pollution (affecting habitat and/or species)
___Other_____
___Unknown

2. SPECIES MANAGEMENT WITHIN LESOTHO.

2.1. Management measures

2.1.1. *Management history*

Historically and presently there is no national monitoring framework of biological diversity, including *P. sidoides*, in Lesotho. The Lesotho Highlands Development Authority (LHDA) is however, engaged in flora and fauna monitoring programs within two of its areas, the Malibamatso catchment (Phase 1A) and the Mohale catchment (Phase 1B). The Range Management Division of the Ministry of Agriculture also did some small scale baseline studies for the flora in Pelaneng/Bokong and Malibamatso/Motsuku in 1990/1991 where permanent transects were established, but monitoring of these have been irregular due to limited resources allocated to the projects. The data emanating from these studies has also not been published. The current exploitation of the wild populations of *P.sidoides* is not monitored. The mapping of the populations and studies on regeneration potential are incomplete.

In addition, rangeland degradation in Lesotho has reached a critical level due to overgrazing and poor range management practices. Overgrazing has in turn led to progressive replacement of palatable grasses by invader species such as *Chrysocoma ciliata*. Annual soil loss from rangelands is estimated at 23.4 million tons per year (Chakela.

1981). Frequent droughts and occasional fires also contribute to range degradation in this country.

2.1.2. *Purpose of the management plan in place*
There is no national management plan

2.1.3. *General elements of the management plan*
There is no national management plan.

2.1.4. *Restoration or alleviation measures*
There is no national management plan for restoration or alleviation

2.2. Monitoring system

2.2.1. *Methods used to monitor harvest*
There is no national monitoring system in place

2.2.2. *Confidence in the use of monitoring*
There is no national monitoring system in place

2.3. Legal framework and law enforcement: Provide details of national and international legislation relating to the conservation of the species.

Lesotho lacks comprehensive national environmental laws although an umbrella Conservation Bill that has specific provisions for conservation of biological diversity has been drafted and awaits enactment. Currently, most conservation laws in Lesotho focus on improvement of economic or agricultural benefits rather than direct conservation of flora and ecological processes. Six pieces of legislation directly address biodiversity conservation, namely:

- **The Environment Act of 2001:**

Part V Section 33 (1), of the Environmental Act 2001, states that no person shall operate, execute or carry out a project or activity specified in the Schedule without an environmental impact assessment licence issued by the Lesotho Environment Authority.
Part V Section 33 (2) of the Environmental Act 2001: The Authority may, if it is satisfied that the environmental impact statement is adequate, issue an environmental impact assessment licence on the terms and conditions appropriate and necessary to facilitate sustainable development and sound environmental management.
Part V Section 28 (3) of the Environmental Act 2001: If after considering the project brief, the Authority, in consultation with the Line Ministry is

of the view that the proposed project will not have any significant impact on the environment, it may approve the project or activity.
Section 66. (1) (f) of the Environmental Act 2001.
Prohibit or restrict any trade or traffic in any component of biological diversity.

- **Historical Monuments, Relics, Fauna and Flora Act 41 of 1967:**

In Lesotho there is no permit system used for the harvesting of and trade in *P. sidoides*. However, there are some pieces of legislation, namely section 10(2) of the Historical Monuments, Relics, Fauna and Flora Act 41 of 1967 that:

I. Requires that written consent for harvesting of floral resources be obtained from the Preservation Commission before such activity can be carried out.
II. Lists plants that are protected under the Act. The Act was amended through Legal Notice No. 93 of 2004 to include more species, including *P. sidoides*.

- **Local Government Act of 1997:**

The Local Government Act of 1997 specifies the mandate of the Community Councils that relate to the environment.
Section 5 (1) and Section 5 (2) grants Local Councils control of the following: Natural resources (e.g. sand, stones) and environmental protection (e.g. dongas, pollution), public health (e.g. refuse collection and disposal), land/site allocation, grazing control, markets, streets and public places, parks and gardens, fire, burial grounds, forests (preservation, improving and control of designated forests in local authorities), and water supply in villages. Flora and fauna are not specifically spelled out in this list of natural resources under the Act.

- **The National Parks Act of 1975**, details resource management mandates within National Parks, and,
- **The Managed Resource Areas Order of 1993**. Further information on this body of legislation was not available during this research.
- **The Trade Enterprises Order of 1993**. This legislation provides for the issuance of a Traders' license by the Ministry of Trade, Industry, Cooperatives and Marketing.

Problem areas identified include the quality of environmental legislation and their implementation. Existing statutes governing natural resource management and the protection of the environment are considered inconsistent, inadequate and un-consolidated. They also overlap and are often in conflict with one another. Their implementation

is inadequate because they are inaccessible (i.e. out of print, available only in English, and outdated). In addition, they depend on coercive measures, and are often reactive rather than preventive. For instance, if a company wants to harvest *P. sidoides* they require an EIA clearance letter from the NES issued in terms of the Environment Act of 2001. This letter is issued when NES receives a satisfactory Project Brief or Environmental Management Plan (EMP) from the company. In addition, in terms of the Historical Monuments, Relics, Fauna and Flora Act 41 of 1967, the company must obtain a permit from the Protection Preservation Commission (PPC) for harvesting flora listed under the Act. However, the Act does not allow issuance of permits for trade and export purposes, and PPC in its history have not issued any permits for export or trade purposes. To resolve these inadequacies and inconsistencies, the PPC must be re-established and a system for issuing permits for trade purposes must be developed. Without this natural resource management in Lesotho will continue to be ineffective.

Other factors that contribute to poor implementation of environmental legislation include poorly trained personnel, inadequate financial resources, weak administrative and organisational structures, institutional conflicts, scarcity of monitoring equipment and lack of environmental education and public awareness programmes.

Legal reforms were initiated as early as 1989 to address the shortcomings in environmental legislation and in institutional capacity. This has culminated in the drafting of a draft Environmental Bill and in the establishment of the National Environment Secretariat (NES) to spearhead and co-ordinate environmental issues and ensure compliance with international conventions and treaties.

Although Lesotho is a signatory to the Convention on International Trade in Endangered Species (CITES), it does not have many of the required implementation structures, such as dedicated CITES implementing legislation.

Traders in Lesotho are required by law to obtain collection permits from the NES in terms of the Environment Act of 2001. In reality this requirement only applies to large scale operations with many people selling this species on a small scale in urban markets not having permits. The collection of plants from any site in Lesotho also requires permits in terms of the Historical Monuments, Relics, Fauna and Flora Act of 1967 and the less formal process of obtaining permission from the traditional leaders in the particular area.

P.sidoides populations naturally occur on rangelands which are primarily used for livestock grazing. The use of Lesotho's rangelands is the responsibility of Range Management Areas (RMAs)/ Grazing Associations (GA) which are specially designated management units

designed to promote sustainable use of Lesotho's rangelands. However RMA's are not common throughout the country. They are found only in certain areas and even many of those that have been established are reportedly barely functional. Most of the rangelands are still controlled by traditional chiefs and the local government councils. Indeed in those areas where RMAs are present, management powers are delegated to them. The areas used for summer grazing in the mountains (animal posts) still remains the exclusive right of the Principal Chiefs without local government involvement.
In conclusion, the current legislative system providing a legal basis for the harvest of *P. sidoides* is unclear, appearing to be work in progress. The lack of transparency in the legislative and administrative requirements is not conducive to a well-managed and legal natural resource industry in Lesotho.
The main issues identified during this research are:

- It is not clear which body of legislation mandates the implementation of CITES in Lesotho.
- There is no one single authority in Lesotho that can authorise harvest of natural resources. This is epitomised by the situation where a trader in possession of a harvest permit issued in terms of the Environment Act of 2001 by the National Environmental Secretariat was arrested by police for illegal harvest because they did not have a permit issued in terms of the Historical Monuments, Relics, Fauna and Flora Act 41 of 1967 and Local Government Act of 1997.
- The Historical Monuments, Relics, Fauna and Flora Act 41 of 1967 legislation relevant to this natural resource management is not implementable since the responsible institutional arrangements are not in place. The body that administers this law, namely, "Protection Preservation Commission of Natural and Historical monuments" was instituted but is currently not functional. In addition, Environmental Impact Assessments are currently not obligatory complicated by the fact that the Act does not cover harvesting for trade purposes, rather for small-scale collections such as research purposes.

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

3.1. Type of use (origin**) and destinations (**purposes**) (**e.g. commercial, medicinal, subsistence hunting, sport hunting, trophies, pet, food**). Specify the types and extent of all known uses of the species. Indicate the extent to which utilization is from captive-bred, artificially propagated, or wild specimens**

Pelargonium species in general, have been used in southern Africa as useful medicinal plants for many years providing relief for colic, diarrhoeas and dysenteries (Watt and Breyer-Brandwijk, 1962). *P. sidoides* forms part of a group of *Pelargonium* species with red-coloured fleshy roots also used to treat the above mentioned abdominal upsets. The plants are prepared as decoctions, in water and often with milk (Watt and Breyer-Brandwijk, 1962). In confirmation of this usage, Dold and Sizane (2002), surveyed 15 South African based harvesters and found seven using *P. sidoides*/ *P. reniforme* to treat stomach aches; four prepared the remedy in milk.

In more recent times the species has become an ingredient in a number of commercially produced medicinal remedies, including one called "Umckaloabo" used to treat bronchitis in both adults and children (van Wyk, *et al*., 1997). Anon 3 (2003), advertises *P. sidoides* for sale in the form of dried sliced root and tinctures for the treatment of sinus, throat and respiratory tract infections.

At the level of more formal medical practice, several scientific trials on extracts of *P. sidoides* have demonstrated positive clinical effects (Koch, E., *et al*, 2002; Bereznoy, V.V., *et al*, 2003), thus providing incentives to continue the harvest of not only this species, with its sought after active ingredient "umckalin"but others that have similar medicinal extracts, such as *P. reniforme*. Although the name "Umckaloabo" is used globally to describe medicines from *P. sidoid*es and *P. reniforme*, the main exploitative pressure is on the former because of its superior "umckalin" content compared to other species. Although the benefit of this remedy has been known for many years it is only since 2001 that large scale commercial wild harvesting commenced in South Africa and more recently in Lesotho, to supply the international market. The dominant export destination for this plant and its products is Germany.

This species are harvested from the wild mainly in the Eastern Cape Province of South Africa and in the South-eastern and North-western districts of Lesotho. Some harvest of agriculturally produced roots occurs in the Western Cape and Free State provinces of South Africa but not thus far in Lesotho. Current legislative measures in South Africa and Lesotho generally require permits for harvest, transport and export. However, legislative and institutional constraints in Lesotho and the lack of effective management systems in both countries has resulted in the issuance of few permits and confusion about the permit issuance procedure. This has led to the situation where a large portion of the harvest conducted to date in both countries has been regarded as illegal.

The main threats to wild populations of *P.sidoides* in Lesotho are habitat loss due mainly to encroachment by human settlements and harvest for commercial use in medicinals.

3.2. Harvest:

3.2.1. *Harvesting regime* (extractive versus non extractive harvesting, demographic segment harvested, harvesting effort, harvesting method, harvest season)

In Lesotho, all *P. sidoides* is harvested from wild populations during the growing season that extends from about September through to April of each year. Harvesters who are paid per kilogram of wet material, harvest the ligno-tubers using spades, pick-axes or other suitable tools. Mature plants with ligno-tubers estimated to be older than seven years old and showing significant levels of secondary "bark" formation and a dark red colour under the bark when injured are the primary target of the industry. Typically, because of its brittleness and tendency to grow under rocks, only part of a ligno-tuber system is harvested. The ligno-tuber stem sections remaining in the soil often resprout within weeks to months after harvest.

3.2.2. *Harvest management/ control* (quotas, seasons, permits, etc.)

In Lesotho, there is minimal national control over harvest management. Apart from the recently conducted non-detriment finding, to date there has been no attenpt to quantify a quota, harvest season, harvest methodologies, rate of resource recovery or other management systems. These activities have been left almost entirely up to individual traders who have voluntarity imposed harvest management system on their own operations. However the effectiveness or appropriateness of such voluntary systems have not been formally assessed.

3.3. Legal and illegal trade levels: To the extent possible, quantify the level of legal and illegal use nationally and export and describe its nature.

Given the fragmented and poorly co-ordinated legislative environment in Lesotho, a large part of the annual harvest volume of approximately that ranges from 17,000 kg to 36,000 kg may be regarded as having been illegally harvested. This is despite the fact that traders may have obtained a harvest permit from one agency but omitted to obtain the necessary permit from another agency also with responsibility for the resource. This legal confusion is possibly the most urgent issue to be resolved if the industry is to be placed on a legal and well-managed footing in Lesotho. In addition, some Basotho citizens harvest over the border in neighbouring South Africa and either import the material back into Lesotho or sell directly to South African-based traders. It is thought that most of this unregulated and largely unquantified cross-border trade is illegal.

II. Non-detrimental Finding procedure (NDFs)

Provide detailed information on the procedure used to make the non-detriment finding for the species evaluated.

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

__Partially, YES

In 2005, TRAFFIC was invited by the National Environmental Secretariat of Lesotho to provide CITES training for its Management and Scientific Authorities as well as law enforcement staff from other government agencies. Subsequent to this invitation, during 2006, TRAFFIC conducted a needs assessment at a workshop convened in Maseru comprising 30 officials from the National Environmental Secretariat, police and other agencies. At this workshop, apart from identifying training needs, a priority list of traded species was identified, the most important being *Pelargonium sidoides*. A project proposal to provide CITES training to the Scientific Authority of Lesotho was compiled and *P. sidoides* was included to facilitate theoretical and field based training in the elements of a non-detriment finding as prescribed in article IV of the CITES.

Having identified the priority species, the following activities were subsequently implemented as part of the non-detriment finding (NDF):

a) Non-detriment findings within the CITES context are generally limited in scope to the guidance provided in article IV of the Convention relating to Appendix II listed species and of Rosser and Haywood (2002). However, as the intent of the NDF in Lesotho was to provide content for an integrated species management plan the research and final report was structured following the principles and criteria of the ISSC-MAP guidelines outlined in Anon (2007) and summarised in Annex 1. Although these guidelines incorporate content required for making a CITES NDF, they additionally include aspects such as benefit sharing, market specifications and worker safety, crucial to ensuring sustainable management of species utilised at an industrial scale.
b) A literature review of mainstream scientific and grey literature for the period 2001 to 2008 was conducted at the South African National Biodiversity Institute, Pretoria and University of Witwatersrand, Johannesburg.
c) On the 21st to 24th January 2008 a CITES training workshop on the role and function of CITES Scientific Authorities (SA's) was conduc-

ted with the Lesotho Scientific Authority. During this workshop the non-detriment finding checklist developed by Rosser and Haywood (2002) and the International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) was utilised to assess the Lesotho SA's knowledge (including threats) of *P. sidoides*, to develop priorities for further field research and interviews and to guide the content of the non-detriment finding report. On the basis of the "Spider" or "Radar" chart generated following Rosser and Haywood (2002) the following information gathering and research priorities were identified (Figure 1 & Table 1).

Figure 1: Radar chart for P. sidoides generated by the LSA according to the non-detriment finding checklist of Rosser and Haywood (2002).

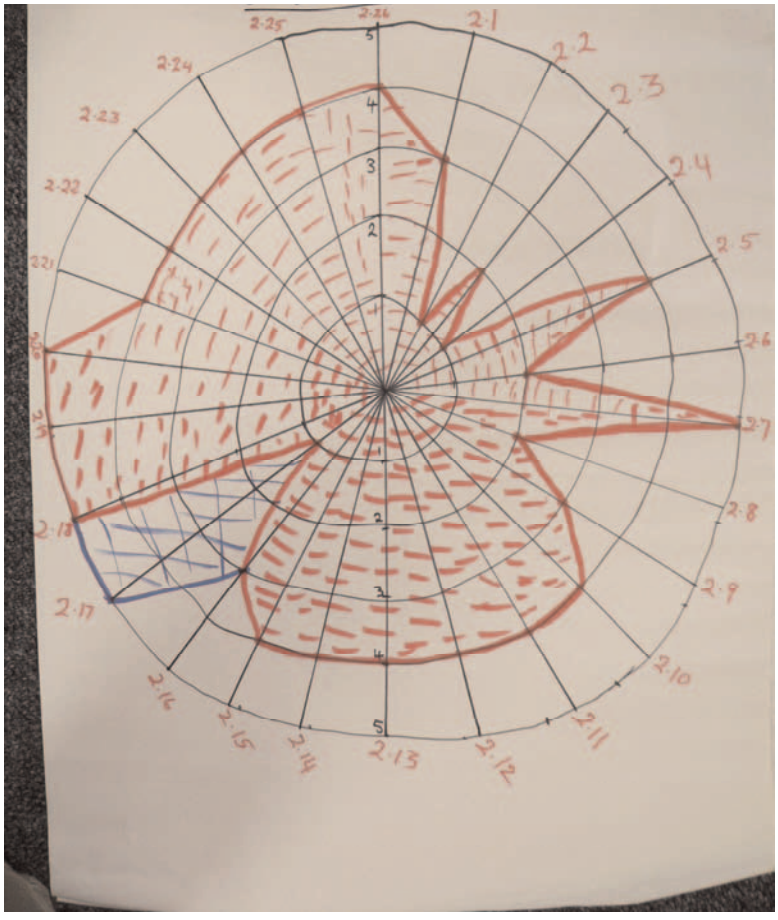

Table 1: Information gathering and research priorities identified following the non-detriment finding guidelines of Rosser and Haywood (2002).

NDF Criterion number according to Rosser and Haywood (2002)	Criterion Description
2.5	Research national distribution
2.7	Research national population trends
2.10	Research illegal harvest or trade
2.11	Research management history
2.12	Identify management plan or equivalent
2.13	Research aim of harvest regime in management planning
2.14	Develop quotas
2.15	Research extent of harvesting in Protected Areas (PA)
2.16	Research extent of harvesting in areas with strong resource tenure or ownership
2.17	Research harvesting in areas with open access
2.18	Establish whether there is confidence in harvest management
2.19	Identify methods used to monitor harvest
2.20	Establish whether there is confidence in harvesting monitoring
2.21	Research the impact of utilization compared with other threats
2.22	Research existence of incentives for species conservation
2.23	Research existence of incentives for habitat conservation
2.24	Research the proportion of plants strictly protected from harvest

Having identified the fact that an integrated management plan was a critical element of future efforts to manage the trade in *P. sidoides*, the LSA were guided through a theoretical introduction to the International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) (Anon. 2007). The ISSC-MAP provides an integrated approach to species management. Sets of open-ended questions relevant to each section of ISSC-MAP were considered by the LSA (Annex 2) and the answers again provided guidance on priority research activities or information gathering required to compile a species management plan. Knowledge gaps identified in this way included the following:

- Q: Is the collection of the species following specific volume and quality instructions from the buyer?
- A: *"No. We don't know the quality requirements but we can safely say there are no volume restrictions."*
- Q: How are illness, injury, financial losses related to collection of this resource handled, and by whom?
- A: *"No illnesses, no injury, no financial (support). They are not handled at all."*

From the answers provided to the ISSC MAP questions additional priorities were added to those provided in Table 1, for instance:

- Determining whether government and industry on behalf of communities were implementing Access and Benefit Sharing principles, and
- Determining whether traders provide specific volume and quality instructions to traders.

d) On the 17th to 24th February 2008, field-work and interviews aimed at obtaining the information listed in Table 1 and derived from the ISSC-MAP questionnaire, including, distribution, density, trade volumes and harvest methodologies, was conducted at 20 sites in Lesotho. Interviews were conducted with community members and two companies active in the harvest and trade of this species using the same ISSC-MAP questionnaire in Annex 2. At each of the 20 survey sites, five transects were conducted. The transects were prepared by first measuring a 100 metre base-line that ran perpendicular to the direction of the slope. Each of the five 50 metre long individual transects were laid out up the slope. The altitude and GPS coordinate were recorded at the start and finish of each transect. A team of three proceeded to walk up the line of the transect holding a 1.8 metre long pole over the transect line and counting each plant occurring within the poles breadth. Counts were also taken of plants with flowers, holes made during previous harvests and plants re-sprouting from previously harvested holes. A separate team dug out one plant within each transect using a pickaxe. The harvested plants were photographed and labelled with GPS coordinates, altitude, photograph number and locality name. The ligno-tuber fresh and dry weight, diameter, length, and presence of white, pink and red ligno-tuber age-groups were recorded.

e) On the 17th to 20th June 2008, a data analysis workshop was convened by the South African National Biodiversity Institute in Pretoria, South Africa to determine the distribution and density of *P. sidoides*

using Arc-GIS to identify areas of habitat, climate and geography suitable for *P. sidoides*. Available distribution and trade data, in conjunction with the results of the GIS analysis were used to determine the maximum possible population available for harvest and whether current harvest volumes were sustainable. Data layers used for this project were SANBI 2006 SA Vegetation Types (Mucina & Rutherford 2006), altitude, aspect, climate (based on frost duration, mean temperature of the coldest month and precipitation), national land cover (NLC) and Lesotho *P. sidoides* coordinate points, which were exported into ArcView 3.2a. as point data. All analysis was done using ESRI's ArcView 3.2a and ARCGIS 9.2 software. Vegetation type was used as a proxy for soil type.

Four GIS models were used to analyse the data, namely.
Model 1: The RULE-BASED MODEL for distribution modelling was applied based on expert knowledge. This model used vegetation (Lesotho Highland Basalt grassland), altitude (range 2100 to 2500 metres), aspect (32° to 165°), climate and precipitation (based on frost duration, mean temperature of the coldest month and precipitation > 800 mm per annum) as its main parameters. An index between -4 and -3 was established for the climate layer; the lower the value the more frost there is and the lower the temperature.

Model 2: The CLIMATIC-ENVELOPE MODEL was based on three of the same variables utilised in the first model namely altitude (2100 to 2500), aspect (32° to 165°) and climate (-4 to –3). The main difference between this model and the first was that the computer programme set the limits of the variables, independently of expert input. The locality of the species is plotted using parameters such as altitude vs. aspect to see if there is a correlation. Within the range there should be at least a 10%: 90% chance that it occurs within that range. The 10% rule will shift the 90% box envelope to the area where 90% of the data points occur.

Model 3: The DISTANCE-BASED MODEL was a refinement of the Climatic-envelope method. The main difference is that concentric circles ("envelopes") calculated at fixed distances away from an average value of, for instance altitude, are calculated to include areas encompassing the largest number of locality points. The circle does not have to have a regular shape and can be an oval or oblong as long as it encircles the majority of the data. This method is more accurate than the climatic envelop method. The 10% rule does not apply as in model 2 above, only the average value.

Model 4: An ALTERNATIVE INDEPENDENT CLIMATE MODEL was also tested to confirm the validity of the field data. This model made use of nine climatic factors including, the number of growth days per year, soil water stress, frost duration, growth temperature (degrees multiplied by 10), mean temperature of the hottest month, mean temperature of the coldest month and mean annual precipitation. Unlike the previous three models altitude was excluded because *P. sidoides* grows from high altitude to low altitude (almost down to sea level) and realistically this parameter would not always appear to be a good indicator.

Following on from the analysis and given the high degree of overlap between the four models it was decided to conduct two further analyses, namely:

- To overlap each of the models with land use data (distinguishing between natural, agricultural and degraded areas)(NLC) to assess the result.
- To blend all the models above to produce an "average" model and then overlay with NLC.

The results of this work made it possible to select Model 1 as being the most relevant for the dataset. The Model was used to estimate the total population of *P. sidoides* in Lesotho at approximately five million plants. Using interview and field data it was determined that the annual harvest of ligno-tubers ranged from 17,000 to 360,000 plants per annum and that the slow re-growth of the ligno-tubers limited repeat harvesting cycles to at least seven years. The maximum total harvest of plants over this period amounted to approximately 2.5 million plants or approximately half of the country's total population. From this and the fact that tuber re-growth occurs slowly it could be deduced that the current harvest levels are detrimental to the species in Lesotho.

2. CRITERIA, PARAMETERS AND/OR INDICATORS USED

The criteria and principles included in Rosser and Haywood (2002) and the ISSC MAP (Anon. 2007) were used. As the Rosser and Haywood (2002) criteria were limited to non-detriments findings required in terms of CITES Article IV, the ISSC-MAP criteria (Annex 1) were used to identify gaps and compile the information required for developing an integrated species management plan.

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

See above

4. EVALUATION OF DATA QUANTITY AND QUALITY FOR THE ASSESSMENT

See above

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

Although it was possible to determine average plant density, predicted total population and make an assessment of detriment based upon trade volumes, it was not possible to calculate an accurate quota because of inadequate information on ligno-tuber re-growth rates. For management purposes a quota was determined using a simple percentage estimate of total harvest, in this case 10%. However, this estimate is regarded as an interim quota useful for managing the resource until more detailed field data on resource recovery is available.

6. RECOMMENDATIONS

The main recommendation stemming from the non-detriment finding work in Lesotho is that the process be expanded to enable the development of an integrated management plan for the species. To simply identify trade that is detrimental is only the start, the next logical step is to develop a management plan that lays out a process of conservation action into the future. The use of the ISSC-MAP to prioritise the gathering of information required to conserve medicinal plants, forms a useful basis for such a plan.

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