

## **Conservation of Endangered Species: *Aloe polyphylla* in Lesotho**

Mofokeng Maleribe Julia and Ge Jiwen

School of Ecology and Environmental Sciences,

China University of Geosciences, Wuhan, Hubei 430074, P.R. China

**Abstract:** Biodiversity conservation has always been important to people because they use biodiversity daily. Despite this, biodiversity remains highly endangered especially from anthropogenic activities leading to extinction including species legally protected. Spiral Aloe (*Aloe polyphylla*), endemic to Lesotho only but valuable worldwide is a good example. The aim of this study was to assess the effectiveness and sustainability of strategies used to conserve *Aloe polyphylla* in protected areas and also to find out the best method between ex-suit and in-suit for conserving *Aloe polyphylla*. Both in-suit and ex-suit strategies were studied in *Aloe polyphylla* conservation. The research was done from May to July 2008. Interviews were conducted in Katse Botanical Garden, National University of Lesotho Botanical Garden, Ts'ehlanyane National Park, Ts'ehlanyane village and Ministry of Environment in Lesotho. Both closed-ended and open-ended interviews were used to gather information. Purposive methods were used to sample the respondents in all areas of study. The results showed that *Aloe polyphylla* is effectively conserved through simple propagation methods, which make them sustainable. No conserved natural species was found, which revealed that a lot of species in the wild are still in danger. It has also been found that as for now, ex-suit conservation is the best method for *Aloe polyphylla*, because the laws protecting this species in the wild are not yet very effective and strict enough. It has therefore been concluded that natural *Aloe polyphylla* is not yet fully protected and soon it will extinct in the wild.

**Key words:** Assessment, effectiveness, sustainability, protected areas, conservation and *Aloe polyphylla*

### **INTRODUCTION**

Among the indigenous members of *Liliaceae* in South Africa that are considered highly endangered is spiral aloe (*Aloe polyphylla*) (Emanoil, 1994). The plant is highly valued for its ornamental and medicinal properties. It has therefore, always been over-collected for years. The main threats faced by *Aloe polyphylla* include overgrazing, unsustainable harvesting as it has become a prized collector's item by plant enthusiasts and people interested in its medicinal properties and the increasing rarity of its pollinator, the Malachite Sunbird (Ecoscape Nursery, 2003) as well as habitat loss and fragmentation.

Because of these threats *Aloe polyphylla* has lately been listed as one of the most endangered succulent species. Majors have been taken to protect it. It has therefore been included in protected areas like national parks and botanical gardens.

In Southern Africa especially Lesotho, the natural location and home of *Aloe polyphylla*, it was 1st given legal protection in 1938 by a proclamation issued by the Resident Commissioner of Basutoland,

which prohibited its removal, export, sale or destruction (Talukdar, 1983). This proclamation was then replaced in 1963 by the Historical Monument, Relics, Fauna and Flora Act No. 41 of the Lesotho Government. In 1970, the Protection and Preservation Commission (PPC) of the Government of Lesotho issued a public notice prohibiting the removal and/or export of this aloe (Chakela, 1999).

There have been attempts to breed it in captivity and make it available for sale. This is to undercut over exploitation and the illegal market (Leipzig, 1996). The establishment of *Aloe polyphylla* nurseries such as the one started by the Agricultural Research Division (ARD) in Maseru, are meant to reduce pressure on the natural populations (Chakela, 1999). Chakela goes on to show that *Aloe polyphylla* was 1st propagated from the seeds and later a method was developed to propagate it from the leaves. It is also propagated at Katse Botanical Garden and National University of Lesotho Botanical Garden. These efforts between conservationists and nurseries to propagate plants for commercial trade are having some successes in reducing the numbers of spiral aloes collected from wild populations.

Collected *Aloe polyphylla* has virtually no chance of being re-established in cultivation. It is also shown that when propagated, it takes too long for it to grow and at times it never comes up well. Because of its status and the fact that it cannot be easily propagated, it was therefore found necessary to conduct this research in order to find out whether *Aloe polyphylla* conservation is really successful before it is too late. It is naturally rare as it is only endemic to Lesotho. The study found out the best way to conserve *Aloe polyphylla*.

**Description of the study area:** Three protected areas all found in Lesotho were studied. They are Ts'ehlanyane National Park (located in Leribe district), Katse Botanical Garden (located in Thaba-Tseka district) and National University of Lesotho Botanical Garden (located in Maseru district). They are all found in Lesotho and conserve *Aloe polyphylla*. The main concentration was at Ts'ehlanyane National park because as it is for in-suit conservation, it contains high levels of endemism, it is highly vulnerable to impact from legal and illegal use and it has significant threats which are known to exist (Hockings *et al.*, 2000). It therefore, suits the purpose of this study. *Aloe polyphylla* in this place was highly negatively affected. The other 2 study areas were selected according to the study. It has been shown from the literature that they too conserve *Aloe polyphylla*.

Ts'ehlanyane National Park (TNP) is located at the interface between the Eastern Mountain province of Lesotho and the lowlands, which are surrounded by the relatively dry interior of South Africa. In relation to much of the subcontinent, TNP enjoys abundant freshwater resources. It is located deep in the front range of the Maluti Mountains at the foot of the Holomo Pass. TNP has an altitude ranging from 1940-3112 m and is considered mostly sub-alpine. It owes its origin to the access road to the Hlotse tunnel as part of the Lesotho Highlands Water Project. This proclaimed protected pristine area lies at the junction of the Ts'ehlanyane and the Holomo Rivers. Over 5600 ha of extremely rugged mountain terrain are protected within this park, which includes one of the very few remaining indigenous woodlands in Lesotho. Some of the finest examples of Che-che (*Leucosidea sericea*) woodland are preserved at the heart of this area, with a number of rare undergrowth plants that are unique to this woodland habitat. On the banks of the rivers and streams are stands of Berg Bamboo (*Thamnochlamus tessellates*), which are of significant cultural significance to Basotho. The reserve also, encompasses a reasonable proportion of very rare mountain fynbos that do not occur anywhere else in the world and also recorded to be in excess of 220 flowering

plant species. The diversity of this habitat types is exceptionally high and derived from the large altitudinal range that the park has. Almost all species found in this park, with the exception of the clawless otter (*Aonyx capensis*), grey rhebuck (*Pelea capreolus*) and rock hyrax (*Procavia capensis*) are considered to be endangered in the park area.

The park is comprised principally of the Sub-alpine Belt, but includes a limited area of Alpine Tundra, up to 3.112 m asl. Its lowest point (c 1940 m asl) is just above the interface between the Sub-alpine and Montane Belts. This consists of rolling upland plateau, which extends westwards of the Drakensberg escarpment. The system is everywhere bounded by a sharp convex break of slope and is entirely underlined by basaltic rocks. There are steep valley slopes descending from the High Plateau that merge into topographically similar slopes below. The system largely consists of straight simple basaltic slopes, falling from about 3.200-2.600 m into the Sub-alpine Belt.

The park itself consists principally of the cliff faces and precipitous scarp and valley slopes of the Sub-alpine Belt. The mass wastage processes are extremely active and few areas of deep soil are present in the park. A high proportion of the park consists of thin skeletal soils lying directly over rock. The soils are relatively young and shallow, derived from the underlying basalt or dolerites. Soils of the summit areas and valley sides are generally shallow (<600 mm) and of medium texture (loams to clay loams).

These Alpine and Sub-alpine Belts are sensitive environments, which respond rapidly to disturbances and poor land-use methods. While the soils are inherently stable by virtue of their high organic matter content and favourable state of aggregation, they are nevertheless susceptible to erosion from high intensity rain storm, particularly if the vegetation cover on steep slopes is decreased. *Erosion gullies* form rapidly following poor siting of roads, paths or other forms of development. Recovery rates are extremely slow. Bared or eroded areas may not recover in many decades. The unique attributes of the alpine flora and ecosystem clearly indicate the need for priority to be given to sustainable land uses and appropriate conservation measures for the vegetation.

Many of the high altitude vegetation formations present in this park are found nowhere else and constitute 2 of the 7 floristic regions of Africa South of the Sahara, namely the Afro-alpine and the Afromontane Regions. The principal occurrence of Afro-alpine vegetation in southern Africa is in eastern Lesotho and the western portion of Kwazulu-Natal together with the northern portion of the Eastern Cape in South Africa. However, the greatest portion lies within Lesotho.

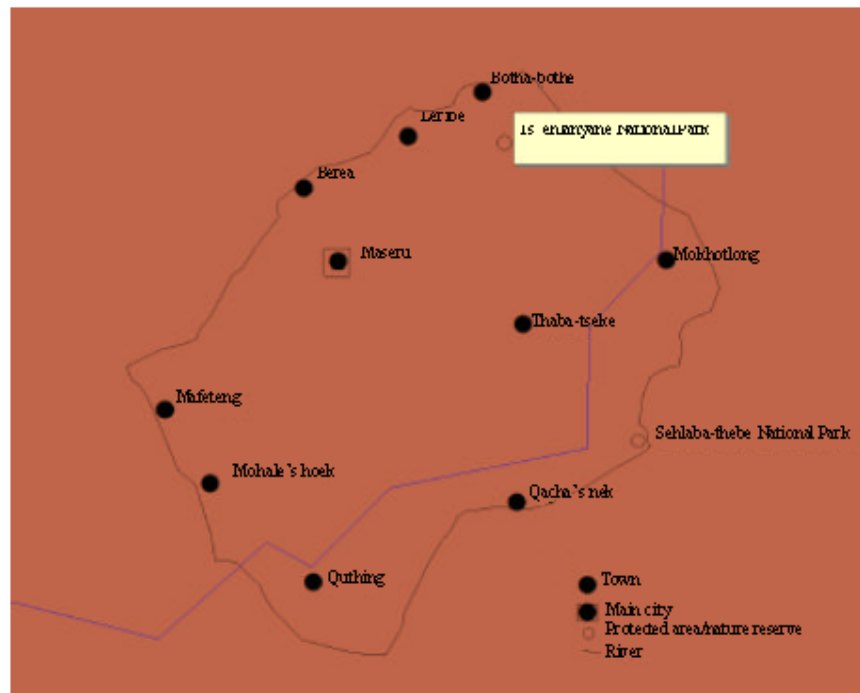


Fig. 1: The location of Ts'ehlanyane National Park. Source: June/July 2008, the research

The altitudinal range of TNP is approximately between 1.900-3.150 m, a range of 1.250 m. At least 90% of the area lies between 2.100 and 2.900 m. considered at the scale of the park, there are several major vegetation types in each belt or bioclimatic zone found in this park. These are poorly distinguished on the ground as a result of anthropogenic factors. The sub-alpine fynbos communities of TNP are of exceptional conservation importance for the following reasons:

- They are a very rare type of plant community-there are few occurrences elsewhere in the Drakensberg mountain system
- They are endemic only to this place so do not appear anywhere else in the world. TNP communities are probably the largest in the entire mountain
- The compositions of the communities found here are significantly different compared to these communities in the KwaZulu-Natal Drakensberg and are highly threatened having suffered considerably as a result of increased fire frequencies induced by man this century

Ts'ehlanyane people depend on subsistence agriculture and harvesting natural resources for a variety of needs, mainly firewood, handcrafts, medicine, food,

construction and socio-cultural amenities. They have done so since time immemorial and are singularly responsible for the good conservation value that the area represents. The area has the longest history of conservation championed by a local traditional authority in Lesotho. Figure 1 shows the location of Ts'ehlanyane National Park.

## MATERIALS AND METHODS

The research was carried out from May-July 2008. Both open-ended and closed-ended interviews were conducted in the 3 protected areas. The questionnaires used in the closed interviews were developed by the researcher with the guidance from previous studies and other related agencies. The other interviews (mostly open-ended) were conducted in Ts'ehlanyane village. The respondents were workers from TNP, the botanists, villagers (traditional doctors, farmers, herd boys and shepherds) from Ts'ehlanyane village. Experts from the Ministry of Environment were also interviewed about their involvement and consent about the protection of spiral aloes.

The qualitative methods were used to construct strata in the village. A stratified sampling method was used to divide the village into 4 strata. The aim of this research was to obtain more rich information and that

means the respondents have to be people who really have the rich information about the subject of the study.

In cases like this, Babbie (1992) indicates that it is important that the sample is chosen on the basis of the researcher's knowledge of the population in which the study is to be conducted. Polit and Beck (2004), therefore, say that a purposive or judgmental sampling, which is based on the belief about the researcher's knowledge about the population can be used to hand-pick sample members. In this way, the sample members will be people with the necessary information for the study. Respondents were then chosen using purposive sampling in all areas of the study as to make sure that they all have good knowledge about *Aloe polyphylla*.

The researcher adopted a phenomenological (qualitative) approach, using semi-structured interviews and observations as data-collection techniques (Polit and Beck, 2004). During the interviews narrative description data was collected (Polit and Beck, 2004). The semi-structured, in-depth interviews with the individual respondents were the primary data-collection tool. The advantages of semi-structured interviews were that more complex issues could be triggered, answers could be clarified and more in-depth as well as sensitive information could be obtained (Bowling, 1997). To further enrich and support the data, the researcher observations, field notes as well as taking pictures of *Aloe polyphylla* formed part of the study. Tables and standard method were used to analyse data. Results from all protected areas were then compared to make a conclusion of the results.

## RESULTS AND DISCUSSION

### Results on general conservation of biodiversity

**The main aim of establishing the protected area:** The 3 protected areas were mainly established for different reasons. Ts'ehlanyane National Park was established mainly as a way of compensating the Ts'ehlanyane villagers for their lost resources through the Lesotho Highlands Development Authority's (LHDA) Adit construction. Katse Botanical Garden (KBG) was established in order to rescue biodiversity around the Lesotho Highlands Water Projects (LHWP) areas and to address local community outcry for loss of their key medicinal plants. It was also established to contribute in National Biodiversity Strategy. The National University of Lesotho Botanical Garden (NULBG) was established for teaching purposes and conservation of threatened plants.

**Methods of management used in the protected areas:** Propagation is the main conservation management

method used in the three protected areas. TNP also uses natural conservation through the following activities:

- Workshops, fire-bells and annual inspection for land degradation especially from tourists through hiking. Revegetation with native species
- Removal of native species through fire breaks also used as borders
- Annual species monitoring (increasing or decreasing populations depending on the species needs)

### Findings on *Aloe polyphylla* conservation

**Availability and characteristics of *Aloe polyphylla*:** It has been found that all the 3 protected areas have *Aloe polyphylla*. *Aloe polyphylla* is a high altitude species, which prefers basaltic soils and is endemic only to Lesotho. Its leaves are uniquely arranged in a spiral way starting from the centre going either leftwards or rightwards (anticlockwise and clockwise). This arrangement of the leaves also shows the sex of the plant. Spirals going leftwards are for the male plant while the ones that spiral in the right direction are for the female plant. It is a stem less aloe. Its leaves are thorny at the edges and have apple green colour (Fig. 2).

**Uses of *Aloe polyphylla*:** The findings show that *Aloe polyphylla* is mainly used for traditional medicinal purposes (especially, as a charm for good luck). It is also used for cleansing purposes in the tradition of Basotho. It is also used for ornamental purposes and toiletries manufacturing.

**The reasons for protecting *Aloe polyphylla*:** *Aloe polyphylla* has been protected because it is a National Flower of Lesotho, make it recover after it has been over harvested during the LHDA's Adit construction in Ts'ehlanyane area and to implement the National Conservation Plan of Lesotho. The main reason why it has been protected is because it is highly endangered so its access is being restricted so that it can have undisturbed longer life.

**Threads faced by *Aloe polyphylla*:** Illegal collection which leads to over harvesting for illegal sales and medicinal purposes are the main threads faced by this species. Overgrazing has also been pointed out as an indirect thread to *Aloe polyphylla* (Fig. 3).

**Methods used to conserve *Aloe polyphylla*:** The main conservation method used by the three protected areas is Ex-suit (propagation). Both leaves and seeds are used to cultivate it. The seeds used for propagation are collected

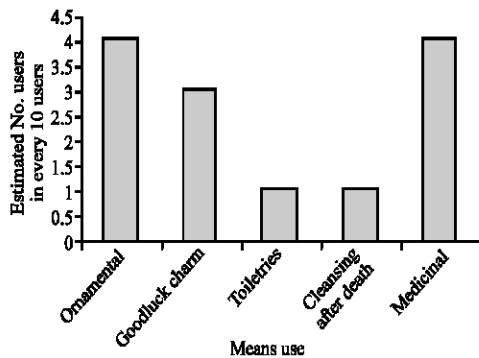


Fig. 2: Uses of *Aloe polyphylla* in Lesotho (Source: June/July 2008, the research)

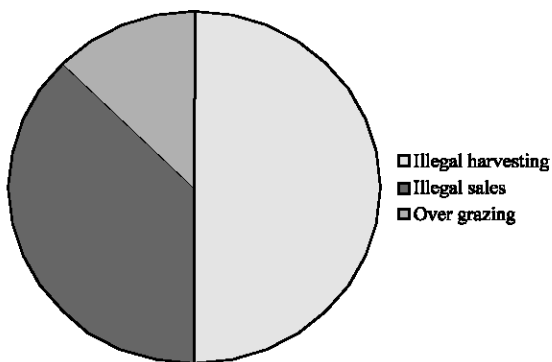


Fig. 3: The main threads faced by *Aloe polyphylla* (June/July 2008, research)

from the wild colonies in Mokhotlong and Leribe district as here this species is still found in large numbers. They are thoroughly cleaned and then stored in a cool dry place before they are used. As for the off-shoots, they are collected directly from their mothers and planted directly as there is no need to store them. TNP has future plans of establishing colonies in the park for *Aloe polyphylla* as a way of improving its conservation.

**Findings from the Ts'ehlanyane communities:** The findings show that *Aloe polyphylla* is mainly used for medicinal and ornamental purposes in the village. The communities also have started cultivating it in their homesteads, though some have not yet succeeded from lack of correct knowledge on propagating it. It has also been found out that the Ts'ehlanyane communities blame overharvesting for the extinction of *Aloe polyphylla* in their area, which accelerated its extinction. They also showed that now it can only be found in very inaccessible places where not everyone can reach which automatically conserves it because most people now do not know that *Aloe polyphylla* can still be found in this area. They

suggested that the government should strictly enforce the laws that protect it because now it has not yet done so. It is freely harvested by anyone. They have also shown that more establishments of protected areas in all habitats of *Aloe polyphylla* can really protect it. They suggested also that national botanical gardens and individual ones should be highly encouraged to save the little natural species left in the wild.

#### Findings from the ministry of environment

**Conservation of *Aloe polyphylla* by Government of Lesotho (GOL):** The ministry of Environment has shown that the GOL is involved in conservation of biodiversity through Laws established to protect biodiversity including *Aloe polyphylla*. These Laws are lately enforced effectively through the help of newly established Local Councils. The ministry is also carrying out Environmental Awareness Programmes such as workshops, public gatherings and others to teach people on the importance of protecting biodiversity including *Aloe polyphylla*. It has also encouraged people to establish their own botanical gardens in their homes as to reduce the pressure on the plants in the wild.

#### Effectiveness and sustainability of *Aloe polyphylla*

**conservation:** Though the ministry does not implement most of the strategies it encourages people to implement, it has shown that methods used to conserve endangered species in Lesotho are effective and sustainable. This can be supported by the increasing numbers of established botanical gardens including Katse Botanical Garden.

#### Problems encountered in relation to conservation of *Aloe polyphylla*:

There are many challenges facing conservation of *Aloe polyphylla* and biodiversity in general in Lesotho. But the main ones are over-harvesting of *Aloe polyphylla* for commercial purposes and over-utilisation. Another challenge is that the issue of local botanical gardens is still new so most of them are not yet really successful. As a result people are forced to go back in the wild to harvest the natural ones.

#### Future plans about *Aloe polyphylla* conservation:

The GOL has future plans for biodiversity conservation. There is a plan of establishing the national botanical and the site has already been selected but the problem is funds. It is also planning on carrying out more environmental awareness programmes.

**General conservation of biodiversity:** Ts'ehlanyane National Park and Katse Botanical Garden were

established as a remediation method to biodiversity after the destruction that was brought by the giant Project between Lesotho and the Republic of South Africa (LHDA). The 2 areas would not have been established if it was not because of the need to correct the project disturbances. The other protected area, NULBG would not have been established if it was not because of the need in The National University of Lesotho to study about plants and their protection. None of the three protected areas was mainly established just to protected biodiversity and none of them belongs to the government fully (at least as for now).

TNP is engaged in both ex-suit and in-suit conservation. The reason for use of both conservation methods is; because some of the species here are extremely endangered that they need extra protection while others had already extinct at the time of the establishment. The only way to have them is reintroducing them back through propagation. As the in-suit conservation TNP is involved in activities that hinder species disturbances like removing or stopping encroachment of alien species as they can disturb the existence of the native ones. There are workshops in order to get more training on conservation. There is also annual monitoring and inspection to make sure that all species are still healthy and to check for any form of land degradation. This helps the park management to see the problems on time so that they are solved at an early stage. Native species are used to revegetate the land that can be found to be degraded so that there is no chance of alien species. Species are always monitored so that there is no either overpopulation or depopulation. The other 2 protected areas botanical gardens so they use propagation as their means of conservation.

***Aloe polyphylla* conservation:** All the 3 protected areas conserve *Aloe polyphylla* because it is highly endangered in Lesotho. It may extinct if no serious measures are taken to conserve it. It can be easy recognized by the following characteristics: the unique arrangement of its leaves, which spiral from the centre. This arrangement of its leaves signifies the sex of the plant. The spirals going leftwards are for a male plant while the ones going on the right side are for the female plant. Its leaves have apple green colour and are thorny at the edges. It is a stem-less aloe. It is a high altitude species only endemic to Lesotho and prefers basaltic soils.

*Aloe polyphylla* like many other succulents is mainly used as an ornamental plant. Most people plant it at their homesteads for this purpose. It is also used for medicinal reasons and in manufacturing of toiletries. It is a traditional medicine so it sometimes used for traditionally

cleansing after the death. As it can be seen that *Aloe polyphylla* can be used in different ways, this explains the reason why it is now highly endangered and have completely extinct in some areas. It has been illegally over-harvested mainly for illegal sales. It has been illegally over harvested in Ts'ehlanyane area by people who came to that area in search for work during the construction of the Adit of LHWP. This is why it was found extremely necessary to establish KBG and TNP as to conserve the little species left after the destruction brought by activities of LHDA. It is also very important to Basotho because it is their National Flower.

The main method used in these three protected areas to conserve *Aloe polyphylla* is artificial propagation. The other 2 study areas are botanical gardens so it is obvious that the method used is artificial propagation. But as for TNP, *Aloe polyphylla* is propagated because the natural one is not available anymore in the park. At the time when, the park was established it has already extinct except for only one big that was left. But this one also was illegally harvested as it has grown very close to the path. It therefore, had to be reintroduced into the park through propagation. All the propagated species progress pretty well. The only reason why the species would die is if it is not being given the necessary care or if the soil is too much fertile for it. It has been shown that other people who used fertilisers to cultivate it have failed, which means fertilisers are not good for its survival. It is normally planted on pure soil such as river sand then watered directly from the roots/soil to avoid contact of soil and water between the leaves as that will make it rot and die. TNP has future plans of planting *Aloe polyphylla* in large quantities as well as to establish colonies in the park.

**GOL biodiversity conservation:** GOL is involved in biodiversity conservation in general not just *Aloe polyphylla*. There have always been Laws protecting biodiversity in Lesotho and *Aloe polyphylla* has always been included in those Laws as one of the priority species. Beside laws, there have been workshops and awareness programmes carryout in order to teach people about the importance of conserving biodiversity in Lesotho. Local communities have also been encouraged to establish their own botanical gardens at homes in order to reduce the pressure on the wild species. *Aloe polyphylla* is highly included in all these programmes. There are lots of posters in Lesotho put in order to make people aware of its importance and also of how crucial it is to conserve it. Most of these programmes or activities have been found to be successful and effective so far, except for the establishment of individual botanical gardens. This strategy of individual botanical gardens is still new so in most cases it is not successful as some

people do not really know how to implement it. So far, it has only been successful in areas fully supervised by Katse Botanical Garden. Though some of these activities are successful, there is still a problem of illegal overharvesting of *Aloe polyphylla* that is not protected for illegal sales. Most of its natural habitats are not protected. Because of this and many other problems, the GOL has future plans of establishing another botanical garden. There are plans to establish the National botanical garden. The site has been chosen already and the problem is Funds.

Figure 4 and 5 show how sustainable and effective protected areas are in conservation of *Aloe polyphylla* in conservation. This is caused by lack of knowledge about Lesotho. Ex-suit seems to be more effective than in-suit

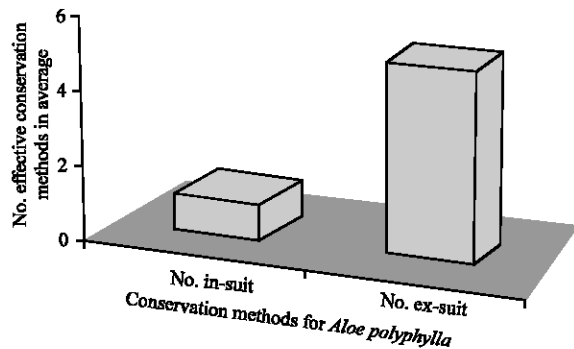


Fig. 4: The effective method for *Aloe polyphylla* conservation in Lesotho (June/July 2008, research)

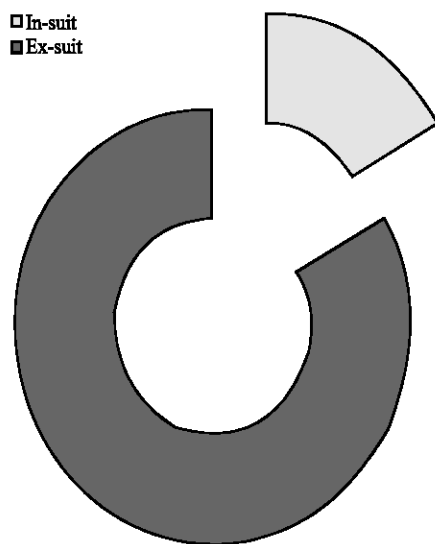


Fig. 5: Sustainable conservation methods used to conserve *Aloe polyphylla* in Lesotho (June/July 2008, research)

*Aloe polyphylla* protection. Most people who use this plant are not yet aware of the importance of conserving it. As a result ex-suit becomes more sustainable also in conservation of this species. Simple and reliable methods are used to propagate this species so it can always be propagated easily.

## CONCLUSION

National parks (in-suit conservation) are the best way to conserve biodiversity as they protect species in their natural habitats where there are all conditions needed for their survival. In Lesotho, national parks alone cannot save the endangered species because of several reasons such as lack of information especially on people living around the park areas. This is the case in Ts'ehlanyane National Park too. Laws are not too strict that govern biodiversity conservation in Lesotho. Anyone can harvest whatever species in the wild. This is the same case with *Aloe polyphylla*. So for it to be fully protected, it really has to be conserved in botanical gardens. Its numbers in the wild still continue to decrease from overharvesting. There are still more areas that need to be protected which are also at high risk, same as the one which was in Ts'ehlanyane. If no measures are taken to protect them, *Aloe polyphylla* will soon extinct in those places too. For *Aloe polyphylla* conservation in Lesotho, botanical gardens are the best option as the numbers of this species in the wild have really gone down. So to have it for future, it has to be propagated. It is also propagated in Ts'ehlanyane because of this need. In Lesotho, parks will only survive if the government strictly enforces the laws on biodiversity conservation. The propagation method of *Aloe polyphylla* seems to be effective and sustainable as it can easily be planted on pure soil and simply be watered. It does not require fertilisers, which may not be available at other times, so it can always be easy to propagate it forever. The main thread of this species in Lesotho has always been overharvesting, which means if it is not over harvested, the few numbers left in the wild can be protected. All other threads are just minor ones and can easily be solved. The conclusion about effectiveness and sustainability of protected areas in conservation of *Aloe polyphylla* in Lesotho can easily be shown from the Fig. 4 and 5, respectively.

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