

Can the plunder of quiver trees be controlled?

An insatiable market for the Northern Cape's *Aloe dichotoma* could be tipping the scales towards its extinction

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The lollypop silhouettes of *Aloe dichotoma*, the quiver tree or kokerboom, are an integral part of the Northern Cape landscape. Unfortunately their architectural beauty and low water requirements have not escaped the prying eyes of landscapers and flora traders who now concentrate on this species to such an extent that the long-term sustainability of the species is in jeopardy. Drought-stricken farmers collect *Aloe dichotoma* specimens from their farms and sell them in order to keep their farms going. In fact, some farmers remove *Aloe dichotoma* populations to 'improve' their grazing, thus increasing the pressure on the wild *Aloe dichotoma* populations.

The Directorate of Conservation and Environment (DTEC) in the Northern Cape have investigated the situation to determine whether the exploitation of *Aloe dichotoma* in its natural

state is feasible, and if so, what measures need to be put into place to ensure sustainable utilisation.

A natural history

The genus *Aloe* belongs to the family Asphodelaceae (formerly Liliaceae). *Aloe dichotoma* is a perennial tree succulent that can grow 3-9 m high, but has been known to reach heights of 12 m. When it gets to 2 m or 3 m high, the plant starts to dichotomously branch into several branches. These branches, together with the leaves that are borne in terminal rosettes, give the tree its lollypop appearance.

Flowering time is from June to August, when bright fleshy yellow flowers are borne on short and erect inflorescences. The flowers produce a lot of nectar, which is a valuable source of food to various birds and bees, thus playing the role of polli-

CLIMATE CHANGE

Modelling work by The Climate Change Research Group at the South African National Biodiversity Institute suggests that species and ecosystems in the western parts of southern Africa would be affected the most by climate change. We wondered if early impacts of climate change might already be apparent in these regions, and Wendy Foden, one of our M.Sc. students, attempted to relate signs of long term increases in water deficits in northern Namaqualand and southern Namibia to patterns of adult mortality in populations of *Aloe dichotoma*. The kokerboom is the ideal species for this work, as it has a huge geographic range, a long lifespan, and dead individuals remain standing for many years after they succumb, providing a history of mortality. Wendy's substantial and award-winning study has confirmed that declining populations can be related to deteriorating climatic conditions. While climate change is not likely to cause the extinction of this species in the next 100 years, Wendy's work shows the value of protecting this species from additional human caused stresses.

Guy F Midgley, Climate Change Group, SANBI, Kirstenbosch

RIGHT: Long-lived species like *Aloe dichotoma* are at the mercy of variable climatic events - and vandalism. Photo: E. Powell.



nator and provider. The seeds have two or three wings attached to them, which suggests that they are wind-dispersed over relatively short distances in the vicinity of the mother plant.

The growth rate of a juvenile *Aloe dichotoma* is faster than that of an adult plant. The juvenile stage lasts for about fifty years, whereas the adult stage lasts three times longer (up to 150 years) during which time relatively few changes to its size and shape occur. The senescent stage takes about fifty years, making the average lifespan of *Aloe dichotoma* 250 years. Considerable variation exists however, as the growth rate is influenced by external environmental factors such as soil type, climate, diseases and grazing pressure.

Long-lived species like *Aloe dichotoma* are at the mercy of variable climatic events. *Aloe dichotoma* seedlings need to develop sufficient water storage capacity as soon as possible to enable them to survive the cyclical dry periods. This means that seedling survival requires a series of favourable climatic events, a suitable microhabitat and protection against predation and competition. It also means that they are greatly influenced by drought.

Distribution and conservation

Aloe dichotoma is restricted to the drier western parts of Namibia and South Africa. In South Africa it occurs predominantly in the Northern Cape, with a few growing in the Western Cape. It is an endemic species of the Succulent Karoo and Nama Karoo biomes (Namaqualand and Bushmanland regions).

Aloe dichotoma is an extremely opportunistic species and it occurs in a variety of habitats - ranging from rocky arid mountain areas to flat sandy plains on different soil types, and in different climates - from winter, bimodal, as well as summer rainfall areas as long as they are low rainfall regions. Within this array of habitats and climates, you will find *Aloe dichotoma* either as an isolated individual or in dense stands, called quiver tree forests, for example the famous 'forest' just south of Kenhardt.

Aloe dichotoma is protected in the Northern Cape under the Environmental Conservation Ordinance No. 19 of 1974. According to the Ordinance, no collection, cultivation, trade, export or import of *Aloe dichotoma* is allowed without a valid permit issued by the relevant conservation authority. It also provides for the Director of Conservation to subject licensing to conditions deemed fit



ABOVE: The lollypop silhouettes of *Aloe dichotoma*, the quiver tree or kokerboom, are an integral part of the Northern Cape landscape. Photo: E Powell.

to ensure the species future survival. These conditions are then attached to the permit being issued. Similarly, *Aloe dichotoma* is protected in the other provinces of South Africa, although it only occurs naturally in the Northern Cape and Western Cape.

According to the international IUCN criteria for species conservation status assessments, *Aloe dichotoma* is not threatened at this stage. However, it is listed as an Appendices II species in CITES (Convention on International Trade in Endangered Species). CITES addresses the international trade of a species and for a species to be CITES listed, there must be concern for the impact that trade has on natural populations. In Namibia, *Aloe dichotoma* is protected under the Nature Conservation Ordinance No. 4 of 1975. Permits are needed from the Ministry of Environment and Tourism of Namibia to collect, trade, grow, import and export.

As a signatory to the Global Strategy for Plant Conservation, South Africa

has an obligation to conserve its flora to the best of its ability. This Strategy was adopted and approved in Decision VI/9 of the sixth meeting of the Conference of Parties (CoP) to the Convention on Biological Diversity (CBD) in The Hague in 2002 and states that conservation authorities have an obligation to document plant diversity, conserve it, ensure that it is utilised sustainably and promote an awareness of it.

The long term survival of *Aloe dichotoma* is threatened by drought, consumption by baboons, porcupines and other rodents (possibly the dassie rat *Petromys typicaus*), fungal infections and aphid infestations. Trampling, weed invasion and goat browsing in sensitive nursery areas also impact heavily on the aloes. Recently, two factors that threaten the sustainability of the aloes were identified as climate change and 'wild crafted collections' (trade). Indications are that climate change could cause a 50% reduction of the distribution range of *Aloe dichotoma* in the Northern Cape

by 2050. Add to this the impact of the 'collection' of about forty-one *Aloe dichotoma* trees every month, and you have a problem.

Generally *Aloe dichotoma* trees are being traded by for about R2 000 -R3 000 per metre height. The estimated 'wild crafted trade' for 2004 from the Northern Cape was R742 000. This is quite a good incentive for a farmer struck by severe drought. The extent of illegal collections is not known, but indications are that it is fairly large. Young trees and seedlings do not have extensive root systems making it easy for collectors to remove them from the wild.

An additional challenge facing the Directorate of Conservation and Environment is whether *Aloe dichotoma* impacts negatively on grazing capacity. Some farmers claim that they want to remove some of the trees to improve their grazing as they are 'encroaching' on their farms. Although it is not scientifically proven yet, preliminary surveys reveal that this statement is unfounded. Further research is underway to confirm or contradict

BELOW: *Aloe dichotoma* is regarded as a 'keystone species' in the arid Karoo providing food, nesting and shelter sites, as well as water in times of drought, for a variety of animals. Photo: E Powell.



preliminary findings beyond doubt.

How bleak is the future?

Research indicates that rapidly changing climate patterns will cause the extinction of many plant species within the next 100 years. *Aloe dichotoma* might be one of these as its mortality rates have already increased dramatically and its recruitment levels have declined over the past few decades as a consequence of the reduced rainfall and increased rainfall variability caused by climate change. *Aloe dichotoma* recruitment is increasing in the winter rainfall region, while it is decreasing in the summer rainfall regions. Recent genetic studies also indicated that the *Aloe dichotoma* populations in the north are genetically more diverse than those in the south, implying that the northern populations are older than those in the south. It takes many years for a species to build up genetic diversity, and therefore the southern distribution might have been established more recently. *Aloe dichotoma* appears to be 'migrating' to the south as a response to the changing climate.

Recent research on *Aloe peglerae* (that has a lifespan of sixty years) indicated that sustainable utilisation is not possible as the sustainable quota of 0.12% (to be collected annually) was regarded as not being financially viable. The precautionary principle for *Aloe dichotoma* (with a lifespan of 150 years) would thus be to not allow future collections from the wild, except for that of seed for artificial propagation. Although these are different species, they are from the same genus and might have similar sensitivities toward harvesting impacts. Going by the *Aloe peglerae* results, seed can be collected sustainably if less than 10% of the seeds from a population are collected each year, making sure that collections are distributed throughout the population to spread the impact. A seed collection quota that is specifically for *Aloe dichotoma* still needs to be determined.

The main concern of the conservation authority regarding the collection of, and trade in, *Aloe dichotoma* from the wild is the possible over-exploitation of the species, the accompanying risk of the erosion of the genetic quality and diversity of the species and the collective impact that wild collections and climate change might have on the species' survival. Other factors with regard to the function and ecological role of *Aloe dichotoma* in its natural environ-

ment need to be considered as well. For instance, *Aloe dichotoma* is regarded as a 'keystone species' in the arid Karoo, providing food for birds (including mousebirds, dusky sunbirds, and pied barbets), nesting and shelter sites for various birds like the pied barbet that makes holes in its trunk, the sociable weavers, pygmy falcon, and redheaded finches and other species like baboons. It is also a valuable source of water for animals, like porcupines, in times of drought. Also of importance in considering the role of *Aloe dichotoma* is the fact that its distribution range occurs within the Succulent Karoo Biome, which is an international biodiversity hotspot.

It is a long-lived species, dependent on sporadic environmental events like good rainfall at crucial growing stages. This, and the fact that its seeds might only be viable for two years in its natural environment, is cause for concern. The trade in *Aloe dichotoma* might be a recurrent event in its life cycle too, as thirty years ago when a ten-year drought was in full swing during the seventies, farmers also traded with the species. This trade must have ceased at the end of the drought when farmers returned to their normal farming practices.

Soon a proclamation will be published in the *Government Gazette* banning all *Aloe dichotoma* collections from the wild for an interim period. Various surveys and inspections will be conducted during this time to enable the Directorate of Conservation and Environment to develop a sustainable quota system should data indicate that sustainable utilisation is possible. *Aloe dichotoma* seed may presently be collected from the wild under permit, but no more than 10% of a population's seed may be removed, and collection points must be distributed over the population's distribution range to conserve a representative gene pool for the species. During the interim period, the feasibility of a core conservation area will be investigated and the possibilities of implementing 'stewardships' and community based natural resource management projects will be explored.

I urge students and researchers to obtain more information that will help us to conserve biodiversity, because without help, conservation authorities will not be able to manage the situation properly, and we will lose several of our economically valuable species.

For a list of references, please email the Editor at Voget@kingsley.co.za.