ALOACEAE

THE CONSERVATION STATUS OF *ALOE* IN SOUTH AFRICA: AN UPDATED SYNOPSIS

INTRODUCTION

The Aloaceae is a medium-sized family of about 510 species of succulent-leaved, petaloid monocots, geographically restricted to the Old World (Smith & Van Wyk 1998a). The area of highest species diversity is southern Africa, particularly South Africa (Van Wyk & Smith 1996a), with other centres of diversity occurring in the East-Afro Arc of tropical southern Africa (West 1974), eastern Africa (Carter 1994; Lavranos 1995), Saudi Arabia (Collenette 1985), Yemen (Wood 1982), and Madagascar (Reynolds 1966).

The genus *Aloe* L., which is by far the largest genus in the Aloaceae, is an important component of the South African flora from taxonomic (Reynolds 1950), phylogenetic (Smith & Van Wyk 1991), ethnomedicinal (Van Wyk & Smith 1996b), chemical/chemotaxonomic

(Viljoen & Van Wyk 1996), ecotourism (Smith & Van Wyk 1998b) and horticultural (Smith & Van Wyk 1996, 1998c) perspectives. The wide-ranging interest in the genus amongst many scientists and collectors has affected the survival of wild populations.

Until recently, contributions on the threatened species of South African *Aloe* were restricted to single-species narratives, such as *A. bowiea* Schult. & Schult.f. (Smith 1989, 1991; Smith & Van Wyk 1990), *A. micracantha* Haw. (Smith 1993a) and *A. vossii* Reynolds (Willis & Willis 1995). Hilton-Taylor & Smith (1994) were the first to provide a comprehensive synopsis of the conservation status of southern African *Aloe* and its generic relatives. For example, they cite that, apart from illegal collecting activities, other factors that lead to the decline of some populations of *Aloe* species include overgrazing, mining and industrial activities, commercial forestry, insect predation, urbanization, agricultural development and fragmentation effects on narrow distribution ranges. Forty-nine *Aloe* species occurring in the *Flora of southern Africa* (*FSA*) region (Botswana, Lesotho, Namibia, South Africa and Swaziland) were assigned Red List status (Hilton-Taylor & Smith 1994). Of these species, 44 occur in South Africa. All species of *Aloe* appear on CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendices. However, of the southern African species only *A. albida* (Stapf) Reynolds, *A. pillansii* L.Guthrie, *A. polyphylla* Schönland ex Pillans, *A. thorncroftii* Pole Evans and *A. vossii* Reynolds are included in Appendix I (CITES 1998).

Plant Red Data Lists document extinct, threatened and potentially threatened plant species (including subspecies, varieties, and taxonomically undescribed groups recognized as being distinct) that have been assigned categories of urgency for conservation according to the World Conservation Union's Species Survival Commission (IUCN-SSC) (IUCN 1994). Red Data Lists enable decision-makers, research specialists and field managers to set more clearly defined goals and priorities. *Aloe*, a prominent and conspicuous component of the southern African flora, is a flagship genus for conservation efforts and its protection will therefore set a standard for the protection of lesser known plant species.

Although species of *Aloe* occur throughout southern Africa, the subtropical eastern seaboard of South Africa contains a significant number of taxa, many of which are threatened for a variety of reasons. The conservation status of most of the species of *Aloe* occurring in KwaZulu-Natal were recently assessed by Scott-Shaw (1999). Those species that are under some sort of threat in KwaZulu-Natal, but which are plentiful in other provinces are not accorded a national conservation status here. These include the traditionally utilized *A. aristata* Haw., which also occurs in the Free State, and Eastern and Western Cape.

Hilton-Taylor & Smith (1994) applied the 'old' categories in their account of the conservation status of the *Aloe* species of the *FSA* region. Shortly thereafter, the IUCN-SSC adopted a new set of Red List guidelines which are intended to be more objective, widely applicable to terrestrial and aquatic biota, and useful to Red List compilers and field managers alike (IUCN 1994). Milestones in the improvement of these guidelines include their applicability at different geographical scales—national, regional and subregional (Gärdenfors *et al.* 1999), and a review of the IUCN (1994) Red List categories and their defining criteria (IUCN-SSC Criteria Review Working Group 1999). The review arose out of a need to assess harvested species, long-lived animal species (such as elephants and marine turtles) and the status of some small and narrowly distributed endemic plants and vertebrates. Revised guidelines may be officially adopted by the IUCN-SSC in October 2000 (Gärdenfors *et al.* 1999).

This paper updates and summarizes the current conservation status of species of *Aloe* in South Africa. It provides conservation perspectives on the genus over the past five years, with emphasis on Red Data Lists (Hilton-Taylor & Smith 1994; Hilton-Taylor 1996), using the 'new' IUCN Red List categories (IUCN 1994). The legal, protection and conservation data used by Hilton-Taylor & Smith (1994) have remained more or less unchanged and are still applicable. This information is therefore not repeated here. The main objective of this paper is to contribute towards determining which *Aloe* species are in need of conservation, and to make broad recommendations on future studies and *in situ* monitoring.

MATERIAL AND METHODS

The taxonomic treatment of *Aloe* follows Van Wyk & Smith (1996a). Red List categories are assigned in accordance with guidelines and concepts set by the IUCN-SSC (IUCN 1994), and are based on herbarium specimens housed at PRE, published information, field observations and known distribution ranges of species of *Aloe*. In a few instances the category assigned represents a best estimate based on available information.

Quantitative criteria are used to place a species in a particular Red List category (for details see IUCN 1994). The term 'threatened' is used to describe species which are Critically Endangered, Endangered or Vulnerable. The criteria rely on data derived from estimates, projections, inferences or quantitative analyses. These data include percentage of decline in population or distribution, the number of mature individuals and suspected/anticipated future population declines.

Criterion A was used where we could estimate percentage decline over the past ten years. Ten years was preferred rather than three generations, because it is difficult to estimate generation time reliably without comprehensive field work or autecological studies. At least a 20% decline had occurred in this period of time (placing the taxon in the VU category). In some cases it may well be higher, but more reliable data would be necessary to estimate a 50% or higher decline. Criterion B was used in cases where the taxon had a continuing decline along with a restricted distribution range and either a small number of locations or severe fragmentation. Criterion C could not be used, as it was too difficult to estimate population sizes. All taxa which were not experiencing a decline, but had a restricted distribution range (< 100 km^2) were classified as Vulnerable according to Criterion D2.

The Lower Risk categories are assigned to taxa that do not satisfy the criteria for being threatened, and such taxa are not listed in Table 2, but reported separately. The Data Deficient category is assigned to taxa for which there is not enough information to do an assessment.

RESULTS AND DISCUSSION

During the present study the global conservation status of 68 *Aloe* taxa occurring in South Africa was assessed. Our results showed that the data for 38 of these *Aloe* species meet the criteria for one of the categories of threat, namely Critically Endangered, Endangered or Vulnerable (Figure 5). In order to draw attention to species in the Data Deficient category, they are listed with the threatened species in Table 2. Although the number of species for which no assessment could be made are proportionately low (Figure 5), they do occur in four of the eight provinces of South Africa (Figure 6) and their unknown status should concern conservation agencies, field botanists and researchers. At present, no threatened *Aloe* species are known from the Free State. *A. peglerae*, a striking species, occurs in the North-West and in Gauteng. Continual census work and monitoring of this species need to be implemented. KwaZulu-Natal and Northern Cape each have 11 species of threatened aloes (Figure 6). Further updates of, and refinements to

TABLE 2.—IUCN Red List status of *Aloe* species in South Africa. Author citations are contained in Smith *et al.* (1997)

Taxon	Global IUCN (1994) status	Hilton-Taylor (1996)	Province*	Justification for allocation of global status
A. albida	EN B1+ 2bcde	V	M	restricted distribution
A. bowiea	CR A1ace B1+2abcde	E	EC	urban and industrial expansion, alien plants, agricultural development
A. brevifolia	VU A1c	nt	WC	agricultural development, illegal collecting
A. buhrii	VU D2	R	NC	restricted distribution
A. chlorantha	EN B1+2e	E	NC	insect predation
A. comosa	VU B1+2c	R	WC, NC	overgrazing and trampling, illegal collecting
A. cooperi subsp. *pulchra*	DD	K	KN	insufficient information
A. dabenorisana	VU D2	R	NC	illegal collecting
A. distans	EN B1+2e	R	WC	restricted distribution, urbanization
A. fouriei	VU D2	K	M	restricted distribution
A. gerstneri	VU B1+2abce	R	KN	illegal collecting
A. gracilis var. *decumbens*	DD	R	WC	commercial forestry
A. haemanthifolia	VU D2	R	WC	restricted distribution
A. hardyi	VU D2	K	M	restricted distribution
A. inconspicua	VU D2	R	KN	restricted distribution
A. khamiesensis	VU B1+2e	K	NC	illegal collecting
A. krapohliana	VU A1cd	V	NC, WC	illegal collecting, mining
A. longistyla	VU A1acd	V	WC, EC	illegal collecting, overgrazing and trampling
A. meyeri	VU D2	R	NC	restricted distribution
A. micracantha	VU A1ace B1+2ac	R	EC	urbanization, agricultural development
A. modesta	DD	K	M, KN	insufficient information
A. monotropa	VU D2	R	NP	mining, illegal collecting
A. nubigena	VU D2	nt	M	restricted distribution
A. parviflora	DD	not listed	KN	insufficient information
A. pearsonii	EN B1+2abce	V	NC + Namibia	mining, overgrazing and trampling, illegal collecting
A. peglerae	EN A1acde B1+2bce	R	G, NW	illegal collecting, urbanization
A. petrophila	VU D2	R	NP	restricted distribution
A. pictifolia	VU D2	R	EC	restricted distribution
A. pillansii	EN A1acde B1+2be	E	NC + Namibia	overgrazing and trampling, illegal collecting, mining, predation, introduced pathogens
A. pratensis	VU B1+2bce	K	EC, KN	planting of crops, exploitation for medicinal purposes, illegal collecting
A. prinslooi	VU A1cd	R	KN	illegal collecting
A. pruinosa	VU A1acde B1+2abce D2	R	KN	urban and industrial expansion
A. ramosissima	VU A1ce D2	V	NC + Namibia	mining, overgrazing and trampling
A. reitzii var. *reitzii*	VU D2	I	M	restricted distribution
A. reitzii var. *vernalis*	VU D2	R	KN	restricted distribution
A. reynoldsii	VU A1c D2	V	EC	habitat degradation
A. saundersiae	EN B1+2bcd	V	KN	planting of crops, overgrazing and trampling
A. simii	EN B1+2b	V	M	planting of crops, habitat degradation, commercial forestry
A. soutpansbergensis	VU B1+2be	R	NP	illegal collecting
A. striata subsp. *komaggasensis*	VU D2	R	NC	restricted distribution
A. thompsoniae	EN B1+2e	I	NP	illegal collecting
A. vogtsii	DD	R	NP	agricultural development, commercial forestry, urbanization
A. vossii	EN B1+2bcde	R	NP	bush encroachment, burning, trampling

* EC, Eastern Cape; G, Gauteng; KN, KwaZulu-Natal; M, Mpumalanga; NC, Northern Cape; NP, Northern Province; NW, North-West; WC, Western Cape.

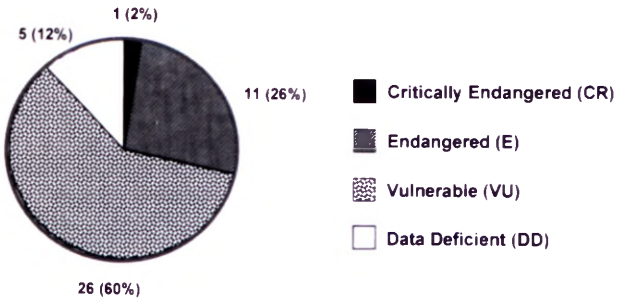

FIGURE 5.—IUCN status of *Aloe* species listed in Table 2. Numbers and percentages of species placed in the relevant IUCN categories are in relation to the total number of 43 listed.

the data presented here, will be recorded in a database held at the National Herbarium (PRE).

The following 19 taxa were listed by Hilton-Taylor & Smith (1994) as being not threatened, and here similarly, they are not assigned a threatened status, but are categorized as Lower Risk (least concern) i.e. LR(lc). These are: *Aloe affinis*, *A. angelica*, *A. chortolirioides* var. *chortolirioides*, *A. chortolirioides* var. *woolliana*, *A. dewetii*, *A. dominella*, *A. dyeri*, *A. greatheadii* var. *davyana*, *A. greenii*, *A. hlangapies*, *A. integra*, *A. kraussii*, *A. linearifolia*, *A. minima*, *A. rupestris*, *A. striata* subsp. *karasbergensis*, *A. suffulta*, *A. thorncroftii* and *A. vanbalenii*.

The status of three species previously listed as threatened by Hilton-Taylor (1996) has been changed. *A. vryheidensis* which was listed as Rare, is now assigned a status of Lower Risk (near threatened) i.e. LR(nt) because of its extremely wide distribution range (see Van Wyk & Smith 1996a: 71) and lack of known threats at present. *A. arenicola* was previously listed as Vulnerable and is now listed as LR(lc) because of its wide distribution range along the west coast of the Western Cape and Northern Cape. The third is *A. falcata* which is now classified as LR(nt). Although previously classified as Vulnerable due to illegal collecting and agricultural activities, this widespread species is probably not under threat at present, as the *Aloe* craze of the 70's has lost momentum in recent years.

Aloe kniphofioides, *A. mudenensis* and *A. thraski* were assessed by Scott-Show (1999) but not by Hilton-Taylor (1996). These species are categorized here as LR(lc). While the status of the former did not change, the latter two were categorized by Scott-Shaw as LR(nt), but our data do not support this interpretation.

Two species of *Aloe*, *A. polyphylla* from Lesotho and *A. bowiea*, are the most threatened in southern Africa. Of these two, *A. bowiea* with its narrower geographical distribution range is more threatened. With less than 2 000 individuals thought to be left in nature, one of three known populations extinct and another threatened by urban and industrial expansion, this species may soon join the ranks of those taxa that are extinct in the wild. Although Scott-Shaw (1999) refers to the unconfirmed occurrence of *A. polyphylla* in the KwaZulu-Natal Drakensberg, this has yet to be substantiated by a herbarium or other record. The species is therefore still only known from and endemic to Lesotho. From an ethnomedical perspective, Marshall (1998) rates *A. polyphylla* as one of the three most threatened taxa out of 102 species shortlisted as being of conservation concern in the 17 East and southern African countries surveyed.

Through the efforts of Reynolds (1950, 1966) and Jeppe (1969), *Aloe* species became popular in domestic and amenity horticulture in South Africa, contributing to the 'aloe craze' of the 1970s. In his benchmark publication on South African aloes, Reynolds (1950) gave detailed locality information for the known species, thereby facilitating the often illegal collecting of specimens of a number of species and the wanton destruction of some populations. An international and often illegal trade in South African aloes is ongoing, and has recently been documented by Newton & Chan (1998). Some *Aloe* species are difficult to cultivate away from their natural habitats and large numbers of individuals undoubtedly ended up on compost heaps. Along with the introduction of species from wild populations, a number of natural enemies of *Aloe*, especially snout beetles, white and brown scale insects and spider mites, entered domestic gardens (De Villiers & Schoeman 1988; Myburgh 1990) and even some previously uninfected natural areas (Williamson 1998). These pests eventually led to the

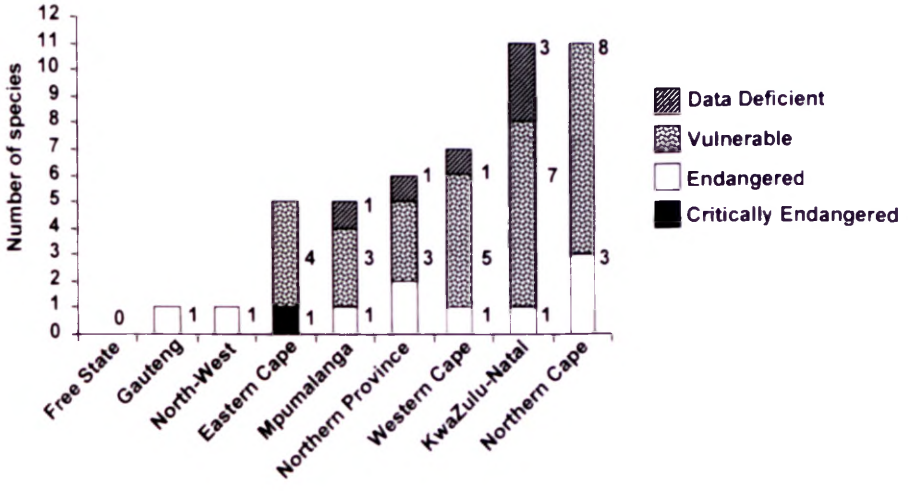

FIGURE 6.—Distribution of 43 *Aloe* species, listed in Table 2, in the nine provinces of South Africa.

demise of many cultivated plants and, concurrently, a decline in the popularity of aloes as garden plants.

However, with the increasing realization that water-wise gardening techniques should become part of southern African gardening practices (Fourie 1984; Honig *et al.* 1998, 1999), species of *Aloe* are again becoming popular in cultivation. In the past 30 years a number of species and strains of some species have fortunately proven themselves to be resilient against insect and mite infestations and superior strains are commercially available. In particular, the non-threatened *A. arborescens* Mill. has shown itself to be exceptionally suitable as a striking landscape plant. Many gardeners currently realize that it is better to have a smaller selection of well-grown subjects than a comprehensive collection of sickly plants.

Plant use is playing an increasingly important role in determining the conservation status of *Aloe* species. In some instances, such as *A. pratensis* Baker and *A. aristata*, specimens are being transported over long distances to established ethnomedicinal marketing sites where whole plants are being sold for as little as US$0.50. The reasons for this trend may be various: it may indicate a specific preference for the species, or it could mean that the plants are becoming rarer closer to the market, or even that gardeners purchasing through the *muthi* markets are creating a demand for taxa that are otherwise difficult or relatively costly to obtain from nurseries and gardening shops. However, not all *Aloe* species traded in the markets are threatened. Numerous non-threatened species such as the widely grown barrier plants *A. striatula* Haw. and *A. arborescens* are also available in the market, as are the dry leaves of *A. ferox* Mill. and *A. marlothii* Berger, which are sold as snuff components. Ironically, the traditional healer community may, whilst destructively harvesting some *Aloe* taxa, be simultaneously promoting the *ex situ* conservation of other selected *Aloe* species. Crouch & Hutchings (1999) inventoried the plants grown in five healer gardens in KwaZulu-Natal and found (of 198 taxa catalogued) the Aloaceae to be the most cultivated family, with 17 taxa represented, including 11 from the genus *Aloe*. Both the extra-provincial *A. brevifolia* Mill. and *A. striatula* Haw. var. *caesia* Reynolds were noted in cultivation.

The grass-leaved aloes of South Africa present an interesting challenge for conservationists in general (Craib 1996). These species have an effective defence mechanism (camouflage). In their natural grassland habitats, casual succulent plant collectors are likely to mistake their leaves for those of pooid species. However, as a result of difficulties experienced in locating grass-leaved aloes in the wild, especially when they are not in flower, entire populations could easily be exterminated through sheer ignorance of their presence. This is particularly applicable in the Grassland Biome and mist belt of the eastern Drakensberg Escarpment of South Africa, which are subject to extensive agricultural activity and commercial forestry. As is the case with species of the related alooid genera, *Haworthia* (Craib 1990) and *Chortolirion* (Hargreaves 1989; Smith 1993b), it is unlikely that grass-leaved aloes will recolonize a habitat once it has been disturbed. Where possible, localities of graminoid *Aloe* species should be monitored for decline or expansion.

Very few species of *Aloe* take kindly to invasive alien plant infestations, *A. greatheadii* Schönland var. *davyana* (Schönland) Glen & D.S.Hardy being a notable exception. This species seems to thrive in the shade and profuse leaf litter of Australian *Eucalyptus* trees. However, in Eastern Cape the habitats of *A. africana* Mill., *A. bowiea*, *A. ferox*, *A. pluridens* Haw. and *A. speciosa* Baker are increasingly threatened by jointed cactus, *Opuntia aurantiaca* Lindl.; prickly pear, *O. ficus-indica* (L.) Mill.; 'rooikrans,' *Acacia cyclops* A.Cunn. ex G.Don; and Port Jackson willow, *Acacia saligna* (Labill.) H.L.Wendl. With the exception of *A. bowiea*, these species are fortunately exceedingly common and not threatened by the alien invaders.

CONCLUSION

Now, more than ever, it is important to inform conservation authorities of those taxa that are threatened and in dire need of protection. A commitment to Red Data Lists will be necessary to achieve a solution for the conservation of *Aloe* species. Conservation authorities should be at the forefront in this endeavour. Indeed, without appropriate conservation measures in place to ensure the long-term viability of natural populations (Hilton-Taylor 1997), future survival prospects look bleak for a number of *Aloe* species. It is hoped that the listing of the conservation status of *Aloe* species provided here will stimulate and support *in situ* conservation efforts and species recovery programmes.

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