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Plant species richness, endemism, and genetic resources in Namibia

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Namibia is a floristically diverse, arid to mesic country, with several highly distinct taxa. Including naturalized plants, there are about 4334 vascular plant species and infraspecific taxa within the country's borders, a substantial increase from the existing major reference work. Dominant families are the Poaceae (422 species), Fabaceae (377), Asteraceae (385) and Mesembryanthemaceae (177). Freshwater algae and most other groups of lower plants remain poorly known. Concentrations of plant species richness are found in the Succulent Karoo biome, Kaokoveld, Otavi highland/Karstveld area, Okavango Basin, and Khomas highlands. Recent studies have led to a new estimate of 687 endemic plant species, defined as those contained wholly within Namibia's borders, amounting to about 17% of the Namibian flora. At least a further 275 species are Namib Desert endemics shared between the Kaokoveld and southern Angola (75 spp.) and between the Succulent Karoo and northwestern South Africa (200 spp.). Research on plant genetic resources is focused on species of potential or actual agricultural importance, such as pearl millet, *Pennisetum glaucum*, and cucurbits. Many wild plants have considerable genetic diversity and development potential. Primary threats to plant diversity fall in the category of poor land management and inappropriate development.

Keywords: floristic diversity; genetic diversity; endemism; Namibia.

Introduction

Namibia is floristically diverse and complex, with a variety of unusual taxa reflecting the land's long millennia as an island of great aridity amid a sea of more dynamic, less arid habitats (Werger, 1978; Kingdon, 1990). Phytogeographically, Namibia holds part of three floristic regions: the Zambezian regional centre of endemism, Kalahari-Highveld transition zone, and Karoo-Namib regional centre of endemism (White, 1983). The latter includes two recognized centres of plant diversity: the Kaokoveld and the Succulent Karoo (WWF/IUCN, 1994). There appears to be a strong correlation between species richness and endemicity (Rebelo, 1994), and there are at least five clear foci of plant species diversity and endemism in Namibia (Maggs *et al.*, 1994). Plant species richness in Namibia greatly exceeds previous estimates, and we still know little about the richness of groups such as freshwater algae, mosses, and ferns. Marine algae are discussed elsewhere in this publication (Sakko, this issue). While plant diversity is not high in terms of overall species richness, there has been pronounced radiation in several families such as the Acanthaceae and Mesembryanthemaceae.

Aside from the unique desert gymnosperm *Welwitschia mirabilis*, many regional specialists are found in this southwestern arid zone. The specialisation of many taxa in the Namib and Kalahari Deserts and surrounding regions may offer significant potential for use in restoring degraded lands or in areas undergoing desertification due to poor

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agricultural land management (Kolberg, 1997). As excessive and increasing demands are being placed on Namibia's plant resources, seriously limiting future options for sustainable development, concerted efforts must be made to document plant diversity and develop action plans to protect plant resources, especially where threats are most acute.

Regional perspective

Southern Africa contains almost 10% of the world's flora, with an estimated 23 404 vascular plant species and infraspecific taxa (Arnold and De Wet, 1993; Cowling and Hilton-Taylor, 1994). The region has the largest number of vegetation types of all the floras in Africa (Gibbs Russell, 1985). This floristic diversity is concentrated in eight distinct 'hotspots,' including two in Namibia, the Succulent Karoo and Kaokoveld (Cowling and Hilton-Taylor, 1994). The remarkable diversity and high level of endemism in the southern African flora has been discussed in detail (e.g. Goldblatt, 1978), mapped for selection of protected areas (Rebelo, 1994), and inventoried on an ongoing basis (Gibbs Russell *et al.*, 1984a; Arnold and De Wet, 1993). Species richness is not even throughout the region; a third of the region's flora occurs on 4% of the land area (Rebelo, 1994). The Cape hotspot is the world's richest centre of floral diversity (8600 species), but within the region the Succulent Karoo follows a close second (4750 species, Cowling and Hilton-Taylor, 1994).

While southern Africa has an extraordinarily high diversity of vascular plants, it is not clear whether lower plants are similarly diverse. The regional and national status of bryophytes, pteridophytes and freshwater algae is vague. Stoneworts in Namibia are a small percentage of a cosmopolitan family.

National situation

The floristic reference work *Prodromus einer Flora von Südwestafrika* (Merxmüller, 1966–1972) provides the essential descriptions and diagnostic keys for the Namibian flora. The *Flora of Southern Africa* and *Flora Zambesiaca* projects also include Namibian taxa. Ongoing taxonomic revisions and monographs in the region contribute continuously to local records. However, plant distribution data in these publications are often based on inadequate collections, not uniformly gathered throughout Namibia. There are still large gaps where collecting activity has been low (Gibbs Russell *et al.*, 1984b). Lower plants are more poorly collected than the rest of the flora (Russell and van Rooy, 1988), and have been subjected only to taxonomic and a few physiological studies. Data on their ecology or local uses are sparse (unpublished observations).

The National Herbarium of Namibia (WIND), in existence since 1953, houses over 64 000 vascular plant specimens. In 1992 the National Botanical Research Institute (NBRI) was formed to include the National Herbarium, the National Plant Genetic Resources Centre, the Vegetation Survey Unit and the National Botanic Garden. An update on the inventory of Namibian taxa, based on herbarium holdings and literature (Kolberg *et al.*, 1992), is being assiduously updated as part of the *Flora of Namibia* project. Future publications will include neglected groups like the cryptogams, aided by the final computerization of herbarium specimen data.

Table 1. Synopsis of plant taxa in Namibia

Taxon	Families	Genera	Species*	Naturalized species	Total, including naturalized
Algae (freshwater)	?	?	?	?	?
Stoneworts	1	2	7	–	7
Mosses/liverworts	21	46	91	–	91
Ferns	12	19	61	1	62
Gymnosperms	1	1	1	–	1
Monocots	33	129	968	26	994
Dicots	124	730	3010	179	3189
Total	192	927	4138	206	4344

* Includes recognized infraspecific taxa.

Species status

A synopsis of the Namibian flora is given in Table 1, based on the NBRI's ongoing *Flora of Namibia* project. There are now nearly 4350 plant species and infraspecific taxa recorded from Namibia (including naturalized taxa), versus 3210 in Merxmüller (1966–72). A recent global overview (WWF/IUCN, 1994), although based on outdated figures, credits Namibia with double the number of species of Botswana, four-fifths that of Angola and slightly less than those of Zambia and Zimbabwe. The Namibian flora resembles the Sudanese flora in number of species and infraspecific taxa, even though Sudan has nearly twice the land area of Namibia and more than twice the number of vegetation types (Gibbs Russell, 1985). Judgments by many taxonomists over many years, however, may make these direct comparisons misleading.

The dominant families of Namibian flora are those for southern Africa as a whole. Most speciose are the Poaceae (grasses, approximately 422 species); Asteraceae (composites, 385 species); Fabaceae (legumes, 377 species) and Mesembryanthemaceae (vygies, 177 species). The Orchidaceae, the world's second largest plant family, is hardly represented in arid Namibia. The Scrophulariaceae is unusually dominant here, perhaps due to the occurrence of both tropical and arid environments (Gibbs Russell, 1985). The monotypic Welwitschiaceae, represented by *Welwitschia mirabilis*, is the only gymnosperm in Namibia. As a general rule, Africa has a very poor gymnosperm flora. Total species richness for Namibia will vary with further taxonomic revision and intensified collection. Certain dominant groups, such as the Mesembryanthemaceae, may be greatly reduced in number when they are critically revised.

Figures for freshwater algae are not available. This group has received little attention in the past despite its importance in freshwater ecosystems. Another poorly known hydrophytic group is the Charophyta or stoneworts. The cosmopolitan family Characeae is represented in Namibia by two genera and seven species, all important as food for waterfowl. Confusion still reigns in the taxonomy of this group (Wood, 1978). Local research has been almost non-existent in all the cryptogam groups, due to a lack of in-country expertise. A recent review by the NBRI indicates that bryophytes are surprisingly widely distributed and successful in Namibia's arid environment. Altogether 91 bryophyte species (32 liverworts, 59 mosses) belonging to 21 families are known to occur (unpublished observations).

Twelve families of ferns occur in a great variety of habitats in Namibia, ranging from fully aquatic to xerophytic. Currently, 61 species in 19 genera are recorded from this country. Two families, Adiantaceae and Marsileaceae, are highly diverse, with more than half of the southern African Adiantaceae and 13 of 16 Marsileaceae occurring here (unpublished observations).

Distribution and areas of high richness

The analyses of richness and distribution of Namibian vascular plants for this paper in general are based on an earlier preliminary identification of diversity hotspots (Maggs *et al.*, 1994). The southern Namib falls within the floristically rich, semi-arid Succulent Karoo, which holds about a third of all Namibian vascular plants. This high richness may be due to the area's microclimatic variability. The southern Namib, like the adjacent Richtersveld region of South Africa, receives both winter and summer rainfall, with local aridity due to rain shadow effects. Coastal mists and fog from the west increase local climatic variability (Werger, 1978). Recent speciation of succulent groups has also enhanced the area's richness, although the taxonomy of many groups needs revision, and the area's relative richness may partly reflect intensive sampling.

The Kaokoveld is known to have high floristic individuality (WWF/IUCN, 1994), but also shows very strong relationships with other floristic regions. There are many endemic elements (defined as 100% of the global distribution within Namibia's political borders), as well as taxa related to the rest of the Karoo-Namib and to southern Angola. A number of species belong to taxa with disjunct distributions in arid regions on either side of the equator, indicating a former connection between southwest and northeast Africa (De Winter, 1971). A range of habitats is encountered in this district, due in part to its tremendous geological complexity.

The Otavi highland/Karstveld area is a species-rich 'island' of higher altitude and rainfall within the broadly defined Kalahari Basin. This hilly area supports relic populations of southern vascular plant elements with an earlier widespread distribution. The higher altitudes, cooler temperatures and sheltered sites also offer refuge from harsh conditions to mosses and ferns (unpublished observations).

High species richness in the Okavango region probably stems largely from the incursion of tropical species down the Okavango River. The river also supports elements of the Zambezian Domain, which is characterized by many widely distributed species. The high rainfall and habitat diversity of this region underlie its plant species richness. These habitats include wetlands, dry deciduous woodlands on sand, microphyllous woodlands on clay, riverine forests, and specialized habitats on quartzites in the Andara area.

High species richness in the Windhoek district is almost certainly partly an artefact of sampling effort, but the district also features high altitude habitats, such as Auas mountains (up to 2479 m), which may support specialised taxa. Little is known of the flora of these mountains, the second highest in Namibia, despite their proximity to the capital city.

The distribution of cryptogams in Namibia can only be described with caution due to very scanty records. These groups appear to have the same general distribution as the higher plants (Jones, cited in Werger, 1978), but this must be clarified by intensified collecting and taxonomic work.

Table 2. A first estimation of endemic plant taxa in Namibia

Taxon	Endemic genera	Endemic species*
Algae (freshwater)	?	?
Stoneworts	–	1
Mosses/liverworts	–	3
Ferns	–	1
Gymnosperms	–	–
Monocots	2	103
Dicots	14	579
Total	16	687

* Includes recognized infraspecific taxa.

Endemicity

A provisional listing of endemic plants in Namibia totals 687 taxa confined within the country's political boundaries (Table 2). This table is based on recent taxonomic studies which have vastly escalated previous estimates. We have not considered near-endemics here, as there is uncertainty about the extent of their distribution in neighbouring countries, especially Angola. For the purposes of this paper, near-endemics are those taxa that also occur just over the border.

We now estimate that about 17% of the Namibian vascular flora is wholly endemic, a figure far exceeding estimates from most of our neighbouring countries. Except for Angola (24.3%) and South Africa (70%), Namibia surpasses Botswana (0.8%), Zambia (4.4%) and Zimbabwe (2.1%) with a surprisingly high percentage of endemism for an arid region (WWF/IUCN, 1994; see also Cowling *et al*., 1989; Hilton-Taylor, 1994a, b). Two regional centres of endemism fall partly within Namibia, as identified by the Centres of Plant Diversity Project (WWF/IUCN, 1994) and Namibian botanists (Maggs *et al*., 1994). The Kaokoveld, in the present Kunene and Erongo Regions, and the Succulent Karoo are our primary Namibian endemic hotspots.

Kaokoveld endemics (23 taxa) are well-defined and often taxonomically isolated, such as the monotypic genus *Kaokochloa* (Poaceae). Many are endemic relics with connections to northeast Africa (Verdcourt, 1969; Goldblatt, 1978). Intense recent speciation is occurring within certain groups, such as *Petalidium* (Nordenstam, 1974). In addition to 136 Namibian endemic taxa found in this region, 75 near-endemics are shared between the Kaokoveld and Angola.

An area unusually rich in endemic species is the Brandberg massif in the Erongo region. The Brandberg has eight of its own endemic plants, as well as 90 Namibian endemics. The high altitude of this isolated relic inselberg, and the cool, moist conditions at its summit, could explain this high endemism. Although the Brandberg flora appears unique, further studies of the surrounding inselbergs are needed to confirm this.

The Succulent Karoo of the southern Namib Desert is extraordinarily rich in endemics, with 180 Namibian endemic and nearly 200 near-endemic taxa. Recent speciation within succulent groups could contribute to this. The genus *Lithops*, for example, has 92% endemism, although the figure is inflated by infraspecific taxa. Most hot deserts have high endemism, despite their limited plant cover, and mountains occurring in hot deserts considerably increase total endemicity (Major, 1988).

At present, rather few lower plant species wholly endemic to Namibia are known: one fern (unpublished observations), three mosses (unpublished observations) and one stonewort (Table 2). However, numerous southern African endemics occur here. It has been suggested that Namibia partially represents a major centre of diversity and endemism for the xerophytic liverwort genus *Riccia* (Perold, 1991). Too little is known about freshwater algae to estimate their degree of endemicity.

Genetic diversity

Wild plants in Namibia have considerable genetic diversity and development potential, especially in the fields of agriculture and pharmaceuticals. Namibia is predominantly a rangeland, rather than a crop-growing country, but the subsistence economy of hundreds of thousands of farmers in the northern regions depends heavily on crops such as pearl millet *Pennisetum glaucum*. Research and development in the field of crop production in Namibia was minimal before Independence in 1990 (Lechner, 1992), but has increased greatly since. A 1991 national workshop on plant genetic resources (Maggs and Strohbach, 1992) led to the establishment of Namibia's National Plant Genetic Resources Centre (NPGRC), and focused attention on the diversity and adaptations of landraces of millet and other crops, such as cucurbits.

Little is known of the genetic diversity of either wild or cultivated plants in Namibia. With the exception of the Cucurbitaceae (melons), genus *Citrullus* (watermelon), none of the centres of diversity of the world's crops falls within Namibia (Esquinas-Alcazar and Gullick, 1983; Hawkes, 1983), but simply not enough is known to dismiss Namibia as an area of low plant genetic diversity. The few small-scale evaluations of genetic diversity in Namibian crops have been done on a morphological or performance basis (Monyo *et al*., 1992; Appa Rao *et al*., 1994; MAWRD, 1993, 1994), with no work based on more direct molecular methods (Newbury and Ford-Lloyd, 1993; Ford-Lloyd and Newbury, 1994). Phenotypically, however, there appears to be considerable geographic variation in the traditional crops of subsistence farmers, such as pearl millet, sorghum *Sorghum bicolor* subsp. *bicolor*, groundnut *Arachis hypogaea*, bambara groundnut *Vigna subterranea*, cowpea *Vigna unguiculata*, watermelon *Citrullus lanatus* and others (Harlan, 1973, 1975; De Wet *et al*., 1976; Harlan and Stemmler, 1976; Zeven and De Wet, 1982; Arnold, 1983). In controlled experiments, differences in performance and morphology of Namibian pearl millet and sorghum landraces were correlated with their areas of origin and cultivation (MAWRD, 1993, 1994; Monyo *et al*., 1992; Appa Rao *et al*., 1994). The past isolation of Namibian crop farmers appears to have led to the development of distinct local landraces, which were until recently not jeopardised by western agronomic research and development.

Wild relatives of domesticated plants are numerous and diverse. The genetic proximity of these wild species to the crop has not been adequately investigated, and their agricultural value is mostly unknown. There appears to be good potential for using such species, with respect to traits imparting drought tolerance and pest resistance. However, despite the importance of these gaps in our knowledge of plant genetic resources, more pressing issues continually demand priority for the limited resources available for scientific investigations in Namibia.

Conservation and harvesting

Plant species are disappearing at an alarming rate throughout the world, with 10% of recorded species classified as rare or endangered (Newton and Bodasing, 1994). The survival of rare species is also jeopardised by unscrupulous specialist collectors. No reliable Namibian data exist, but legal and illegal trade in 'spectacular succulent' species like the halfmens, *Pachypodium namaquanum*, is thought to be considerable. Efforts should focus not only on *in-situ* protection of rare species, but also on controlling their commercialization and export.

Hilton-Taylor (1996) cites red data status for 266 Namibian plants, compared to 56 in previous studies (Hall *et al.*, 1980). Hilton-Taylor (pers. comm.) has added a number of additional species, but as elsewhere, the conservation status of plants in Namibia is dynamic, and will change with greater research effort and with environmental and social influences. A list of 365 plant taxa has been proposed for protection under new draft legislation being prepared by the Directorate of Environmental Affairs in 1997, excluding species protected under forestry law. Of the 365 taxa, 190 (28%) are endemic to Namibia, 24 (3.5%) of which appear on the CITES list. Most endemic taxa have not yet been assigned a conservation status.

Plant harvesting for export, local sale, or subsistence use is currently very poorly monitored in most cases in Namibia, but this is changing. Unsustainable harvesting can quickly pose a serious risk of local extinction for many species. Plant protection efforts need to include urban and peri-urban areas, which are often overlooked. However, Namibia's national economy could only benefit by the non-destructive, sustainable harvesting of plant resources. The sale of succulent plants, for example, can generate substantial national revenues if responsibly produced and marketed. Overharvesting of species like devil's claw *Harpagophytum procumbens* would reduce exports and lose foreign exchange for Namibia as steadier markets are sought elsewhere. The degradation of plant communities through loss of diversity also has economic implications for land uses such as tourism (Richardson *et al.*, 1997).

Namibia is fortunate in not yet having the high rates of extinction and environmental degradation experienced in some developing countries. Yet certain habitats face increasing threats which jeopardize plant species. Increases in human population, burgeoning exploitation of plant resources, large development projects, monoculture cash-cropping, and overgrazing are serious threats to the floristically rich areas of the Okavango River system, Kaokoveld, and southern Namib (Maggs *et al.*, 1994). The extent of these threats to the flora is not well documented, but there is sufficient evidence that the level of protection is currently inadequate. Plants which are as yet poorly documented are of special concern. For example, 21 of the 61 Namibian ferns are considered rare or very rare (unpublished observations) but have not received much conservation attention to date. This applies equally to mosses, freshwater algae and stoneworts. As for the higher plants, conservation status assessment of many of these groups is impossible without better systematic and ecological data.

The role of protected areas

As elsewhere in southern Africa, Namibia's protected area network is not well located with regard to hotspots of plant diversity and endemism (Rebelo, 1994). Although nearly 14%

of Namibia's land area has been proclaimed for conservation, the full range of vegetation types is by no means protected (Barnard *et al*., this issue). Only eight of the 13 vegetation types identified by Giess (1971) contain protected areas, some of which represent less than 5% of the vegetation type (Du Plessis, 1992; Fig. 2 in Barnard *et al*., this issue). In the past, conservation areas were not selected systematically and decisions were biased towards large mammal species, tourism potential, or political expediency (Barnard *et al*., this issue). Ignorance of diversity and endemism resulted in both playing little role in these decisions.

Namibia must make earnest attempts to afford protection to neglected vegetation types. For example, the savannas occupied by commercial farmers for the last century or so have no formal conservation status. Many farmers are sensitive to conservation needs, so the savanna receives some measure of *in-situ* protection. However, the biodiversity of many commercial farms has been badly eroded through poor management, including overgrazing and bush encroachment (Strohbach, 1992; Quan *et al*., 1994).

Major Namibian diversity or endemism hotspots, which should be a fundamental criterion for selecting conservation areas, fall outside such areas at present. For example, while the southern Namib hotspot receives *de facto* protection as a restricted diamond-mining area, this is only a temporary mining concession. Mining activities themselves cause some disturbance to the natural environment (Pallet, 1995), while recreational off-road driving and plant poaching pose a more serious threat. In the Kaokoveld hotspot, former protection within the originally vast 'Game Reserve No. 2,' which became the Etosha National Park, was lost through deproclamation under the terms of the 1963 Odendaal Commission, a South African colonial measure aimed at procuring ethnically partitioned 'homelands' (Barnard *et al*., this issue). Ironically, many areas of high diversity and endemicity are heavily used, support high human densities, or are targeted for major development projects. A sensitive interface exists between rural people and plants needing protection. Local people depend heavily on plant resources for their subsistence and livelihood. Therefore, their participation in decision-making and conservation monitoring is essential for the long-term success of plant conservation strategies (Cunningham, 1994).

Institutional linkages

The NBRI is responsible for undertaking and coordinating botanical research in Namibia. It needs to strengthen existing linkages and establish new agreements with international institutes. A regional project (Southern African Botanical Diversity Network) to coordinate botanical activities in southern Africa has recently been initiated, and will help ensure that Namibian expertise and material are consulted in the compilation of regional Floras and other publications. Namibia could play a vital role in research and conservation activities regarding plant resources that are shared across borders. For example, strong floristic affinities exist between Namibia and Angola. Given Angola's ongoing political instability and inadequate conservation measures, Namibia could help promote and protect a threatened regional heritage.

The bioprospecting potential of Namibian plants appears good. More extensive surveys to document plant use in the field, and develop promising plant extracts in the laboratory, can be done through collaboration with internationally reputed institutes. Intellectual property rights and patenting issues need further legislative attention, however, so that Namibia benefits directly from product development.

Major constraints

Namibia faces several basic constraints of institutional capacity in countering threats to botanical diversity.

- Lack of trained manpower, due to a lack of post-BSc botany training at the University of Namibia.
- Government budget shortages have severely limited funding for research and staff. Donor agencies will finance applied work, but not essential biosystematic work.
- Poor coordination and planning of botanical research in the past resulted in duplication, major gaps, and little systematic sampling.
- No evaluation was made of botanical studies undertaken.
- With no research prioritization in the past, visiting scientists often chose taxa and study areas without consulting local counterparts. This will persist until a strong national programme is put into place to direct botanical research.
- Baseline botanical data left the country with colonial civil servants and foreign scientists, adding to the duplication and lack of direction.

Major threats to botanical diversity in Namibia

Plant diversity is primarily threatened by rapidly increasing anthropogenic land transformation:

- Conversion of land to agriculture without incentives for good management has led to over-stocking, bush encroachment, overgrazing, deforestation, and the spread of invasive aliens.
- Poorly considered development has included unplanned urbanization, dam building, water extraction, mining development, and the improvement of road networks.

The areas of greatest botanical importance are most at risk of land transformation due to inadequate conservation protection. Environmental assessments (EAs) are carried out for large development projects, as directed by the Namibian Cabinet (Tarr, 1996). Unfortunately, EAs are often carried out on corporate timetables, and can be ineffective if species richness is underestimated through inappropriately timed EA fieldwork, if studies are poorly coordinated, often using inexperienced foreign consultants, and if results and recommendations of EA reports are disregarded by developers.

In the area of legislation and enforcement, revised legislation for the protection of indigenous plants urgently needs completion, and measures for stricter enforcement are badly needed. Prosecution for plant poaching is currently difficult, partly because conservation and customs officers are untrained in the identification of rare and threatened species sought by collectors. Finally, mechanisms to recognize intellectual property rights and accrue benefits have not yet been designed, and there is so far no national mechanism to compensate local people for the use of genetic resources or local knowledge. In this vacuum, Namibia, like other nations, is being exploited by institutions in the industrial world.

To counter these threats, Namibia needs to improve its botanical capacity through coordination and collaboration; prioritize its research activities; promote biosystematic research related to management needs; improve data access; intensify fieldwork in priority areas; update legislation and enforcement measures; promote the sustainable use of plant

resources, especially for agricultural and pharmaceutical purposes; and develop mechanisms for the equitable sharing of benefits derived from this use.

Conclusions

Namibia has a very high level of plant endemicity, as its taxa have adapted to its unique and harsh environments over evolutionary time. This endemicity is perhaps more impressive than the country's overall species richness. Many of our plant resources, endemic or not, show tremendous potential for research and development. In particular, plants of possible use in agriculture and land reclamation could be extremely important, both here and in other arid countries experiencing land degradation. The need for effective plant conservation cannot be overstated in an arid country such as Namibia, where many people live on the edge of poverty. The sustainable use of plant resources must be advocated and controlled in energetic and creative ways, to ensure that plant resources will continue to sustain future generations. Although much valuable floristic work has been undertaken in Namibia in the past, improved data analysis is imperative for future conservation management. The NBRI, together with affiliated institutions and individuals, is taking urgent measures to improve our botanical knowledge base.

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