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Threatened plants at the south-western corner of Africa

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ABSTRACT

An account is given of the extent of floristic and habitat destruction in the area currently and formerly covered by the Cape Floristic Kingdom. An evaluation is given of the proportions of habitat threats and other factors affecting a sample of critically rare species. It is shown that invasive plants introduced from other countries pose a major threat to critically rare species in the areas where natural vegetation has not been fully replaced by suppressive land-uses. The value of the Cape Flora as a genetic resource for purposes such as an expanding cut-flower export-industry is demonstrated and research needs in this field are outlined.

RÉSUMÉ

PLANTES MENACÉES DANS LE COIN SUD-OCCIDENTAL DE L'AFRIQUE

Un compte rendu de l'étendue de la destruction de la flore et de l'habitat dans la région actuellement et antérieurement couverte par l'Empire floristique du Cap, est donné. Une évaluation des proportions des menaces pour l'habitat ainsi que d'autres facteurs affectant un échantillon d'espèces critiquement rares est donnée. Il est montré que des plantes envahissantes introduites d'autres pays créent une menace grave pour les espèces critiquement rares dans les régions où la végétation naturelle n'a pas été complètement supprimée par l'exploitation du sol. La valeur de la flore du Cap en tant que ressource génétique pour des buts tels qu'une expansion de l'industrie d'exportation des fleurs coupées est démontrée et les besoins de rechereches dans ce domaine sont soulignés.

INTRODUCTION

The aim of this paper is to examine the methods of study, results and reactions to the unusually severe threatened-plant problem in the south-western Cape Province, South Africa. The setting for this problem is the belt of coastal mountains and flats carrying the peculiar protea, heath and restio flora, known, because of its richness in species and distinctness of taxa, as the Cape Floristic Kingdom. The Cape Kingdom is by far the smallest of the six into which the world's terrestrial vegetation is divided (Good, 1964; Takhtajan, 1969; Hall, 1978). Having about 6 000 species in natural areas formerly totalling 4,6 million hectares, it is the most species-rich major floristic region in the world (Hall, 1978). Excluding minor outliers, the Cape Kingdom's area passes from Vanrhynsdorp 250 km south to Cape Town, and thence 800 km eastwards to Grahamstown, in a sometimes patchy belt 40–150 km wide. Succulent karoo floras, grasslands and Afro-montane forests are distinct elements of the Palaeo-tropical Kingdom that penetrate the belt, but which are excluded from consideration in this paper owing to their different habitats, distribution patterns and less severe threatened-plant problems.

METHODS

A survey of threatened plants in the western Cape Province was started in 1974. A team of two graduate assistants searched herbarium records, literature and communications from specialists on various taxa, looking for candidate species for the threatened-plant list. The criteria for listing excluded taxonomically doubtfully distinct species, but included significantly different or 'important' infra-specific taxa. As the Cape Kingdom has been fairly well recorded in herbaria, the presence of few herbarium specimen-localities could be taken as a reasonable indicator of rarity. This, coupled with general knowledge of the intensity of replacement of natural habitats by other land-uses, gave what proved to be a fairly reliable list of candidates for field study.

The field-studies were planned from regional, monthly lists of taxa made from data compiled in dossiers on each species. Each species-dossier carries a photograph of a specimen or a copy of an illustration, a taxonomic description, and a list of localities and flowering-times. The A4-size card bearing these data can be put into a protective transparent folder for field use. Indexes and monthly lists of taxa for each $\frac{1}{4} \times \frac{1}{4}$ degree area were prepared with the aid of a computer-based data-bank (Hall, 1981). Data are collected at the sites of threatened-plant populations according to a schedule which covers geographical distribution, habitat features, population biology, threats to survival and recommendations for conservation (Hall *et al.*, 1980b). Reports of this kind have been completed for about 350 species, with others only partly complete pending further visits to field sites.

Where the survey has revealed locally high concentrations of threatened and critically rare plants, a regional report is drawn up bringing together the findings on all threatened species and habitats in the area, for use in planning sanctuaries and nature reserves.

The preliminary findings of this and other surveys were published as lists of threatened and rare taxa for Southern Africa (Hall *et al.*, 1980b). This snapshot view is being supplemented by a gazette carrying data on the changing survival-status and actions being taken on especially critical taxa in the Cape Kingdom. This gazette will be produced

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TABLE 1.—Estimated numbers of vascular plant species that are threatened, critically rare or recently extinct in the Cape Floristic Kingdom. The categories are those defined by the IUCN (Lucas & Synge, 1978)

IUCN category	Number of species
Recently extinct	36
Endangered, close to extinction	98
Vulnerable and declining	137
Critically rare	383
Indeterminate, in one of the above categories	279
Uncertain, probably in one of the above categories	688
Total	1 621

periodically from a computer data-bank where the information will be accumulated.

RESULTS

The current estimates of the numbers of threatened, critically rare and recently extinct vascular plants in the Cape Kingdom are given in Table 1. The former natural area of the Cape Kingdom, prior to partial replacement by agriculture and other land-uses, is estimated to be 4,6 million hectares. This is less than 2% of the area of Southern Africa (including South West Africa/Namibia and Botswana). It is remarkable that the Cape Kingdom has, in this small area, 68% of Southern Africa's plants in hazard (Hall *et al.*, in press).

The chief threats affecting these plants are shown in Table 2. By far the worst threat is the invasion of plant habitats by escaped alien species brought to the Cape mainly from Australia and Europe for binding drift-sands, hedges, timber, tannin production, firewood and stock-feed supplements. Although these thicket-forming alien plants remain useful in several of these ways, their indiscriminate introduction and natural spread into wild flora areas today gives widespread concern for the future of the Cape Floristic Kingdom (Shaughnessy, 1980; Hall & Boucher, 1977; Hall, 1979). The chief problems are that the introductions are well-adapted to the widespread nutrient-poor soils in the Cape Kingdom, are encouraged by periodic fires, and in the case of the especially dangerous Australian Acacias, have a massive production of long-lived seed which is not heavily damaged by insects as in the plants' land of origin (Milton & Hall, 1981). Most of the other threats are directly related to human population growth and the consequent need to expand areas of intensive land-usage. Plants in the Cape Kingdom quite often have rather localized distributions, some naturally as small as a few hectares. Quite minor expansions of land-uses may significantly damage or even destroy a species' only population. For example, a single quarry has destroyed the habitat of *Moraea loubseri,* making it extinct in the wild. Human population-growth in the south-western Cape remains rapid, having had a total increase by one-fifth in the 1971–1980 census decade. The region is an important source of agricultural produce for Southern Africa which has a total monthly population increase of about 60 000 persons, which lays yet further stress on local agricultural expansion.

TABLE 2.—The chief destructive habitat pressures affecting wild plants in the Cape Floristic Kingdom, and the percentage of a sample of 200 threatened, critically rare or extinct species affected in each case (from Hall *et al.*, 1980a)

Habitat pressure	% of sample affected
Invasion of habitat by alien plants	54
Ploughing and related agricultural activities	26
Urban and industrial expansion	24
Over-frequent fires in vegetation	20
Grazing and browsing by livestock	14
Wild flower-picking for pleasure or profit	7
Road construction	6
Trampling	6
Dam construction	4
Quarrying	3
Afforestation	2
Natural pathogens	1

These conditions lie in sharp contrast to Europe, where the flora appears to be more robust, perhaps from its post-glacial pioneer origins, and where plant distributions are seldom as miniature as those quite often found in the Cape. Furthermore, the combination of threats from population growth in Europe seems to be less: however, perhaps losses went unrecorded during such episodes as the deforestation for expansion of agricultural land in the Middle Ages.

Similar unrecorded depradations may have taken place in the south western Cape lowlands. There is archaeological evidence that by 2 000 years ago, pastoralists were herding sheep and burning vegetation in this area to promote fresh growth. When historical records began some 300 years ago, there were already several thousand Hottentots living on the Cape Flats.

Their impact upon the vegetation, especially any sensitive and local rarities, would have been considerable. Numbers of plants may have already become extinct in the lowlands and others may have become so rare that their later extinctions went unrecorded by the early plant-collectors. This may partly account for the fact that only some 40% of the Cape Kingdom's plants in hazard are from the lowlands (below 300 m) where the most widespread replacement of natural vegetation has taken place in historical times (Hall *et al.*, 1980a).

REACTIONS TO THE THREATENED-PLANT PROBLEM

The Cape Kingdom is recognized as a crisis zone for the loss of genetic diversity. This statement encompasses not only the plants that are being made extinct but also the many others that have had their variability reduced by the widespread losses of local populations (Hall *et al.*, 1980b).

A common but misleading belief is that a permanent solution can be sought by holding small samples of natural populations in horticulture. These small populations are genetically at risk, especially in the case of short generation time species such as annuals, which may, relatively rapidly, drift away from the original richly varied gene-pool, perhaps with deleterious inbreeding effects. This may be accentuated by the alien conditions of horticulture, in artificially fertilized and watered soils; also microclimates that due to spaced arrangements and weeding may be unfamiliar to plants used to crowded conditions in the wild; and, finally, an absence of pollinators and other associates which may be necessary for survival. Other hazards may be new opportunities for hybridization, perhaps taking place introgressively at a low but significant frequency and not previously experienced by the species in the wild; finally, there is the risk of catastrophic loss of the species by disease if all the plants are held in the same area. Failure of the horticultural option may also take place if interest in conserving the plant by growing it should become lessened by change of staff, loss of records or simple lack of concern. Long-term conservation should, in this light, clearly take place in wild habitats where there exist the pressures and amenities that had caused adaptations in the populations of the species in the past. The chief rôle of horticulture for threatened species should be to provide a temporary home for raising large numbers of individuals for use in restoring natural populations in the wild (Hall & Rycroft, 1979).

With the patchy nature of many of the Cape Kingdom's relics, wild populations of some species will need to be monitored and cared for on a semi-horticultural, management basis. Based on 1972 Landsat imagery and other observations, only 39% of the wild vegetation remains, much of it penetrated and diluted by invasive thickets of alien species (Hall, 1978). Costly restoration plans are already under way in mountain catchments to remove alien vegetation: in a single twelve-month period in 1980/1981 over 28 000 hectares of Australian Hakea were cleared in the south-western Cape alone (J. A. Fenn, pers. comm.). Buffer-zones will need to be created around restored areas to cushion them from external impacts: to this end, recent legislation allows alien plant clearing up to 5 km outside the catchment boundary. This good progress in offsetting the effects of insularization in mountain areas is at present only weakly reflected in the lowlands, although there are encouraging glimmerings of change. The lowlands are virtually all held in private ownership and a communication problem must be overcome before the threatened-plant crisis there can be solved.

It is relatively simple matter to communicate the need for action directly from a research unit to a receptive body such as a conservation or forestry authority: in fact this is a well-worn channel for a steady flow of scientific findings.

Communication to private, profit-orientated land-owners presents considerable difficulties, especially within the rather limited confinements of local and Provincial funding. There is barely any educational tradition to appeal to: school curricula have only recently included the conservation of flora in biology courses. There are virtually no adult-guidance programmes such as local interpretive centres. Only one small museum, at Hout Bay on the Cape Pensinsula, carries an adequately comprehensive exhibit on the threatened-plant crisis. Such guidance is also virtually absent in the few private and subsidized nature reserves in the lowlands. A little information is available on some of the more common species in illustrated books, dealing with parts of the lowlands. One may conclude from this that there is little reason to expect public pride, concern and interest in the lowland flora. With a few distinguished exceptions, this is true of most lowland landowners. Commercial activity, in utilizing the flora for the R3 million cut-flower export industry, is of value in conserving a limited number of more spectacular species, 65% of which are taken from the wild, mostly in the nearby mountains. For general picking of supporting foliage ('Cape Greens'), the industry may be hazardous for the less easily recognized threatened species. The cut-flower industry is a marginal activity over most of the lowlands, where good-quality soils are better suited to more profitable food-production. For many

landowners, the conservation of the flora, even of threatened species, may have a hobby-like ring to it, a pastime or naturalist's activity entirely divorced from the practicalities of farmland management.

Conservation of threatened lowland plants should be preceded and accompanied by adult guidance on a large scale to reach most landowners. The methods should fall into the category known as environmental interpretation (Sharpe, 1976). These are defined as programmes which are given in a leisure setting, at the site of a natural phenomenon, and are 'neither education nor entertainment alone, but a subtle mixture of both.' The programmes require interpretive centres, self-guided trails through nature areas, conducted visits, short entertaining talks and supporting information channelled through pamphlets, books and the public media (Hall, 1983). The aim is to generate a strong tone of pride-of-place and personal involvement through local participation. Once started, the programmes are surprisingly efficient in generating an adequate ethic that allows and encourages conservation actions to go ahead: this has been shown particularly well in both the built and the natural environments in Europe. The effect is to guide people into a cultural appreciation of nature. More importantly, it can help show humanity's critical dependence on the intactness and proper functioning of the biosphere (Polunin, 1980).

CONCLUSIONS: POSSIBLE RELEVANCE ELSEWHERE IN SOUTHERN AFRICA

Hedberg (1979) has reviewed the possibilities and needs for conservation of plant species and vegetation in Africa. The main needs identified were basic taxonomic data and the practical application of theory by means of functional conservation bodies. Meeting the taxonomic needs lies squarely in the hands of botanists who provide the primary flora treatments. The provision of functional conservation bodies cannot be adequate without, in the first place, public support for funding for staff and equipment. This support must come from public interest otherwise the programmes may become, in a sense, artificial and, unless self-reinforcing, could eventually fail. Public interest is also needed if reserves for flora are to be made by subtraction from land in private ownership or publicly used commonage. Scientists and conservators owe the public an explanation for their wishes to set aside land as reserves and to undertake costly conservation programmes. The explanations should show in clear terms the benefits of having the reserves. The best ways of putting across these important ideas appear to be by the methods of environmental interpretation, which is likely to have a critically important future rôle in the conservation of the great plant life of Africa.

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