LIMESTONE FYNBOS

Unique, useful and under-conserved

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Above. **Fascinating geological form: a limestone cliff at Hagelkraal.**
Photo: C. Willis.

Although most fynbos vegetation occurs on acidic soils derived from Table Mountain Sandstone, one group of fynbos plants is found on the alkaline soils of limestone outcrops.

Unique

This is the unique limestone fynbos, which is restricted mainly to soils of the Bredasdorp geological formation and is also known as limestone proteoid fynbos, because of the presence of members of the Proteaceae family in this group.

The coastal region stretching from Gansbaai in the west to the mouth of the Gouritz River in the east (see map) is recognized as a botanical entity, the Bredasdorp-Riversdale centre of endemism. The limestone outcrops found here are relatively young in geological time, only a few million years old. Their formation was an important event for the evolution of new fynbos species. New habitats and soil conditions were created and new species evolved on limestone-derived soils. These are now confined to this area.

The coastal lowland areas of the Cape Floristic Region are threatened by agricultural expansion, urbanization and alien plant encroachment. Limestone fynbos, being specialized and restricted in its distribution, is one of the most threatened vegetation types in the region. In recognition of and in response to this, the Flora Conservation Committee (FCC) of the Botanical Society undertook to sponsor three research projects: an examination of the conservation status of limestone fynbos in terms of floristic information, utilization and threats to this vegetation type at fifteen sites (Heydenrych 1994); an investigation of the taxonomic and biological aspects of endemism of limestone fynbos plants and a study (using three different mathematical programmes developed by Australian scientists) to determine the ideal reserve configuration for limestone fynbos plants.*

The first step was to produce a list of limestone-endemic (plants restricted to limestone) fynbos plants. A hundred and ten plant species were considered to be limestone endemics. Information on the distribution of limestone fynbos plants in the areas shown on the map was obtained during a week-long field survey of 15 sites in November last year. These records were supplemented with data from the PRECIS data base, Protea Atlas, Cape Nature Conservation's data base, taxonomic revisions and herbarium specimens from the Bolus and Compton herbaria.

What did we find? The area with the highest number of limestone endemics was De Hoop Nature Reserve with 69 species and, apart from a small concentration of endemics around the Stilbaai area (including Pauline Bohnen Nature Reserve), the greatest richness of limestone endemics were found to occur in the region between the Soetanysberg and the Breede River. Generally, sites where greater limestone areas are exposed support greater numbers of species than isolated limestone 'islands'.

The 110 limestone fynbos species showed varied distribution patterns, some being found throughout the region and others

restricted to a single site . A large proportion of limestone fynbos species (42%) were found to be local endemics, with very narrow distribution ranges. Results from the field study indicated that only 4 species occurred at all 15 field sites. However, 25 species were recorded at single sites only. This high percentage of local endemism is attributable to edaphic (soil) specialization by limestone fynbos plants and the fragmented nature of the limestone habitats within the region.

The genus *Erica* contained the most endemic species, 12 in all, followed by *Agathosma* with 9 species, *Aspalathus* with 8 and *Muraltia* with 7. The Rutaceae, Ericaceae, Fabaceae, Polygalaceae and Sterculiaceae had higher than expected numbers of species than would be expected in non-limestone fynbos. Specialized nutrient uptake mechanisms such as mutual arrangements between plants and micro-organisms in the Ericaceae and Fabaceae (ericoid mycorrhizae and rhizobia respectively) may explain edaphic specialization and speciation in these groups.

Limestone fynbos contains a large proportion of rare plants. Twenty-nine (26%) of the limestone endemics have been listed in the *South African Red Data Book* for plants. Only two areas showed higher than expected numbers of rare species: the Melkhoutfontein/Stilbaai area east of the Kafferkuils River and the Hagelkraal area.

Limestone fynbos, although distinct from other vegetation types, should not be managed in isolation. Management practices such as burning should include limestone fynbos as well as surrounding vegetation types. In addition, the maintenance of habitats adjacent to limestone fynbos areas is important for the survival of species such as insect pollinators. Certain insects such as horseflies (normally regarded as pests!) are important pollinators of some plant species including ericas. (See *Veld & Flora*, **79**(2), June 1993). These insects could be critically important for maintaining several limestone fynbos species. Many of these insect species have larval stages in freshwater vleis and the use of pesticides or the infilling of wetlands for urban developments, could have far-reaching effects on seemingly un-related natural systems.

Useful

Areas in which limestone fynbos occurs are usually tranquil and scenic, often with sea views and interesting geological formations. This is important for ecotourism in the region. Limestone fynbos areas are also important for farming such as low-intensity grazing and wildflower harvesting. The wildflower industry for the fynbos as a whole is worth more than R45 million per annum. Limestone fynbos species that are commercially harvested include *Leucadendron meridianum*, *Leucadendron muirii*, *Leucospermum patersonii*, *Mimetes saxatilis* and *Protea obtusifolia*.

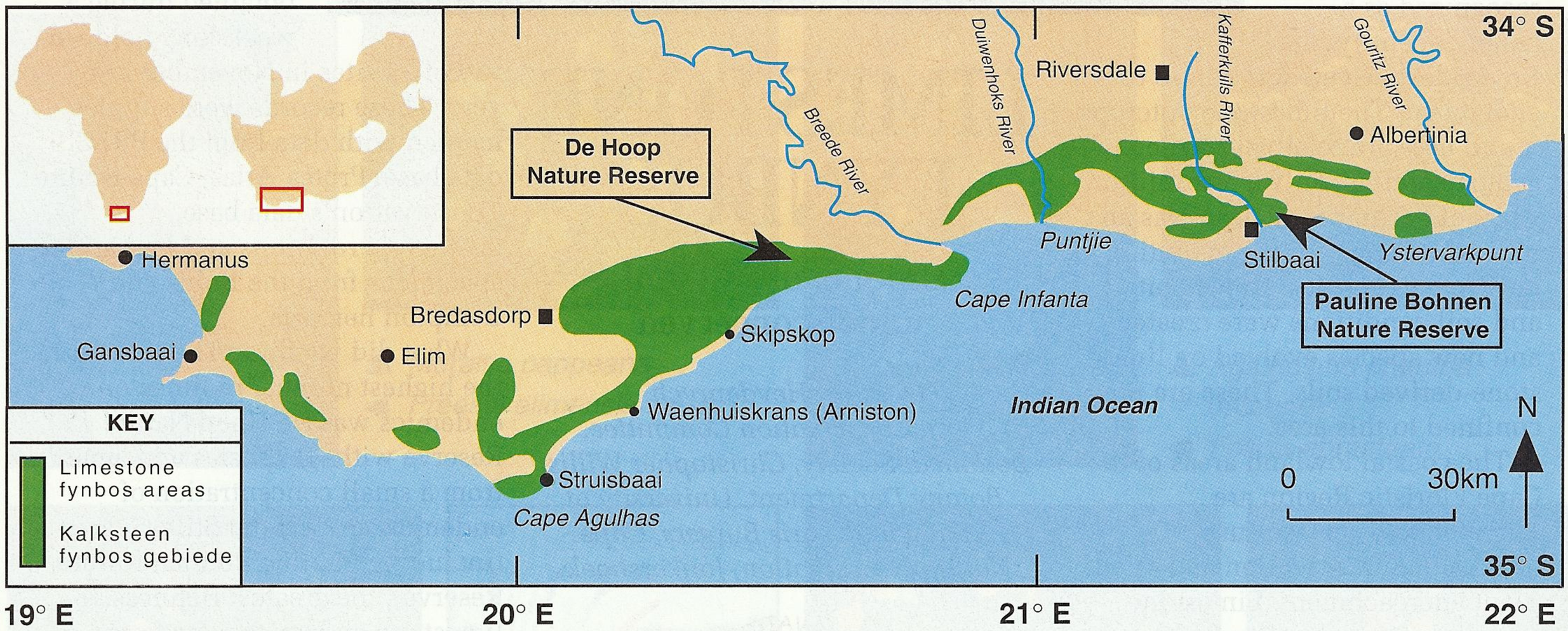
Horticulturally, limestone fynbos species have great potential. Twenty-four species are already in cultivation at Kirstenbosch National Botanical Garden. Many of these plants may be better choices for coastal gardens with alkaline soils than their acid-loving counterparts.

There may also be potential medicines, condiments or other products amongst limestone fynbos species still to be discovered. Recently a commercial buchu compound was discovered in the essential oil of *Diosma haelkraalensis*, a limestone endemic (see *Veld & Flora*, **80**(2), June 1994).

Under-conserved

There are many factors threatening the viability of limestone fynbos communities. The biggest threat is the encroachment by invasive alien vegetation, especially rooikrans *(Acacia cyclops)*. The Flora Conservation Committee is currently supporting the biological control work of the Plant Protection Research Institute (PPRI) at Stellenbosch, which includes the control of *Acacia cyclops*. Other threats to limestone fynbos vegetation include land clearing for agriculture, resort development (for example, at Struisbaai), inappropriate fire management and the over-harvesting of wildflowers.

In the limestone areas depicted on the map there are only two formal nature reserves that conserve limestone fynbos, De Hoop Nature



Reserve and Pauline Bohnen Nature Reserve. Many other protected areas in this region are coastal state forests which do not contain limestone fynbos and have been planted with invasive alien *Acacia* species to stabilize drift sand. De Hoop and Pauline Bohnen reserves are thus vitally important and should be seen as core conservation areas for the region. However, these reserves do not adequately conserve all limestone fynbos plants. Twenty-one per cent of all limestone fynbos species and 38% of the *South African Red Data Book* species do not occur in either the De Hoop or Pauline Bohnen Nature Reserves. More reserves in other key areas, including new core areas, will therefore need to be established.

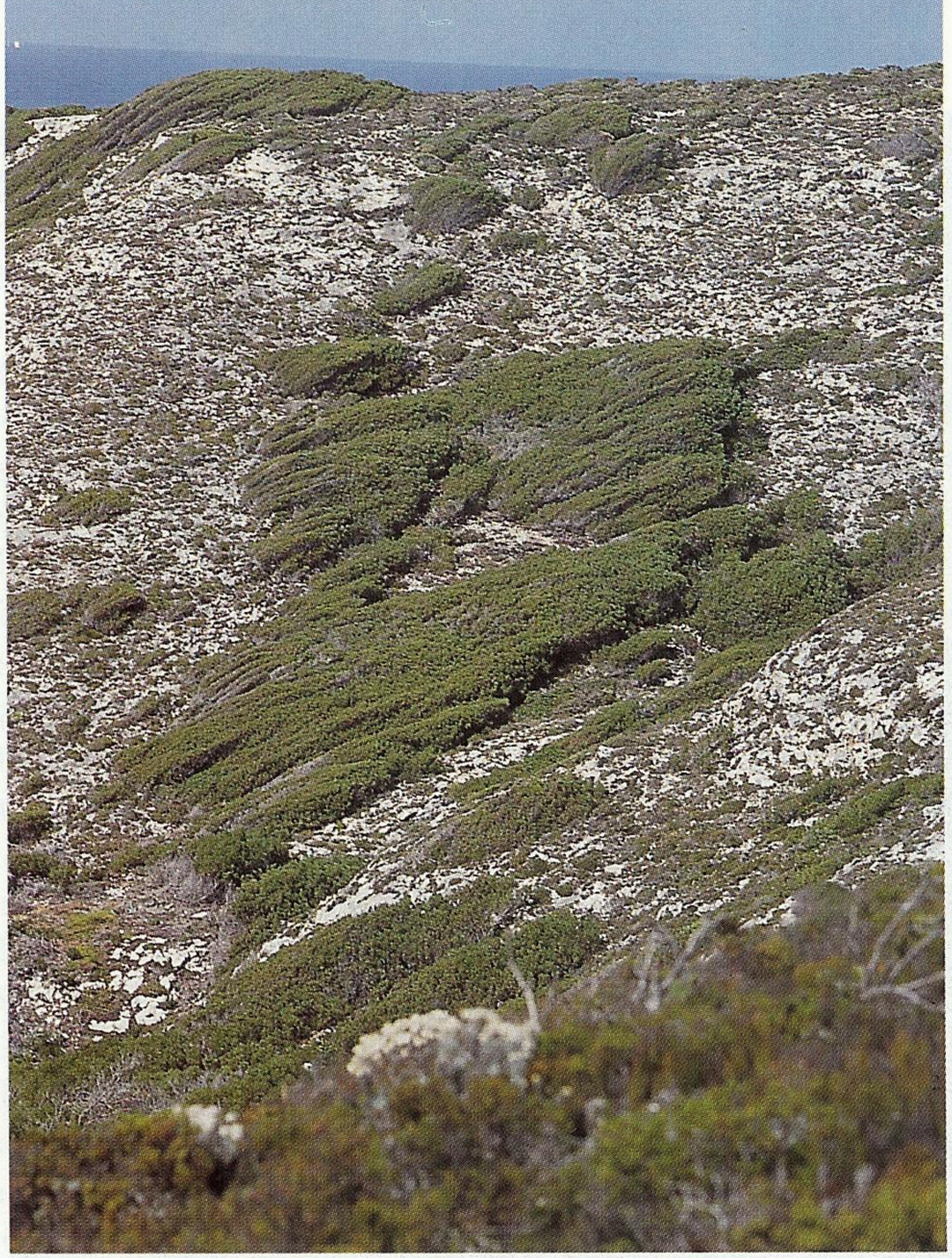
Where should conservation efforts be focused? Based on the distribution of 110 limestone fynbos species, De Hoop Nature Reserve and Hagelkraal were found to be the most important areas for the conservation of these species. These two areas also ranked highest in terms of topographic and soil diversity. This is important for conservation because more soil types will support more vegetation types. In addition, the preservation of many soil types will also allow for the continuation of evolutionary processes. Hagelkraal was the only overlap between the ideal reserve configuration recorded in this study and that of a similar study, based on the distribution of the Proteaceae. Hagelkraal is therefore an obvious choice as a core area for conservation.

Apart from the above areas, sites selected as vital in a reserve system to adequately conserve limestone fynbos species were Soetanysberg, Struisbaai/Agulhas, Waenhuiskrans (Arniston), Vermaaklikheid-Blombos and the Stilbaai east (Pauline Bohnen) area. Many reserves are required because of the high levels of local endemism in limestone fynbos plants.

But patterns of species richness

Top. **A typical limestone fynbos landscape. *Erica scytophylla* protrudes from a limestone crack at De Hoop Nature Reserve.**

Below. ***Erica occulta*, a very strange and rare limestone-endemic plant, found only at Hagelkraal.** Photos: C. Willis.



Dark green thickets of rooikrans *(Acacia cyclops)* invade sparsely-covered limestone near Cape Agulhas.
Photo: C. Willis.

and rarity alone should not be used for determining conservation strategies for a region, nor should limestone fynbos patches be seen in isolation. The influence of the surrounding vegetation needs to be recognized. Conservation efforts should therefore be focused in areas which, in addition to being species-rich, are not heavily infested with alien plants, span gradients of soils and vegetation types and are conducive to local participation with a common vision in mind. Thus, an integrated landscape approach should be adopted for the region.

Where to now? The acquisition of new land for the establishment of reserves is difficult, both politically and financially. The key to further conservation efforts therefore lies with the private land owners' ability to protect biodiversity on their properties for themselves, and for the generations to follow. Ideally this should be done using collaborative programmes such as conservancy networks or contractual national parks, which link up with state-owned core areas.

At present, limestone fynbos areas are seen as wastelands by many farmers as they are not agriculturally productive. We hope that this attitude will change, especially as the farming of fynbos (recently recognized as an agricultural resource) and ecotourism, are both expanding industries. Unless an integrated management approach which has the blessing of the local inhabitants of an area is adopted, the long term conservation of the Cape lowland fynbos, including the unique limestone-endemic flora, will not be achieved.

Reference

Heydenrych, B. (1994). Limestone fynbos: unique but threatened. An investigation into the conservation status of limestone fynbos in the southern Cape. *Flora Conservation Committee Report*, 94/1. Botanical Society of South Africa, Kirstenbosch.

*The reports on the last two research projects will soon be available. Please contact the address below for further information. Christopher Willis used his research project towards an M.Sc. in Conservation Biology at the University of Cape Town.

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