Growing in a Wild State

by
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and
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Western Australia's flora enjoys world renown for its richness, uniqueness and colourful displays. Just under 8 000 species have been recorded, but the true figure may be more than 10 000. Some 80% of the plants in the South-West are found nowhere else in the world, and about 2 000 species are rare, endangered, vulnerable or geographically restricted. Some can be cultivated, but ultimately each of our precious plants has to get by on its own - in the wild.

Previous page - Mountain villarsia *(Villarsia calthifolia)*, a declared rare plant found among granite rocks in the Porongurup Range.
Photo - David Coates

Dieback has affected most populations of feather-leaved banksia *(Banksia brownii))*, a species found in the Stirling Ranges.
Photo - Steve Hopper ▲

ACCORDING to a recent assessment, Western Australia has 43% (1 442) of the Australian total of rare or threatened plant taxa (species, subspecies or varieties) with 83% being restricted to the South-West. About 1 500 species are used commercially in the wildflower, seed nursery, beekeeping and timber industries.

Threats to Western Australia's flora typically come from a wide range of often interrelated events. These include continued clearing of land, invasive weeds, grazing, pests and disease, inappropriate fire regimes, recreation pressures, roadworks and urban development. Studies on the geographical distribution and biology of rare or threatened species show that their vulnerability has been due mostly to the activities of Europeans. Sometimes, however, rarity is due to specific habitat requirements.

The distribution of plant species across Western Australia is uneven, many being found only in the South-West. Geologically, this region has been isolated from eastern Australia for about 30 million years. The flora has undergone immense evolutionary change in a short geological period, and the level of richness in the area is equivalent to that of tropical rainforest areas, such as the Philippines Archipelago or Malaysia.

A FLORA BESIEGED

On a map, the pattern of species-richness in the South-West would show up as a northwest-to-southeast dumbbell-shaped zone through the Wheatbelt to the northern and southern heathlands. It is here that most of Western Australia's rare and threatened plant species are concentrated, and where extensive land clearing of vegetation and modification of the environment has taken place. Many species now persist in this area in small isolated populations as remnants of the indigenous vegetation.

Any plans for conserving the State's flora need to consider the multimillion-dollar wildflower industry. Some 70% of its exports is taken from wild populations on Crown land or private property. The industry is growing; in 1989 the number of licences issued for the taking of flora for sale was 1420, compared to 653 in 1981. Most of the heavily exploited species are widespread, although a few are geographically restricted and may require research before they can give a sustainable yield.

Dieback disease, caused by the fungus *Phytophthora cinnamomi* and, to a lesser extent, other fungal diseases, is of major concern to the wildflower industry and the Department of Conservation and Land Management (CALM). In the south coastal areas there are hundreds of susceptible plant species, including many used in the wildflower trade for seed and cut flowers. Heavily exploited species, such as scarlet banksia (*Banksia coccinea*) and Baxter's banksia (*Banksia baxteri*), and rare species, such as feather-leaved banksia (*Banksia brownii*), face localised extinction in the next few years because of the disease.

Lichens and other non-vascular plants such as algae and fungi are now protected flora.
Photo - Gerhardt Saueracker ◄

Sand mallee *(Eucalyptus eremophila)*, a widespread mallee of the Wheatbelt and Goldfields.
Photo - Jiri Lochman ◄

This rare donkey orchid *(Diuris purdiei)* is found in the Perth metropolitan area and near Peel Inlet.
Photo - Andrew Brown ▲

Fortunately, it's not too late to conserve most of the State's native flora. At present, there are 94 presumed extinct plants - less than 1% of the estimated total number of plant species in Western Australia. However, this should not lead to complacency; there is still much that needs to be done in protection, research and management if the survival in the wild of many native plant species is to be assured.

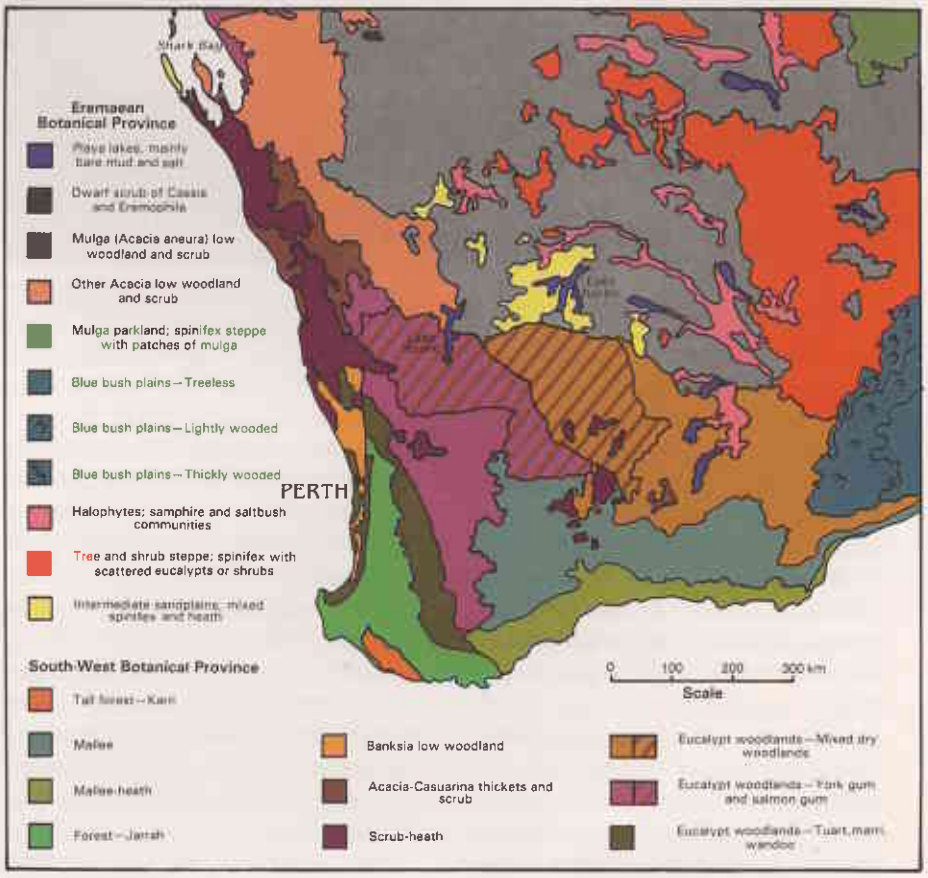
PROTECTION

The Wildlife Conservation Act (1950-1987) and Conservation and Land Management Act (1985) provide the guidelines and legislation for the conservation of the State's flora.

Under the Wildlife Conservation Act, CALM is responsible for the protection of all classes of native flora on all lands and waters throughout Western Australia. From October 1987 "protected flora" included flowering plants, conifers, cycads, ferns, fern allies and non-vascular plants (mosses, liverworts, algae, fungi and lichens).

The protection of non-vascular plants has added a new dimension to conserving the State's flora. Although many species in these groups are poorly known and relatively inconspicuous, they still constitute a valuable component of the State's flora and, as such, protection under the Wildlife Conservation Act is justified.

Following amendments to the Wildlife Conservation Act in 1980, additional protection was provided for plants that are rare, in danger of extinction, or are considered at risk over a longer period. Under the Act, these plants can be declared "rare" by the Minister for Conservation and Land Management. The schedule of Declared Rare Flora is reviewed annually, and plants may be added to or deleted from the list at the Minister's discretion by notice in the Government Gazette. Some 247 plants are now listed on the schedule.



This legislation has been a major incentive to work on rare and threatened plants in Western Australia. It remains the most powerful legislative protection for threatened plants in any State in Australia.

THE NEED TO SURVEY

Protection of flora has also gained impetus in recent years from increased efforts in research and management by CALM, Kings Park, and the State's universities. CALM is placing increased emphasis on plant descriptions, field surveys and the mapping of rare and threatened plants - the minimum information needed to develop plans for conservation.

Since the distribution of WA's rare and threatened flora is uneven, CALM's efforts are presently concentrated in the most highly populated area - the South-West. Here, priority areas for survey have been identified, either because of the high proportion of rare and threatened

Scarlet banksia *(Banksia coccinea)* is used extensively by the wildflower industry but is extremely susceptible to dieback. Native pollinators such as the honey possum are crucial for its survival.
Photo - Steve Hopper ▲

flora or because of the degree of threat (usually due to land clearing). Botanists are now surveying some of these areas in detail.

As well as relying on professional botanists for surveying and monitoring flora populations, CALM is encouraging members of the public to give a hand. Projects coordinated by CALM botanist Steve Hopper, such as the 'Banksia Atlas', the 'Survey of Rare and Poorly Known Eucalypts of Western Australia' and the 'Survey of Endangered Poison Plants of Western Australia', have relied heavily on the public for surveying and mapping plants to assess their conservation status.

DOSSIERS FOR PLANTS

Information on ecology, genetics, reproduction and dieback susceptibility is also essential in developing conservation plans for rare and threatened plants. Work on the rose mallee (*Eucalyptus rhodantha*) provides a good example. Population, genetic and life history studies by Jane Sampson (University of Western Australia) and Shapelle McNee (Curtin University) have provided the basis for a management program that should ensure its long-term survival in the few places where it persists - as remnants on private property and road-verges. These studies also found that harmful inbreeding effects in a small disturbed stand of 14 rose mallees were much higher than in larger, relatively undisturbed stands. These results show a need to maintain larger populations of the rose mallee - more than 35 - with an adequate understorey to support pollinators, such as honeyeaters and honey possums, if inbreeding is to be minimised.

The Quairading banksia (*Banksia cuneata*), now confined to seven small populations in the Wheatbelt, is another species where life history and genetic data are proving useful in developing conservation techniques. This species is of particular interest not only because of its rarity but also because it is an ancient species, of evolutionary importance, with features intermediate between banksias and a related genus, *Dryandra*. The area where it occurs has been extensively cleared or modified due to grazing and weed invasion. Recruitment into populations is dependent on fire, which is required for seed release. Research by

The Wongan Hills triggerplant
Stylidium coroniforme

A rare species known from four populations in the Wheatbelt with a range of about 100 km. Grows on exposed sheet laterite amongst low scrub. The original population had been reduced to less than 10 plants before it was fenced off to exclude stock in 1981. By 1986 the population had increased to 84 plants. Fencing has proved to be an effective management tool for protecting rare plant populations.

The rose mallee
Eucalyptus rhodantha

A rare mallee known from remnant stands in only two areas in the Wheatbelt over a range of about 100 km. It grows on grey sandy soil in flat or slightly undulating country occurring as almost pure communities in low heath. The surrounding area has been extensively cleared for agriculture and less than 500 plants remain in nine stands. A management program has been recently prepared for this species by CALM.

Byron Lamont and colleagues (Curtin University) on one population revealed that vast amounts of seed (over 17 000) were released from each plant after a fire, yet less than 5% germinated and only 0.1% of those survived the first summer drought. Sufficient rainfall following the fire-induced seed release is essential for long-term survival.

The establishment of new seedlings in populations of the pine banksia (*Banksia tricuspis*), another rare species, depends on a complex series of biological interactions for seed production and fire for seed release. Stephen van Leeuwen (CALM) and Byron Lamont (Curtin University) have found that this species is largely dependent upon pollinators such as honeyeaters and honey possums for pollination and seed set. Furthermore, about 60% of the inflorescences are eaten by moth larvae, which in turn are eaten by Carnaby's cockatoo. The cockatoos eat sufficient moth larvae to ensure that at least some inflorescences set fruit and produce seed. As with the Quairading banksia seedlings, mortality can be high because of summer drought stress, with only 0.4% of germinated seedlings surviving to five years after the fire.

Genetic studies on another rare species, the grass wattle (*Acacia anomala*), have revealed that the southern populations consist of large vegetatively reproducing clones that sprout from underground rootstocks. Seed production has never been observed. In the northern populations there is no vegetative reproduction and each individual plant is genetically distinct. Insect pollinators such as native bees ensure seed production, and seedling establishment has been observed in these populations.

OPTIONS

These and similar studies have provided valuable clues for CALM staff to develop appropriate options for conserving and managing rare and threatened plant species. Other examples include the Wagin banksia (*Banksia oligantha*), the feather-leaf banksia (*Banksia brownii*), the underground orchid (*Rhizanthella gardneri*), Purdie's donkey orchid (*Diuris purdiei*), and the Wongan Hills triggerplant (*Stylidium coroniforme*).

Because of the high number of rare and threatened flora in the South-West, adequate protection and management is a difficult task, particularly given the range of protection and management issues. For instance, in the South Coast region, most populations occur in national parks controlled by CALM, while in the cereal-growing areas many more populations occur on road reserves and private property. Liaison with property owners, the Main Roads Department and local shires is crucial for the protection and management of these populations. In this regard the production of Flora Wildlife Management Programs for Regions, Districts or other defined areas (i.e., national parks) is vital, given the number of taxa and populations now considered at risk in some areas. Although they lack the detailed biological data on individual species, these programs allow priorities to be set for future research and protection. This tells CALM staff which management actions each species requires - fencing, dieback hygiene, fire exclusion, weed control, liaison with landowners, etc. - and even whether further research is necessary at all.

Cultivating threatened plant species provides another option, namely the re-establishment of a species in the wild from cultivated stocks. Kings Park has an active propagation research program which could be used for this purpose. However, there are at present only a few species so endangered that this option is needed. Furthermore, just because a species is under cultivation, efforts to preserve populations in the wild should not be neglected; it is much better to protect and manage the genetic resources of wild populations than rely on the typically limited possibilities of cultivated species.

Pine banksia *(Banksia tricuspis)* not only depends on pollinators such as honeyeaters and honey possums for pollination and seed set, but also on Carnaby's cockatoo. The cockatoos feed on moth larvae which eat the flowering parts of the pine banksia. Sufficient moth larvae are eaten to ensure at least some flowering parts remain and seed production occurs.
Photo (left) - Michael Morcombe
Photo (right) - Steve Hopper

CONSERVING THE GENES

Conserving genetic diversity is a fundamental goal of State, national and global conservation strategies. Given the extreme richness and diversity in Western Australia's flora, we need to make a special effort to conserve it. Protection by the Wildlife Conservation Act is very important, but legislation alone will not suffice. One thing we need is continued efforts in research and management, but perhaps another requirement is even more important: more involvement by the public in conserving plants in the wild. This makes it an absolute necessity to increase everyone's awareness of the value of Western Australia's flora - of which three quarters are found nowhere else on the planet. ◘

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In the central Kimberley, a screw-pine-surrounded creek - just one of the threatened areas in this fragile frontier. Turn to page 22.

Until 1984 more was known about what was underneath the Nullarbor than what was on top. But with such a vast area to study, where do we start? See page 16.

LANDSCOPE

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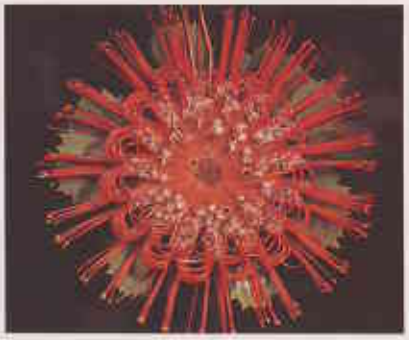

Public awareness and involvement is vital in the conservation of WA's rare and endangered flora. Page 49.

Ten WA mammal species have become extinct in the last 200 years. What can be done to ensure no more are lost forever? Page 28.

Forests protect our environment. They also provide timber. How do we strike a balance? Turn to page 35.

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COVER

Dolphins and whales are perhaps the best-known inhabitants of Western Australia's coastal waters. But this unique area is also home to an astonishing range of marine flora and fauna, from sea-turtles and coral reefs in the north to sea-grass banks and great white sharks in the south. See page 10.

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