Declared Rare Flora and Other Plants in need of Special Protection in the Northern Forest Region

by Anne E. Kelly, D.J. Coates, I. Herford, S.D. Hopper, M.O'Donoghue and L. Robson

1990

Wildlife Management Program No 5

Department of Conservation and Land Management

WESTERN AUSTRALIAN WILDLIFE MANAGEMENT PROGRAM NO. 5

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FOREWORD

Western Australian Wildlife Management Programs are a series of publications produced by the Department of Conservation and Land Management. The programs are prepared in addition to Regional Management Plans to provide detailed information and guidance for the management and protection of certain exploited or endangered species (e.g. Kangaroos, Noisy Scrub-bird and the Rose Mallee).

This program provides a brief description of the appearance, distribution, habitat and conservation status of the Declared Rare Flora in CALM's Northern Forest Region and makes recommendations for research and management action necessary to ensure their continued survival. By ranking the species in priority order for these requirements, Departmental staff and resources can be allocated to species most urgently in need of attention.

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ABBREVIATIONS

D	Dwellingup District	VCL	Vacant Crown Land
W	Wanneroo District	SEC	State Energy Commission
J	Jarrahdale District	MRD	Main Roads Department
M	Mundaring District	MPA	Management Priority Area

CALM Department of Conservation and Land Management

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PART ONE: INTRODUCTION

1. The Need for Management

Western Australia has a unique flora characterised by its diversity and the high degree of endemism among its species. The vascular flora, containing over 7000 described taxa (Green 1985), is poorly documented. This is largely a consequence of the rarity of many species, over 2000 of which have been recognized as rare, geographically restricted or poorly collected (Marchant and Keighery 1979). The State has almost half (43 per cent) of the Australian total of rare or threatened plant species, 83 per cent of these being restricted to the south-west (Briggs and Leigh 1988). An estimated 2000 species remain undiscovered or undescribed.

Although some plants are rare because of their requirement for a specific restricted habitat, the majority have become rare because of the activities of European settlers. Extensive clearing of vegetation and modification of the environment has caused the extinction of some species and placed the survival of many others in jeopardy. Rare species are concentrated largely in the wheatbelt and surrounding regions where only relicts of the indigenous vegetation remain. Continued land clearing, some fire regimes, exotic weeds, grazing, pests and disease, recreation pressures, roadworks, and indiscriminate herbicide use continue to threaten and destroy the State's flora.

The State Conservation Strategy, Wildlife Conservation Act (1950-1985), and Conservation and Land Management Act (1984-1987) provide the guidelines and legislative basis for the conservation of the State's indigenous plant and animal species. Under the Wildlife Conservation Act, the Department of Conservation and Land Management (CALM) is responsible for the protection of flora and fauna on all lands and waters throughout the State. Section 23F of the Act (Appendix I) gives the Minister for CALM statutory responsibility for the protection of those classes of flora declared to be rare. In 1988 226 taxa were classified as Declared Rare Flora (Appendix II). Policy Statement No 9 - Conservation of Endangered Flora in the Wild (Appendix III) outlines the legislation and Departmental policy and guidelines for Declared Rare Flora Conservation.

Despite considerable progress in recent years, there is still much to be learnt about the taxonomy, distribution, population biology and factors influencing the survival of rare and threatened species. Such information is essential if appropriate management and protection strategies are to be implemented. In addition, successful conservation of those species declared to be rare can only be achieved through co-operation and assistance between the Department, private landowners, local shires and authorities, government agencies and research institutions.

This Wildlife Management Program collates the available biological and management information on the Declared Rare Flora in CALM's Northern Forest Region and provides lists of other species within the Region in need of special protection. The Northern Forest Region was chosen as the first Region to be studied in detail because of its manageable number of Declared Rare species and its proximity to research personnel and the metropolitan area. Figure 1 shows the location of the Northern Forest Region in relation to the other CALM Management Regions of the State.

2. Objective of the Program

The objective of this program for the Northern Forest Region is:

To ensure and enhance, by appropriate management, the continued survival in the wild of populations of Declared Rare Flora and other plants in need of special protection.

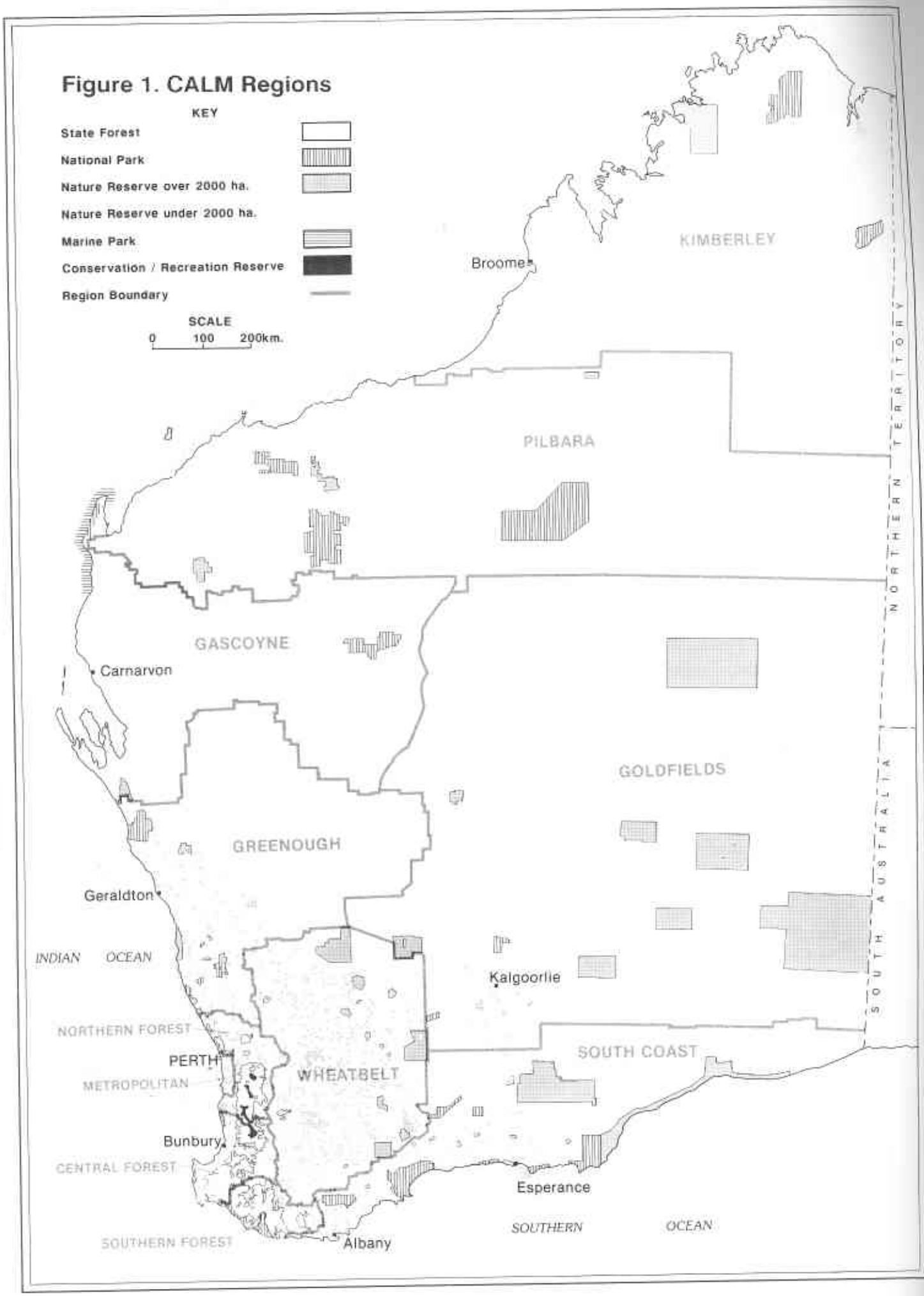


Figure 1. CALM Regions
KEY
State Forest
National Park
Nature Reserve over 2000 ha.
Nature Reserve under 2000 ha.
Marine Park
Conservation / Recreation Reserve
Region Boundary
SCALE
0 100 200km.
KIMBERLEY
Broome
PILBARA
NORTHERN TERRITORY
GASCOYNE
Carnarvon
GOLDFIELDS
SOUTH AUSTRALIA
GREENOUGH
Geraldton
INDIAN OCEAN
Kalgoorlie
NORTHERN FOREST
PERTH
METROPOLITAN
WHEATBELT
SOUTH COAST
Bunbury
CENTRAL FOREST
Esperance
SOUTHERN OCEAN
SOUTHERN FOREST
Albany

It aims to achieve this by:

- providing a useful reference document to CALM staff and other landowners for the day to day management and protection of Declared Rare Flora populations;
- directing Departmental resources within the Region to those species most urgently in need of attention;
- assisting in the identification of Declared Rare species and their likely habitats;
- fostering an appreciation and increased awareness of the importance of protecting and conserving Declared Rare Flora and other plants in need of special protection.

3. Rare flora legislation and guidelines for gazettal

The Wildlife Conservation Act (1950-1985) protects all classes of indigenous flora throughout the State. Protected flora includes:

Spermatophyta	-	flowering plants, conifers and cycads
Pteridophyta	-	ferns and fern allies
Bryophyta	-	mosses and liverworts
Thallophyta	-	algae, fungi and lichens

Section 23F of the Act (Appendix I) provides special protection to those taxa (species, subspecies, varieties) considered by the Minister for CALM to be:

- Endangered (in danger of extinction) - the taxon is in serious risk of disappearing from the wild state within one or two decades if present land use and other causal factors continue to operate;
- Rare - less than a few thousand adult plants of the taxon existing in the wild;

  or

- In Need of Special Protection - the taxon is not presently in danger of extinction but is at risk over a longer period through continued depletion, or largely occurs on sites likely to experience changes in land use which could threaten its survival in the wild.

This is achieved by declaring them to be 'rare' by notice published in the *Government Gazette*. CALM's Policy Statement No. 9 (Appendix III) discusses the legislation relating to Declared Rare Flora and outlines the criteria for gazettal.

Under the provisions of Section 23F, the 'taking' of Declared Rare Flora is prohibited by any person on any category of land throughout the State without the written approval from the Minister. A breach of the Act is liable to a penalty of up to $10 000. The legislation refers only to wild growing populations and applies equally to Government officers and private citizens on Crown and private land.

To 'take' in relation to any flora includes 'to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means'. This includes not only direct destruction or injury by human hand or machine but also such activities as allowing grazing by stock, introducing pathogens, altering water tables so as to inundate or deprive the flora of adequate soil moisture, allowing air pollutants to harm foliage, and burning.

The schedule published in the Government Gazette is revised annually to accommodate additions and deletions to the Declared Rare Flora. To qualify for gazettal, plants (not including hybrids) must satisfy certain requirements as defined in Policy Statement No. 9:

- the taxon (species, subspecies, variety) must be well-defined, readily identifiable and represented by a voucher specimen in a State or National Herbarium. It need not be formally described under conventions in the International Code of Botanical Nomenclature, but such a description is preferred and should be undertaken as soon as possible after listing on the schedule;
- the taxon must have been thoroughly searched for in most likely habitats in the wild by competent botanists during the past five years;
- the searches have established that the plant in the wild is either rare, endangered or deemed to be threatened and in need of special protection.

Plants may be deleted from the Rare Flora schedule where:

- recent botanical survey has shown that the taxon is no longer rare, endangered or in need of special protection;
- the taxon is shown to be a hybrid;
- the taxon is presumed to be extinct (has not been collected or reliably observed over the past 50 years, or all known wild populations have been destroyed more recently);

  or

- the taxon is no longer endangered because it has been adequately protected by reservation of land on which it occurs or because population numbers have increased beyond the danger point.

4. Responsibilities within the Department

- reviewing Departmental policy on Declared Rare Flora is the responsibility of the Department of Conservation and Land Management Corporate Executive;
- identification of Declared Rare Flora is the initial responsibility of Herbarium and Flora Conservation Research Program staff, but should, with appropriate training, become a Regional responsibility;
- locating Declared Rare Flora is the responsibility of Flora Conservation Research Program staff, the Wildlife Branch, Regional operations staff and volunteers outside CALM;
- determination of land status and preparation of material for notification to landowners is the responsibility of Wildlife Branch;
- hand-delivered notification to landowners of Declared Rare Flora populations is the responsibility of Regional staff and Wildlife Branch;
- production and maintenance of a Declared Rare Flora register, to provide status and location information for operational procedures on CALM land, is the responsibility of the Environmental Protection Branch and Regional operations staff;

- advice on management prescriptions is the responsibility of Flora Conservation Research Program staff, the Regional Ecologist and the Botanist, Wildlife Branch;
- management, protection and regular inspection of Declared Rare Flora populations is the responsibility of staff of the Northern Forest Region;
- enforcement matters relating to the provisions of the Wildlife Conservation Act are the responsibility of Wildlife Officers in the Wildlife Branch;
- implementation and revision of the management program is the responsibility of Northern Forest Region, Flora Conservation Research Program and Wildlife Branch.

5. The Northern Forest Region

The Northern Forest Region (Fig. 2) extends from Moore River in the north, to the eastern boundary of the Northam Shire and south to Wandering. The southern boundary extends from Yalgorup to Waroona and east along the Murray River. It is bounded on the west by the Indian Ocean and the Metropolitan Region. At the time of the 1986 census 250 000 people populated the Region (Australian Bureau of Statistics 1987), most of them (80 per cent) living in the eastern suburbs of Perth within the Regional boundary. Eight hundred thousand people residing in the Metropolitan Region are within half an hour's drive of some part of the Northern Forest Region. Its largest centres are Mandurah, Northam, Pinjarra and York.

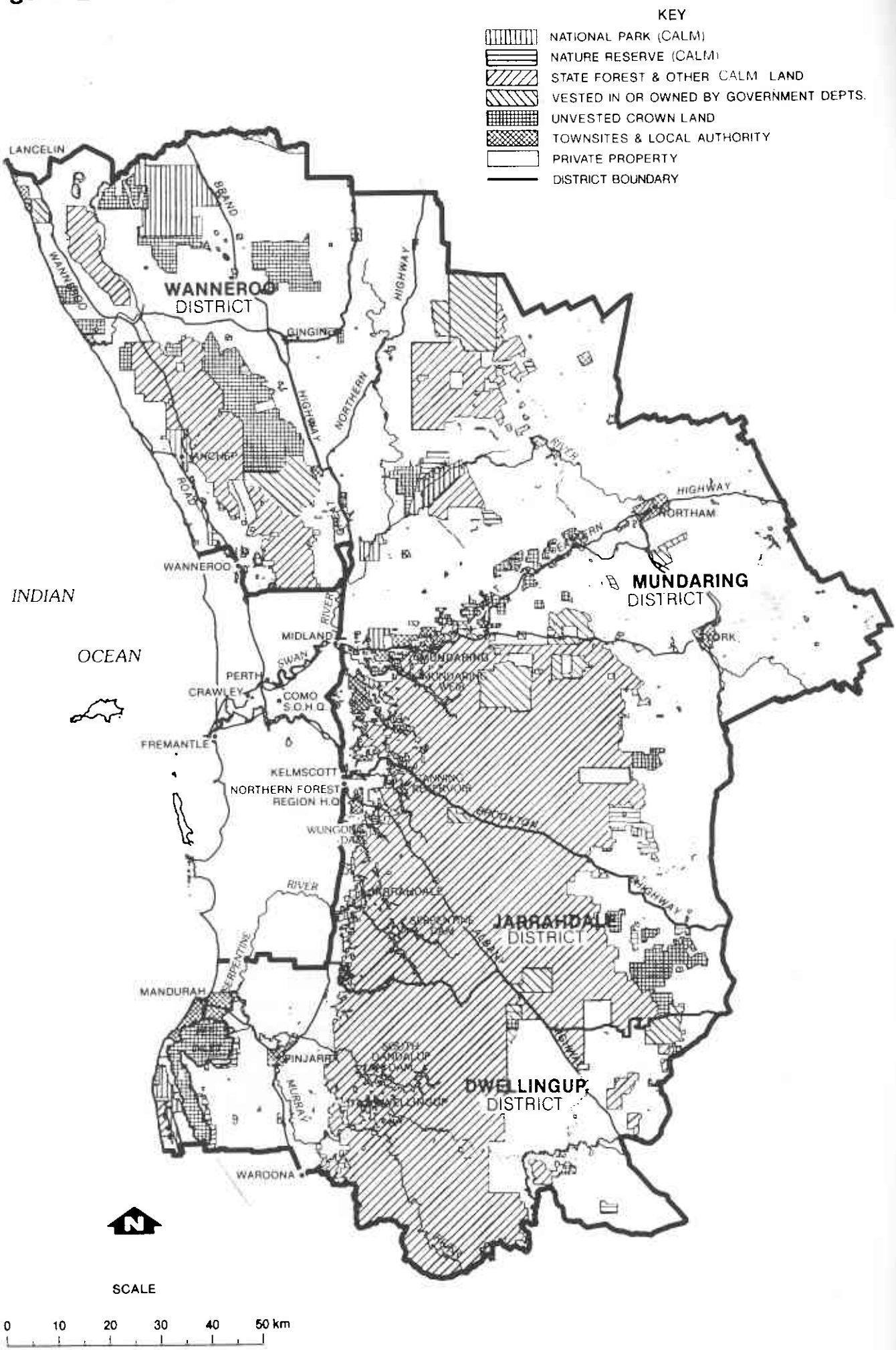
The Northern Forest Region, with a total area of 1.97 million hectares, is divided into four Management Districts. The Mundaring District, the largest in the Region, extends from Julimar State Forest south to the Brookton Highway. The Jarrahdale District extends from Brookton Highway to an east-west boundary south of the Serpentine Dam. Wanneroo and Dwellingup are the most northerly and southerly Districts respectively. The Regional Headquarters is located at Kelmscott. Within the Region 0.65 million hectares (33 per cent) is CALM land and a further 0.05 million hectares is unvested land managed by the Department. The Northern Forest Region Management Plan (CALM 1987) outlines the management and conservation strategies for land and water in the Region vested under the CALM Act, together with the wildlife responsibilities included in the Wildlife Conservation Act.

The Northern Forest Region lies within the South Western Botanical Province (Beard 1980) where it experiences a mediterranean climate characterised by hot, dry summers and cool, wet winters. Rainfall in the Region decreases from south to north and decreases east of the Darling Scarp. Average annual rainfall ranges from 400 mm east of Northam to 1300 mm near Dwellingup.

The Swan Coastal Plain and laterite plateau of the Darling Range form part of the Darling Botanical District (Beard 1980). That part of the Region east of the Darling Range (Toodyay, Northam and York Shires) falls into the Avon Botanical District. The Darling Scarp, rising sharply from the coastal plain up to 300 metres above sea level, is the most striking physical feature in the Region. Running parallel to the coast, it separates the Darling Plateau from the coastal plain south of Bullsbrook and from the Dandaragan Plateau in the north. The Gingin Scarp separates the Dandaragan Plateau from the coastal plain. The gently undulating Darling Range is the uplifted edge of the Western Plateau which extends eastward to the goldfields.

Jarrah (*Eucalyptus marginata*) forest, growing on the gravelly soils of the laterite crusted plateau, is the dominant vegetation formation in the Region. It extends from the southern boundary, northward along the scarp and plateau as far as Bindoon, from where its northwards limit runs in a south-easterly direction along a line towards Toodyay (Beard 1982). A quarter of the State's remaining jarrah forest

Figure 2. The Northern Forest Region



occurs in the Northern Forest Region. Jarrah is dominant and is usually accompanied by marri (*E. calophylla*), blackbutt (*E. patens*), *Banksia grandis* and *Allocasuarina fraseriana*. The understorey is rich in members of the Proteaceae, Myrtaceae and Papilionaceae.

With the decline in rainfall to the north and east, the forest is replaced by mixed woodland of jarrah, marri, wandoo (*E. wandoo*) and powderbark wandoo (*E. accedens*). Wandoo dominates the woodlands along the western edge of the wheatbelt where the rainfall is too low for jarrah. Marri-wandoo woodland occurs along the western fringe of the jarrah forest on the deeper soils of the Darling Scarp.

Grey, white or yellow sandy soils of relatively poor quality cover most of the coastal plain. Low banksia woodland (*B. attenuata, B. menziesii, B. ilicifolia*) occurs on the drier areas north of Perth. Jarrah-marri woodland with a banksia and sheoak understorey is common on the moister sites to the south. Heath and scrub grow on the narrow zone of sand dunes along the coast. Limestone ridges further inland support a jarrah, tuart (E. *gomphocephala*) and peppermint (*Agonis flexuosa*) woodland south of Yanchep, which is replaced by banksia woodland and scrub heath in the north.

The relatively fertile red loams east of the Darling Range support open woodlands of York gum (*E. loxophleba*) and jam (*Acacia acuminata*). They are often interspersed with woodlands of salmon gum (*E. salmonophloia*) and wandoo. *Allocasuarina huegeliana* dominates the rocky granite outcrops.

While much of the vegetation in the Region remains relatively untouched, large areas to the east and north-east have been extensively cleared for farming. In these areas only relicts of the indigenous vegetation remain in a few nature reserves and on rocky hilltops, narrow road verges and small uncleared areas on private land. On the western edge of the Region continued expansion of the metropolitan area will inevitably have an increasing impact on the vegetation.

6. Botanical History of the Northern Forest Region (from Beard (1981), Grieve (1975), and Marchant *et al.* (1987))

Botanical exploration commenced inland from the Perth area with the arrival of the first settlers in 1829. Earlier collections of the unique native flora had been made by Dutch explorer Wilhelm Vlamingh, who visited and named the Swan River in 1696. In 1827, Captain Stirling and N.S.W. Colonial Botanist Charles Fraser collected botanical specimens and explored along the Swan River to determine suitability of the area for European settlement.

James Drummond, Curator of the Botanical Gardens at Cork in Ireland, arrived at the Swan River in 1829 with Captain Stirling's colonising party. He was to settle at Toodyay and soon began botanical exploration and collecting that continued for three decades. He travelled widely throughout the south-west of the State, to remote areas of the colony as far south as Augusta, east to the Barren Mountains and north to the Murchison River. Drummond's collections, comprising some 2000 new species, were sent to England and distributed to herbaria in Europe. Unfortunately, he did not record locality details and his collections are of little use in determining past distribution of species in the Region.

Captain James Mangles and Baron von Huegel collected in the Perth area during visits to the colony in the early 1830s. The State's first Surveyor General, John Septimus Roe, collected plant specimens while exploring in the east and north of the Region in 1836. In 1839, John Lindley produced 'A Sketch of the Vegetation of the Swan River Colony'. The publication, in which Lindley described many of the species, was based largely on herbarium collections forwarded to England by Drummond and Mangles.

The German botanist Ludwig Priess visited the colony from 1839-1842 and accompanied Drummond on some of his expeditions. Priess collected mainly in the well-settled areas and was able to provide precise

locality information. His collections were published in 'Plantae Preissianae' (Lehmann 1844-1848) and are valuable early distribution records.

Botanical collection was continued in the latter half of the nineteenth century by local enthusiasts who sent their specimens to Ferdinand von Mueller, the Government Botanist in Melbourne. Von Mueller was the first to draw attention to the special character of south-western Australia as a phytogeographic region. He assisted Bentham in the production of 'Flora Australiensis' (1863-1878) by providing specimens and descriptions of new species.

The German botanists Ludwig Diels and Ernst Pritzel collected widely in the Region during 1900-1901, making short excursions into the Darling Range between the Swan and Collie Rivers. Their collections were described in 'Fragmenta Phytographiae Australiae Occidentalis' (1904-1905), an illustrated book and major authority on the Western Australian flora. In an account of the flora and vegetation of Western Australia, Diels (1906) divided the southern half of the State into a south-western and an Eremaean (Desert) Botanical Province. The provinces, based on the seasonality of rainfall, were further divided into botanical districts.

Fortunately, some collecting occurred before clearing of much of the natural vegetation for agricultural and urban development. W.V. Fitzgerald (1867-1929), A. Morrison (1849-1913) and C.R.P. Andrews (1879-1951) made collections in and around Perth, particularly over the period extending from 1900-1920. In 1897, Morrison was appointed to the newly-established post of Government Botanist. He was succeeded by Dr F. Stoward, W.M. Carne and C.A. Gardner.

Charles Gardner made an outstanding contribution to the study of the State's flora. He was employed as a botanical collector by the Forests Department in 1920, transferring to the Department of Agriculture in 1924. He held the position of Government Botanist and Curator of the State Herbarium from 1927 until his retirement in 1961. Gardner travelled widely throughout Western Australia, collecting specimens and retracing the steps of Drummond who explored some 100 years earlier. He prepared numerous papers and books on the vegetation, recognising a Northern Botanical Province and extending the botanical districts to cover the whole State.

Gardner was accompanied on a number of his expeditions by medical doctor and amateur botanist William Blackall who developed the 'Blackall Key', an illustrated key for the recognition of Western Australia's native flora. Considerable progress had been made with this work before his death in 1941. The project was completed after several years by the Head of the University Botany Department, Professor Brian Grieve.

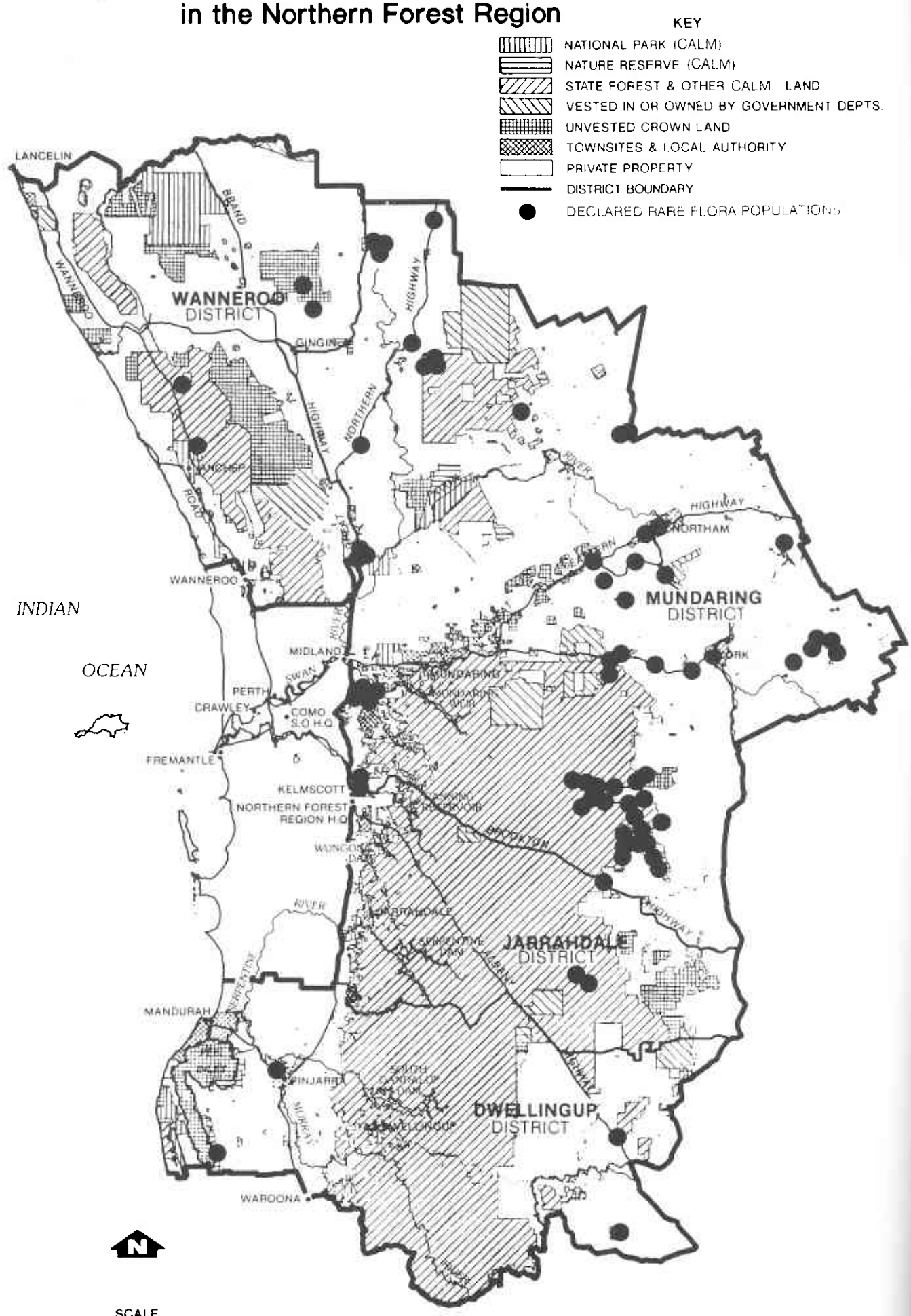
In 1964, an overall mapping project for the State, the Vegetation Survey of Western Australia, was established. John Beard systematically described and mapped (1:1 000 000) the vegetation, defining distinct regions on the basis of characteristic landscape and vegetation. On the basis of this work, Beard (1980) revised the botanical districts and boundaries of the South Western Botanical Province defined by previous authors.

In 1980, the Department of Conservation and Environment produced an 'Atlas of Natural Resources' for an area known as System 6 (Department of Conservation and Environment 1983). Virtually the whole of the Northern Forest Region is within this System, which comprises the Darling Range and Swan Coastal Plain from Bridgetown to north of the Moore River. This broad ecological study included maps for geological and mineral resources, landform, soils, land use and vegetation. It was the basis of a report to Government to resolve land use and conservation conflicts in the area by developing a system of parks and reserves.

Numerous other detailed investigations have been conducted for specific areas in the Region. In his quantitative ecological studies within the northern jarrah forest, Havel (1975a and b) recognized the close relationship between site conditions and associated vegetation types.

In 1987, botanists of the State Herbarium published a two-volume Flora of the Perth region. It keys out and describes species recorded from the coastal plain and western edge of the Darling Plateau near Perth. This book, the first to systematically document flora for any region in the State, contains a large proportion of the species represented in the Northern Forest Region. Despite this comprehensive work, much of the flora of the Northern Forest Region remains poorly known and further botanical exploration and taxonomic research is required.

Figure 3. Distribution of Declared Rare Flora populations in the Northern Forest Region



PART TWO: DECLARED RARE FLORA IN THE NORTHERN FOREST REGION

Twenty-three taxa of Declared Rare Flora were known to occur within the boundaries of the Northern Forest Region in 1988. An illustration and brief description of the morphology, distribution, habitat, and conservation status is provided for each of these species. The impact of certain management techniques (fire, mechanical disturbance, weed invasion, grazing, dieback, and canopy cover) is noted and recommendations made for management and protection action necessary to ensure their continued survival. Illustrations and/or photographs of the Declared Rare species are included in a book on Western Australia's Endangered Flora (Hopper, van Leeuwen, Brown and Patrick 1990).

Descriptions of species were compiled by consulting references and discussion with botanists. Distribution and habitat were recorded from Departmental Rare Flora files. Emphasis was placed on the particular habitat characteristics of locations in the Northern Forest Region. Only extant populations surveyed by officers of the Department in recent years are included. Herbarium records may indicate a wider range and larger number of populations, some of which may have been destroyed since the time of collection.

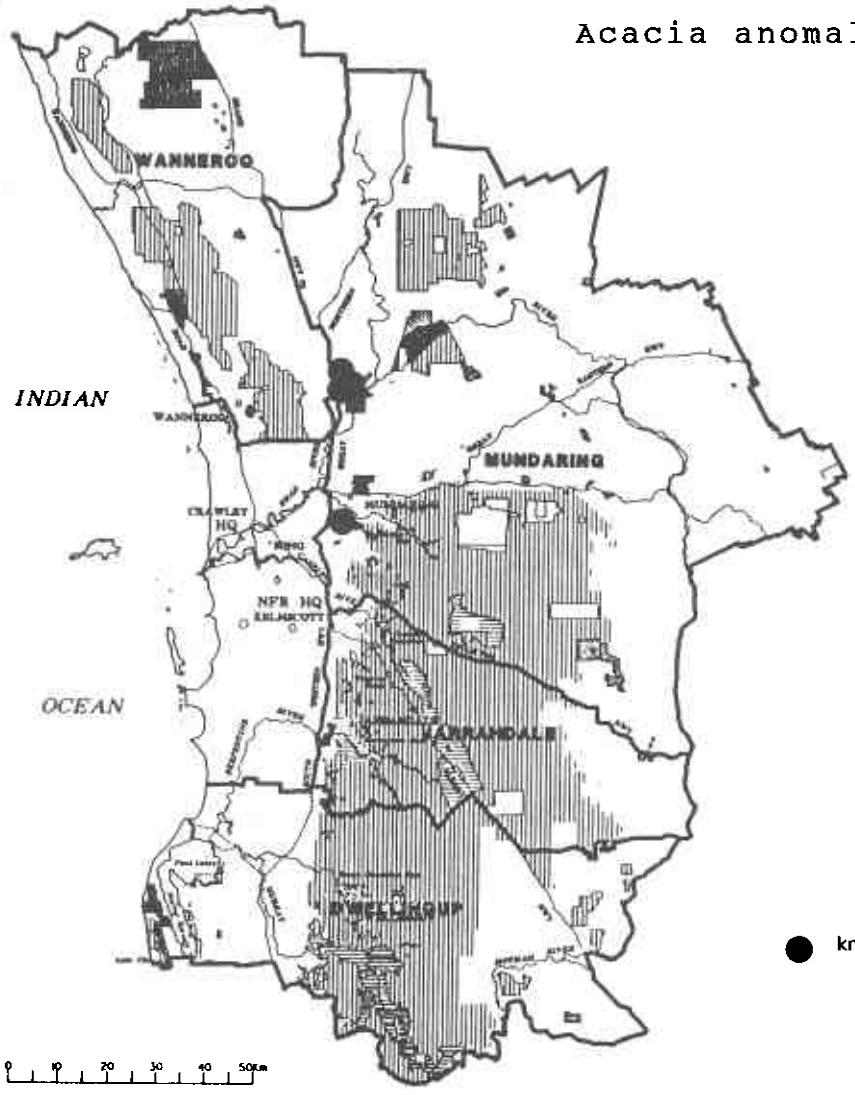
Conservation status was determined from field observations and population and location details on Departmental files. It is a brief summary of the number and condition of Rare Flora populations throughout the species' range and the threats to their survival. Success with propagation and the extent of general cultivation is also noted. A detailed table for each species lists the location size, condition and land status of populations in the Northern Forest Region. Location within Districts of the Region - Dwellingup (D), Jarrahdale (J), Mundaring (M) and Wanneroo (W) - is included. Precise locality details are contained in confidential Rare Flora registers and Departmental files.

Impact of fire, soil disturbance, weed invasion, dieback, canopy cover and grazing was noted (where known) from observations made in the field during routine monitoring and from discussion with research personnel. Management and research requirements were determined on the basis of conservation status and from general location information on the Rare Flora files.

Twelve of the 24 taxa treated in the Program are endemic to the Northern Forest Region. Three of these *Asterolasia nivea, Ptychosema pusillum* and *Eucalyptus* sp. (eastern forest), are recorded from a single locality. Nine species have not been recorded from land reserved for conservation purposes anywhere throughout their range. Four species, *A. nivea, P. pusillum, Darwinia apiculata* and *Lechenaultia laricina*, are considered to be in danger of extinction.

Figure 3 maps the distribution of all Declared Rare Flora populations in the Northern Forest Region. Over one third (33.7 per cent) of the 86 populations occur entirely or partly on private land. No populations are located on land currently classified as national park and only 14 populations (15.2 per cent) fall within nature reserves. The Mundaring District contains 82.5 per cent of the total Rare Flora populations in the Region. This is indicative of its larger size, a concentration of rare species in cereal growing areas and more intensive botanical survey in areas close to the metropolitan area.

Acacia anomala



● known population(s)

Juvenile leaves

Phyllode

Winged stem with
cylindrical inflorescences

ACACIA ANOMALA C.A. Gardner ex Court

Chittering Grass Wattle

This unusual wattle was first collected in 1961 by H.H. Kretchmar and C.A. Gardner on the coastal sandplain between Muchea and Chittering. Further collections were made in the area in 1965 and 1966. An undated specimen was collected from Bickley by W.H. Loaring. *Acacia anomala* was considered extinct when described by Court in 1978 because extensive searches had failed to relocate this species at either locality. It was not until 1980 that it was rediscovered on the edge of a gravel pit near Bullsbrook. It has since been located at other sites in this vicinity and near Kalamunda.

A. anomala is a spindly rush-like shrub growing to 0.5 m in height, with several slender, dull green stems arising from near the base. The lower stems are usually terete while the upper stems have prominent wings up to 0.2 cm wide. Juvenile leaves have few pairs of leaflets. Sharply pointed phyllodes, to 10 cm long and 0.7 cm wide, are scattered or absent. Numerous tiny yellow flowers are clustered into cylindrical inflorescences up to 2.5 cm long and 1 cm across. The shortly stalked inflorescences are solitary at the nodes. As its name suggests, the affinities of this species to other members of the genus are quite obscure. It shows some resemblance to *A. willdenowiana* which has winged phyllodes and globular (not cylindrical) flower heads. *A. anomala* is inconspicuous except when in flower over a short period in August-September.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

A. anomala is confined to the Northern Forest Region where it is found on shallow grey sands over laterite on the western slopes of the Darling Range. It grows entangled among other low shrub species in open low eucalypt woodland (jarrah, marri, wandoo and powderbark) over heath dominated by *Grevillea, Dryandra, Hakea* and *Acacia* species. It is known from populations at two localities (Kalamunda and Bullsbrook) 40 km apart.

CONSERVATION STATUS

Endangered	✓	Rare	✓	In Need of Special Protection

A rare and very restricted species known from a total of 13 relict populations near Kalamunda and Bullsbrook. It is not represented on any conservation reserve and extensive survey of indigenous vegetation between the two localities have failed to locate additional populations. The largest and healthiest populations are located in bushland west of Kalamunda, where the majority of plants occur on public parklands with a few individuals extending onto nearby private land and road verge.

The site is relatively undisturbed, but populations may be endangered by rubbish dumping, wood collecting, roadworks and further development in the area. Plants at this locality reproduce vegetatively by slender rhizomes. No seed production has been observed.

In the Bullsbrook region, *A. anomala* is largely confined to private land, with small populations occurring on road verges and in a recreation reserve near the townsite. Despite management of the reserve to protect this species, the population and associated vegetation has become badly degraded. Past disturbances and grazing and trampling by kangaroos have contributed to the deterioration of the area.

At present, survival of this species in the wild relies entirely on the goodwill and co-operation of local shires and private landowners. *A. anomala* is not in general cultivation, but like other members of this genus should be easy to propagate from seed. A detailed management plan is currently being prepared for this species.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent Survey	District	Population	Land Status	No. of plants	Condition
Other Lands					
31/8/87	M	Kalamunda	private	9	good
31/8/87	M	Kalamunda	public parklands	180-200 (3 pops)	good
5/10/87	M	NE of Bullsbrook	recreation reserve	26	poor
5/10/87	M	NE of Bullsbrook	road verge	11	good
17/9/87	M	NE of Bullsbrook	private	3	
5/10/87	M	NE of Bullsbrook	private	50	good
10/82	M	NE of Bullsbrook	private	17	
10/82	M	NE of Bullsbrook	private	14	
10/82	M	E of Bullsbrook	private	3	
5/10/87	M	E of Bullsbrook	private	10	Good
*	M	E of Bullsbrook	private		

*unsurveyed locality

Response to Fire - not known, although other *Acacia* species regenerate well from seed.

Response to Soil Disturbance - not known.

Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *Species* - not known. *Acacia* species are often resistant.

Grazing Impact - susceptible to grazing.

Influence of Canopy Cover - grows entangled among other low shrub species.

MANAGEMENT REQUIREMENTS

- close liaison with shires, private landowners and local authorities to ensure protection from accidental destruction;
- consult with shires regarding population management;
- acquisition of land as a nature reserve;
- install rare flora marker pegs;
- protect populations from grazing;
- collect seed and introduce to suitable habitats in conservation reserves;
- establish in cultivation;
- monitor populations annually;
- do not burn.

RESEARCH REQUIREMENTS

- investigate response to fire;
- further survey of typical habitats in the Region.

REFERENCES

Coates (1988); Court (1978); Leigh, Boden and Briggs (1984); Rye and Hopper (1981).

ACACIA APHYLLA Maslin

Leafless Rock Wattle

Despite its proximity to Perth, this extremely unusual and distinctive wattle was not discovered until 1964 when it was collected by Royce at Spencers Brook. It was described by Maslin in 1974 after a number of subsequent collections from the Helena River Valley.

Acacia aphylla is an erect, widely branching shrub to 2 m tall, with spiny, glaucous, hairless branches and phyllodes reduced to small deciduous scales. Lacking normal foliage it appears quite leafless. The golden yellow flowers are packed into spherical flower heads, 6-7 mm across. The heads, on stalks about 1 cm long, are solitary at each node. The fruit is a purplish grey, narrowly-oblong pod, up to 9 cm long and 0.4 cm wide. Oblong seeds are black and shiny. *A. aphylla* has no known relatives and is of considerable interest in terms of evolution and plant geography (Lucas and Synge 1978). Flowering is from August-October with the pods maturing from December-March.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

A. aphylla is restricted to the Northern Forest Region, where it is known from disjunct localities (60 km apart) in the Darling Range near Perth and in the Northam area. It grows on and around granite outcrops within jarrah-marri forest or woodland dominated by *Eucalyptus loxophleba* (York gum). At a locality in the Mundaring region it is found growing on shallow soil over continuous laterite. This species is the only wattle known to grow in granite rock crevices.

CONSERVATION STATUS

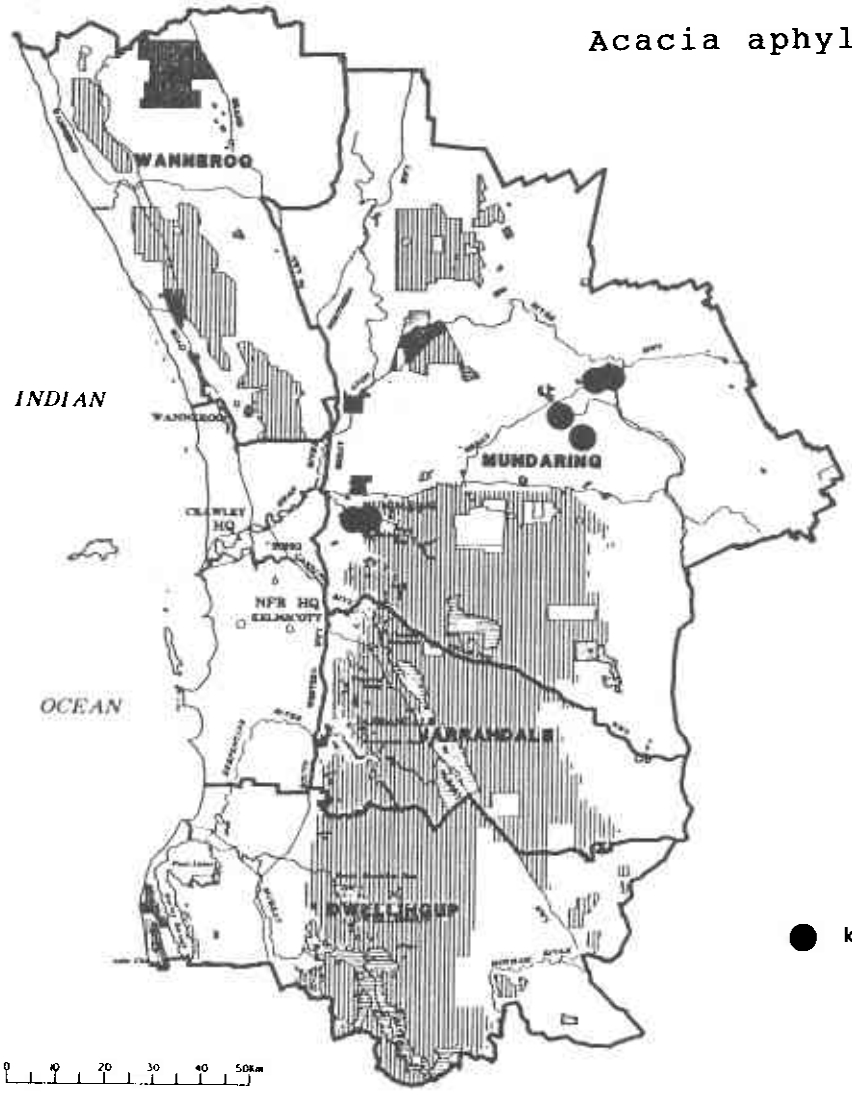
Endangered	Rare ✓	In Need of Special Protection

A. aphylla is a rare and interesting wattle with unusual habitat requirements. Near Perth it is known from two populations in a proposed nature reserve and in State forest and adjoining private land. Further east, a number of small populations are located on private, Commonwealth and shire land. Two populations occur in nature reserves in the Northam area. Growing on the shallow soils of granite rock exposures, this species appears to suffer severely from prolonged summer drought. Few seedlings are present in many of the populations despite high annual seed production. It may benefit from occasional fire, as numerous seeds germinate after a hot summer burn. *A. aphylla* can be propagated easily and is in general cultivation.

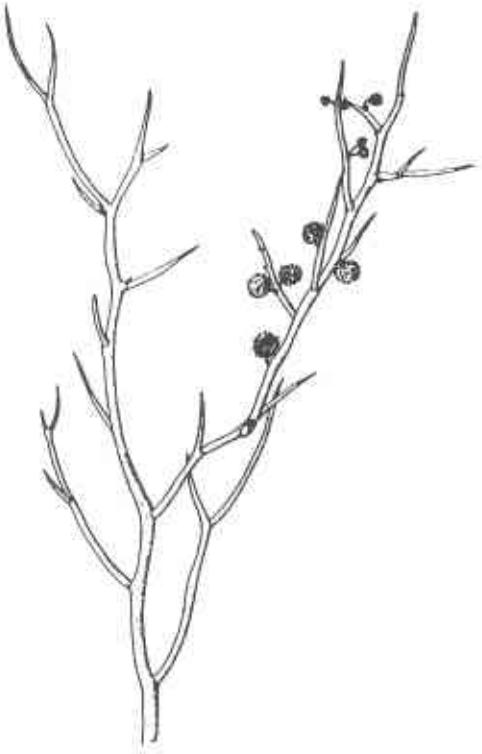
POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
8/7/82	M	S of Clackline	nature reserve	many	good
3/1/85	M	Mokine	nature reserve	-	
Other Lands					
7/7/86	M	Mundaring	private and state forest	-	under SEC line

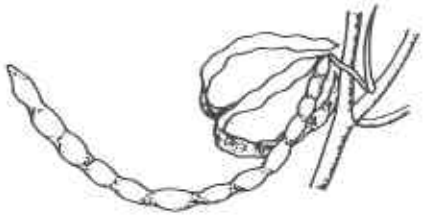
Acacia aphylla



● known population(s)



Leafless branching stem
with globular flowerheads



Mature and dehisced pods

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION (*continued*)

28/3/84	M	Helena Valley	parkland - proposed nature reserve	1000 +	
31/1/85	M	Mokine	private	80	fenced
12/1/84	M	SW of Northam	Commonwealth (leased) + private	100 +	fenced
24/6/83	M	SW of Northam	private (2 properties)	5?	
24/6/83	M	SW of Northam	shire common - leased	50	
24/6/83	M	SW of Northam	private (2 properties)	5 + numerous seedlings	fenced

Response to Fire - plants killed by fire but populations regenerate if seed is present in the soil.

Response to Soil Disturbance - not known.

Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *Species* - not known. *Acacia* species are generally resistant.

Grazing Impact - mature plants not grazed.

Influence of Canopy Cover - generally found in open areas surrounded by woodland or forest.

MANAGEMENT REQUIREMENTS

- close liaison with shire and private landowners;
- inform operations staff of population locations;
- install rare flora marker pegs;
- exclude stock grazing;
- monitor populations annually, particularly in relation to drought deaths;
- collect seed for storage;
- autumn burn at minimum of 12-yearly intervals to allow regeneration from seed and flowering;
- acquisition of land as a nature reserve should be given high priority.

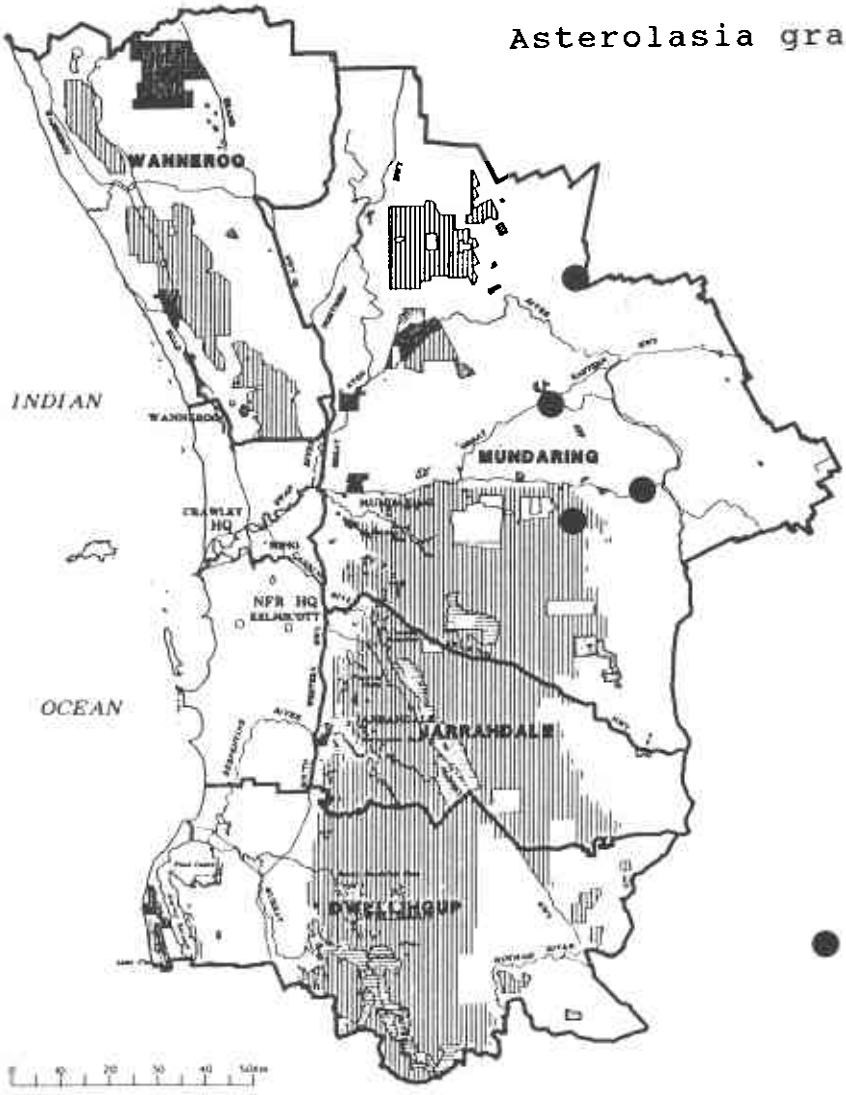
RESEARCH REQUIREMENTS

- set up permanent monitoring quadrats;
- investigate water balance physiology and ability to withstand drought conditions;
- conduct research on fire and life history;
- further survey of typical habitats in the Region;
- investigate factors restricting distribution when numerous like habitats exist.

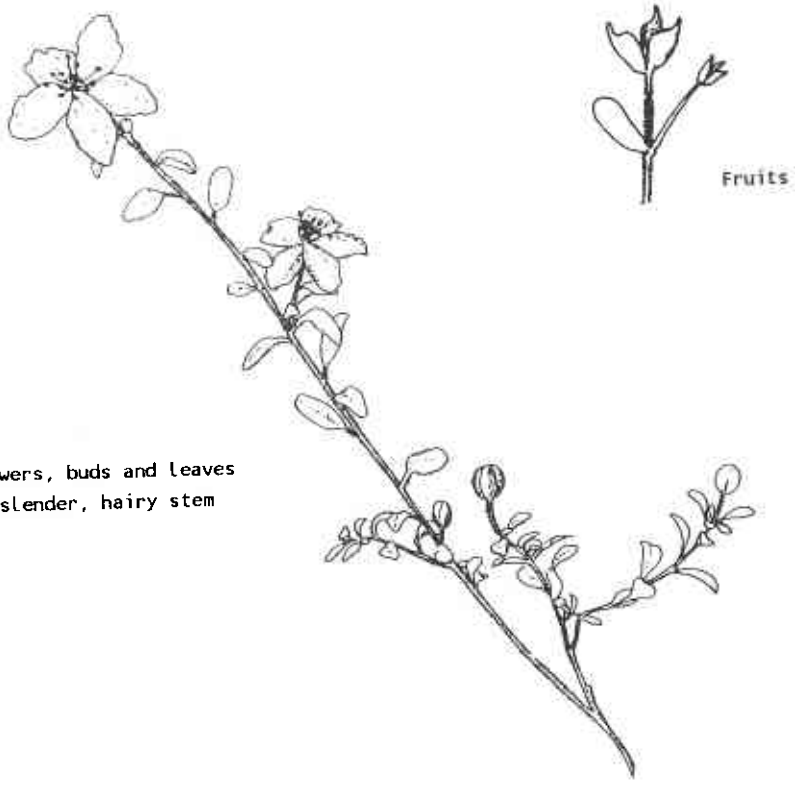
REFERENCES

Lucas and Synge (1978); Leigh, Boden and Briggs (1984); Maslin (1974); Rye and Hopper (1981).

Asterolasia grandiflora



● known population



Fruits

Flowers, buds and leaves
on slender, hairy stem

ASTEROLASIA GRANDIFLORA (Hook.) Benth.

This species was first collected by James Drummond and it was included in Bentham's 'Flora Australiensis' (1863-1878) as *Asterolasia grandiflora* after earlier descriptions as *Phebalium grandiflora* (1848) and *Eriostemon grandiflorus* (1859). In 1971 it was regarded by Wilson as *Urocarpus grandiflorus* and known by this name until 1987 when it reverted back to the older valid generic name.

A. grandiflora is a low, often straggling shrub to 0.5 cm in height, with striking pink flowers up to 3 cm in diameter. Its slender branches and shortly stalked leaves are clothed with brown, stellate hairs. Oblong to ovate leaves 1-1.5 cm long, have blunt tips and recurved margins. The slender stalked flowers, with 20-25 stamens and petals densely hairy on the underside, are in terminal or axillary umbels of about 3 flowers. In the northerly population, taller, more robust plants have narrower leaves and flower from June to August. Plants in the southern populations are shorter and more scrambling in habit, and flower from late July through to mid October.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

A. grandiflora is confined to the Northern Forest Region, where it is found on brown loam, gravel and between lateritic boulders on level ground high in the landscape. It is restricted to the 300-500 mm rainfall zone, extending from near Toodyay to south-west of York (50 km). It grows among fairly thick scrub in open *Eucalyptus accedens* woodland, often with *E. calophylla* and *E. drummondii*. Associated scrub includes *Dryandra, Xanthorrhoea, Leptospermum, Trymalium, Scaveola, Petrophile* and *Dampiera* species.

CONSERVATION STATUS

Endangered	Rare	In Need of Special Protection ✓

This geographically restricted species endemic to the Northern Forest Region is known from four populations with an estimated total of over 3000 plants. It is well represented on a nature reserve north-east of Toodyay and may exist in large areas of the reserve yet to be surveyed. Another large population is located on a shire gravel reserve near York. Plants in the uncleared areas are in good condition and regeneration is occurring on some disturbed sites. It is unlikely that this species is more common in the Region as many suitable habitats have been cleared or heavily grazed. *A. grandiflora* has been successfully established in cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
	M	ENE of Toodyay	nature reserve	1000 +	good
Other Lands					
10/2/87	M	SW of York	gravel reserve-shire	1000 +	good
28/12/83	M	SSW of Clackline	private	50	heavily grazed
	M	SW of York	State forest	1000 +	good

Response to Fire - not known. Probably killed by fire and regenerating from seed.

Response to Soil Disturbance - seedlings more evident in cleared and disturbed areas.

Grazing Impact - sensitive to grazing. Grazed plants shoot vigorously and have fewer or no fruit.

Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *Species* - not known.

Influence of Canopy Cover - does not favour deeply shaded sites. Apparently requires unshaded or disturbed areas for seed germination.

MANAGEMENT REQUIREMENTS

- close liaison with the shire and private landowners to prevent accidental destruction of populations;
- consult with shire regarding management of the reserve and rehabilitation of disturbed areas;
- protect populations from heavy grazing;
- install rare flora marker pegs;
- roadside plants can be graded (under permit) as this species is abundant in adjacent vegetation;
- conduct operations under dieback hygiene conditions;
- monitor populations annually;
- autumn burn only at minimum of 12-yearly intervals;
- collect seed for storage and establish in cultivation;
- acquisition of the gravel reserve as a nature reserve once extraction has ceased.

RESEARCH REQUIREMENTS

- further survey of similar habitats in the Region to locate additional populations;
- set up permanent monitoring quadrats;
- conduct research on drought tolerance, fire and life history.

REFERENCES

Bentham (1863-1878); Patrick (1984); Wilson (1971); Wilson (1987).

ASTEROLASIA NIVEA Wilson

Bindoon Starbush

Asterolasia nivea was first collected near Bindoon by C.A. Gardner in 1960, again from the same locality in 1963 and from south of the Moore River in 1966. Wilson described it as *Urocarpus niveus* in 1980 based on a collection from north of Bindoon in 1979. It was transferred to the earlier generic name *Asterolasia* in 1987.

This species is a weak, densely branched sub-shrub to 0.5 m, characterised by its scattered, narrowly oblong leaves (6-12 mm in length and 1.5-4 mm wide) and small, white flowers up to 15 mm across. The slender branches and shortly stalked leaves are sparsely pubescent with stellate hairs. Flowers have 16-20 stamens and inconspicuous sepals. They are borne terminally in clusters of 3-6 flowers or singly on short axillary shoots. The elliptic petals are covered on the outer side with solid globular hairs. Although superficially resembling the white flowered *A. pallida*, it is more closely related to *A. grandiflora*, which has similar petal hairs but different leaf shape, flower size and colour. *A. nivea* flowers from August through to October.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Occurring only in the Northern Forest Region and known from a single location north of Bindoon. It grows on lateritic loam in open *Eucalyptus drummondii, E. wandoo* and *E. calophylla* woodland over heath dominated by *Allocasuarina humilis, Adenanthos cygnorum, Dryandra polycephala* and *Grevillea synapheae*.

CONSERVATION STATUS

Endangered	Rare	In Need of Special Protection
√	√	

A. nivea is an extremely rare and endangered species represented by six mature individuals and approximately 80 seedlings at the type locality in roadside vegetation north of Bindoon. Extensive land clearing has destroyed much of its original habitat but additional populations may exist in unsurveyed indigenous vegetation in the area. The local shire, Main Roads Department, and adjoining landowner have been notified of the population location so that accidental damage by road maintenance, indiscriminate weed spraying or verge burning can be avoided. Rare flora marker pegs have been installed at the site. The long term survival of this species in the fragile road verge habitat is seriously threatened. Attempts to propagate *A. nivea* by tissue culture have been unsuccessful.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

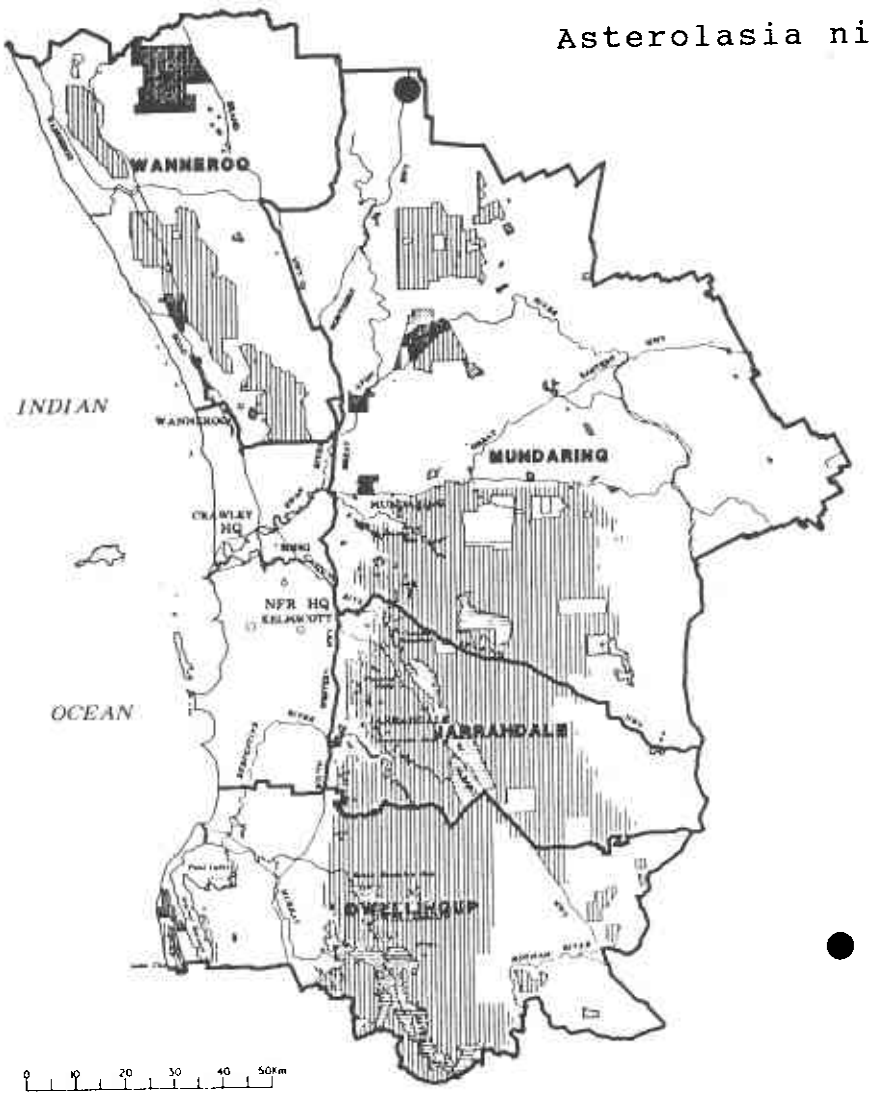
Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
26/8/87	M	N of Bindoon	road verge - MRD	6 (mature) 80+ seedlings	good

Response to Fire - not known. Probably killed by fire and relying on seed for regeneration.

Response to Soil Disturbance - not known.

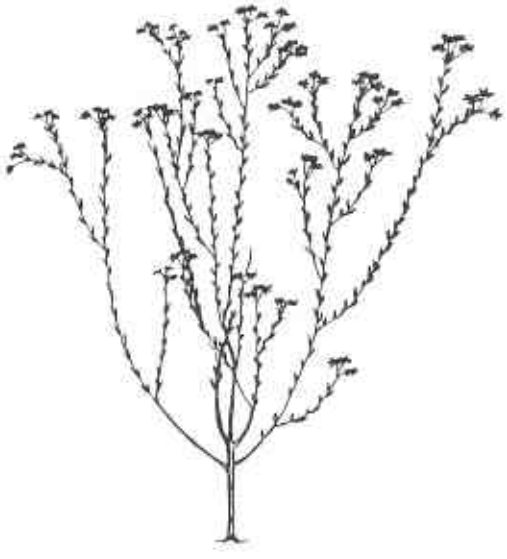
Grazing Impact - not known.

Asterolasia nivea



● known population

Fruits



Habit of plant

Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *Species* - not known.

Influence of Canopy Cover - grows in open and shaded situations. Leaves in shade are papery and flat while those in open are somewhat leathery with recurved margins.

MANAGEMENT REQUIREMENTS

- close liaison with the shire, adjoining landowner and local authorities to ensure protection of population from accidental damage;
- inspect population annually;
- protect population from fire by applying protective autumn burn to adjacent road verge vegetation;
- collect seed for storage;
- establish in a nearby conservation reserve and maintain in cultivation once suitable propagation techniques have been developed;
- conduct operations under dieback hygiene conditions.

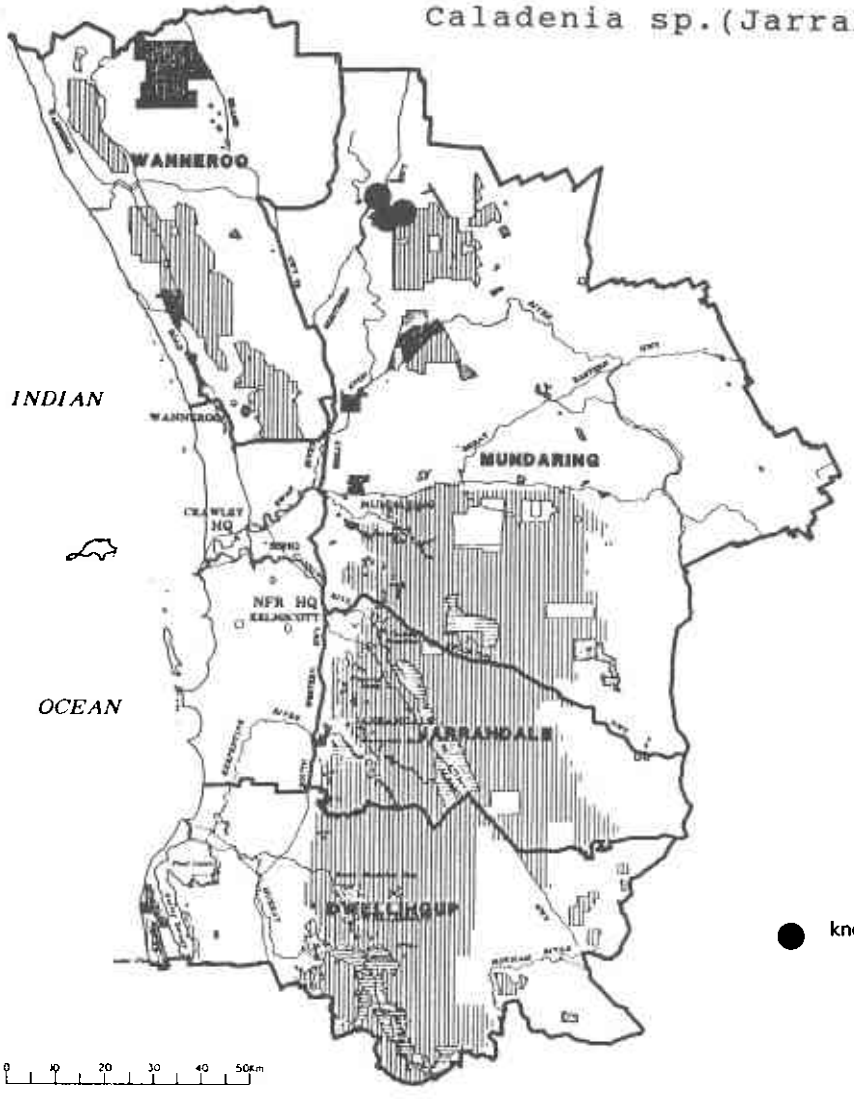
RESEARCH REQUIREMENTS

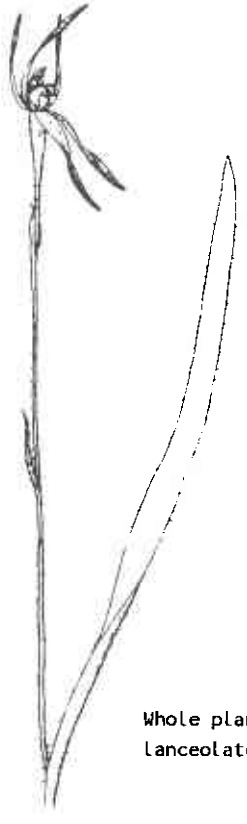
- thoroughly survey bushland in the Bindoon area to locate and subsequently protect any surviving populations;
- continue efforts to propagate this species;
- set up permanent monitoring quadrats;
- conduct research on fire and life history and develop species management plan.

REFERENCES

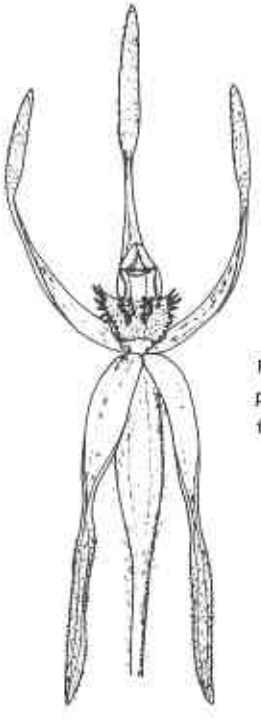
Millar (1982); Patrick and Hopper (1982); Wilson (1980); Wilson (1987).

Caladenia sp.(Jarrah forest)





Whole plant with large lanceolate leaf



Flower with 'clubbed' perianth segments and fringed labellum

CALADENIA SP. (JARRAH FOREST) S.D. Hopper 3990

An undescribed species, to be named *Caladenia arrecta* Hopper & Brown, with spider-like flowers and a single lanceolate leaf arising from the base of an erect, hairy stem. Yellow-green sepals and petals with maroon striations are broad at the base and contracting to heavy clubbed tips. 'Clubs' are orange in colour and over half the length of the segments. The erect dorsal sepal is 25-35 mm in length. The fringed labellum is yellowish with a maroon tip, and calli arranged in four rows. Included with *C. longiclavata* var. *magniclavata* in past years, it is now considered a distinct taxon and can be distinguished by its erect petals and larger clubbing of the segments. The above-ground portion of the plant dies back to an underground tuber over summer. Flowers in August - October.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

A widespread species found in the Northern Forest, Central Forest, and South Coast Regions with a range of 800 km extending between Bindoon, Witchcliffe and Esperance. It has been collected from a number of sites within its range but is now known from only a few populations at four disjunct localities. In the Northern Forest Region, populations north-east of Bindoon grow high in the landscape on rocky lateritic loam. Scattered individuals are found in low open scrub below woodland dominated by *Eucalyptus wandoo*. This species has also been reported from the Darling Range near Perth.

CONSERVATION STATUS

Endangered	Rare	In Need of Special Protection ✓

A species recorded from less than 100 individuals in 6 populations, including three in the Northern Forest Region, but believed to be more abundant throughout the forests of the south-west. The largest and most significant known populations are located on private land in the Northern Forest Region. Scattered plants occur in nearby Julimar State Forest. Thorough survey of likely habitats is necessary to accurately assess the conservation status of this species. It is unknown in cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Other Lands					
	M	NE of Bindoon	private	20+	
10/9/83	M	NE of Bindoon	private	40+	
23/8/87	M	NE of Bindoon	State forest	3	

Response to Fire - killed if burnt when above-ground parts are present (July-November).

Response to Soil Disturbance - not known.

Susceptibility to Weed Invasion - suppressed growth.

Susceptibility to Phytophthora *Species* - not known.

Grazing Impact - a succulent plant susceptible to grazing.

Influence of Canopy Cover - not known.

MANAGEMENT REQUIREMENTS

- close liaison with private landowners to ensure protection of populations from accidental damage;
- exclude grazing;
- install rare flora marker pegs;
- collect seed for storage;
- monitor populations annually;
- do not burn during flowering/vegetative phase (August-November).

RESEARCH REQUIREMENTS

- survey typical habitats in the Region to locate further populations.

REFERENCES

A.P. Brown[1] (personal communication).

1 A.P. Brown, Department of Conservation and Land Management, Wildlife Research Centre.

CALADENIA DORRIENII Domin

Cossack Spider Orchid

Caladenia dorrienii was described and named by Domin in 1912 after earlier collections from the Kojonup-Cranbrook area. It was reduced to a variety of *C. filamentosa* in 1971 but has since been recognized as a distinct species. Often growing in clusters or clumps, it can be distinguished from members of the *C. filamentosa* group by its shorter perianth segments, crossed lateral sepals and labellum splashed with red. The slender stem (up to 15 cm) is erect and hairy, with a narrow, linear leaf clasping the base and a short bract midway along its length. Narrow, linear sepals and petals are greenish white, with longitudinal red veins and darkly coloured, glandular, hairy tips. The erect dorsal sepal is 25-30 mm in length. The ovate labellum, on a short claw, has a few obtuse teeth along its margin and two rows (7-8 each) of closely set calli along the middle. *C. dorrienii* flowers in September - October with the above-ground portion of the plant dying off over summer.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Previously recorded in the Bridgetown-Kojonup-Cranbrook area and known in recent years from only two localities in the Wheatbelt Region near Frankland and Chowerup. A collection in the Dale area of the Northern Forest Region has extended its range to over 240 km. It was found growing on black loamy soil among dense herbs in open *Eucalyptus rudis* woodland.

CONSERVATION STATUS

Endangered	Rare ✓	In Need of Special Protection

C. dorrienii is known from only three isolated localities in extensively cleared farmlands. A few hundred individuals occur on private and shire land in the Wheatbelt Region while a single plant has been found in State forest of the Northern Forest Region. The northerly extension of this species' range suggests that it may be more abundant and widely distributed in remnants of natural vegetation throughout the south-west. *C. dorrienii* is not in general cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
20/10/87	J	SW of Beverley	State forest	1	

Response to Fire - killed if burnt when above-ground parts (flowers and leaves) are present (July-November).

Response to Soil Disturbance - not known.

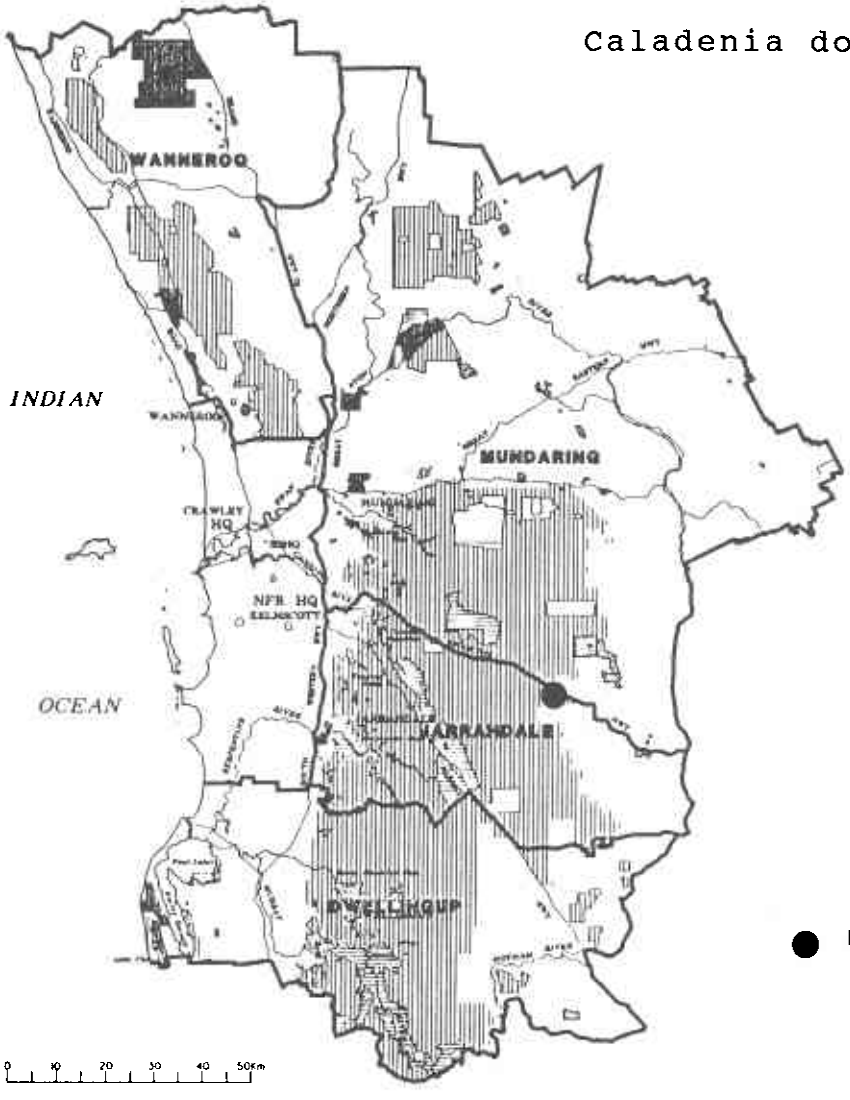
Susceptibility to Weed Invasion - growth suppressed.

Susceptibility to Phytophthora *Species* - not known.

Grazing Impact - subject to grazing.

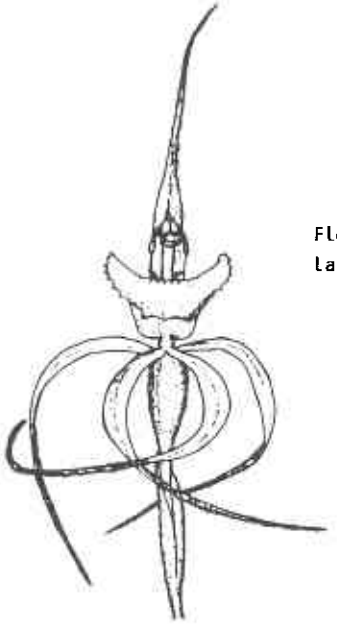
Influence of Canopy Cover - not known.

Caladenia dorrienii



● known population

Whole plant



Flower with crossed lateral sepals

MANAGEMENT REQUIREMENTS

- inform operations staff of population location;
- install rare flora marker pegs;
- do not burn during flowering/vegetative phase (August-November);
- inspect population annually.

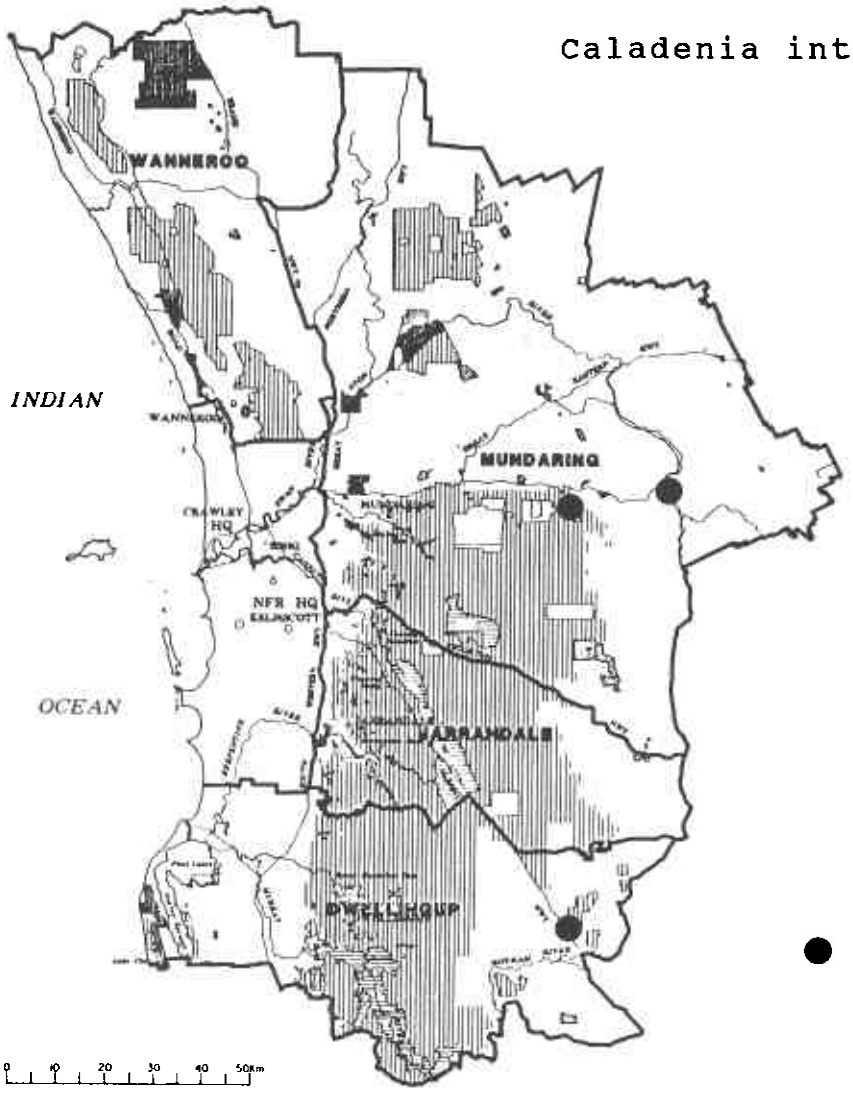
RESEARCH REQUIREMENTS

- conduct extensive surveys of typical habitats in the Region to locate additional surviving populations.

REFERENCES

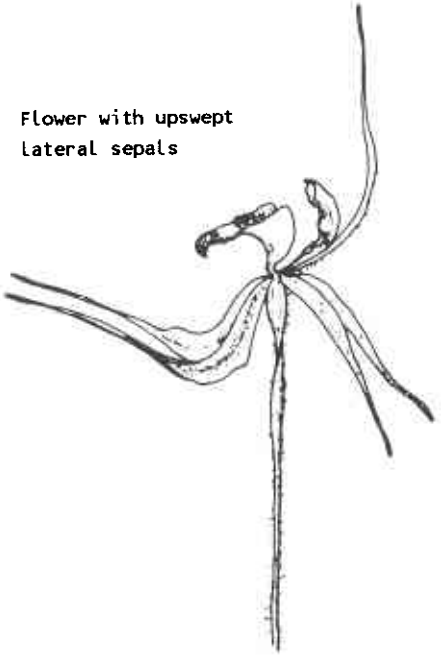
Erickson (1978); Hoffman and Brown (1984); Pelloe (1930).

Caladenia integra



known population

Flower with upswept lateral sepals



Labellum (front view)

Whole plant

CALADENIA INTEGRA E. Coleman

Smooth-lipped Spider Orchid

This spider orchid, characterised by its upswept lateral sepals and smooth edged labellum, was described in 1933 by Edith Coleman after a number of earlier collections from Mt Bakewell and the Kendenup area. It has an erect stem, varying in height from 30-70 cm, with two conspicuous bracts and a hairy, broadly lanceolate leaf 10-20 cm long. The large solitary flower has cream and green perianth segments with red central portions. The dorsal sepal (45-70 mm) is erect and then reflexed. Lateral sepals are longer and bent upwards. Petals are short (about 50 mm) and pointed. The tri-lobed labellum, on a short narrow claw, is yellowish-green with a maroon tip and delicate red veins. Dark 'golf-stick' calli are arranged irregularly. The column is much incurved. *Caladenia integra* can be distinguished from the closely related *C. falcata* by its entire, not serrate, labellum. It flowers in September - October with above-ground parts dying off over summer.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

C. integra is known from scattered localities in the Northern Forest, Wheatbelt and South Coast Regions between York and Tenterden (285 km). It was collected from the Murchison area in 1948 but has not been seen there since. An undescribed allied species is located east of Esperance. In the Northern Forest Region, populations near York and Crossman are found growing beneath *Allocasuarina* woodland on shallow soils surrounding granite exposures.

CONSERVATION STATUS

Endangered	Rare	In Need of Special Protection	√

C. integra is a widespread species known from seven populations at six localities. It is poorly represented on conservation reserves, and like many orchids is plentiful at a limited number of sites. In the Northern Forest Region, three large and relatively undisturbed populations occur on private land, in State forest (management priority area) and in a regional park near York. A few individuals have recently been located on a road reserve north of Crossman. Sites in the Northern Forest Region are a high priority for protection and management, as human activity and weed encroachment threaten the only other significant population which occurs on shire and private land in the Wheatbelt Region. *C. integra* is not in general cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Other Lands					
9/85	M	York	regional park - shire	1000 +	some weed invasion
9/86	M	York	private	500-1000 +	
8/9/87	N	WSW of York	State forest (MPA)	300 +	good
27/9/87	M	N of Crossman	road reserve	2	

Response to Fire - killed if burnt when above-ground parts are present (July-November).
Response to Soil Disturbance - not known.
Susceptibility to Weed Invasion - suppresses growth.
Susceptibility to Phytophthora *Species* - not known.
Grazing Impact - susceptible to grazing.
Influence of Canopy Cover - shelters under shrubs.

MANAGEMENT REQUIREMENTS

- close liaison with shire and private landowners;
- consult with shire regarding management of regional park and conservation of rare species;
- reclassify management priority area as conservation park;
- control invading weeds;
- control recreational activities on granite outcrops;
- exclude mineral exploration from State forest locality;
- inspect populations annually;
- do not burn during flowering/vegetative phase (August-November);
- study effect of autumn burns on regeneration.

RESEARCH REQUIREMENTS

- further survey of granite outcrops in the Region;
- set up permanent monitoring quadrats;
- conduct research on pollination biology and the impact of prolonged drought.

REFERENCES

Coleman (1933); Erickson (1978); Hoffman and Brown (1984).

DARWINIA ACEROSA Fitzgerald

Fine-leaved Darwinia

Darwinia acerosa, a densely branched spreading shrub up to 0.4 m in height, was first collected by W.V. Fitzgerald near Mogumber in 1903 and described and named by him the following year. Subsequent collections were made at the type locality in 1934 and 1965 before extensive clearing of the area.

This species, resembling *D. masonii* and *D. purpurea*, is characterised by its very fine, crowded leaves and hemispherical, drooping flower heads which terminate the short whitish branchlets. The leaves, up to 1 cm long and 0.1 cm wide, are finely pointed or hooked. Each flower head (ca. 2 cm across) is comprised of 40-50 small, yellow-green flowers with red styles, surrounded by numerous pointed, leaf-like bracts. The conspicuous green bracts with purplish-red margins are longer than the flowers but do not hide them. A healthy plant may have some 200-300 flower heads. The fruit, a dry nut containing a single soft white seed, is topped by the withered petals. Flowers during September-October.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Apparently once widespread in the area, it is now restricted to a few populations over a range of 18 km between Mogumber and Wannamal (Northern Forest and Greenough Regions). It grows on and around granite outcrops, in orange sandy clay and gravel in open *Eucalyptus calophylla* and *Allocasuarina* woodland. *Xanthorrhoea, Grevillea, Melaleuca, Calothamnus, Gastrolobium, Hakea, Dryandra* and *Calytrix* species dominate the associated scrub and heath.

CONSERVATION STATUS

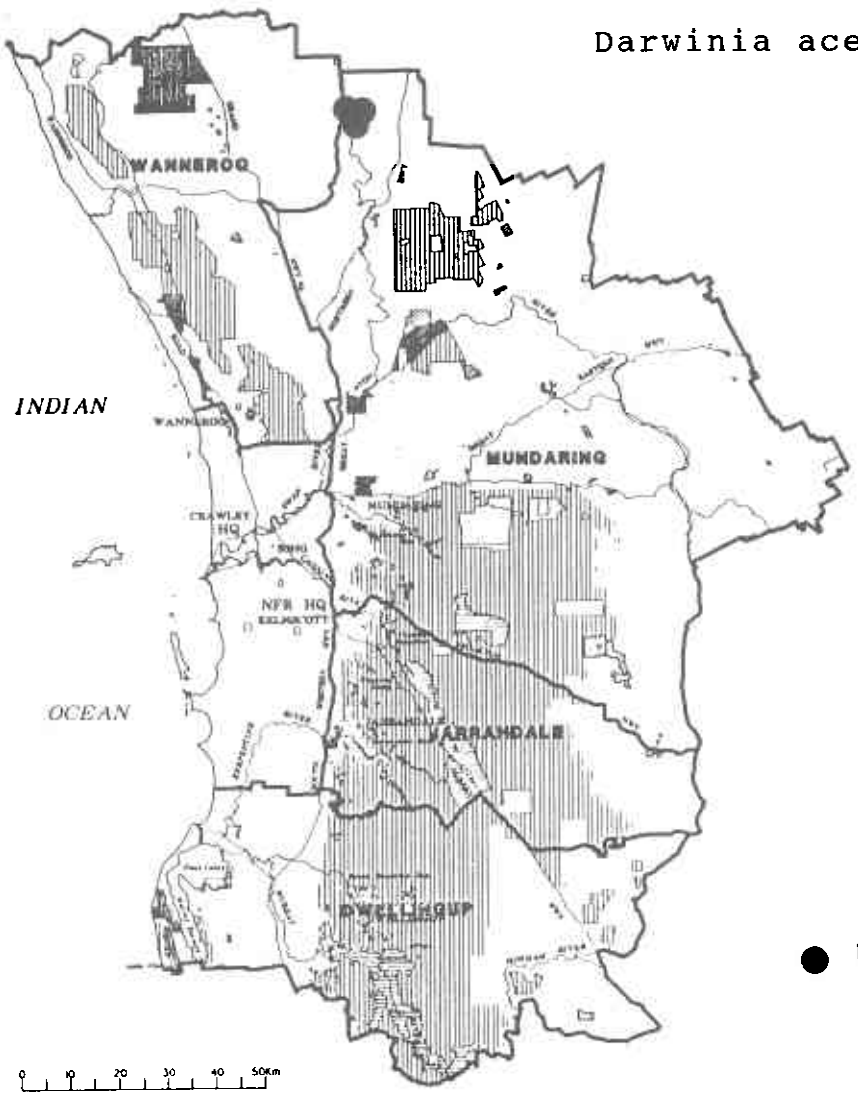
Endangered	Rare	In Need of Special Protection ✓

A geographically restricted species with four of the six known localities occurring in the Northern Forest Region. All populations, totalling several thousand plants, are on private property. The populations are under no immediate threat as the sites are generally unsuitable for farming because of their rocky nature. However, some localities are subject to grazing by stock and weed invasion which may have a significant influence on population recruitment. A proposal to acquire land in the Northern Forest Region as a nature reserve is under consideration. Propagated from cuttings, *D. acerosa* is known in cultivation but is not common.

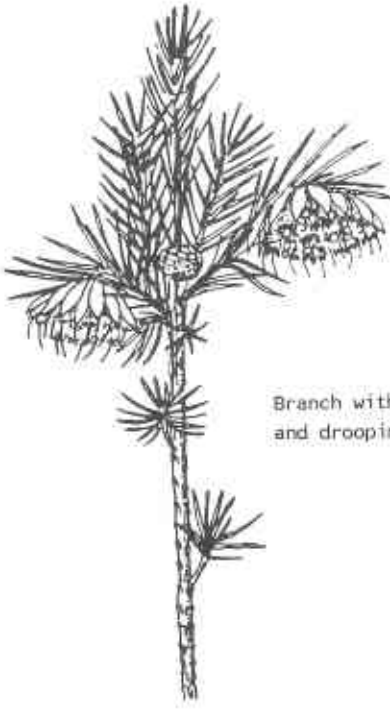
POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Other Lands					
1982	M	S of Wannamal	private	500 +	healthy
1987	M	S of Wannamal	private	500 +	healthy
1982	M	Wannamal	private	1000 +	healthy, some grazing
26/10/87	M	N of Wannamal	private	1500	healthy, weed invasion

Darwinia acerosa



● known population



Branch with crowded leaves and drooping flowerheads

Flowerhead (from beneath)

Single flower

Response to Fire - probably killed by fire and regenerating from seed.

Response to Soil Disturbance - a good colonizer favouring open exposed areas.

Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *Species* - not known.

Grazing Impact - mature plants apparently unpalatable.

Influence of Canopy Cover - grows in open exposed areas.

MANAGEMENT REQUIREMENTS

- close liaison with landowners regarding protection of populations;
- acquisition of land as a nature reserve is a high priority;
- fence grazed populations and control weed species;
- protect from fire;
- inspect sites regularly;
- maintain in cultivation.

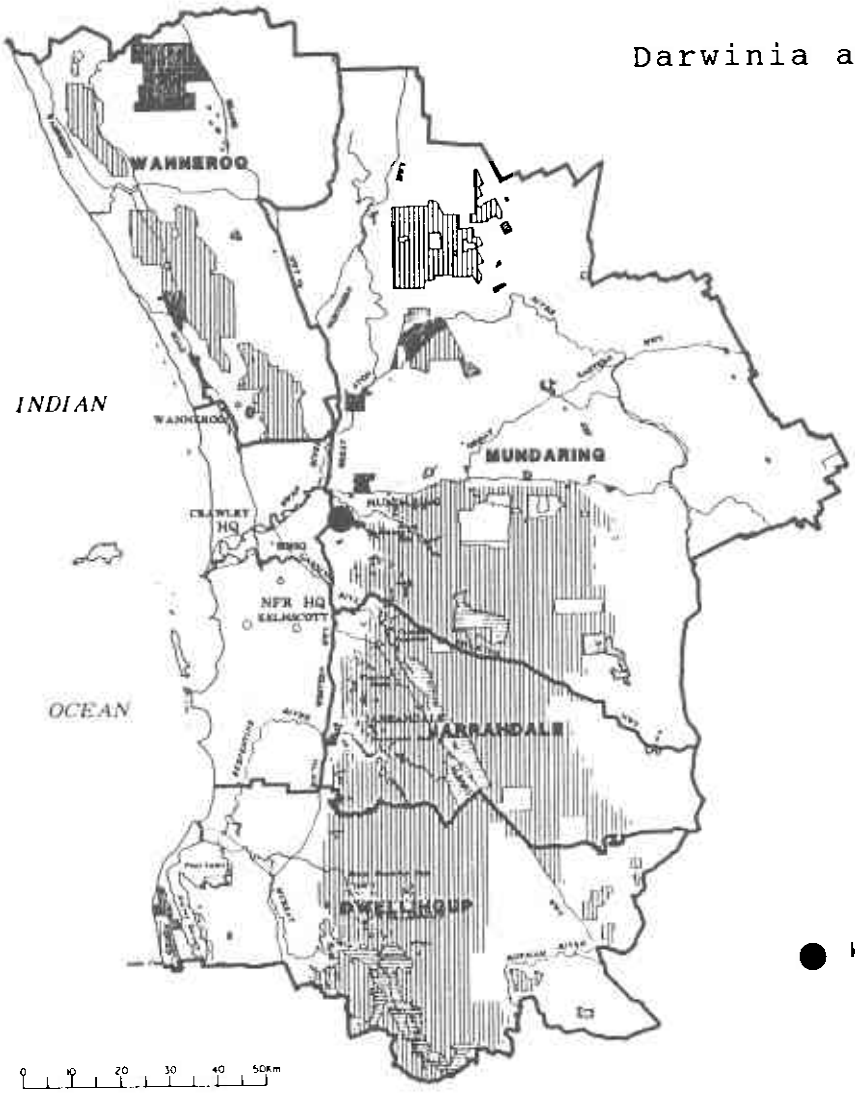
RESEARCH REQUIREMENTS

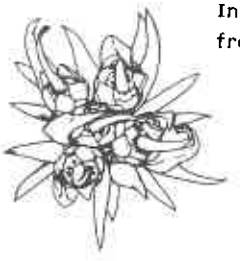
- set up permanent monitoring quadrats;
- conduct research on drought tolerance, fire and life history;
- undertake further survey of typical habitats in the Region.

REFERENCES

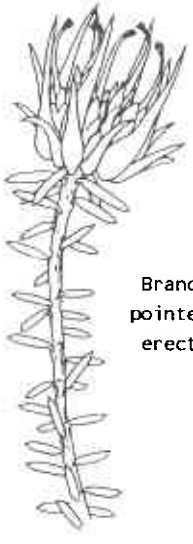
Fitzgerald (1904); Millar (1982); Rye and Hopper (1981).

Darwinia apiculata





Inflorescence (viewed from beneath)



Branch with sharply pointed leaves and erect inflorescence

Habit of plant

Illustrations by Margaret Menadue

DARWINIA APICULATA N.G.Marchant

A densely branched rounded shrub 40-50 cm tall, named and described by Marchant in 1984 from a specimen collected near Kalamunda in 1982. Its specific name refers to the scattered, linear leaves (6 mm x 0.5 mm) with distinctive sharply pointed (apiculate) tips. It is largely glabrous, with slender, red, young branches and simple, 4-8 flowered, terminal inflorescences held erect. Petals are green and often tinged with red. Calyx lobes are short and stamens are half the length of the petals. The style is red. Indehiscent fruits, with one or rarely two seeds, are surrounded by the dried floral parts. Superficially resembling *Darwinia helichrysoides* and *D. oederoides*, it can be distinguished from them by its calyx lobes, corolla tubes, densely branched habit and smaller bracts and bracteoles. Flowering has been recorded in October.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

This species, endemic to the Northern Forest Region, is known only from the type locality and nearby bushland in Kalamunda. It grows on shallow gravelly soil over continuous laterite, in open jarrah-marri woodland with *Allocasuarina fraseriana* over patches of *Dryandra sessilis* and occasional *Xanthorrhoea preissii*.

CONSERVATION STATUS

Endangered	Rare	In Need of Special Protection
✓	✓	

Approximately 350 individuals of this rare and very restricted species occur sporadically over 5-6 ha of parkland and adjacent Crown land west of Kalamunda. A disjunct population of 10-12 plants has been reported from private land near this locality. Parts of the larger population may be threatened by future development of the site, wood collecting and incursion of weeds introduced by dumping of household rubbish. Typical habitats in the Region have been extensively surveyed, but many areas likely to support this species have been cleared for housing. *D. apiculata* is unknown in cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Other Lands					
22/12/87	M	W of Kalamunda	parklands and Crown land	350+	healthy
*	M	W of Kalamunda	private	10-12	

*unsurveyed locality

Response to Fire - probably killed by fire and regenerating from seed.

Response to Soil Disturbance - a good colonizer.

Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *Species* - not known. *Darwinia* species are generally susceptible.

Grazing Impact - not known.

Influence of Canopy Cover - grows in open sites.

MANAGEMENT REQUIREMENTS

- close liaison with shire, local authorities and private landowners to ensure protection of populations from accidental damage;
- acquisition of land as a nature reserve is desirable;
- install rare flora marker pegs;
- protect from fire;
- collect seed for storage;
- establish in cultivation;
- inspect population annually.

RESEARCH REQUIREMENTS

- set up permanent monitoring quadrats;
- research on drought tolerance, fire and life history;
- undertake further surveys of typical habitats in the Region.

REFERENCES

Marchant (1984).

DAVIESIA MICROPHYLLA Benth.

Daviesia microphylla is a profusely flowering shrub, first collected from the Darling Range by Priess in 1843 and later described by Bentham in 1864. Growing to a height of about 25 cm, it has short, spreading branches and minute, rigid leaves (2-4 mm long) ending in a sharp point. Small branchlets end in stout thorns. The pea-like flowers are orange and red. The fruit is a small triangular-shaped pod 10-12 mm. Resembling *D. incrassata* in the form of petals and pods, it can be distinguished by its leaf shape and the presence of spinescent branchlets. *D. microphylla* flowers for a short period in July-August.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Apparently once common between Perth and Cunderdin, this species is now confined to the Northern Forest Region and known from only one area in the Darling Range 37 km west of Beverley. A number of small populations scattered over some 24-25 km appear to be the only survivors of the extensive clearing of land for farming. *D. microphylla* grows on white-grey loamy sands or lateritic gravel in open wandoo-marri woodland over a low open heath understorey.

CONSERVATION STATUS

Endangered	Rare	In Need of Special Protection √

This species is known from numerous scattered populations in State forest (proposed conservation park) and an adjoining nature reserve. It is plentiful within its restricted range, occurring along road verges and extending into surrounding bushland. It has apparently not suffered from the seven-yearly fuel reduction burns in the State forest. Members of this genus are easily propagated from seed.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
25/3/87	M	W of Beverley	nature reserve	127	good
Other Lands					
23/10/85	M	W of Beverley	State forest (numerous populations)	6000+	good

Response to Fire - regenerates from the base after fire. Fire is usually a stimulus to regeneration in the genus *Daviesia* .

Response to Soil Disturbance - colonizes disturbed sites. *D. microphylla* is found along graded road verges.

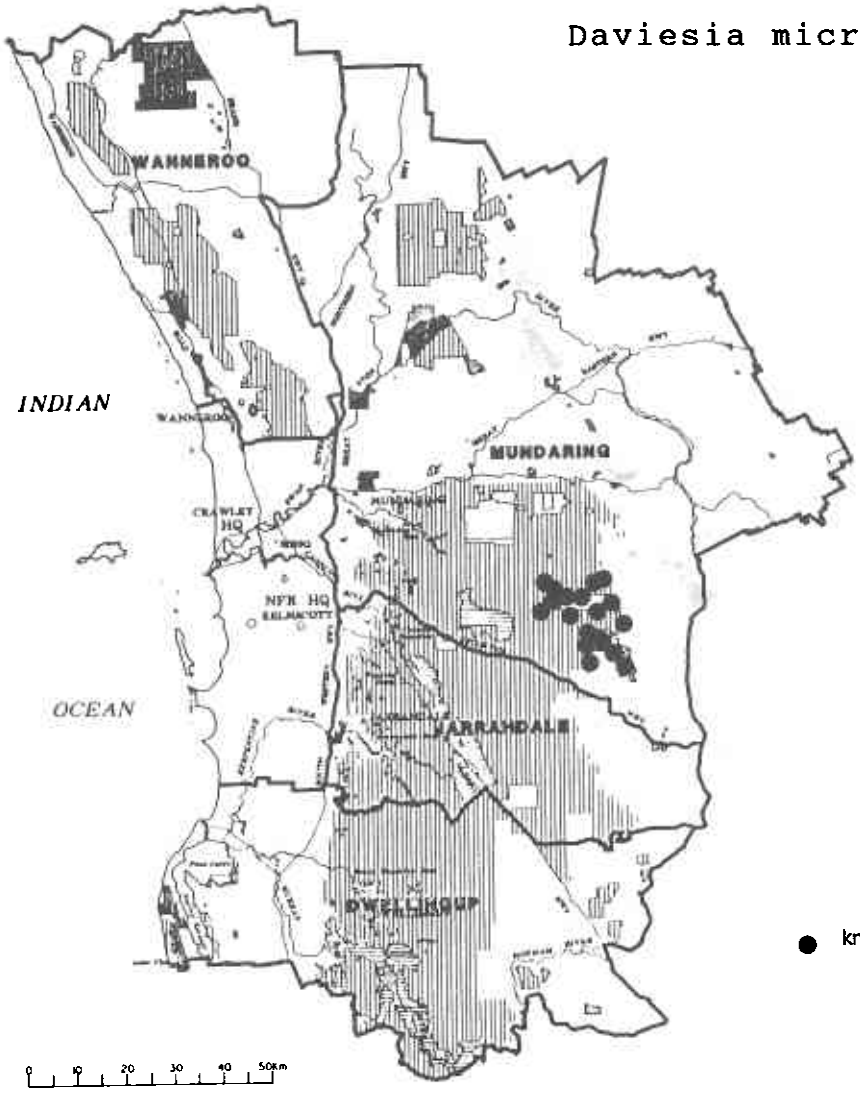
Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *Species* - not known. *Daviesia* species may be susceptible.

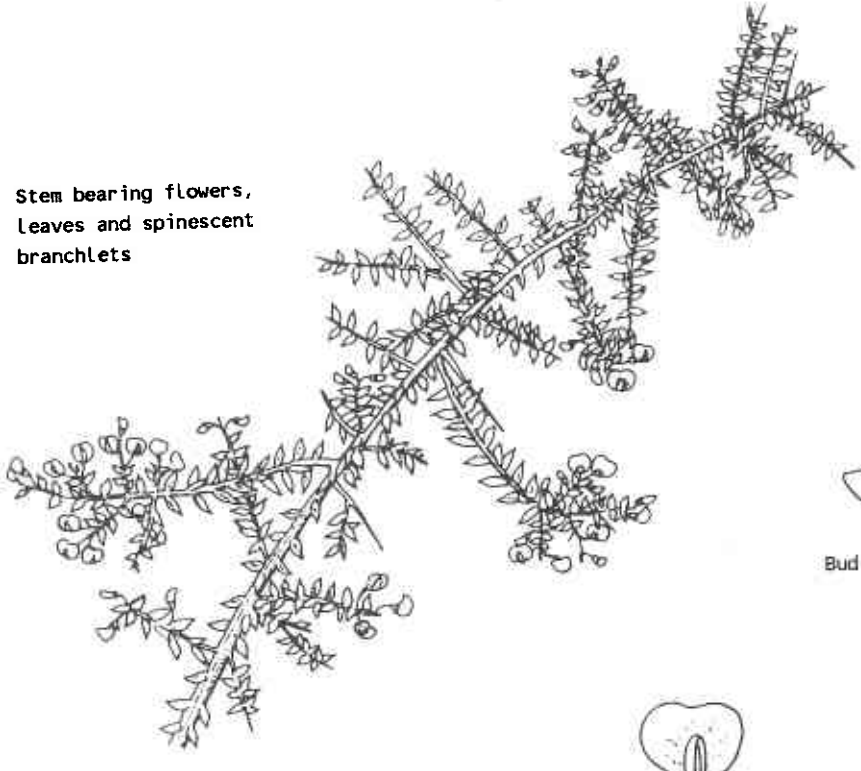
Grazing Impact - not known.

Influence of Canopy Cover - grows in open sites.

Daviesia microphylla



● known population(s)



Stem bearing flowers, leaves and spinescent branchlets

Bud (side view)

Flower (front view)

MANAGEMENT REQUIREMENTS

- inform operations staff of population locations;
- plan and supervise logging operations and mining exploration to ensure populations are not disturbed;
- conduct operations under dieback hygiene conditions;
- roadside plants can be graded (under permit) as this species is a disturbance opportunist;
- autumn burn at no less than seven-yearly intervals;
- inspect populations annually.

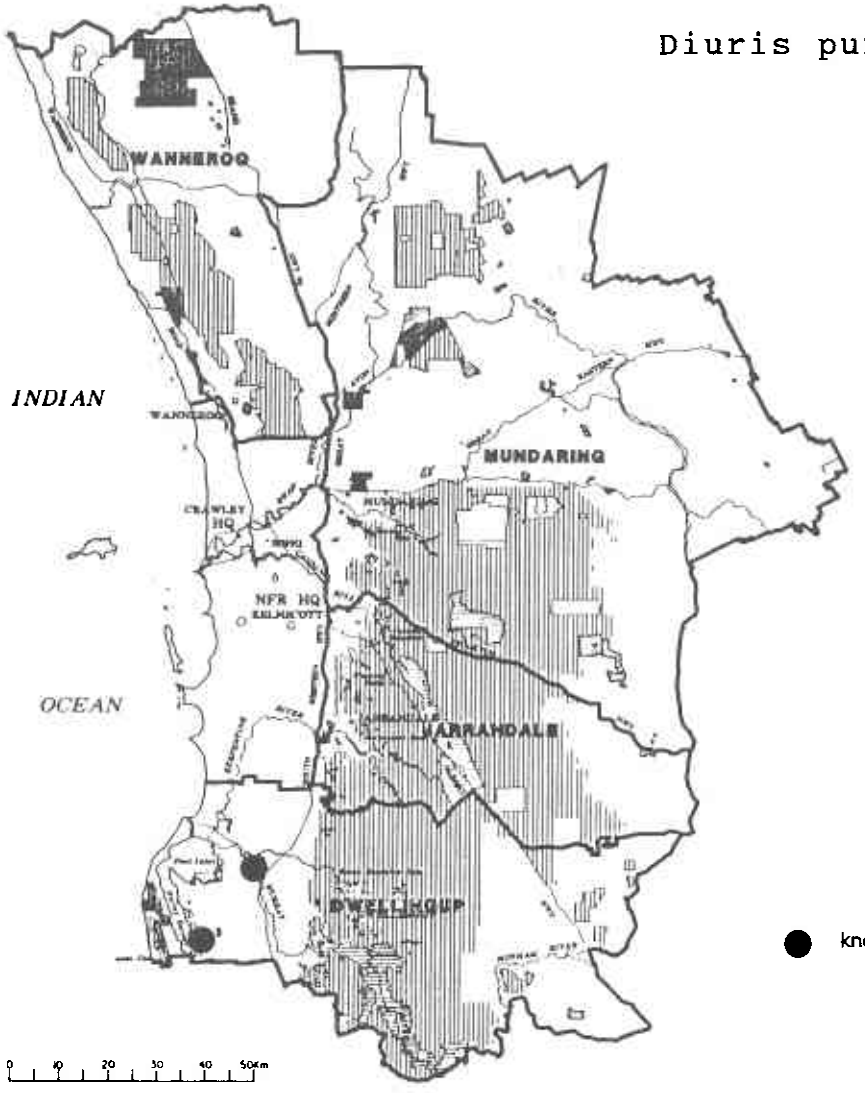
RESEARCH REQUIREMENTS

- further survey of suitable habitats in the Region;
- set up permanent monitoring quadrats;
- conduct research on fire and life history.

REFERENCES

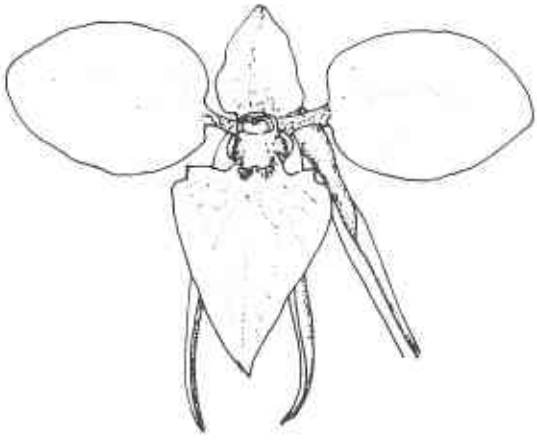
Bentham (1864); Crisp (1983); Leigh, Boden and Briggs (1984).

Diuris purdiei



● known population

Whole plant with spirally twisted leaves and flowers on a single spike



'Donkey-like' flower with erect dorsal sepal and tri-lobed labellum

DIURIS PURDIEI Diels

Purdie's Donkey Orchid

Diuris purdiei was named by Diels in 1903, in honour of Western Australian botanical collector Alexander Purdie who first collected it near Cannington in 1901. It is a small, slender orchid varying from 12-45 cm in height, with 5-10 narrow, spirally twisted leaves (8-10 cm long) arising from a widened base. Usually 2 white cylindrical tubers are located 10-40 mm below the soil surface. Up to 8 distinctive 'donkey-like' flowers are borne on a single spike. Flowers are yellow with red-brown markings at the base of the labellum and on the underside of the lateral petals. The dorsal sepal, coloured like the petals, stands erect. Longer narrow lateral sepals are greenish in colour and partly hidden behind the conspicuous tri-lobed labellum. The middle lobe is much longer than the fringed lateral lobes. The fruit is a small, urn shaped capsule with numerous fine seeds. The pollinator is unknown but is assumed to be a small native bee such as those observed pollinating other *Diuris* species. Scarab beetles have also been seen feeding at the flowers. *D. purdiei* flowers in September-October only after a summer fire. Above-ground portions of the plant die back below ground level over summer.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Occurring in the Northern Forest, Metropolitan and Central Forest Regions on sandy clay soils in winter-wet areas on the coastal plain between Canningvale and Yarloop (100 km). In the Northern Forest Region, populations west and south-west of Pinjarra are located among native sedges and heath in open *Melaleuca* woodland with occasional *Eucalyptus calophylla, E. marginata* and *Nuytsia floribunda*. The lower shrub storey is dominated by *Xanthorrhoea preissii, Melaleuca* species and *Hypocalymma angustifolium*.

CONSERVATION STATUS

Endangered	Rare	In Need of Special Protection	√

This species is largely confined to private and shire land in the Metropolitan Region, with approximately 2200 individuals recorded from seven localities. A single population has been reported from private land near Yarloop. In the Northern Forest Region, populations occur in a nature reserve and on vacant Crown land currently under consideration for acquisition as a nature reserve. The populations at these localities are a high priority for protection and management as continuing land developments endanger the existing metropolitan sites.

D. purdiei is difficult to recognize except when in flower, and unknown populations may occur in areas long unburnt. Its requirement for a summer burn and proximity to residential areas places the long-term survival of many populations in jeopardy. This species has been successfully propagated but is not in general cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Conditions
Conservation Reserves					
2/10/84	D	SW of Pinjarra	nature reserve	600 +	good
Other Lands					
27/10/84	D	W of Pinjarra	VCL - proposed nature reserve	200 +	good

Response to Fire - requires a summer burn (January to March) to initiate flowering. Fires at any other time of year may be detrimental.

Response to Soil Disturbance - not known.

Susceptibility to Weed Invasion - suppresses growth.

Susceptibility to Phytophthora *Species* - not known.

Grazing Impact - susceptible to grazing.

Influence of Canopy Cover - not known.

MANAGEMENT REQUIREMENTS

- acquisition of VCL as a nature reserve is a high priority;
- close liaison with shire and local authorities;
- inform operations staff of population locations;
- install rare flora marker pegs;
- maintain in cultivation;
- inspect sites annually;
- do not burn during flowering/vegetative phase (July-November).

RESEARCH REQUIREMENTS

- further survey of seasonal swamplands in the Region;
- set up permanent monitoring quadrats;
- investigate the impact of exotic bees on native pollinators;
- determine the effect of autumn burns on regeneration and flowering.

REFERENCES

Diels (1903); Erickson (1978); Maddocks and Lamont (1984); Nicholls (1969); Patrick and Hopper (1982).

DROSERA OCCIDENTALIS Morrison

Minute Pygmy Sundew

A small insectivorous herb, about 1 cm across, described by Morrison in 1912 from a specimen collected on newly cultivated land at Byford. Also known as the Western Sundew, it shows some resemblence to *Drosera pygmaea*, a species from south-eastern Australia and New Zealand. Like other pygmy sundews, the leaves (about 20) are arranged in a basal rosette which in this species is often partially concealed by sand. They are covered with minute, glandular hairs which exude a sticky substance that attracts and traps small insects. The characteristic white flowers are borne singly on reddish brown stalks, 1-2 cm tall. This fibrous rooted perennial dies back to ground level during summer. Flowering occurs in October-December.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Found in the Northern Forest and Metropolitan Regions on the coastal plain from Gingin to Coolup (170 km). It grows among native sedges on the sandy swamp flats near the foot of the Darling scarp.

CONSERVATION STATUS

Endangered	Rare	In Need of Special Protection √

A species probably more abundant and widely distributed than is currently recognized, despite extensive clearing and draining of suitable habitats within its range for agricultural and urban development. At present, only one of the four recorded localities in the Northern Forest Region has been surveyed. This population of some 10 000+ plants is located on a recreation reserve near Bullsbrook. Discrete marker pegs have been installed by the shire but illegal trail-bike riding is reported to occur in the area. Unsurveyed populations on private land and a timber and flora reserve are located at Gingin, Pinjarra and Coolup. Several hundred individuals in two populations occur at Beechboro and Kenwick in the metropolitan area.

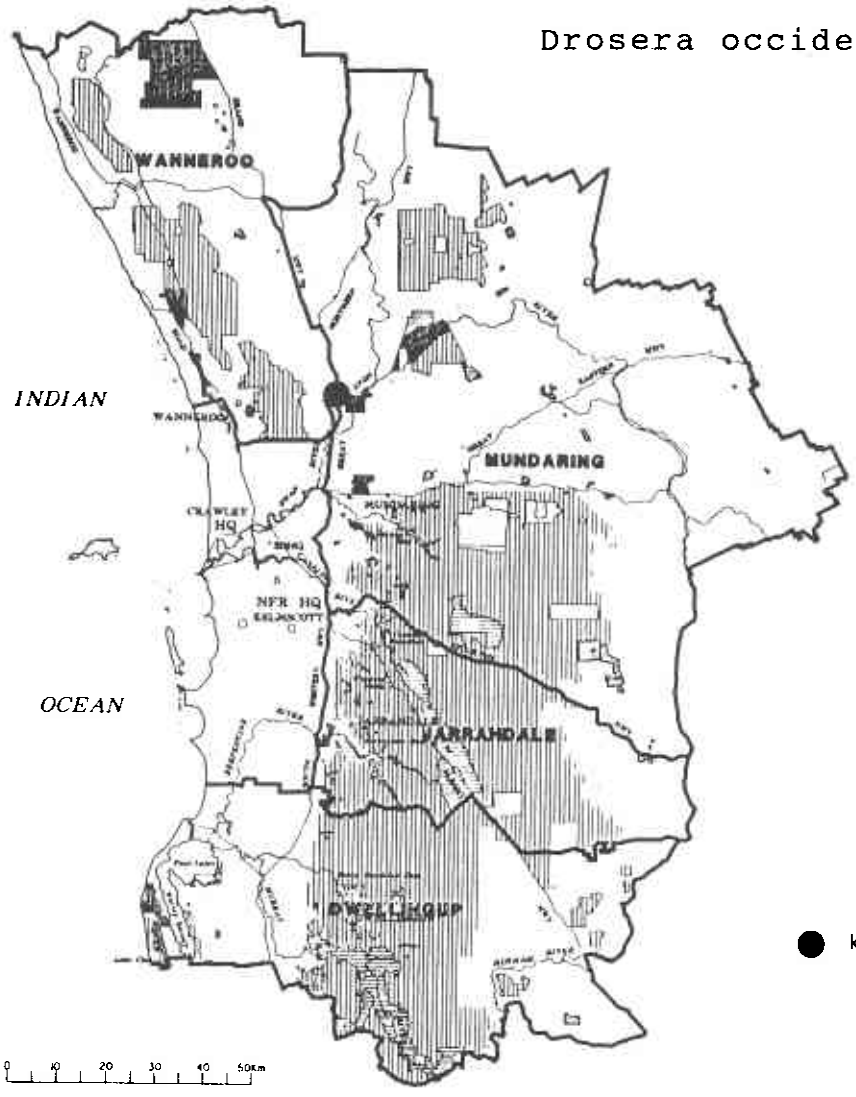
D. occidentalis is an inconspicuous species that is easily overlooked because of its diminutive size and summer dehydration. Further survey to locate surviving populations is needed to enable accurate assessment of conservation status and subsequent management and protection. This species has been successfully propagated in culture but is not in general cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

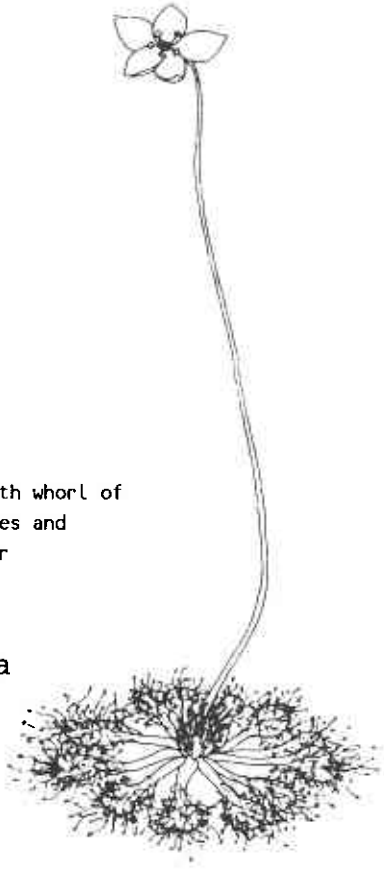
Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
*	D	Coolup	timber & flora reserve		
Other Lands					
6/10/87	M	Bullsbrook	recreation reserve-shire	10 000+	good
*	D	W of Pinjarra	private - industrial estate		
*	W	N of Gingin	private		

*unsurveyed populations

Drosera occidentalis



Whole plant (actual size)



Whole plant with whorl of glandular leaves and solitary flower

Illustrations by Luisa Braganca and Barbara Rye

Response to Fire - killed by fire and regenerating from seed.

Response to Soil Disturbance - has been located on cleared and disturbed sites.

Susceptibility to Weed Invasion - a small plant suppressed by weeds.

Susceptibility to Phytophthora *Species* - *Drosera* species are generally tolerant and are often found growing on old dieback sites.

Grazing Impact - not applicable.

Influence of Canopy Cover - not known.

MANAGEMENT REQUIREMENTS

- close liaison with shire and landowners regarding protection and management of populations;
- survey known localities and notify landowners, local authorities and operations staff of population locations;
- install rare flora marker pegs;
- inspect populations annually;
- autumn burn only at minimum of 12-yearly intervals.

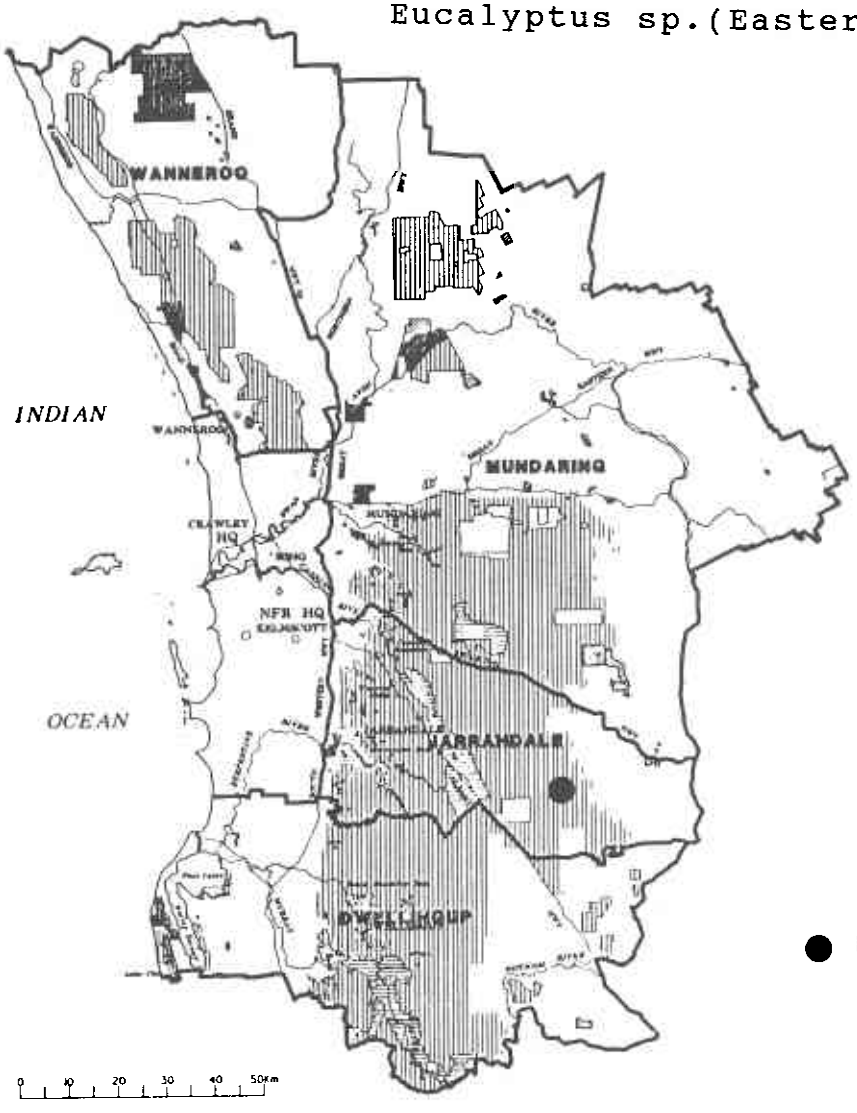
RESEARCH REQUIREMENTS

- conduct further field surveys to accurately map this species' distribution.
- investigate this species' response to different fire regimes.

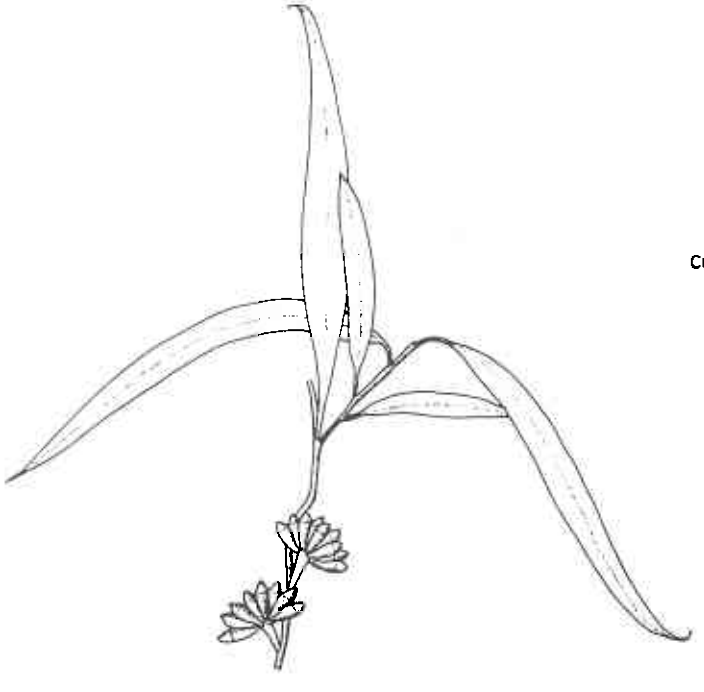
REFERENCES

Erickson (1968); Leigh, Boden and Briggs (1984); Lowrie (1989); Morrison (1912); Rye and Hopper (1981).

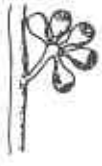
Eucalyptus sp.(Eastern forest)



● known population



Branch with narrow leaves
and spindle-shaped buds



Cupular fruits

EUCALYPTUS SP.[2] (EASTERN FOREST) M.I.H. BROOKER 9046

This species, now described as *Eucalyptus latens* Brooker, is a mallee to 4 m with grey-brown and light coppery, smooth stems and narrow, elongated leaves. Small flowers are creamy white. Related to *E. foecunda*, it can be distinguished by its occurrence in the jarrah forest, smooth stems and smaller, oblong-linear, glaucous juvenile leaves. Flowers in May-June.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Possibly endemic to the Northern Forest Region and known from a single location near North Bannister where it is found in a slight gully situation on brown sandy loam over clay. It grows emergent from a dense *Allocasuarina humilis* shrubland in open marri-wandoo woodland surrounded by jarrah, marri and occasional wandoo forest.

CONSERVATION STATUS

Endangered	Rare	In Need of Special Protection
√	√	

An extremely rare species confined to a large dense stand in Jarrahdale State Forest. The population is threatened by future land use and possible dieback infection of the area. Similar mallees reported in forest further east may be representatives of this species. It is not known in cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
27/3/88	J	N of North Bannister	State forest	100 +	healthy

Response to Fire - regenerates from lignotuber.

Response to Soil Disturbance - not known.

Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *Species* - not known.

Grazing Impact - not known.

Influence of Canopy Cover - not known.

MANAGEMENT REQUIREMENTS

- exclude from prescribed burns until fire response research is carried out;
- plan and supervise logging operations and mining exploration to ensure the population is not disturbed;

2 Now *Eucalyptus latens* (Brooker 1988)

- inform operations staff of population locations;
- install rare flora marker pegs;
- conduct operations under dieback hygiene conditions;
- collect seed for propagation and storage;
- monitor annually.

RESEARCH REQUIREMENTS

- extensive survey to locate additional populations;
- research on fire and life history.

REFERENCES

Brooker and Kleinig (in press).

EUCALYPTUS SP. (YANCHEP) M.I.H. BROOKER 8608

A 2-3 m mallee with an affinity to *Eucalyptus conglobata* and proposed for description as *E. argutifolia* Grayling & Brooker ined. It has smooth, grey and pale coppery bark, glossy green foliage and white flowers. Adult leaves are ovate to broadly lanceolate, up to 10 cm long and 4 cm wide. Juvenile leaves are broadly elliptical to orbicular (7 x 6 cm). The branchlet pith is glandular. Inflorescences are axillary, unbranched and usually 7 (up to 11) flowered. Buds are ovoid to cylindrical (0.8-1.2 x 0.5-0.6 cm) and the operculum is hemispherical. The cupular to cylindrical fruits are sessile or shortly pedicellate. Seeds are red-brown, flattish and somewhat wrinkled. Flowers during March-April.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Confined to the Northern Forest Region where it occurs high in the landscape on limestone ridges (ca. 11 km apart) north of Yanchep. It grows on yellow sand over limestone, emergent from heath and thickets including *Dryandra, Melaleuca, Xanthorrhoea* and *Grevillea* species.

CONSERVATION STATUS

Endangered	Rare ✓	In Need of Special Protection

An extremely rare species known from two isolated localities in State forest near Yanchep. The southerly population, of about 15-20 'clumps', occurs on land proposed for addition to the Yanchep National Park. At the northern site, two clumps are located adjacent to an access road where they are endangered by road maintenance operations. This species is not known in cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
12/1/88	W	N of Yanchep	State forest	15-20 clumps	good
12/1/88	W	N of Yanchep	State forest	2 clumps	

Response to Fire - lignotuberous regrowth.

Response to Soil Disturbance - not known.

Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *Species* - not known.

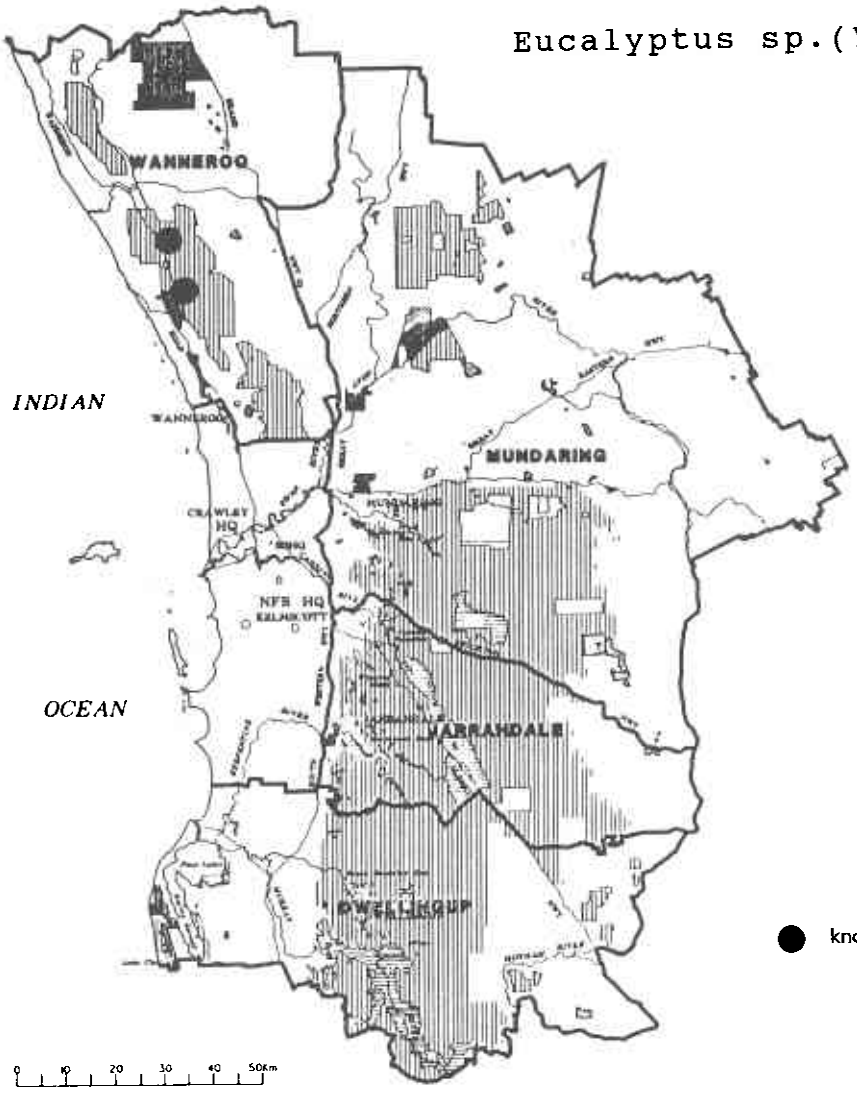
Grazing Impact - not known.

Influence of Canopy Cover - emergent from heath.

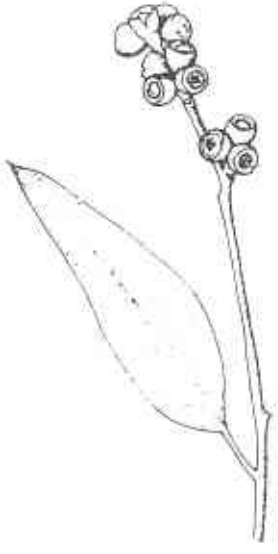
MANAGEMENT REQUIREMENTS

- exclude populations from prescribed burning;
- inform operations staff of population locations;
- install rare flora marker pegs (northern site);

Eucalyptus sp.(Yanchep)



● known population(s)



Sessile or shortly pedicellate fruits

Branch with ovate to broadly lanceolate leaves and ovoid to cylindrical buds

- ensure limestone mining is excluded from the vicinity of rare flora populations;
- collect seed for storage;
- monitor annually.

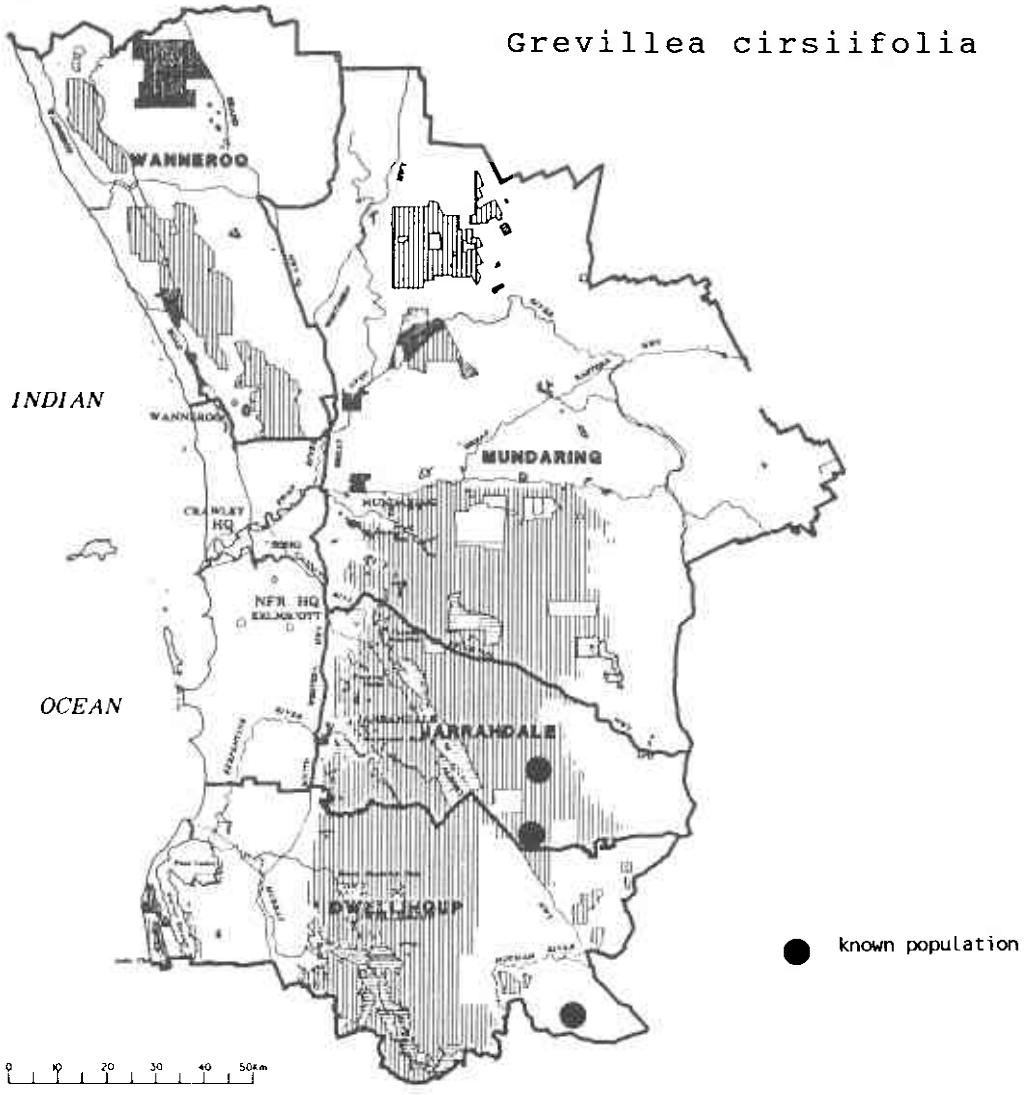
RESEARCH REQUIREMENTS

- further survey of typical habitats in the Region;
- research on fire and life history.

REFERENCES

Brooker and Kleinig (in press); P. Grayling (1989).

Grevillea cirsiifolia



Prostrate stem bearing erect leaves and flowering stalk

GREVILLEA CIRSIIFOLIA Meissn.

Varied-leaf Grevillea

Grevillea cirsiifolia was described and named by Meissner in 1848 from an earlier collection made by Drummond. It is a prostrate shrub with few branches and narrow, erect leaves up to 20 cm long. It is covered with short hairs, particularly on the young growth and underside of the leaves. Leaf margins are entire, toothed or deeply divided and are rolled under slightly. Numerous small, pale yellow flowers, up to 0.5 cm long, are arranged loosely along erect, leafless stalks. The perianth tube is hairy inside and the glabrous stigma is thick but flattened. Fruits (1 cm x 0.8 cm) are rather flat. Flowering occurs from September to December.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

This species is distributed over a geographical range of 280 km, from east of Jarrahdale in the Northern Forest Region, south through the Wheatbelt Region to Denmark in the Southern Forest Region. It is found growing near Jarrahdale and Boddington in *Allocasuarina humilis* scrub over low heath, on shallow yellow-brown sandy loam on laterite ridge-top plateaus. Dominant heath species include *Dryandra armata, Calothamnus* sp., *Synaphaea* sp., *Lepidosperma angustatum, Banksia sphaerocephala, Hemigenia* sp. and *Daviesia incrassata*.

CONSERVATION STATUS

Endangered	Rare √	In Need of Special Protection

G. cirsiifolia has been surveyed at only four of the recently recorded localities - in a nature reserve and State forest of the Northern Forest Region, and in road verge vegetation and adjoining State forest near Manjimup. Further collections have been made from State forest near Denmark and two localities in the Wheatbelt Region. The large population (several hundred plants) south-east of Boddington is the only confirmed occurrence on a conservation reserve and is therefore a high priority for protection and management. This species can be easily propagated from seed but is not in general cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
22/4/86	D	SE of Boddington	nature reserve (2 populations)	500 +	good
6/5/88	J	E of Jarrahdale	State forest	18	
12/8/88	J	NE of Dwellingup	State forest	200 +	good

Response to Fire - not known.

Response to Soil Disturbance - not known. Found growing on road verge near Manjimup.

Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *Species* - not known. Members of this genus are generally susceptible.

Grazing Impact - spiny leaf margins may deter herbivores.
Influence of Canopy Cover - grows in both open and shaded situations.

MANAGEMENT REQUIREMENTS

- protect from fire;
- exclude mineral exploration and logging from the area;
- collect seed for storage;
- establish in cultivation;
- inspect population annually.

RESEARCH REQUIREMENTS

- set up permanent monitoring quadrats;
- conduct research on fire and life history;
- further survey of suitable habitats in the Region.

REFERENCES

Bentham (1870); Rye and Hopper (1981).

GREVILLEA SACCATA Benth.

Pouched Grevillea

Grevillea saccata is a spreading, semi-prostrate shrub with broad, red flowers and erect, linear leaves. It was described by Bentham in 1870 after an earlier collection by Drummond, and has since been collected from a number of localities in the Hill River - Badgingarra region. The flowers, up to 1 cm long and 0.5 cm wide, have two distinct rows of hairs along the inside. They are borne terminally or in the upper leaf axils in small groups. The hairy style, with a one-sided enlargement at the tip, just protrudes. Leaves are undivided and the margins curled. Mature leaves are stalkless and up to 3 cm long. The branches and young leaves are covered with short hairs. Flowering occurs in June-August.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Located almost entirely within the Greenough Region and known from only a single locality in the lateritic uplands of the Northern Forest Region. Its range extends from north of Badgingarra southward to near Gingin (115 km), where it grows in yellow-brown sandy and lateritic soils in very open *Eucalyptus* (*E. calophylla, E. marginata, E. lanepoolei*) woodland over *Banksia menziesii - B. attenuata* scrub and low heath.

CONSERVATION STATUS

Endangered	Rare ✓	In Need of Special Protection

In the Greenough Region, *G. saccata* is known from four road verge populations near Badgingarra and an unsurveyed population on a nature reserve south of Dandaragan. In the Northern Forest Region, several hundred plants in three populations occur on a proposed nature reserve (currently vacant Crown land) and adjoining private land north of Gingin. Parts of these populations are endangered by road maintenance operations and regular buffer burning. With the roadside populations further north being small and subject to weed invasion, the large populations in the Northern Forest Region are a high priority for protection and management. This species is commercially exploited in the nursery trade (Rye, Hopper and Watson, 1980) and well established in cultivation. It is probably more widely distributed in remnants of natural vegetation throughout its range.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

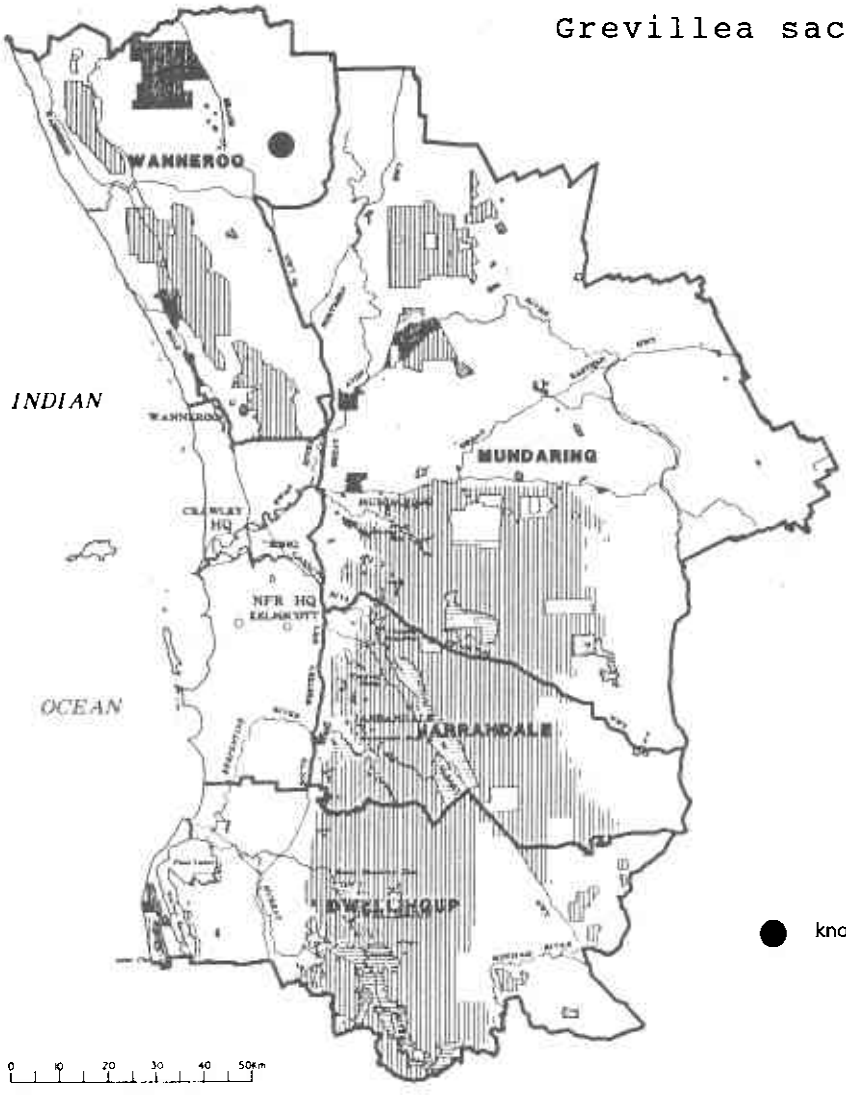
Date of most recent surveys	District	Population	Land Status	No. of plants	Condition
Other Lands					
30/6/88	W	N of Gingin	VCL and private	431	good
30/6/88	W	N of Gingin	VCL	626	good
30/6/88	W	N of Gingin	VCL	25	

Response to fire - apparently regenerating from rootstock, responds well after an autumn burn.

Response to soil disturbance - not known.

Susceptibility to weed invasion - not known.

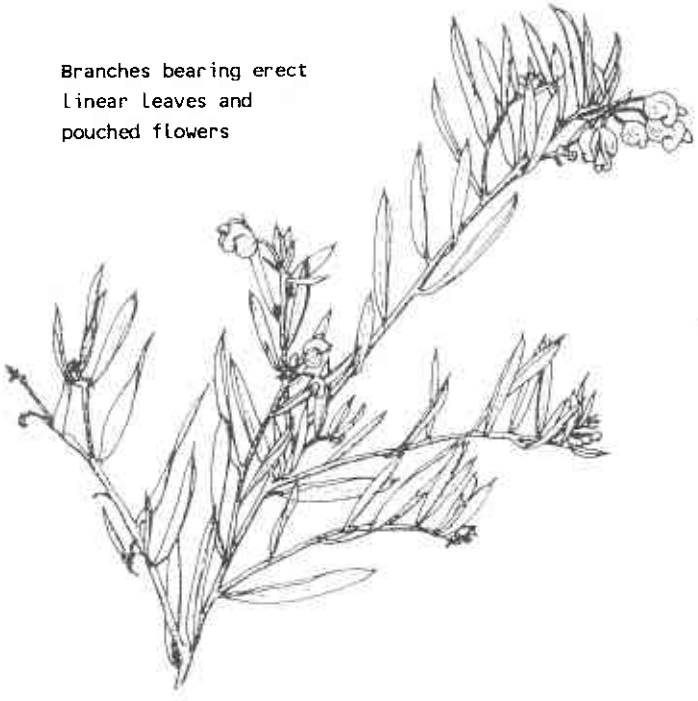
Grevillea saccata

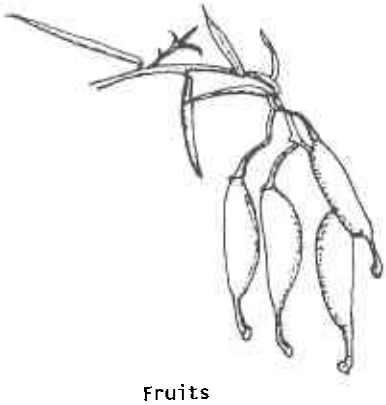


● known population

Flower (side view)

Branches bearing erect linear leaves and pouched flowers





Fruits

Susceptibility to Phytophthora *Species* - not known.

Grazing Impact - not known.

Influence of Canopy Cover - found in both open and shaded situations.

MANAGEMENT REQUIREMENTS

- notify shire, local authorities and CALM operations staff of population locations;
- acquisition of the VCL as a nature reserve is a high priority;
- exclude populations from prescribed burning;
- install rare flora marker pegs;
- Autumn burn only at minimum of 12-yearly intervals;
- do not grade roadside plants;
- inspect populations annually.

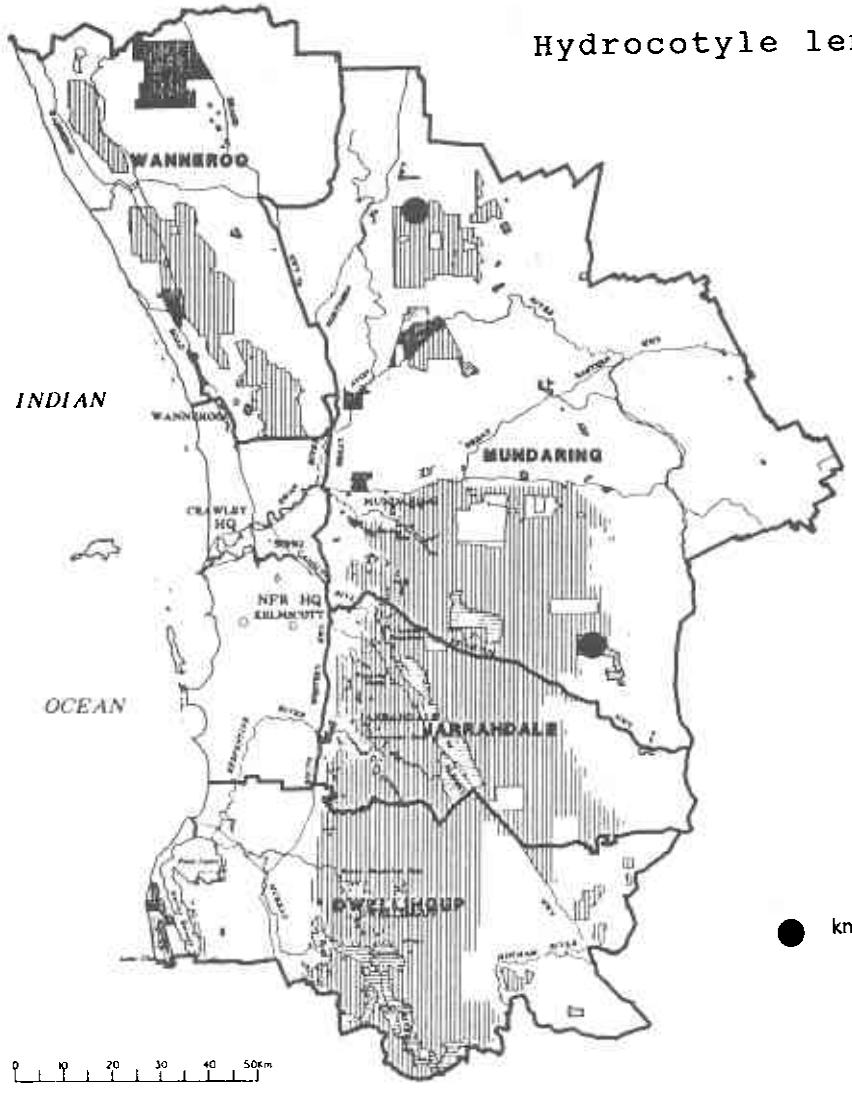
RESEARCH REQUIREMENTS

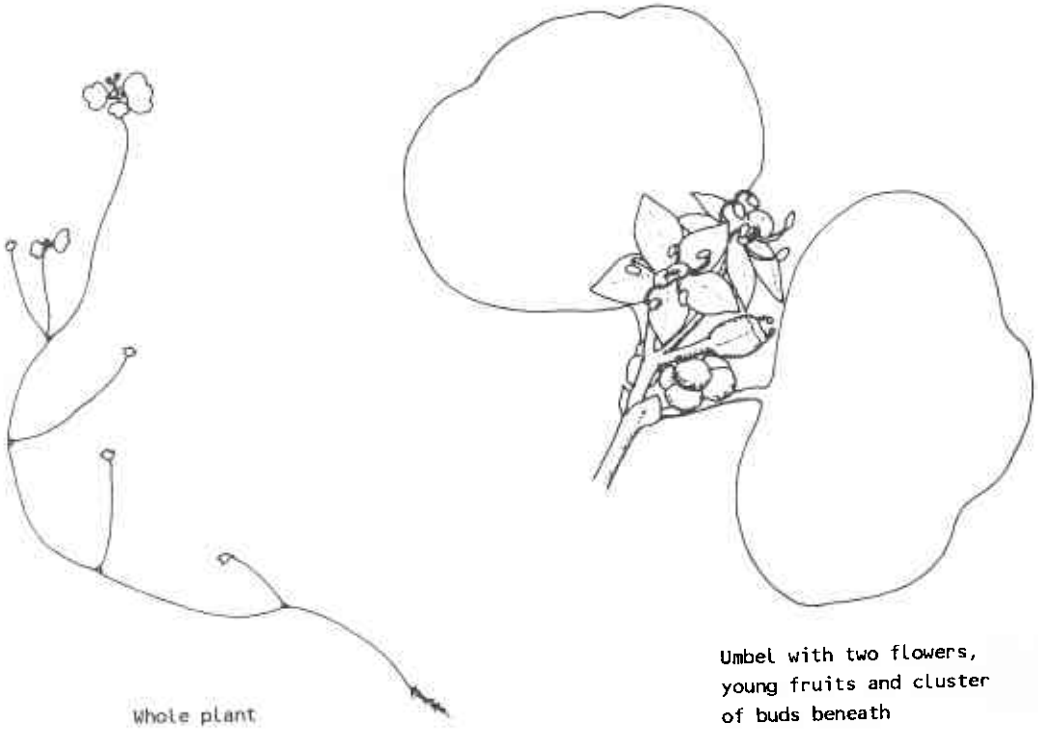
- research on fire and life history;
- set up permanent monitoring quadrats;
- further survey of the proposed nature reserve and other typical habitats in the Region.

REFERENCES

Bentham (1870); Rye and Hopper (1981).

Hydrocotyle lemnoides





Whole plant

Umbel with two flowers, young fruits and cluster of buds beneath

HYDROCOTYLE LEMNOIDES Benth.

Aquatic Pennywort

Hydrocotyle lemnoides, an aquatic plant, was described by Bentham in 1867 from a single collection made by Drummond. It has been recorded on several subsequent occasions from an area 30 km north of Perth. It is an annual herb with fine, thin, usually hairy stems and more or less rounded leaves (up to 0.5 cm in width) on slender stalks. The stipules are relatively large. Shortly stalked, apparently unisexual flowers, are in umbels of 3-6. Petals are mauve and up to 1 mm long. The broad and flattened fruits (ca. 1 mm long) are on distinct individual stalks and a larger common stalk. Flowers in September-October.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

H. lemnoides is found in shallow seasonal freshwater swamps in the Metropolitan and Northern Forest Regions. It is known from four localities between Bindoon and south-west of Beverley (100 km). It grows with stems rooted in the clay and leaves floating on the surface.

CONSERVATION STATUS

Endangered	Rare	In Need of Special Protection	√

A geographically restricted species known in the Northern Forest Region from a large population in a nature reserve south-west of Beverley and from State forest east of Bindoon. Two further populations, of several thousand individuals, occur in a nature reserve and proposed nature reserve in the Metropolitan Region. *H. lemnoides* was probably more widely distributed in areas now drained and cleared for urban development, but may still exist in unsurveyed swamplands in State forest of the Region.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent surveys	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
11/9/87	M	W of Beverley	nature reserve	1000 +	good
16/9/88	M	E of Bindoon	State forest	1000 +	good

Response to Fire - not known. Population regenerates each year from small seeds that may be destroyed by intense fire.

Response to Soil Disturbance - not applicable.

Susceptibility to Weed Invasion - not applicable.

Susceptibility to Phytophthora *Species* - not known.

Grazing Impact - not applicable.

Influence of Canopy Cover - not applicable.

MANAGEMENT REQUIREMENTS

- inspect population each winter;
- protect swamp from fire.

RESEARCH REQUIREMENTS

- survey seasonal wetlands in the Region to enable more accurate mapping of this species' distribution.
- conduct research on the impact of fire on population regeneration.

REFERENCES

Aston (1973); Bentham (1867); Rye and Hopper (1981).

LECHENAULTIA LARICINA Lindl.

Scarlet Lechenaultia

Lechenaultia laricina was described and named by Lindley in 1839 based on a collection of James Drummond's in 1837. It is an erect, much branched, bushy shrub with small, fine leaves 5-11 mm long. Leaves are densely crowded, terete and somewhat fleshy. The bark is rough except on new growth. Tubular flowers (19-23 mm long) are sessile in the upper leaf axils and cover the plant when in full flower. They vary from scarlet to orange-red, usually more orange in the centre. Petal lobes have broad wings with a small point between. The inside of the petals are hairy only at the base. Two of the petals are erect above the tube but not joined. The style is straight.

L. laricina can be distinguished from the closely related *L. hirsuta* by its glabrous habit, and from *L. superba* which has yellowish flowers, longer leaves and a more upright habit. In the past it has frequently been confused with other species, particularly *L. formosa*, and consequently was thought to be more abundant and widely distributed than it actually was. Flowering occurs from late October through to late December.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Apparently once common in the Region between Northam, Meckering and Meenaar, *L. laricina* is now known only in the Northern Forest Region with a range (55 km) extending from Spencers Brook to south-west of Beverley. It grows on sand or gravelly loam, usually in open eucalypt woodland (jarrah, marri, wandoo) over open scrub.

CONSERVATION STATUS

Endangered	√	Rare	√	In Need of Special Protection

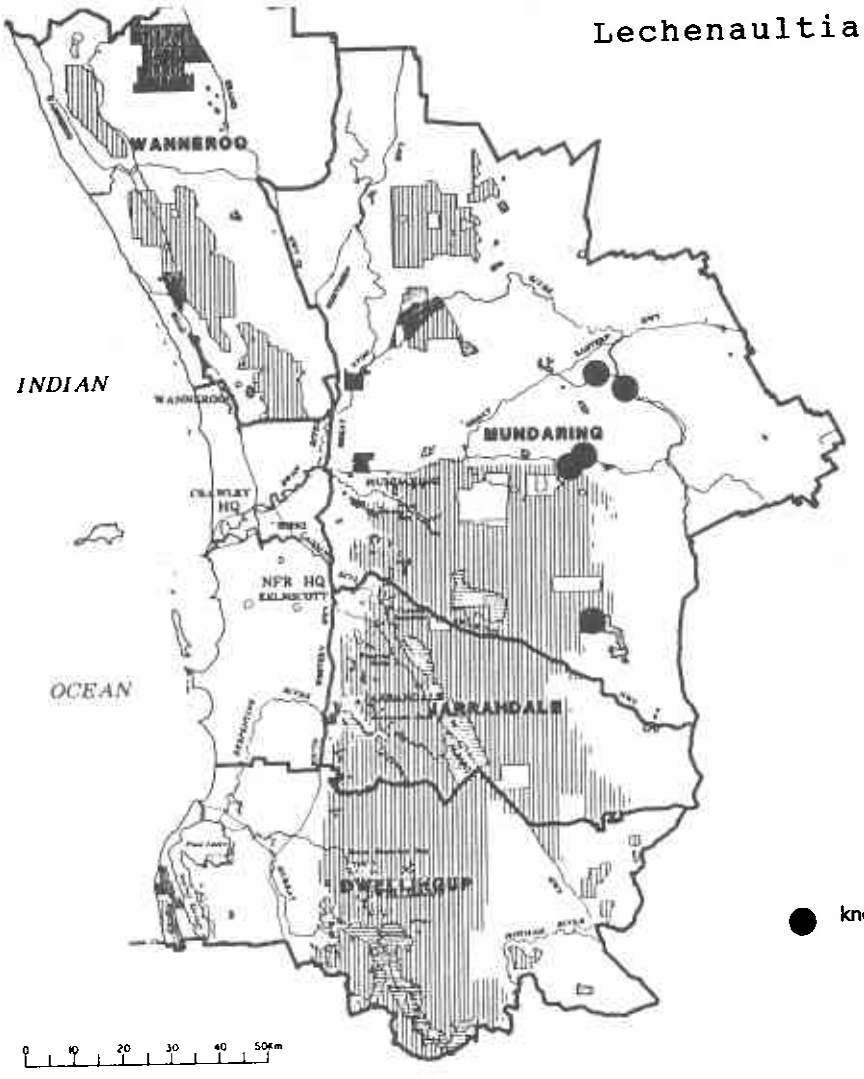
L. laricina is a geographically restricted species known from only a few hundred plants at five localities. It is poorly represented on conservation reserves, and at some sites is growing in weed-invaded areas where little, if any, natural vegetation remains. A population of some 34 individuals, in a nature reserve south-west of Beverley, is the only known occurrence in undisturbed habitat. Two large populations (100+ plants) are located on road verge and railway reserve where they are vulnerable to damage by road maintenance operations and frequent burning.

L. laricina is a pioneering species shaded out by dense vegetation. It may require regular disturbance or fire to open up areas and allow regeneration from rootstock and seed. Recent discovery of new populations indicates that the true distribution of this species is poorly recorded. *L. laricina* is well established in cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
5/6/86	M	W of York	nature reserve	1	?extinct
9/3/88	M	SW of Beverley	nature reserve	34	good

Lechenaultia laricina



Single fruit

Branch with crowded leaves and tubular flowers

Flower (side view)

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION (*continued*)

Other Lands					
9/3/88	M	W of York	road verge	100	good
9/3/88	M	Spencers Brook	shire reserve	20	poor
9/3/88	M	W of York	State forest	3	good
9/3/88	M	S of Northam	railway reserve	100	-

Response to Fire - regenerates from woody rootstock.

Response to Soil Disturbance - a pioneering species favouring disturbed sites.

Susceptibility to Weed Invasion - suppresses both young and mature plants.

Susceptibility to Phytophthora *Species* - not known.

Grazing Impact - not known.

Influence of Canopy Cover - shaded out by dense vegetation. Grows only in open areas.

MANAGEMENT REQUIREMENTS

- close liaison with shire and local authorities regarding protection of populations from verge burning, herbicide spraying and roadworks;
- inform operations staff of population locations;
- install rare flora marker pegs;
- do not disturb roadside plants;
- fence populations subject to grazing;
- control weed species;
- collect seed for storage and establish in conservation reserves;
- inspect populations annually;
- autumn burn at minimum of 12-yearly intervals pending research on fire and life history.

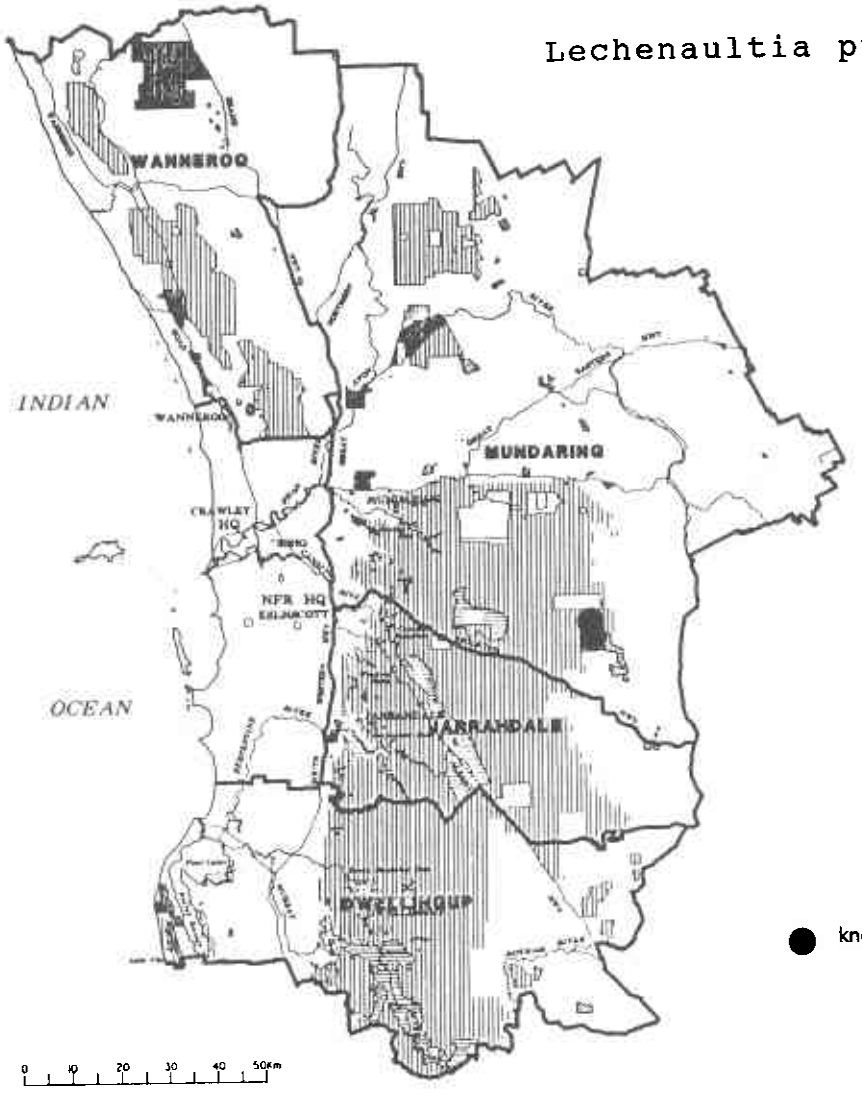
RESEARCH REQUIREMENTS

- further field surveys of typical habitats in the Region;
- set up permanent monitoring quadrats;
- research on fire and life history.

REFERENCES

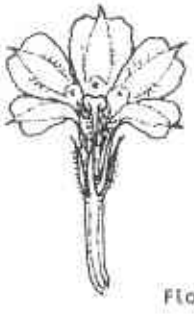
Bentham (1869); Blackall and Grieve (1974); Morrison (1987b).

Lechenaultia pulvinaris



Leaves and flowers clustered at the branchlet ends

Pointed, hairy leaf



Flower

LECHENAULTIA PULVINARIS C.A. Gardner

Cushion Lechenaultia

This prostrate sub-shrub was first collected by E.M. Cronin near Lake Lefroy in 1893. The specimen was sent to Ferdinand von Mueller in Melbourne who intended describing it as *Lechenaultia croniniana*. It remained undescribed when he died in 1896. In 1961, it was rediscovered south of Corrigin by Charles Gardner and subsequently described by him in 1964.

Its specific name refers to the characteristic pulvinate (cushion-like) growth habit. Fine, greyish green foliage forms low, rounded cushions up to 7 cm in height and 30 cm in diameter. Pointed, hairy, linear leaves (up to 1 cm in length) are densely clustered at the branchlet ends. The stems are often below ground. Flowers are sky blue or purple around the edge and pale yellow in the middle. They are solitary in the upper leaf axils and cover the plant when in full flower. Five petals, hairy on the inner side, form a tube 8 mm long, the lobes 3 mm long. Each lobe ends in a narrow point and has two broad wings on either side. Petals are not erect and the flowers, similar to those of *L. expansa*, are open along one side. Green sepals are narrow and hairy. The style has an enlarged pink stigma. When not in flower it resembles *L. tubiflora* which has a similar habit and scarlet or cream to yellow flowers. The fruit, an elongated capsule (4-5 mm in length) containing a few brown ridged seeds, remains hidden among the leaves. *L. pulvinaris* flowers from late October through to January.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

L. pulvinaris occurs at two disjunct localities over a total geographical range of 140 km, near Dumbleyung in the Wheatbelt Region and south-west of Beverley in the Northern Forest Region. It grows in deep white sand on level ground high in the landscape. In the Northern Forest Region it is located mainly along firebreaks, with some individuals found on bare ground below dense *Allocasuarina acuaria* thicket and in open scrub below *Banksia menziesii - Eucalyptus calophylla* open woodland.

CONSERVATION STATUS

Endangered	Rare	In Need of Special Protection √

It is difficult to assess the conservation status of this species as it appears to experience cycles of decline in the wild. In the Wickepin-Wagin-Dumbleyung area, an estimated 4400 plants had been recorded (since 1982) on nature reserves, private land and road verge over a 19 km range. Large populations had flourished in open areas created by a fire in 1980. Some of these populations have not been seen during recent surveys and once-large healthy populations have declined to a few individuals.

In the Northern Forest Region, two populations (8 km apart) occur in a nature reserve and adjoining State forest south-west of Beverley. The populations are concentrated along open sandy breaks, with fewer less-healthy individuals in adjacent bushland. Some plants are badly grazed and damaged by rabbit diggings. It is unlikely that *L. pulvinaris* is widespread in the reserve and State forest because of its preference for open disturbed sites. Field observations suggest that this species may be somewhat short-lived and might require periodic disturbance (fire or clearing) of the area. Whole plants have been successfully propagated but are difficult to maintain for extended periods. It is in general cultivation only to a very limited extent.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
25/3/87	M	SW of Beverley	nature reserve	100	mostly healthy
Other Lands					
25/3/87	M	SW of Beverley	State forest	Few (1000+ in Dec '86)	badly grazed and damaged

Response to Fire - appears to encourage regeneration from rootstock and seed.

Response to Soil Disturbance - a disturbance opportunist, growing on firebreaks, road verges and in open patches among low or dwarf scrub.

Susceptibility to Weed Invasion - suppresses growth and may eliminate this species from a site.

Susceptibility to Phytophthora *Species* - not known.

Grazing Impact - heavy grazing (kangaroos, rabbits) evident at some localities.

Influence of Canopy Cover - becomes shaded out by dense vegetation and does not grow near tree species.

MANAGEMENT REQUIREMENTS

- install rare flora marker pegs;
- grade firebreaks at no less than five-yearly intervals;
- collect seed for storage;
- maintain in cultivation;
- autumn burn at minimum of 12-yearly intervals, pending research on response to fire;
- inspect populations annually.

RESEARCH REQUIREMENTS

- set up permanent monitoring quadrats;
- conduct research on fire and life history;
- further survey of habitats that might support this species.

REFERENCES

Gardner (1964); Morrison (1987a); Morrison (1987b); Patrick (1983).

PTYCHOSEMA PUSILLUM Benth. ex Lindl.

Dwarf Pea

P. pusillumis, commonly known as the Dwarf Pea, is the only Western Australian representative in this genus. It was first collected by Drummond in the early 1800s and described by Bentham in Lindley's 'A sketch of the Vegetation of the Swan River Colony' (1839-40). Further collections were made in 1902 and 1913 but it was not collected again until 1971. Despite periodic surveys of the locality, this inconspicuous and elusive species was not relocated until 1986.

Ptychosema pusillum is an erect, slightly hairy, herb-like plant growing to 10 cm high. Its pinnate leaves have 5-11 narrow obovate leaflets, 2-10 mm long and 1-2 mm wide. The rather large (ca. 1.5 cm long) typical pea flowers, deep red to brownish and yellow in colour, are borne singly on long stalks at the ends of the stems and branches. They resemble those of the Lamb Poison, *Isotropis cuneifolia*. The fruit is a flattened, dry pod which splits down both sides to release a few hard seeds. Flowers in October-November.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Confined to the Northern Forest Region and known from a single locality north-east of Gingin. It grows among low scrub and a variety of herbs in *Banksia-Eucalyptus* woodland (*B. attenuata, B. menziesii, B. grandis, E. todtiana, E. marginata*) adjoining a paperbark swamp.

CONSERVATION STATUS

Endangered	√	Rare	√	In Need of Special Protection

This very rare species is scattered over a small area of uncleared woodland on private property adjacent to a proposed nature reserve near Gingin. About 70 'leaf clumps' were counted when last seen in 1986. No use of the land is planned in the forseeable future and the property managers are prepared to protect the vegetation from grazing and clearing. This species, like many other legumes, has proved difficult to propagate (by cutting or tissue culture) and no free-growing plants have been successfully cultivated.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Other Lands					
3/11/86	W	NE of Gingin	private	70 'leaf clumps'	good

Response to Fire - not known.

Response to Soil Disturbance - not known.

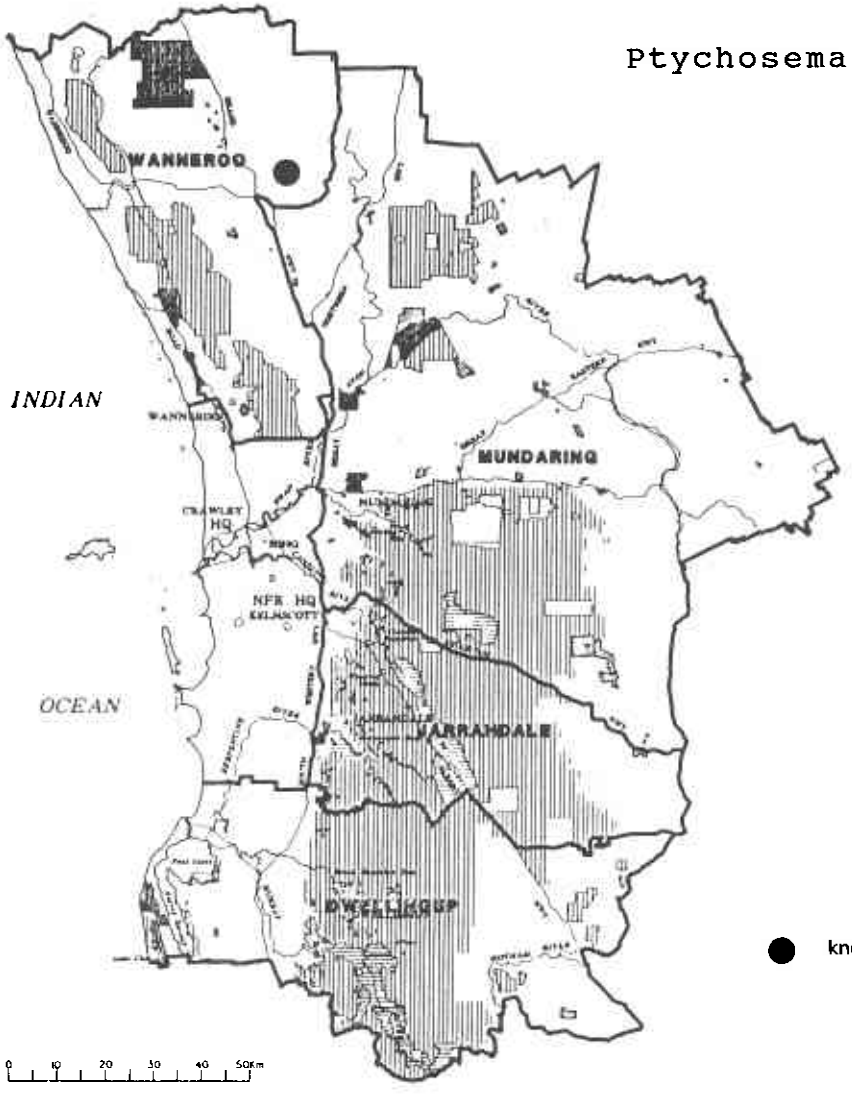
Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *Species* - not known.

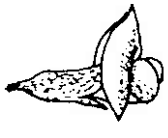
Grazing Impact - not known.

Influence of Canopy Cover - not known.

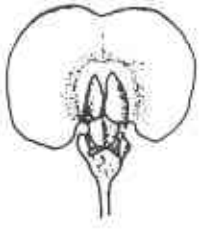
Ptychosema pusillum



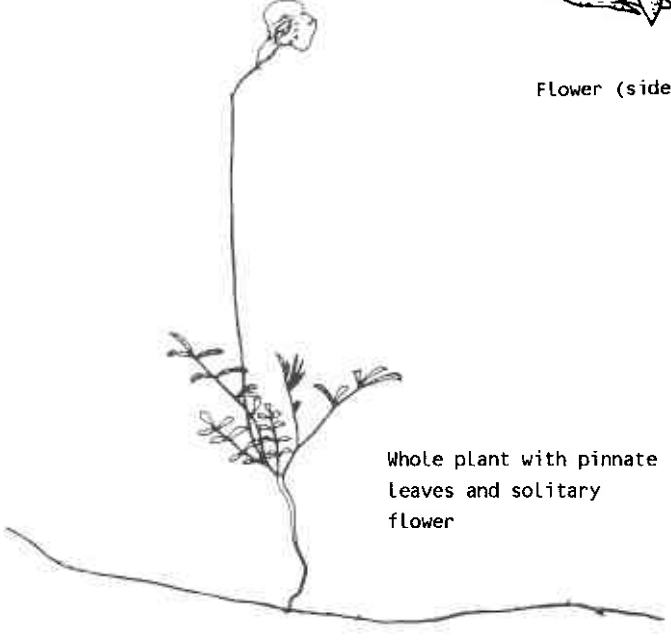
● known population



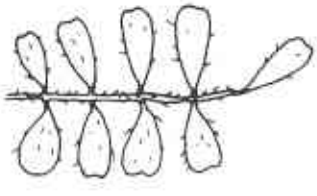
Flower (side view)



Flower (front view)



Whole plant with pinnate leaves and solitary flower



Pinnate leaf with narrow obovate leaflets

MANAGEMENT REQUIREMENTS

- close association with property owners/managers to ensure protection of populations from clearing and grazing;
- exclude fire;
- collect seed for storage and maintain in cultivation once propagation techniques have been developed;
- acquisition of land as a nature reserve should be given high priority;
- establish in a suitable habitat in a conservation reserve;
- monitor populations annually.

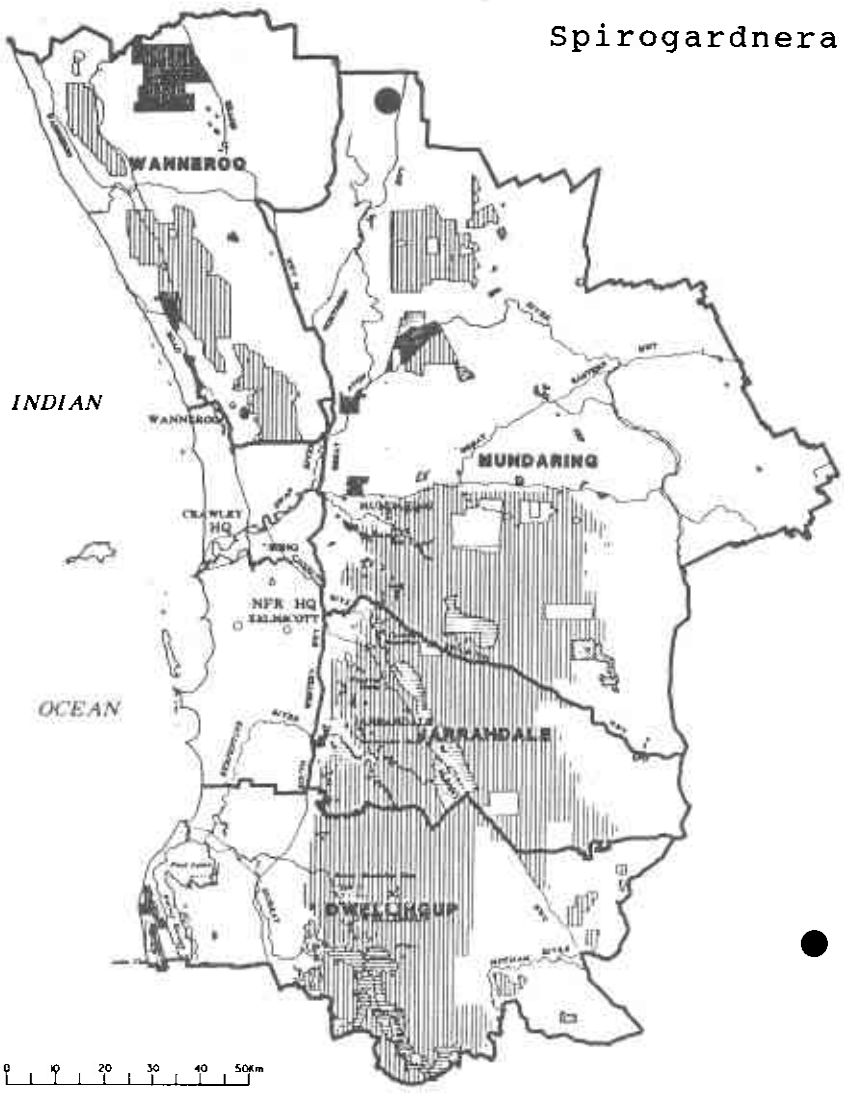
RESEARCH REQUIREMENTS

- undertake a thorough search of habitats likely to support this species;
- develop propagation techniques;
- research on fire and life history.

REFERENCES

Bentham (1864); Lee (1973); Millar (1982); Rye and Hopper (1981).

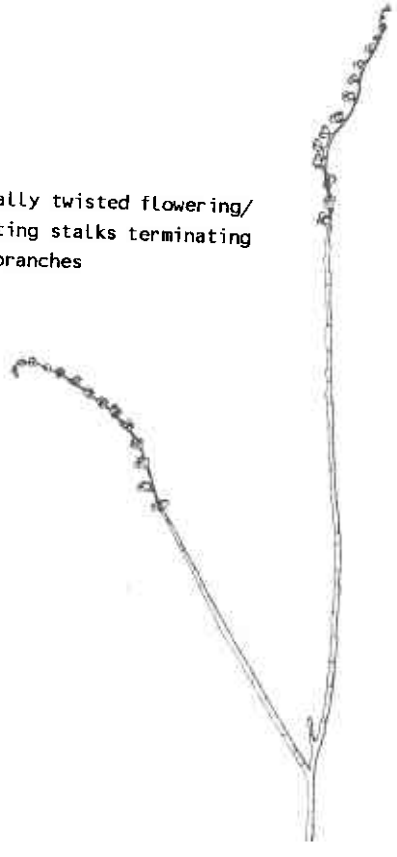
Spirogardnera rubescens



● possible location

Open flower and bud
(viewed from above)

Spirally twisted flowering/
fruiting stalks terminating
the branches



Sessile fruit

SPIROGARDNERA RUBESCENS Stauffer

Spiral Bush

A member of the family Santalaceae and the only species in the genus. Named in honour of Charles Gardner who discovered it near Wannamal in 1962. It is an erect, spindly, semi-parasitic shrub to 1.6 m, with no leaves and only a few reddish tinted bracts persisting at the base of the inflorescence. Branches and branchlets are cylindrical and hairless. Tiny flowers (ca. 0.2 cm long), in sessile clusters of 3 or 4, are arranged along the characteristic spirally twisted flowering stalk. The stalks are succulent, brown-green in colour and up to 5 cm long. Flowers are white outside and yellow-green with fine hairs inside, becoming red towards the end of flowering. The succulent, yellow-green fruit is stalkless and surrounded by the persistent, reddish purple perianth segments. Flowers from August-November.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Spirogardnera rubescens was originally collected east of Wannamal in sclerophyll forest of *Eucalyptus wandoo* with *Santalum acuminatum* on lateritic granitic soil. It is now known only from the Greenough Region between Badgingarra, Coorow and Eneabba.

CONSERVATION STATUS

Endangered	Rare	√	In Need of Special Protection

This species is relatively abundant (about 500 plants in 6 populations) in patches of roadside vegetation in cleared farmland of the Greenough Region. Small populations have also been reported from two national parks in the district. Apparently requiring moderately fertile soils, it has suffered seriously from land clearing throughout its range. *S. rubescens* is unknown in cultivation and like other semi-parasites may prove very difficult to propagate.

Response to Fire - appears to be killed by fire.

Response to Soil Disturbance - not known.

Susceptibility to Weed Invasion - not known.

Susceptibility to Phytophthora *species* - not known.

Grazing Impact - not known.

Influence of Canopy Cover - not known.

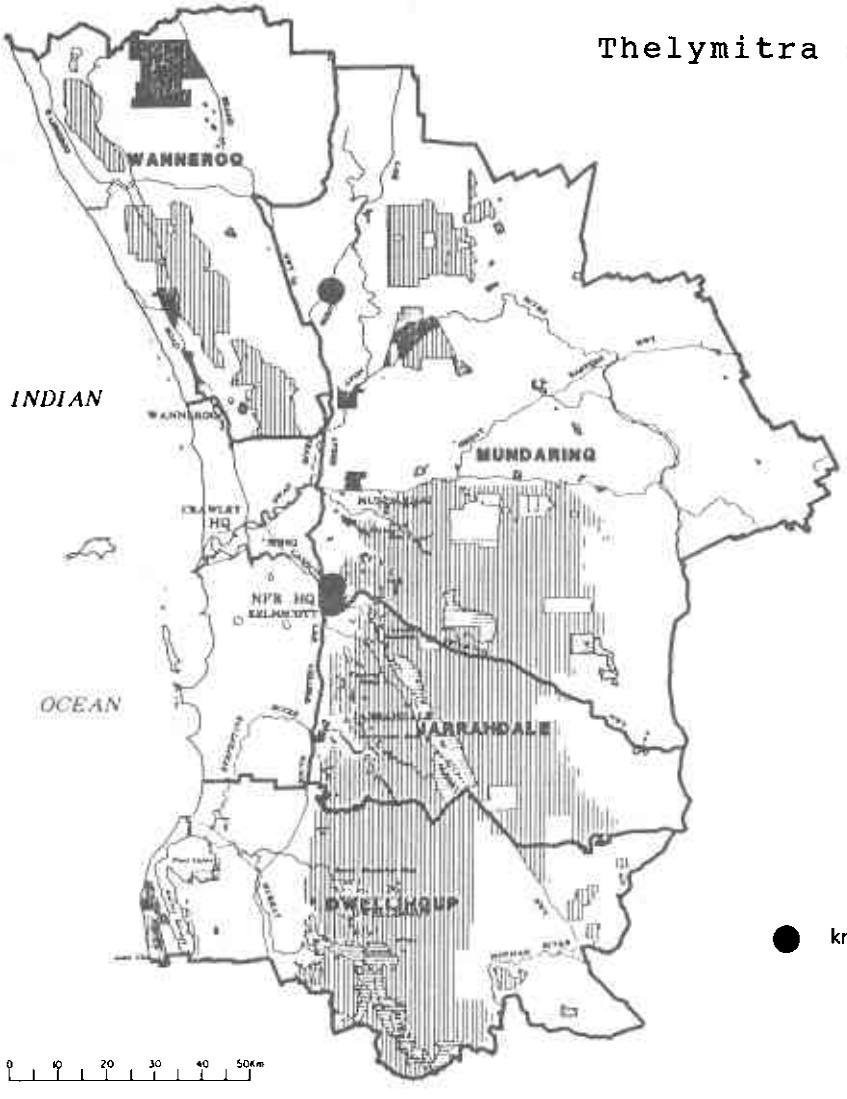
MANAGEMENT REQUIREMENTS

- survey type locality and similar habitats to locate and appropriately protect any surviving populations in the Region;
- notify CALM staff, shire and local authorities as required.

REFERENCES

Leigh, Boden and Briggs (1984); Rye and Hopper (1981); Stauffer (1968).

Thelymitra stellata



Broad lily-like leaf

Star-like flowers
on robust stem

THELYMITRA STELLATA Lindl.

Star Orchid

This attractive orchid with conspicuous star-like flowers was described and named as *Thelymitra stellata* by Lindley in 1840 from a Drummond collection. It is very similar to the leopard orchid, *T. fuscolutea*, and was reduced to a variety of this species in 1971. It has recently been recognized as a distinct species.

Unlike most orchids, species in this genus have symmetrical flowers with similar sepals and petals and a simple, unmodified labellum. *T. stellata* has as many as six flowers (2.5 - 3 cm in diameter) on a robust stem growing to 50 cm in height. They are predominantly golden-brown in colour, sometimes yellow with orange stripes on the sepals and petals. The column hood is deeply fringed on either side and usually bright orange in colour. The central portion is woolly with dense papillate glands. A single, broad, lily-like leaf, up to 9 cm long and 4 cm wide, clasps the stem at the base.

T. stellata can be distinguished from the widespread leopard orchid by its smaller leaf and flowers, and less blotched more uniformly golden-brown sepals and petals. It flowers in October-November, with the leaf usually shrivelled by the time of flowering. The stem dies back below ground level after seed set. Flowers remain closed during cool overcast weather and are probably pollinated by pseudocopulating beetles as observed in *T. fuscolutea*.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Recorded from the Greenough, Northern Forest, Central Forest and Southern Forest Regions with a geographical range (ca. 570 km) extending from Eneabba and Mt Lesueur in the north, along the Darling Range south to near Walpole. In the Northern Forest Region, populations located at Chittering, Armadale and Gosnells grow among low scrub in open *Eucalyptus* woodland (jarrah, marri, wandoo) on sandy or gravelly soils over laterite.

CONSERVATION STATUS

Endangered	Rare ✓	In Need of Special Protection

T. stellata is a widespread species known from numerous small populations, none of which occur on conservation reserves. Populations in the Northern Forest Region are confined to road verge, private and shire land where they are vulnerable to damage by road maintenance operations and indiscriminate burning. This species is probably more abundant throughout its range, particularly in vast areas of unsurveyed vegetation on lateritic breakaways in the Eneabba-Mt Lesueur region. *T. stellata* can be propagated easily but is not in general cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Other lands					
20/10/83	M	Chittering	road verge - shire	9	-

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION (*continued*)

5/11/87	M	Armadale	parklands - shire	12
*	M	Gosnells	wildflower sanctuary - shire	
*	M	Gosnells	private	

*unsurveyed localities

Response to Fire - killed if burnt when above-ground parts are present (August-December).

Response to Soil Disturbance - not known.

Susceptibility to Weed Invasion - suppresses growth.

Susceptibility to Phytophthora *Species* - not known.

Grazing Impact - a succulent plant susceptible to grazing.

Influence of Canopy Cover - not known.

MANAGEMENT REQUIREMENTS

- close liaison with shire and private landowners;
- install rare flora marker pegs;
- do not disturb roadside plants;
- inspect populations annually;
- collect seed for storage;
- establish in cultivation;
- do not burn from August to December.

RESEARCH REQUIREMENTS

- further survey of suitable habitats in the Region;
- conduct research on pollination biology.

REFERENCES

Bentham (1873); Erickson (1968); George (1971); Patrick and Hopper (1982).

THOMASIA SP. (York) A.S. George 8075

This undescribed species, with a close affinity to *Thomasia montana*, is an upright shrub to 1 m, with ovate or broadly oblong leaves up to 2.5 cm long and 1 cm wide. Brownish, stellate hairs cover the stems, petioles and blunt tipped leaves. The flowers, in long axillary racemes, have a conspicuous purplish pink, cup-shaped calyx about 1.5 cm in diameter. Divided into five lobes and clothed in hairs it surrounds the minute, glabrous, darkly coloured petals and fused stamens. Petals are spatulate in shape and appressed against the calyx. The fruit is a three-chambered capsule with several seeds. Flowering occurs from mid-September to late October.

This species has often been mistaken as *T. montana* which once grew in the York vicinity but is now known only in the Wheatbelt Region. *T. montana* can be distinguished by its semi-erect, ovoid petals with hairy margins and a more cupped calyx with deeply divided lobes.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

Confined to the Northern Forest Region, this species occurs over a 10 km range in remnants of natural bushland east of York. Growing on level ground, it forms part of the open scrub layer in *Eucalyptus wandoo* woodlands on deep yellow sand over gravel. It is often found growing in a circle about 1 m from the base of a wandoo. Associated species include *Allocasuarina huegeliana, Grevillea vestita, Dryandra frazeri, Bossiaea rufa* var. *foliosa* and *Hibbertia huegelii*.

CONSERVATION STATUS

Endangered	Rare ✓	In Need of Special Protection

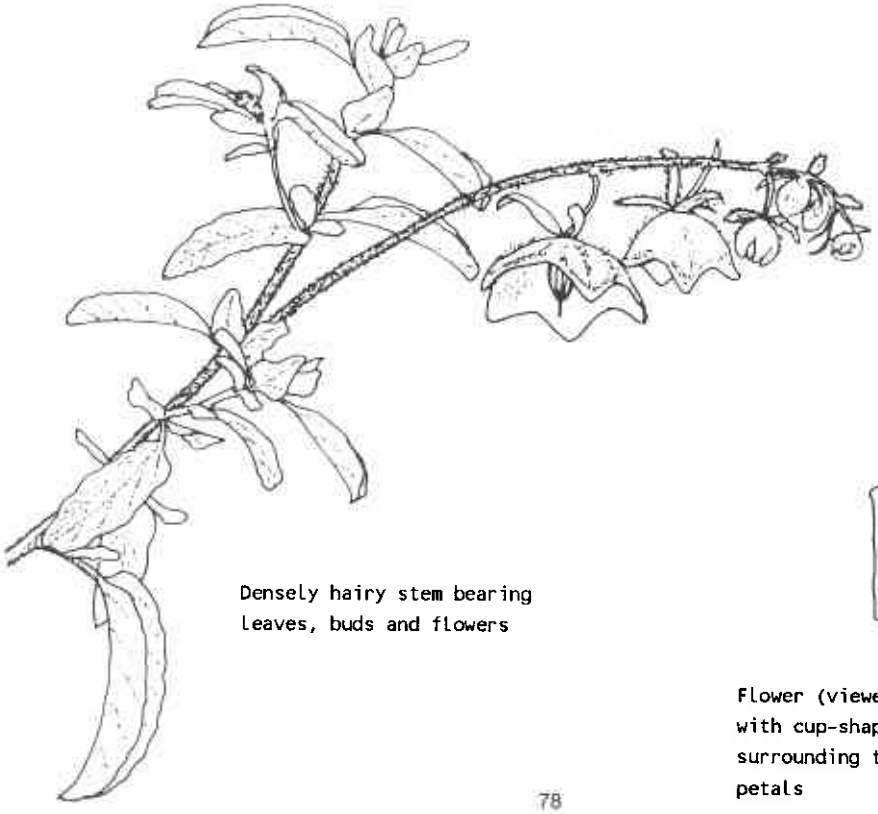
A rare species known from five localities over a very restricted range. The largest and healthiest population occurs on a shire gravel reserve considerably degraded in the past by gravel extraction, rubbish dumping, vehicle access and weed invasion. A smaller and less vigorous population occurs on an extensively weed-invaded and rabbit-infested nature reserve. Continued sand removal, wood collecting and rubbish dumping by the public endangers existing plants. Three small populations are found on narrow weed-invaded road verges adjacent to cultivated or grazed land. Some plants are under immediate threat by road maintenance operations. Long-term survival of roadside populations is unlikely unless active conservation measures are taken. This species is unknown in cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
10/9/85	M	E of York	nature reserve	550	poor
Other Lands					
10/9/85	M	E of York	gravel reserve - shire	1000	healthy - some weed invasion
10/9/85	M	E of York	road verge (3 populations)	44	weed invaded

Thomasia sp.(York)

● known population



Densely hairy stem bearing leaves, buds and flowers

Flower (viewed from beneath) with cup-shaped calyx surrounding the minute petals

Response to Fire - not known.

Response to Soil Disturbance - does not favour disturbed sites.

Susceptibility to Weed Invasion - seed germination and seedling growth appears to be inhibited by weeds.

Susceptibility to Phytophthora *Species* - not known. Members of this genus are generally tolerant.

Grazing Impact - not known.

Influence of Canopy Cover - healthiest plants are found in open areas.

MANAGEMENT REQUIREMENTS

- close liaison with shire regarding protection and management of populations under their control;
- limit public access to reserves and rehabilitate disturbed areas;
- install rare flora marker pegs;
- control rabbit grazing and weed invasion;
- collect seed for storage;
- establish in cultivation;
- autumn burn at minimum of 12-yearly intervals;
- inspect populations annually;
- acquisition of the reserve once gravel supplies have been depleted would be valuable.

RESEARCH REQUIREMENTS

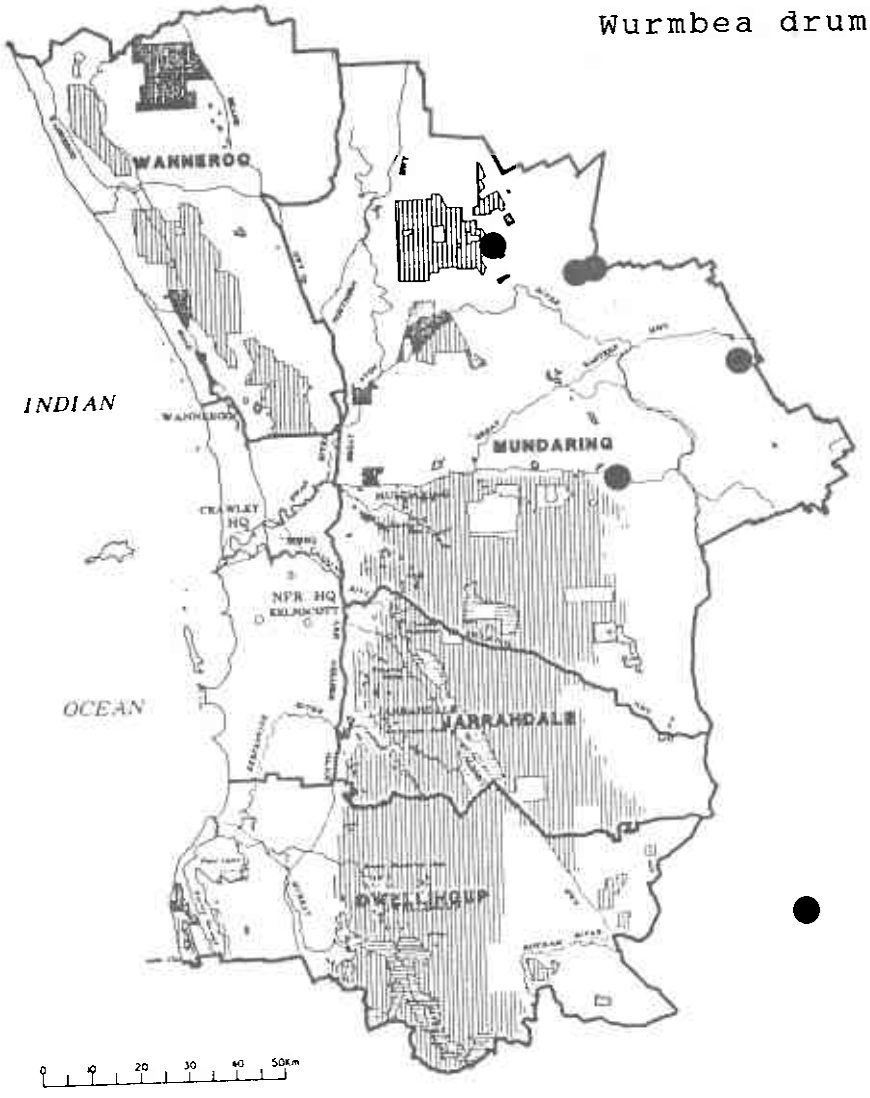
- conduct research on fire and life history;
- set-up permanent monitoring quadrats;
- further survey of suitable habitats in the Region.

REFERENCES

Hopper[3] (personal communication); Patrick (1984).

3 S.D. Hopper, Department of Conservation and Land Management, Wildlife Research Centre.

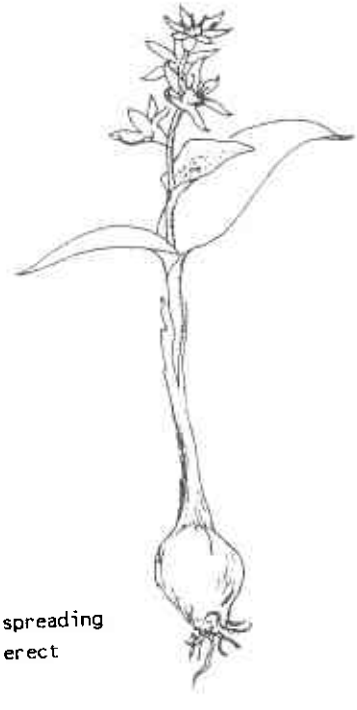
Wurmbea drummondii



known population

Male flower

Female flower



Whole plant with spreading basal leaves and erect upper leaf

WURMBEA DRUMMONDII Benth.

Wurmbea drummondii was first collected by Drummond and named in his honour by Bentham in 1878. It is a small herb up to 5 cm tall, with two ovate to broadly lanceolate (up to 1.4 cm wide) basal leaves spreading flat on the ground. An upper leaf, distant from the lower two, is shorter, sharply pointed and erect. Flowers 2-10 small, white or yellowish-white are borne in a dense or open spike. Perianth segments, rounded at the apex, are rather spreading. Segments are about 7 mm long and joined into a cup-shaped tube from quarter to half their length. Flowers are of one sex or both, as are the plants. The ellipsoidal corm (1-1.5 cm long) is 3-4 cm below the surface. Resembling *W. pygmaea*, it can be distinguished by its shorter and broader leaves, more spreading perianth segments and more numerous flowers on a stouter inflorescence axis. *W. drummondii* flowers in June-July with the above-ground portion of the plant dying off until the following flowering period.

DISTRIBUTION AND HABITAT IN THE NORTHERN FOREST REGION

A widely distributed species occurring in the Greenough, Northern Forest and Central Forest Regions. Its range of some 330 km extends from north of Moora to south of Tincurrin. In the Northern Forest Region it is most commonly found growing in *Eucalyptus loxophleba* (York gum) and *Acacia acuminata* (jam) woodland on clay or loamy soils.

CONSERVATION STATUS

Endangered	Rare ✓	In Need of Special Protection

W. drummondii is known from nine small populations scattered over a wide geographical range. Favouring rich fertile soils, it is found in remnants of natural vegetation in areas extensively cleared for farming. It is represented on five nature reserves, three occurring within the Northern Forest Region. Two additional populations have been located on private land and in road verge vegetation in this Region. *W. drummondii* has proved to be an elusive species and has not been seen at some sites during recent surveys. Weed incursion may have eliminated it from some of the known localities. This species can be propagated easily from seed but is not in general cultivation.

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION

Date of most recent survey	District	Population	Land Status	No. of plants	Condition
Conservation Reserves					
1/6/84	M	S of Meenaar	nature reserve	100	some weed invasion
	M	NE of Toodyay	nature reserve		weed invaded
29/7/85	M	W of York	nature reserve	20	some weed invasion

POPULATIONS KNOWN IN THE NORTHERN FOREST REGION (*continued*)

Other Lands					
4/7/82	M	NW of Dewars Pool	road verge	few	weed invaded and frequent fires
13/7/84	M	NE of Toodyay	private	20	good

Response to Fire - emerges and flowers during winter while remaining dormant for most of the year.

Response to Soil Disturbance - not known.

Susceptibility to Weed Invasion - growth suppressed owing to small size and susceptibility to shading of ground-level leaves.

Susceptibility to Phytophthora *Species* - not known.

Grazing Impact - a succulent plant probably grazed.

Influence of Canopy Cover - not known.

MANAGEMENT REQUIREMENTS

- conduct surveys of known localities to determine abundance and identify factors threatening population survival;
- close liaison with landowners and local authorities to ensure protection of populations;
- inform operations staff of population locations;
- control invading weeds;
- conduct operations under dieback hygiene conditions;
- inspect populations annually;
- spring - early autumn burn at minimum of 12-yearly intervals.

RESEARCH REQUIREMENTS

- further survey of typical habitats in the Region.

REFERENCES

Bentham (1878); Macfarlane (1980).

PART THREE: OTHER SPECIES OF IMPORTANCE IN THE NORTHERN FOREST REGION

In addition to the 24 Declared Rare Flora, a number of other species of importance occur (or have occurred) within the Northern Forest Region. The 145 plants in need of special protection are divided into the following categories:

- Presumed Extinct Species
- Poorly Known Species
  - Priority One
  - Priority Two
  - Priority Three
- Species Requiring Monitoring
- Species with Significant Outlying Populations in the Region
- Geographically Restricted Species
  - Endemic to the Region

    range less than 50 km

    range between 50 and 160 km
  - Not endemic to the Region

    range less than 50 km

    range between 50 and 160 km

Taxa once known to exist in the area but now presumed to be extinct are listed in Table 1. Plants in this category have not been collected or reliably observed over the past 50 years, or the total known wild populations have been destroyed more recently. The majority of these species are known from one or a few collections made by early botanical explorers who provided poor locality details. It is likely that many of the presumed extinct species were located in areas now cleared for agricultural, industrial and urban development. Some species, however, may have escaped recent attention because of their small size and inconspicuous habit. They may, during the course of further field surveys, be rediscovered. Illustrations of some of the presumed extinct species are included in a book on Western Australia's Endangered Flora (Hopper, van Leeuwen, Brown and Patrick, 1990). Thorough survey of likely habitats is required.

Poorly known taxa considered for declaration as Rare Flora but in need of urgent further survey are listed in Table 2. These species fall into one of three categories according to their degree of threat:

- Priority One species - known from one or a few localities on lands under threat (e.g. road verges, urban areas, active mineral leases).
- Priority Two species - known from one or a few localities on land not under immediate threat.
- Priority Three species - known from several localities, some of which are on lands not under immediate threat.

Poorly known species do not meet the survey requirements for gazettal as Rare Flora (Appendix III). Some taxa may prove to be abundant and widespread when more thoroughly documented. If, after adequate survey, the species prove to be truly rare, endangered or in need of special protection they may be added to the Rare Flora schedule. Extensive survey of likely habitats in the wild is required to determine their

Table 1. PRESUMED EXTINCT SPECIES OF THE NORTHERN FOREST REGION

Species	District	Previously Recorded Locations	Flowering
Calocephalus globosus	M	Kauring	-
Centrolepis caespitosa	D	Byford	Nov
Comesperma xanthocarpum		Perth	Dec
Frankenia conferta	M	E of York	-
Glyceria drummondii	M,W	?Gingin	-
Hemigenia obtusa		?Observatory Hill	-
Lepidium drummondii		'Swan River' (Darling district	-
Lepyrodia heleocharoides	M	Parkerville	Dec
Tetraria australiensis	J	Serpentine	Dec

D = Dwellingup, J = Jarrahdale, M = Mundaring, W = Wanneroo.

conservation status and enable appropriate legislative protection where necessary. All populations of species listed as poorly known should be protected from accidental damage or destruction.

Table 3 lists those species within the Region requiring further monitoring. These taxa have been adequately surveyed, many are represented on conservation reserves and are not presently endangered or in need of special protection. Their status may change, however, if present circumstances alter (e.g. land clearing, dieback infection). They may go onto (or back onto) the Rare Flora schedule in the future. These species should be monitored during routine operations.

Species with disjunct outlying populations in the Region are listed in Table 4. Populations occurring outside the species' normal range often have unusual genotypes and should be protected in an effort to maximise the genetic resources within the species.

Endemic and non-endemic species to the Region occurring over a restricted geographical range are recorded in Table 5. Two categories of geographical restriction are recognized - those species occurring over a range of less than 50 km and those known from ranges between 50 and 160 km. The list was based on that compiled by Rye (1982) for the south-western flora and supplemented by information from additional literature (Barrett 1982; Gillen 1982; Patrick 1985; Marchant *et al.* 1987) and Departmental records. Limited time prevented a more thorough search being undertaken for geographically restricted species.

Some geographically restricted species, with ranges partly or entirely within the Region, have undoubtedly been omitted. Species now geographically restricted may have escaped attention because they have been recorded over a wider range in the past. Distributions indicated in the table may exceed the present range, as some recorded populations may have become extinct. Some species may be more widespread than is indicated owing to further more recent discoveries outside the listed range. Geographically restricted species are the lowest priority with respect to conservation action considered herein, but deserve some special attention.

Table 2. POORLY KNOW SPECIES IN THE NORTHERN FOREST REGION CONSIDERED FOR DECLARATION BUT IN NEED OF URGENT FURTHER SURVEY.

Species	District	Distribution in the Northern Forest Region	Flowering
Priority One Species			
Only known from one or a few localities on lands under threat e.g., road verges, urban areas, active mineral leases etc.			
Acacia anarthros	M	E of Wannamal	May-Jun
Anthocercis gracilis	M,D	Mundaring, North Dandalup	Sep-Oct,Apr
Asteridea gracilis	M	Gosnells, Helena Valley	Sep-Oct
Diplolaena andrewsii	M	Swan View	Jul-Oct
Gastrolobium epacridoides	M	Darling Scarp	Sep
Gonocarpus pithyoides	W	Yanchep	Oct-Nov
Hemiandra linearis	M	Chidlow	
Platysace eatoniae	M	W of York	-
Stylidium utricularioides	M,J	Bullsbrook, Death Adder Creek	Oct-Dec
Thelymitra benthamiana	M	Gidgegannup	Oct-Nov
Thysanotus fastigiatus	M	Kalamunda, Roleystone	May-Nov
Haloragis tenuifolia	M	Wooroloo, Midland	Nov-Dec
Priority Two Species			
Known from one or a few localities on land not under immediate threat.			
Acacia aff. *congesta*	M	SW of York	
Acacia subflexuosa	M,J,D	Bullsbrook, Jarrahdale, Wandering	Aug-Jan
Astroloma foliosum	M	Ellis Brook-Lesmurdie Falls	Jun-Sep
Calothamnus graniticus subsp. *leptophyllus*	D	Oakley Dam	Jun-Aug
Calytrix sylvana	M	New Norcia - Bindoon	Aug-Oct
Darwinia pimelioides	M	Glen Forrest, Bullsbrook	Oct
Darwinia aff. *thymoides*	M	W of York	Oct-Nov
Eremaea aff. *pauciflora*	M	Clackline	Spring
Grevillea uniculata subsp. *florida*	M	N Bindoon	-
Helipterum pyrethrum	M	Bullsbrook	Oct-Nov
Lasiopetalum cardiophyllum	D	Bannister	Nov
Parsonsia diaphanophleba	D,J	Murray River, Serpentine River, Coolup	Jan-Feb, May-Jun
Pimelia rara	M	Mundaring	Dec-Feb

Table 2 (*continued*)

Species	District	Distribution in the Northern Forest Region	Flowering
Pithocarpa achilleoides	M	Wooroloo, Bindoon	Jan-Apr
Table 2 (*continued*)			
Platysace cirrosa	M	W of York	-
Stylidium aff. *repens*	J	Canning Dam	Dec
Stylidium rigidifolium	M	Gooseberry Hill, Pickering Brook	Oct-Nov
Tetratheca similis	M	Bindoon, Mt Dale area	Aug-Sep
Thysanotus arbuscula	M	Forrestfield, Helena Valley	Nov-Dec
Trymalium urceolare	M	Bindoon-Toodyay	Sep-Oct
Verrauxia verreauxii	M	SW of Beverley	Dec-Jan
Priority Three Species			
Known from several localities, some of which are on lands not under immediate threat.			
Aotus cordifolia	M	Red Hill, Gidgegannup, Helena Valley, Byford	Aug-Dec
Dryandra polycephala	M	Bindoon, Chittering Valley	Jul-Oct
Eucalyptus foecunda	D,W	Lancelin-Lake Preston	Jan-Mar
Jacksonia sericea	D	Perth-Pinjarra	Jan-Feb
Lasiopetalum glabratum	M,J	York, Carmel, Serpentine	Nov
Persoonia sulcata	M	Glen Forrest, NE of Toodyay	-
Restio stenostachyus	W,M	Gingin-Perth	Feb-May
Scholtzia eatoniana	M	York	Nov-Dec
Senecio gilbertii	M	Bindoon, York	Sep-Nov
Tetratheca pilifera	M,W	Two Rocks, Chidlow	Aug-Sep

D = Dwellingup, J = Jarrahdale, M = Mundaring, W = Wanneroo.

Table 3. SPECIES IN THE NORTHERN FOREST REGION REQUIRING MONITORING

Species	District	Known Locations	Flowering
Banksia chamaephyton	W	Boonanarring Hill-Eneabba	Oct-Dec
Boronia tenuis	M,J,D	Helena Valley-Wagerup	Aug-Sep
Caladenia gemmata var. *ixioides*	M	Bindoon - Mt Observation	Sep-Oct
Calothamnus rupestris	M	Red Hill-Boyagin Rock	Jul-Nov
Eucalyptus exilis	M	Eneabba-Mundaring-Wickepin	Sep-Oct
Grevillea drummondii subsp. *drummondii*	M	Bolgart-Bindoon	Jun-Oct
Grevillea drummondii subsp. *pimelioides*	M,J	Helena Valley, Canning Rv	Jun-Oct
Hemigenia platyphylla	M	York	Sep-Oct
Hibbertia miniata	M,W	Bindoon-Moora	Jul-Oct
Lasiopetalum bracteatum	M	Mundaring-Kalamunda	Oct-Nov
Stachystemon axillaris	W	Wanneroo-Eneabba	Feb-Mar, Jun-Sep
Synaphaea pinnata	M	Millendon-Gosnells	Sep-Oct

D = Dwellingup, J = Jarrahdale, M = Mundaring, W = Wanneroo.

Table 4. SPECIES WITH SIGNIFICANT OUTLYING POPULATIONS IN THE NORTHERN FOREST REGION

Species	District	Outlying populations	Flowering
Acacia chrysocephala	M	W of York	May-Aug
Caladenia triangularis	M	Clackline	Sep-Oct
Callistachys lanceolata	M	Helena Valley	Sep-Dec
Choretrum glomeratum var. *chrysanthum*	M	E of Northam	
Eucalyptus decurva	M,J,D	E of Mt Cooke, W of York, W of Beverley, W of Brookton, Mt Dale, S of Boddington	May-Sep
Eucalyptus aff. *flocktoniae*	M	E of Wannamal	
Lomandra nutans	M	W of York, Clackline	Sep-Oct

D = Dwellingup, J = Jarrahdale, M = Mundaring, W = Wanneroo.

Table 5. GEOGRAPHICALLY RESTRICTED SPECIES OF THE NORTHERN FOREST REGION

Species	District	Geographical Range	Distance (km)	Flowering
1. Species Endemic to the Region				
(i) Geographical range less than 50 km				
Baeckea sp. A[a]	M	Chittering Valley		Dec
Baeckea sp. B[a]	M	Darling Scarp and Range		Jul-Aug, Dec-Jan
Billardiera drummondiana var. *collina*	M	Mundaring-Gooseberry Hill	15	Aug-Oct
Billardiera parviflora var. *guttata*	M,J	Armadale-Serpentine	25	Mar-Aug
Darwinia sp. A[b]	M	Muchea		Oct-Dec
Goodenia arthrotricha	M	Wannamal		Nov-Dec
Grevillea ornithopoda	J,D	Jarrahdale-Pinjarra	35	Sep-Oct
Grevillea candolleana	M	Toodyay	20	Aug-Sep
Hakea cristata	M	Smiths Mill-Helena Valley	35	May-Sep
Halgania corymbosa	M	Smiths Mill-Gosnells	50	Aug-Nov
Isopogon scaber	M,J	Jarrahdale-Brookton Hwy	30	Sep-Oct
Lepyrodia heleocharoides	M	Helena Valley		Dec
Leucopogon aff. *polymorphus*	M	Bindoon-Chittering Valley	20	Jul,Oct
Scaevola aff. *helmsii*	M,D	Brookton Hwy		Nov-Jan
Schoenus capillifolius	M	Upper Swan		?Nov
Trymalium angustifolium	M	Muchea-Helena Valley	45	May-Jun
*Wahlenbergia stricta***	J	Mt Cooke Area		Nov
(ii) Geographical range between 50 km and 160 km				
Acacia horridula	M,J	Helena Valley-Serpentine	60	May-Aug
Beaufortia purpurea	M	Red Hill-Gooseberry Hill	65	Oct-Jan
Conostylis setosa	M,J,D	Bindoon-Dwellingup	150	Oct-Nov
Dryandra praemorsa	M,J,D	Clackline-Dwellingup	120	Jul-Oct
Eremaea purpurea	M,W	Wanneroo-Mooliabeenee	55	Oct-Feb
Grevillea glabrata	M,J,D	Wooroloo-North Bannister	85	Jul-Oct
Grevillea scabra	M	Bolgart - SW of York		Oct
Hemigenia sericea var. *parviflora*	M,J,D	Perth-Dwellingup	85	Aug-Nov
Hibbertia nymphaea	M	Helena Rv-Serpentine Rv	65	Aug-Dec
Hibbertia ovata	M	Wongamine-Gosnells	85	Aug-Sep
Hibbertia pachyrrhiza	M.J.	Chittering-Jarrahdale	95	Oct-Jan
Hypoxis sp. A[a]	M	Mundaring-Brookton Hwy		Jul-Sep

Table 5 (*continued*)

Species	District	Geographical Range	Distance (km)	Flowering
Lepidosperma sp. A[a]	M	Darling Scarp and foothills		Jun
Leucopogon gracillimus	M,J,D	Perth-Pinjarra-York	85	Jul
Lomandra brittanii	M.J.D	Perth-Boddington	115	Oct-Nov
Petrophile biloba	M	Wannamal-Gosnells	105	Jul-Sep
Ptilotus sericostachyus subsp. *roseus*	M.J.D	Perth-Pinjarra	80	Sep-Dec
Scaevola lanceolata	W,M,J,D	Muchea-Waroona	140	Sep-Nov
Stylidium sp. A[a]	M,J,D	Helena Valley-Boddington	105	Dec-Feb
Thysanotus scaber	M,J,D	Avon Rv-Boddington	140	Oct-Nov
2. Species Not Endemic to the Region				
(i) Geographical range less than 50 km				
Banksia laricina	W	Badgingarra-Moore Rv NP	50	Apr-Jul
Calothamnus pachystachyus	M	Gillingarra-Bindoon	50	Aug-Oct
Conostylis pauciflora	D	Lake Clifton-Lake Preston	25	Aug-Oct
Dryandra sp. A[a]	M,W	Gingin-New Norcia	50	Jul-Sep
Jacksonia decumbens	M,W	Mogumber-Mooliabeenee	35	Nov-Feb
Thelymitra sp. A[a]	W	Wanneroo-Jandakot	40	Sep-Oct
(ii) Geographical range between 50 km and 160 km				
Acacia drewiana subsp. *drewiana*	M,W	Perth-Bindoon	70	Apr-Jul
Acacia drummondii subsp. *affinis*	M,W	Bullsbrook-New Norcia	80	Jul-Oct
Astroloma macrocalyx	M,W	Perth-Regans Ford	115	Apr-Jul
Boronia crenulata var. *gracilis*	M,J,D	Mundaring-Wagerup	115	Aug-Oct
Boronia ovata	M,W	Gosnells-New Norcia	130	Sep-Oct
Conospermum huegeli	M,J,W	Mogumber-Serpentine Falls	150	Jul-Aug
Eucalyptus laeliae	M,J,W	Helena Valley-Harvey	135	Dec-Feb
Gastrolobium acutum	M,W	Gosnells-New Norcia	125	Aug-Sep
Grevillea endlicheriana	M,J	Mogumber - SE of Perth	130	Jul-Sep
Hakea loranthifolia	M	Hoddy Well-E of Pingelly	125	Aug-Oct
Hakea myrtoides	M	Mogumber-York	120	Jul-Aug
Hibbertia lasiopus	M	New Norcia-Kalamunda	115	Jul-Oct
Hibbertia montana	M	York-Boyagin	65	Sep-Nov
Hypoxis vaginata[b]	D	Coolup-Capel	95	Jul-Sep
Juncus polyanthemus	D	Perth-Harvey	130	Oct-Nov

Table 5 *(continued)*

Species	District	Geographical Range	Distance (km)	Flowering
Lasiopetalum membranaceum	D	Dwellingup-Capel	115	Sep-Nov
Leptomeria empetriformis	W,D	Mandurah-Yanchep	110	Jul-Nov
Lepyrodia sp. A[(a)]	M,J,D	W of Beverley-Collie	155	Jul-Sep
Table 5 (*continued*)				
Leucopogon squarrosus	M,W,J	Fremantle-Moore Rv	115	Mar-Oct
Microcorys longifolia	M	Mogumber-Mundaring	105	Sep-Nov
Opercularia echinocephala	M,J,D	Perth-Yarloop	110	Aug-Nov
Patersonia rudis	M,J,D	New Norcia-Canning Dam	135	Oct-Jan
Ptilotus esquamatus	M,J,D	Perth-Harvey	130	Nov-Jan
Scaevola holosericea	D	Perth-Bunbury	155	Oct-Nov
Scaevola platyphylla	M	New-Norcia-Armadale	135	Sep-Jan
Senecio leucoglossus	M,J,D	Mundaring-Harvey	140	Aug-Dec
Stylidium pubigerum	M	Perth-Wongan Hills	145	Sep-Oct
Xyris sp. A[(a)]	J,D	Byford-Brunswick Junc.	115	Oct-Nov

[(a)] taxa described in Flora of the Perth Region (Marchant *et al.*, 1987)
[(b)] collected in other Australian States.

D = Dwellingup, J - Jarrahdale, M = Mundaring, W = Wanneroo.

PART FOUR: THE PLAN FOR MANAGEMENT

The objective of the program is:

to ensure and enhance, by appropriate management, the continued survival in the wild of populations of Declared Rare Flora and other plants in need of special protection.

1. Determining Priorities

Part Two assesses the abundance and conservation status of each Declared Rare Flora within the Region and makes recommendations for protection, research and management. On the basis of these recommendations, each species was ranked on a scale of 1 to 3 under 19 categories (Table 6) recognized as potential threats or protection and management requirements. Species with a low degree of threat or urgency for management and research action were given a score of 1. Those with a high degree of threat were allocated a score of 3. Species not threatened or in need of action were marked -. The scores were summed for each of the 24 species and for each threat/requirement category. Table 6 summarizes the perceived threats, and management and research requirements for each Declared Rare species in the Northern Forest Region.

Table 7 lists the 24 Declared Rare Flora in priority order according to the urgency of their requirement for protection and management action. Species with a high ranking score are most threatened and/or most in need of action. It is intended that all requirements for each species, as outlined in the previous species treatments, will be implemented. Work will be conducted, programmed or deferred according to priority, available funds and existing resources and workloads. Attention is directed to Table 7 to determine with which species action should commence. This will enable resources and staff within the Northern Forest Region to be allocated where most urgently required.

Species most in need of attention for a particular management or research requirement can be determined from Table 6.

Ranking the categories illustrates which are the most critical threats/requirements in the Region. The Table indicates those taxa that are (or may be) threatened by particular activities, in addition to providing for continued research and management once requirements listed for the priority species are fulfilled.

Table 6 DECLARED RARE FLORA IN THE NORTHERN FOREST REGION SCORED (1-3) ACCORDING TO THE DEGREE OF THREAT OR URGENCY FOR MANAGEMENT AND RESEARCH ACTION

	Location of other populations	Liaison with landowners	Research	Fire exclusion	Vulnerability - small population size	Linear marking	Firebreak/road construction	Propagation	Seed collection	Monitoring quadrats	Recreational damage	Land acquisition	Mining	Drought	Dieback hygiene	Fencing/grazing control	Re-establishment	Weed control	Logging	TOTAL
Asterolasia nivea	3	3	3	3	3	3	3	3	3	3	3	-	-	2	3	-	3	-	-	41
Darwinia apiculata	3	3	3	3	1	3	3	3	3	3	3	3	-	3	-	1	-	-	-	38
Lechenaultia laricina	3	3	2	1	3	3	3	1	2	2	1	-	-	1	-	1	2	3	-	31
Acacia anomala	-	3	1	3	1	2	3	3	3	-	-	3	-	2	2	2	3	-	-	31
Ptychosema pusillum	3	3	3	3	3	-	-	3	3	-	-	3	-	-	-	3	3	-	-	30
Eucalyptus sp. (eastern forest)	3	-	2	3	3	3	2	2	3	-	1	-	3	-	3	-	-	-	2	30
Thomasia sp. (York)	1	3	2	1	2	3	3	3	2	2	-	2	2	-	-	-	-	3	-	29
Acacia aphylla	2	2	2	2	1	2	2	1	1	2	2	2	-	3	-	2	1	-	-	27
Eucalyptus sp. (Yanchep)	3	-	2	3	3	3	3	2	3	-	1	-	3	-	-	-	-	-	-	26
Grevillea saccata	2	3	2	2	2	2	3	-	-	2	-	3	3	2	-	-	-	-	-	26
Lechenaultia pulvinaris	2	-	3	1	2	3	3	3	3	2	2	-	1	-	-	-	-	-	-	25
Grevillea cirsiifolia	2	-	2	3	1	3	3	-	3	2	1	-	2	-	1	-	-	-	2	25
Asterolasia grandiflora	2	2	2	1	1	2	-	1	1	2	-	1	3	2	2	2	-	-	-	24
Diuris purdiei	2	3	2	1	1	2	2	2	-	2	1	3	-	-	1	-	-	-	-	22
Caladenia integra	2	3	2	3	1	-	-	-	-	2	3	2	2	1	-	-	-	1	-	22
Darwinia acerosa	1	3	2	3	1	-	-	-	-	2	-	3	-	2	-	2	-	2	-	21
Thelymitra stellata	3	3	2	1	1	3	3	1	-	-	3	-	-	-	-	-	-	-	-	20
Daviesia microphylla	1	-	1	1	1	1	-	-	1	1	1	-	2	1	3	-	-	-	3	18
Caladenia dorrienii	3	-	1	1	3	-	-	2	-	-	1	-	-	-	2	-	-	-	1	14
Wurmbea drummondii	2	2	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	12
Caladenia sp. (jarrah forest)	3	3	1	1	1	-	-	-	-	-	1	-	-	-	1	1	-	-	-	12
Drosera occidentalis	2	3	-	2	1	1	-	-	-	-	3	-	-	-	-	-	-	-	-	12
Hydrocotyle lemnoides	2	-	2	3	1		-	-	-	-	-	-	2	-	-	-	-	-	-	10
Spirogardnera rubescens	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
TOTAL	57	47	45	45	43	41	36	33	31	27	27	25	24	19	18	18	15	12	7	

Table 7. NORTHERN FOREST REGION DECLARED RARE SPECIES (AS AT JULY 1988) RANKED IN ORDER OF PRIORITY FOR PROTECTION AND MANAGEMENT ACTION.

1. *Asterolasia nivea*	13. *Asterolasia grandiflora*
2. *Darwinia apiculata*	14. *Diuris purdiei*
3. *Lechenaultia laricina*	15 *Caladenia integra*
4. *Acacia anomala*	16. *Darwinia acerosa*
5. *Ptychosema pusillum*	17. *Thelymitra stellata*
6. *Eucalyptus* sp. (eastern forest) M.I.H. Brooker 9046	18. *Daviesia microphylla*
7. *Thomasia* sp. (York) A.S. George 8075	19. *Caladenia dorrienii*
8. *Acacia aphylla*	20. *Caladenia* sp. (jarrah forest) S.D. Hopper 3990
9. *Eucalyptus* sp. (Yanchep) M.I.H. Brooker 8608	21. *Wurmbea drummondii*
10. *Grevillea saccata*	22. *Drosera occidentalis*
11. *Lechenaultia pulvinaris*	23. *Hydrocotyle lemnoides*
12. *Grevillea cirsiifolia*	24. *Spirogardnera rubescens*

2. Management and Research Actions

Confidential Rare Flora registers, with precise locality details of known populations, are maintained in the Regional and District offices. The register is updated regularly as required. All populations within the Region are to be inspected annually to observe fluctuations in population numbers and to monitor changes in the habitat which may threaten survival.

i) Location of Other Populations

Further survey of suitable habitats in the wild is a requirement for all of the Declared Rare Flora in the Region. Some species are in need of urgent attention, either because of the small number or size of known populations, or their poor representation in conservation reserves. Species most urgently in need of intensive field surveys are:

Asterolasia nivea

Ptychosema pusillum

Darwinia apiculata

Eucalyptus sp. (eastern forest)

Eucalyptus sp. (Yanchep)

Lechenaultia laricina

Caladenia dorrienii

Caladenia sp. (jarrah forest)

Wurmbea drummondii

Spirogardnera rubescens

ii) Liaison with Landowners

Close association and cooperation with private landowners is essential to ensure the continued survival of the majority of Declared Rare species in the Region. Survival of some species currently relies entirely on the good will of local Shires and private landowners. Departmental staff are required to provide advice and

assistance, regarding conservation and management, to landholders and other agencies with Rare Flora populations on land under their control. Landowners are requested to arrange their operations so that the area of Rare Flora will not be destroyed or damaged in any way. Priority species for staff liaison with landowners are:

Asterolasia nivea

Ptychosema pusillum

Darwinia apiculata

Acacia anomala

Darwinia acerosa

Caladenia integra

Caladenia sp. (jarrah forest)

Lechenaultia laricina

Diuris purdiei

Grevillea saccata

iii) Research

Few of the Declared Rare species within the Region have been subject to detailed studies. Research into the taxonomy, genetic systems, population biology and ecology of the species is needed to determine the best means of protecting and managing populations. Response to fire regimes, drought tolerance, susceptibility to *Phytophthora* species and other introduced pathogens and impact of exotic bees on native pollinators (particularly of members of the Orchidaceae) requires special attention. The following species are most urgently in need of research:

Asterolasia nivea

Ptychosema pusillum

Lechenaultia laricina

Lechenaultia pulvinaris

Darwinia apiculata

Acacia aphylla

Diuris purdiei

Darwinia acerosa

Thomasia sp. (York)

iv) Protection from Fire

A number of species, particularly those known from only one or a few localities, require exclusion or protection from fire or specially tailored fire regimes. These species should be excluded from prescribed burns on CALM and other lands or only be burnt in accordance with specifically developed fire regimes. Such regimes will need to be developed by both research and regional staff. These species will also need to be protected (by construction of protective breaks or by reduction of fuels in surrounding areas) where possible from potential uncontrolled fires unless such fires fit the conditions determined for the particular fire regime developed for that species. Species requiring protection/exclusion from fire until specific fire regimes are developed are:

Asterolasia nivea

Ptychosema pusillum

Darwinia apiculata

Eucalyptus sp. (eastern forest)

Eucalyptus sp. (Yanchep)

Caladenia integra

Darwinia acerosa

Acacia anomala

Hydrocotyle lemnoides

Grevillea cirsiifolia

NB: In the suppression of uncontrolled fires, the protection of human life and property takes precedence over the protection of endangered flora.

v) Protection from Accidental Destruction

Many species within the Region are vulnerable to damage or destruction owing to their extremely small population size or the small area occupied by the known populations. Bulldozing, off-road-vehicles, rubbish dumping, weed control and recreation site development are potential threats to such species. Protection is to be achieved by alerting Departmental officers and private landowners of the location of Rare Flora populations, and ensuring that populations and surrounding habitats are excluded from operations and activities conducted in the vicinity. Species requiring protection from accidental destruction are:

Wurmbea drummondii

Asterolasia nivea

Ptychosema pusillum

Eucalyptus sp. (eastern forest)

Eucalyptus sp. (Yanchep)

Caladenia dorrienii

Lechenaultia laricina

Grevillea saccata

Lechenaultia pulvinaris

vi) Linear Marking

Populations in need of linear marking are generally located along roads and firebreaks where they are vulnerable to damage or destruction by maintenance operations. Permanent, but discrete, marker pegs are to be installed at all Declared Rare Flora populations occurring along linear routes within CALM land. The Main Roads Department has developed a field marking system for demarcating environmentally significant areas on road reserves. Local shires have been encouraged to adopt such a system. Populations on CALM and other lands most urgently in need of linear marking are:

Lechenaultia laricina

Thomasia sp. (York)

Eucalyptus sp. (Yanchep)

Lechenaultia pulvinaris

Grevillea cirsiifolia

Darwinia apiculata

Eucalyptus sp. (eastern forest)

Grevillea saccata

Thelymitra stellata

Acacia anomala

Acacia aphylla

Diuris purdiei

vii) Propagation

Although conservation of the Declared Rare Flora in their natural habitats is the priority, all species should ideally be established in cultivation. This would eliminate any need for harvesting of wild populations and ensure safety against extinction, particularly for those species known in the wild from only a few individuals. Some Declared Rare Flora of the Northern Forest Region are already well established in cultivation.

Stock plants of the following species should be propagated and maintained in cultivation in Departmental nurseries. Any species with horticultural potential should be established in general cultivation.

Asterolasia nivea

Ptychosema pusillum

Darwinia apiculata

Acacia anomala

Eucalyptus sp. (eastern forest)

Eucalyptus sp. (Yanchep)

Lechenaultia pulvinaris

Diuris purdiei

Caladenia dorrienii

Thomasia sp. (York)

viii) Seed Collection and Storage

Collection and long term storage of seed from wild populations of Declared Rare Flora provides a source of propagation material for future cultivation, in addition to ensuring protection of populations, or more importantly species, from extinction. Seed should be collected from the following species for storage:

Asterolasia nivea

Ptychosema pusillum

Darwinia apiculata

Acacia anomala

Eucalyptus sp. (eastern forest)

Eucalyptus sp. (Yanchep)

Lechenaultia pulvinaris

Lechenaultia laricina

Grevillea cirsiifolia

Thomasia sp. (York)

ix) Installation of Permanent Monitoring Quadrats

A network of permanent monitoring quadrats is to be established on populations of all species of Declared Rare Flora within the Region. The following species are the highest priority for permanent monitoring:

Asterolasia nivea

Darwinia apiculata

Lechenaultia laricina

Lechenaultia pulvinaris

Diuris purdiei

Grevillea saccata

Thomasia sp. (York)

Asterolasia grandiflora

Grevillea cirsiifolia

Acacia aphylla

Monitoring quadrats require annual inspection.

x) Protection from Recreational Damage

A number of species in the Region are located at sites where they are actually or potentially at risk from recreational activities. These may include a range of pursuits from camping, bushwalking and passive recreating, to off-road vehicle use and organised activities such as orienteering and rogaining. Species occurring in high profile situations (e.g. along major highways), where they may be subject to picking, are also included in this category. Recreation should be controlled or excluded from sensitive sites depending on the degree of threat. The following species are in need of protection from recreational damage:

Caladenia integra

Drosera occidentalis

Lechenaultia pulvinaris

Darwinia apiculata

Acacia aphylla

Asterolasia nivea

Thelymitra stellata

xi) Land Acquisition

Acquisition of land by the Department, either by donation, exchange or purchase, is required for those species not well represented on conservation reserves anywhere throughout their range. Acquisition would enable appropriate management and protection practices to be implemented on land maintained, as much as possible, in a natural state. Plants occurring on land reserved for nature conservation are generally considered to be less endangered than those on land designated for other purposes. It should be noted, however, that presence on a reserve contributes to, but does not guarantee, population survival. Reserves, like other areas, are subject to disturbances such as weed invasion and mining activities.

Negotiations are currently underway for acquisition of some sites within the Region. Where land is not available for this purpose, other alternatives (e.g. establishment in suitable habitats in reserves) need to be considered. The following are priority species for land acquisition:

Privately Owned Land	Crown/Shire Land
Ptychosema pusillum	*Darwinia apiculata*
Acacia anomala	*Acacia aphylla*
Darwinia acerosa	*Acacia anomala*
Caladenia integra	*Grevillea saccata*
	Diuris purdiei
	Thomasia sp. (York)

xii) *Phytophthora* Species (Dieback) Hygiene

Insufficient research information is available to assess the impact of the soil-borne pathogens, *Phytophthora* species, on Declared Rare Flora in the Region. Plants not destroyed by direct infection may be affected indirectly by structural and ecological changes in the community caused by dieback. Disturbances such as mining, logging and road construction are known to promote the spread of the disease, particularly in moist, relatively low-lying sites unless carried out under strictly controlled hygiene conditions. Any operations in localities likely to support the pathogen should be conducted under strict hygiene conditions. Urgent research on the impact of dieback on Declared Rare species is required.

xiii) Protection from Grazing

The following species require protection from grazing, either by fence construction or agreement with landowners to exclude stock from population localities:

Ptychosema pusillum

Acacia anomala

Lechenaultia laricina

Darwinia acerosa

Asterolasia grandiflora

Acacia aphylla

Thomasia sp. (York)

xiv) Re-establishment in Suitable Habitats in the Wild

Species poorly represented on conservation reserves should be propagated and re-established in suitable, less vulnerable habitats on land designated for nature conservation. Species requiring re-establishment into the wild by CALM staff under approved management programs are:

Asterolasia nivea

Ptychosema pusillum

Acacia anomala

Lechenaultia laricina

xv) Control of Competitive Weeds

Control of weeds in and near Rare Flora populations on CALM land is to be conducted by Regional staff. Officers of the Department should liaise closely with the Agricultural Protection Board, Main Roads Department and private landowners if weed control is required near Rare Flora populations on other lands. Weeds are to be removed by hand where a selective herbicide may destroy or damage Declared Rare Flora. The following species require weed control or eradication at some or all of their population localities:

Wurmbea drummondii

Thomasia sp. (York)

Lechenaultia laricina

Darwinia acerosa

Caladenia integra

xvi) Possible Future Threats

A number of operations are potential threats to the survival of Declared Rare Flora in the Region, where these operations are not properly planned and supervised. The most important of these are:

- construction and maintenance of roads and firebreaks;
- logging;
- mining.

Inspection of sites for Declared Rare Flora should be conducted prior to any operations that could either temporarily or permanently destroy the vegetation. It is important to ensure that areas zoned for such activities have been surveyed for Declared Rare Flora. Where populations have been located, operations may require re-alignment (roads, fire breaks) re-location (mining) or special microscale planning and supervision (logging operations).

3. Other Plants in Need of Special Protection in the Northern Forest Region.

The priority for conservation action for other plants in need of special protection in the Region (Tables 1-5) is:

- Presumed extinct species
- Poorly known species in need of urgent further survey
  - Priority One
  - Priority Two
  - Priority Three
- Species requiring monitoring
- Species with significant outlying populations in the Region
- Geographically restricted species
  - endemic to the Region

    range less than 50 km

    range between 50 and 160 km
  - not endemic to the Region

    range less than 50 km

    range between 50 and 160 km

4. Term of the Management Program

This program shall run for a 10-year period, unless subsequent research or changes to the schedule of Declared Rare Flora cause it to be superseded earlier. During this period, the Department of CALM may institute any changes to the provisions outlined in this program as are found, through further research, to be necessary for conservation of the Declared Rare Flora in the Region.

REFERENCES

Aston, H.I. (1973). *Aquatic Plants of Australia.* Melbourne University Press, Melbourne.

Australian Bureau of Statistics (1987). Census of June 1986. Unpublished.

Barrett, G.J. (1982). Rare and Geographically Restricted Plants of the Swan Coastal Plain and Darling Scarp. Department of Fisheries and Wildlife Western Australia Unpublished Report Number 14.

Beard, J.S. (1980). A new phytogeographic map of Western Australia. *Research Notes. Western Australian Herbarium* **3** : 37-58.

Beard, J.S. (1982). *Vegetation Survey of Western Australia. Swan. 1:1 000 000 Vegetation Series*. University of Western Australia Press, Perth.

Bentham, G. (1863-1878). *Flora Australiensis*. Vols 1-7. Lovell Reeve and Co., London.

Blackall, W.E. and Grieve, B.J. (1974, 1980). *How to Know Western Australian Wildflowers*. Parts 1-3A. University of Western Australia Press. Perth.

Briggs, J. and Leigh, J. (1988). Rare or Threatened Australian Plants. *Australian National Parks and Wildlife Service. Special Publication No. 14* : Canberra.

Brooker (1988). *Eucalyptus foecunda* revisited and six related new species (Myrtaceae) *Nuytsia* 6 (3) : 325-334.

Brooker, M.I.H. and Kleinig, D. (1990). *Field Guide to Eucalypts. Vol. 2.* Inkata. Melbourne.

Coates, D.J. (1988). Genetic diversity and population genetic structure in the rare Chittering grass wattle, *Acacia anomala* (Court). *Australian Journal of Botany* **36** : 273-286.

Coleman, E. (1933). Description of a new *Caladenia* (Orchid). *Victorian Naturalist* **49** : 246.

Court, A.B. (1978). Three new species of *Acacia* (Mimosaceae) from Western Australia. *Nuytsia* **2** : 168-177.

Crisp, M.D. (1983). *A Report to World Wildlife Fund of Australia on Project 13: Taxonomy, Ecology and Conservation of the Genus Daviesia*. National Botanic Gardens, Canberra City, A.C.T.

Department of Conservation and Environment (1980). Atlas of Natural Resources, Darling System, Western Australia.

Department of Conservation and Environment (1983). *Conservation Reserves for Western Australia. As recommended by the Environmental Protection Authority. The Darling System - System 6.*

Department of Conservation and Land Management (1987). *Northern Forest Region - regional management plan*.

Diels, L. (1903). Two new species of Orchidaceae from Western Australia. *Journal of the Proceedings of the Mueller Botanical Society of Western Australia* **1** (11) : 79-80.

Diels, L. and Pritzel, E. (1904-5). Fragmenta Phytographiae Australiae Occidentalis. *Botanischer Jarhbrucher* **35**, 55-662, Leipzig.

Diels, L. (1906). *Die Vegetation der Erde VII. Die Pflanzenwelt von West-Australien jüdlich des Wendekreises.* Wilhelm Englmann. Leipzig.

Erickson, R. (1968). *Plants of Prey in Australia*. Lamb Publications Pty. Ltd., Perth.

Erickson, R. (1978). *Orchids of the West*. 3rd Edn. Paterson Brokensha Pty. Ltd., Perth.

Fitzgerald, W.V. (1904). Additions to the West Australian Flora. *Journal of the Western Australian Natural History Society* **1** : 3-36.

Gardner, C.A. (1964). Contributiones Florae Australiae Occidentalis. *Journal of the Royal Society of Western Australia* **47** : 54-64.

George, A.S. (1971). A Checklist of the Orchidaceae of Western Australia. *Nuytsia* **1** (2) : 166-196.

Gillen, K. (1982). Geographically restricted plants of the Jarrah and Karri forests of south west Western Australia. *Department of Fisheries and Wildlife Western Australia Unpublished Report Number 16.*

Grayling, P. (1989). An Investigation of Taxonomy, Reproductive Biology and Hybridity in Four Taxa of *Eucalyptus* of Extreme Rarity. Honours Thesis. Botany Department. University of Western Australia.

Green, J.W. (1985). *Census of the Vascular Plants of Western Australia*. 2nd Edn. Western Australian Herbarium, Department of Agriculture, Perth.

Grieve, B.J. (1975). Botany in Western Australia. A survey of progress : 1900-1971. *Journal of the Royal Society of Western Australia* **58** (2) : 33-53.

Havel, J.J. (1975a). Site vegetation mapping in the northern jarrah forest (Darling Range). (I) Definition of site vegetation types. Forests Department Bulletin 86.

Havel, J.J. (1975b). Site vegetation mapping in the northern jarrah forest (Darling Range). (II) Location and mapping of site vegetation types. Forests Department Bulletin 87.

Hoffman, N. and Brown, A. (1984). *Orchids of South West Australia*. University of Western Australia Press. : Perth.

Hopper, S.D., van Leeuwen, S., Brown, A. and Patrick, S. (1990). *Western Australia's Endangered Flora.* Department of Conservation and Land Management, Perth.

Lee, A.T. (1973). A new genus of Papilionaceae and related Australian genera. *Contributions from the New South Wales. National Herbarium* **4** (7) : 412-430.

Lehmann, J.G.C. (Editor) (1844-1848). Platae Preissianae sive Enumeratio Plantarum, quas in Australasia Occidentalie et Meridionali-occidentali annis 1838-41 collegit Ludwig Preiss. Volumes 1 and 2. Meisner, Hamburg.

Leigh, J., Boden, R. and Briggs, J. (1984). *Extinct and Endangered Plants of Australia*. Macmillan Company. Pty Ltd., Melbourne.

Lindley, J. (1839-1840). A sketch of the vegetation of the Swan River Colony. In: *Appendix to the first 23 volumes of Edwards Botanical Register*. London.

Lowrie, A. (1989). *Carnivorous Plants of Australia* Volume 2. University of Western Australia Press.

Lucas, G. and Synge, H. (Eds) (1978). *The IUCN Plant Red Data Book.* International Union for Conservation of Nature and Natural Resources, Morges, Switzerland.

Macfarlane, T.D. (1980). A Revision of *Wurmbea* (Liliaceae) in Australia. *Brunonia* **3** (2) : 145-208.

Maddocks, T.I. and Lamont, B.B. (1984). *The ecology, conservation status and propagation of two Gazetted Rare Orchids* Caladenia gemmata *forma* lutea *and* Diuris purdiei. School of Biology, W.A. Institute of Technology, Perth.

Marchant, N.G. (1984). A new species of *Darwinia* (Myrtaceae) from the Perth Region, Western Australia. *Nuytsia* **5** (1) : 63-66.

Marchant, N.G. and Keighery, G.J. (1979). Poorly Collected and Presumably Rare Vascular Plants in Western Australia. *Kings Park Research Notes No. 5.*

Marchant, N.G., Wheeler, J.R., Rye, B.L., Bennett, E.M., Lander, N.S. and Macfarlane, T.D. (1987). *Flora of the Perth Region.* Western Australian Herbarium, Department of Agriculture, W.A. 2 vols.

Maslin, B.R. (1974). Studies in the genus *Acacia.* 2. Miscellaneous new phyllodinous species. *Nuytsia* **1** (4) : 315-340.

Millar, K.A.G. (1982). Rare and Geographically Restricted Plants of Western Australia. Department of Fisheries and Wildlife Western Australia Unpublished Report Number 19.

Morrison, A. (1912). New and rare Western Australian plants. *Journal of Botany, British and Foreign* 50 *: 164-168.*

Morrison, D.A. (1987a). The phytogeography, ecology and conservation status of *Lechenaultia.* R.Br. (Goodeniaceae). *Kingia* **1** (1) : 85-133.

Morrison, D.A. (1987b). *Lechenaultia.* In: *Australian Plants* **14** (111) : 99-114.

Nicholls, W.H. (1969). *Orchids of Australia.* Thomas Nelson (Australia). Ltd. : Melbourne.

Patrick, S.J. (1983). Rare and Geographically Restricted Plants of Western Australia. Department of Fisheries and Wildlife Western Australia Unpublished Report Number 22.

Patrick, S.J. (1984). Rare and Geographically Restricted Plants of Western Australia. Department of Fisheries and Wildlife Western Australia Unpublished Report Number 26.

Patrick S.J. (1985). Rare and Geographically Restricted Plants of Western Australia. Department of Conservation and Land Management Unpublished Report No. 28.

Patrick S.J. and Hopper, S.D. (1982). A Guide to the Gazetted Rare Flora of Western Australia. Supplement 1 to Report No. 42. Department of Fisheries and Wildlife Western Australia Report Number 54.

Pelloe, E.H. (1930). *West Australian Orchids.* E.H. Pelloe, Perth.

Rogers, R.S. (1920). Contributions to Australian Orchidology. *Transactions of the Royal Society of South Australia.* **44** : 322-359.

Rye, B.L. (1982). Geographically restricted plants of Southern Western Australia. Department of Fisheries and Wildlife Western Australia Report Number 49.

Rye, B.L. and Hopper, S.D. (1981). A Guide to the Gazetted Rare Flora of Western Australia. Department of Fisheries and Wildlife Western Australia Report Number 42.

Rye, B.L., Hopper, S.D. and Watson, L.E. (1980). Commercially exploited vascular plants native in Western Australia. Census, atlas and preliminary assessment of Conservation status. Department of Fisheries and Wildlife Western Australia Report Number 40.

Stauffer, H.U. (1968). Santalales studies 4. *Spirogardnera*, a new genus of Santalaceae from Western Australia. *Naturforschente Gesellschaft in Zurich*. **113** : 307 (translation).

Wilson, P.G. (1971). Taxonomic notes on the Family Rutaceae, principally of Western Australia. *Nuytsia* **1** : 197-207.

Wilson, P.G. (1980). A new species of *Urocarpus* (Rutaceae) from Western Australia. *Nuytsia* **3** (2) : 211-213.

Wilson, P.G. (1987). The names *Asterolasia* F. Muell. and *Urocarpus*; Harvey (Rutaceae). *Nuytsia* **6** (1) : 7-8.

GLOSSARY

apiculate	with a short, sharp point at the apex
appressed	pressed closely to another organ but not united
axil	the upper angle formed by the junction of the stem with a leaf or similar organ
axillary	in the axils
bract	a leaf-like structure occurring between the normal leaves and the flower or inflorescence
bracteole	a small structure, similar in form to a bract and occurring singly or paired on the stalk or calyx of a flower
calli	glandular, wart-like structures occurring on the labellum of some orchids
calyx	the outermost whorl of a flower, usually consisting of sepals or a calyx tube and calyx lobes. The calyx tube is formed by fusion of the individual sepals. A calyx lobe is one of the free upper parts of the calyx when it is partially fused to form a tube.
capsule	a dry fruit formed from two or more fused compartments and splitting at maturity to release the seeds
claw	the conspicuously narrowed base of a petal or labellum
column	a structure formed by fusion of the style, stigma and stamen(s), as in the Orchidaceae
corm	a short, swollen, firm-fleshed, subterranean organ producing stems, leaves and flowers and serving as an organ of perennation and vegetative reproduction
corolla	the inner whorl of a flower, usually consisting of petals or a corolla tube and corolla lobes. A corolla tube is formed when the individual petals are completely or partially fused.
deciduous	falling off at the end of the growth period or at maturity
elliptic	oval in outline
endemic	having a distribution confined to a particular geographical region
entire	smooth undivided margin without any incisions or teeth
glabrous	without hairs
glaucous	blue-green in colour with a whitish bloom
habit	form of a plant including the size, shape, texture and stem orientation
indehiscent	referring to a fruit, not opening or splitting at maturity to release the seeds
indigenous	native to the area in which it occurs; not introduced
inflorescence	an arrangement of more than one flower, usually comprising individual flowers, bracts, pedicels and peduncles
involucre	a whorl of bracts surrounding or beneath an inflorescence, resembling and performing the function of a calyx of a single flower
labellum (lip)	the usually modified lower petal/perianth segment of the orchid flower, often differing in morphology and patterning from the two lateral petals
lanceolate	narrow and tapering at both ends
leaflet	one of the distinct segments of a compound leaf

lignotuber a woody, usually underground rootstock, often giving rise to numerous above-ground stems

mallee growth form, typical of certain eucalypt species, in which a few to many woody stems arise separately from a lignotuber

nodes point on the stem from which leaves or bracts originate

nut a dry indehiscent 1-seeded fruit with a hard woody wall

obovate shape resembling an egg with the narrowest end near the point of attachment

operculum a lid or cover becoming detached at maturity e.g. in *Eucalyptus*

orbicular almost circular and flattened

papillate having small projections (usually extension of epidermal cells) on the surface of an organ

pedicel the stalk of an individual flower

peduncle the stalk of an inflorescence

perennial a plant continuing its growth from year to year. In herbaceous perennials, leaves and flowers die back to an underground storage or perennating organ. Woody perennials have persistent above-ground parts.

perianth a collective term for the petals and sepals, applied when the petals and sepals are similar in appearance or when either is missing

petal the usually brightly coloured and conspicuous individual segments of the corolla

petiole the stalk of a leaf - adjective: petiolate

phyllode a leaf whose blade is much reduced or absent and whose petiole has assumed the form and function of the whole leaf

pinnate divided into segments

pith a region of relatively unspecialized tissue (parenchyma) found in the centre of many plant stems

pod a dry, usually many-seeded fruit which splits down both sides on ripening to release the seeds

prostrate describing a plant that grows closely along the ground

pseudocopulation the attempt by a male insect to mate with a flower or parts of a flower which it mistakes (because of colour, shape or scent of the flower) for a female of the same species. Pollination of the flower is achieved during this process frequently observed in the orchid family.

pubescent covered with fine, short hairs

raceme an indeterminate inflorescence with the individually stalked (pedicellate) flowers arising from a simple elongated main axis (peduncle)

rhizome a usually underground stem, bearing buds in axils of reduced scale-like leaves and serving as a means of perennation and vegetative propagation

rosette a tuft of leaves radiating outwards from the stem at ground level. Ranging in form from a hemispherical tuft to a flat whorl.

sepal the usually green and leaf-like individual segment of the calyx. In some species, the sepals may be brightly coloured and assume the function of petals.

sessile	without a stalk
spathulate	spoon shaped; a structure broad at the apex and narrowed towards the base
spike	an unbranched inflorescence in which sessile flowers are borne on an elongated axis
spinescent	ending in a spine; modified to form a sharp pointed structure
stamen	male reproductive organ of a flowering plant, bearing pollen and typically consisting of a stalk (filament) and pollen bearing portion (anther)
stellate	star-shaped, usually referring to hairs with radiating branches
stigma	the usually papillate or glandular receptive tip of the style which receives the pollen at pollination
stipule	one of a pair of leaf-life, scale-like or bristle-like structures inserted at the leaf base or along a petiole
style	the stigma and its stalk, attached to the summit of the ovary
tepals	individual perianth part in flowers that have no distinct calyx or corolla, as occurs in many monocotyledons
terete	cylindrical in cross section
terminal	at the apex or end furthest away from the organs point of attachment
tuber	the usually underground, swollen part of a stem or root, modified for storage and lasting for one year only
umbel	an inflorescence in which the flowers are borne on individual pedicels of equal length originating from a common point on top of the peduncle
unisexual	having stamens and carpels in separate flowers

(2) A person who makes or obtains a record pursuant to paragraph (b) of subsection (1) of this section shall retain the record for not less than twelve months and produce it on demand to a wildlife officer.

Rare or endangered species of flora.
Added by No. 86 of 1976, s. 17 (As amended by No. 28 of 1979, s. 7.).

23F. (1) In this section "rare flora" means flora for the time being declared to be rare flora for the purposes of this section.

(2) Where the Minister is of opinion that any class or description of protected flora is likely to become extinct or is rare or otherwise in need of special protection, he may, by notice published in the *Government Gazette* declare that class or description of flora to be rare flora for the purposes of this section throughout the State.

(3) The Minister may vary or revoke a notice published under subsection (2) of this section by subsequent notice or notices published in the *Government Gazette.*

(4) A person shall not, whether or not he is—

(a) the holder of a license issued under this Act to take protected flora;

(b) the owner or occupier of private land on which rare flora exists; or

(c) authorised by the owner or occupier of land on which rare flora exists,

take any rare flora unless—

(d) where he is not the holder of a license issued under this Act, he first obtains the consent thereto in writing of the Minister;

(e) where he is the holder of a license issued under this Act, he first obtains the further consent thereto in writing of the Minister.

(5) [*This subsection was in section 23F. as added by No. 86 of 1976, however it was repealed by No. 28 of 1979 at the time section 23F. came into operation.*]

(6) A person who takes any rare flora contrary to the provisions of this section is liable on conviction to a penalty not exceeding one thousand dollars. *

(7) Where an owner or occupier of private land who has been refused consent to take rare flora on that land satisfies the Minister that he will suffer loss of use or enjoyment of the land by reason of that refusal, the Minister shall inform the Treasurer in writing accordingly and the owner or occupier shall be paid compensation for that loss at such rate or rates per annum as—

(a) is agreed between the owner or occupier and the Treasurer; or

(b) in default of agreement, is determined by a valuer appointed by agreement between the Treasurer and the owner or occupier, or in default of agreement on such an appointment, by a valuer appointed by the Minister,

for such period, not exceeding five years, as the loss continues.

(8) Where compensation has been paid under subsection (7) of this section for a period of five years in respect of any particular land, the Minister shall not refuse an application by the owner or occupier of that land to take rare flora on that part of the land for the loss of use or enjoyment of which compensation has been so paid.

(9) Notwithstanding that compensation has been paid under subsection (7) of this section, whether for a period of five years or for a lesser period, for the loss of use or enjoyment of any land, that land may at any time be taken by the Governor under and subject to the Public Works Act, 1902 for any of the purposes of this Act.

* *Amended to ten thousand dollars on the 28 October 1985 Amendment Act No 58.*

APPENDIX II

[Extract from Government Gazette (No. 69) of 15 July 1988]

WILDLIFE CONSERVATION ACT 1950

019882F3705.

PURSUANT to the provisions of subsection (2) of section 23F of the Wildlife Conservation Act 1950, I hereby declare that protected flora of the taxa listed in the schedule to this notice growing in its original state and not in its domesticated or cultivated state are rare flora throughout the whole of the State.

The previous notice relating to rare flora published in the *Government Gazette* on 25 September 1987 is hereby cancelled.

BARRY HODGE,
Minister for Conservation
and Land Management.

Schedule

Acacia anomala
Acacia aphylla
Acacia argutifolia
Acacia denticulosa
Acacia depressa
Acacia guinetii
Acacia merrickae
Acacia pharangites
Acacia semicircinalis
Acacia simulans
Acacia vassalii
Acacia sp. (Chiddarcooping) J. Brown 59 & A. Williams
Acacia sp. (Wongan Hills) K. F. Kenneally 7496
Adenanthos cunninghamii
Adenanthos dobagii
Adenanthos ellipticus
Adenanthos eyrei
Adenanthos ileticos
Adenanthos pungens
Adenanthos velutinus
Allocasuarina fibrosa
Anigozanthos bicolor subsp. minor
Anigozanthos humilis subsp. chrysanthus
Anigozanthos viridis subsp. terraspectans
Aponogeton hexatepalus
Asplenium obtusatum
Asterolasia drummondii
Asterolasia grandiflora
Asterolasia nivea
Baeckea arbuscula
Banksia brownii
Banksia cuneata
Banksia goodii
Banksia sphaerocarpa var. dolichostyla
Banksia tricuspis
Banksia verticillata
Banksia sp. (Wagin) S. D. Hopper 4171
Billardiera mollis
Boronia adamsiana
Caladenia bryceana
Caladenia cristata
Caladenia dorrienii
Caladenia integra
Caladenia plicata
Caladenia wanosa
Caladenia sp. (Murchison) S. D. Hopper 3270
Caladenia sp. (Esperance) D. R. Voigt 36
Caladenia sp. (Cape Naturaliste) S. D. Hopper 4518
Caladenia sp. (jarrah forest) S. D. Hopper 3990
Caladenia sp. (Northampton) S. D. Hopper 3347
Caladenia sp. (Leeuwin-Naturaliste) S. D. Hopper 4670
Caladenia sp. (coastal plain) S. D. Hopper 3400
Caladenia sp. (Moresby Range) G. J. Keighery 3328
Caladenia sp. (southern forest) S. D. Hopper 3553
Caladenia sp. (Muir) S. D. Hopper 3521
Caladenia sp. (salt lakes) S. D. Hopper 4162
Caladenia sp. (Dunsborough) S. D. Hopper 5520b
Chamelaucium sp. (Busselton) G. J. Keighery 3655
Chamelaucium sp. (S coastal plain) R. D. Royce 4872
Conospermum toddii
Conostylis drummondii
Conostylis lepidospermoides
Conostylis micrantha
Conostylis misera
Conostylis rogeri
Conostylis seorsiflora subsp. trichophylla
Conostylis wonganensis
Coopernookia georgei
Corybas sp. (Albany) L. Byrne 10
Darwinia acerosa
Darwinia apiculata
Darwinia carnea
Darwinia collina
Darwinia macrostegia
Darwinia masonii
Darwinia meeboldii
Darwinia oxylepis
Darwinia squarrosa
Darwinia wittwerorum
Darwinia sp. (Scott River) G. J. Keighery 3582
Darwinia sp. (Stirling Range) G. J. Keighery 5732
Daviesia euphorbioides
Daviesia microphylla
Daviesia purpurascens
Daviesia spiralis
Daviesia sp. (Three Springs) M. D. Crisp 6480
Daviesia sp. (central wheatbelt) M. D. Crisp 6612
Daviesia sp. (Ravensthorpe) M. D. Crisp 6065
Daviesia sp. (Norseman) M. D. Crisp 5943
Daviesia sp. (Stirling Range) K. R. Newbey 5113
Daviesia sp. (Eneabba) S. D. Hopper 4829
Diuris drummondii
Diuris purdiei
Diuris sp. (Kwinana) A. P. Brown 10.9.84
Diuris sp. (Northampton) A. P. Brown 203
Drakea jeanensis
Drakaea sp. (Kalbarri) A. P. Brown 8.82
Drakaea sp. (south west) S. D. Hopper 3566
Drakaea sp. (Great Southern) S. D. Hopper 3461
Drosera fimbriata
Drosera occidentalis
Drummondita ericoides
Drummondita hassellii var. longifolia

Dryandra serratuloides
Dryandra sp. (Stirling Range) F. Lullfitz 3379
Eremophila denticulata
Eremophila inflata
Eremophila merrallii
Eremophila microtheca
Eremophila nivea
Eremophila racemosa
Eremophila resinosa
Eremophila serpens
Eremophila ternifolia
Eremophila verticillata
Eremophila virens
Eremophila viscida
Eriostemon wonganensis
Eucalyptus beardiana
Eucalyptus bennettiae
Eucalyptus brevipes
Eucalyptus burdettiana
Eucalyptus ceracea
Eucalyptus cerasiformis
Eucalyptus coronata
Eucalyptus crucis subsp. crucis
Eucalyptus erectifolia
Eucalyptus goniantha subsp. goniantha
Eucalyptus insularis
Eucalyptus johnsoniana
Eucalyptus lateritica
Eucalyptus merrickiae
Eucalyptus mooreana
Eucalyptus rhodantha
Eucalyptus steedmanii
Eucalyptus suberea
Eucalyptus synandra subsp. (wheatbelt) A. S. George 16203
Eucalyptus sp. (Pingaring) M. I. H. Brooker 9109
Eucalyptus sp. (eastern forest) M. I. H. Brooker 9046
Eucalyptus sp. (Midlands Highway) M. I. H. Brooker 8734
Eucalyptus sp. (Moresby Range) S. D. Hopper 2759
Eucalyptus sp. (Yandanooka) M. I. H. Brooker 9205
Eucalyptus sp. (Cape Naturaliste) K. H. Rechinger 58888
Eucalyptus sp. (Norseman) S. D. Hopper 2736
Eucalyptus sp. (E Nambung) M. I. H. Brooker 9025
Eucalyptus sp. (Badgingarra) M. I. H. Brooker 9026
Eucalyptus sp. (Northampton) M. I. H. Brooker 9196
Eucalyptus sp. (Yanchep) M. I. H. Brooker 8608
Eucalyptus sp. (N Coomallo) M. I. H. Brooker 8823
Gastrolobium appressum
Gastrolobium glaucum
Gastrolobium tomentosum
Grevillea baxteri
Grevillea cirsiifolia
Grevillea dryandroides
Grevillea inconspicua
Grevillea infundibularis
Grevillea involucrata
Grevillea prostrata
Grevillea saccata
Grevillea scapigera
Hakea aculeata
Hakea megalosperma
Hakea tamminensis
Halosarcia bulbosa
Hemiandra gardneri
Hemiandra rutilans
Hemigenia viscida
Hensmania chapmanii
Hibbertia bracteosa
Hydrocotyle lemnoides
Kennedia beckxiana
Kennedia glabrata
Kennedia macrophylla
Lambertia echinata
Lambertia fairallii
Lambertia orbifolia
Laxmannia jamesii
Lechenaultia chlorantha
Lechenaultia laricina
Lechenaultia pulvinaris
Lechenaultia superba
Lepidium catapycnon
Leucopogon obtectus
Microcorys eremophiloides
Microtis globula
Myoporum salsoloides
Myoporum turbinatum
Neogoodenia minutiflora
Pityrodia augustensis
Prasophyllum triangulare
Prostanthera carrickiana
Prostanthera magnifica
Pterostylis pusilla
Pterostylis sp. (Northampton) S. D. Hopper 3349
Ptychosema pusillum
Pultenaea pauciflora
Rhagodia acicularis
Rhizanthella gardneri
Ricinocarpos trichophorus
Roycea pycnophylloides
Spirogardnera rubescens
Stawellia dimorphantha
Stylidium coroniforme
Stylidium galioides
Stylidium plantagineum
Stylidium scabridum
Tetratheca aphylla
Tetratheca harperi
Thelymitra psammophila
Thelymitra stellata
Thomasia montana
Thomasia sp. (York) A. S. George 8075
Thryptomene wittweri
Tribonanthes purpurea
Veticordia fimbrilepis
Verticordia helichrysantha
Verticordia hughanii
Verticordia staminosa
Verticordia sp. (Fitzgerald) C. A. Gardner 9148
Villarsia calthifolia
Wurmbea drummondii
Wurmbea humilis
Wurmbea tubulosa
Wurmbea sp. (Cape Naturaliste) S. D. Hopper 5871
Xyris sp. (Stirling Range) G. J. Keighery 7951

APPENDIX III

CONSERVATION OF ENDANGERED FLORA IN THE WILD

CALM POLICY STATEMENT NO.9

Background

(N.B. Existing legislation uses the term 'rare flora'. It is necessary to continue to use this term when quoting the legislation but the term 'endangered flora' is to be used generally, as it will replace the other term when the act is amended.)

The Department of Conservation and Land Management has statutory responsibilities for endangered flora conservation. This is a major concern because:

> W.A. has a flora that is exceptionally rich in localized and rare endemic plant species. Moreover, areas where rare species are concentrated coincide predominantly with the wheatbelt and other areas where there has been extensive clearing or modification of the native flora.
>
> Section 23F of the Wildlife Conservation Act prohibits the taking (injury or destruction) of declared rare flora by any person on any land throughout the State without the consent in writing of the Minister. A breach of this provision may lead to a fine of up to $10 000. The flora provisions of the act are binding on the Crown.

Officers of the Department need to know how to identify declared rare flora, to know where it occurs, and to know how best to manage it. Moreover, the act prescribes that endangered flora be protected on all categories of land throughout the State. Hence, the legislation requires officers of the Department to advise and otherwise deal with a broad spectrum of land owners and users. Endangered flora conservation is thus an issue of high public profile, and one where the Department's activities are subject to intense public scrutiny.

Legislation

Rare flora is described in subsection 23F(1) of the Wildlife Conservation Act as "flora for the time being declared to be rare flora for the purposes of this section". Further clarification is provided in subsection 23F(2):

'Where the Minister is of opinion that any class or description of rare flora is likely to become extinct or is rare or otherwise in need of special protection, he may, by notice published in the Government Gazette declare that class or description of flora to be rare flora for the purposes of this section throughout the State'.

The Schedule of Declared Rare Flora

The schedule of Declared Rare (Endangered) Flora is reviewed annually.

Plants (not including hybrids) which are protected flora declared under the Wildlife Conservation Act may be recommended for gazettal as declared rare (endangered) flora if they satisfy the following criteria:

> The taxon (species, subspecies, variety) is well-defined, readily identified and represented by a voucher specimen in a State or National Herbarium. It need not necessarily be formally described under conventions in the International Code of Botanical Nomenclature, but such a description is preferred and should be undertaken as soon as possible after listing on the schedule.

Have been searched for thoroughly in the wild by competent botanists during the past five years in most likely habitats, according to guidelines approved by the Executive Director (see Table 2).

Searches have established that the plant in the wild is either:

a) rare

or

b) in danger of extinction;

or

c) deemed to be threatened and in need of special protection.

> (Plants which occur on land reserved for nature conservation may be considered less in need of special protection than those on land designated for other purposes).

The status of an endangered plant in cultivation has no bearing on this matter. The legislation refers only to the status plants in the wild.

Plants *may be deleted* from the schedule of declared rare (endangered) flora where:

> recent botanical survey as defined above has shown that the taxon is not rare, in danger of extinction or otherwise in need of special protection;
>
> the taxon is shown to be a hybrid;
>
> the taxon is presumed to be extinct (has not been collected or reliably observed over the past 50 years, or all known wild populations have ben destroyed more recently).
>
> *or*
>
> the taxon is no longer endangered because it has been adequately protected by reservation of land where it occurs, or because its population numbers have increased beyond the danger point.

'Taking' Endangered Flora

In the Wildlife Conservation Act (subsection 6 (1)) the following definition is given:

> 'to take' in relation to any flora includes to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means;'

Thus, taking declared endangered flora would include not only direct injury or destruction by human hand or machine but such activities as allowing stock to graze on the flora, introducing pathogens that attack it, altering water tables such that the flora is deprived of adequate soil moisture or is inundated, allowing air pollutants to harm foliage, etc.

In the case of endangered plants which need fire for regeneration, burning at an appropriate time may not injure the population and may not constitute 'taking' in the spirit of the Act. However, in case of endangered plants sensitive to fire, burning may be detrimental to the long-term survival of the population and allow fire to burn them would be to 'take'.

Operational Objective

To conserve endangered flora in the wild in W.A. and to comply with Section 23F of the Wildlife Conservation Act.

Policy

The Department will:

(1) Identify, locate and seek to conserve endangered flora.

(2) Undertake research into the taxonomy, population biology, ecology, protection and propagation of endangered flora.

(3) Implement management practices to preserve endangered flora and its habitat.

(4) Publicize the need for conservation of endangered flora, and encourage involvement in conservation from all sectors of the community.

(5) Liaise with other land management and research agencies and private land owners to enhance the study and conservation of endangered flora.

(6) Develop and manage a geographic data base for endangered flora at its headquarters and at regional and district offices.

Strategies

To accomplish the Department objective and policies, staff will:

(1) Undertake training in Departmental obligations to conserve and manage endangered flora.

(2) Nominate Endangered Flora Officers (addition to District Wildlife Officers) in each region and district who shall be responsible for identifying, locating, mapping, training staff, overseeing management programs and providing liaison and advice on endangered flora.

(3) Establish and maintain field herbaria, photographic collections, map records and other aids concerning endangered flora at each ranger station and district and regional office.

(4) Arrange an inspection to establish whether declared endangered flora are present before undertaking any activity on CALM land that involves permanent destruction (i.e. clearing for road-making, building, mining or other purposes) of native flora.

(5) Ensure that no known endangered flora is destroyed, damaged, or otherwise injured by Departmental staff or their contractors without first obtaining a ministerial permit to do so.

(6) Ensure that any burning program (for fire protection purposes) will not cause irreparable damage to species of endangered rare flora known to be susceptible to fire.

(7) Observe other operational guidelines for protection of endangered flora on CALM lands as detailed in Administrative Instruction No.24 'Protection of Endangered Flora in Departmental Operations'.

(8) Monitor known populations of endangered flora.

(9) Maintain a geographic and biological data base on endangered flora.

(10) Develop management programs for species of endangered flora.

(11) Collect seed and propagate endangered flora in Departmental nurseries. Replant propagated material in the wild under approved management programs.

(12) Undertake research on the distribution, taxonomy, genetic systems, population biology, ecology, protection and propagation of endangered flora.

(14) Acquire land through donation, exchange or purchase to protect endangered flora where land and/or funds are available.

(15) Maintain a system for listing and delisting flora on the declared endangered schedule.

(16) Establish a consultative committee with the W.A. Herbarium, Kings Park Board, tertiary institutions and other relevant organizations to ensure that research and management of declared endangered flora are co-ordinated.

(17) Publicize information on endangered flora (without disclosing precise locations) and encourage community involvement in the conservation of endangered flora.

(18) Maintain, through the Wildlife and Land Administration Branch, central records of all correspondence, discoveries of endangered flora populations, basic information on susceptibility to fire or dependence on fire for regeneration, applications for ministerial permits and other matters to do with declared endangered flora.

(19) Refer enforcement matters regarding the taking of declared endangered flora to the appropriate District Wildlife Officer.

Guidelines for Surveys of Plants Proposed for Listing on the Schedule of Endangered Flora

The intensity of survey necessary to understand the conservation status of a plant varies according to a number of factors. Important considerations are:

1. **Geographical range**

   A taxon extending over 10 km of terrain will take less time to survey than one that occurs over 100 km.

2. **Area of available habitat**

   Taxa confined to specific localized habitats (e.g. granite outcrops) will require less time to survey than those more catholic in habitat preference.

3. **Plant Size**

   Large conspicuous perennial plants (e.g. eucalypts) can be identified and counted more quickly than small inconspicuous annuals.

4. **Seasonality and identification**

   Some plants are identifiable and conspicuous on vegetative features at any time of year. Others only stand out during flowering or fruiting, which may be confined to just a few weeks in the year, and may also be dependent on good seasonal conditions.

5. **Disturbance opportunism**

   Some plants only germinate and/or flower following disturbance events such as bushfire or earthworks, and hence can only be surveyed after such events.

Based on these considerations, and the accumulated survey experience of many botanists and other CALM officers who have searched for hundreds of Western Australian plants over the past decade, the following matrix provides guidelines as to the duration of search necessary for plants to be considered for addition or deletion to the schedule of Endangered Flora.

Extremes of plant taxa in terms of ease and seasonality of identification are given.

		Recommended period of full time field survey	
Geographical Range	Area of available habitat	*Taxon easily identifiable any time	** Taxon identifiable with difficulty over short flowering period in certain years
<50 km	small	0.5-1 month	1-2 months over several years
	large	1-2 months	3-6 months over a decade
> 50 km	small	3-6 months	6-12 months over a decade
	large	6-12 months	not possible ?

*e.g. large perennial plants identifiable any time on vegetative characteristics - *Eucalyptus crucis*, *Banksia tricuspis*

**e.g. short-lived small annuals with inconspicuous flowers - *Hydrocotyle* spp., annual sedges etc.

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