

154

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# RESEARCH NOTES



## CONTENTS

G. Abbott: The vascular flora of the Porongurup Range, South Western Australia, pp. 1-16.

R. M. Richardson and D. H. S. Richardson: A Systematic List with Distributions of the Lichen species of Western Australia based on collections in the Western Australian Herbarium, pp. 17-29.

E. A. Griffin, R. J. Hladik and S. D. Hopper: Flora Conservation Values of Vacant Crown Land South of Mount Adams, Western Australia, pp. 31-47.

## INSTRUCTIONS TO AUTHORS

1. Papers dealing with flora and vegetation of Western Australia will be considered for publication.
2. Style should follow that of a recent issue. All *instructions*, including drawings, maps, graphs, and photographs, should follow a single, numbered sequence in each paper. They should be submitted in their final size for printing (maximum dimensions 15 cm x 24 cm including space for caption). *References* should quote titles of periodicals in full. Authors should suggest a *short title* for page headings.
3. Papers will be reviewed by an editorial committee. Contributions should be addressed to The Editor, Research Notes, Western Australian Herbarium, Department of Agriculture, George Street, South Perth, Western Australia 6151.
4. VOUCHER SPECIMENS: It is suggested that botanical names central to the objective of the paper be supported by specimens deposited in a recognized herbarium and that the institution be cited in the paper. It is desirable to quote, in the paper, numbers identifying specimens whose determination is uncertain. An explanatory note on the subject is available from the Editor.

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THE VASCULAR FLORA OF THE PORONGURUP RANGE  
SOUTH-WESTERN AUSTRALIA

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## ABSTRACT

*The Porongurup Range has a vascular flora of 368 species in 67 families.*

*The three main vegetation units differ in their species richness: 85 species were recorded in Eucalyptus diversicolor (karri) forest, 255 species in E. marginata (jarrah) forest and open-scrub, and 119 species on granitic rock exposures. The number of species found in one only of these units was: 21 (karri), 163 (jarrah), 55 (granitic rocks). The flora of granitic rocks has a greater similarity to that of jarrah forest and open-scrub than to that of karri forest.*

*Only two species (Hibbertia bracteosa and Villarsia calthifolia) are known to be endemic to the Porongurup Range.*

*Several species that are prominent in similar habitats around or near the Porongurup Range are listed. A list of widespread species with apparently isolated populations in the Porongurup Range is also provided.*

## INTRODUCTION

The Porongurup Range (maximum altitude 655 m) rises from a plain between Albany and the Stirling Ranges, South-western Australia. The area above 300 m is approximately 3200 ha. Half of this area consists of tall open forest isolated by about 50 km from the nearest similar habitat. About 2300 ha of the Range and adjoining areas are National Park.

This paper is based essentially on plant collections made by me between 1974 and 1980, on all major peaks except Twin Peaks, Collier Peak and Halls Peak; most attention was given to the area between Woodlands Road and Millinup Pass. The Porongurup Range is here defined as being bounded by Woodlands Road and the 300 m contour line, with the addition of one area below 300 m, namely the Mira Flores estate on the southern side. A topographical map of the Range is given in Figure 1.

As the area has now been quite thoroughly collected, the 368 species listed in Appendices 1 and 2 probably represent some 90% of a total vascular flora approaching 400 species.

## ENVIRONMENT

### Geology and Soils

The Porongurup Range is representative of the country rock of the Archaean Plateau of Western Australia, consisting of granites and gneisses. On parts of this plateau are numerous granitic monadnocks of which the Porongurup Range is probably the largest.

On the upper parts of the Range there is much exposed granitic rock, and except in valleys soils (sands) are not deep. On the lower slopes, deep red loams have developed. Still further downslope, soils are gravelly (lateritic) sands.

### Climate

There is no temperature recording station at the Range, but temperatures are probably slightly more equable than at nearby Mt. Barker (mean daily maxima in January and July = 27.4 and 14.8°C respectively; mean daily minima in same months = 13.3 and 6.5°C).

Rainfall data for Porongurup Village on the north side of the Range, just below the 300 m contour, are as follows:

	J	F	M	A	M	J	J	A	S	O	N	D	Y
Mean rainfall (mm)	31	33	46	64	98	102	107	93	92	94	54	34	848
Median rainfall (mm)	19	28	43	58	84	93	97	96	96	80	48	32	838
Mean No. raindays	7	8	10	13	16	18	20	17	17	16	11	8	160

These data are for the period 1914-1978 where records are available (usually 29-33 years). They show that about two-thirds of the annual rainfall falls between May and October inclusive. The Porongurup Range is also one of the few places in Western Australia where snow occasionally falls.

It seems very likely that the southern (windward) side of the Range would receive over 900 mm because of an orographic effect; this is evidenced by higher quality jarrah forest on the southern slopes relative to that of the northern slope.

### Vegetation

Four vegetation units are recognizable: tall open forest (estimated area 1700 ha); open forest, including small areas of open-scrub, formerly continuous with the chief vegetation type surrounding the Range; a lithic complex of mossland, herbland and fernland (total area about 250 ha); and pasture. These units have been mapped by Abbott (1981).

Tall open forest has *Eucalyptus diversicolor* (karri) as dominant and *E. calophylla* (marri) as subdominant. This unit is restricted to deep, red loams. The understorey vegetation may be low and sparse (often dominated by *Pteridium aquilinum*) or dense and tall (dominated by *Albizia lophantha*, *Acacia urophylla* or *Trymalium spathulatum*). These differences may reflect variation in soil depth, effective moisture, and fire history.

Open forest consists of jarrah and marri, and occurs on laterite soils and freely-draining sands. Understorey is rarely dense. The main understorey species are *Bossiaea linophylla*, *Xanthorrhoea preissii*, *Hibbertia* spp., *Acacia leioderma*, *Agonis hypericifolia*, *A. parviceps*, *Myoporum tetrandrum* and *Leucopogon revolutus*. At lower levels near the 300 m contour, where drainage is impeded, open forest becomes open-scrub, dominated by *Astartea fascicularis*, *Kunzea recurva*, *Banksia littoralis*, *Melaleuca preissiana*, *Agonis hypericifolia* and *A. parviceps*.

Lithic complex refers to the vegetation present on shallow soils associated with rock exposures. These are covered with mosses, lichens, *Cheilanthes tenuifolia* and *Thryptomene saxicola* where soils are shallow. In valleys or where soil is deeper, *Eucalyptus megacarpa* and *E. cornuta* occur with dense thickets dominated by *Agonis linearifolia*, *Acacia heteroclita* and *Hakea varia*.

Pasture, sown to subclover, with many other non-native plant species present, now virtually encircles the Porongurup Range.

#### PREVIOUS BOTANICAL STUDIES

James Drummond visited the Range in 1843 and 1848 and probably collected widely there. Unfortunately, his precise collecting localities are unknown. He recorded that:

"Soon after the rains set in. a beautiful little annual everlasting flower (*Helipterum cotula*)\* covers the tops of the Perongarup hills, in many places giving them the appearance of being covered with snow" (1849, p.250).

"The Perongarup are clothed with mosses and *Jungermannia* and lichens, as rank and luxuriant as I have seen them in the moist rich valleys in the south of Ireland. These, as they grow and decay, lay the foundation of a soil which is covered with grasses and sow thistles equally rank to the tops of the hills; these, in their turn, furnish a soil which is covered with gigantic gum trees (karri), many of them 100 feet high, without a branch - by far the finest I have seen in any country" (1849, p.251).

Drummond in a letter to Hooker dated 21.2.1844, noted a species of *Villarsia* (*V. calthifolia*), one foot in breadth. Also mentioned were two new species of fern (*Asplenium*). He recorded that the granite slopes are poor in plant species in contrast to the ironstone gravels.

\*Brackets indicate interpolations by I. Abbott.

A description of the flora, including mosses and lichens, of granite rocks of the Porongurup Range was provided by Smith (1962) in a paper also containing habitat photographs. Some of the species recorded by Smith have not been relocated during the present study despite thorough searching. These, together with several herbarium records noted in the course of other work, are listed in Appendix 2.

## BIOGEOGRAPHY

Probably the most interesting biogeographical feature of the flora of the Porongurup Range is the occurrence of karri some 50 km NE of the main tract of karri forest at Denmark. This occurrence is a relict one. Karri forest several thousand years ago covered a larger area of South-western Australia than at present, probably when annual rainfall was higher (Churchill 1968).

There are still no regional lists of the plant species occurring in karri forests, or between Albany and the Stirling Ranges. Consequently, this section does not pretend to be a complete treatment of the place of the Porongurup Range flora in a regional floristic context. Instead, I shall discuss the diversity of plant species in the various vegetation units in the Range, compare its endemic flora with that of the nearby Stirling Ranges, highlight interesting absences of plant species from the Porongurup Range, and list some of those species with outlying populations in the Porongurup Range.

### Species richness

The number of plant species recorded in the three major vegetational units was as follows: karri forest, 85; jarrah forest, 255; granitic rocks, 119 (Appendix 1). This confirms Drummond's observation (recorded above) that fewer plant species are found on granitic rocks than in jarrah forest, though this should not be surprising given the relatively small extent of exposures of granitic rocks. The number of species found only in one of the three major vegetation types was: karri forest, 21; Jarrah forest, 163; granitic rocks, 55. The flora of granitic rocks has a greater similarity with that of jarrah forest (.19, using Sorensen's coefficient) than with karri forest (.08).

### Endemic species

Only two species of vascular plants are known to be endemic to the Porongurup Range: *Hibbertia bracteosa* and *Villarsia calthifolia*. All occurrences (with one exception noted below) are above 400 m altitude, on granitic rocks. *H. bracteosa* has been found on Devil's Slide, King Alfred's Castle, Morgan's View and Nancy's Peak but not on Castle Rock; it might also be expected to occur also on Twin Peaks and Collier Peak which were not visited. *V. calthifolia* has been recorded on Devil's Slide, Morgan's View and Nancy's Peak, and in karri forest (just below the 300 m contour) in Mira Flores estate.

The percentage of plant species endemic to the Porongurup Range (0.54%) is much lower than the 5% endemic to the Stirling Ranges National Park (N.G. Marchant, pers. comm.). This difference is consistent with the

concept of several authors that species in South-western Australia seem to have evolved mainly at the drier margins of the southwest corner (see Hopper 1979).

#### Absences

Species occurring nearby but not in the Porongurup Range can be conveniently considered to belong to one of two categories: those that occur around the Range, and those that occur near the Range. I found the distribution maps of Churchill (1961) useful in selecting good examples of each class of species.

Species absent from the Porongurup Range, but occurring around it, include: *Adenanthos obovata* Labill., *Banksia coccinea* R.Br., *B. ilicifolia* R.Br., *B. quercifolia* R.Br., *Borya nitida* Labill., *Casuarina decussata* Benth., *Eucalyptus decipiens* Endl., and *E. occidentalis* Endl.

Species absent from the Porongurup Range, which is just outside their area of distribution, include: *Acacia pentadenia* Lindl., *Adenanthos cuneata* Labill., *Agonis flexuosa* (Spreng.) Schauer, *A. juniperina* Schauer, *Anigozanthos flavidus* Redoute & DC., *Bossiaea aquifolia* Benth., *Boronia gracilipes* F.Muell., *Casuarina huegeliana* Miq., *Chorilaena quercifolia* Endl., *Crocea angustifolia* Sm., *Eucalyptus rudis* Endl., *E. tetragona* (R.Br.) F.Muell., *E. wandoo* Blakely, *Exocarpos sparteus* R.Br., *Hibbertia cuneiformis* (Labill.) Sm., *Lambertia inermis* R.Br., *Macrozamia riedlei* (Fisch. ex Gaud.) C.A. Gardner, *Persoonia longifolia* R.Br., *Podocarpus drouyniana* F.Muell., and *Thomasia quercifolia* (Andr.) J.Gay.

#### Outliers

Widespread plant species with a population apparently isolated in the Porongurup Range includes: *Acacia urophylla*, *Agonis linearifolia*, *Albizia lophantha*, *Eucalyptus diversicolor*, *E. megacarpa*, *Hovea elliptica*, *Mirbelia dilatata*, *Trymalium spathulatum* and *Xanthorrhoea gracilis*. It is also likely that species listed solely under karri or granite in Appendix 1 will prove to have an isolated population in the Range.

#### FIRE

According to Iffla (1979, Chapter 24), aborigines avoided the Porongurup Range. There is some historical evidence that few aborigines lived in the main tract of karri forest near Manjimup, especially in summer (Talbot 1973). Talbot also records that dense thickets of understorey were widespread in the karri forests upon the arrival of European man. These points suggest that the Range may have been little burnt by aborigines. On the other hand, lightning stikes are frequent in summer and would probably have started occasional fires in karri forest (Underwood 1978).

It appears, then, that the role of fire in affecting the structure and floristic composition of understorey in karri forest in the Porongurup Range remains to be worked out.

## ACKNOWLEDGEMENTS

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N.G. Marchant made useful comments on an earlier version of this paper.

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## APPENDIX 1

SPECIES COLLECTED IN THE PORONGURUP RANGE  
DURING 1974-1980

This list comprises only species collected by me since 1974. In Appendix 2 is a supplementary list of species recorded earlier but not collected after thorough searches between 1974 and 1980. This procedure has been followed to encourage future collectors to look for them specially.

In this list, the occurrence of species in karri forest, jarrah forest or on granitic rocks is recorded as K, J or G, respectively. It is to be expected that further observations in the Range will alter the categorisation



of some species. An asterisk signifies a naturalized alien species.

Mosses and lichens and other non-vascular plants were not collected, and so have been omitted from the list.

Voucher specimens are deposited in the Western Australian Herbarium (PERTH).

## ADIANTACEAE

- Adiantum aethiopicum* L. K  
*Cheilanthes tenuifolia* (N.L.Burman)Swartz K J G

## AIZOACEAE

- Carpobrotus modestus* S.T.Blake G

## APIACEAE

- Daucus glochidiatus* (Labill.)Fisch.,  
 C.A.Meyer & Ave-Lall. K J G  
 ?*Homalosciadium homalocarpum* (F.Muell.)Hj.Eichler ?  
*Hydrocotyle callicarpa* Bunge J  
*H. diantha* DC. G  
*Platysace compressa* (Labill.)Norman J G  
*Trachymene anisocarpa* (Turcz.)B.L.Burttt G  
*T. pilosa* Sm. J G  
*Xanthosia pusilla* Bunge J  
*X. rotundifolia* DC. K J

## ARACEAE

- \**Zantedeschia aethiopica* (L.)Spreng. K J

## ASTERACEAE

- \**Arctotheca calendula* (L.)Levyns J G  
*Brachycome ciliaris* (Labill.)Less. G  
*Chrysocoryne drummondii* A.Gray J  
 \**Cirsium vulgare* (Savi)Ten. K J  
 \**Conyza albida* Spreng. K J  
 \**C. bonariensis* (L.)Cronquist K J  
 \**Gnaphalium candidissimum* Lamarck J  
 \**G. luteo-album* L. J  
*G. sphaericum* Willd. J  
*Helichrysum bracteatum* (Vent.)Andr. K J G  
*H. ramosum* DC. K  
*Helipterum cotula* (Benth.)DC. G  
 \**Hypochoeris glabra* L. K J G  
*Ixiolaena viscosa* Benth. J  
*Lagenifera huegelii* Benth. K J  
*Millotia myosotidifolia* (Benth.)Steetz. G  
*M. tenuifolia* Cass. J G  
*Olearia paucidentata* (Steetz.)Benth. G  
 \**Picris hieracioides* L. K J G  
*Pithocarpa corymbulosa* Lindl. J  
*Quinetia urvillei* Cass. G  
*Rutidosia multiflora* (Nees)B.L. Robinson G  
*Senecio hispidulus* A.Rich. K G  
*S. ramosissimus* DC. K  
*Siloxerus humifusus* Labill. K J  
 \**Sonchus oleraceus* L. ?

## CAMPANULACEAE

- Wahlenbergia stricta* Sweet K J

## CARYOPHYLLACEAE

- \**Cerastium glomeratum* Thuill. K J G

CARYOPHYLLACEAE (cont.)			
* <i>Petrorhagia prolifera</i> (L.) P.W.Ball & V.H.Heywood	K		
* <i>Polycarpon tetraphyllum</i> (L.) L.	K	J	G
* <i>Spergularia rubra</i> (L.) J. & C. Presl			G
* <i>Stellaria media</i> (L.) Vill.		J	G
CASUARINACEAE			
<i>Casuarina fraserana</i> Miq.		J	
<i>C. humilis</i> Otto & Dietr.		J	
CENTROLEPIDACEAE			
<i>Aphelia cyperoides</i> R.Br.		J	G
<i>Brizula muelleri</i> Hieron.			G
<i>B. nutans</i> (Hook.f. ex Benth.) C.A.Gardner		J	
<i>Centrolepis aristata</i> (R.Br.) Roemer & Schultes		J	G
<i>C. drummondii</i> (Nees) Walp.			G
<i>C. polygyna</i> (R.Br.) Hieron.		J	
<i>C. strigosa</i> (R.Br.) Roemer & Schultes		J	G
CONVULVULACEAE			
<i>Dichondra repens</i> J.R. & G.Forester	K	J	
CRASSULACEAE			
<i>Crassula colorata</i> (Nees) Ostenf.	K	J	
<i>C. decumbens</i> Thunb.			G
<i>C. pedicellosa</i> (F.Muell.) Ostenf.			G
CYPERACEAE			
<i>Carex appressa</i> R.Br.			G
<i>Cyathochaeta avenacea</i> Benth.		J	
<i>Gahnia trifida</i> Labill.		J	
<i>Lepidosperma angustatum</i> R.Br.			G
<i>L. effusum</i> Benth.	K		G
<i>Mesomelaena stygia</i> (R.Br.) Nees		J	
<i>M. tetragona</i> (R.Br.) Benth.		J	
<i>Schoenus</i> sp. (annual)		J	
<i>S. lanatus</i> Labill.		J	
<i>S. minutulus</i> F.Muell.		J	
<i>S. nanus</i> (Nees) Benth.			G
<i>Scirpus brunonianus</i> S.T.Blake		J	
<i>S. cernuus</i> Vahl		J	G
<i>S. inundatus</i> (R.Br.) Spreng.		J	
<i>S. nodosus</i> Rottb.	K	J	
<i>Tetraria octandra</i> (Nees) Kuekenenthal		J	G
DENNSTAEDTIACEAE			
<i>Asplenium adiantoides</i> (L.) Lamarck			G
<i>A. flabellifolium</i> Cav.			G
<i>Pteridium aquilinum</i> (L.) Kuhn	K	J	
DILLENACEAE			
<i>Hibbertia amplexicaulis</i> Steud.		J	
<i>H. bracteosa</i> Turcz.			G
<i>H. lineata</i> Steud.		J	
<i>H. microphylla</i> Steud.		J	
<i>H. montana</i> Steud.		J	
<i>H. ? pulchra</i> Ostenf.		J	
DROSERACEAE			
<i>Drosera ? erythrorhiza</i> Lindl.		J	
<i>D. glanduligera</i> Lehm.		J	
<i>D. menziesii</i> R.Br.		J	
<i>D. pallida</i> Lindl.		J	
<i>D. pulchella</i> Lehm.		J	
<i>D. subhirtella</i> Planch.			G

## EPACRIDACEAE

<i>Andersonia caerulea</i> R.Br.	J		
<i>A. sprengelioides</i> R.Br.			G
<i>Astroloma baxteri</i> DC.	J		
<i>A. pallidum</i> R.Br.	J		
<i>Leucopogon australis</i> R.Br.	J		
<i>L. capitellatus</i> DC.	J		
<i>L. carinatus</i> R.Br.	J		
<i>L. elegans</i> Sonder			G
<i>L. propinquus</i> R.Br.	J		
<i>L. reflexus</i> R.Br.			G
<i>L. revolutus</i> R.Br.	K	J	
<i>L. verticillatus</i> R.Br.	K	J	
<i>Lysinema ciliatum</i> R.Br.		J	
<i>Sphenotoma capitatum</i> (R.Br.) Lindl.		J	
<i>Styphelia tenuiflora</i> Lindl.		?	

## EUPHORBIACEAE

<i>Phyllanthus calycinus</i> Labill.	J		
<i>Poranthera microphylla</i> Brongn.	J		

## GENTIANACEAE

* <i>Centaurium spicatum</i> (L.) Fritsch	K	J	
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## GERANIACEAE

* <i>Erodium cicutarium</i> (L.) L'Hérit.	K	J	
* <i>Geranium molle</i> L.	K		
<i>Pelargonium australe</i> Willd.			G

## GOODENIACEAE

<i>Dampiera linearis</i> R.Br.	K	J	G
<i>Goodenia caerulea</i> R.Br.		J	
<i>G. filiformis</i> R.Br.		J	
<i>Lechenaultia formosa</i> R.Br.		J	
<i>Scaevola striata</i> R.Br.	K	J	G
<i>Velleia trinervis</i> Labill.			G

## HAEMODORACEAE

<i>Anigozanthos bicolor</i> Endl.		J	
<i>Conostylis setigera</i> R.Br.		J	
<i>Haemodorum spicatum</i> R.Br.		J	

## HALORAGACEAE

<i>Gonocarpus rudis</i> (Benth.) Orchard			G
<i>Haloragis brownii</i> (J.D.Hooker) Schindler	K		G

## IRIDACEAE

<i>Patersonia occidentalis</i> R.Br.		J	
* <i>Romulea rosea</i> (L.) Eckl.			G
* <i>Watsonia ? bulbifera</i> J.W.Mathews & L.Bolus	K	J	

## JUNCACEAE

* <i>Juncus bufonius</i> L.		J	
<i>J. capitatus</i> Weig.		J	
<i>J. holoschoenus</i> R.Br.		J	
<i>J. pallidus</i> R.Br.		J	
<i>J. pauciflorus</i> R.Br.	K	J	
<i>Luzula meridionalis</i> Nordensk		J	

## LUNCAGINACEAE

<i>Triglochin centropcarpa</i> Hooker			G
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## LEGUMINOSAE

<i>Acacia browniana</i> H.L.Wendl		?	
<i>A. drummondii</i> Lindl.		J	G
<i>A. heteroclita</i> Meisn.			G
<i>A. leioderma</i> Maslin		J	
<i>A. myrtifolia</i> (Sm.) Willd.	K	J	

## LEGUMINOSAE (cont.)

Acacia pulchella R.Br.	K		
A. urophylla Benth. ex Lindl.	K		
Albizia lophantha (Willd.)Benth.	K		
Bossiaea linophylla R.Br.		J	
Brachysema subcordatum Benth.	K		G
Chorizema diversifolium DC.		J	
C. ilicifolium Labill.	K	J	
C. rhombeum R.Br.		J	
*Cytisus proliferus L.f.	K		
Daviesia cordata Sm.		J	
D. decurrens Meisn.		J	
D. horrida Preiss ex Lehm.		J	
*Dipogon lignosus (L.)Verdc.		J	
Eutaxia densifolia Turcz.		J	
E. obovata (Labill.)C.A.Gardner			G
Gompholobium knightianum Lindl.		J	
G. ovatum Meisn.		J	
G. polymorphum R.Br.		J	
Hardenbergia comptoniana (Andr.)Benth.		J	G
Hovea chorizemifolia (Sweet)DC.		J	
H. elliptica (Sm.)DC.	K	J	
Kennedia coccinea Vent.		J	G
K. microphylla Meisn.		J	
*Lablab purpureus (L.)Sweet	K		
*Lotus subbiflorus Lag.	K	J	
Mirbelia dilatata R.Br.	K		
Oxylobium lanceolatum (Vent.)Druce	K	J	
*Psoralea pinnata L.	K		
Sphaerolobium alatum Benth.		J	
*Trifolium compestre Schreber	K	J	
*T. subterraneum L.		J	
Viminaria juncea (Schrad. & Wendl.)Hoffmanns.	K	J	
LENTIBULARIACEAE			
Polypompholyx tenella (R.Br.)Lehm.			G
LILIACEAE			
Agrostocrinum scabrum (R.Br.)Baill.		J	G
Burchardia multiflora Lindl.			G
Caesia parviflora R.Br.		J	
Calectasia cyanea R.Br.		J	
Chamaescilla corymbosa (R.Br.)F.Muell. ex Benth.			G
Dasypogon bromeliifolius R.Br.		J	
Dianella revoluta R.Br.		J	
Laxmannia sessiliflora Decaisne		J	
Lomandra micrantha (Lindl.)Ewart		J	
Kingia australis R.Br.		J	
Stypandra grandiflora Lindl.		J	G
Thysanotus multiflorus R.Br.		J	
Thysanotus patersonii R.Br.		J	
Tricoryne humilis Endl.		J	
Xanthorrhoea gracilis Endl.		J	
X. preissii Endl.		J	G
LINDSAEACEAE			
Lindsaea linearis Swartz		J	
LOBELIACEAE			
Isotoma hypo-crateriformis (R.Br.)Druce		J	
Lobelia alata Labill.	K	J	
L. rhombifolia De Vriese		J	

## LOGANIACEAE

- Logania serphyllifolia* R.Br. J  
*Mitrasacme paradoxa* R.Br. J G

## LORANTHACEAE

- Nuytsia floribunda* (Labill.)R.Br. ex Fenzl J

## LYTHRACEAE

- Lythrum hyssopifolia* L. K

## MALVACEAE

- Sida hookeriana* Miq. G

## MENYANTHACEAE

- Villarsia calthifolia* F.Muell. K G  
*V. parnassifolia* (Labill.)R.Br. J

## MYOPORACEAE

- Myoporum tetrandrum* (Labill.)Domin K

## MYRTACEAE

- Agonis hypericifolia* Schauer J  
*A. linearifolia* (DC.) Schauer K G  
*A. parviceps* Schauer J  
*Astartea fascicularis* (Labill.)DC. J  
*Calothamnus* sp. (either *preissii* Schauer or  
*lehmannii* Schauer) J  
*C. rupestris* Schauer J  
*Darwinia citriodora* (Endl.)Benth. G  
*D. oederioides* (Turcz.)Benth. J  
*D. vestita* (Endl.)Benth. J  
*Eucalyptus calophylla* Lindl. K J  
*E. cornuta* Labill. G  
*E. diversicolor* F.Muell. K  
*E. marginata* Donn ex Sm. J  
*E. megacarpa* F.Muell. G  
*Kunzea recurva* Schauer J  
*Melaleuca blaeriifolia* Turcz. G  
*M. densa* R.Br. J G  
*M. preissiana* Schauer J  
*M. scabra* R.Br. J  
*M. thymoides* Labill. J  
*Thryptomene saxicola* (A.Cunn. ex Hooker)Schauer G  
*Verticordia densiflora* Lindl. J

## OLACACEAE

- Olax phyllanthi* (Labill.)R.Br. J

## ONAGRACEAE

- Epilobium billardierianum* Ser. K

## ORCHIDACEAE

- Caladenia flava* R.Br. J G  
*C. menziesii* R.Br. G  
*C. nana* Endl. J G  
*C. patersonii* R.Br. J  
*C. sericea* Lindl. G  
*Cryptostylis ovata* R.Br. J G  
*Diurus longifolia* R.Br. G  
*Elythranthera brunonis* (Endl.)George K  
*Lyperanthus nigricans* R.Br. J G  
*Microtis alba* R.Br. K  
*M. unifolia* (G.Forster)H.Reichenb. ?J  
\**Monadenia micrantha* Lindl. K J G  
*Prasophyllum brownii* H.Reichenb. J  
*Pterostylis barbata* Lindl. G  
*P. vittata* Lindl. J

ORCHIDACEAE (cont.)			
Thelymitra fuscolutea R.Br.		J	
T. mucida Fitz.		?J	
T. nuda R.Br.	K	J	
OROBANCHACEAE			
Orobanche australiana F.Muell.	K	J	
OXALIDACEAE			
Oxalis corniculata L.	K	J	G
PHILYDRACEAE			
Philydrella pygmaea (R.Br.)Caruel		J	
PITTOSPORACEAE			
Billardia floribunda (Putterl.)F.Muell.		J	
B. granulata (Turcz.)E.M.Bennett			G
B. variifolia DC.		J	
Sollya heterophylla Lindl.	K	J	G
PLANTAGINACEAE			
*Plantago lanceolata L.	K	J	G
POACEAE			
Agrostis avenacea Gmel.			G
*Aira cupaniana Guss.		J	G
*Avena barbata Link		J	G
*Briza maxima L.		J	G
*B. minor L.	K	J	
*Bromus diandrus Roth.			G
*B. hordeaceus L.		J	
Danthonia caespitosa Gaud.		J	G
Deyeuxia quadriseta Benth.		?	
*Holcus lanatus L.	K	J	G
*Hordeum ? leporinum Link		J	
Microlaena stipoides (Labill.)R.Br.		J	
Neurachne alopecuroides R.Br.		J	
*Poa annua L.		J	G
P. serpentum Nees		J	G
*Sporobolus africanus (Poir.)Robyns & Tournay			G
Stipa compressa R.Br.		J	G
S. semibarbata R.Br.		J	
*Vulpia bromoides (L.) S.F.Gray		J	G
*V. myuros (L.)C.C.Gmelin		J	
POLYGALACEAE			
Comesperma calymega Labill.		J	
C. confertum Labill.		J	
POLYGONACEAE			
*Rumex acetosella L.	K	J	G
PORTULACACEAE			
Calandrinia calyptrata J.D.Hooker			G
C. neesiana Hj.Eichler			G
PRIMULACEAE			
*Anagallis arvensis L.	K	J	G
PROTEACEAE			
Banksia grandis Willd.		J	
B. littoralis R.Br.		J	
B. gardneri George		J	
B. sphaerocarpa R.Br.		J	
Dryandra armata R.Br.		J	
D. formosa R.Br. (? introduced - garden escape)		J	
D. nivea (Labill.)R.Br.		J	
D. pteridifolia R.Br.		J	
Grevillea brownii Meisn.		J	

## PROTEACEAE (cont.)

<i>Grevillea pulchella</i> (R.Br.)Meisn.	J		
<i>Hakea amplexicaulis</i> R.Br.	J		
<i>H. corymbosa</i> R.Br.	J		
<i>H. prostrata</i> R.Br.	J		
<i>H. ruscifolia</i> Labill.	J		
<i>H. trifurcata</i> (Sm.)R.Br.	J		
<i>H. undulata</i> R.Br.	J		
<i>H. varia</i> R.Br.	J	G	
<i>Isopogon attenuatus</i> R.Br.	J		
<i>I. formosus</i> R.Br.	J		
<i>Persoonia elliptica</i> R.Br.	J		
<i>Petrophile diversifolia</i> R.Br.	J		
<i>P. longifolia</i> R.Br.	J		
<i>P. serruriae</i> R.Br.	J		
<i>Synaphaea</i> aff. <i>favosa</i> R.Br.	J		

## RANUNCULACEAE

<i>Clematis pubescens</i> Huegel ex Endl.	K	J	
<i>Ranunculus colonorum</i> Endl.	K	J	

## RESTIONACEAE

<i>Anarthria gracilis</i> R.Br.	J		
<i>A. prolifera</i> R.Br.	J		
<i>Hypolaena exsulca</i> R.Br.	J		
<i>Lepyrodia drummondiana</i> Steud.	J		
<i>L. hermaphrodita</i> R.Br.	J	G	
<i>Loxocarya fasciculata</i> (R.Br.)Benth.	J		
<i>L. pubescens</i> (R.Br.)Benth.	J		
<i>Restio laxus</i> R.Br.	J		

## ROSACEAE

<i>Acaena</i> ? <i>echinata</i> Nees	K	J	
* <i>Rubus fruticosus</i> L.agg.	K		

## RUBIACEAE

<i>Galium</i> sp.	K	J	
<i>Opercularia hispidula</i> Endl.	K		G
<i>O. volubis</i> R.Br. ex Benth.	K		G

## RUTACEAE

<i>Boronia crenulata</i> Sm.	K	J	G
<i>B. spathulata</i> Lindl.		J	

## SAPINDACEAE

<i>Dodonaea oblongifolia</i> Link			G
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## SCROPHULARIACEAE

* <i>Bellardia trixago</i> (L.)All.	K	J	G
<i>Gratiola peruviana</i> L.		J	
* <i>Parentucellia latifolia</i> (L.)Caruel		?	
* <i>P. viscosa</i> (L.)Caruel	K	J	G
* <i>Prunella vulgaris</i> L.	K		
* <i>Verbascum virgatum</i> L.	K		
<i>Veronica calycina</i> R.Br.	K	J	

## SOLANACEAE

* <i>Solanum nigrum</i> L.	K	J	G
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## STACKHOUSIACEAE

<i>Stackhousia pubescens</i> A.Rich.		J	
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## STERCULIACEAE

<i>Rulingia corylifolia</i> R.A.Graham			G
<i>Thomasia</i> sp.	?		

## STYLIDIACEAE

<i>Levenhookia pusilla</i> R.Br.	J	G	
<i>Stylidium adnatum</i> R.Br.	J		

## STYLIDIACEAE (cont.)

<i>Stylidium amoenum</i> R.Br.	J	
<i>S. breviscapum</i> R.Br.	J	
<i>S. brunonianum</i> Benth.	J	
<i>S. calcaratum</i> R.Br.	J	G
<i>S. corymbosum</i> R.Br.	J	G
<i>S. crassifolium</i> R.Br.	J	
<i>S. repens</i> R.Br.	J	

## THYMELAEACEAE

<i>Pimelea</i> sp.		G
<i>P. ? lehmanniana</i> Meisn.	J	
<i>P. sylvestris</i> R.Br.	J	
<i>P. rosea</i> R.Br.	J	G

## TREMADRACEAE

<i>Tetratheca affinis</i> Endl.	J	
<i>Tremandra diffusa</i> R.Br.	J	
<i>T. stelligera</i> R.Br.	J	

## APPENDIX 2

SPECIES PREVIOUSLY COLLECTED  
IN THE PORONGURUP RANGE, BUT NOT FOUND DURING 1974-1980

All but one of the following species are supported by voucher specimens, which are indicated after each species name by the collector's name and the herbarium in which the specimen is filed: UWA = Department of Botany, University of Western Australia; PERTH = Western Australian Herbarium, Department of Agriculture, South Perth.

## ADIANTACEAE

*Anogramma leptophylla* (L.) Link - G.G.Smith, UWA

## AIZOACEAE

*Carpobrotus rossii* (Haw.) Schwantes - G.G.Smith, UWA

## APIACEAE

*Hydrocotyle blepharocarpa* F.Muell. - G.G.Smith, UWA

*H. hirta* R.Br. ex A.Rich. - A.S.George, PERTH

## ASTERACEAE

\**Cotula turbinata* L. - Listed by Smith (1962) as *Cenia turbinata* (L.) Pers. but no herbarium specimens have been located.

*Podolepis lessonii* (Cass.) Benth. - G.G.Smith, UWA

## CENTROLEPIDACEAE

*Centrolepis glabra* (F.Muell. ex Sonder) Hieron - G.G.Smith, UWA

## CRASSULACEAE

*Crassula sieberiana* (Schultes & J.H.Schultes) Druce - G.G.Smith, UWA

## CYPERACEAE

*Scirpus marginatus* Thunb. - P.G. Wilson, PERTH

\**S. prolifer* Rottb. - W.E.Blackall, PERTH

## EPACRIDACEAE

*Leucopogon oppositifolius* Sonder - W.E.Blackall, PERTH

## EUPHORBIACEAE

*Ricinocarpos glaucus* Endl. - T.E.H.Aplin, PERTH

## GOODENIACEAE

*Dampiera hederaceae* R.Br. - R.D. Royce, PERTH

*Goodenia leptoclada* Benth. - K. Newbey, PERTH



## HYPOXIDACEAE

*Hypoxis glabella* R.Br. - G.G.Smith, UWA

*H. occidentalis* Benth. - G.G.Smith, UWA

## LEGUMINOSAE

*Pultenea obcordata* (R.Br.) Benth. - K.Newbey, PERTH

\**Trifolium dubium* Sibth. - G.G.Smith, UWA

## OPHIOGLOSSACEAE

*Ophioglossum lusitanicum* L. - G.G.Smith & B.Dell, UWA

## ORCHIDACEAE

*Corybas dilatatus* (Rupp & Nicholls) Rupp & Nicholls - G.G.Smith, UWA;  
A.S.George, PERTH

## RUTACEAE

*Boronia molloyae* Drummond - W.A.Blackall, PERTH

## STYLIDIACEAE

*Levenhookia dubia* Sonder - G.G.Smith, UWA; R.D.Royce, PERTH

## THYMELEACEAE

*Pimelea lehmanniana* Meisn. - K.Newbey, PERTH

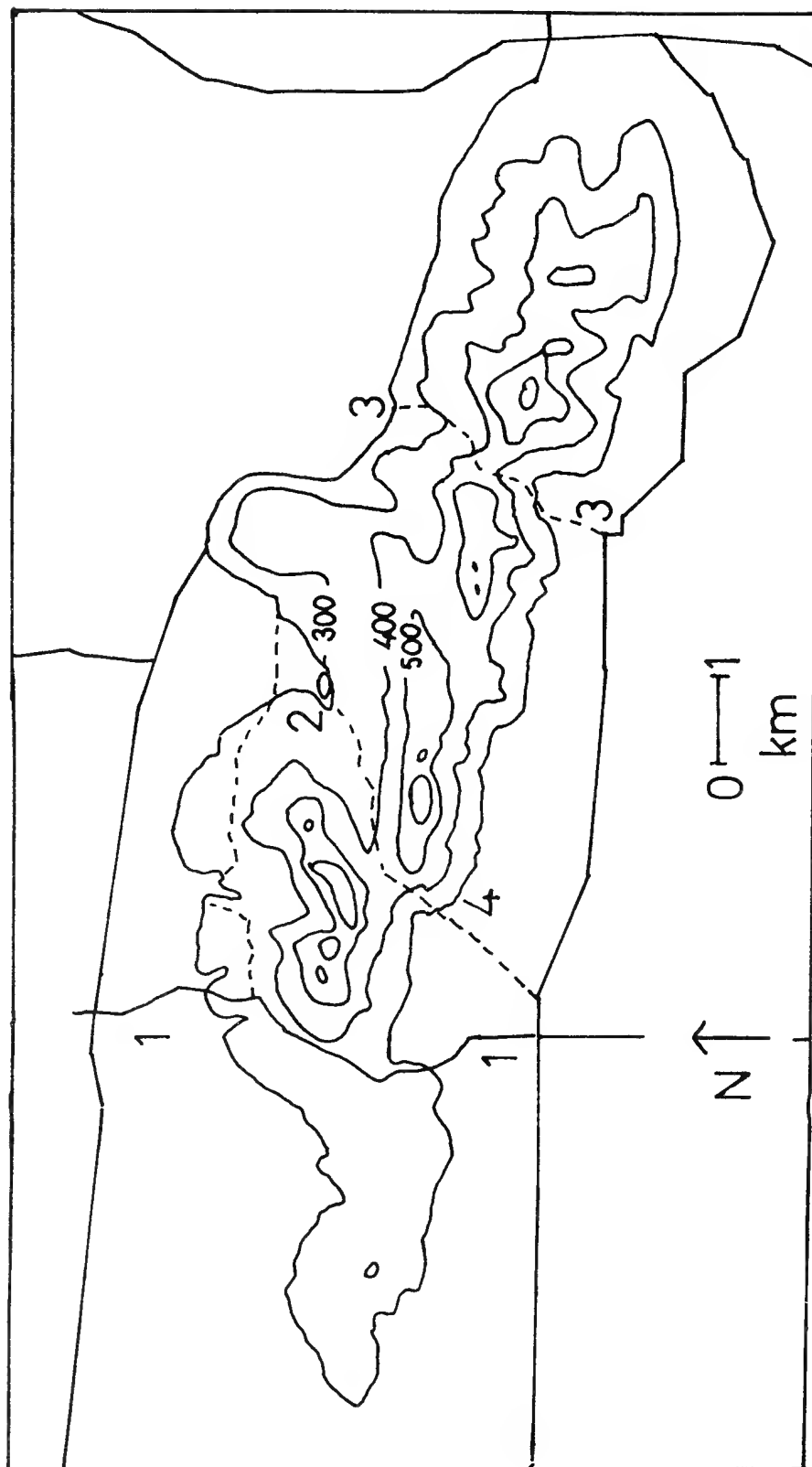


Fig. 1. Topographical map of the Porongurup Range, showing 300-600 m contours (contour interval - 100 m). 1 = Woodlands Road, 2 = Bolganup Dam, 3 = Millinup Pass, 4 = Mira Flores estate.

A SYSTEMATIC LIST WITH DISTRIBUTIONS OF THE LICHEN SPECIES  
OF WESTERN AUSTRALIA, BASED ON COLLECTIONS IN THE  
WESTERN AUSTRALIAN HERBARIUM

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ABSTRACT

*One hundred and ninety-four lichen species are reported from Western Australia with information on their distribution. The list of species is based on provisionally determined specimens deposited in the Western Australian Herbarium. The lichen flora of the state is diverse, the most luxuriant growth occurring in the south-western corner. As little is known of the lichens of the remainder of the state, particularly the north-east, much research remains to be done on their taxonomy and distribution.*

INTRODUCTION

Little intensive research has been done on the lichen flora of Western Australia though collections were made at quite an early date. The earliest taxonomic publication appears to be that of Fries (1846), who described 23 species, the result of collections by L. Preiss from Rottneest Island and the south-west part of the state. The following year Taylor (1847) listed 16 lichens from Western Australia in his catalogue of the W.J. Hooker Herbarium. Mueller (1887) collated the early records and produced a list of Australian lichens, including two species from Western Australia which had not previously been recorded: *Cladia aggregata* and *Cladonia retipora*, the latter now segregated in Western Australia as *Cladia ferdinandii*.

In the 1890s, according to Sammy (1970), F.R.M. Wilson recorded a further 20 lichen species for Western Australia. Wilson did not collect in the state but was sent specimens by the naturalist A.J. Campbell.

The start of a new era of interest in the lichen flora of Western Australia was marked by the publication, in 1955, of an annotated list based on collections made between 1929 and 1952 and deposited in the herbarium of the University of Western Australia (Bibby and Smith 1955). Thirty-six species were recorded with a brief mention of their distribution

Smith (1962) studied the flora of the granite outcrops in the Porongurup Range, near Mount Barker, finding 12 species of which two, *Collema* sp. and *Cladonia chlorophaea*\*, were not included in his earlier paper (Bibby & Smith 1955). A very different habitat, the Nullarbor Plain, was examined by Johnson and Baird (1970) who recorded 12 lichen species and made brief descriptions of their habitats. Sammy and Smith (1974) studied the area of coastal limestone near Perth where they described and gave habitat preferences for 13 lichens. Recently, Sammy has been working on his extensive collections made from Western Australia, particularly the north-west of the state, but the results have yet to be published.

The purpose of the present paper is to provide a list of the Western Australian lichen species represented in the Western Australian Herbarium (PERTH). The specimens have been curated to a high standard, are available for study and should allow botanists to determine lichen specimens with greater ease. It is also hoped that the publication of this annotated list will encourage further collecting and stimulate lichenological research in Western Australia.

#### METHODS

The recent book by Filson and Rogers (1979) was found to be very useful for determination of the specimens collected. Provisional determinations for many crustose species were made using the following papers: Dobson (1979), Duncan (1970), Fink (1935) and Smith (1911, 1918). Other useful publications were Dahl and Krog (1973), Elix (1979) and Martin and Child (1972).

Hand sections were cut of fruiting structures and chemical spot-tests were carried out using 10% KOH, calcium hypochlorite and Steiner's stable paraphenylenediamine solution.

The names and authorities given in the list of lichens are in most cases derived from Filson and Rogers (1979). The specimens are currently curated under these names in the Western Australian Herbarium. However where the names in our list differ from the checklist of Hawksworth, James and Coppins (1980), footnotes give the revised names. The localities given for each species are from data on specimens in the Western Australian Herbarium, supplemented by records from the Herbarium of the University of Western Australia. For those unfamiliar with the geography of the state, most sites may be located with the help of Anon (1980).

Duplicates of the lichen specimens marked in the list with the symbol + have been lodged in the Herbarium, National Museum of Canada, Ottawa, Ontario, and the Herbarium of Trinity College, University of Dublin, Ireland.

#### DISCUSSION

Habitat descriptions are not given in this paper, since many of the species listed are also found in South Australia and their habitats described in the recent book by Filson and Rogers (1979).

\* Not included in the present list as the Western Australian Herbarium holds no material.

According to Erickson et al. (1979) Western Australia may be divided into 16 plant regions; the lichen flora of some of these is discussed below.

Certain species such as *Cladia aggregata*, *Chondropsis semiviridis*, *Parmelia rutidota*, *Parmelia tasmanica* and *Teloschistes chrysophthalmus*, are recorded in many of the vegetation regions but others, such as *Synalissa symphorea*, appear to be restricted to the drier interior including the Transitional Woodland and the region of Mulga, Wattle, Scrub and Spinifex.

The Swan Coastal Plain and Darling Scarp have many crustose, foliose and fruticose representatives. The following species tend to be abundant: *Cladia aggregata*, *Chondropsis semiviridis*, *Disploschistes scruposus*, *Heterodea muelleri*, *Siphula coriacea*, *Xanthoria parietina*, several species of *Parmelia* and *Usnea* spp.

The Jarrah and Karri Forests are surprisingly poor in corticolous lichens. This may be due to periodic shedding of the *Eucalyptus* bark, inhibitory substances and frequent fires. *Lepraria candelaris* occurs infrequently on tree bases and *Thysanothecium hyalinum* is common on burnt wood.

The Albany District, by contrast, has a diverse lichen flora and this is the only area in Western Australia in which *Parmeliella plumbea*, *Rinodina confragosa* and *Solenopsora vulturiensis* have been found. *Cladonia* and *Parmelia* spp. are abundant and the genera *Anzia*, *Buellia*, *Caloplaca*, *Heterodea*, *Lecanora*, *Lecidea*, *Lepraria*, *Pertusaria*, *Teloschistes* and *Xanthoria* are common.

The most varied and abundant lichen growth appears to be in the Stirling Range. Lichens of particular interest include *Arthonia* sp. *Stereocaulon* aff. *dactylophyllum*, *Umbilicaria* sp. Others such as *Catillaria atropurpurea*, *Leptogium lichenoides*, *Pannaria pityrea*, *Usnea* spp. and *Pseudocyphellaria* spp. cover extensive areas of many of the south-facing slopes. The genera *Cladonia* and *Parmelia* are also well represented.

The Southern Sandplains and Heaths are rich in soil lichens such as *Chondropsis semiviridis*, *Cladia aggregata*, *Cladia ferdinandii*, *Dermatocarpon lachneum*, *Fulgensia subbracteata*, *Heterodea muelleri*, *Lecidea crystallifera* and *Siphula coriacea*. Yellow-green *Parmelia* spp., including *P. callifolia*, *P. australasica*, *P. tasmanica* and *P. terrestris*, are also abundant on soil and rocks.

Few specimens have been collected from the Barrens or the Northern Sandplains and heath regions. In contrast, lichens seem to be widespread and locally abundant, on soil and rocks, in partially shaded areas or south-facing slopes of the Wheatbelt, Transitional Woodland and in the region of Mulga, Wattle Scrub and Spinifex. Species include *Chondropsis semiviridis*, *Heterodea beaugleholei*, *Heterodea muelleri*, *Diploschistes* and *Lecidea* spp. *Candelariella*, *Cladonia*, *Parmelia* and *Phycia* spp. are also common.

Lichens of the Nullarbor Plain have been listed, by Johnson and Baird (1970), but no mention is made of their abundance or importance. *Lecanora sphaerospora* and *Lecidea* aff. *glauca* are the only species of the twelve recorded which do not appear from other sites in Western Australia.

The North-West Coastal Region and the Ranges and Tablelands in that area are not well represented in the Western Australian Herbarium collections.

The Kimberley Region is another that requires additional study: interesting records to date include *Acarospora* aff. *flava*, *Bacidia microphyllina*, *Buellia* aff. *retrovertens* and *Rocella* aff. *montagnei*.

### SYSTEMATIC LIST OF LICHENS

The arrangement of lichenized fungi follows Hale (1974).

#### CLASS FUNGI IMPERFECTI

+Lepraria candelaris (L.)Fr. <sup>1</sup>	Collie River, Gairdner River, Prince Regent River Reserve.
Lepraria chlorina (Ach.)Ach. <sup>2</sup>	Toolbrunup
+Lepraria incana (L.)Ach.	Albany, Fitzgerald River National Park, Prince Regent River Reserve.
Leparia membranacea (Dicks.)Lett.	Drysdale River National Park, Hopetoun, Porongurup Range.

#### CLASS BASIDIOMYCETES

No lichens were found from this class.

#### CLASS ASCOMYCETIDAE Subclass Loculoascomycetidae

Order MYRANGIALES	
ARTHONIACEAE	
Arthonia sp.	Toolbrunup
MYRANGIACEAE	
+Dermatina quercus (Massal.)Zahlbr. <sup>3</sup>	Gairdner River
Order PLEOSPORALES	No lichens were found from this order of fungi.
Order HYSTERIALES	
ROCELLACEAE	
Rocella aff. montagnei Bel.	West Kimberley.
Order LECANORALES	
LICHINACEAE	
+Epebe lanata (L.)Vainio	Corrigin, Lower King, Porongurup Range, Toolbrunup.
Synalissa symphorea (Ach.)Nyl. <sup>4</sup>	Kalgoorlie, Millbillillie Station, Yeelirrie.
Pyrenopsidium sp.	Houtman Abrolhos.
Pyrenopsis sp.	West River.
COLLEMATACEAE	
+Collema coccophorum Tuck.	Houtman Abrolhos, Lake Cronin, Porongurup Range, Rottnest Island.
+Leptogium aff. azureum (Swartz)Mont.	Toolbrunup

- 1 *Chrysothrix candelaris* (L.)Laundon
- 2 *Chrysothrix chlorina* (Ach.)Laundon
- 3 *Mycoporum quercus* (Massal.)Muell.Arg.
- 4 *Synalissa ramulosa* (Hoffm.)Fr.

## HEPPIACEAE

- Peltula australiensis* (Muell.Arg.)Filson Kalgoorlie.  
 +*Peltula euploca* (Ach.)Poelt ex Ozenda  
 & Clauz Ravensthorpe.

## PANNARIACEAE

- Pannaria elatior* Stirton South Bluff.  
*Pannaria rubiginosa* (Thunb. ex Ach.)Del. Toolbrunup.  
*Parmeliella* sp. Albany.  
 +*Parmeliella plumbea* (Lightf.)Vainio Albany.

## PELTIGERACEAE

- Peltigera dolichoriza* (Nyl.)Nyl. Lake King, Pemberton,  
 Porongurup Range.

## CLATHRINACEAE

- +*Cladia aggregata* (Sw.)Nyl. Albany, Bruce Rock,  
 Busselton, Elleker, Forrest,  
 Harvey, Hyden, Kendenup,  
 Lake King, Lake Magenta,  
 Lake Matilda, Lower King,  
 Manjimup, Mount Barker,  
 Mount Chudalup, Mount Ragged,  
 Mundaring, Nannup, Narrogin,  
 Northcliffe, Palgarup,  
 Porongurup Range, Ravens-  
 thorpe, Recherche Archipel-  
 ago, Shannon River, Wongan  
 Hills.  
 +*Cladia ferdinandii* (Muell.Arg.)Filson Fitzgerald River National  
 Park, Kulin, Esperance, Lake  
 Carmody, Lake King, Mount  
 Madden, Ongerup, Pallarup  
 Rocks, Porongurup Range,  
 Sullivan Rock.  
 +*Cladia schizopora* (Nyl.)Nyl. Albany, Stirling Range,  
 Toolbrunup.  
*Cladia sullivanii* (Muell.Arg.)Martin Beacon.

## HETERODEACEAE

- Heterodea beaugleholei* Filson Bald Rock, Boulder Rock,  
 Bullabulling, Dooklakine,  
 Kalgoorlie, Kambalda,  
 Southern Cross, Tammin.  
 +*Heterodea muelleri* (Hampe)Nyl. Ajana, Armadale, Bruce Rock,  
 Burracoppin, Carbine,  
 Coolgardie, Derdibin Rock,  
 Fitzgerald River National  
 Park, Graham Rock, Jumnania  
 Rocks, Kulin, Lake Magenta,  
 Merredin, Mingenew, Moora,  
 Mount Barker, Mount Rupert,  
 Mundaring, Ongerup,  
 Ravensthorpe, York.

## STICTACEAE

- +*Pseudocyphellaria australiensis* Magn. Albany, Bridgetown, Porongurup  
 Range, Toolbrunup, West Cape  
 Howe.  
*Pseudocyphellaria crocata* (L.)Vainio Mount Chudalup, Porongurup  
 Range, West Cape Howe.

## GRAPHIDACEAE

- Graphis scripta* (L.)Ach. West Cape Howe.

## THELOTREMATACEAE

*Thelotrema lepadinum* (Ach.) Ach.

Jarrahdale, Pemberton.

## LECIDEACEAE

*Bacidia microphyllina* (Tuck.) Riddle

Drysdale River National Park.

*Bacidia* aff. *sabuletorum* (Shreb.) Lett.

Albany.

*Catillaria atropurpurea* (Schaer.) Th. Fr.

Toolbrunup.

*Catillaria chalybeia* (Borr.) Massal.

Kulin.

*Catillaria* aff. *lenticularis* (Ach.)

Albany.

Th. Fr.

*Lecidea contigua* (Ach.) Vainio

Bolgart, Lake Magenta, Wongan Hills.

+*Lecidea crystallifera* Tayl.

Forrest, Lake King, Mount Hunt, Yeelirrie.

*Lecidea* aff. *cyathoides* (Ach.) Ach.<sup>5</sup>

Corrigin.

*Lecidea decipiens* (Hoffm.) Ach.<sup>6</sup>

Dorre Island, Forrest, Houtman Abrolhos, Kalgoorlie, Kambalda, Katanning, Lake Cronin, Lake Magenta, Madura, Millbillillie, Mount Rupert, Narrogin, Southern Cross, Wiluna, Wongan Hills, Yeelirrie, Yinnietharra.

*Lecidea laeta* Stirton

S.E. Kulin.

*Lecidea limitata* (Scop.) Gray

Mount Rupert, Nannup.

*Lecidea* aff. *lopadiodes* (Th. Fr.) Grumn.<sup>7</sup>

Lower King.

+*Lecidea* aff. *macrocarpa* (DC.) Steud.<sup>8</sup>

Albany.

+*Lecidea planata* Muell. Arg.

Boddington, Elverdton, Forrest, Kalgoorlie, Kulin, Mount Hunt, Ongerup.

+*Lecidea* aff. *psammophila* (Muell. Arg.) Zahlbr.

Fitzgerald River National Park, Kulin, Lake King.

*Lecidea* aff. *templetonii* T. Tayl.

Elverdton.

*Lecidea* aff. *scalaris* (Ach.) Ach.<sup>9</sup>

Albany.

*Rhizocarpon* aff. *alpicola* (Schaer.)

Toolbrunup.

Rabenh.

*Rhizocarpon* aff. *obscuratum* (Ach.)

Albany.

Massal.

*Rhizocarpon polycarpum* (Hepp.) Th. Fr.

Toolbrunup Peak.

*Rhizocarpon tinei* (Tornab.) Runemark

Kalgoorlie, Porongurup Range, Toolbrunup.

*Toninia caeruleonigricans* (Lightf.)

Lake King.

Th. Fr.

## STEREOCAULACEAE

*Stereocaulon corticatulum* Nyl.

Toolbrunup.

+*Leprocaulon microscopicum* (Vill.) Gams ex Hawksworth

Corrigin.

## CLADONIACEAE

*Cladonia amaurocraea* (Flörke) Schaer.

Ongerup, Porongurup Range, West Cape Howe.

+*Cladonia balfourii* Cromb.

Albany.

+*Cladonia calycantha* Del. ex Nyl.<sup>10</sup>

Garden Island, Hopetoun, Kulin, Mount Barker.

5 *Fuscidea cyathoides* V. Wirth & Vezda

6 *Psora decipiens* (Hedw.) Hoffm.

7 *Trapelia mooreana* (Carrol) P. James

8 *Huilia macrocarpa* (DC.) Hertel

9 *Hypocenomyce scalaris* (Ach.) Choisy

10 Very similar, if not the same as *Cladonia verticillata* (Hoffm.) Schaer.



- Cladonia capitata* (Michx.) Spreng.  
 +*Cladonia capitellata* (Hook. f. & Tayl.) Bab.  
*Cladonia fimbriata* (L.) Fr.  
*Cladonia macilenta* Hoffm.  
*Cladonia pityrea* (Flörke) Fr.<sup>11</sup>  
*Cladonia pocillum* (Ach.) O.-J. Rich.  
*Cladonia scabriuscula* (Del. in Duby) Nyl.  
*Cladonia squamosa* (Scop.) Hoffm.  
 +*Cladonia squamosula* Muell. Arg.  
 +*Cladonia subfurcata* (Nyl.) Arnold  
*Cladonia* aff. *subsquamosa* (Nyl. ex Leighton)  
*Cladonia* aff. *xanthoclada* Crombie  
 +*Thysanothecium hyalinum* (Tayl.) Nyl.
- Kulin.  
 Albany, Fitzgerald River, Porongurup Range.  
 Toolbrunup.  
 Augusta.  
 West Cape Howe.  
 Bluff Knoll.  
 Albany.  
 Albany, Toolbrunup.  
 Toolbrunup.  
 Albany.  
 Shannon River.  
 Albany, Bridgetown, Bunbury, Elleker, Lower King, Mount Cooke, Perth.
- UMBILICARIACEAE  
*Umbilicaria* aff. *polyphylla*
- DIPLOSCHISTACEAE  
*Diploschistes ocellatus* (Vill.) Norm.  
 +*Diploschistes gypsaceus* (Ach.) Zahlbr.  
*Diploschistes scruposus* (Schreb.) Norm.
- Evanston, Jumnania, Kambalda, Wongan Hills.  
 Stirling Range.  
 Drysdale River National Park, Kalgoorlie, Kulin, Lake Magenta, Mount Rupert, Narrogin, Ongerup, Perth, Tammin.
- PERTUSARIACEAE  
 +*Pertusaria flavicans* Lamy  
*Pertusaria leioplaca* DC.  
*Pertusaria pertusa* (Weigel) Tuck.  
*Pertusaria* aff. *pustulata* (Ach.) Duby  
*Pertusaria wulfenii* DC.<sup>12</sup>
- Albany, Ravensthorpe, Wongan Hills.  
 Elleker, Gillingarra, West Cape Howe.  
 Gairdner River.  
 Ravensthorpe.  
 Byford.
- ACAROSPORACEAE  
*Acarospora* aff. *flava* (Bell.) Trev.  
*Acarospora schleicheri* (Ach.) Mass.  
*Acarospora sinopica* (Wahlenb.) Körber  
*Maronea* sp.  
*Sarcogyne clavus* (DC.) Kremp.  
*Sarcogyne privigna* (Ach.) Massal.  
*Sarcogyne regularis* Körber  
*Sarcogyne* aff. *simplex* (Davies) Nyl.<sup>13</sup>
- Ord River  
 Godfreys Tank, Great Sandy Desert, Kalgoorlie, Kununurra, Mount Augustus, Mount Newman, Yeelirrie.  
 Great Sandy Desert.  
 Yeelirrie.  
 Albany, Stirling Range.  
 Yeelirrie.  
 Kalgoorlie.  
 Albany, Kalgoorlie, Kambalda.
- LECANORACEAE  
*Aspicilia calcarea* (L.) Mudd  
*Candelariella antenaria* Räs.
- Garden Island, Nullarbor Plain, Ravensthorpe, Rottnest Island, Tagon Harbour.  
 Kulin, Wongan Hills.

11 *Cladonia anomaea* (Ach.) Ahti & P. James

12 *Pertusaria hymenea* (Ach.) Schaer

13 *Polysporina simplex* (Davies) Nyl.

- Candelariella vitellina* (Hoffm.)  
Muell.Arg.  
*Haematomma* sp.  
+*Haematomma puniceum* (Sm. apud Ach.)Mass.
- Lecania erysibe* (Ach.)Mudd  
*Lecanora atra* (Huds.)Ach.
- Lecanora* aff. *campestris* (Schaer.)  
*Lecanora* aff. *chlarona* (Ach.)Nyl.  
+*Lecanora expallens* Ach.  
*Lecanora* aff. *muralis* (Schreb.)Rabenh.  
+*Lecanora* aff. *pallida* (Schreb.)Rabenh.  
*Lecanora* aff. *rupicola* (L.)Zahlbr.  
*Ochrolechia pseudotartarea* (Vainio)  
Verseghy  
*Ochrolechia subathallina* Magn.  
*Ochrolechia subpallescens* Verseghy  
*Solenopsora vulturiensis* Massal.
- PARMELIACEAE  
*Anzia wilsonii* Räs.
- Candelaria* sp. Mass.  
+*Chondropsis semiviridis* F.Muell. ex Nyl.
- +*Hypogymnia pulchrilobata* (Bitt.)Elix  
+*Hypogymnia* aff. *pulverata* (Nyl. apud  
Cromb.)  
*Hypogymnia subphysodes* (Kremp.)Filson
- +*Menegazzia foraminulosa* (Krempelh.)  
Bitter.  
*Menegazzia subpertusa* Martin in ed.  
*Parmelia* sp.  
*Parmelia australasica* Galloway  
*Parmelia callifolia* Kurokawa
- Parmelia caperata* (L.)Ach.  
*Parmelia cheelii* Gyel.
- Parmelia* aff. *congesta* Kurokawa & Filson  
*Parmelia congesta* Kurokawa & Filson  
*Parmelia convoluta* Kremp.  
*Parmelia dissecta* Nyl.  
*Parmelia flavescens* tireagens Gyel.  
*Parmelia furcata* Muell.Arg.  
*Parmelia hypoclystoides* (Muell.Arg.)Gyel.  
*Parmelia hypoprotocetrarica* Kurokawa &  
Elix
- Narrogin, Pingelly, West  
River.  
Mount Manning.  
Boddington, Kulin, Lake King,  
Mount Elvire, Mount Rupert,  
Toodyay, West River.  
West River.  
Albany, Augusta, Denmark,  
Mount Victoria, Nannup.  
Drysdale River National Park.  
Mount Rupert.  
Augusta.  
Houtman Abrolhos.  
Hopetoun, Kulin.  
Albany, Toolbrunup.  
Mount Elvire.  
Nannup.  
Gillingara, Wongan Hills.  
Albany.  
Albany, Capel, Namalook,  
Nannup, Porongurup Range.  
Cocklebidy.  
Forrest, Hyden, Kalgoorlie,  
Kambalda, Lake King, Lake  
Magenta, Madura, Pinjarra,  
Weira.  
Broomehill, Kulin, Ongerup,  
West River.  
Elix, Augusta.  
Blackwood River, Darradup,  
Dwellingup, Echo Bluff,  
Greenbushes, Nannup,  
Nornalup, Pemberton,  
Porongurup Range, Toolbrunup.  
Porongurup Range.  
Northcliffe.  
West Cape Howe.  
Albany, Mount Madden.  
Carbine, Comet Vale, Evanston,  
Kalgoorlie, Kambalda, Lake  
King, Mount Hunt, Mount  
Madden, Mount Rupert, Paynes  
Find.  
Albany, Condingup.  
Boddington, Mount Madden,  
Mount Walker.  
Toolbrunup.  
Lower King, Southern Cross.  
Mount Mary.  
Augusta Toolbrunup.  
Ravensthorpe.  
Walebing.  
Kalgoorlie.  
Sullivan Rock.

- Parmelia metaclystoides* Kurokawa & Filson  
*Parmelia mexicana* Gyel.
- Parmelia pellis* Filson  
 +*Parmelia perlata* (Huds.) Ach.
- Parmelia pertinax* Kurokawa & Filson  
*Parmelia plittii* Gyel.
- +*Parmelia pulla* Ach.
- +*Parmelia pruinata* Muell. Arg.
- +*Parmelia reptans* Kurokawa apud C. Baker et al.
- +*Parmelia reticulata* Tayl. apud Mack.  
*Parmelia rimalis* Kurokawa apud Kurokawa & Filson  
*Parmelia rutidota* Hook. f. & Tayl.
- Parmelia scabrosa* Tayl.
- +*Parmelia soledians* Nyl.
- Parmelia* aff. *spodochroa* Kurokawa & Filson  
 +*Parmelia subalbicans* Stirt.  
*Parmelia subdistorta* Kurokawa  
*Parmelia subrudecta* Nyl.  
 +*Parmelia tasmanica* Hook. & Tayl.
- +*Parmelia terrestris* Kurokawa & Filson  
 +*Parmelia tinctina* Maheu & Gillet
- Parmelia ustulata* Kurokawa & Filson  
*Parmelia verrucella* Esslinger
- USNEACEAE  
*Ramalina calicaris* (L.) Fr.  
 +*Ramalina ecklonii* (Spreng.) Meyen et Flowtow.
- Mount Hunt.  
 Byford, Kalgoorlie, Katanning, West Cape Howe, West River.  
 Byford, West Cape How.  
 Peppermint Grove Beach, Rottnest Island.  
 Mount Hunt.  
 Kennedy Range, Mount Hunt, Yeelirrie.  
 Albany, Kambalda, Lake Magenta, Lower King, Mount Hunt, Porongurup Range, Toolbrunup.  
 Kambalda, Kulin, Mount Barker, Porongurup Range, West River.  
 Kambalda, Lake King, Mount Hunt, West River, Wongan Hills.  
 Albany, Condingup, Darradup.  
 Yeelirrie.  
 Baladjie Rock, Bolgart, Broomehill, Byford, Cape Arid National Park, Cocklebidy, Collie River, Comet Vale, Corrigin, Harvey, Hopetoun, Kalgoorlie, Kambalda, Kendenup, Kulin, Lake King, Mount Madden, Mount Singleton, Ongerup, Paynes Find, Ravensthorpe, Rottnest Island, Wongan Hills, Yeelirrie.  
 Baladjie Rock, Mount Singleton, Yeelirrie.  
 Cocklebidy, Peppermint Grove Beach.  
 Kambalda.  
 Corrigin, Wongan Hills.  
 Kambalda.  
 Hopetoun.  
 Cape Arid National Park, Esperance, High Island, Kalgoorlie, Lower King, Pinjarra, Katanning, West Cape Howe, Wongan Hills.  
 Carbine, Lake King.  
 Albany, Mount Hunt, Pinjarra, Yeelirrie.  
 Yeelirrie.  
 Albany, Kalgoorlie, Mount Hunt, West River.  
 Kulin.  
 Boyup Brook, Broome, Lake King.

- +*Ramalina geniculata* Hook.f. & Tayl. Fitzgerald River National Park, Gairdner River, Israelite Bay, Kulin, Lake King.
- Ramalina inflata* Hook.f. and Tayl. Cape Arid National Park, Hyden, Kulin, Ongerup, Three Springs, Winchester. Gairdner River, Kulin.
- +*Ramalina pusilla* le Prev. Boyagin Rock, Cape Arid National Park, Kulin, Latham, Mount Madden, Northcliffe, Ongerup, Pemberton, Perth, Ravensthorpe, Shannon River, Southern Cross, Sullivan Rock, Wyalkatchem.
- +*Siphula coriacea* Tayl. ex Nyl. Darradup. Gairdner River, Harvey, Kulin. Peppermint Grove Beach.
- Usnea arida* Mot. Peppermint Grove Beach.
- Usnea inermis* Mot. Porongurup Range.
- +*Usnea* aff. *filipendula* Stirt. Toolbrunup.
- +*Usnea* aff. *ramulosissima* Stevens & Rogers Boddington, Bolgart, Broomehill, Corrigin, Dwellingup, Kendenup, Kulin, Lake Grace, Lake King, Mount Rupert, Ongerup, Perth, Pingelly, Porongurup Range, Toolbrunup, Winchester.
- Usnea ramulosissima* Stevens & Rogers Sullivan Rock.
- +*Usnea* aff. *rubiginea* (Michaux)Massal. Fraser Range.
- +*Usnea scabrida* Tayl. Corrigin.
- Usnea torulosa* (Muell.Arg.)Zahlbr. Albany, Collie River, Lower King, Toolbrunup.
- Usnea xanthopoga* Nyl. Dorre Island.
- PHYSICACEAE East Wallabi Island.
- +*Anaptychia japonica* (Sato)Kurokawa Lake King, Mount Elvire.
- +*Anaptychia obscurata* Tuck. in Nyl. Kulin.
- Buellia alboatra* (Hoffm.)Diechm.<sup>14</sup> Gillingara, West River.
- Buellia canescens* (Dicks.)de Not.<sup>15</sup> Drysdale River National Park.
- +*Buellia disciformis* (Fr.)Mudd Albany, Ravensthorpe, Stirling Range, West River.
- Buellia parasema* (Ach.)de Not. Drysdale River National Park.
- +*Buellia punctata* (Hoffm.)Massal. East Wallabi Island, Yeelirrie.
- Buellia* aff. *retrovertens* Tuck. Augusta.
- Buellia stellulata* (Tayl.)Mudd. Kitchener.
- Buellia* aff. *stigmaea* Tuck. Cocklebidy, Kulin, Mount Rupert, Norseman.
- Buellia subalbula* (Nyl.)Muell.Arg. Kulin
- Buellia subdisciformis* (Leight.)Vainio Byford.
- Physcia aegialita* Ach.<sup>16</sup> Bullfinch, Lake Moore, Ord River.
- Physcia aipolia* (Ehrh. in Humb.)Furnr. Corrigin.
- Physcia alba* (Fee)Muell.Arg.
- Physcia* aff. *albicans* (Pers.)Thoms.
- Physcia stellaris* (L.)Nyl.
- Physcia* aff. *tribacia* (Ach.)Nyl.

14 *Diplotomma alboatrum* (Hoffm.)Flotow.15 *Diploicia canescens* (Dickson)Massal.16 *Dirinaria aegialita* (Ach.)Moore

- Pyxine coccifera* (Fay)Nyl.  
*Pyxine cocoos* (Swartz)Nyl.  
*Pyxine petricola* Nyl.
- TELOSCHISTACEAE  
*Caloplaca aurantiaca* (Lightf.)Th.Fr.<sup>17</sup>  
*Caloplaca cerina* (Ehrh. ex Hedw.)Th.Fr.  
*Caloplaca cinnabarinna* (Ach.)Zahlbr.  
*Caloplaca ferruginea* (Huds.)Th.Fr.  
*Caloplaca fulgens* (Sw.)Elenk.  
*Caloplaca halocarpa* (Hoffm.)Wade  
*Caloplaca aff. lactea* (Massal.)Zahlbr.  
  
*Caloplaca marina* (Wedd.)Zahlbr.  
*Blastenia* sp.  
*Fulgensia subbracteata* (Nyl.)Poelt  
*Teloschistes chrysophthalmus* (L.)Th.Fr.
- Xanthoria ectanea* (Ach.)Räs. ex Filson
- Xanthoria parietina* (L.)Beltr.
- Order SPHAERIALES  
 VERRUCARIACEAE  
 +*Dermatocarpon lachneum* (Ach.)A.L.Smith<sup>18</sup>
- Prince Regent Reserve.  
 Prince Regent Reserve.  
 Ord River Station.
- Gillingarra, Kendenup,  
 Rottnest Island.  
 Peppermint Grove Beach.  
 Katanning.  
 Kulin, Lake Grace, Ongerup.  
 Drysdale River National Park.  
 Houtman Abrolhos.  
 Drysdale River National Park,  
 East Wallabi Island.  
 Albany, Augusta.  
 Bullfinch, Lake King, Walebing.  
 Houtman Abrolhos, Lake King.  
 Ardath, Buniche, Busselton,  
 Collie River, Corrigin,  
 Cranbrook, Denmark, Forrest,  
 Gairdner River, Harvey,  
 Hithergreen, Israelite Bay,  
 Kendenup, Kitchener, Kulin,  
 Lake King, Lake Preston,  
 Latham, Madura, Mondrain  
 Island, Murchison River,  
 Ongerup, Pinjarra, Porongu-  
 rup Range, Tagon Harbour,  
 Three Springs, Wongan Hills.  
 Albany, Cape Arid National  
 Park, Carnarvon, Cocklebidy,  
 Dorre Island, East Wallabi  
 Island, Garden Island,  
 Houtman Abrolhos, Kalannie,  
 Lake Barlee, Lake King, Lake  
 Moore, Madura, Mondrain  
 Island, Rottnest Island,  
 Shark Bay, Southern Cross,  
 Tagon Harbour.
- Albany, Bremer Bay, Busselton,  
 Cape Leeuwin, Carnarvon,  
 Elgin, Garden Island,  
 Kalbarri, Kendenup, Lake  
 King, Mandurah, Mondrain  
 Island, Mount Barker, Mount  
 Stirling, Newdegate,  
 Rottnest Island, Southern  
 Cross.
- Houtman Abrolhos, Kalgoorlie,  
 Kulin, Lake Cronin, Lake  
 Grace, Perth, Porongurup  
 Range, Ravensthorpe, Rottnest  
 Island.

17 *Caloplaca ferruginea* (Huds.)Th.Fr.

18 *Catapyrenium lachneum* (Ach.)R.Sant.

Endocarpon sp.	Millbillillie.
Endocarpon victorianum Muell.Arg.	Kalgoorlie.
Verrucaria calciseda DC.	Yeelirrie.
Order CALICIALES	No lichens were found from this order of fungi.

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FLORA CONSERVATION VALUES OF VACANT CROWN LAND  
SOUTH OF MOUNT ADAMS, WESTERN AUSTRALIABy E.A. Griffin<sup>1</sup>, R.J. Hnatiuk<sup>2</sup> and S.D. Hopper<sup>3</sup>

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Present address: Bureau of Flora and Fauna, Department of Home Affairs and Environment, P.O. Box 1252, Canberra City, A.C.T. 2601.
3. Western Australian Wildlife Research Centre, P.O. Box 51, Wanneroo, W.A. 6065.

## ABSTRACT

A 13,253 ha area of vacant Crown land located south of Mt. Adams (south east of Dongara) was found to contain 290 plant species of which members of the Proteaceae (19 per cent of the total), Myrtaceae (17 per cent) and Leguminosae (12 per cent) were dominant. The area lies in a part of the northern sandplains not represented in nature reserves or national parks. The terrain grades from undulating sandplains in the west up to dissected laterites in the centre and east. It contains the only known populations of certain undescribed species of *Lasiopetalum*, *Micromyrtus*, *Stylidium* and *Synaphea*. It also contains populations of several other rare or restricted plants, including some known to be poorly represented in conservation reserves e.g. *Conostylis dielsii* and *Eucalyptus macrocarpa*. Because of its conservation values, it is recommended that this vacant Crown land become a Class A Nature Reserve vested in the Western Australian Wildlife Authority.

## INTRODUCTION

In the Mount Adams region, situated between the Arrowsmith and Irwin Rivers, south-east of Dongara (Figure 1), there are substantial areas of vacant Crown land currently under consideration for release for Agriculture. In this paper a 13,253 ha area of vacant Crown land located immediately south of Mt. Adams (Figures 1 and 2) was surveyed to determine its flora conservation values. For brevity this vacant Crown land is hereafter referred to as the VCL.

The VCL is under pressure to be released for farming. However, mapping of the soil types (Department of Lands and Surveys, unpublished data) has revealed that the numbered blocks (Figure 2) contain an undesirably high proportion of "poor soils" in the form of deep sands (35% average per block as against 20% maximum desirable).

This survey was undertaken to provide data to assist the Environmental Protection Authority's Working Group on Land Releases to weigh up the conservation values of the VCL against other criteria for release. It summarises what is known about the flora of the VCL and discusses the values of the land for a potential nature reserve. The VCL is discussed in relation to studies in three other areas in the southern part of the Irwin Botanical District which have similar soil types. Each of these three areas includes a major existing or proposed nature reserve, viz. Burma Road Reserve (A26663), South Eneabba Reserve (C31010) and the Mt. Lesueur Reserves (Ride 1975) (Figure 1).

## RESULTS AND DISCUSSION

### a. Landform and Soils

The western part of the VCL is a broad sandy plain which rises up to a strongly dissected plateau in the centre and the east. Within the dissected plateau are broad, shallow valleys which are occasionally bordered by steep erosion slopes or breakaways. The sandy plain, dissected plateau and the deflated scarp between represent parts of three geomorphic units: the Coastal Belt, Arrowsmith Region and Gingin Scarp respectively (Baxter 1977).

Present soil types have developed on the local erosion products of an ancient lateritic soil (Churchward 1970) which was derived from underlying sandstones, siltstones and shales of the Mesozoic Yarragadee Formation (Lowry 1974). Grey sands partially cover the gravels and duricrust of the ancient plateau soils. The shallow erosion slopes are mainly yellow sands and gravels derived from the laterite profile. Leached grey and white sands are present in the centre of some valleys. Clay loams occur in winter-wet depressions and in areas where the Yarragadee Formation is exposed at the base of breakaways and on some gentle erosion slopes.

### b. Vegetation

The vegetation was assessed on the basis of structure, but available time prevented any definition of the vegetation units based on floristic composition. However, a relationship between soil type and floristic composition has been recognised (see Hnatiuk and Hopkins in press), so the soil types on which the structural formations occurred were noted.

Beard (1976a) defined the vegetation of the Dongara area on physiognomic criteria and in the VCL he recognised three vegetation units in two Vegetation Systems. They are Scrubheath on deep sandy flats in the Eridoon System and Heath on laterite and Scrubheath on lateritic sandplain in the Tathra System. Scrubheath on lateritic sandplain is the most extensive unit represented in the VCL. Heath on laterite occurs on the occasional exposures of laterite in the central and eastern part. While extensive areas

of Scrubheath on deep sandy flats occur to the west of the VCL, only a very small amount actually occurs in it. Within the Tathra System, Beard (1976a) suggests there are minor occurrences of *Melaleuca* thickets scattered woodlands and mallees. This classification of Beard has not been adopted as the scale of resolution was too coarse for this study.

The major structural formations (after Muir 1977) in the VCL are:

- i) low heath, open to closed; (0.5 to 2 m tall), rich in shrub species with no discernible dominants; occasionally with scattered emergents up to 4 m tall such as *Acacia scirpifolia*, *Banksia menziesii*, *Eucalyptus todtiana*, *Macrozamia riedlei* or *Nuytsia floribunda*; Figures 3 and 4; occurring on grey sands, yellow sands and lateritic gravels;
- ii) low woodland of *Eucalyptus accedens* (to 10 m) over open low heath; Figure 5; occurring on clayey soils;
- iii) open to closed scrub mallee of *Eucalyptus tetragona*, *E. foecunda*, *E. falcata* and *E. jucunda* (to 2.5 m) over open low heath; mainly on yellow sands and lateritic gravels; and
- iv) open low woodland of *Eucalyptus camaldulensis* (to 5 m) over thickets of *Acacia scirpifolia* (2 to 3 m); on sandy depressions and drainage lines.

#### c. Flora

The VCL has a rich flora. The 290 species listed in Appendix 1 were recorded in the course of three brief visits during 1980. This number suggests that the area may prove to be as rich as that south of Eneabba in which, after detailed study and intensive collecting, Hopkins and Hnatiuk (1981) recorded 429 species.

The 290 species represent 44 families and 127 genera. Thirteen of the species are apparently undescribed and six were unidentifiable because of inadequate material. Almost half (47 per cent) were from only three families; Proteaceae (54 spp.-19 per cent), Myrtaceae (49 spp.-17 per cent) and Leguminosae (34 spp.-12 per cent). Thirteen families (30 per cent) and 72 genera (57 per cent) were each represented by only one species. Ten genera were represented by six or more taxa: *Hakea* 15, *Eucalyptus* 12, *Acacia* 11, *Conostylis* 8, *Melaleuca* 8, *Stylidium* 8, *Verticordia* 8, *Banksia* 7, *Hibbertia* 7 and *Dryandra* 6. Species from these genera represent 31 per cent of the total.

The representation of major families in the VCL is similar to that at Eneabba (Hnatiuk and Hopkins in press). Epacridaceae is the only family with proportionally fewer species present in the VCL than at Eneabba. There were few differences in the genera present but there were more *Acacia* and *Eucalyptus* and fewer *Leucopogon*, *Drosera* and *Daviesia* species in the VCL than at Eneabba.

The Jaccard similarity coefficient, using available species composition data (see Appendix 1 for sources) indicate that the VCL was more similar to the Eneabba area (Jaccard coefficient = 0.41) than to the Mt. Lesueur-Cockleshell Gully area (0.36) or the Burma Road Reserve (0.22). The Eneabba area was less similar to the Burma Road Reserve (0.15) than was the VCL to

the Burma Road Reserve. These values are only roughly indicative of floristic similarity. A precise assessment is not possible because each area has received different levels of study.

Hnatiuk and Hopkins (in press) indicated that about 25% of the flora of the Eneabba area was endemic to the southern part of the Irwin Botanical District. A similar degree of endemism is probable for the VCL.

There are 17 described species which Marchant and Keighery (1979) reported as rare or restricted to a geographic range of distribution less than 160 km (Table 1). Recent collections have extended the range of some of these species; however, with recently described and undescribed species, there are still at least 16 species present which have a geographic range of less than 160 km.

Table 1. Rare and Geographically Restricted Species.

	Categories of Marchant and Keighery (1979)	Recent Assessment
<i>Acacia fagonioides</i>	-	GR
<i>Anigozanthos pulcherrimus</i>	E	-
<i>Banksia candolleana</i>	F	-
<i>Banksia leptophylla</i>	F	-
<i>Banksia scabrella</i>	B	GR
<i>Calothammus longissimus</i>	E	-
<i>Cassytha pomiformis</i>	A	?
<i>Conospermum nervosum</i>	E	-
<i>Conostylis aculeata</i> ssp. <i>breviflora</i>	-	GR
<i>Conostylis dielsii</i>	E	GR
<i>Conostylis</i> sp. (SDH 170)	-	GR
<i>Dampiera lindleyi</i>	D	-
<i>Darwinia speciosa</i>	-	GR
<i>Diplolaena ferruginea</i>	E	-
<i>Dodonaea ericoides</i>	D	-
<i>Gastrolobium pauciflorum</i>	F	GR
<i>Hovea stricta</i>	F	-
<i>Isopogon adenanthoides</i>	E	GR
<i>Isopogon linearis</i>	F	-
<i>Isopogon tridens</i>	-	GR
<i>Jacksonia foliosa</i>	D	-
<i>Lasiopetalum drummondii</i>	F	-
<i>Lasiopetalum</i> sp. (RJH 800023)	-	VGR
<i>Lepidosperma pubisquameum</i>	D	-
<i>Leucopogon strongylophyllus</i>	D	-
<i>Leucopogon</i> sp. (EAG 2800, 2801)	-	GR
<i>Macropidia fuliginosa</i>	F	-
<i>Micromyrtus</i> sp. (RJH 800019)	-	VGR
<i>Olax</i> sp. aff. <i>phyllanthi</i> (RJH 771499)	-	GR
<i>Petrophile chrysantha</i>	F	GR
<i>Stylidium leptocalyx</i>	D	-
<i>Stylidium maitlandianum</i>	D	-
<i>Stylidium</i> sp. (EAG 2794)	-	VGR
<i>Synaphea</i> sp. (RJH 800017)	-	VGR
<i>Verticordia grandis</i>	F	-
<i>Xanthorrhoea reflexa</i>	D	-

Table 1 (cont.)

1. Categories of Marchant and Keighery (1979)
  - A - No specimens
  - B - Rare
  - D - Poorly collected
  - E - Restricted < 100 km
  - F - Restricted > 100 km < 160 km
2. Recent Assessment of Geographic Restriction (Griffin 1981, Rye in press, this paper)
  - VGR - Geographically Very Restricted < 50 km
  - GR - Geographically Restricted > 50 km < 160 km
  - ? - Insufficient information.

Four undescribed species, *Lasiopetalum* sp. (RJH 800023), *Micromyrtus* sp. (RJH 800019), *Stylidium* sp. (EAG 2794) and *Synaphea* sp. (RJH 800017), are known only from the VCL. *Leucopogon* sp. (EAG 2800, 2801) is known from only one other area south of Eneabba. Two Irwin River endemics, *Banksia scabrella* and *Conostylis dielsii*, occur in the VCL. *Banksia scabrella* is also known to occur in the Burma Road Reserve but *Conostylis dielsii* is not known from any other nature reserve. For most of the other geographically restricted species (Table I) and for some more widespread species such as *Eucalyptus falcata*, *E. macrocarpa* and *E. pyriformis*, the VCL represents the northern limit of their known distribution range.

The conservation status of *Eucalyptus macrocarpa* populations has recently been assessed (Anon. 1981). The 180 plants growing on the VCL represent the largest number of a distinct Northern Sandplains race in any conservation reserve or potential reserve. The only other significant population on Crown land is at Eneabba where mining for mineral sands is currently taking place.

#### CONSERVATION SIGNIFICANCE

The floristic composition of the kwongan or shrubland (Beard 1976b) on lateritic uplands in this part of the northern sandplains varies along east-west and north-south gradients (E.A. Griffin, A.J.M. Hopkins and R.J. Hnatiuk, unpublished data). This regional variation is not fully represented in existing conservation reserves (Figure 2). The creation of a nature reserve of the VCL would partially overcome the deficiencies between the Arrowsmith and Irwin Rivers.

Agricultural development in the region between Geraldton and the Arrowsmith River has left little uncleared land except for the VCL and a somewhat larger adjacent area of vacant Crown land. Excluding the coastal area which is floristically dissimilar to the rest of the area, only about 1% of this region has been set aside for conservation reserves. This is far below the minimum of 5% recommended by the IUCN. With the declaration of the VCL as a nature reserve, the amount of land in conservation reserves would be substantially increased to 3%.

There are a number of species in the VCL which are at the extremities of their known geographic range, e.g. *Acacia fagonioides*, *Calothamnus longissimus*, *Conospermum nervosum*, *Isopogon adenanthoides*, *I. tridens* and

*Petrophile chrysantha*. The preservation of populations of such species would greatly contribute to the maintenance of their genetic diversity. The VCL is probably sufficiently large to maintain viable populations of geographically restricted species as well as other species not represented in other conservation reserves.

The VCL has relatively few minor disturbances in the way of small gravel pits, tracks and mining exploration lines. Invasion by naturalized alien plant species is negligible and their occurrence is restricted mainly to the boundary of the VCL adjacent to developed agricultural land.

Conservation reserves may also provide protection for geomorphic features. The VCL contains several which are representative of this area. Study of these features in an undisturbed environment would be valuable in elucidating the relationships between soils, geomorphology and the floristic composition of the vegetation.

The VCL, because of its size and habitat diversity, would probably support viable populations of many species of the fauna of the area. No faunal records were made for the VCL but numerous birds were observed including parrots nesting in trees of *Eucalyptus accedens*.

#### RECOMMENDATION

It is recommended that the vacant Crown land south of Mt. Adams (Victoria locations 10935 to 10939 inclusive and the unnumbered location between them and Tomkins Road) be created a Class A Reserve for the purposes of Conservation of Flora and Fauna and vested in the Western Australian Wildlife Authority.

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#### APPENDIX 1

#### SPECIES LIST FOR THE VCL SOUTH OF MT. ADAMS

Voucher specimens have been lodged at PERTH for as many species as possible. In some cases, where only sterile material could be obtained, vouchers have not always been lodged. In others, the identification is consistent with voucher specimens marked "Eneabba Survey 1977" (from Hnatiuk and Hopkins, in press) or "EAG Laterite Survey 1978/79" (from E.A. Griffin, A.J.M. Hopkins and R.J. Hnatiuk, unpublished data).

Abbreviations used in the following list are - "sp." for undescribed species (followed by collectors initials and number if a voucher specimen is available); "?" for determinations which were uncertain because either the correct application of the name was in doubt, or the material was inadequate; "+" for presence of species in other areas denoted; "+L" for species found near Eneabba (E.A. Griffin, A.J.M. Hopkins and R.J. Hnatiuk, unpublished data) additional to Hopkins and Hnatiuk (1981); "+X" for species found at the Burma Road Reserve (E.A. Griffin, R.J. Hnatiuk, S.D. Hopper and B.R. Maslin, unpublished data).

## Also found in the

	Eneabba area (A)	Mt. Lesueur- Cockleshell Gully area (B)	Burma Rd Nature Reserve (C)
<i>Acacia auronitens</i> Lindl.	+	+	+X
<i>A. blakelyi</i> Maiden	+	-	+X
<i>A. comans</i> W.V.Fitzg.	-	-	-
<i>A. dilatata</i> Benth.	-	-	-
<i>A. fagonioides</i> Benth.	+	-	-
<i>A. jacksonioides</i> Maslin	-	-	-
<i>A. lasiocarpa</i> Benth.	+	+	+X
<i>A. saligna</i> (Labill.)H. Wendl.	+	+	-
<i>A. scirpifolia</i> Meisn.	-	-	-
<i>A. stenoptera</i> Benth.	+L	+	-
<i>A. tamminensis</i> E.Pritzel	-	+	-
<i>Acanthocarpus preissii</i> Lehm.	+L	-	-
<i>A. sp.</i> (EAG 2784)	-	-	-
<i>Actinostrobilus arenarius</i> C.A.Gardner	-	-	+
<i>Adenanthos cygnorum</i> Diels	+	+	-
<i>Amphipogon</i> sp.	+	+	-
<i>Andersonia</i> ? <i>heterophylla</i> Sonder	+	-	-
<i>Anigozanthos humilis</i> Lindl.	+	+	+
<i>A. pulcherrimus</i> Hooker	-	+	-
<i>Astroloma microdonta</i> F.Muell. ex Benth.	+	+	-
<i>A. serratifolium</i> (DC.)Druce	+	+	-
<i>Baeckea camphorosmae</i> Endl.	+	+	-
<i>B. grandiflora</i> Benth.	+	+	-
<i>Banksia attenuata</i> R.Br.	+	+	+
<i>B. candolleana</i> Meisn.	+	+	-
<i>B. leptophylla</i> George	+	-	-
<i>B. menziesii</i> R.Br.	+	+	+
<i>B. prionotes</i> Lindl.	-	-	+
<i>B. scabrella</i> George	-	-	+X
<i>B. sphaerocarpa</i> R.Br.	+	+	+
<i>Beaufortia elegans</i> Schauer	+	+	-
<i>Billardiera</i> sp.	-	+	-
<i>Boronia coerulescens</i> F.Muell.	+	-	+X
<i>B. ramosa</i> (Lindl.)Benth.	+	+	-
<i>Burchardia umbellata</i> R.Br.	+	+	+
<i>Calandrinia calypttrata</i> J.D.Hooker	-	-	-
<i>Calectasia cyanea</i> R.Br.	+	+	+
<i>Calothamnus blepharospermus</i> F.Muell.	-	-	-
<i>C. homalophyllus</i> F.Muell.	-	-	-
<i>C. longissimus</i> F.Muell.	+	-	-
<i>C. sanguineus</i> Labill.	+	+	+X
<i>Calotis hispidula</i> (F.Muell.)F.Muell.	-	-	-
<i>Calytrix brachyphylla</i> (Turcz.)Benth.	-	+	-
<i>C. empetroides</i> (Schauer)Benth.	+	+	-
<i>C. flavescens</i> A.Cunn.	+	+	+
<i>C. fraseri</i> A.Cunn.	-	-	-
<i>Carpobrotus</i> sp.	+	-	-
<i>Cassytha filiformis</i> L.	-	-	-
<i>C. ? pomiformis</i> Nees	+L	+	-
<i>Casuarina campestris</i> Diels	+L	-	-



## Also found in the

	Eneabba area	Mt. Lesueur- Cockleshell Gully area	Burma Rd Nature Reserve
<i>Casuarina humilis</i> Otto & Dietr.	+	+	-
<i>C. microstachya</i> Miq.	+	+	-
<i>Caustis dioica</i> R.Br.	+	+	-
<i>Chamaescilla corymbosa</i> (R.Br.)F.Muell. ex Benth.	-	+	-
<i>Chorizema aciculare</i> (DC.)C.A.Gardner	+ <sub>L</sub>	-	+
<i>Chrysocoryne pusilla</i> (Benth.)Endl.	+	-	-
<i>Comesperma drummondii</i> Steez	+	+	-
<i>C. volubile</i> Labill.	-	+	-
<i>Conospermum nervosum</i> Meisn.	+	+	-
<i>C. triplinervium</i> R.Br.	+	+	+
<i>Conostylis aculeata</i> R.Br.	+	+	-
<i>C. aculeata</i> R.Br. ssp. <i>breviflora</i> S.D.Hopper	+	+	-
<i>C. androstemma</i> (Lindl.)F.Muell.	+	+	-
<i>C. aurea</i> Lindl.	+	+	-
<i>C. candicans</i> Endl.	-	-	+
<i>C. crassinervia</i> J.W.Green	+	+	-
<i>C. dielsii</i> W.V.Fitzg.	-	-	-
<i>C. neocymosa</i> S.D.Hopper	-	-	-
<i>C. sp.</i> (SDH 170)	-	-	-
<i>Crassula colorata</i> (Nees)Ostenf.	+	+	-
<i>Cryptandra glabriflora</i> Benth.	+	-	-
<i>C. pungens</i> Steud.	+ <sub>L</sub>	+	+
<i>Dampiera lavandulacea</i> DeVriese	-	+	-
<i>D. lindleyi</i> Lindl.	-	+	+
<i>D. linearis</i> R.Br.	-	-	+
<i>D. spicigera</i> Benth.	+	+	-
<i>D. trigona</i> DeVriese	-	-	-
<i>Darwinia speciosa</i> (Meisn.)Benth.	+	-	-
<i>Daviesia benthamii</i> Meisn.	-	-	-
<i>D. daphnoides</i> Meisn.	+ <sub>L</sub>	+	+ <sub>X</sub>
<i>D. divaricata</i> Benth.	+	+	-
<i>D. nudiflora</i> Meisn.	+	+	-
<i>D. pedunculata</i> Benth. ex Lindl.	+	+	-
<i>Dianella revoluta</i> R.Br.	-	+	+
<i>Diplolaena ferruginea</i> P.G.Wilson	+	+	+
<i>Diplopeltis huegelii</i> Endl.	-	+	+
<i>Dodonaea ericoides</i> Miq.	+ <sub>L</sub>	+	-
<i>Drosera erythrorhiza</i> Lindl.	+	+	-
<i>D. leucoblata</i> Benth.	+	+	-
<i>D. macrantha</i> Endl.	+	+	+
<i>D. ? menziesii</i> R.Br.	+	+	+
<i>D. stolonifera</i> Endl.	+	+	-
<i>Dryandra bipinnatifida</i> R.Br.	+	+	-
<i>D. carlinoides</i> Meisn.	+	+	+
<i>D. fraseri</i> R.Br.	+ <sub>L</sub>	+	-
<i>D. nivea</i> (Labill.)R.Br.	+	+	+
<i>D. sessilis</i> (Knight)Domin	+	+	+
<i>D. shuttleworthiana</i> Meisn.	+	+	+
<i>Ecdeiocolea monostachya</i> F.Muell.	+	+	+ <sub>X</sub>

## Also found in

	Eneabba area	Mt. Lesueur- Cockleshell Gully area	Burma Rd Nature Reserve
<i>Elythranthera</i> ? <i>brunonis</i> (Endl.)George	+	+	-
<i>Eremaea</i> sp. aff. <i>acutifolia</i> F.Muell.	+	+	+X
<i>E. beaufortioides</i> Benth.	+	+	-
<i>E. violacea</i> F.Muell.	+	+	-
<i>Eucalyptus accedens</i> W.V. Fitzg.	+	-	-
<i>E. camaldulensis</i> Dehnh.	-	-	-
<i>E. dongarraensis</i> Maiden et Blakely	-	-	-
<i>E. drummondii</i> Benth.	+	+	-
<i>E. eudesmioides</i> F.Muell.	+L	+	+
<i>E. falcata</i> Turcz.	-	-	-
<i>E. foecunda</i> Schauer	-	-	-
<i>E. jucunda</i> C.A.Gardner	+	-	-
<i>E. macrocarpa</i> Hooker	+	-	-
<i>E. pyriformis</i> Turcz.	+L	-	-
<i>E. tetragona</i> (R.Br.)F.Muell.	+	-	-
<i>E. todtiana</i> F.Muell.	+	+	-
<i>Gastrolobium obovatum</i> Benth.	+	-	-
<i>G. pauciflorum</i> C.A.Gardner	+	+	-
<i>G. spinosum</i> Benth.	+L	+	+
<i>Geleznowia verrucosa</i> Turcz.	+	-	+X
<i>Glischrocaryon</i> ? <i>aureum</i> (Lindl.)Orchard	+	+	-
<i>Gompholobium aristatum</i> Benth.	+	+	-
<i>G. knightianum</i> Lindl.	+	+	+
<i>Goodenia berardiana</i> (Gaud.)Carolin	-	-	-
<i>G. careulea</i> R.Br.	+	+	+
<i>G. hassallii</i> F.Muell.	-	+	-
<i>Grevillea</i> ? <i>bitemata</i> Meisn.	-	-	-
<i>G. eriostachya</i> Lindl.	+	-	-
<i>G. polybotrya</i> Meisn.	+	-	+
<i>G. uncinulata</i> Diels	-	-	-
<i>Guichenotia micrantha</i> (Steetz.)Benth.	-	-	-
<i>G. sarotes</i> Benth.	+	+	-
<i>Haemodorum paniculatum</i> Lindl.	+	+	-
<i>Hakea auriculata</i> Meisn. var. <i>auriculata</i>	+	+	+
<i>H. auriculata</i> Meisn. var. <i>spathulata</i> Benth.	+L	+	-
<i>H. baxteri</i> R.Br.	-	-	-
<i>H. brachyptera</i> Meisn.	+	-	-
<i>H. cinerea</i> R.Br.	+	+	-
<i>H. ? circumalata</i> Meisn. (EAG 2806, 2804)	+	-	+
<i>H. costata</i> Meisn.	+	+	-
<i>H. incrassata</i> R.Br.	+	+	-
<i>H. lissocarpha</i> R.Br.	+	+	+
<i>H. obliqua</i> R.Br.	+	+	-
<i>H. prostrata</i> R.Br.	+	+	-
<i>H. ruscifolia</i> Labill.	+	+	-
<i>H. smilacifolia</i> Meisn.	+	-	+
<i>H. stenocarpa</i> R.Br.	+	+	+
<i>H. trifurcata</i> (Sm.)R.Br.	+	+	+X
<i>H. sp. aff. falcata</i> R.Br. (EAG 2799)	-	-	-
<i>Halgania</i> sp. (EAG 1714)	+L	-	-
<i>Helipterum cotula</i> (Benth.)DC.	+	+	+
<i>H. demissum</i> (A.Gray)Druce	-	-	-
<i>H. laeve</i> (A.Gray)Benth.	-	-	-
<i>H. manglesii</i> (Lindl.)Benth.	-	-	+
<i>Hibbertia acerosa</i> (R.Br. ex DC.)Benth.	+	+	-

## Also found in the

	Eneabba area	Mt. Lesueur- Cockleshell Gully area	Burma Rd Nature Reserve
<i>Hibbertia aurea</i> Steud.	+L	+	+
<i>H. hypericoides</i> (DC.) Benth.	+L	+	-
<i>H. spicata</i> F. Muell.	+L	+	-
<i>H. subvaginata</i> (Steud.) F. Muell.	-	-	-
<i>H. sp.</i> (RJH 800015)	+L	-	-
<i>H. sp. aff. furfuraceae</i> (R.Br. ex DC.) Benth. (RJH 771310)	+	+	-
<i>Hovea stricta</i> Meisn.	+	+	-
<i>Hybanthus floribundus</i> (Walp.) F. Muell.	+	+	+
<i>Hydrocotyle sp.</i>	-	-	-
<i>Hypocalymma xanthopetalum</i> F. Muell.	+	+	-
<i>Isopogon adenanthoides</i> Meisn.	+	+	+
<i>I. divergens</i> R.Br.	+L	+	-
<i>I. linearis</i> Meisn.	+	+	-
<i>I. ? tridens</i> F. Muell.	+	-	+
<i>Isotoma hypocrateriformis</i> (R.Br.) Druce	-	+	-
<i>Isotropis cuneifolia</i> (Sm.) Benth. ex B.D. Jackson	+L	+	-
<i>Jacksonia angulata</i> Benth.	-	-	-
<i>J. foliosa</i> Turcz.	-	-	-
<i>J. horrida</i> DC.	-	-	-
<i>J. restioides</i> Meisn.	+	+	+
<i>J. ? spinosa</i> (Labill.) R.Br.	-	-	-
<i>Johnsonia pubescens</i> Lindl.	+	-	-
<i>Lambertia multiflora</i> Lindl.	+	+	-
<i>Lasiopetalum drummondii</i> Benth.	+	+	-
<i>L. indutum</i> Steud.	-	-	-
<i>L. sp.</i> (RJH 800023)	-	-	-
<i>Laxmannia grandiflora</i> Lindl.	-	-	-
<i>L. sessiliflora</i> Dcne.	+	-	-
<i>Lechenaultia biloba</i> Lindl.	+	+	-
<i>Lepidobolus chaetocephalus</i> F. Muell.	+	+	-
<i>Lepidosperma pubisquamum</i> Steud.	+	-	-
<i>L. viscidum</i> R.Br.	-	+	+
<i>Leptospermum erubescens</i> Schauer	+	+	+X
<i>L. spinescens</i> Endl.	+	+	-
<i>Leucopogon strongylophyllus</i> F. Muell.	-	-	-
<i>L. sp.</i> (EAG 2800, 2801)	+L	-	-
<i>L. sp.</i>	-	-	-
<i>Levenhookia dubia</i> Sonder	+L	+	-
<i>Logania spermacoea</i> F. Muell.	+	+	-
<i>Lomandra hastilis</i> (R.Br.) Ewart	+	+	-
<i>L. preissii</i> (Endl.) Ewart	+	+	-
<i>Loxocarya cinerea</i> R.Br.	+	+	-
<i>L. fasciculata</i> (R.Br.) Benth.	+	+	-
<i>Lyginia barbarta</i> R.Br.	+	+	-
<i>Lyperanthus nigricans</i> R.Br.	-	+	-
<i>Lysinema ciliatum</i> R.Br.	+	+	+
<i>Macropidia fuliginosa</i> (Hook.) Druce	+	+	+
<i>Macrozamia riedlei</i> (Fisch. ex Gaud.) C.A. Gardner	+	+	+

## Also found in the

	Eneabba area	Mt. Lesueur- Cockleshell Gully area	Burma Rd Nature Reserve
<i>Melaleuca cardiophylla</i> F.Muell.	-	-	-
<i>M. ? holosericea</i> Schauert	+L	-	+X
<i>M. radula</i> Lindl.	+L	+	+
<i>M. scabra</i> R.Br.	-	+	+
<i>M. ? sclerophylla</i> Diels	-	-	-
<i>M. tricophylla</i> Lindl.	+	+	-
<i>M. uncinata</i> R.Br.	+	-	-
<i>M. urceolaris</i> F.Muell. ex Benth.	-	-	-
<i>Mesomelaena stygia</i> (R.Br.)Nees var. <i>deflexa</i> Kükenthal	+	-	-
<i>M. stygia</i> (R.Br.)Nees var. <i>preissii</i> (Nees) Kükenthal	+	-	-
<i>M. stygia</i> (R.Br.)Nees var. <i>pseudostygia</i> Kükenthal	+	+	-
<i>M. tetragona</i> (R.Br.)Benth.	+	+	+X
<i>Micromyrtus</i> sp. (RJH 800019)	-	-	-
<i>Mirbelia floribunda</i> Benth.	-	-	+
<i>M. spinosa</i> Benth.	+	+	-
<i>Monotaxis grandiflora</i> Endl.	+	+	-
<i>Neurachne alopecuroidea</i> R.Br.	+	+	-
<i>Nuytsia floribunda</i> (Labill.)R.Br. ex Fenzl	+	+	+
<i>Olax benthamiana</i> Miq.	+	+	+
<i>O. sp. aff. phyllanthi</i> (Labill.)R.Br. (RJH 771499)	+L	+	-
<i>Olearia rudis</i> (Benth.)F.Muell.	-	-	+
<i>Opercularia spermacoceae</i> Labill.	+L	+	-
<i>Patersonia graminea</i> Benth.	-	-	-
<i>P. occidentalis</i> R.Br.	+L	+	-
<i>Petrophile chrysantha</i> Meisn.	+L	+	-
<i>P. drummondii</i> Meisn.	+	+	-
<i>P. ericifolia</i> R.Br.	+	-	+
<i>P. macrostachya</i> R.Br.	+	+	+
<i>P. media</i> R.Br.	+	+	-
<i>P. megalostegia</i> F.Muell.	+L	-	-
<i>P. seminuda</i> Lindl.	-	+	-
<i>P. shuttleworthiana</i> Meisn.	+L	+	-
<i>Pileanthus filifolius</i> Meisn.	+	+	-
<i>Pimelea angustifolia</i> R.Br.	+	+	-
<i>P. imbricata</i> R.Br.	-	+	+
<i>P. ? suaveolens</i> (Endl.)Meisn.	+L	+	+
<i>P. sulphurea</i> Meisn.	+	+	-
<i>Pityrodia bartlingii</i> (Lehm.)Benth.	+	+	+
<i>P. verbascina</i> (F.Muell.)Benth.	+	+	-
<i>Podolepis</i> sp.	-	-	-
<i>Podotheca gnaphalioides</i> Grah.	+	-	+
<i>P. pygmaea</i> A.Gray	+	-	-
<i>Prasophyllum cyphochilum</i> Benth.	-	-	-
<i>Ptilotus manglesii</i> (Lindl.)F.Muell.	-	+	-
<i>Quinetia urvillei</i> Cass.	-	-	-
<i>Restio</i> sp.	-	-	-
<i>Scaevola anchusifolia</i> Benth.	-	+	+

## Also found in the

	Eneabba area	Mt. Lesueur- Cockleshell Gully area	Burma Rd Nature Reserve
<i>Scaevola canescens</i> Benth.	+	+	+
<i>Schoenus odontocarpus</i> F.Muell.	-	-	-
<i>S. subflavus</i> Kükenthal	+	+	-
<i>Scholtzia laxiflora</i> Benth.	+	+	+
<i>Spaerolobium macranthum</i> Meisn.	+	+	+
<i>Stackhousia brunonis</i> Benth.	+	+	+
<i>S. pubescens</i> A.Rich.	-	+	-
<i>Stirlingia latiflora</i> (R.Br.)Steud.	+	+	+
<i>S. simplex</i> Lindl.	+	+	-
<i>Stylidium adpressum</i> Benth.	+	+	-
<i>S. crossocephalum</i> F.Muell.	+	+	+
<i>S. divaricatum</i> Sonder	+L	+	-
<i>S. leptocalyx</i> Sonder	-	+	-
<i>S. leptophyllum</i> DC.	-	-	-
<i>S. maitlandianum</i> E. Pritzel	+	+	-
<i>S. repens</i> R.Br.	+	+	-
<i>S. sp.</i> (EAG 2794)	-	-	-
<i>Synaphea sp.</i> (RJH 800017)	-	-	-
<i>Templetonia biloba</i> (Benth.)Polhill	+	+	-
<i>Tersonia brevipes</i> Moq.	+L	-	-
<i>Thelymitra campanulata</i> Lindl.	+	+	-
<i>Thomasia ? cognata</i> Steud. (EAG 2774)	-	-	-
<i>Thysanotus dichotomus</i> (Labill.)R.Br.	+	-	-
<i>T. patersonii</i> R.Br.	+	+	-
<i>Trachymene pilosa</i> Sm.	+	+	-
<i>Trymalium ledifolium</i> Fenzl.	-	+	-
<i>T. ? wichurae</i> Nees	+L	-	-
<i>Ursinia anthemoides</i> (L.)Poir.	-	+	-
<i>Velleia trinervis</i> Labill.	-	+	-
<i>Verrauxia reinwardtii</i> (DeVriese)Benth.	+	-	+
<i>Verticordia brownii</i> (Desf.)DC.	+L	-	-
<i>V. densiflora</i> Lindl.	+	+	-
<i>V. grandiflora</i> Endl.	+	-	-
<i>V. grandis</i> Drumm.	+	+	+
<i>V. monadelpha</i> Turcz.	-	-	-
<i>V. ovalifolia</i> Meisn.	+	-	-
<i>V. pennigera</i> Endl.	+	+	+
<i>V. picta</i> Endl.	+	-	+
<i>Viminaria juncea</i> (Shrad. & Wendl.)Hoffmanns	+L	+	-
<i>Waitzia paniculata</i> F.Muell. ex Benth.	+	+	+
<i>Xanthorrhoea reflexa</i> D.A.Herb.	+	+	+X
<i>Xylomelum angustifolium</i> Kipp. et Meisn.	+	-	+

(A) Hopkins and Hnatiuk (1981)

(B) E.A. Griffin and A.J.M. Hopkins (unpublished data)

(C) Beard and Burns (1976)

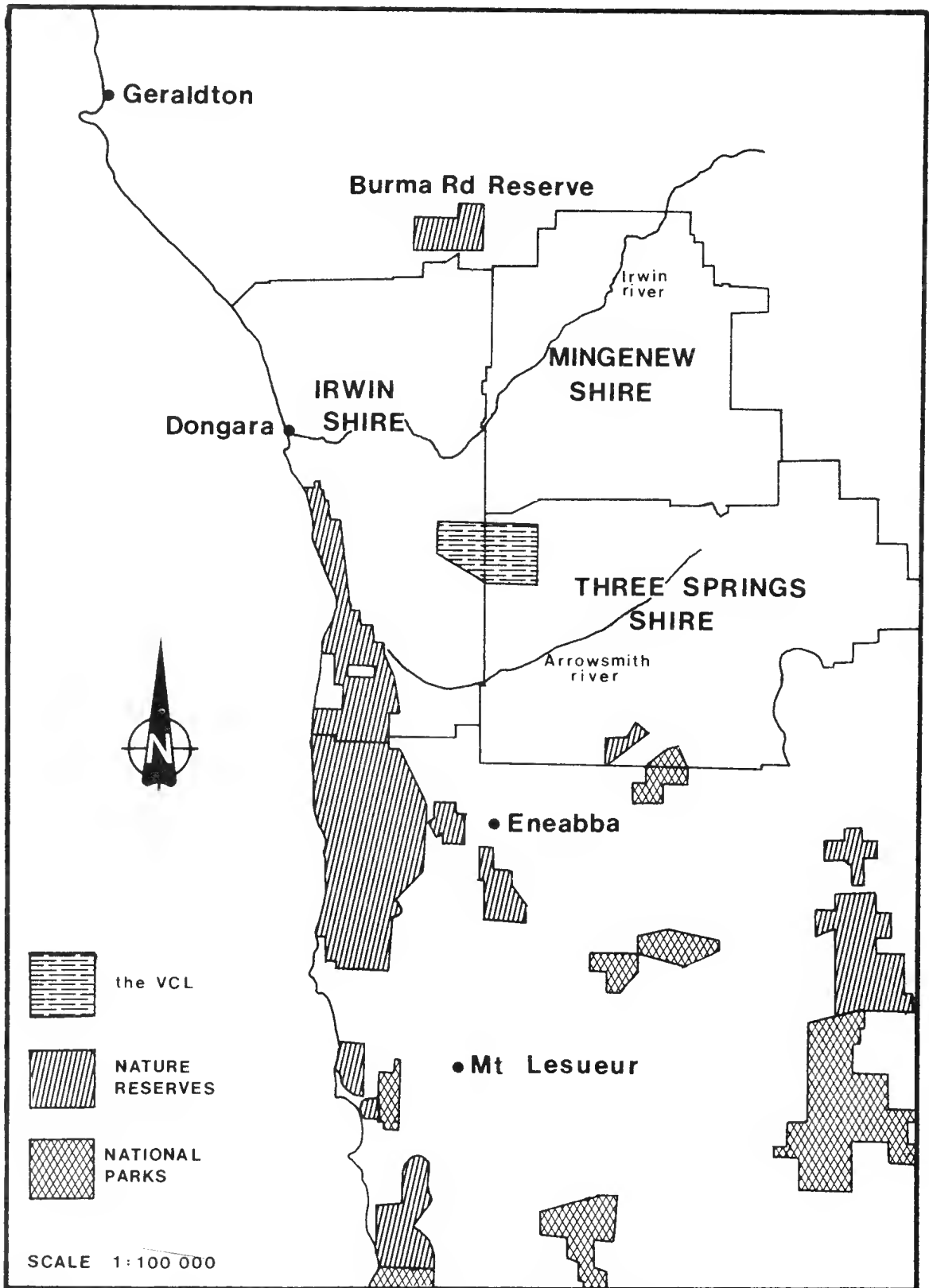


Fig. 1. Location map of the VCL with National Parks and Nature Reserves greater than 2,000 ha.

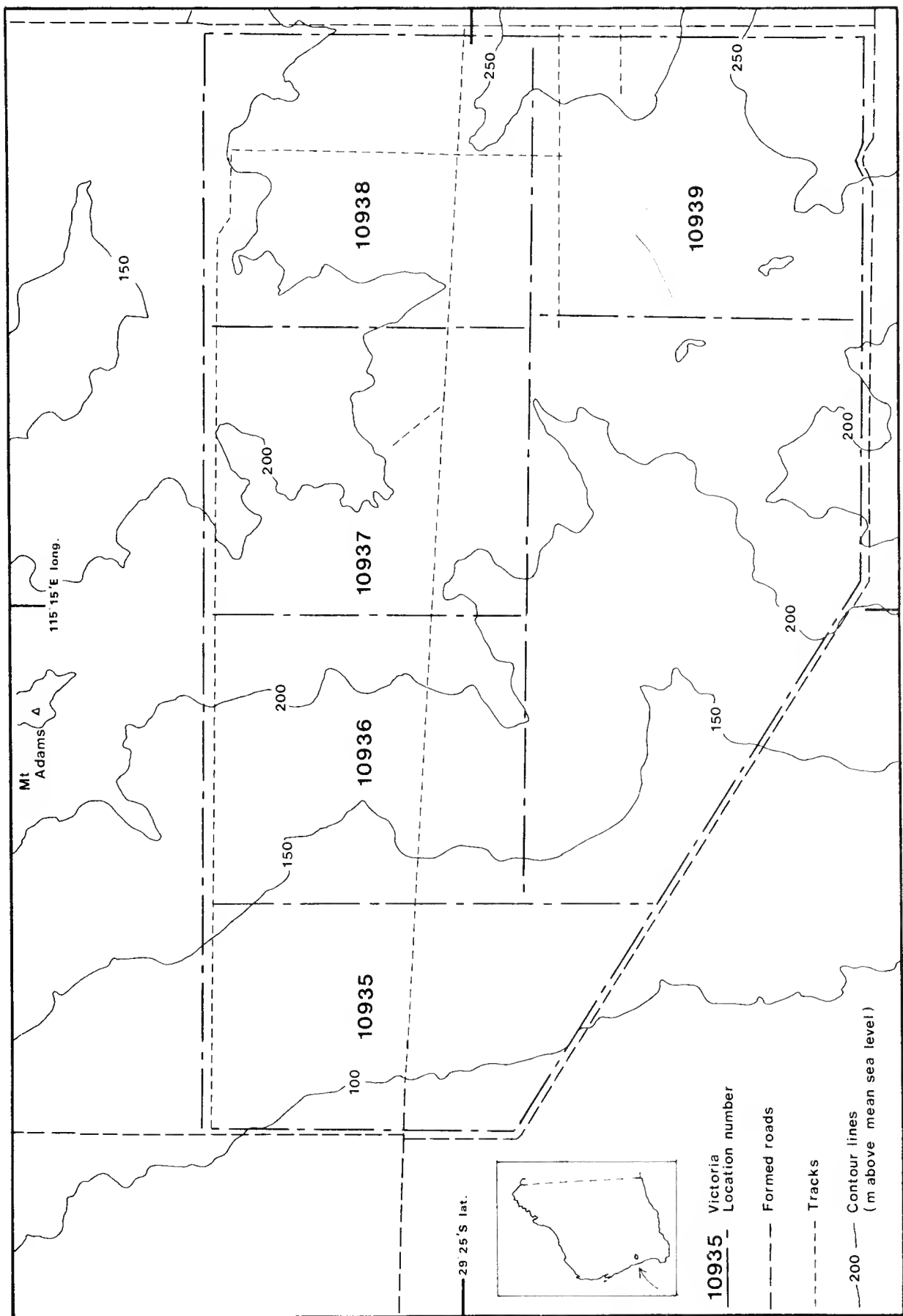


Fig. 2. Contour map of the VCL with roads and Victoria location numbers.



Fig. 3. Open low-heath with emergent *Eucalyptus tottiana* in foreground.



Fig. 4. Open low-heath with *Eucalyptus accedens* low-woodland right hand centre.





Fig. 5. Open low heath on slight lateritic breakaway.





