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FLORA CONSERVATION VALUES OF VACANT CROWN LAND SOUTH OF MOUNT ADAMS, WESTERN AUSTRALIA

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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 However, mapping of the soil types (Department of Lands and Surveys, unpublished data) has revealed that the numbered blocks (Figure 2) contain an undesirably high proportion of "poor soils" in the form of deep sands (35% average per block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
Acacia fagonioides	-	GR
Anigozanthos pulcherrimus	E	-
Banksia candolleana	F	-
Banksia leptophylla	F	-
Banksia scabrella	B	GR
Calothamnus longissimus	E	-
Cassytha pomiformis	A	?
Conospermum nervosum	E	-
Conostylis aculeata ssp. breviflora	-	GR
Conostylis dielsii	E	GR
Conostylis sp. (SDH 170)	-	GR
Dampiera lindleyi	D	-
Darwinia speciosa	-	GR
Diplolaena ferruginea	E	-
Dodonaea ericoides	D	-
Gastrolobium pauciflorum	F	GR
Hovea stricta	F	-
Isopogon adenanthoides	E	GR
Isopogon linearis	F	-
Isopogon tridens	-	GR
Jacksonia foliosa	D	-
Lasiopetalum drummondii	F	-
Lasiopetalum sp. (RJH 800023)	-	VGR
Lepidosperma pubisquameum	D	-
Leucopogon strongylophyllus	D	-
Leucopogon sp. (EAG 2800, 2801)	-	GR
Macropidia fuliginosa	F	-
Micromyrtus sp. (RJH 800019)	-	VGR
Olax sp. aff. phyllanthi (RJH 771499)	-	GR
Petrophile chrysantha	F	GR
Stylidium leptocalyx	D	-
Stylidium maitlandianum	D	-
Stylidium sp. (EAG 2794)	-	VGR
Synaphea sp. (RJH 800017)	-	VGR
Verticordia grandis	F	-
Xanthorrhoea reflexa	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 1) 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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REFERENCES

Anon. (1981). The Mottlecah - A plant in need of a place to grow. *S.W.A. N.S.* 11(3): 7-10. (Department of Fisheries and Wildlife, Perth).

Baxter, J.L. (1977). *Heavy Mineral Sand Deposits of Western Australia, Mineral Research Bulletin 10* Geological Survey, Western Australia. 148pp.

Beard, J.S. (1976a). *Vegetation Survey of Western Australia. The Vegetation of the Dongara Area, Western Australia. Map and Explanatory Memoir. 1:250,000 series.* Vegmap Publications, Perth. 24 pp.

Beard, J.S. (1976b). An indigenous term for the Western Australian sandplain and its vegetation. *Journal of the Royal Society of Western Australia* 59: 55-57.

Beard, J.S. and Burns, A.C. (1976). *Vegetation Survey of Western Australia. The Vegetation of the Geraldton Area, Western Australia. Map and Explanatory Memoir. 1:250,000 Series.* Vegmap Publications, Perth. 37 pp.

Churchward, H.M. (1970). Erosional modifications of a lateritized landscape over sedimentary rocks. Its effects on soil distribution. *Australian Journal of Soil Research* 8: 1-19.

Griffin, E.A. (1981). *Rare and Geographically Restricted Plants of Western Australia. Restricted Species of the Northern Sandplain between the Moore and Irwin Rivers.* Department of Fisheries and Wildlife confidential Report. (about 500 pp.)

Hnatiuk, R.J. and Hopkins, A.J.M. (in press). An Ecological Analysis of Kwongan South of Eneabba, Western Australia. *Australian Journal of Ecology* 6(4).

Hopkins, A.J.M. and Hnatiuk, R.J. (1981). An Ecological Survey of the Kwongan South of Eneabba, Western Australia. *Wildlife Research Bulletin Western Australia* 9. 33 pp.

Lowry, D.C. (1974). *Geological Survey of Western Australia 1:250,000 Geological Series Explanatory Notes. Dongara-Hill River, Western Australia. (Sheets SH/50-59).* Australian Government Publishing Service, Canberra. 33 pp.

Marchant, N.G. and Keighery, G.J. (1979). Poorly collected and presumably rare vascular plants of Western Australia. *Kings Park Research Notes No. 5.* 103 pp.

Muir, B.G. (1977). Biological Survey of the Western Australian Wheatbelt Part 2 - Vegetation and Habitat of Bendering Reserve. *Records of the Western Australian Museum, Supplement No. 3.* 142 pp.

Ride, W.D.L. (1975) (ed.) *Conservation reserves in Western Australia: Report of the Conservation Through Reserves Committee to the Environmental Protection Authority.* Department of Environmental Protection, Perth.

Rye, B.L. (in press). Geographically restricted plants of southern Western Australia. *Department Fisheries and Wildlife of Western Australia Report* 48.

APPENDIX I

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

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

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

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

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

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

(A) Hopkins and Hnatiuk (1981)
(B) E.A. Griffin and A.J.M. Hopkins (unpublished data)
(C) Beard and Burns (1976)

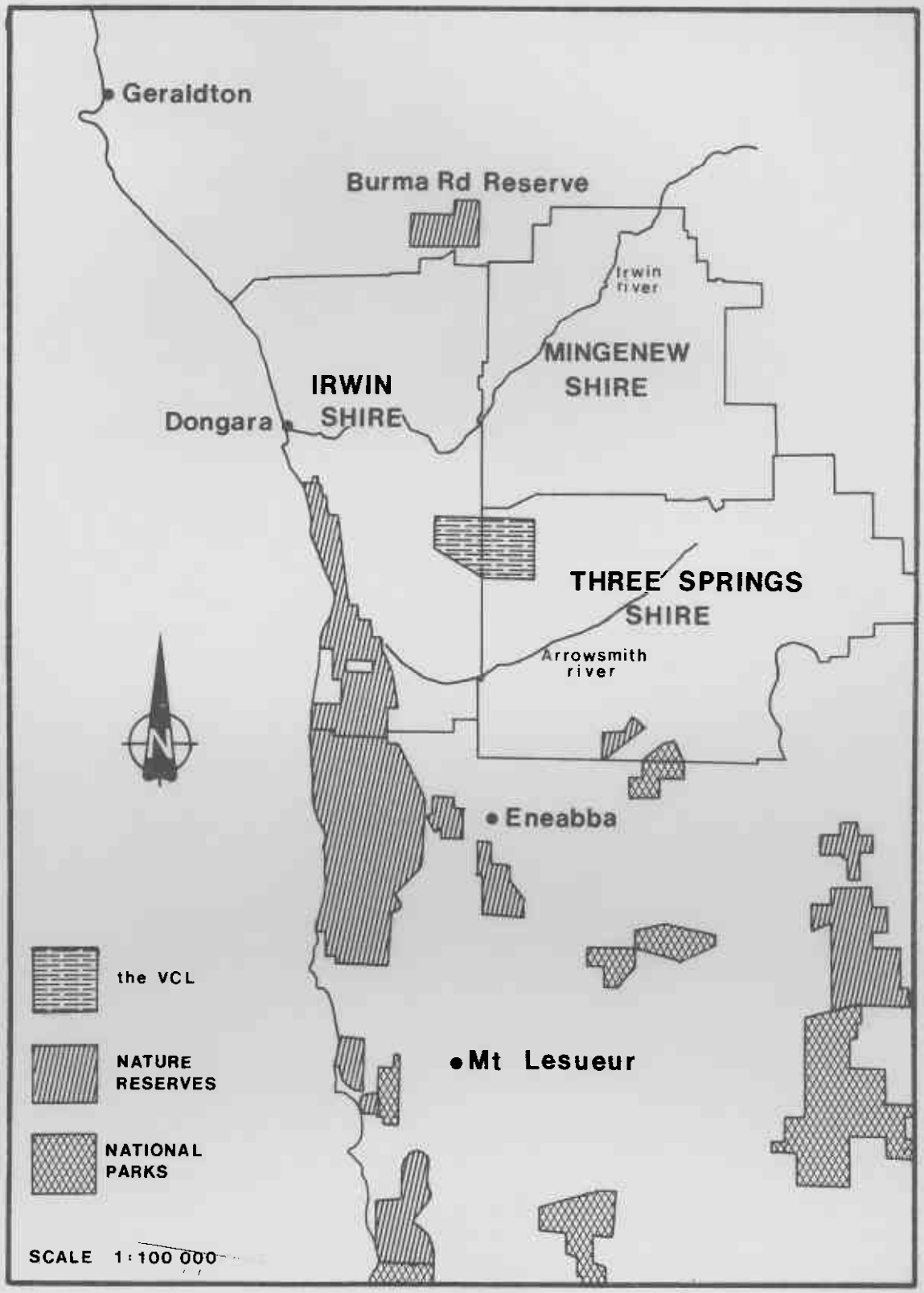

Fig. 1. Location map of the VCL with National Parks and Nature Reserves greater than 2,000 ha.

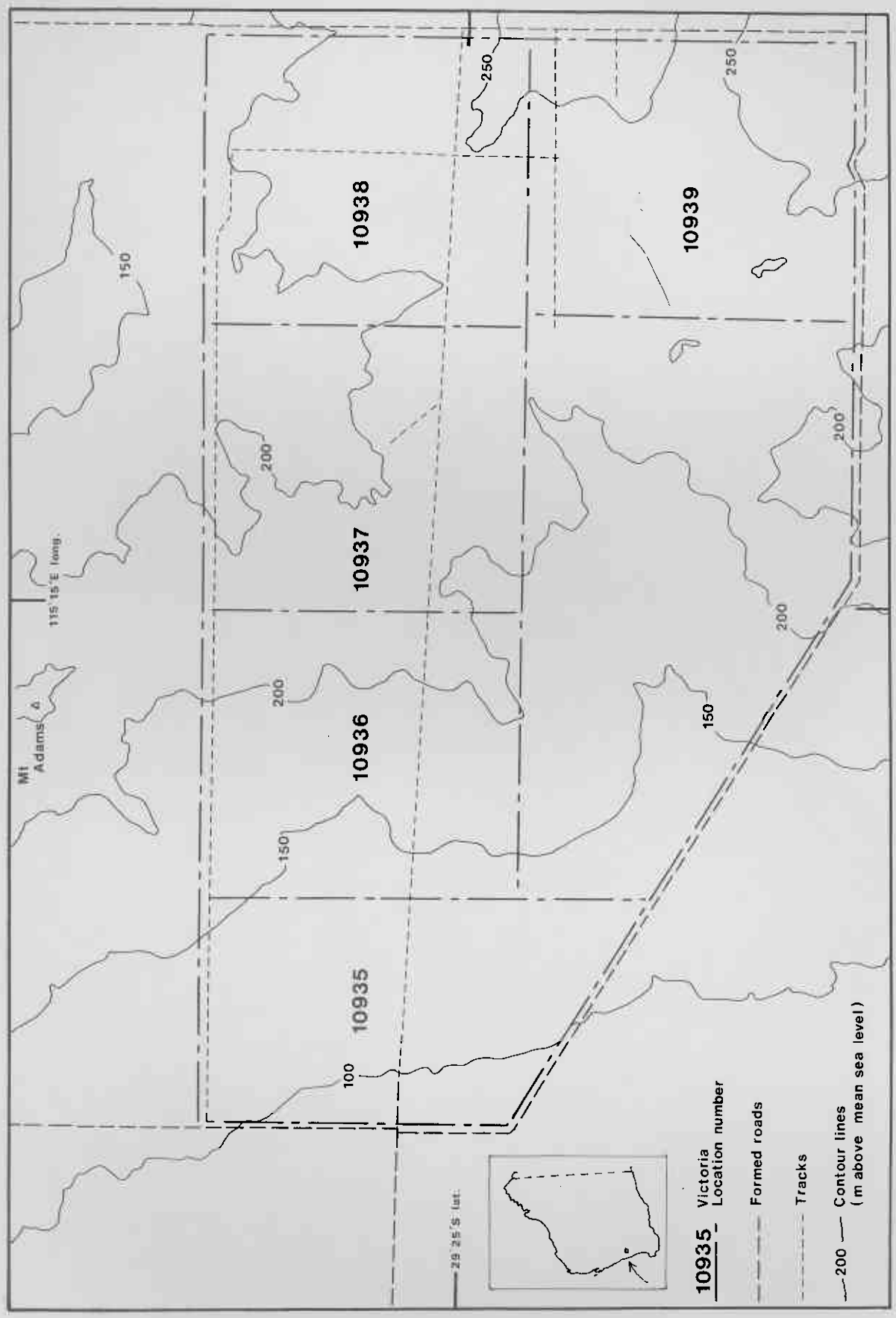

Fig. 2. Contour map of the VCL with roads and Victoria location numbers.

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

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

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