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THE PLANTS OF HUMMOCKY HILLS, NORTHERN TASMANIA

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Abstract. A survey of vascular plants, lichens and bryophytes is reported for a region of the northern Midlands encompassing the summit ridge of Hummocky Hills and its eastern slopes down to low-lying terraces about 1 km west of the Midlands Highway. Despite its use for agricultural purposes, mainly sheep grazing, the area contains a considerable number of native species, including some species that are considered to be rare in Tasmania or poorly represented in State Reserves.

INTRODUCTION

Hummocky Hills is a series of low elevation summits forming eastern outliers to the Great Western Tiers. The area is situated between the South Esk and Macquarie Rivers about 19 km south of Evandale and comprises virtually the only hills in an expanse of level to gently inclined lands situated between the precipitous tiers in the west and the foothills of the Ben Lomond Plateau in the east. There is a trig station (477m elevation, A.M.G. 5194 53801) at its most northerly summit, but the middle and southern peaks are of a similar height.

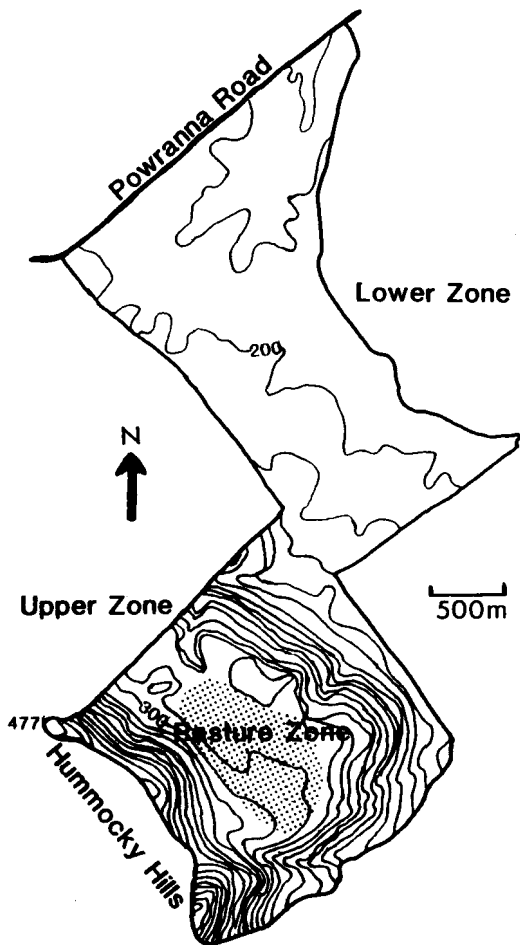


Fig. 1. Map of the study area at Hummocky Hills in northern Tasmania showing the location of the three zones surveyed. The improved pasture zone is stippled.

Because the geographical position of Hummocky Hills places it in a rain shadow, rainfall is less than might be expected if one only considered elevation. The surrounding plains have an average annual rainfall of the order of 600-700mm. There is a marked, visually discernible difference in the vegetation of the lower and upper slopes of Hummocky Hills, probably reflecting the underlying geology and soil formations more than differences in altitude, rainfall or other climatic factors.

STUDY AREA

The area surveyed was mostly on the eastern slopes of Hummocky Hills, west of the homestead "Powranna" (Fig. 1). Access to the survey area was mainly by means of a gravel road that leaves the Powranna Road (Road No. B53) approximately 1km west of its junction with the Midlands Highway. The survey area included around 6 km² of almost flat land south and east of the Tarmak International Dragway in the Woodstock soil association (names of soil associations follow Nicolls 1958), and a further 5 km² on the eastern side of the summit ridge of Hummocky Hills. The western and northern slopes of the Hills were not surveyed, although some portions of the southern slopes were examined, access being provided by a gravel road which leads to the Mount Joy Road (Road No. C520). Three broad zones were differentiated.

[1] The Lower slopes (Woodstock soil association)

The almost level to gently sloping lands west of the Midlands Highway up to around the 230m contour had their origins as ancient river terraces formed by the South Esk River. Some of these lower slopes in a corridor west of the Midlands Highway and south of the Powranna Road have been extensively cleared for grazing, but there are still large tracts of lands containing "unimproved" native dry sclerophyll bushland. In these wooded lowlands, the dominant trees are black peppermint (*Eucalyptus amygdalina*) and silver wattle (*Acacia dealbata*), with significant pockets of bull oak (*Allocasuarina littoralis*) and honeysuckle (*Banksia marginata*). The major disturbance to these lands has been grazing by domestic stock, although some portions have undergone limited clearing for the production of firewood and fenceposts, and for woodchipping. The areas that have been completely cleared for grazing have generally had their pastures improved by the addition of fertilizers and are excluded from this survey. There are two large and several small artificial lakes on the northeastern side of the Hills which may dry out during the summer months. The Woodstock soils are lateritic and of low fertility, with the surface being a dark brownish grey loamy sand to sandy loam with some ironstone gravel (Nicolls 1958).

[2] The Upper slopes (Deddington and Eastfield soil associations)

The higher altitude region of Hummocky Hills, ranging from 230-477m, contains mainly two soil associations derived from Jurassic dolerite, the Deddington and the Eastfield. The Deddington soil association is the most extensive in the district, occupying most of the foothill country of the Ben Lomond Plateau. However, west of the South Esk River it is represented only by the top of Hummocky Hills, from about the 365m contour to the three summits. The terrain is moderately steep and the surface stony, with frequent rocky outcrops. The profiles of the Deddington soils often conform with the Eastfield soils but shallower profiles with less development of bleached subsurface

horizons are more common in the former (Nicolls 1958). Such profiles contain small to moderate amounts of rounded, ferruginous gravel. The vegetation on the Deddington soils is dry sclerophyll forest dominated by white gum (*Eucalyptus viminalis*) with silver wattle, black wattle (*Acacia mearnsii*) and some black peppermint also present. Agricultural use of this soil association is confined mostly to grazing in more or less open woodland.

Below the Deddington association of Hummocky Hills are found soils belonging to the Eastfield soil association. These are also of doleritic origin, but differ from the Deddington association in being situated on less rugged terrain at a lower general elevation, the soil distinctions being of lesser importance (Nicolls 1958). Due to greater accessibility, there has been more extensive agricultural development on these soils than on the Deddington. The Eastfield soils are characterized by a grey-brown or fine sandy loam surface, with a light grey fine sand to sandy loam subsurface. The profile often contains partially weathered dolerite fragments and loose stones. Much of the vegetation supported on this soil association has undergone partial clearing, but a considerable amount of the woodland remains, the dominant species being black peppermint and black wattle. In the area reported on here, a small but prominent creek cuts through the Eastfield soil association, exposing the underlying dolerite rock.

[3] Improved pastures (Arnon mudstone soils)

Below the Deddington soil association of the rocky summits of Hummocky Hills is found a broad, relatively flat shelf, which contains some mudstone soils of the Arnon soil association interspersed among the Eastfield soils. The Arnon soils are formed on Permian mudstones and siliceous metamorphic rocks at dolerite contacts (Nicolls 1958). Most profiles have a grey to grey-brown loam, fine sandy loam or clay loam surface. On the eastern slopes of Hummocky Hills, much of the original vegetation of this association has been cleared and converted to improved pasture for sheep grazing and, to a lesser extent, cattle grazing. The most conspicuous species are grasses and clovers, with thistles, "dandelions", docks and bartsias also abundant.

METHODS

Visits were made on a weekly or bi-weekly basis between September 1991 and February 1993. An attempt was made to cover as much of the area as possible, using the available gravel and dirt tracks and also travelling cross-country frequently. Collections of material were made of all plant groups except algae and non-lichenised fungi. A qualitative measure of abundance (local, rare, occasional, frequent or common) was ascribed to each species of flowering plant and fern in each zone. For the mosses and liverworts, because positive identification of a species in the field was difficult, no measure of abundance was given, but a record was made of the zones in which each species was found. For the lichens, which often require chemical analysis for species determination, only the presence of a species in the study area was recorded.

RESULTS AND DISCUSSION

The species recorded in this survey, with estimates of abundance (where available) for each of the three survey zones, are listed in Appendix 1. The scientific names of the flowering plants and ferns follow Buchanan *et al.* (1989); those of the mosses follow Dalton *et al.* (1991); those of the liverworts follow

Table 1. Summary statistics of plant groups in each survey zone.

	Lower	Pastures	Upper	Total
Vascular plants:				
Dicotyledons	110	55	117	151
Monocotyledons	77	32	59	86
Ferns	1	1	5	5
Subtotals	188	88	181	242
Bryophytes:				
Mosses	12	4	17	20
Liverworts	2	0	4	5
Subtotals	14	4	21	25

Ratkowsky (1987). For the lichens, scientific names and authorities are given in full, as there have been many alterations and additions to the checklist previously published by Kantvilas (1989). A total of 312 plant taxa was recorded, comprising 151 dicotyledons, 86 monocotyledons, five ferns, 20 mosses, five liverworts and 45 lichens. This level of plant diversity is comparable to that found in similar surveys of the Trevallyn State Recreation Area (Ratkowsky *et al.* 1993) and three other reserves of remnant native bushland near Launceston (Ratkowsky *et al.* in press).

The most abundant families of flowering plant were the daisies (Asteraceae) with 34 species and the grasses (Poaceae) with 33 species. Pea flowers and wattles (Fabaceae) were represented by 19 species and the sedges (Cyperaceae) by 16 species. The ferns exhibited little diversity, as only five species were recorded, with austral bracken (*Pteridium esculentum*) being the only fern species observed in the Lower and Pasture zones. Similarly, the bryophytes also lacked diversity, the meagre list of species containing no unusual entries. The lichen flora appears to be typical of disturbed dry sclerophyll bushland in Tasmania (G. Kantvilas, unpublished observations). The dominant families are the Parmeliaceae, containing the conspicuous foliose genera, *Flavoparmelia*, *Neofuscelia*, *Parmelina*, *Parmotrema*, *Punctelia* and *Xanthoparmelia*, which occur on trees and rocks, and the Cladoniaceae (*Cladonia*) which occurs on soil. Species of *Usnea* (Old Man's Beard) are also common, especially the epiphytic *Usnea inermis*. Two lichen records are particularly noteworthy. The crustose lichen *Hafellia dissa*, is rare in Tasmania, as is the foliose species *Rimeliella subcaperata*, which is recorded from Tasmania for only the second time.

Several higher plant species considered to be rare or poorly reserved in Tasmania (see Kirkpatrick *et al.* 1991) were also found. Three species not present in National Parks or equivalent reserves are *Helipterum demissum*, *Millotia tenuifolia* and *Brunonia australis*. These species, together with the poorly reserved species (reported in none or only one State Reserve by Kirkpatrick *et al.* 1991) *Hydrocotyle callicarpa*, *Helipterum australe*, *Rutidosia multiflora*, *Haloragis heterophylla*, *Myriophyllum integrifolium*, *Persicaria prostrata*, *Aphelia gracilis* and *Dichopogon strictus*, were at least locally abundant in the area surveyed, and some of these species were rather widespread. Three other poorly reserved species were found

Table 2. Number of exotic species of flowering plants in each zone, with the ratio of exotic to native species given in parentheses.

	Lower	Pastures	Upper	Total
Dicotyledons	31 (0.39)	30 (1.20)	36 (0.44)	45 (0.42)
Monocotyledons	13 (0.20)	12 (0.60)	10 (0.20)	16 (0.23)

less abundantly. These were the fern *Pleurosorus rutifolius*, which was only found on a dolerite boulder on the steep eastern face below the summit ridge, *Aphelia pumilio*, which was found only once on soils of the Woodstock association, and *Gratiola pubescens*, which was local to the margins of one of the large artificial lakes in the Woodstock association. Of the species listed above, only *Helipterum demissum* was considered by Kirkpatrick *et al.* (1991) to be endangered in Tasmania. However, its distribution at Hummocky Hills suggests that it is an opportunistic coloniser. This small species appears to be colonising areas which have undergone considerable disturbance, particularly at the sides of roads bulldozed in gravel or unconsolidated sandy soils.

Off the total of 242 species of vascular plants 188 were found in the Lower zone and 181 were present in the Upper zone, making those two zones almost equally species-rich, with both being much richer than the Pastures zone (Table 1). There is a considerable overlap of species between the Lower and Upper zones. Only a few vascular plant species which are abundant (frequent or common) in the Lower zone are not found in the Upper zone (Appendix 1). Aside from a herb (*Montia fontana*), a sedge (*Lepidosperma lineare*), and three grasses (*Danthonia setacea*, *Poa annua*, *Stipa mollis*), the only large species in this category was a tree (*Allocasuarina littoralis*) and a shrub (*Acrotriche serrulata*). No vascular plant species that was abundant in the Upper zone was also absent from the Lower zone. The visually discernible difference between the lower and upper zones results mainly from differences in the distributions of higher plants in the zones. These include differences amongst (1) the eucalypts, with *E. amygdalina* being dominant in the Lower zone in contrast to *E. viminalis* dominating the upper zone, (2) the wattles, with *A. dealbata* and *A. melanoxylon* being more abundant in the Lower than in the Upper zone, and (3) the Epacridaceae (see Appendix 1), these species occurring more abundantly in the Lower than in the Upper zone. In addition, the greater abundances of *Exocarpos cupressiformis*, *Hibbertia serpyllifolia* and *Lomandra longifolia* in the lower zone, and the presence of *A. littoralis* and *B. marginata* in that zone but not in the Upper zone, lead to the impression of a greater biomass in the Lower zone.

The much smaller number of vascular plant species observed in the improved pastures on the Arnon mudstone soils (less than half of that found in either the Lower or Upper zones) suggests that the conversion of wooded bushlands into improved pastures greatly reduces the diversity of species present. Although the number of exotic species is almost the same in all three zones, the number of native species in the Pasture zone is much less than that in the Lower or Upper zones, so that the ratio of exotics to natives is about three times higher in Pastures than in the other two zones (Table 2).

The Lower zone has itself undergone modification of its structure from what

it must have been prior to European settlement as a result of the introduction of exotic grazing animals, and the fact that there has been some felling of trees for fencing, firewood and woodchipping. However, in the absence of any adjacent "control" plot from which disturbance and grazing has been excluded, any assessment on the extent to which modern agriculture has affected the vegetation must remain speculative.

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Appendix 1. List of species and their abundance in each zone within the survey area

Key to Abundances:

- l = local (growing in a few places only, sometimes abundantly)
 r = only 1-3 plants observed, rare
 o = widespread but only occasional
 f = widespread and frequent
 c = widespread and common

Key to Zones:

- L - dry sclerophyll bushlands of low elevation
 P - improved pastures on Arnon mudstone soils
 U - dry sclerophyll bushlands of higher elevation

(I) indicates that the species is introduced to Tasmania.

FLOWERING PLANTS	Zone				
	L	P	U		
Amaranthaceae					
<i>Ptilotus spathulatus</i>	-	o	r	<i>Cynoglossum suaveolens</i>	- - r
Apiaceae				<i>Echium plantagineum</i> (I)	- o -
<i>Daucus glochidiatus</i>	-	-	o	<i>Myosotis discolor</i> (I)	- o o
<i>Eryngium vesiculosum</i>	l	-	-	<i>Pentaglottis sempervirens</i> (I)	r - -
<i>Hydrocotyle callicarpa</i>	f	c	o	Brassicaceae	
Asteraceae				<i>Capsella bursa-pastoris</i> (I)	- - r
<i>Arctotheca calendula</i> (I)	f	o	o	<i>Erophila verna</i> (I)	- - r
<i>Brachyscome aculeata</i>	o	-	o	<i>Lepidium campestre</i> (I)	- r -
<i>Brachyscome spathulata</i> ssp. <i>glabra</i>	-	-	r	Brunoniaceae	
<i>Carduus tenuiflorus</i> (I)	o	f	o	<i>Brunonia australis</i>	o - l
<i>Cassinia aculeata</i>	r	-	o	Campanulaceae	
<i>Centipeda minima</i>	o	-	l	<i>Wahlenbergia stricta</i>	o r o
<i>Cirsium vulgare</i> (I)	o	-	o	Caryophyllaceae	
<i>Craspedia glauca</i>	r	-	-	<i>Cerastium glomeratum</i> (I)	f c o
<i>Cymbonotus preissianus</i>	-	l	l	<i>Moenchia erecta</i> (I)	c c c
<i>Filago gallica</i> (I)	f	-	o	<i>Sagina apetala</i> (I)	- - r
<i>Gnaphalium involucreatum</i>	f	o	o	<i>Silene gallica</i> (I)	- o -
<i>Helichrysum apiculatum</i>	l	-	-	<i>Spergularia rubra</i> (I)	o l r
<i>Helichrysum scorpioides</i>	o	-	-	Casuarinaceae	
<i>Heliopsis scabra</i>	-	-	l	<i>Allocasuarina littoralis</i>	c - -
<i>Heliopsis scabra</i>	-	-	l	Centrolepidaceae	
<i>Heliopsis scabra</i>	l	-	l	<i>Aphelia gracilis</i>	o l l
<i>Hypochoeris glabra</i> (I)	o	f	o	<i>Aphelia pumilio</i>	r - -
<i>Hypochoeris radicata</i> (I)	o	o	o	<i>Centrolepis aristata</i>	o - l
<i>Lagenifera huegelii</i>	-	-	o	<i>Centrolepis strigosa</i>	o - r
<i>Lagenifera stipitata</i>	f	-	o	Clusiaceae	
<i>Leontodon taraxacoides</i> (I)	f	f	o	<i>Hypericum gramineum</i>	o - f
<i>Leptorhynchus squamatus</i>	f	r	o	Convolvulaceae	
<i>Microseris lanceolata</i>	-	-	r	<i>Convolvulus erubescens</i>	r - r
<i>Millotia tenuifolia</i>	f	-	r	<i>Dichondra repens</i>	o - f
<i>Olearia argophylla</i>	-	-	l	Crassulaceae	
<i>Olearia stellulata</i>	r	-	r	<i>Crassula decumbens</i>	c c o
<i>Pseudognaphalium luteo-album</i>	o	-	l	<i>Crassula peduncularis</i>	o l l
<i>Rutidosia multiflora</i>	o	l	l	<i>Crassula sieberana</i>	o - o
<i>Senecio glomeratus</i>	l	-	-	Cyperaceae	
<i>Senecio hispidulus</i>	-	-	o	<i>Carex gaudichaudiana</i>	r - -
<i>Senecio jacobea</i> (I)	r	-	l	<i>Carex inversa</i>	r - r
<i>Solenogyne gunnii</i>	r	-	r	<i>Carex longebrachiata</i>	l - -
<i>Sonchus asper</i> (I)	-	-	r	<i>Cyperus tenellus</i>	f l l
<i>Taraxacum officinale</i> (I)	o	-	-	<i>Eleocharis acuta</i>	l l l
<i>Tolpis barbata</i> (I)	l	o	o	<i>Eleocharis sphacelata</i>	l - -
Boraginaceae				<i>Isolepis fluitans</i>	l l -
				<i>Isolepis hookeriana</i>	l - -

<i>Isolepis marginata</i>	1 - -	Hypoxidaceae	
<i>Isolepis platycarpa</i>	1 - -	<i>Hypoxis glabella</i>	o o 1
<i>Lepidosperma elatius</i> var. <i>ensiforme</i>	o - 1	<i>Hypoxis hygrometrica</i>	1 - o
<i>Lepidosperma inops</i>	o - o	Iridaceae	
<i>Lepidosperma laterale</i>	o o o	<i>Diplarrhena moraea</i>	r - -
<i>Lepidosperma lineare</i>	f - -	Juncaceae	
<i>Schoenus apogon</i>	c o o	<i>Juncus articulatus</i> (1)	o 1 1
<i>Schoenus nitens</i>	1 - -	<i>Juncus bufonius</i>	f c o
Dilleniaceae		<i>Juncus pallidus</i>	o o o
<i>Hibbertia serpyllifolia</i>	f - r	<i>Juncus procerus</i>	1 1 1
Droseraceae		<i>Juncus subsecundus</i>	f o 1
<i>Drosera peltata</i> ssp. <i>peltata</i>	c f o	<i>Luzula densiflora</i>	o - o
<i>Drosera peltata</i> ssp. <i>auriculata</i>	o o o	Juncaginaceae	
<i>Drosera pygmaea</i>	1 - 1	<i>Triglochin centrocarpa</i>	1 - -
Epacridaceae		Lamiaceae	
<i>Acrotriche serrulata</i>	f - -	<i>Prunella vulgaris</i> (1)	o - r
<i>Astroloma humifusum</i>	f - o	Lauraceae	
<i>Leucopogon collinus</i>	r - -	<i>Cassytha melantha</i>	o - -
<i>Leucopogon virgatus</i>	f - r	Lentibulariaceae	
<i>Lissanthe strigosa</i>	c - o	<i>Utricularia monanthos</i>	- - 1
Euphorbiaceae		Liliaceae	
<i>Poranthera microphylla</i>	f - o	<i>Arthropodium milleflorum</i>	- - r
Fabaceae		<i>Bulbine bulbosa</i>	r - r
<i>Acacia dealbata</i>	c - f	<i>Burchardia umbellata</i>	- - r
<i>Acacia mearnsii</i>	o - o	<i>Chamaescilla corymbosa</i>	r - r
<i>Acacia melanoxyylon</i>	o - r	<i>Dianella revoluta</i> var. <i>revoluta</i>	o - -
<i>Acacia verticillata</i>	o - r	<i>Dichopogon strictus</i>	o - o
<i>Bossiaea prostrata</i>	r - r	<i>Thysanotus patersonii</i>	o - r
<i>Daviesia latifolia</i>	r - r	<i>Wurmbea dioica</i>	f f f
<i>Glycine clandestina</i>	- - r	Linaceae	
<i>Hovea linearis</i>	r - -	<i>Linum marginale</i>	- - r
<i>Kennedia prostrata</i>	o - r	Lythraceae	
<i>Lotus tenuis</i> (1)	o o o	<i>Lythrum hyssopifolia</i>	1 - 1
<i>Platylobium obtusangulum</i>	r - -	Myrtaceae	
<i>Pultenaea pedunculata</i>	f - o	<i>Eucalyptus amygdalina</i>	c - o
<i>Trifolium campestre</i> (1)	r o o	<i>Eucalyptus ovata</i>	- - r
<i>Trifolium dubium</i> (1)	f c o	<i>Eucalyptus viminalis</i>	f - c
<i>Trifolium glomeratum</i> (1)	- o r	<i>Leptospermum scoparium</i>	o - -
<i>Trifolium repens</i> (1)	o c o	Onagraceae	
<i>Trifolium subterraneum</i> (1)	f c o	<i>Epilobium</i> sp.	- r 1
<i>Ulex europaeus</i> (1)	f o o	Orchidaceae	
<i>Vicia tetrasperma</i> (1)	- - 1	<i>Acianthus reniformis</i>	r - r
Gentianaceae		<i>Caladenia angustata</i>	o - -
<i>Centaureum erythraea</i> (1)	f - f	<i>Caladenia catenata</i>	o - r
<i>Cicendia filiformis</i> (1)	f f 1	<i>Diuris sulphurea</i>	o - -
<i>Sebaea ovata</i>	o o o	<i>Eriochilus cucullatus</i>	o - -
Geraniaceae		<i>Glossodia major</i>	f - r
<i>Erodium cicutarium</i> (1)	o o o	<i>Microtus unifolia</i>	o - 1
<i>Geranium potentilloides</i>	o 1 o	<i>Pterostylis nana</i>	1 - -
<i>Geranium solanderi</i>	- - o	<i>Pterostylis nutans</i>	o - r
<i>Pelargonium australe</i>	- - o	<i>Pterostylis pedunculata</i>	1 - -
Goodeniaceae		<i>Thelymitra pauciflora</i>	o - r
<i>Goodenia elongata</i>	1 - -	<i>Thelymitra rubra</i>	r - r
<i>Goodenia lanata</i>	o o o	Oxalidaceae	
Haloragaceae		<i>Oxalis corniculata</i>	f o o
<i>Gonocarpus tetragynus</i>	f - o	Pittosporaceae	
<i>Haloragis heterophylla</i>	1 - -	<i>Bursaria spinosa</i>	f - f
<i>Myriophyllum integrifolium</i>	1 - 1	Plantaginaceae	

<i>Plantago coronopus</i> (1)	f f o	Rosaceae	
<i>Plantago lanceolata</i> (1)	o f -	<i>Acaena echinata</i>	f o o
<i>Plantago varia</i>	f o o	<i>Acaena novae-zelandiae</i>	o o o
Poaceae		<i>Crataegus monogyna</i> (1)	- - r
<i>Agrostis aemula</i>	r - r	<i>Rosa rubiginosa</i> (1)	r - r
<i>Agrostis avenacea</i>	o - r	<i>Rubus parvifolius</i>	- - r
<i>Agrostis capillaris</i> (1)	o o -	Rubiaceae	
<i>Aira caryophylla</i> (1)	f f c	<i>Asperula conferta</i>	r r o
<i>Aira elegantissima</i> (1)	f - o	<i>Galium gaudichaudii</i>	- - o
<i>Anthoxanthum odoratum</i> (1)	o - l	<i>Galium murale</i> (1)	o - o
<i>Briza maxima</i> (1)	l - -	<i>Opercularia varia</i>	o - -
<i>Briza minor</i> (1)	o o o	Santalaceae	
<i>Bromus hordeaceus</i> (1)	o f l	<i>Exocarpos cupressiformis</i>	c - o
<i>Bromus sterilis</i> (1)	- - l	<i>Exocarpos strictus</i>	r - -
<i>Cynosurus echinatus</i> (1)	o c o	Scrophulariaceae	
<i>Danthonia caespitosa</i>	o o o	<i>Gratiola pubescens</i>	l - -
<i>Danthonia dimidiata</i>	o - -	<i>Limosella australis</i>	l - -
<i>Danthonia pilosa</i>	o o o	<i>Mazus pumilio</i>	- - l
<i>Danthonia racemosa</i>	o - -	<i>Parentucellia latifolia</i> (1)	o f r
<i>Danthonia setacea</i>	c - -	<i>Parentucellia viscosa</i> (1)	- o -
<i>Deyeuxia quadrifida</i>	o - o	<i>Veronica calycina</i>	- - r
<i>Ehrharta stipoides</i>	f o o	<i>Veronica gracilis</i>	r o o
<i>Eragrostis molybdea</i>	o - l	<i>Verbascum virgatum</i> (1)	- - l
<i>Hemarthra uncinata</i>	- - r	Stylidiaceae	
<i>Holcus lanatus</i> (1)	o o o	<i>Stylidium graminifolium</i>	o - o
<i>Hordeum murinum</i> ssp <i>leporinum</i> (1)	f l	Thymelaeaceae	
<i>Lolium perenne</i> (1)	- f -	<i>Pimelea humilis</i>	o r o
<i>Pentapogon quadrifidus</i>	- - o	Typhaceae	
<i>Poa annua</i> (1)	c c -	<i>Typha latifolia</i> (1)	l l -
<i>Poa labillardieri</i>	o o o	Violaceae	
<i>Poa rodwayi</i>	- - o	<i>Hymenantha dentata</i>	- - r
<i>Stipa mollis</i>	f o -	<i>Viola hederacea</i>	c - c
<i>Stipa pubinodis</i>	- - o	Xanthorrhoeaceae	
<i>Stipa semibarbata</i>	o - o	<i>Lomandra longifolia</i>	c r o
<i>Stipa stiposa</i>	o - l		
<i>Themeda triandra</i>	o r o	FERNS	
<i>Vulpia bromoides</i> (1)	o o o	Adiantaceae	
Polygalaceae		<i>Adiantum aethiopicum</i>	- - o
<i>Comesperma volubile</i>	o - -	Aspleniaceae	
Polygonaceae		<i>Asplenium flabellifolium</i>	- - l
<i>Persicaria prostrata</i>	l - -	<i>Pleurosorus rutifolius</i>	- - r
<i>Rumex acetosella</i> (1)	f f r	Dennstaedtiaceae	
<i>Rumex brownii</i>	- o r	<i>Pteridium esculentum</i>	c o c
<i>Rumex crispus</i> (1)	- r -	Sinopteridaceae	
Portulacaceae		<i>Cheilanthes austrotenuifolia</i>	- - o
<i>Calandrinia calyptata</i>	- - r		
<i>Montia australasica</i>	- l -	MOSESSES (no abundance data)	
<i>Montia fontana</i>	f - -	Bartramiaceae	
Potamogetonaceae		<i>Breutelia affinis</i>	+ - +
<i>Potamogeton tricarinatus</i>	l l l	Bryaceae	
Primulaceae		<i>Bryum argenteum</i>	+ - -
<i>Anagallis arvensis</i> ssp. <i>arvensis</i> (1)	o o -	<i>Bryum billardieri</i>	+ - -
Proteaceae		<i>Bryum capillare</i>	+ - -
<i>Banksia marginata</i>	o - -	<i>Bryum campylothecium</i> (?)	+ + +
<i>Persoonia juniperina</i>	r - -	<i>Bryum</i> sp.	- - +
Ranunculaceae		Dicranaceae	
<i>Clematis gentianoides</i>	- - l	<i>Campylopus clavatus</i>	+ + +
<i>Ranunculus glabrifolius</i>	l l -	<i>Campylopus introflexus</i>	+ - +

Ditrichaceae		<i>Cladonia humilis</i> (With.) Laundon var.
<i>Ceratodon purpureus</i>	+ - +	<i>humilis</i>
<i>Eccremidium pulchellum</i> (?)	- - +	<i>Cladonia pleurota</i> (Flörke) Schaerer
Fissidentaceae		<i>Cladonia praetermissa</i> Archer var.
<i>Fissidens taylorii</i>	- - +	<i>praetermissa</i>
Grimmiaceae		<i>Cladonia rigida</i> (J.D. Hook. & Taylor) Hampe
<i>Grimmia pulvinata</i>	- - +	var. <i>rigida</i>
<i>Racomitrium crispulum</i>	- - +	<i>Flavoparmelia haysomii</i> (Dodge) Hale
Hypnaceae		<i>Flavoparmelia rutidota</i> (J.D. Hook. & Taylor)
<i>Hypnum cupressiforme</i>	+ - +	Hale
Polytrichaceae		<i>Hafellia dissa</i> (Stirton) Mayrhofer & Sheard
<i>Polytrichum juniperinum</i>	+ - +	<i>Heterodea muelleri</i> (Hampe) Nyl.
Pottiaceae		<i>Hypogymnia turgidula</i> (Bitter) Elix
<i>Barbula calycina</i>	+ - +	<i>Hypogymnia pulverata</i> (Nyl.) Elix
<i>Barbula crinita</i>	- + +	<i>Hypogymnia subphysodes</i> (Krempelh.) Filson
<i>Tortula princeps</i>	- + +	<i>Lecidea</i> sp. A
<i>Triquetrella papillata</i>	+ - +	<i>Lecidea</i> sp. B
Thuidiaceae		<i>Menegazzia caesiopruiosa</i> P. James
<i>Thuidium furfurosum</i>	- - +	<i>Mycocalicium albonigrum</i> (Nyl.) Tibell
LIVERWORTS (no abundance data)		<i>Neofuscelia pulla</i> (Ach.) Esslinger
Aytoniaceae		<i>Opegrapha</i> sp.
<i>Asterella drummondii</i>	- - +	<i>Parmelina conlabrosa</i> (Hale) Elix & Johnston
Fossombroniaceae		<i>Parmelina pseudorelicina</i> (Jatta) Kantvilas & Elix
<i>Fossombronia</i> sp.	+ - -	<i>Parmotrema chinense</i> (Osbeck) Hale & Ahti
Frullaniaceae		<i>Pertusaria gibberosa</i> Müll. Arg.
<i>Frullania falciloba</i>	- - +	<i>Pertusaria trimera</i> (Müll. Arg.) Archer
Geocalyceae		<i>Pseudocyphellaria neglecta</i> (Müll. Arg.) Magnusson
<i>Chiloscyphus semiteres</i>	+ - +	<i>Punctelia subrudecta</i> (Nyl.) Krog
Marchantiaceae		<i>Pyrrhospora laeta</i> (Stirton) Hafellner
<i>Lunularia cruciata</i>	- - +	<i>Rimeliella subcaperata</i> (Krempelh.) Kurok
LICHENS (no zones or abundance data)		<i>Rinodina</i> sp.
<i>Buellia disciformis</i> (Fr.) Mudd aggr.		<i>Teloschistes spinosus</i> (J.D. Hook. & Taylor)
<i>Caloplaca</i> sp.		J. Murray
<i>Candelariella xanthostigmoides</i> (Müll. Arg.) R.W. Rogers		<i>Usnea inermis</i> Motyka
<i>Cladia aggregata</i> (Sw.) Nyl.		<i>Usnea oncodes</i> Stirton
<i>Cladonia capitellata</i> var. <i>capitellata</i> (J.D. Hook. & Taylor) Church. Bab.		<i>Usnea scabrata</i> Taylor ssp. <i>tayloriana</i> G.N. Stevens
<i>Cladonia capitellata</i> var. <i>squamatica</i> Archer		<i>Xanthoparmelia australasica</i> D. Galloway
<i>Cladonia cervicornis</i> (Ach.) Flotow ssp. <i>verticillata</i> (Hoffm.) Ahti		<i>Xanthoparmelia elixii</i> Filson
<i>Cladonia corniculata</i> Ahti & Kashiwadani		<i>Xanthoparmelia flaviscentireagens</i> (Gyelnik) D. Galloway
<i>Cladonia gracilis</i> (L.) Willd. ssp. <i>tenerrima</i> Ahti		<i>Xanthoparmelia tasmanica</i> (J.D. Hook. & Taylor) Hale
		<i>Xanthoria ligulata</i> (Körber) P. James

BOOK REVIEW

Taming the Great South land: A History of the Conquest of Nature in Australia

by William Lines

Published by Allen & Unwin, Australia, Price \$1995

Reviewed by D.G. Hird.

Two centuries of Australia's environmental, social and political history are narrated in bold style in this volume. Indeed, a sorry sequence of events from the early unregulated seal and whale slaughters through the extensive clearing for agriculture to more recent engineering feats and wholesale forestry programs is documented in spirited style. Fundamental to the conquest of nature was the displacement of aboriginal Australians, including by massacre and catastrophic epidemic disease. The author links these processes to the employment of foreign capital and laws which, often in the name of an "Enlightenment" philosophy, have so changed the continent and indeed the recent world.

Most of the historical incidents described here are graphic. Devastation began early, not just with formal colonisation and implementation of British law, but often also in unregulated ways. No party to the settlement process is spared in this account. The treatment of aboriginals is particularly saddening. Acclimatisers receive vilification, so also do many who welcomed localised resemblance of naturalised environments to those of the admirer's home country. As mechanisation developed into the twentieth century contentious projects such as the damming of Lake Pedder and proposals including the use nuclear-explosives to clear channels through the Great Barrier Reef draw critical attention. Topicality is maintained through criticism of current proposals including those of the Very-Fast-Train and the Multi-Function-Polis.

While it is impossible to deny that Australia has been deeply and often environmentally despoiled, I nonetheless found difficulty with several aspects of this book. The first was with accuracy; for example on page 12 aborigines are described as "having an interconnected culture across Australia" - what about Tasmania where 10-12 thousand years of separation was one of the most significant known isolation events in human history? On the same page Western Australian deserts are described as Australia's only undegraded land - apparently despite the presence of feral pests such as the rabbit and domestic cat and the concomitant loss of native fauna. Second, I found it difficult to find due credit to early advocates of the protection of natural heritage. For example, Charles Darwin and John Gould expressed concern and regret at the treatment of aboriginals and the thylacine respectively in their visits to Tasmania in the 1830's and 1840's. Similarly, scientists tend to be assumed to be invariably in league with developers throughout this book, the great increase in conservation effort and research of recent decades receives little acknowledgement. Third, hindsight seems to be vigorously applied, such as in the foreseeable effects of acclimatised species. We now know too well of the defencelessness of many native species and of the futility of attempting to cultivate fragile soil types. Finding cures for problems such as those of feral species are seldom as easy as attributing blame.

I found this volume a provocative sequel to books like A.J. Marshall's *The Great Extinction*. It concludes with advocacy of eco-activism and is reminiscent of this genre of environmental concern; Tasmanian readers might note that it is dedicated in part to the "Earth First" group. This book is an evocative and anguished view of an important part of the environment and conservation spectrum.