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Editor.

NATIONAL CONSERVATION STRATEGY
THE BEGINNING OF A NEW CONSCIOUSNESS

Approximately 150 delegates representing development, conservation, government and academic interests, assembled in Canberra over the long weekend, 10-13 June 1983, and agreed to adopt a National Conservation Strategy for Australia, based on the World Conservation Strategy (WCS) prepared by the I.U.C.N., the United Nations and the World Wildlife Fund. The WCS promotes the relationship between conservation and development as an issue of global importance, and has called upon all countries of the world to prepare its own strategy, which Australia to its credit has now done.

The final document, despite its imperfections, is a landmark as it represents the first national consensus reached in Australia on a conservation question. The further task is to persuade all the State governments to prepare and implement their own conservation strategies within the framework of the national strategy. The Victorian Government has released a Draft Conservation Strategy for public discussion on 16 August, 1983.

The Governor-General, Sir Ninian Stephen, in an address to the Canberra conference, told his audience that: "We are in the course of modifying the age-old habits of man. At responsible government levels and in our communities we begin for the first time to look upon the fauna and flora about us as not just objects to be used to satisfy man's needs but as elements of life on Earth whose survival is essential to our survival and whose well-being and preservation from destruction is vital to our own. This is more than just a slight shift along man's course of development; it marks the beginning of a new consciousness of the world about us, of the destructive role we have hitherto played in it and of the consequences that lie ahead if we don't mend our ways".

SOME NOTES ON WHITE COCKATOOS

Mrs. Mary Davis of Bellerive reports: "On a recent trip to the West Coast on 16th March, 1983 three large flocks of white cockatoo (Sulphur-crested Cockatoo) were observed a few miles northwest of Ouse and up to Cleveland. Two fresh road-killed white cockatoos were picked up from the verge of the road round a sharp bend and a third was found in the same area, nearer to Ouse on the return journey ten days later, probably killed at the same time as the first two. Very large flocks of (Yellow-tailed) Black-Cockatoo were seen from Lake Margaret on the 19th March and two white cockatoo flew in to perch on a dead tree about 30 feet from the Lake Margaret pipeline track in the late afternoon. They remained there for about 20 minutes. We also heard a large flock of Black-Cockatoo flying in to roost in the trees in the Yolande River Valley below the pipeline."

Although the Yellow-tailed Black-Cockatoo is no stranger to wet habitats, including coastal heaths, wet sclerophyll forest, mixed forest and temperate rainforest, it always comes as a surprise to me to see the Sulphur-crested Cockatoo in such habitats. However, Len Wall believes that the white cockatoo species is "most widespread in rainforest, although not abundant" there. It regularly forms large flocks of 200-300 birds at Ouse. David Rounsevell has reported (Tasmanian Naturalist No. 69, April 1982, p.4) that flocks of round 400 birds can be seen near Lake Echo in certain seasons. It has also been seen at Southport and at such apparently unlikely spots as the Serpentine Dam, Lake Emmett at Mt. Field, Mt. Eliza and the Lune River. It is, of course, not confined to such habitats, and is also spasmodically seen in pastoral country such as Epping Forest and Delmont.

Thus, there seems to be two widely different habitats for this species, the first being forested high rainfall areas in which the cockatoos obtain their food mainly from the trees, and the second being open plains in which the birds are seen feeding on the ground. The plains are often bordered by, or have islands of, dry savanna woodland.

D.A. Ratkowsky

CITATION OF ENGLISH NAMES FOR BIRDS

Henceforth, the Tasmanian Naturalist will use the recommended English names for Australian birds as adopted by the Royal Australian Ornithologists Union and published as a supplement to The Emu, Volume 77, May 1978. This usage conforms with that of the journal of the Bird Observers' Association of Tasmania. Differences in name between the new list and that of several older checklists for the more common Tasmanian birds were given in the Tasmanian Naturalist No. 63, October 1980, pp. 4-7.

DARWIN AND THE TASMANIAN DUNG BEETLES

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It is generally little known that Charles Darwin with his holistic interest in everything 'natural' around him had a special liking for beetles, for he once said: 'Whenever I hear of the capture of rare beetles, I feel like an old warhorse at the sound of a trumpet". As seemingly nothing has escaped the attention of this great naturalist, it is not surprising that he also wrote some penetrating thoughts on the role of dung beetles and their preferential likings for certain kinds of animal droppings.

Indeed, it is of special interest to note that Darwin was the first collector of Tasmanian beetles in general (Lea, 1926), and dung beetles in particular, when he visited Hobart Town on board HMS Beagle between 2 and 17 February, 1836. He was surprised to find: ". . . four species of *Onthophagus*, two of *Aphodius*, and one of a third genus, very abundant under the dung of cows; yet these latter animals had then been introduced only thirty-three years. Previously to that time, the Kangaroo and other small animals were the only quadrupeds; and their dung is of a very different quality to that of their successors introduced by man" (Darwin, 1840).

Some 120 years later the present author found this relationship to be different throughout mainland Australia (Bornemissza, 1960), where grasslands are fouled at the rate of some 300 million cow pads per day which often persist for prolonged periods. It was recently possible to examine the conditions in Tasmania and to compare them with those in the south-eastern parts of mainland Australia.

During the Pleistocene era Tasmania was intermittently part of mainland Australia from which it was last separated only 12,500 years ago (Jennings, 1961). Also, in relation to its size, Tasmania was more extensively glaciated than its counterparts across Bass Strait (Derbyshire, 1972). Its coprid fauna, consisting of seven *Onthophagus* species including *O. anisocerus* Erichson as the only endemic species (Matthews, 1972), is essentially an impoverished extension of that of the South Gippsland fauna in Victoria where fifteen species have been recorded. For reasons of close comparability this report deals only with those six species which occur on both sides of Bass Strait and quotes one typical example only (Table 1) for the phenomena described.

To study the food and habitat selection of dung beetles, several hundred baited pitfall traps were laid in Gippsland in the early 1960's along a transect line from Morwell through Mirboo North to Tidal River, at Wilsons Promontory, and over two hundred more recently in Tasmania. The traps consisted of small plastic cups of 500ml capacity baited with a standard volume of 100ml of fresh field collected dung, not older than 8 hours, in all instances. These were always set in replicates from 4 to 32 traps per habitat type or kind of dung, according to the aims of the study; they were stocked with dung only once and exposed in the field for 24 hours. The examples quoted in this paper derived from trapping series dealing with food preferences only. They are comparable on both sides of Bass Strait in every respect, including closely matched habitats, seasonal conditions, dung types and dung quality, times of exposure and trapping equipment.

TABLE 1. Comparison of food preferences of *Onthophagus* species between southern Victoria and Tasmania. Data are total number of beetles caught in four traps for each kind of dung set in either series simultaneously. Trapping site and time for Victoria (S. Gippsland): Boolarra, March 1963; for Tasmania: Waddamana, March 1982.

Species	Wallaby		Wombat		Cattle		Horse		Sheep	
	Vic.	Tas.	Vic.	Tas.	Vic.	Tas.	Vic.	Tas.	Vic.	Tas.
O. auritus	2	4	1	3	0	8	0	4	0	3
O. australis	22	10	12	7	19	12	20	11	22	7
O. fuliginosus	2	12	2	16	0	10	0	13	0	12
O. mutatus	20	33	26	28	0	18	0	25	0	16
O. posticus	6	18	2	27	8	26	10	32	6	35
O. pronus	3	5	6	9	0	8	0	12	0	6
TOTALS	55	82	49	90	27	82	30	97	28	79

As shown in Table 1, with the exception of *O. australis* Guer., significantly less beetles were trapped in Victoria than in Tasmania, as reflected in abundance values and species composition. Furthermore, in Tasmania the most striking phenomenon that emerged is the constant attraction of *O. auritus* Erichson, *O. fuliginosus* Erichson, *O. mutatus* Harold and *O. pronus* Erichson to cattle and horse dung, whereas along the transect line in Gippsland, the author failed to find these species in hundreds of traps baited with dung of domestic animals or in many thousands of droppings examined. Among the latter, only a single specimen of *O. auritus* was found in a cow pad near Boolarra.

The relatively high abundance levels recorded for *O. fuliginosus*, *O. posticus* Erichson and *O. pronus* in Tasmania suggest that these beetles find their optimal conditions there rather than on the mainland. However, none of them was found by the writer to be numerous enough to bury significant amounts of dung of domestic stock.

The four *Onthophagus* species collected by Darwin were probably *auritus*, *fuliginosus*, *mutatus* and *posticus* (all then undescribed) which are common around Hobart and all over Tasmania, whereas the other two species have not been found in the Hobart area where Darwin collected. One of the two *Aphodius* spp. recorded as "very abundant" by Darwin was probably *Aphodius pseudotasmaniae* Given which swarm frequently during December – March in many parts of Tasmania and Victoria, often completely shredding cattle and horse droppings. The species belonging to the third genus mentioned by Darwin was probably *Proctammodes sculptus* Hope (subfam. *Aphodiinae*), common but never abundant in Tasmania, parts of Victoria and New South Wales.

Data presented in this article show how the observations of Darwin were accurate, for all dung beetle species may commonly be found on cattle, sheep and horse dung in Tasmania in contrast to the mainland. Furthermore, a significant shift in habitat preference was also found in that some of the Tasmanian species are adapted to a wider range of habitats than their conspecific counterparts on the mainland. This flexibility was probably developed during the Pleistocene period, due to more extensive glaciation stress in Tasmania than on the Australian mainland.

Extensive data accumulated over the years are under evaluation and the phenomena reported here, together with studies related to habitat preferences, will be documented in more detail elsewhere.

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A BOTANICAL SURVEY IN THE COLONELS HILLS, AN AREA OF SCLEROPHYLL BUSHLAND NEAR TOOMS LAKE

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Introduction

The Colonels Hills are located approximately 10 kilometres north of Tooms Lake, towards the inland margin of Tasmania's Eastern Tiers (Figure 1). The area covered by the present survey comprises a block of Crown land, 184 hectares in area, occupying the central portion of Colonels Hills, and extending south-east, to the Macquarie River and east to the Long Marsh Water Reserve. The survey area is located in the moist subhumid cool climatic zone (Gentilli, 1972), and has an altitudinal range from 380 metres to 500 metres a.s.l. The rock type throughout the region is Jurassic dolerite, which crops out along ridges, exposed tier surfaces, and in river and creek beds. Sparsely vegetated boulder fields spill from ridgelines down steep slopes. In this part of the Eastern Tiers, the Macquarie River cuts through a series of scenic gorges before it takes a westward course through the eastern Midlands, where it flows in a more leisurely and sinuous fashion.

Land in the region is being managed for a variety of purposes. A major land use is production of pump and sawlogs from State and private forests. Private forests have recently been clearfelled to the north and west of the Crown land block, and clearfelling may be contemplated for the southern portion of Colonels Hills, which is also privately owned. A similar land use is proposed for State Forest west of the Crown land, and on State Forest east of the Macquarie River, located within the Tooms Lake Conservation Area. The Crown land block itself, because of a legislative oversight, has been considered as State Forest and is portrayed as such on recent land tenure maps (Lands Department, 1982).

State and private forests are dissected by several recently made logging roads. Somewhat surprisingly, little evidence was seen of selective logging within the Crown land block. Neither was there evidence of recent grazing by domestic stock, although rough grazing, accompanied by regular firing, was undoubtedly practised in the not-too-distant past. The region has a long history of European settlement and exploitation. Graziers and their sheep dispersed from the township of Campbelltown, laying claim to the undulating country of the eastern Midlands. The original vegetation comprised grassy *E. amygdalina – E. viminalis* open-forests and woodlands, with *E. ovata, E. rodwayi* or *E. pauciflora* dominating flats and hollows subject to waterlogging or cold-air drainage. Until the advent of the export woodchip industry in 1970, intensive agriculture had been largely confined to the more arable flats, with the woodlands and open-forests which occupied the slopes and tier surfaces being utilised for rough grazing. However, much of the timbered country has been cleared over the last ten years; Kirkpatrick and Dickinson (1982) estimate that over 3000 hectares of natural vegetation have been lost in the eastern Midlands between 1972 and 1980.

Further east, on the more rugged highlands of the Eastern Tiers, the extensive belt of State Forest, located mainly within the Tooms Lake Conservation Area, supports a variety of forest types which are committed for the production of pulp and sawlogs. The major communities are *E. amygdalina – E. dalrympleana/E. viminalis* open-forests with a xeric or grassy understorey (sites subject to occasional drought stress), and *E. delegatensis – E. dalrympleana* (tall) open-forests (sites with comparatively high moisture availability). Other eucalypts occurring within State Forest in the region include *E. pulchella* (ridgetops and insolated slopes), *E. pauciflora* (flats subject to cold-air drainage), and *E. ovata* and *E. rodwayi* (poorly drained flats and hollows).

One of the earliest and most interesting episodes of European endeavour in the area was the commencement in 1842 of the building of an earthfill dam some 20 metres high using convict labour. The site is located one kilometre east of the present study area. The project was initiated by Ross landowners who wanted to harness the waters of the Macquarie River for irrigation. Although their services were initially honorary, convicts had to be paid for their labour in 1844. The landowners could not raise the eight thousand pounds to complete the dam and so the project was abandoned. At present there remain the two large embankments which were to form part of the dam wall, and also the remains of the stone buildings which formed the convict station.

The area surrounding the Long Marsh Dam is managed as water catchment by the Trustees of the Macquarie Water District. Logging is not carried out within the area vested in the Trustees. The southern portion of this vested area is being considered by the National Parks and Wildlife Service for classification as a Conservation Area. If this proposal becomes a reality the historical and natural features of the area can be given better long-term protection by a management plan devised by the Macquarie Water Trust and the Service.

Methods

Detailed floristic and habitat information was obtained from 10 non-permanent plots, of circa 30m radius, established in different plant communities in the area surveyed. Vegetation data recorded comprised the floristic composition, height and canopy cover of the tree, shrub and ground layers. Site data noted included landform, altitude, aspect, slope, drainage, surface rock cover, soil depth, and signs of past disturbance and fire-damage. This information formed the basis for site descriptions of each community, and assisted in preparation of the vegetation map (Figure 2). Use was also made of aerial photographs (scale 1:15000) to determine the extent of the different communities.

Species lists were also compiled for each community whilst traversing the survey area. These resulted in a more detailed floristic inventory than if information had been obtained solely from the non-permanent plots.

Vegetation

The five communities comprising the vegetation of the Colonels Hills Crown land block are described below. The distribution of the communities is shown in Figure 2. The boundaries between open-forest and woodland communities tend to be gradational. However, the boundary between the *E. delegatensis* – dominated (tall) open-forest and the riparian community lining the Macquarie River is sharply defined. Old growth and second growth trees are present in all forest and woodland communities, and eucalypt regrowth is a common component of the understorey.

In the Eastern Tiers members of the peppermint group and white gum group exhibit clinal variation. *Eucalyptus amygdalina* is the most widespread member of the peppermint group in the region. However, as site drought susceptibility increases on insolated slopes or as exposed ridgelines are approached, *E.* aff. *pulchella* individuals are increasingly encountered. In some situations *E.* aff. *amygdalina* and *E.* aff. *pulchella* may co-occur, elsewhere individuals are intermediate in diagnostic morphological characters, such as bark and leaf form.

In eastern Tasmania the white gum cline is mainly altitudinal, with pureform *E. viminalis* occupying lowland site ($<$ 300 metres a.s.l.) and *E. dalrympleana* occupying highland sites ($>$ 500 metres a.s.l.). Intermediate individuals occupying the 300 to 500 metre altitudinal range are common in the Eastern Tiers, and the area surveyed was no exception. Generally, the higher and less drought susceptible the site, the more white gum individuals resemble *E. dalrympleana* in adult and seedling morphology (Phillips and Reid, 1980).

1. *Eucalyptus ovata – E. amygdalina* woodland

Eucalyptus ovata – E. amygdalina woodlands are located in slight depressions which receive run-off from surrounding slopes and are subject to periodic waterlogging. Surface rock cover is less than 10 percent. The community is dominated by *E. ovata*, with *E. amygdalina* largely confined to better drained and aerated soils towards the perimeter of the stands. Tree height varies from 18 to 30 metres, and canopy cover from 10 to 20 percent. The community grades into *E. amygdalina – E. dalrympleana/E. viminalis* open-forest. The community is characterised by a dense ground layer, overtopped by a sparse shrub stratum. The main shrub species are *Acacia verticillata, Acacia melanoxylon, Acacia dealbata, Banksia marginata*, eucalypt regrowth, *Leptospermum scoparium* and *Lomatia tinctoria*.

The ground layer is dominated by sclerophyllous monocotyledons. *Lepidosperma elatius* and *Gahnia grandis* form clumps to 1.5 metres, while *Lepidosperma laterale, Lepidosperma filiforme, Lomandra longifolia* and *Leptocarpus tenax* form a 0.5 – 1 metre stratum which exceeds 60 percent cover. Clumps of *Poa labillardieri* and other grass species *(Deyeuxia quadriseta, Danthonia pilosa, Microlaena stipoides, Agrostis hiemalis)* complete the total ground cover. Several herbaceous species add to the ground layer diversity. They include *Lindsaea linearis, Cotula reptans, Gnaphalium umbricola, Stellaria multiflora, Linum marginale, Wahlenbergia gymnoclada* and *Viola hederacea*.

2. *Eucalyptus amygdalina – E. dalrympleana/E. viminalis* open-forest.

Eucalyptus amygdalina – E. dalrympleana/E. viminalis open-forest is the most extensive community in the area surveyed, and is widespread throughout the region. The community occurs on tier surfaces and slopes not prone to waterlogging or severe droughting. Soils tend to be shallow, though surface rock-cover varies considerably, from 10 percent on well-drained lower slopes, to 90 percent on mid-slope boulder fields.

Eucalyptus amygdalina is the dominant species, while *E. dalrympleana/E. viminalis* is typically present as a minor species. *Eucalyptus ovata* is occasional on sites with somewhat impeded drainage. Tree height varies from 20 to 30 metres, canopy cover averages 40 percent. The shrub layer is moderately dense (25 to 50 percent cover). Frequent species in the medium-tall shrub layer are *Acacia dealbata, Banksia marginata* and eucalypt regrowth, with *Acacia melanoxylon, Exocarpos cupressiformis, Hakea epiglottis, Bursaria spinosa* and *Cyathodes divaricata* occasional. Frequent low shrubs are *Acacia dealbata, Cyathodes divaricata, Lomatia tinctoria* and *Epacris impressa* (erect), and *Hibbertia* sp. *(hirsuta?)* and *Acrotriche serrulata* (procumbent).

The ground layer is moderately dense to dense (25 to 70 percent cover), and is dominated by *Poa rodwayi, P. labillardieri* and *Lomandra longifolia*. Other species include the grasses *Danthonia pilosa, Danthonia dimidiata, Deyeuxia quadriseta, Dichelachne rara, Microlaena stipoides, Pentapogon quadrifidus, Stipa nervosa* as well as *Dianella tasmanica* and *Lepidosperma laterale*. Bracken *(Pteridium esculentum)* may be present as a minor species (< 5 percent cover). Several herbaceous species were recorded, including *Bossiaea prostrata, Geranium potentilloides, Gonocarpus tetragynus, Helichrysum scorpioides, Hypericum gramineum, Pimelea humilis, Viola hederacea, Wahlenbergia gymnoclada* and *Wahlenbergia tadgellii*.

3. *Eucalyptus pulchella* ± *E. amygdalina – E. dalrympleana/E. viminalis* open-forest-woodland.

Eucalyptus pulchella ± *E. amygdalina – E. dalrympleana/E. viminalis* open-forests and woodlands are located on exposed ridgelines and insolated mid and upper slopes. Soils are shallow and surface rock cover tends to be high, either as dolerite sheets or boulder fields.

Eucalyptus pulchella is dominant on sites subject to severe drought stress, with *E. dalrympleana/E. viminalis* present as minor species. Tree height is 12 to 15 metres, and canopy cover 20 to 30 percent. On less drought-susceptible sites, *E.* aff. *amygdalina* is

present as a subdominant or codominant, and both tree height and canopy cover increase. Medium and low shrub layers are sparse. Species include *Hakea epiglottis, Bursaria spinosa, Cyathodes divaricata* (1 - 5 metres) and *Epacris impressa, Acrotriche serrulata, Astroloma humifusum, Lissanthe strigosa* (< 1 metre).

Ground layer coverage tends to be variable, with expansive dolerite sheeting or boulder fields precluding ground layer development locally. However, coverage on sites sampled averaged 50 percent, comprised mainly of grasses, with composition and abundance similar to that described for *E. amygdalina* – dominated open-forest. Sclerophyllous species include *Lomandra longifolia, Lepidosperma laterale, Lepidosperma lineare* and *Lepidosperma lineare* var. *inops.* The diverse herbaceous component includes *Cheilanthes tenuifolia, Crassula sieberana, Gnaphalium umbricola, Pelargonium inodorum* and *Viola hederacea.* Lichens and mosses encrust boulders and outcropping dolerite.

4. *Eucalyptus delegatensis* ± *E. amygdalina – E. dalrympleana* (tall) open-forest.

Eucalyptus delegatensis ± *E. amygdalina – E. dalrympleana* (tall) open-forest occurs extensively in the area surveyed, occupying shaded slopes with comparatively high moisture availability. Surface rock cover is variable.

The community is dominated by *E. delegatensis,* which reaches a height of 35 - 40 metres in the area surveyed. *Eucalyptus amygdalina* may be present as a subdominant on shaded upper slopes and as a minor species in moister situations. *Eucalyptus dalrympleana* occurs as a minor species. The shrub layer is dominated by *Acacia dealbata* and varies from sparse to locally dense. Other species are eucalypt regrowth, *Lomatia tinctoria* and, on rocky sites, *Cyathodes divaricata, Cyathodes glauca, Parahebe formosa, Pimelea nivea* and *Pultenaea juniperina.*

The dense ground layer is dominated by grasses, with *Poa labillardieri* providing the main coverage. Other species include *Dianella tasmanica, Lomandra longifolia* and the ferns *Blechnum nudum, Polystichum proliferum, Pteridium esculentum.* Amongst several species of herbs were *Acaena novae-zelandiae, Asplenium flabellifolium, Clematis aristata, Dichondra repens, Epilobium junceum, Geranium potentilloides, Glycine latrobeana, Lagenophora stipitata, Viola hederacea and Wahlenbergia gymnoclada.*

5. Riparian communities, comprising:–

Cotula reptans – Lilaeopsis brownii	closed-herbfield
Epilobium junceum – Triglochin procera	ephemeral herbland
Eucalyptus amygdalina – E. viminalis	open-forest
Leptospermum lanigerum – Pomaderris apetala – Callistemon viridiflorus	closed-scrub

The riparian vegetation is distinct both in structure and floristic composition, and actually comprises a disjointed mosaic of smaller communities. These include closed-herbfield on lenses of humic black sticky mud adjacent to the river, ephemeral herbland on the river bed, closed-scrub on alluvial flats, and open-forest which fringes the river and occurs on loamy alluvial soils and adjacent steep, rocky banks.

The dominant variables determining structure and species composition of the riverine communities are fire frequency and moisture availability. There is some protection in the riverine corridor from the higher fire frequencies of the surrounding landscape. Fire-protected niches include cliffs, crevices in rocks, and the bare rocky river bed itself.

Leptospermum lanigerum – Pomaderris apetala – Callistemon viridiflorus closed-scrub occurs on alluvial islands and disjointed marginal pockets which would be flooded from time to time. This scrub appears to be even-aged, and is possibly either completely destroyed in large floods and/or is maintained at a uniform height by mechanical damage from flood-carried debris.

Cotula reptans – Lilaeopsis brownii closed-herbfield occur in small patches on the river margins. *Utricularia dichotoma* is sometimes present, while in some damper hol-

lows *Villarsia reniformis* occurs.

Epilobium junceum ephemeral herbland is found on alluvial sediment, which occurs sporadically on the exposed bedrock of the river bed. *Oxalis corniculata* and *Scirpus* sp. are associated species. *Triglochin procera* ephemeral herbland is represented by this one species in some of the permanent river pools.

Eucalyptus amygdalina – E. viminalis open-forest, where it occurs on alluvial flats fringing the river, is characterised by a dense 2 to 5 metre shrub layer. *Pomaderris apetala, Acacia mucronata, Banksia marginata, Dodonaea viscosa* and eucalypt regrowth are the major components. Near the riverine margins of this community the substrate of alluvium and decomposing floodwater debris is occupied by 100 percent ground layer coverage, comprising mainly *Poa* spp. and other grasses. Other species include *Juncus australe, Pelidosperma laterale, Blechum nudum, Blechnum penna-marina* and *Utricularia dichotoma.*

Open-forest occupying steep, rocky and cliffed river margins is characterised by a lower fire frequency than forest and woodland communities occurring elsewhere in the survey area. Species comprising a dense medium shrub layer include *Coprosma hirtella, Notelaea ligustrina, Parahebe formosa, Pimelea nivea* and *Pultenaea juniperina.* Ground layer coverage is largely determined by microclimate, but is typically low on sites subject to occasional drought stress. *Luzula* sp. was observed on the tops of a few very large boulders, but in all cases appeared to be suffering from the effects of the prolonged drought. *Microsorium diversifolium* occurs on the talus and as a lithophyte on the small cliffs. *Asplenium flabellifolium* and *Blechnum wattsii* were growing amongst the interstices of some boulders. A colony of the filmy fern *Hymenophyllum rarum* was observed on a highly shaded and fire-protected rock face.

Discussion

The vegetation sampled in the Colonels Hills is typical of much of the natural vegetation of the inland margin of the Eastern Tiers. As such it is becoming an increasingly scarce resource as old growth forests on private land and in State Forest are being clear-felled for pulp and sawlogs. The lack of regeneration to eucalypts following clear-felling of private forests in the area is a cause for concern. A characteristic feature of the forest and woodland communities in the Colonels Hills is the presence of a dense ground layer dominated by grasses (notably *Poa* spp.) and containing a large complement of herbaceous dictotyledons. Conversely, the *Acacia dealbata* – dominated shrub stratum has a comparatively low density and diversity. On more rugged terrain in the Eastern Tiers the above situation tends to be reversed. In the vicinity of Moaners Tier, 2 kilometres east of Tooms Lake and 11 kilometres south-east of Colonels Hills, grasses are only a minor component of a sparse ground layer, while *Bedfordia salicina* dominates a typically dense shrub layer (Duncan, Harris and Brown, 1981).

The riparian community adjacent to the Macquarie River also differs considerably from the wet sclerophyll communities usually associated with streams and gullies in upland areas of the Eastern Tiers to the east of the study area. Riverine and gully corridors in the latter locations are characterised by a dense shrub understorey, dominated by mesophytic species such as *Bedfordia salicina, Olearia argophylla, Zieria arborescens* and *Pomaderris apetala. Atherosperma moschatum* and *Dicksonia antarctica* occur locally in mixed forests on sites with very high moisture availability. The absence of riverine wet sclerophyll communities from the area surveyed appears to be a function of the width and orientation of this part of the Macquarie River valley. Species such as *Hymenophyllum rarum*, common in wet sclerophyll and mixed forests elsewhere in the region, are restricted to shaded and fire-protected sites. The combination of variable insolation and consequently variable fire regines, shallow soil development and the ravages of occasional floods, has resulted in the variety of species and communities observed in the riparian environment.

Kirkpatrick (1981) analysed data collected from 17 sites along the Lake Leake Road, which crosses the Eastern Tiers en route from the Central East Coast to Campbelltown. Associations of dominants on the plateau surface at Lake Leake differed somewhat from those observed in the Colonels Hills, some 15 kilometres to the south. In the vicinity of Lake Leake, plateau stands were characterised by the presence of *E. delegatensis*, *E. dalrympleana* and *E. pauciflora*. The tier surface at Colonels Hills is 100 to 200 metres lower than the plateau surface near Lake Leake, and consequently the less severe climatic conditions may account for the absence of *E. pauciflora*, though it was recorded from flats subject to heavy frosts on private property to the west of the survey area. Similarly, *E. pulchella* is common on exposed and insolated sites in the Colonels Hills, whereas along the transect line sampled by Kirkpatrick, *E. pulchella* and *E. viminalis* were found associated with stands on the seaward slopes of the Eastern Tiers, and were absent from stands on the inland margins. However, all species found by Kirkpatrick (1981) to have over 80 percent fidelity to sampled plateau and inland stands were recorded in the Colonels Hills.

Kirkpatrick and Brown (in press) analysed the distribution of Tasmanian endemics occurring in 10 kilometre grid squares over the State. Endemism in areas dominated by dry sclerophyll vegetation was highest on dolerite, a parent material virtually absent from the south-eastern mainland states. Most 10 kilometre grid squares falling on the Eastern Tiers had 6 - 15 endemic species, with highest endemic richness being associated with fire-protected, exposed landforms, such as cliffs, rocky gorges and alpine plateaux. Table 1 indicates a similar trend occurring at the community level in the area surveyed in the present study.

TABLE 1. **Presence of endemic species in plant communities, Colonels Hills.** Ratings of surface rock cover are low (< 10% cover), moderate (20 - 50% cover) and high (> 50% cover). Ratings of drought-stress are relative. Endemic totals which include *Hibbertia* sp. *(hirsuta?)* are indicated (*).

Community	Site Characteristics	Number of Endemics
1. *Eucalyptus ovata – E. amygdalina* woodland	Drought-stress low-moderate; Rock cover low	3
2. *E. amygdalina – E. dalrympleana/E. viminalis* open-forest	Drought-stress moderate; Rock cover low	4*
	Rock cover moderate-high	7*
3. *E. pulchella* ± *E. dalrympleana/E. viminalis* open-forest — woodland	Drought-stress high; Rock cover moderate-high	9*
4. *E. delegatensis* ± *E. amygdalina – E. dalrympleana* (tall) open-forest	Drought-stress low-moderate; Rock cover low	3
	Rock cover moderate-high	6
5. Riparian Communities	Drought-stress variable; Rock cover high	7

A notable omission from the list of endemics is *Bedfordia salicina*, which is common on dolerite uplands in eastern Tasmania, and is elsewhere strongly associated with 11 of the endemics recorded from the Colonels Hills (Kirkpatrick and Brown, in press).

The rare legume *Glycine latrobeana* was collected from *E. delegatensis – E. amygdalina – E. dalrympleana* open-forest south of the main logging road which bisects the Crown Land block. *Glycine latrobeana* has been recorded recently from only six localities in Tasmania, all occurrences being remarkably local. Herbarium records indicate a more widespread distribution in the past, however, alienation of grassy woodlands appears to have substantially reduced its range.

The endemic *Phebalium squameum* ssp. *retusum*, recorded from the riparian closed-scrub community, is included by Kirkpatrick, Brown and Moscal (1980) in their coverage of threatened plants of the Tasmanian Central East Coast, and is classified by Brown, Hoggins and Bayly-Stark (1977) as a "species rare in Tasmania, absent from State Reserves". The same classification is given to the grass *Agrostis hiemalis*, which was common in the *E. ovata – E. amygdalina* woodland stand.

A total of 128 species of vascular plants were recorded on the Crown land block in the Colonels Hills. These comprised 10 pteridophytes from 8 families, 30 monocotyledons from 8 families, and 88 dictoyledons from 37 families. Fifteen (possibly sixteen) of the species are endemics (identification of *Hibbertia* sp. as *Hibbertia hirsuta* is tentative). A full species list, with endemics indicated, is included as Appendix 1. A more intensive survey would certainly add others to the list of species known to occur in this botanically interesting area.

Acknowledgements

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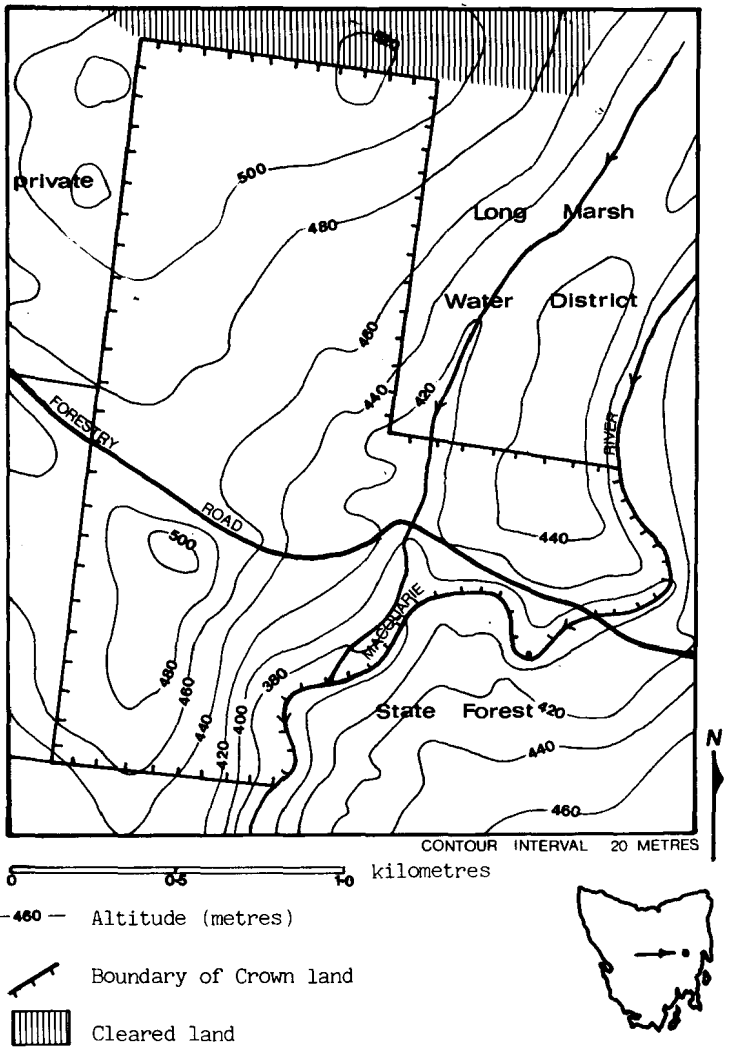
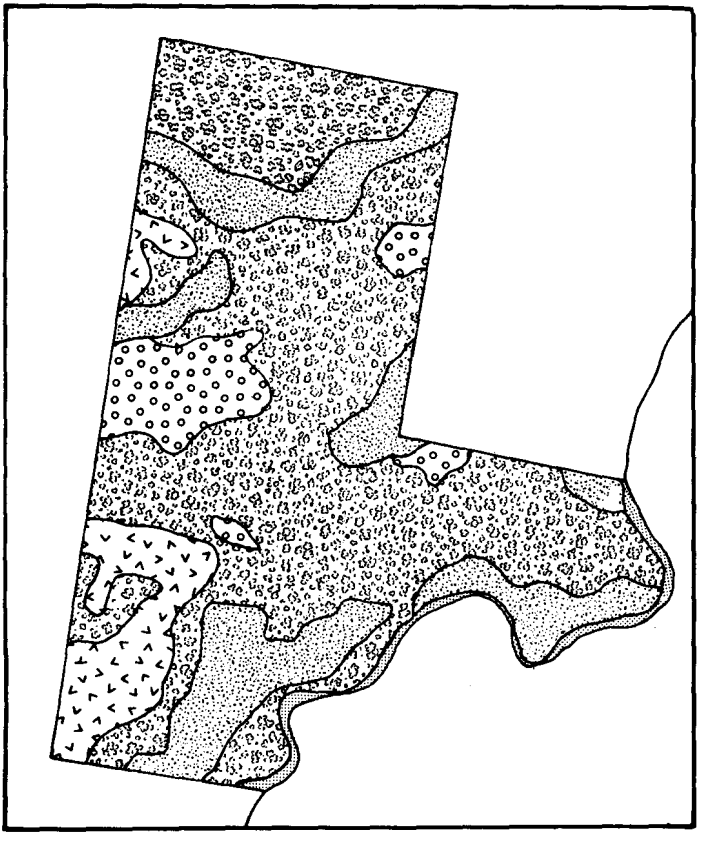


FIGURE 1: GEOGRAPHY OF SURVEY AREA



Eucalyptus ovata - E. amygdalina woodland.

E. amygdalina - E. dalrympleana/E. viminalis open-forest.

E. pulchella ± *E. amygdalina - E. dalrympleana/E. viminalis* open-forest - woodland.

E. delegatensis ± *E. amygdalina - E. dalrympleana* (tall) open-forest.

Riparian communities.

FIGURE 2 : VEGETATION OF SURVEY AREA

APPENDIX 1

VASCULAR PLANTS OBSERVED ON A CROWN LAND BLOCK IN THE COLONELS HILLS, EASTERN TASMANIA

Except where indicated, species nomenclature follows Curtis (1963, 1967) and Curtis and Morris (1975) for dicotyledons and gymnosperms, Willis (1970), Vickery (1970) and Townrow (1973) for monocotyledons, and Jones and Clemesha (1981) for pteridophytes. Endemic species are prefixed by an 'e', and introduced species by an 'i'.

PTERIDOPHYTA : FILICINAE	
ASPIDIACEAE	*Polystichum proliferum*
ASPLENIACEAE	*Asplenium flabellifolium*
BLECHNACEAE	*Blechnum nudum*
	Blechnum penna-marina
	Blechnum wattsii
DENNSTAEDTIACEAE	*Pteridium esculentum*
HYMENOPHYLLACEAE	*Hymenophyllum rarum*
LINDSAEACEAE	*Lindsaea linearis*
POLYPODIACEAE	*Microsorium diversifolium*
SINOPTERIDACEAE	*Cheilanthes tenuifolia*
ANGIOSPERMAE : DICOTYLEDONES	
ASTERACEAE	e *Brachyscome spathulata* var. *glabra*
	i *Cirsium vulgare*
	Cotula reptans
	Gnaphalium collinum
	Gnaphalium umbricola
	Helichrysum scorpioides
	i *Hypochaeris radicata*
	Lagenophora stipitata
	Olearia phlogopappa
	Senecio minimus
CAMPANULACEAE	*Wahlenbergia gymnoclada*
	Wahlenbergia quadrifida
	Wahlenbergia tadgellii
CARYOPHYLLACEAE	*Scleranthus biflorus*
	Stellaria multiflora
CASUARINACEAE	*Casuarina monilifera*
CONVOLVULACEAE	*Dichondra repens*
CRASSULACEAE	*Crassula sieberana*
DILLENIACEAE	e *Hibbertia* sp. *(hirsuta?)*
EPACRIDACEAE	*Acrotriche serrulata*
	Astroloma humifusum
	Brachyloma ciliatum
	e *Cyathodes divaricata*
	e *Cyathodes glauca*
	Epacris impressa
	Lissanthe strigosa
EUPHORBIACEAE	*Beyeria viscosa*
FABACEAE	*Bossiaea prostrata*

	Daviesia ulicifolia
	Glycine latrobeana
	Hovea heterophylla
	Pultenaea juniperina
GENTIANACEAE	*Villarsia reniformis*
GERANIACEAE	*Geranium potentilloides*
	Pelargonium australe
	Pelargonium inodorum
GOODENIACEAE	*Goodenia lanata*
HALORAGACEAE	*Gonocarpus tetragynus*
	Gonocarpus aff. *teucrioides*
HYPERICACEAE	*Hypericum gramineum*
LAMIACEAE	*Prostanthera lasianthos*
	Prunella vulgaris
LENTIBULARIACEAE	*Ultricularia dichotoma*
LINACEAE	*Linum marginale*
MIMOSACEAE	*Acacia dealbata*
	Acacia gunnii
	Acacia melanoxylon
	Acacia mucronata
	Acacia verticillata var. *verticillata*
MYRTACEAE	*Baeckia ramosissima*
	e *Callistemon viridiflorus*
	e *Eucalyptus amygdalina*
	Eucalyptus dalrympleana
	Eucalyptus delegatensis
	Eucalyptus ovata
	e *Eucalyptus pulchella*
	Eucalyptus viminalis
	Leptospermum lanigerum
	Leptospermum scoparium
OLEACEAE	*Notelaea ligustrina*
ONAGRACEAE	*Epilobium junceum*
OXALIDACEAE	*Oxalis corniculata*
PITTOSPORACEAE	*Billardiera longiflora*
	Bursaria spinosa
PLANTAGINACEAE	*Plantago varia*
PROTEACEAE	*Banksia marginata*
	e *Hakea epiglottis*
	e *Lomatia tinctoria*
RANUNCULACEAE	*Clematis aristata*
	e *Clematis gentianoides*
	Ranunculus sp.
RHAMNACEAE	*Pomaderris apetala*
	Pomaderris phylicifolia
ROSACEAE	*Acaena novae-zelandiae*

RUBIACEAE	*Coprosma hirtella*
	Galium australe
RUTACEAE	*Correa reflexa*
	e *Phebalium squameum* ssp. *retusum*
SANTALACEAE	*Exocarpos cupressiformis*
	Leptomeria drupacea
SAPINDACEAE	*Dodonaea viscosa*
SCROPHULARIACEAE	*Gratiola latifolia*
	e *Parahebe formosa*
STYLIDIACEAE	*Stylidium graminifolium*
THYMELAEACEAE	*Pimelea humilis*
	e *Pimelea nivea*
UMBELLIFERAE	*Hydrocotyle* sp.
	e *Lilaeopsis brownii*
VIOLACEAE	*Viola hederacea*
ANGIOSPERMAE : MONOCOTYLEDONES	
CYPERACEAE	*Eleocharis acuta*
	Gahnia sp.
	Gahnia grandis
	Lepidosperma elatius
	Lepidosperma filiforme
	Lepidosperma lineare
	e *Lepidosperma lineare* var. *inops*
	Lepidosperma laterale
	Scirpus sp.
JUNCACEAE	*Juncus australe*
	Luzula sp.
JUNCAGINACEAE	*Triglochin procera*
LILIACEAE	*Dianella tasmanica*
	Stypandra glauca
ORCHIDACEAE	*Eriochilus cucullatus*
POACEAE	*Agropyron scabrum*
	Agrostis hiemalis
	Aira caryophyllea
	e *Danthonia dimidiata*
	Danthonia pilosa
	Deyeuxia quadriseta
	Dichelachne rara
	Microlaena stipoides
	Pentapogon quadrifidus
	Poa labillardieri
	Poa rodwayi
	Stipa nervosa
	Themeda australis
RESTIONACEAE	*Leptocarpus tenax*
XANTHORRHOEACEAE	*Lomandra longifolia*

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