

Vegetation and floristics of Mount Canobolas State Recreation Area, Orange, New South Wales

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The vegetation of Mount Canobolas State Recreation Area (1673 ha), 14 km south-west of Orange (33°21'S, 154°59'E) in the Shire of Cabonne on the Central Tablelands of New South Wales is described. A floristic survey of 50 × 0.04 ha plots was conducted in November 1999. Seven communities are defined based on flexible UPGMA analysis of abundance scores of vascular plant taxa. Mapping of these communities is based on ground truthing, air photo interpretation and substrate.

A total of 309 taxa was recorded including two species listed under the *NSW Threatened Species Conservation Act 1995*: *Eucalyptus canobolensis* and *Eucalyptus saxicola*. Additionally the reserve contains the Mount Canobolas *Xanthoparmelia* lichen community recently listed on the *NSW Threatened Species Conservation Act 1995*. This paper describes the seven communities and discusses their significance and distribution within the Recreation Area. A vegetation map and species list are provided.

Introduction

Mt Canobolas State Recreation Area (1673 ha in area), is approximately 14 km south west of Orange (33°21'S, 154°59'E) within the Shire of Cabonne. It is within the Central Tablelands Botanic Subdivision and the South East Highlands Bioregion (Figure 1). Mt Canobolas (elevation 1397 m) is a significant feature of the landscape and is one of the most highly visited sites in the Central West of New South Wales. The population centres of nearby Orange and Bathurst create a significant visitor pressure on the State Recreation Area and surrounds.

Much of the land that abuts the State Recreation Area is highly modified and under plantation (*Pinus* or stone fruit) or is used for grazing. The western and southern boundaries are shared with land under the control of State Forests of New South Wales, much of which is *Pinus radiata* plantation. All other reserve boundaries are shared with freehold land. There is a freehold in-holding within the eastern portion of the reserve.

This paper is based on a flora survey for the Central West Region of the NSW National Parks and Wildlife Service to provide information for developing appropriate management strategies (Hunter 2000).

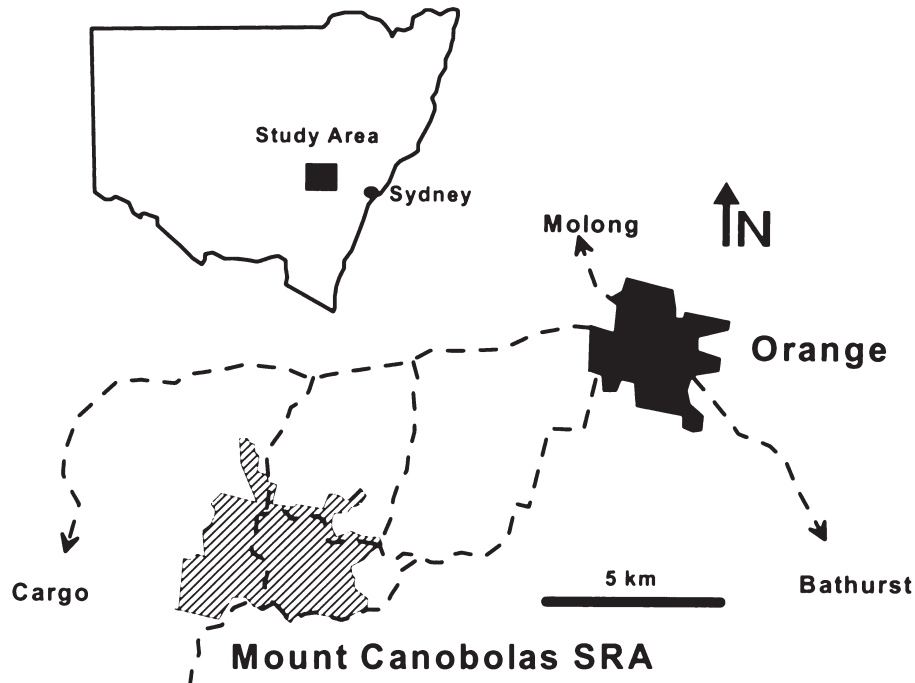


Figure 1: Map of locality of the Mount Canobolas State Recreation Area.

Climate

The rainfall patterns of Mt Canobolas are strongly orographic. The mountain itself rises over 500 m above the surrounding plains. Rainfall is 950 mm MAR which is 200–400 mm a year greater rainfall than the closely adjacent surrounding plains. The summit region has snowfalls in winter. Even during dry periods, much of the summit region may be clothed in cloud thus reducing transpiration and increasing the effective rainfall by dew formation.

Geology and geomorphology

Mount Canobolas is the highest mountain directly west of the Blue Mountains and is the highest and most significant topographic feature within the Central West of New South Wales. Elevation within the State Recreation Area ranges from around 900 m to 1397 m. Gum Ridge forms the approximate southern boundary. Within the reserve this ridge is of significance, as it is almost entirely over 1200 m, with many parts over 1300 m, and effectively modifies the climate of the rest of the reserve from the southerly climatic patterns.

All creeks flowing through the reserve originate from within its boundaries though none achieve any great size. Internal to the reserve is a small relatively broad valley enclosed by Mt Canobolas, Gum Ridge and a small ridge associated with the eastern boundary. This valley has a small and narrow outlet to the east via Towac Creek. Although water flows in all directions from the summit most water exits via Towac Creek (east: Macquarie River Catchment) and Boree Creek (west: Lachlan River Catchment).

Mount Canobolas lies within the Canobolas Volcanic Centre, part of the Orange Province (Meakin et al. 1997). This province occurs directly south-east and west of Orange extending in a west northwesterly direction. It was formed during the Tertiary when extensive volcanic activity was occurring along what is now the eastern highlands of Australia. This region was at that time in a continental intraplate setting and the resultant volcanic activity produced intrusions and flows of basalts, alkali rhyolite and trachyte, and volcani-clastics in the Orange area. These outcrop as domes, dykes, cones, plugs and extensive lava flows.

Tertiary sediments and gravels and Quaternary alluvium are also reported in the area. Sub-basaltic sediments, for example those that are situated about 20 km SSW of Orange, occur below the basalts of the Canobolas Volcanic Centre and are Middle Miocene in age. Tertiary gravels in the area range in age from Miocene to Pliocene.

The Tertiary rocks and sediments are unconformably underlain by Ordovician units — the Oakdale Formation of the Cabonne Group and the older Fairbridge Volcanics of the Kenilworth Group. Rocks of the Oakdale Formation include mafic volcanic sandstone, basalt, siltstone, black shale, chert, breccia and conglomerate and the Fairbridge Volcanics comprise porphyritic augite basalt, hornblende basaltic andesite, and volcanoclastics (Meakin et al. 1997).

History, conservation and landuse

In 1815 Governor Lachlan Macquarie sent surveyor George Evans on an expedition south-west of Bathurst to find the direction of flow of the Macquarie River (Cannon 1987). On 23 May 1815 Evans viewed what was to become Mt Canobolas and named it Jamieson's Table Mountain (Milton 1997). Major Thomas Mitchell was the first to scale Mt Canobolas searching for the course of the Darling River. Due to the altitude and subsequent orographic rainfall, reduced temperatures and highly fertile basaltic soils, most of the flanks of the mountain have long been used for agricultural purposes, in particular for growing stone fruit and *Pinus radiata* plantations.

In 1876 Mt Canobolas was set aside as a water reserve for travelling stock and has been under some form of reservation to the present time. In 1997 Mt Canobolas was placed under the control of the National Parks and Wildlife Service as a State Recreation Area (SRA), after the dissolution of the Canobolas Regional Parklands Reserve Trust, which had administered Mt Canobolas and a further 35 crown reserves within the Central West of New South Wales until then. Milton (1997) chronicles the changes associated with the control and reservation of the Mt Canobolas.

Within the Central West National Parks and Wildlife District 76% of the native vegetation has been cleared, and more than 90% of the remaining vegetation is in fragmented remnants of five square kilometers or less (ERM Mitchell McCotter 1996). Significant large reserves within the region include Goobang National Park to the west and Winburndale Nature Reserve to the east.

Previous investigations

Allan Cunningham, through his involvement with the Oxley expeditions (Oxley 1820), and Mitchell (1839) give broad statements on the surrounding landscapes but make no specific mention of the vegetation on Mt Canobolas. In 1899 R.H. Cambage, a surveyor for the Department of Lands and Mines with a keen interest in botany, appears to have made the first major plant collections from Mt Canobolas. J.H. Maiden, Director of the Sydney Botanic Gardens and J.L. Boorman, botanical collector made collections for the National Herbarium of NSW from Mt Canobolas in 1908.

R.H. Cambage produced the first detailed description of the vegetation in the vicinity of Orange (Cambage 1909). The Soil Conservation Service of NSW (1978) produced broad scale vegetation maps for the Orange district indicating the entirety of Mt Canobolas being of *Eucalyptus dalrympleana* – *Eucalyptus viminalis* Association. Kenna et al. (1998) produced a checklist of some of the more common plants along walking tracks in the State Recreation Area and Hunter (1998) surveyed the populations of *Eucalyptus canobolensis*.

Methods

Fifty, 20 × 20 m quadrats were surveyed for vascular plants scored using the Braun-Blanquet (1982) six point cover abundance scale. Quadrats were placed using a stratified random method using Physiography (Crest, Hill-slope, Open Depressions) and altitude (< or > 1200 m) were used to stratify survey sites. The survey was conducted over five days in November 1999.

Good quality material of species were retained as vouchers by the Central West Region of the NSW NP&WS and duplicates of significant collections submitted to the National Herbarium of NSW. Nomenclature follows that of Harden (1990–1993) except where recent changes have been made.

Analyses and data exploration were performed using options available in the PATN Analysis Package (Belbin 1995a, b). For final presentation of results all species and their relative abundance scores were used and the analysis performed using Kulczynski association measure which is recommended for ecological applications (Belbin 1995a, b) along with flexible Unweighted Pair Group arithmetic Averaging (UPGMA) and the default PATN settings.

Delineation of community boundaries in Fig. 2 was based on the location of sites and their position within the multivariate analysis, air photograph interpretation, substrate and ground truthing. The vegetation map is based on a 1: 25 000 scale. Structural names follow Specht et al. (1995) and are based on the most consistent uppermost stratum.

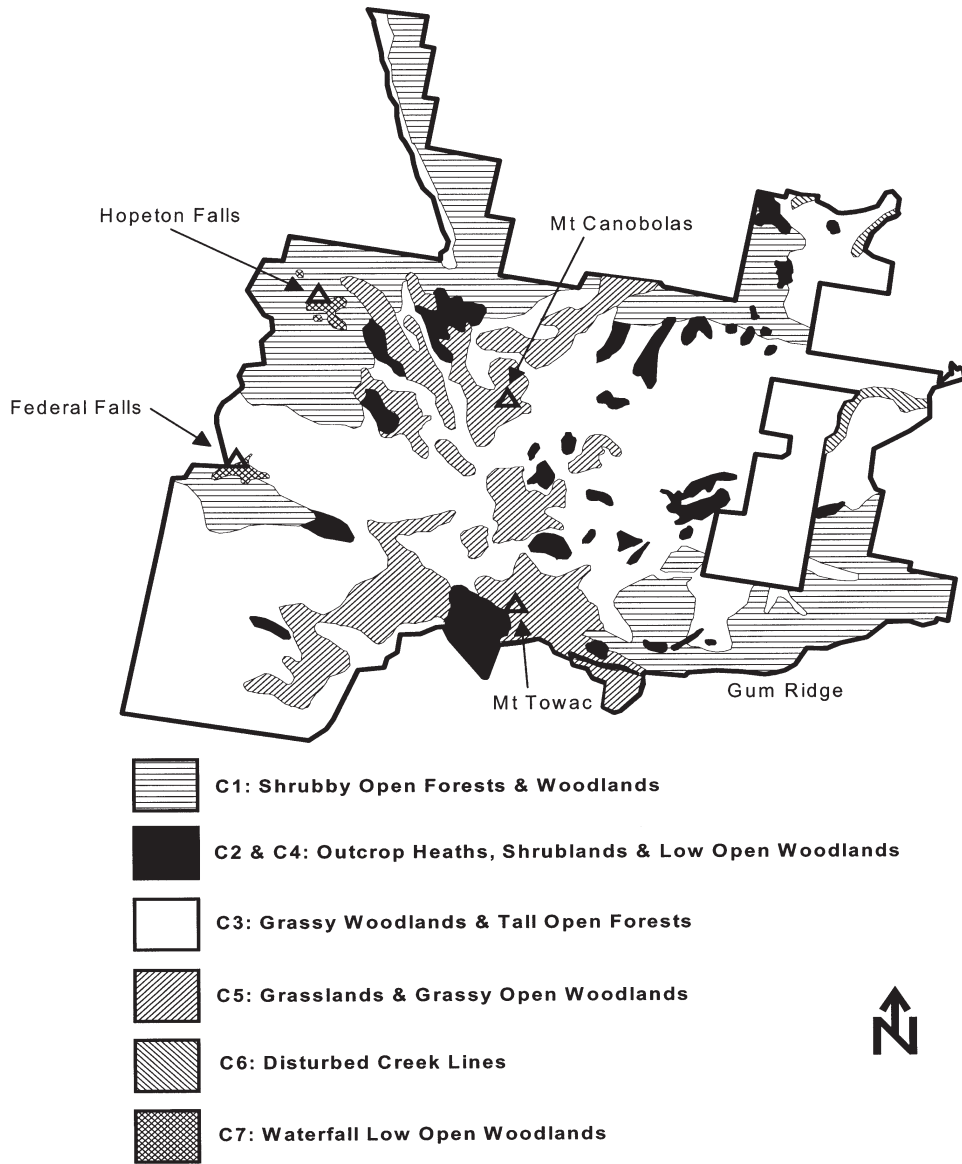


Fig. 2. Map of vegetation communities for Mount Canobolas State Recreation Area. Note Community 2 & 4 have been combined as they cannot be distinguished using API and both occur on rock outcrops.

Table 1: Selected attributes of the seven defined communities at Mount Canobolas State Recreation Area.

Community	Number of Sites	Richness per 400 m ² (average)	Number of Species	Number of Introduced Species	Proportion of Reserve	Number of Hectares
C1: Stringybark – Peppermint	12	22–39 (29)	107	10	26%	427
C2: Outcrop Heaths & Shrublands	1	21 (21)	21	5	2%	10
C3: Snow Gum – Mountain Gum	20	18–34 (27)	133	27	52%	846
C4: Outcrop Low Open Woodlands	6	23–31 (25)	66	7	4%	24
C5: Grasslands & Grassy Open Woodlands	8	22–40 (31)	94	20	15%	242
C6: Disturbed Creek Lines	1	34 (34)	34	17	1%	11
C7: Waterfall Low Open Woodlands	2	29–31 (30)	48	5	< 1%	7

Results

Seven communities were recognised at the dissimilarity measure of c. 0.8. A summary of the community relationships is given by the dendrogram (Fig. 3). The first major division on the dendrogram is the separation of the riparian areas. The next major division separates communities with a strong shrub component from those more forb dominated. In all 309, vascular plant taxa, from 69 families and 93 genera, were recorded from the collation of existing site data and subsequent sampling (Appendix). Approximately 14% (46) of all taxa were introduced to NSW.

Vegetation communities

The vegetation communities within Mount Canobolas SRA are broadly similar to those found in southern NSW, though dominance of the endemic *Eucalyptus canobolensis* is unique. Most of the vegetation communities are of woodland formation with a distinct grassy component. Tall open forests also occur in valleys, heaths and shrublands on shallow soils and rock outcrops, and grasslands within the matrix of other structural forms. Table 1 gives a summary of relevant statistics for each community. Within the following descriptions of communities extreme values are given in brackets.

Community 1: Stringybark – Peppermint Shrubby Open Forests and Woodlands

Distribution: Primarily on shallow but moist soils on red brown to chocolate brown soils (occasionally dark brown). Found from 1000 m to 1340 m particularly if sites are exposed.

Structure: Upper (5–) 15–25 (–30) m tall; (10–) 30–40% cover. Mid shrub not always present 3–8 m tall; 10–30% cover. Low shrub mostly present 1–2 m tall; 20–80% cover. Ground layer < 1 m tall; 30–100% cover.

Trees: *Eucalyptus macrorhyncha*, *Eucalyptus canobolensis*, *Eucalyptus dives*, *Acacia irrorata*, *Eucalyptus dalrympleana* subsp. *dalrympleana*, *Exocarpos cupressiformis*, *Eucalyptus pauciflora*, *Eucalyptus goniocalyx*, *Eucalyptus bridgesiana*, *Eucalyptus rubida* subsp. *rubida*, *Eucalyptus radiata* subsp. *radiata*, *Eucalyptus blakelyi*, *Acacia melanoxylon*.

Shrubs: *Cassinia uncata*, *Hibbertia obtusifolia*, *Mirbelia oxylobioides*, *Cassinia longifolia*, *Pultenaea cunninghamii*, *Melichrus urceolatus*, *Leucopogon attenuatus*, *Hibbertia riparia*, *Pultenaea polifolia*, *Pultenaea subternata*, *Monotoca scoparia*, *Leptospermum myrtifolium*, *Daviesia leptophylla*, *Leucopogon fletcheri* subsp. *brachysepalus*, *Indigofera australis*.

Climbers & trailers: *Hardenbergia violacea*, *Glycine clandestina*, *Desmodium varians*, *Rubus parviflorus*, *Desmodium gunnii*, *Billardiera scandens*.

Ground cover: *Poa sieberiana*, *Themeda triandra*, *Hydrocotyle laxiflora*, *Stackhousia monogyna*, *Lomandra multiflora*, *Luzula flaccida*, *Geranium solanderi* subsp. *solanderi*, *Senecio diaschides*, *Bossiaea neo-anglica*, *Viola betonicifolia*, *Veronica calycina*, *Gonocarpus tetragynus*, *Cymbonotus lawsonianus*, *Echinopogon ovatus*, *Acaena ovina*, *Euchiton gymnocephalus*, *Scutellaria humilis*, *Pteridium esculentum*, *Galium gaudichaudii*, *Brachyscome spathulata*, *Senecio biserratus*, *Scleranthus biflorus*, *Euchiton sphaericus*, *Dianella revoluta*, *Centaurium tenuiflorum*, *Asperula conferta*.

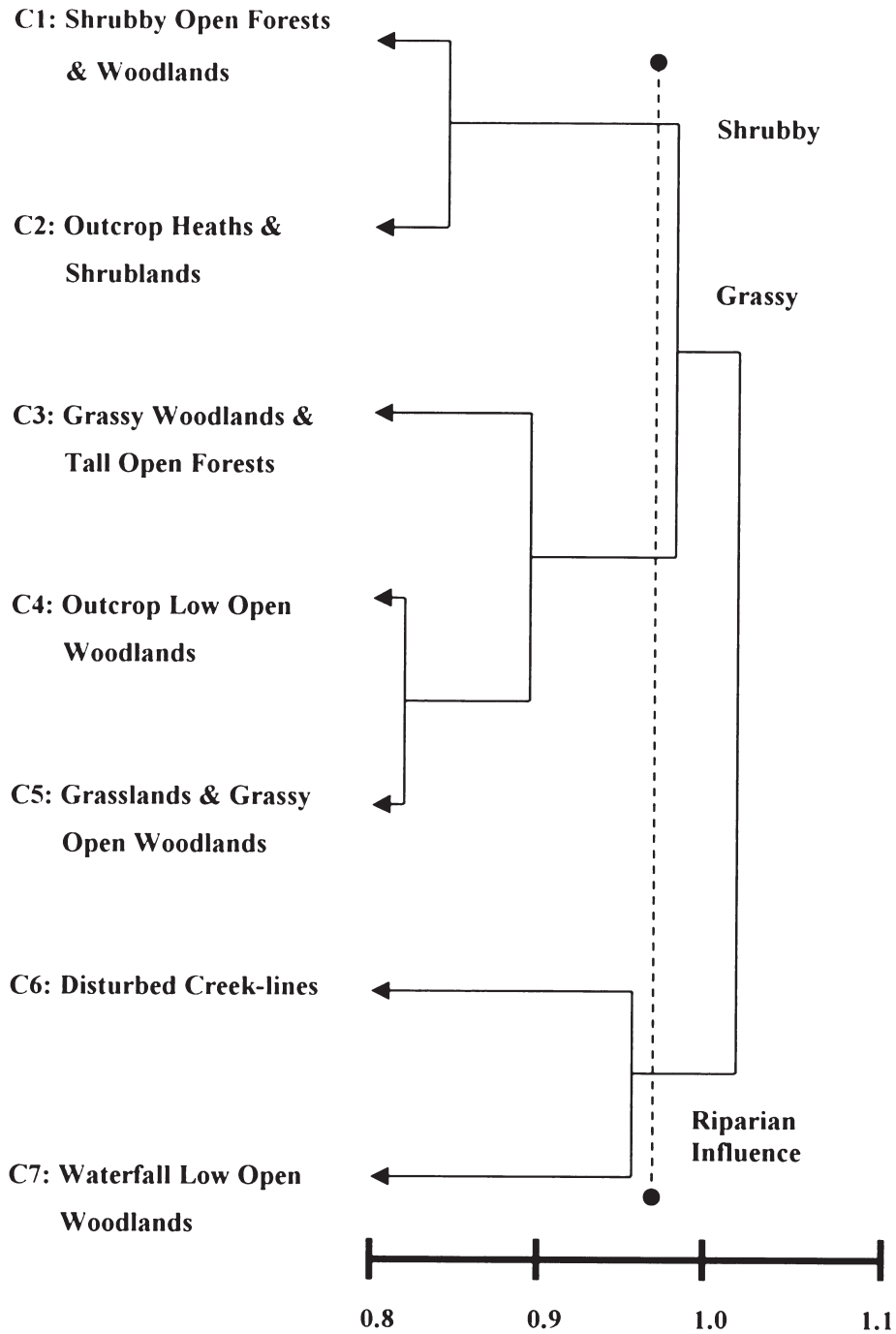


Fig. 3. Summary dendrogram of the full floristic dataset of sites using the Kulczynski association and flexible UPGMA fusion strategy and a β value of -0.1 . Communities have been defined at a dissimilarity level of c. 0.8.

Variability: Two sub-assemblages are distinguished on overstorey dominants and the height of the trees. On less exposed sites, primarily on upper and lower slopes, *Eucalyptus dives* dominated forests occur that commonly obtain heights of 20–30 m and usually have an upper and lower shrub layer. The upper shrub layer often contains *Acacia irrorata*. The second sub-assemblage occurs on drier more exposed sites and is commonly dominated by *Eucalyptus macrorhyncha*. This sub-assemblage is generally shorter and commonly only obtains a height of 15–20 m. Generally only a lower shrub layer is present.

Conservation and management issues: Specht et al. (1995) considered that the assemblage was adequately conserved across its range with occurrences within the Blue Mountains, Kanangra Boyd and Kosciuszko National Parks in NSW and numerous reserves in Victoria. Keith and Bedward (1990) indicate that around 30% of the remaining lands containing a similar community are reserved in the southeast. This community is adequately conserved across its range but that the occurrence within Mt Canobolas SRA is significant due to the unusual assortment of associated species and the community being at its north-western geographic limit of occurrence.

Community 2: Outcrop Heaths and Shrublands

Distribution: Found as highly disjunct and small patches throughout the reserve on skeletal soils.

Structure: Upper 1–3 m tall; 40–100% cover. Ground layer < 0.5 m tall; 20–80% cover.

Shrubs: *Calytrix tetragona*, *Mirbelia oxylobioides*, *Leucopogon attenuatus*, *Cassinia uncata*, *Hibbertia riparia*.

Ground cover: *Poa sieberiana*, *Themeda triandra*, *Cheilanthes austrotenuifolia*, *Stellaria flaccida*, *Senecio diaschides*, *Pterostylis pedunculata*, *Paspalidium constrictum*, *Haloragis heterophylla*, *Gonocarpus tetragynus*, *Crassula colorata* subsp. *acuminata*, *Brachyscome spathulata*.

Variability: Where little or no soil development occurs, or where there are no substantial cracks in the exposed rock, shrubs do not develop or at least do not form dense stands. The community may become sub-assemblage of Community 4 if fire frequencies are too high by decreasing the cover of shrubs and increasing more fire tolerant herbaceous vegetation (Hunter 1999).

Conservation and management issues: Likely to be wholly or restricted to Mt Canobolas and surrounds. This community is likely to be vulnerable to attrition from inappropriate fire regimes and attrition from disturbance due to visitor pressure. Community 2 is limited in extent, highly fragmented, and as such has a number of unique management problems. Such rock outcrop communities contain unique bryophyte communities (including the endangered Mt Canobolas *Xanthoparmelia* lichen community) and herbs that are easily disturbed by trampling. This endangered lichen community consists of *Xanthoparmelia canobolasensis* and *X. metastrigosa*, which are known only from Mt Canobolas, and *X. sulcifera* and *C. fuliginosa* each known from only one other locality in New South Wales (NSW Scientific Committee Final Determination 5 October 2001). The community occurs on rock faces and shallow soils on rock pavements and is threatened by road and drainage works, and collection of bushrock (NSW Scientific Committee

Final Determination 5 October 2001). Tourist visitation of the slopes and summit of Mt Canobolas increases risks of trampling and disturbance to the community. There is also potential for loss of lichen habitat from increased urban encroachment and rural development such as vineyards and orchards on the north and east flanks of Mt Canobolas. Unfortunately, rock outcrops are magnets for visitors as they are open and easy to walk on and often have good views.

Community 3: Snow Gum – Mountain Gum Grassy Woodlands and Tall Open Forests

Distribution: Found at higher altitudes or in protected areas dominating the central portion of the reserve. Soils are variable but primarily chocolate brown and are deep to shallow. The community is distributed from 900–1397 m altitude.

Structure: Upper (5–) 15–35 (–50) m tall; 20–40% cover. Upper shrub layer usually present 4–10 m tall; 10–60% cover. Lower shrub layer usually not present 1–3 m tall; 10–30% cover. Ground cover < 1 m tall; 80–100% cover.

Trees: *Eucalyptus pauciflora*, *Acacia melanoxylon*, *Eucalyptus dalrympleana* var. *dalrympleana*, *Acacia irrorata* subsp. *irrorata*, *Eucalyptus canobolensis*, *Eucalyptus viminalis*, *Eucalyptus mannifera*, *Eucalyptus radiata* subsp. *radiata*, *Eucalyptus polyanthemos* subsp. *polyanthemos*, *Eucalyptus goniocalyx*, *Eucalyptus dives*.

Shrubs: *Cassinia uncata*, *Hibbertia obtusifolia*, *Pultenaea polifolia*, *Pimelea ligustrina* var. *hypericuna*, *Daviesia latifolia*, *Cassinia longifolia*, *Olearia stellutlata*, *Mirbelia oxylobioides*.

Climbers & trailers: *Desmodium varians*, *Rubus parvifolius*, *Glycine tabacina*, *Desmodium gunnii*, *Hardenbergia violacea*, *Glycine* sp. A.

Ground cover: *Poa sieberiana*, *Acaena ovina*, *Pteridium esculentum*, *Geranium solanderi* subsp. *solanderi*, *Ranunculus lappaceus*, *Hydrocotyle laxiflora*, *Senecio quadridentatus*, *Luzula flaccida*, *Senecio diaschides*, *Scleranthus biflorus*, *Cymbanotus lawsonianus*, *Brachyscome spathulata*, *Microlaena stipoides*, *Echinopogon ovatus*, *Asperula conferta*, *Dichondra repens*, *Carex gaudichaudiana*, *Urtica incisa*, *Lomandra filiformis*, *Euchiton gymnocephalus*, *Derwentia derwentiana* var. *glauca*, *Rumex brownii*, *Pterostylis pedunculata*, *Wahlenbergia stricta* subsp. *stricta*, *Craspedia variabilis*, *Blechnum nudum*, *Wahlenbergia victoriensis*, *Viola hederacea*, *Viola betonicifolia*, *Senecio lautus* subsp. *lanceolatus*, *Poa labillardieri*, *Plantago varia*, *Lagenifera stipitata*, *Juncus remotiflorus*, *Gonocarpus tetragynus*, *Epilobium billardierianum*, *Chrysocephalum apiculatum*.

Variability: Sub-assemblages are distinguished primarily by physiography. Tall open forests dominated by *Eucalyptus dalrympleana* subsp. *dalrympleana* and *Eucalyptus viminalis* associated with open depressions (creek lines) with deep soils with trees up to 50 m tall. Grassy woodlands dominated by *Eucalyptus pauciflora* and *Eucalyptus canobolensis* from 5–25 m tall occur on upper slopes and crests on primarily shallow soils are also within this assemblage. There is a high degree of overlap between understorey species in these sub-assemblages and even the dominants of each occur commonly in both. These two sub-assemblages would likely separate out as distinct communities if the creek lines were far more developed, but since they are only barely incised they intergrade too much for separation.

Conservation and management issues: Benson and Keith (1990) indicate that the understorey of many remnants of these type of assemblages are heavily disturbed particularly by grazing. This community is probably adequately conserved across its range. Likely to be at the north-western limit of its distribution within the Mt Canobolas SRA. It is evident that the intense fire that occurred in 1985 has dramatically affected these woodland communities by causing massive germination of a cohort of young *Eucalyptus pauciflora*.

Community 4: Outcrop Low Open Woodlands

Distribution: Found scattered and disjunct across the entire reserve at altitudes from 1100–1360 m. Soils are always skeletal and generally red brown to chocolate or dark brown in colour.

Structure: Upper not always present 5–10 m tall; cover usually 10% but up to 30%. Shrub layer 1–3 m tall; 20–40% cover. Ground layer < 1 m tall; 50–80% cover.

Trees: *Eucalyptus canobolensis*, *Acacia irrorata* subsp. *irrorata*, *Eucalyptus saxicola*.

Shrubs: *Cassinia uncata*, *Phebalium squamulosum*, *Mirbelia oxylobioides*, *Dodonaea viscosa*, *Calytrix tetragona*, *Leptospermum myrtifolium*, *Leucopogon attenuatus*, *Hibbertia obtusifolia*, *Cassinia longifolia*.

Climbers & trailers: None apparent.

Ground cover: *Poa sieberiana*, *Centaurium tenuiflorum*, *Geranium solanderi* var. *solanderi*, *Cheilanthes sieberi*, *Carex gaudichaudiana*, *Luzula flaccida*, *Schoenus apogon*, *Austrodanthonia eriantha*, *Wurmbea dioica* subsp. *dioica*, *Senecio diaschides*, *Scleranthus biflorus*, *Dichelachne micrantha*, *Crassula colorata* var. *acuminata*, *Asplenium flabellifolium*, *Senecio quadridentatus*, *Oreomyrrhis eriopoda*, *Hypericum japonicum*, *Cardamine gunnii*, *Austrostipa racemosa* subsp. *racemosa*, *Rumex brownii*, *Oreobolus pumilio* var. *pumilio*, *Montia fontana* subsp. *chondrosperma*, *Hydrocotyle peduncularis*, *Hydrocotyle laxiflora*, *Digitaria breviglumis*, *Crassula sieberiana*, *Austrodanthonia penicellata*, *Acaena novae-zelandiae*.

Variability: Much variation appears to be associated with soil development and time since of fire. Where little or no soil development occurs, or where there are no substantial cracks in exposed rock, shrubs do not develop or at least do not form dense stands. Where soil development increase substantially trees are able to invade. Rock outcrops with a lowered frequency of fires have a greater proportion of shrubs with an occasional overstorey of *Eucalyptus saxicola*. Mt Towac, which has been burned more frequently, has fewer shrub taxa and is dominated by *Cassinia uncata* and *Acacia irrorata*, and a greater density of herbaceous taxa.

Conservation and management issues: Due to the restricted distribution and most of the community occurring within the SRA this community is probably adequately reserved locally. It should be considered vulnerable, particularly due to inappropriate fire regimes and visitor pressure.

Community 5: Grasslands and Grassy Open Woodlands

Distribution: Found above 1200 m altitude on shallow moist soils of a chocolate brown colour. Usually small and patchily distributed within Community 3.

Structure: Upper not always present (5–) 10–15 (–25) m tall; (5–) 10–20 (–40)% cover. Shrub layer not always present 2–5 m tall; 10–20 (–30)% cover. Ground cover < 1 m tall; 80–100% cover.

Trees: *Eucalyptus pauciflora*, *Eucalyptus canobolensis*, *Acacia irrorata* subsp. *irrorata*, *Eucalyptus dalrympleana* subsp. *dalrympleana*, *Acacia melanoxylon*, *Acacia deanei*.

Shrubs: *Cassinia uncata*, *Pimelea latifolia*, *Hibbertia obtusifolia*, *Acrotriche serrulata*, *Lespedeza juncea* subsp. *sericea*, *Pultenaea cunninghamii*, *Melichrus urceolatus*, *Leptospermum myrtifolium*, *Hibbertia riparia*, *Cassinia arcuata*.

Climbers & trailers: *Desmodium varians*, *Hardenbergia violacea*, *Desmodium gunnii*.

Ground cover: *Poa sieberiana*, *Geranium solanderi* subsp. *solanderi*, *Carex gaudichaudiana*, *Hydrocotyle laxiflora*, *Scutellaria humilis*, *Cheilanthes austrotenuifolia*, *Scleranthus biflorus*, *Acaena ovina*, *Hypericum japonicum*, *Senecio quadridentatus*, *Ranunculus lappaceus*, *Oreomyrrhis eriopoda*, *Euchiton gymnocephalus*, *Cymbonotus lawsonianus*, *Centaurium tenuiflorum*, *Hypericum gramineum*, *Veronica calycina*, *Rumex brownii*, *Oxalis chnoodes*, *Asperula conferta*, *Acaena novae-zelandiae*, *Viola betonicifolia*, *Urtica incisa*, *Stellaria flaccida*, *Schoenus apogon*, *Lomandra multiflora*, *Hydrocotyle pedicellosa*, *Epilobium billardierianum*, *Crassula sieberiana*.

Variability: Trees are a minor component of the community but can occur in low densities and change the community visually but not the overall floristic composition. Shrubs occasionally occur such as *Cassinia*, but are scarce or low to the ground. Intergradation occurs with Community 4 where soils are more skeletal and where fires are frequent.

Conservation and management issues: Keith and Benson (1988) stated that assemblages such as these were mostly cleared for agriculture. Costin (1970) describes them as being degraded to shrublands due to grazing and fire. Keith and Bedward (1999) indicated that 86% of this community was depleted in the Monaro area with only around 0.03% of that not depleted being reserved. It is likely that this community is poorly conserved across its range and that the occurrence within the Mount Canobolas SRA is highly significant.

Community 6: Disturbed Creek-lines

Distribution: Highly disturbed lower creek lines occur in the lower reaches of Towac Creek and a minor creek line that leaves the north eastern corner of the reserve.

Structure: Upper 30–35 m tall; 20% cover. Middle layer 10–20 m tall; 20% cover. Ground layer < 1m tall; 80% cover.

Trees: *Eucalyptus viminalis*, *Eucalyptus stellulata*, *Eucalyptus pauciflora*, *Eucalyptus dalrympleana*.

Shrubs: *Acacia falciformis*, *Leptospermum polygalifolium*, *Pimelea ligustrina* var. *hypericuna*, *Phebalium squamulosum*, *Mirbelia oxylobioides*, *Cassinia uncata*.

Ground cover: *Urtica incisa*, *Pteridium esculentum*, *Geranium solanderi* subsp. *solanderi*, *Scleranthus biflorus*, *Blechnum nudum*, *Acaena ovina*, *Ranunculus lappaceus*, *Adiantum aethiopicum*.

Variability: This community is worth distinguishing despite its derived nature, due to disturbance and weed invasion, as it will need separate consideration and management requirements beyond what is needed in other creek line areas within the reserve.

Conservation and management issues: Of little conservation importance, but if rehabilitated would be a valuable asset to the reserve as it is the only location where *Eucalyptus stellulata* is found. *Eucalyptus stellulata* assemblages in general are considered adequately reserved across their range by Specht et al. (1995), being found in numerous National Parks and other reserves within New South Wales and Victoria.

Community 7: Waterfall Low Open Woodlands

Distribution: Federal and Hopeton Falls.

Structure: Highly variable. Upper 5–30 m tall; 10% cover. Shrub layer 1–2 m tall; 30–90% cover. Ground layer < 1 m tall; 20–40% cover.

Trees: *Eucalyptus goniocalyx*, *Eucalyptus viminalis*, *Acacia melanoxylon*, *Eucalyptus canobolensis*.

Shrubs: *Exocarpus strictus*, *Cassinia uncata*, *Indigofera adesmiifolia*, *Dodonaea viscosa*, *Acacia verniciflua*.

Climbers & trailers: *Billardiera scandens*.

Ground cover: *Senecio lautus* subsp. *lanceolatus*, *Lepidosperma laterale*, *Pellaea falcata* var. *nana*, *Bulbine bulbosa*, *Stypantra glauca*, *Senecio hispidulus* var. *hispidulus*, *Galium migrans*, *Austrostipa racemosa*, *Wurmbea dioica* var. *dioica*, *Vittadinia cuneata*, *Veronica calycina*, *Themeda triandra*, *Pteridium esculentum*, *Poa sieberiana*, *Pleurosorus subglandulosus*, *Plantago varia*, *Imperata cylindrica*, *Gonocarpus tetragynus*, *Geranium solanderi* subsp. *solanderi*, *Dianella caerulea* var. *caerulea*, *Cymbopogon refractus*, *Austrodanthonia eriantha*, *Asplenium flabellifolium*, *Aristida ramosa*, *Sigesbeckia australis*, *Scleranthus biflorus*, *Echinopogon ovatus*, *Drosera peltata*, *Crassula sieberiana*, *Cheilanthes distans*, *Cheilanthes austrotenuifolia*, *Carex gaudichaudiana*.

Variability: Primarily of an open shrubland with an assortment of herbs of equal cover. Stunted *Eucalyptus goniocalyx* may occur where soil development is greater, particularly on the margins of the exposed rock face. The scree slopes at the bottom of the falls has few shrubs but a dense *Senecio* ground cover and the odd taller tree such as *Eucalyptus viminalis*.

Conservation and management issues: Considered adequately reserved but of very limited extent. Specht et al. (1995) considered communities with similar dominants to be reasonably conserved across its range. Blackberry (*Rubus*) is a serious problem at present.

Discussion

The plant communities within Mt Canobolas SRA, on a 0.04 ha quadrat basis, have nearly two-to three-fold greater species richness than comparable communities surveyed elsewhere in the South Eastern Highlands Bioregion (Keith & Bedward 1999), however generally less than what was found in communities from lower altitudes (Lembit 1996, Porteners 1997). For example Keith and Bedward (1999) describe a Dry Grassy Woodland (*E. dives* – *E. dalrympleana* – *E. pauciflora* – *E. rubida*) with 13 spp./0.04 ha, a Dry Grass Forest (*E. pauciflora* – *E. rubida* – *E. viminalis*) with 16 spp./0.04 ha and a Basalt Grassland (*E. pauciflora* – *E. viminalis* with scattered *Acacia melanoxylon*) with 17 spp./0.04 ha on average. Comparable communities here include Community 1 with 29 spp./0.04 ha, Community 3 with 27 spp./0.04 ha and Community 5 with 31 spp./0.04 ha on average. The richness of all communities was relatively uniform, being in general between 25–35 species./0.04 ha (28 average).

Milton (1997) stated that (due to the rapid climb in altitude) the vegetation of Mt Canobolas SRA changed '*as if a line were drawn on a map*'. The results of this survey indicate that this is not the case. There is considerable overlap between communities, particularly with those that are widespread within the SRA. Communities within the SRA have affinities with those described as intermediate in the literature (Beadle 1981, Keith & Bedward 1999). This may be partly due to the small and isolated nature of the remnant.

The occurrence of grasslands and low open grassy woodlands are likely to be natural. These patches may be derived from past fire regimes but are more likely to have formed due to the climate. Ripley (1992) and Benson (1994) discuss that under low rainfall (c. 850 mm MAR) it is likely that dense herbaceous vegetation would exhaust the available moisture in the top layer of soil. Tree seedlings are out-competed. If sites become wetter, the grasslands may become gradually recolonised by shrub and tree species that survive the dry conditions, but in such situations frequent frosts may restrict seedling development (Benson 1994).

Mt Canobolas State Recreation Area is placed within the South Eastern Highlands (SHE) Bioregion and the community descriptions here support this. Within the SEH Bioregion, Mt Canobolas is an outlier at the extreme north and west. In particular, Communities 1, 3 and 5, which are the most extensive within the SRA (92.3% of SRA) show strong affinities with high altitude assemblages, primarily on basalt on the western parts of the Blue Mountains, the western parts of the Southern Tablelands, as well as the Monaro region and central Victoria. Communities 2 and 4, which are restricted to skeletal soils on rock outcrops, are primarily associated with flora of the Southern Tablelands of New South Wales. The stronger herbaceous component of Community 4 shows affinities to the Southern Tablelands but with a distinct relationship with the flora of the North Western Slopes. In contrast, Community 7, which occurs on the most exposed sites within the SRA (i.e. on shallow soils, fully exposed, western facing), has strong relationships with the floras of the northeast and the Central Western parts of the state.

The flora of Mt Canobolas SRA is comparatively cosmopolitan. Milton (1997) quotes Jenny Kenna, president of the Orange Field Naturalist Club, as stating '*Mount Canobolas is a sub-alpine climate which by its location has been isolated from other sub-alpine areas and has allowed plants to evolve in isolation*'. Such beliefs are, probably largely based on the distinctness of the Mt Canobolas flora from the immediately adjacent vegetation. This survey has shown that there is very little support for such beliefs. The flora of Mt Canobolas is distinctly widespread and typical of other high altitude floras; it is possibly even depauperate in terms of high altitude specialists. Only two true endemics exist in Mt Canobolas SRA, both of which are *Eucalyptus* species — *Eucalyptus canobolensis*, the first endemic to be recognised and recently a second endemic species, *Eucalyptus saxicola* (Hunter 2001). Certainly, Mt Canobolas is a disjunct remnant of sub-alpine habitat. However, it is likely that due to its long isolation and very small overall area it has lost, or never obtained, many high altitude specialists.

Conclusion

Mt Canobolas State Recreation Area is a significant isolated high altitude conservation reserve with a comparatively little disturbed habitat. It conserves some of the major and widespread communities found within the South East Highland Bioregion and the vegetation associated with high altitude basaltic soils. Many of the associated communities and species are at the north-western limit of their known distribution; some are highly significant.

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References

- Beadle, N.C.W. (1981) *The vegetation of Australia* (Cambridge University Press: Cambridge).
- Belbin, L. (1995a) *Users guide: PATN Pattern Analysis Package* (Division of Wildlife & Ecology CSIRO: Canberra).
- Belbin, L. (1995b) *Technical Reference: PATN Pattern Analysis Package* (Division of Wildlife & Ecology CSIRO: Canberra).
- Benson, D.H. & Keith, D.A. (1990) The natural vegetation of Wallerawang 1: 100 000 map sheet. *Cunninghamia* 2: 305–336.
- Benson, J.S. (1994) The native grasslands of the Monaro region: Southern Tablelands of NSW. *Cunninghamia* 3: 609–650.

- Braun-Blanquet, J. (1982) *Plant sociology: the study of plant communities* (McGraw Hill: New York).
- Cabbage, R.H. (1909) Notes on the botany of the interior of New South Wales. VII. From Forbes to Bathurst. *Proceedings of the Linnean Society of New South Wales* 27: 561–591.
- Cannon, M. (1987) *The exploration of Australia* (Reader's Digest: Surry Hills).
- Costin, A.B. (1970) Sub-alpine and alpine communities. In R.M. Moore (Ed.) *Australian Grasslands*. (Australian National University Press: Canberra).
- ERM Mitchell-McCotter (1996) *Bathurst Vegetation Survey*. Unpublished Report to the Central West Region NSW NP&WS.
- Faulkner, W. (1996) *Canobolas Regional Parkland Reserves — an Assessment of Conservation Values*. Unpublished Report to the Central West Region NSW NP&WS.
- Harden, G.J. (1990–1993) *Flora of New South Wales Vol. 1–4* (UNSW Press: Sydney).
- Hunter, J.T. (2001) *Eucalyptus saxicola* (Myrtaceae), a new species from the Central Tablelands of New South Wales (Section Maidenaria series Bridgesianae). *Telopea* 9: 403–407.
- Hunter, J.T. (2000) *Vegetation and Floristics of the Mount Canobolas State Recreation Area*. Unpublished Report to the Central West Region of the NSW NP&WS.
- Hunter, J.T. (1998) *Threatened endemic eucalypts of the Central Tablelands*. Unpublished Report to the Central West Region NSW NP&WS.
- Keith, D.A. & Bedward, M. (1999) Native vegetation of the south-east forests region, Eden. *Cunninghamia* 6: 1–218.
- Keith, D.A. & Benson, D.H. (1988) The natural vegetation of Katoomba 1:100 000 map sheet. *Cunninghamia* 2: 107–144.
- Kenna, J.I., Medd, R.W. & Bower, C.C. (1998) *Flora of the walking tracks of Mt Canobolas State Recreation Area* (Orange Field Naturalists & Conservation Society Inc.: Orange).
- Lembit, R. (1996) *Vegetation survey of Evans Crown Nature Reserve*. Unpublished Report to the Central West Region NSW NP&WS.
- Meakin, S., Spackman, J.M., Scott, M.M., Watkins, J.J., Warren, A.Y.E., Moffitt, R.S. & Krynen, J.P. (1997) *Orange*. 1st Edn (1: 100 000 geological map 8731) (Geological Survey of NSW & Australian Geological Survey: Canberra).
- Milton, N. (1997) *Mount Canobolas (The journey towards State Recreation Area status)*. Unpublished PKM 160 Natural Resource Management Assignment Bathurst Campus, University of Sydney (held in NP&WS Bathurst district office).
- Mitchell, T.L. (1839) *Three Expeditions into the Interior of Eastern Australia with the descriptions of the recently explored region of Australia Felix, and the present colony of New South Wales*. Vol. 1 (2nd Edn) (T. & W. Boone: London).
- Oxley, J. (1820) *Journals of two Expeditions into the Interior of New South Wales* (John Murray: London).
- Porteners, M.F. (1997) *Vegetation survey of Goobang National Park*. Unpublished Report to the Central West NSW NP&WS.
- Ripley, E.A. (1992) Grassland climate. In R.T. Coupland *Ecosystems of the World. 8A: Natural Grasslands: Introduction and Western Hemisphere* (Elsevier: Amsterdam).
- Soil Conservation Service of New South Wales (1978) *Orange District Technical Manual* (Soil Conservation Service: Sydney).
- Specht, R.L., Specht, A., Whelan, M.B. & Hegarty, E.E. (1995) *Conservation atlas of plant communities in Australia* (Centre for Coastal Management & Southern Cross University Press: Lismore).

Appendix: Flora of Mount Canobolas SRA. Nomenclature follows that of Harden (1990–1993) except where recent changes have occurred. Taxa found within the survey sites are scored according to their occurrence in each of the seven communities defined. Some taxa were found in previous surveys and have not been verified by the author or opportunistically and therefore are not assigned to a specific community. C1 = Shrubby Open Forests & Woodlands; C2 = Outcrop Heaths & Shrublands; C3 = Grassy Woodlands & Tall Open Forests; C4 = Outcrop Low Open Woodlands; C5 = Grasslands & Grassy Open Woodlands; C6 = Disturbed Creek Lines; C7 = Waterfall Low Open Woodlands. Introduced species are indicated by *.

Taxon	C1	C2	C3	C4	C5	C6	C7	Opportunistic
Adiantaceae								
<i>Adiantum aethiopicum</i>			C3			C6		
<i>Cheilanthes austrotenuifolia</i>	C1	C2	C3		C5		C7	
<i>Cheilanthes distans</i>							C7	
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	C1		C3	C4				
<i>Pellaea nana</i>							C7	
<i>Pteris tremula</i>								O
Amygdalaceae								
* <i>Prunus laurocerasus</i>			C3					
Anthericaceae								
<i>Arthropodium milleflorum</i>				C4	C5			
<i>Thysanotus tuberosus</i>								O
Apiaceae								
<i>Actinotus helianthi</i>								O
<i>Hydrocotyle laxiflora</i>	C1		C3	C4	C5			
<i>Hydrocotyle pedicellosa</i>					C5			
<i>Hydrocotyle peduncularis</i>	C1		C3	C4	C5			
<i>Lilaeopsis polyantha</i>					C5			
<i>Oreomyrrhis eriopoda</i>	C1		C3	C4	C5			
Araliaceae								
<i>Astrotricha linearis</i>								O
* <i>Hedera helix</i>			C3			C6		
* <i>Tetrapanax papyrifer</i>								O
Asphodelaceae								
<i>Bulbine bulbosa</i>	C1		C3				C7	
Aspleniaceae								
<i>Asplenium flabellifolium</i>				C4	C5		C7	
<i>Pleurosorus subglandulosus</i>							C7	
Asteraceae								
* <i>Bidens pilosa</i>			C3					
<i>Brachyscome spathulata</i>	C1	C2	C3					
<i>Bracteantha bracteata</i>								O
<i>Cassinia arcuata</i>					C5			
<i>Cassinia laevis</i>			C3					
<i>Cassinia longifolia</i>	C1		C3	C4				
<i>Cassinia uncata</i>	C1	C2	C3	C4	C5	C6	C7	
<i>Chrysocephalum apiculatum</i>			C3					

Taxon	C1	C2	C3	C4	C5	C6	C7	Opportunistic
Asteraceae cont.								
<i>Chrysocephalum semipapposum</i>								0
* <i>Cirsium vulgare</i>	C1	C2	C3	C4	C5	C6		
* <i>Conyza albida</i>	C1		C3	C4	C5		C7	
* <i>Conyza bonariensis</i>			C3					
<i>Craspedia variabilis</i>			C3		C5			
<i>Cymbanotus lawsonianus</i>	C1		C3	C4	C5			
<i>Cymbanotus preissianus</i>	C1							
<i>Euchiton gymnocephalus</i> (DC.) Holub	C1		C3	C4	C5			
<i>Euchiton sphaericus</i> (Willd.) Holub	C1				C5			
* <i>Hypochaeris radicata</i>	C1	C2	C3	C4	C5		C7	
<i>Lagenifera stipitata</i>			C3					
<i>Microseris lanceolata</i>								0
<i>Olearia chrysophylla</i>								0
<i>Olearia stellulata</i>			C3					
<i>Senecio biserratus</i>	C1							
<i>Senecio diaschides</i>	C1	C2	C3	C4	C5			
<i>Senecio glossanthus</i>			C3					
<i>Senecio hispidulus</i> var. <i>hispidulus</i>							C7	
<i>Senecio lautus</i> subsp. <i>dissectifolius</i>								0
<i>Senecio lautus</i> subsp. <i>lanceolatus</i>	C1		C3				C7	
<i>Senecio linearifolius</i>								0
<i>Senecio quadridentatus</i>	C1		C3	C4	C5			
<i>Senecio</i> sp. E			C3		C5			
<i>Sigesbeckia australis</i>							C7	
<i>Sonchus oleraceus</i>			C3		C5	C6		
* <i>Taraxacum officinale</i>	C1		C3		C5	C6		
<i>Vittadinia cuneata</i> var. <i>cuneata</i>							C7	
Blechnaceae								
<i>Blechnum nudum</i>			C3			C6		
Boraginaceae								
* <i>Amsinckia intermedia</i>			C3			C6		
Brassicaceae								
<i>Cardamine gunnii</i>			C3	C4				
* <i>Hirschfeldia incana</i>						C6		
Callitrichaceae								
<i>Callitriche stagnalis</i>			C3			C6		
Campanulaceae								
<i>Wahlenbergia ceracea</i>								0
<i>Wahlenbergia communis</i>								0
<i>Wahlenbergia luteola</i>								0
<i>Wahlenbergia stricta</i> subsp. <i>stricta</i>	C1		C3	C4				
<i>Wahlenbergia victoriensis</i>	C1		C3		C5			

Taxon	C1	C2	C3	C4	C5	C6	C7	Opportunistic
Caprifoliaceae								
<i>*Lonicera japonica</i>								0
Caryophyllaceae								
<i>*Cerastium glomeratum</i>			C3		C5			
<i>*Petrorhagia nanteuillii</i>					C5		C7	
<i>Scleranthus biflorus</i>	C1		C3	C4	C5	C6	C7	
<i>Stellaria angustifolia</i>				C4				
<i>Stellaria flaccida</i>		C2	C3	C4	C5			
<i>Stellaria multiflora</i>								0
<i>Stellaria pungens</i>								0
Celastraceae								
<i>Maytenus silvestris</i>								0
Clusiaceae								
<i>*Hypericum androsaemum</i>								0
<i>Hypericum gramineum</i>	C1				C5			
<i>Hypericum japonicum</i>	C1		C3	C4	C5			
<i>*Hypericum perforatum</i>			C3					
Colchicaceae								
<i>Burchardia umbellata</i>								0
<i>Wurmbea dioica</i> subsp. <i>dioca</i>	C1			C4	C5		C7	
Commelinaceae								
<i>Commelina cyanea</i>								0
Convolvulaceae								
<i>Convolvulus erubescens</i>								0
<i>Dichondra repens</i>			C3		C5			
Crassulaceae								
<i>Crassula colorata</i> var. <i>acuminata</i>		C2		C4	C5			
<i>Crassula sieberiana</i>				C4	C5		C7	
Cupressaceae								
<i>Callitris endlicheri</i>								0
Cyperaceae								
<i>Carex appressa</i>			C3					
<i>Carex breviculmis</i>					C5			
<i>Carex gaudichaudiana</i>	C1		C3	C4	C5		C7	
<i>Carex inversa</i>			C3					
<i>Eleocharis acuta</i>								0
<i>Fimbristylis dichotoma</i>								0
<i>Gahnia aspera</i>			C3					
<i>Lepidosperma laterale</i>	C1						C7	
<i>Oreobolus pumilio</i> subsp. <i>pumilio</i>				C4				
<i>Schoenus apogon</i>	C1		C3	C4	C5			

Taxon	C1	C2	C3	C4	C5	C6	C7	Opportunistic
Davalliaceae								
<i>Rumohra adiantiformis</i>								0
Dennstaedtiaceae								
<i>Pteridium esculentum</i>	C1		C3			C6	C7	
Dilleniaceae								
<i>Hibbertia obtusifolia</i>	C1		C3	C4	C5			
<i>Hibbertia riparia</i>	C1	C2			C5			
<i>Hibbertia sericea</i>								0
Droseraceae								
<i>Drosera auriculata</i>								0
<i>Drosera peltata</i>							C7	
Dryopteridaceae								
<i>Polystichum proliferum</i>			C3					
Epacridaceae								
<i>Acrotriche serrulata</i>					C5			
<i>Brachyloma daphnoides</i> subsp. <i>glabrum</i> (Blakely) J.T.Hunter								0
<i>Leucopogon attenuatus</i>	C1	C2		C4				
<i>Leucopogon fletcheri</i> subsp. <i>brachysepalus</i>	C1		C3					
<i>Leucopogon fraseri</i>								0
<i>Leucopogon virgatus</i>								0
<i>Melichrus urceolatus</i>	C1		C3		C5			
<i>Monotoca scoparia</i>	C1							
Euphorbiaceae								
<i>Phyllanthus virgatus</i>								0
<i>Poranthera microphylla</i>			C3		C5			
Fabaceae								
<i>Acacia brownei</i>	C1							
<i>Acacia buxifolia</i>								0
<i>Acacia dealbata</i>								0
<i>Acacia deanei</i> subsp. <i>paucijuga</i>					C5			
<i>Acacia falciformis</i>						C6		
<i>Acacia irrorata</i> subsp. <i>irrorata</i>	C1		C3	C4	C5			
<i>Acacia lanigera</i>								0
<i>Acacia melanoxydon</i>	C1		C3		C5		C7	
<i>Acacia verniciflua</i>							C7	
<i>Bossiaea buxifolia</i>								0
<i>Bossiaea neo-anglica</i>	C1			C4				
* <i>Cytisus scoparius</i> subsp. <i>scoparius</i>						C6		
<i>Daviesia latifolia</i>			C3					
<i>Daviesia leptophylla</i>	C1		C3					
<i>Desmodium gunnii</i>	C1		C3		C5			
<i>Desmodium varians</i>	C1		C3		C5			

Taxon	C1	C2	C3	C4	C5	C6	C7	Opportunistic
Lamiaceae								
<i>Ajuga australis</i>								0
<i>Mentha satureioides</i>								0
* <i>Marrubium vulgare</i>		C2		C4	C5			
* <i>Prunella vulgaris</i>			C3					
<i>Scutellaria humilis</i>	C1		C3	C4	C5			
Lomandraceae								
<i>Lomandra confertifolia</i> subsp. <i>pallida</i>								0
<i>Lomandra filiformis</i>			C3	C4	C5			
<i>Lomandra longifolia</i>								0
<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	C1		C3		C5			
Loranthaceae								
<i>Amyema miquelii</i>	C1		C3					
Malaceae								
* <i>Cotoneaster glaucophyllus</i>								0
* <i>Crataegus monogyna</i>			C3					
Myrtaceae								
<i>Angophora floribunda</i>								0
<i>Calytrix tetragona</i>		C2		C4				
<i>Eucalyptus blakelyi</i>	C1							
<i>Eucalyptus bridgesiana</i>	C1							
<i>Eucalyptus canobolensis</i> (L.A.S.Johnson & K.D.Hill) J.T.Hunter	C1		C3	C4	C5		C7	
<i>Eucalyptus dalrympleana</i> subsp. <i>dalrympleana</i>	C1		C3		C5	C6		
<i>Eucalyptus deanei</i>								0
<i>Eucalyptus dives</i>	C1		C3					
<i>Eucalyptus goniocalyx</i>	C1		C3				C7	
<i>Eucalyptus macrorhyncha</i>	C1							
<i>Eucalyptus mannifera</i>			C3					
<i>Eucalyptus pauciflora</i>	C1		C3		C5	C6		
<i>Eucalyptus polyanthemos</i> subsp. <i>polyanthemos</i>			C3					
<i>Eucalyptus radiata</i> subsp. <i>radiata</i>	C1		C3					
<i>Eucalyptus rubida</i> subsp. <i>rubida</i>	C1							
<i>Eucalyptus saxicola</i> J.T.Hunter				C4				
<i>Eucalyptus stellulata</i>						C6		
<i>Eucalyptus viminalis</i>			C3			C6	C7	
<i>Kunzea parvifolia</i>								0
<i>Leptospermum myrtifolium</i>	C1		C3	C4	C5			
<i>Leptospermum polygalifolium</i> subsp. <i>transmontanum</i>						C6		
Onagraceae								
<i>Epilobium billardierianum</i> var. <i>cinereum</i>	C1		C3	C4	C5			

Taxon	C1	C2	C3	C4	C5	C6	C7	Opportunistic
Plantaginaceae								
<i>*Plantago lanceolata</i>	C1		C3					
<i>Plantago varia</i>	C1		C3		C5		C7	
Poaceae								
<i>Aira cupaniana</i>					C5			
<i>Aristida ramosa</i> var. <i>scaberula</i>							C7	
<i>Austrodanthonia eriantha</i> (Lindl.) H.P.Linder				C4	C5		C7	
<i>Austrodanthonia penicellata</i> (Labill.) H.P.Linder	C1			C4				
<i>Austrodanthonia pilosa</i> (R.Br.) H.P.Linder							0	
<i>Austrodanthonia racemosa</i> (R.Br.) H.P.Linder			C3					
<i>Austrostipa densiflora</i> (R.Br.) S.W.L.Jacobs & H.P.Linder				C4			C7	
<i>Austrostipa scabra</i> (Lindl.) S.W.L.Jacobs & J.Everett	C1							
<i>*Briza maxima</i>								0
<i>*Bromus sterilis</i>								0
<i>Cymbopogon refractus</i>							C7	
<i>Dactylis glomerata</i>						C6		
<i>Dichelachne micrantha</i>				C4				
<i>Digitaria breviglumis</i>				C4				
<i>Digitaria brownii</i>								0
<i>Echinopogon ovatus</i>	C1		C3		C5		C7	
<i>Elymus scaber</i> var. <i>scaber</i>								0
<i>Imperata cylindrica</i> var. <i>major</i>			C3				C7	
<i>Microlaena stipoides</i>	C1		C3	C4	C5			
<i>Paspalidium constrictum</i>		C2						
<i>Paspalum dilatatum</i>			C3			C6		
<i>Poa annua</i>								0
<i>Poa labillardieri</i>			C3					
<i>Poa sieberiana</i>	C1	C2	C3	C4	C5		C7	
<i>Themeda triandra</i>	C1	C2		C4	C5		C7	
<i>Tripogon loliiformis</i>			C3		C5		C7	
Polygonaceae								
<i>*Acetosella vulgaris</i>	C1	C2	C3	C4	C5			
<i>Rumex brownii</i>			C3	C4	C5			
Portulacaceae								
<i>Montia fontana</i> subsp. <i>chondrosperma</i>				C4				
Ranunculaceae								
<i>Ranunculus inundatus</i>				C4				
<i>Ranunculus lappaceus</i>	C1		C3		C5	C6		
Rhamnaceae								
<i>Cryptandra amara</i> var. <i>amara</i>			C3					

Taxon	C1	C2	C3	C4	C5	C6	C7	Opportunistic
Rosaceae								
<i>Acaena novae-zelandiae</i>	C1		C3	C4	C5			
<i>Acaena ovina</i>	C1		C3		C5	C6		
* <i>Rosa rubiginosa</i>					C5	C6		
* <i>Rubus chloocladus</i>	C1		C3	C4	C5		C7	
<i>Rubus parvifolius</i>	C1		C3					
Rubiaceae								
<i>Asperula conferta</i>	C1		C3		C5			
<i>Coprosma quadrifida</i>			C3					
<i>Galium aparine</i>			C3		C5	C6		
<i>Galium gaudichaudii</i>	C1			C4				
<i>Galium migrans</i>							C7	
<i>Pomax umbellata</i>				C4				
<i>Nertera granadensis</i>								0
Rutaceae								
<i>Correa reflexa</i> var. <i>reflexa</i>								0
<i>Phebalium squamulosum</i> subsp. <i>squamulosum</i>				C4		C6		
Salicaceae								
* <i>Salix fragilis</i>						C6		
Santalaceae								
<i>Exocarpos cupressiformis</i>	C1		C3					
<i>Exocarpos strictus</i>							C7	
Sapindaceae								
<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>	C1			C4			C7	
Scrophulariaceae								
<i>Derwentia derwentiana</i> subsp. <i>subglauca</i>	C1		C3		C5			
* <i>Orobancha minor</i>								0
* <i>Verbascum thapsus</i>			C3		C5			
<i>Veronica calycina</i>	C1		C3		C5		C7	
Solanaceae								
* <i>Datura stramonium</i>						C6		
Stackhousiaceae								
<i>Stackhousia monogyna</i>	C1			C4	C5			
<i>Stackhousia viminea</i>								0
Stylidiaceae								
<i>Stylidium graminifolium</i>	C1							

