Vegetation and flora of Bald Rock National Park

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Vegetation and Floristics of the Bald Rock & Boonoo Boonoo National Parks

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A Report to the New South Wales National Parks and Wildlife Service

Summary

The vegetation of Bald Rock and Boonoo Boonoo National Parks is described and mapped (scale 1:25 000). This forms part one of the survey of lands within these two reserves with part two of the survey incorporating newly acquired lands. Ten communities are defined based on PATN analysis and one specialised community is as circumscribed by previous surveys. These eleven communities are mapped based on ground truthing, air photo interpretation and altitude. Most communities are of a Tall Open Forest structure, however Woodlands exist along with Heaths, Sedgelands, Shrublands and Closed Forest. The distribution of communities is related to drainage, aspect, slope and soil depth. Many of the communities show considerable variation and intergrade along common boundaries. A number of specialised communities are thought to be restricted to the reserve.

A total of 898 taxa were found from 135 families and 429 genera. At present, only 6% of the flora is exotic in origin. Very few of these exotic species are considered to pose any major threat at present. Twenty-seven ROTAP taxa of which three are TSC Act listed, were found during the survey. A further 52 taxa were thought to be significant in a regional perspective and an additional eight rare species may potentially occur with further investigation.

Most management issues are related to fire regimes. Throughout most of the reserve fire frequency has been high and a considerable reduction in this frequency is suggested for most communities. It is also suggested that a variable and adaptive fire regime is adopted. Monitoring of a subset of the survey plots in subsequent years will enable a review of management practices to allow modification as new information is forthcoming. Introduced plants, pigs and stray cattle are sources of disturbance and will need to be eradicated.

These two reserves are very significant as they represent a large area conserving representatives of some major and widespread communities of the north east of New South Wales as well as some that are unique to the reserve. A very high number of restricted and regionally rare species are found within these reserves some of which are endemic.

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Introduction

1.1 Objectives

This survey of the vegetation of the Bald Rock and Boonoo Boonoo National Parks was prepared by John T. Hunter at the request of the Glen Innes District of the New South Wales National Parks and Wildlife Service. The Glen Innes District required that existing information from previous floristic surveys be collated and that up to 100 stratified sites be surveyed in order to complete a comprehensive survey of the vegetation and flora of the Bald Rock and Boonoo Boonoo National Parks. This report represents the findings of the survey. This information is to be used as a guide for management purposes.

The requirements of the investigation were:

1. Collate existing information from previous vegetation surveys conducted within the Bald Rock and Boonoo Boonoo National Parks. Data sources recovered included 38 full floristic sites:
    - Site descriptions conducted for a vegetation survey of granitic areas of the Northern Tablelands (Roberts 1983).
    - 14 sites from the NRAC vegetation survey of the Upper North East of New South Wales (1993).
    - 3 sites supplementary to the NRAC sites for incorporation into the same document above (1993).
    - 1 site conducted for the inventory of Clarence Valley Rainforest Remnants (Gilmour 1993).
    - Information compiled from University of New England student excursions in 1994 (Clarke 1998).
    - 21 sites conducted for the floristic inventory of the granitic outcrop vegetation of the New England Batholith (Hunter 1999).

- 30 (2 m x 2 m) fire trial plots sampled once a month for 12 months (402 temporal sites) conducted at Bald Rock and the Border Trail in 1996-7 (Hunter 1999).

2. Site placement to be based on selected environmental variables and be distributed based on the area they occupy.
3. Identify weed species and their occurrence.
4. Identify ROTAP and TSC Act species and their occurrence.
5. Identify regionally significant species.
6. Provide known fire ecology information on species and communities.
7. Construction of a vegetation map based on communities as defined by PATN analysis.
8. Provide management recommendations.
9. Collection of voucher specimens for reference.

1.2 Study area

Bald Rock and Boonoo Boonoo National Parks occur approximately 30 km north east of Tenterfield in north eastern New South Wales (Figure 1 & 2) within the Tenterfield Shire. Bald Rock National Park incorporates two disjunct sections, the main park in the north that includes 'Bald Rock' itself and a southern section which occurs *c*. 4 km south of the main park (Figure 2). The study area incorporates land once within the boundaries of several State Forests but have now been incorporated into these present reserves, namely; Jenner State Forest and parts of Boorook State Forest and Boonoo State Forest. Girraween National Park in Queensland adjoins the majority of the western border of Bald Rock National Park. State Forest still adjoins parts of the eastern boundary of Boonoo Boonoo National Park. The eastern boundary of the main section of Bald Rock National Park adjoins a Traveling Stock Reserve (TSR) managed by the Tenterfield Rural lands Protection Board. Other boundaries occur against privately owned land, in particular the south section of Bald Rock National Park which is totally landlocked by private holdings. Both reserves are currently managed by the Glen Innes District of the New South Wales National Parks and Wildlife Service. Part one of the survey only includes areas included in the original park boundaries and as such does not include the new recent additions.

The Reserves occur along the eastern escarpment of the Main Range (Figures 1 & 2) and straddles the Northern Tablelands and the North Coast Botanical Districts (the boundary of which is usually defined at around 800-900 m altitude). At present the parks include 12 083 ha, with 8046 ha in Bald Rock National Park and 4037 ha in Boonoo Boonoo National Park. This land incorporating the new additions has been previously logged in small areas and also under grazing leases for a substantial part of this century and this did not cease until after acquisition by the National Parks and Wildlife Service in 1999. The survey area is covered by two 1:25 000 topographic maps, namely; Bookookoorara and Boonoo Boonoo.

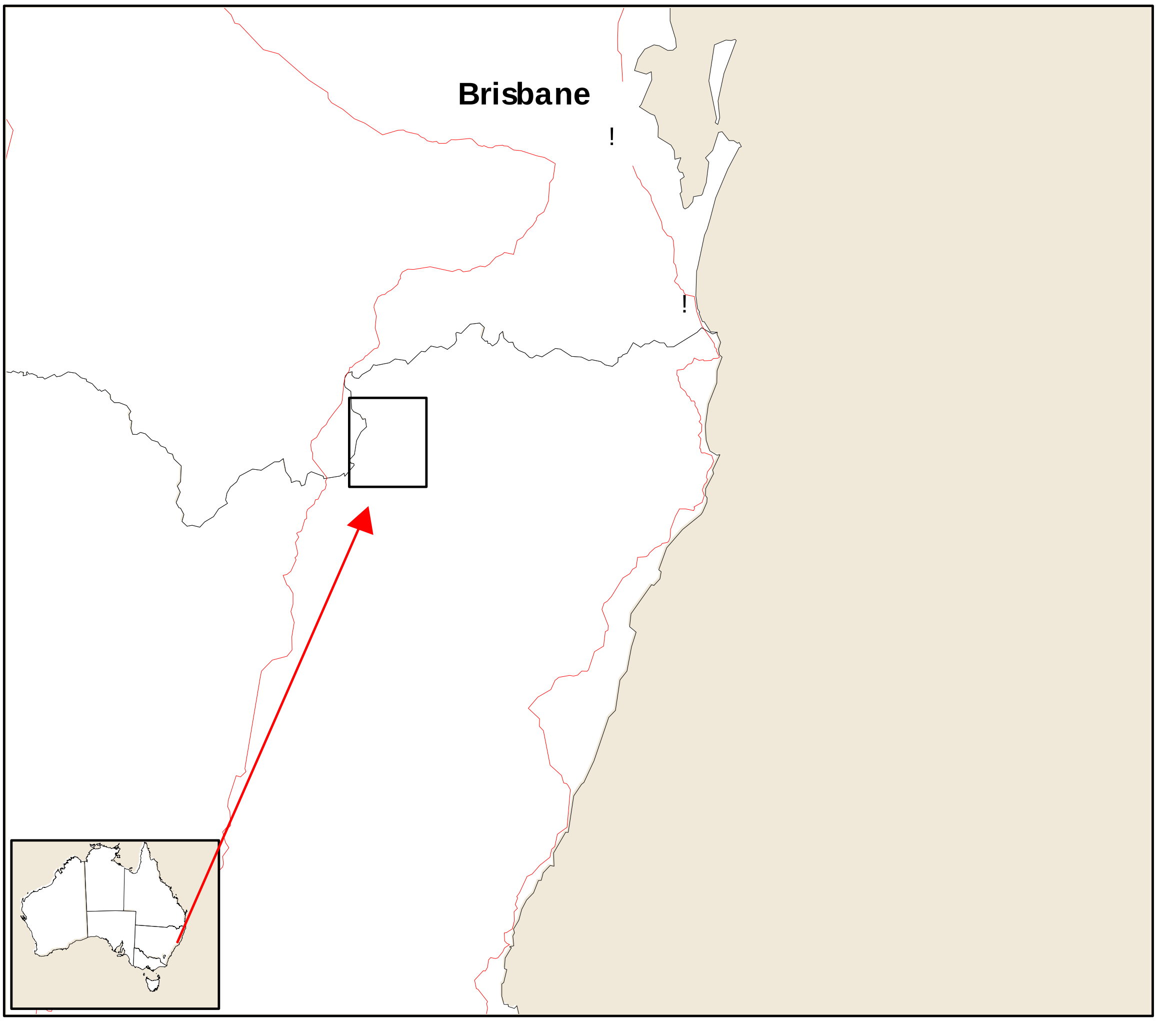


Figure 1: Location of the study region within north eastern New South Wales.

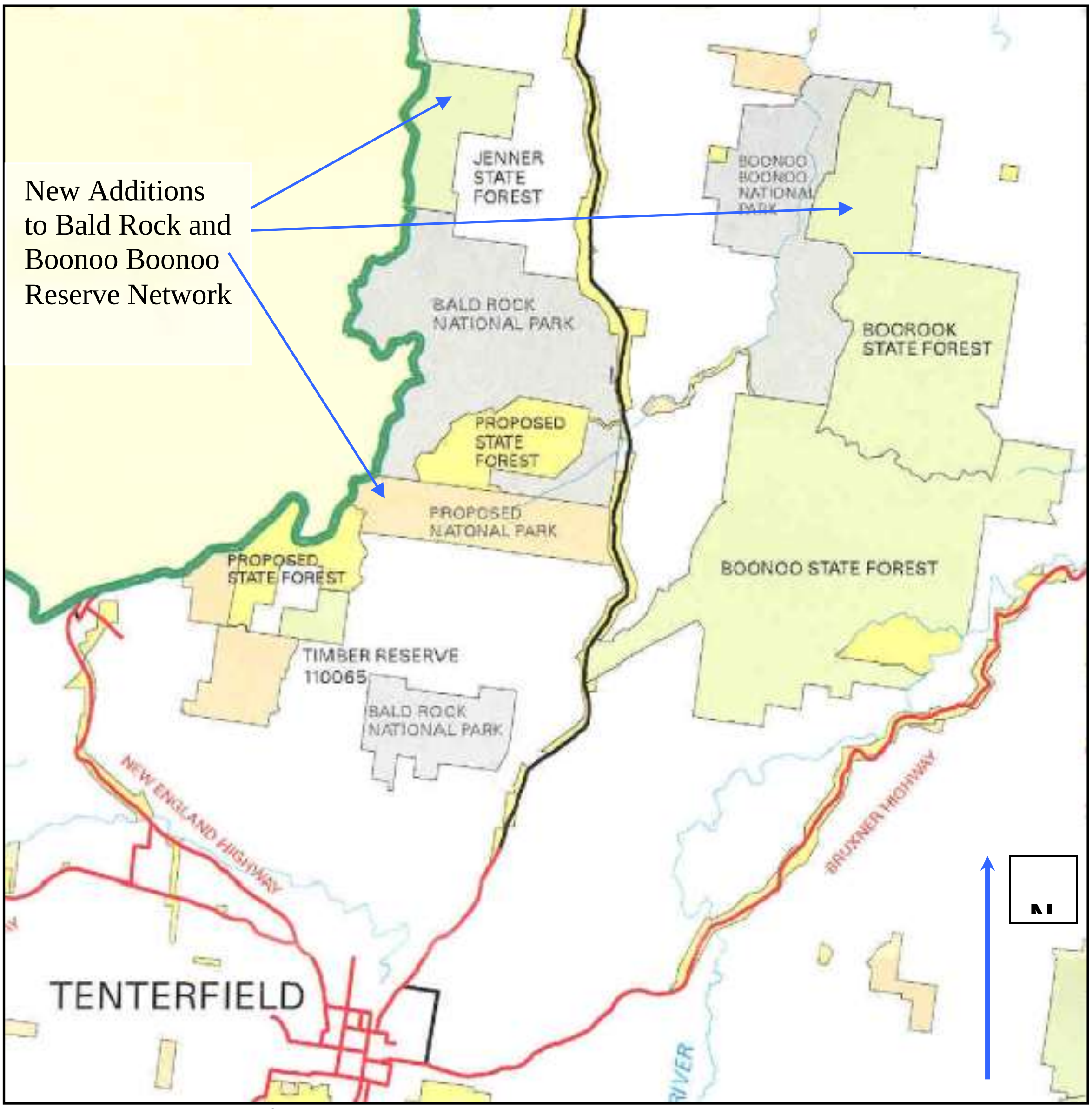


Figure 2: Location of Bald Rock and Boonoo Boonoo National Parks within the study area. The grey areas comprised the region encompassed by part one of the flora survey. New additions to these reserves which will be included in part two of the survey are indicated. Yellow areas constitute crown lands, green State Forests and cream are leasehold lands. (Map adapted from SFNSW 1995).

1.3 Conservation gains and gazettal of the additions

Bald Rock was originally reserved within 250 ha of land declared for public recreation in 1906. After some additions in the 1970's the area was gazetted as Bald Rock National Park. 1500 ha was added in 1987 linking the park to Girraween National Park. Gazettal of the original Boonoo Boonoo National Park was made in 1982 and comprised two parcels of land with a total area of 1345 ha. Additions have been made since that time bringing the total area to 4037 ha. Both parks have since had substantial lands added to them in 1999 due to acquisitions from State Forests under the north east forests agreements a (see Figure 2).

1.4 Climate

Rain falls mostly in the summer (60-70%) due to a predominantly easterly airflow from the Pacific Ocean and the effects of tropical cyclones from the north east (RACAC 1996a). Rainfall that falls on the western side of the batholith runs north and west; that on the east flows eastward towards the adjacent coast. Snow occurs occasionally at higher altitudes. Overall, rainfall ranges from 600-1000 mm annually in the west and 1000-2500 mm annually along the escarpment (RACAC 1996a). Great variability occurs in rainfall and one in every five years on average is drought declared (Division of National Mapping 1986).

The climate of the Bald Rock and Boonoo Boonoo National Parks is typical of the variation shown along the eastern escarpment of the North Coast and Northern Tablelands. The overall climate is temperate with the major variability occurring from east to west. The major regional atmospheric factors are the slow moving high pressure systems that travel from west to east and the fast low pressure systems associated with cold fronts moving from west to east (RACAC 1996a). Average rainfall and humidity decrease during winter and early spring and increase summer to early autumn. The higher tablelands experience a wider range of diurnal temperature fluctuations.

Rainfall in much of the study area is strongly influenced by orographic uplift that results in increased rainfall at the eastern (escarpment) edge of the park. Rainfall decreases with distance inland from the escarpment towards the west. Rainfall varies across the reserves with the highest levels along the eastern escarpment within Boonoo Boonoo National Park (*c.* 1300-1400 MAR). Rainfall drops sharply towards the western border of Bald Rock National Park (*c.* 800 mm MAR) (RACAC 1996a; McDonald *et al*. 1995). Mean annual temperatures are greatest within the lower altitude gorge areas (16-17°C) but are at there lowest on the higher parts of the tablelands, notably around Bald Rock (11-12°C). Dry south west to westerly winds predominate in the winter months.

The dissected nature of the terrain with a deep gorge and slopes leading to high plateau areas dominated by granitic inselbergs results in a range of microclimates. Varying inclination and aspect around the gorge and inselberg country and attendant gully systems greatly affects microclimate with some very steep and protected sites supporting lower than average evaporation rates and potentially double the precipitation due to shedding of water from outcrops.

1.5 Landform

Apart from the larger landform features such as Bornhardts and the Boonoo Boonoo Falls the landforms of both reserves are generally undulating to low hilly with a series of wide flat valleys. These valleys usually contain broad meandering swampy ground fed by the high runoff from the large outcrops. Elevations vary from a maximum of 1277 m (ASL) at the apex of ‘Bald Rock’ to *c*. 540 m (ASL) in the lower parts of the Boonoo Boonoo gorge. Slopes within the gorge areas are steep and slopes of greater than 30^0 are common.

Bald Rock National Park includes many bornhardts and other granite landscape features. The park includes the largest granite monolith in the Southern Hemisphere and the second largest rock within Australia (i.e. Bald Rock). Altitudes generally rise to the west and are at their highest along the NSW/Qld Border. As such most of the water flows to the east and Boonoo Boonoo River has its origins within Bald Rock National Park.

Boonoo Boonoo National Park as with Bald Rock also includes many large scale granite features with Mount Prentice, a large bornhardt, being a significant feature of the western side of the Park. Much of the park however is dominated by the Boonoo Boonoo River which more or less travels through the centre of the reserve. The lands systems within this reserve thus primarily fall towards the river. Boonoo Boonoo Falls is one of the more dramatic landscape features of the reserve and is situated near the northern boundary of the park. The falls have a 60° slide and a 210 m drop into a deep granite gorge.

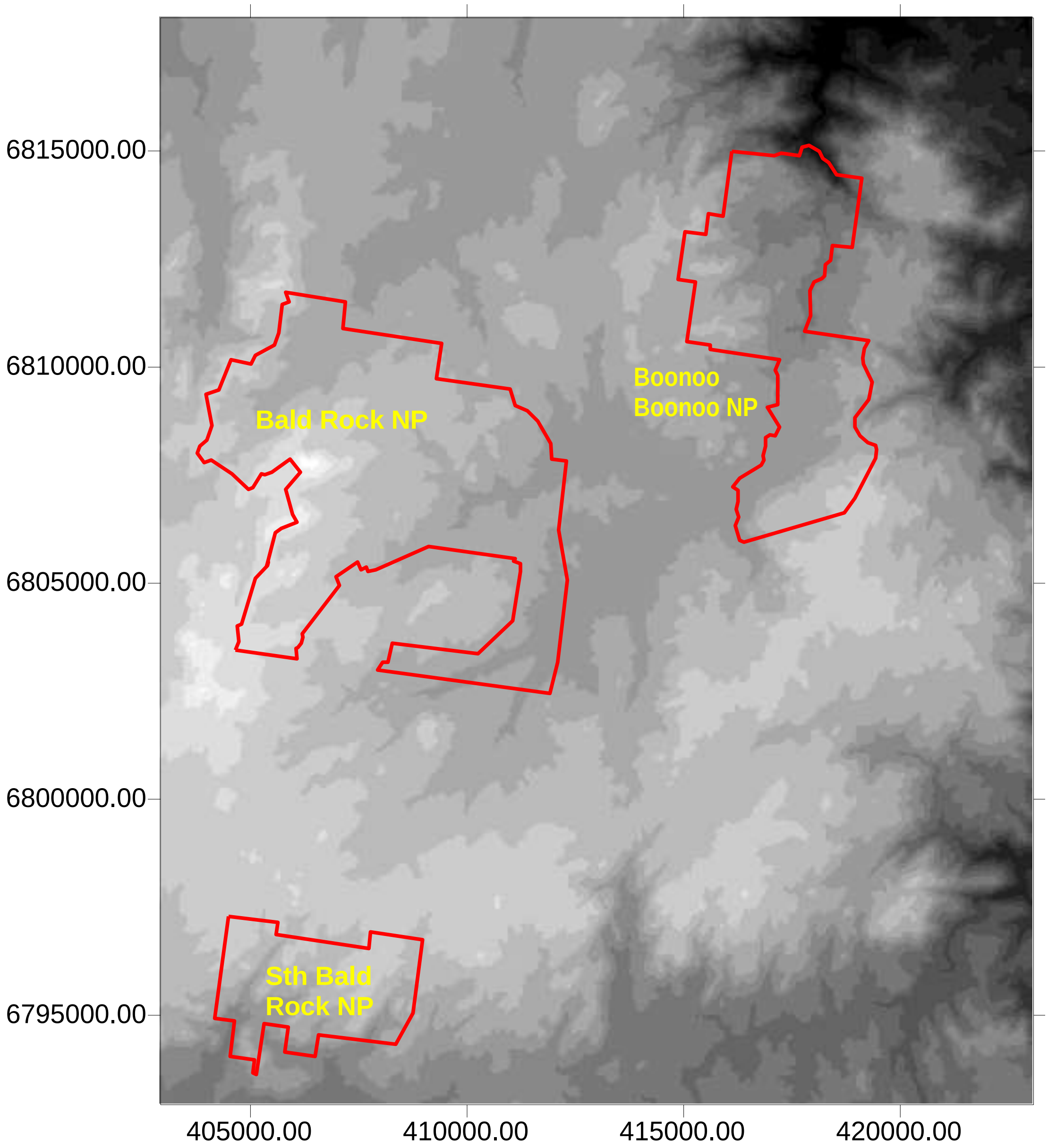


Figure 3: Topographic patterns in the area containing the Bald Rock and Boonoo Boonoo National Parks, boundaries for the reserve do not include more recent additions. Drainage patterns run west to east. Axes are in AMG Co-ordinates.

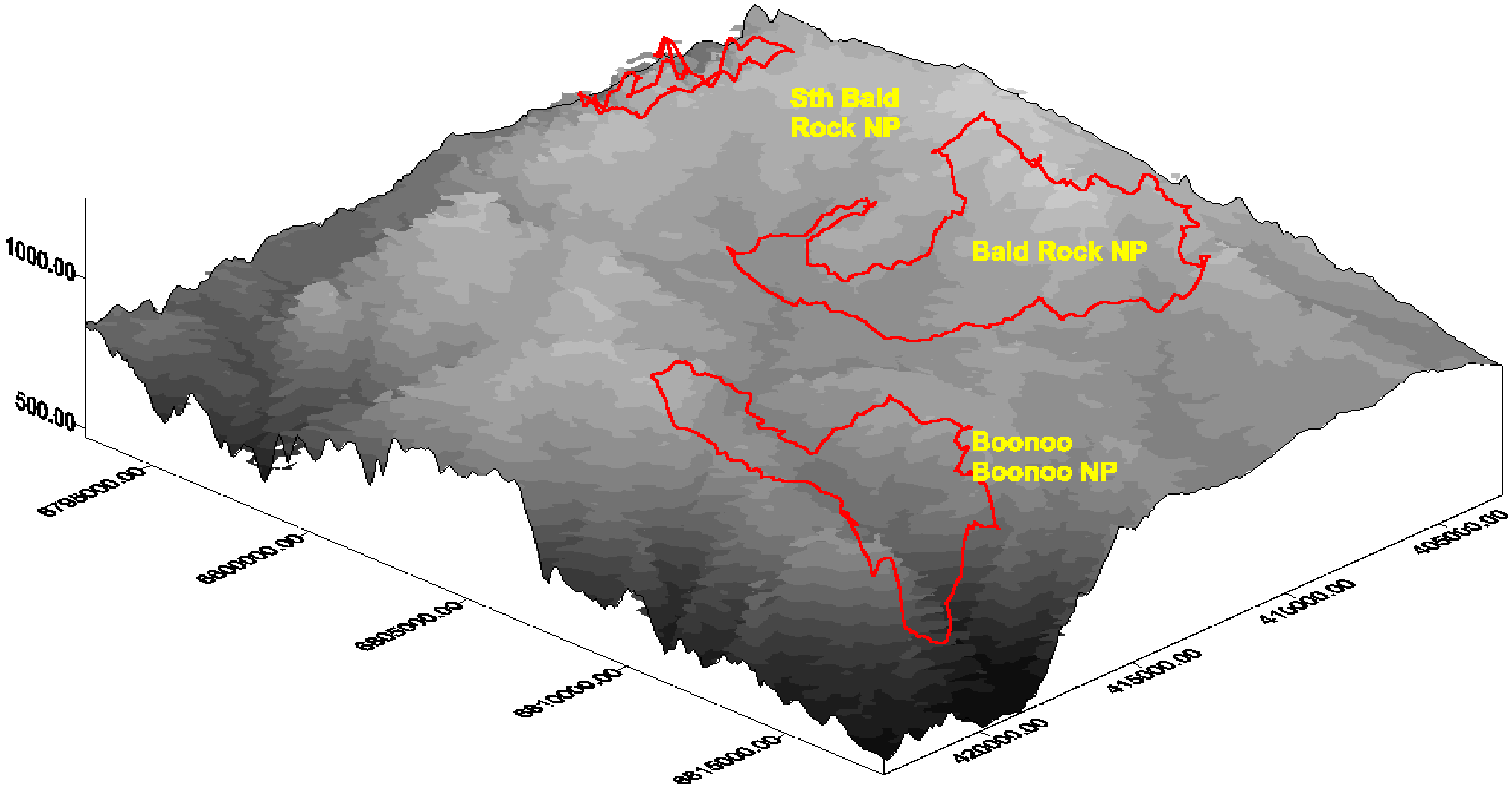


Figure 4: 3-D view of Landform and altitude changes with associated drainage patterns in the area containing the Bald Rock and Boonoo Boonoo National Parks; boundaries for the reserve do not include more recent additions. The red lines indicate the boundaries of this current survey.

1.6 Geology and geological setting

Granitic rocks are the main component of continents. Granite is an igneous rock comprising crystals of quartz, feldspar, mica and/or hornblende or pyroxene (Myers 1997). Quartz and feldspars make up 90% of the rock and it is the proportions of these and the kinds of feldspars that are used in dividing granitic rocks into different types (Myers 1997). A complex of related granitic bodies joined at the subsurface is termed a batholith (Twidale 1982; Myers 1997).

The New England Orogen (NEO), of the New England Fold Belt (NEFB), is a belt of complex geology interpreted to be a tectonic collage of a number of terranes that amalgamated with, and accreted to the eastern margin of Gondwana during the late Paleozoic-early Mesozoic (Flood & Fergusson 1984; Flood & Aitchison 1993) (Figure 4). It is the easternmost tectonic element in the Tasman Orogenic Zone of eastern Australia, and the youngest (Schreibner 1993). It extends for 1500 km from Newcastle in the south almost to Bowen in the north (Murray 1998) (Figure 5). The setting for the assemblage of the majority of these terrains was an active continental convergent margin (Flood & Aitchison 1993) that comprised three major morphotectonic features: The western magmatic arc (an Andean style volcanic chain concealed in the southern NEO); the forearc basin; and the subduction complex or oceanic trench (Day *et al.*1978). The genesis of the NEO began in the Cambrian and extended through various phases of uplift and deformation to the Triassic, with igneous activity lasting through to the Jurassic (RACAC 1996).

With the culmination of the orogenic episode most of the granites formed from the melting of freshly deposited volcanic sediments (RACAC 1996a). These granites form the New England Batholith (Barnes *et al*. 1988). The batholith extends for 400 km in length and 110 km in width, from Stanthorpe in Queensland to Tamworth in New South Wales (Leigh 1968) (Figure 5). It formed during a major period of plutonism between 265-220 Ma ago (Barnes *et al.* 1988). These are some of the youngest granitic rocks within Australia, with those in Western Australia being around 3600 Ma (Willmott & Stephenson 1989). About 255 individual plutons form at least 20 aggregated outcrop areas (Barnes *et al.* 1988). These aggregated areas extend semi-continuously through the central New England Orogen (Leigh 1968; Barnes *et al.* 1988). This represents one of the most significant areas of granitic outcrops in Australia. Within the batholith is Bald Rock, the largest granitic rock and the second largest rock in Australia, being 150 m high, 750 m long and 500 m wide (400 ha in total) (Leigh 1968; Walker 1982) (Figure 5).

In northeast New South Wales, outcrops of granite have been called 'tors'. This term is ambiguous as it is used for all types of granitic landforms including single boulders to large massifs. Twidale (1982) has attempted to clarify the terminology used. This work along with a synopsis presented by Campbell (1997) and Main (1997a), describe the majority of features found in granitic landscapes. A *precis* of some of the more significant features as described within these works is briefly presented here. Reference should be made to these works for further detail or for definitions of additional terms.

- Massif: a large elevated feature formed from an orogenic belt that differs in topography and structure from the adjacent terrain.
- Inselberg: large steeply sided 'island' mountains that arise abruptly from their surroundings. They arise more abruptly than monadnocks.
- Monadnock: an isolated hill or mountain where surrounding areas are level to their limits.
- Bornhardt: is the basic inselberg feature. They are large dome-shaped monoliths, bald and steeply sided with few fractures whereas the surrounding landscape is highly fractured. This feature is further divided. 'Whalebacks' are elongated and elliptical. 'Turtlebacks' are symmetrical with steeply sloping flanks. 'Elephant rocks' are symmetrical in profile. 'Domes' have plan axes of similar length and altitude. 'Sugarloaf' is high and narrow along the plan axis. A bornhardt is the basic positive relief landform from which nubbins and kopjes are formed.
- Nubbin: a block or boulder strewn, hill-sized inselberg.
- Kopje: also known as koppie, a feature comprising angular and blocky rocks in castellated form.
- Pediment: essentially flat or gently sloping rock platform, often grooved and dimpled and slightly included away from an adjacent upland.
- Gnammas: rock basins that are circular, elliptical or irregular depressions in solid bedrock.
- Pavement: a small exposure of low and relatively plain relief.

- Fugitive outcrop: a subsurface basement, high but not yet fully exposed.

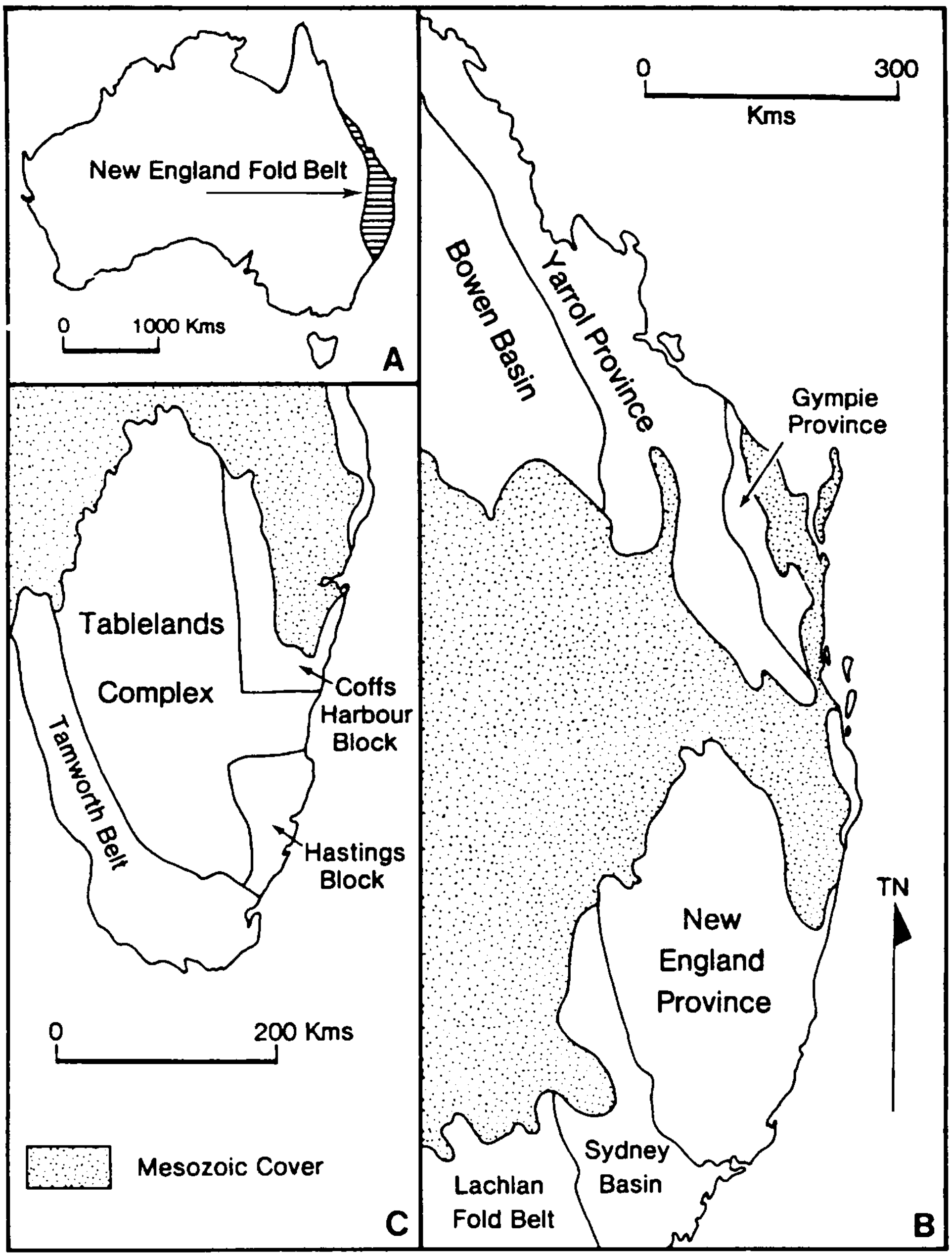


Figure 5: Geological setting. Taken from Flood and Fergusson (1984). A) Location of the New England Fold Belt (or Orogen). B) Subdivisions of the New England Fold Belt. C) Subdivisions of the New England Province.

1.7 Aboriginal landuse

The chronology of Aboriginal prehistory in the district is poorly known. Occupation of the tablelands probably occurred around the mid-Holocene (State Forests of New South Wales 1995). A brief account of Aboriginal occupation and utilization of the north east of New South Wales is given in RACAC (1996c). The granite belt lay on a pathway from northern New South Wales to the Bunya Mountains where aborigines from many areas gathered. The area encompassing these two reserves was included within the districts of the Bundjalung and Kambu-Wul tribes.

1.8 European history and landuse

The initial settlement of this region of New South Wales occurred in 1843 with a Pasture Licence being taken up by Robert Mackenzie for the Tenterfield Run. Early interests were mainly in cattle grazing (Gilmour & Helman 1993). It wasn’t until the 1860’s that extensive clearing began after the introduction of the Robertson Selection Acts (Pearson 1992; RACAC 1996b). By 1890 *c.* 10% of the Northern Tablelands had been ring-barked or cleared (Benson & Ashby 1996). Pasture improvement with a range of exotic species commenced in the 1920s and by the 1970s 19% of the region was sown to improved pastures (Benson & Ashby 1996).

By the late 1860s sawmills were set up in the region (e.g. Bolivia Station) and by the 1880’s there were sleeper cutting operations in the Mount Spirabo area (Pearson 1992). The Forestry Commission was established in 1917 (Pearson 1992). Logging in within the reserve has been selective and has predominantly occurred within the recent new additions. In particular logging occurred within parts of Jenner State Forest in the 1990s. Parts of Boorook State Forest that are now incorporated within the Boonoo Boonoo were logged in the 1970s and also pre-1960 (SFNSW 1995). Mining occurred throughout the region and alluvial tin was found in 1864 (McDonald *et al*. 1995) however a rush did not occur until 1872 (Harmon-Price 1995). At Morgan’s Gully within Boonoo Boonoo National Park there is an example of a race that was cut through the solid granite in order to lower the bed level of the creek to assist in draining the area for mining at the turn of the century (Walker 1982).

1.9 Past fire history and grazing

Wildfires are a common feature of this area of New South Wales. The new additions which where under the management of the State Forests had prescribed fire frequencies of 3-5 years for plateau areas, 4-7 years for gorge country and more than 10 years wetter areas at higher altitudes. It appears that in much of the better grazing areas on the plateau leaseholders probably kept fire frequencies closer to every three years. Grazing permits existed over much of the current reserve until reserve declaration. Most leases were only lightly grazed although burning was an intrical part of grazing practices to create ‘green pick’ for cattle. The largest fires recorded in the area for many years occurred in late 1994 when up to 90% of Bald Rock and the neighbouring Girraween National Parks where burnt.

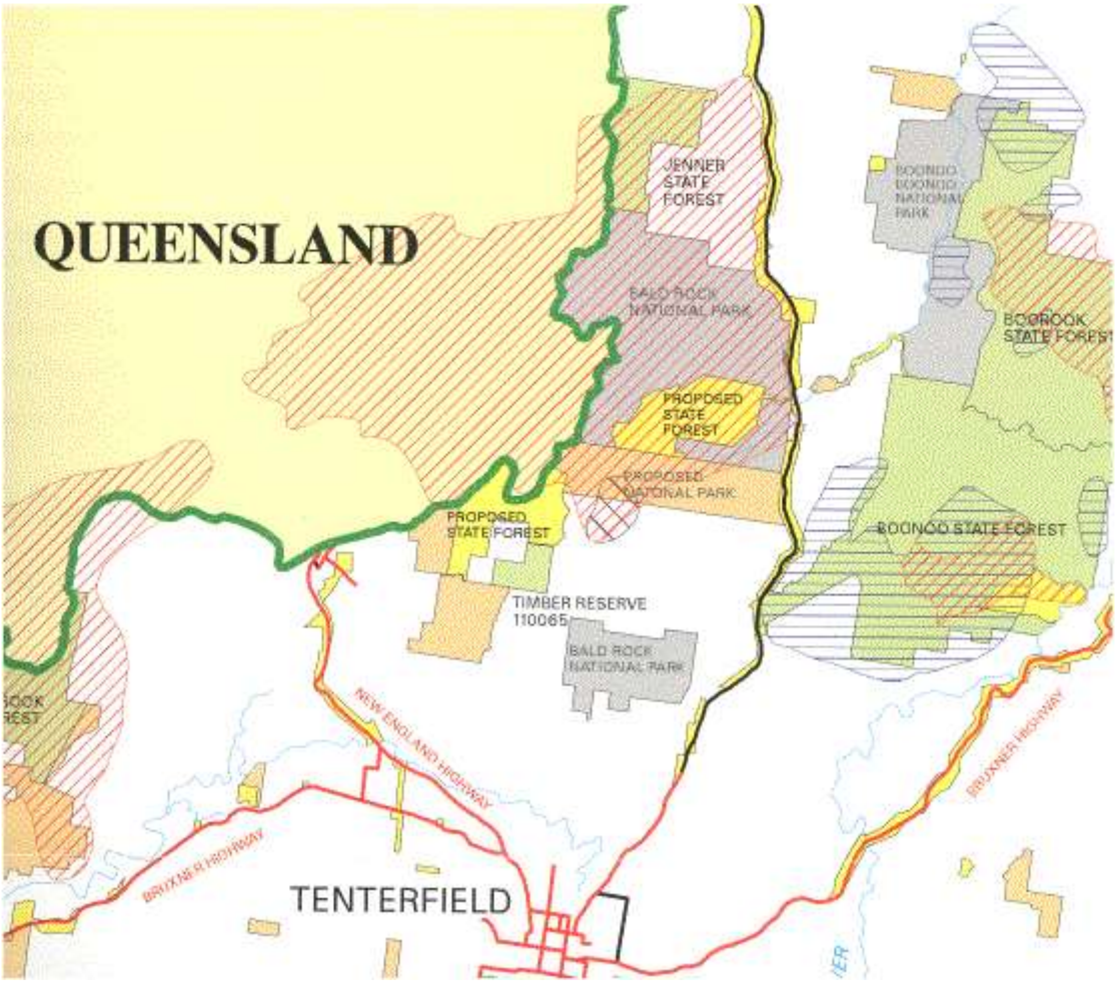


Figure 6: Past fire history of the region. Blue horizontal = 1988-1991. Black diagonal = 1991-1994. Red diagonal = 1994-1995. Taken from SFNSW (1995). Note the large and extensive fires of late 1995. Subsequent fires have occurred over the last 10 yrs.

1.10 Botanical exploration

Alan Cunningham was a botanist and explorer who first passed through this area in 1827 in search of an inland route to Morton Bay from Sydney (Figure 7). Cunningham traveled between Bald Rock and Mount Norman (Girraween NP) on June 26th and stated that he saw '*large detached masses of granite of every shape towering above each other, and in many instances standing in almost tottering positions, constituted a barrier before us*'.

Some of the earliest publications on the vegetation and flora of the north east of New South Wales are those of Turner (1903; 1906). Several collecting trips were made by Botanists from the Botanic Gardens in Sydney over many decades particularly by Maiden, Boorman and Betche. Stanley Blake and Cyril White also collected in the area in the 1930s and 1940s. Many local professional and amateur botanists were also active in this and other parts of the New England namely, Rupp, Blakely, McKie and Youman to name a few.

It wasn't until the late 1950's and early 1960's that any concerted effort was made on surveying the vegetation and flora of the New England. Unfortunately due to arguments amongst those carrying out the surveys, all site data was destroyed and the only record remaining of this work is the annotated checklist published by Gray (1961). Williams (1963) described the major changes in vegetation across the eastern scarp to the western slopes. Williams made his first collected trip to the targeted parks in 1966. Williams (1995) surveyed the dynamics of sedge-heaths on the tablelands at Gibraltar Range National Park (published in Williams & Clarke (1997)). McDonald *et al*. (1995) presents the first published collective checklist of the flora of Bald Rock. It is only in the last decade that a concerted effort has been made to systematically survey the various communities and flora that occur on the New England and the escarpment.

Nearby reserves that have been surveyed systematically include the Torrington State Recreation Area (Clarke *et al.* 1998) and the Demon Nature Reserve (Hunter *et al*. 1999). A number of targeted surveys have occurred in the near or within Bald Rock and Boonoo Boonoo National Parks primarily in last ten years. Roberts (1982) surveyed sites within Bald Rock National Park as part of his thesis on granite vegetation in the New England. A student field trip from the University of New England sampled a number of sites within Boonoo Boonoo National Park in 1994 and a compilation of these efforts is presented by Clarke (1998). State Forests of New South Wales (Binns 1995) conducted a systematic survey of forestry lands (some of which is now incorporated in the current reserves) in 1994. The extensive Natural Resources Audit Council (1995) and the North East Forest Biodiversity Study (1995) surveys of the north east placed sites within and nearby the reserve and subsequently mapped the forest types by Air Photo Interpretation (API) within the two reserves (Figures 7 & 8). Gilmour (1993) surveyed rainforest communities in the Clarence Valley and placed a site within Boonoo Boonoo National Park. Hunter (1999) surveyed primarily outcrops but also forested sites within Bald Rock and Boonoo Boonoo National Parks and across the tablelands in general for a comprehensive biogeographic assessment of outcrop floras (Hunter & Clarke 1998; Hunter 1999). More recently Hunter and Bell (2007ab) have surveyed and analysed the compositional changes in montane bog communities within the New England, including those within Bald Rock and Boonoo Boonoo National Parks.

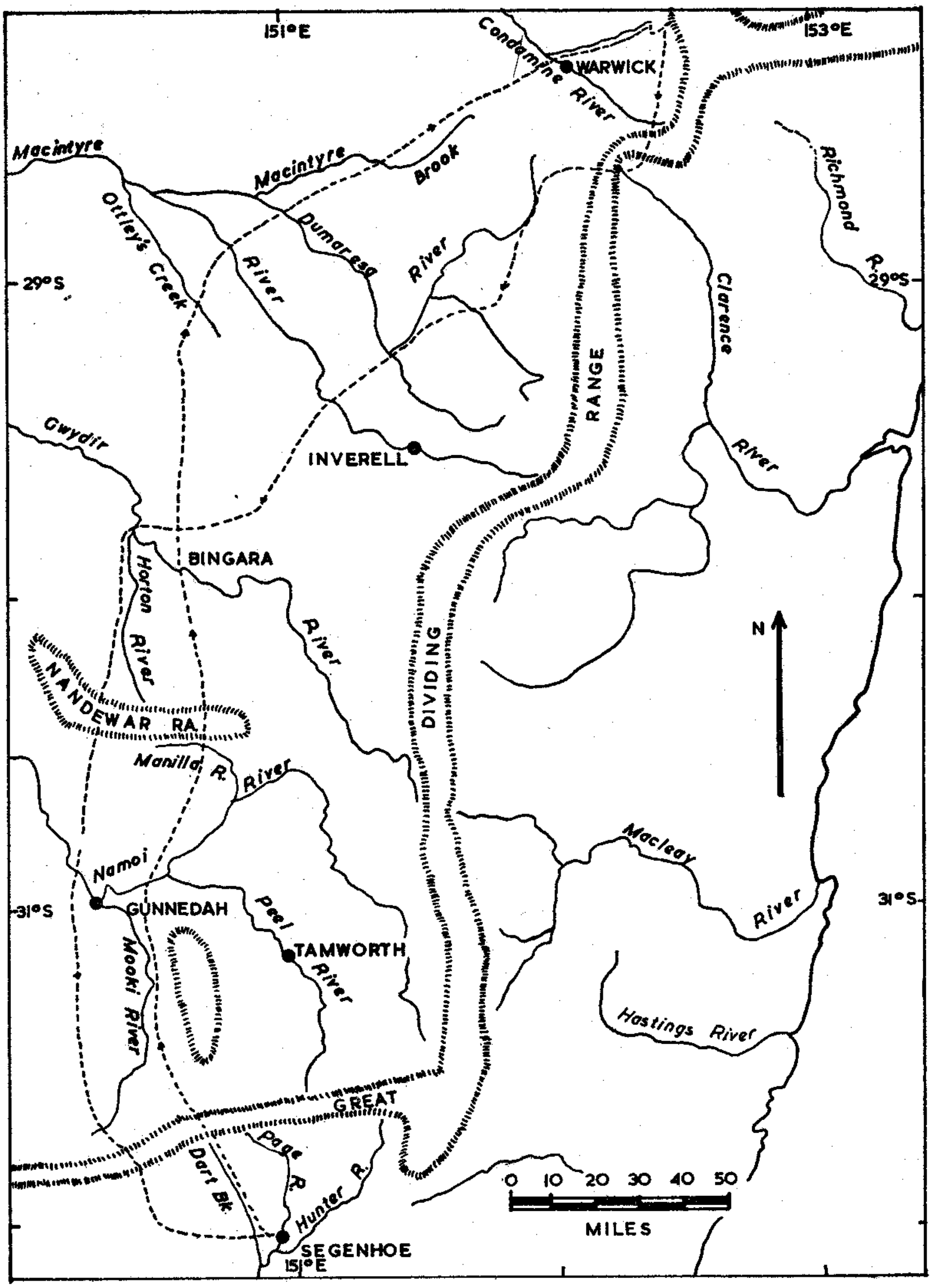


Figure 7: Exploration route of botanist and explorer Alan Cunningham in 1827. Taken from McMinn (1970).

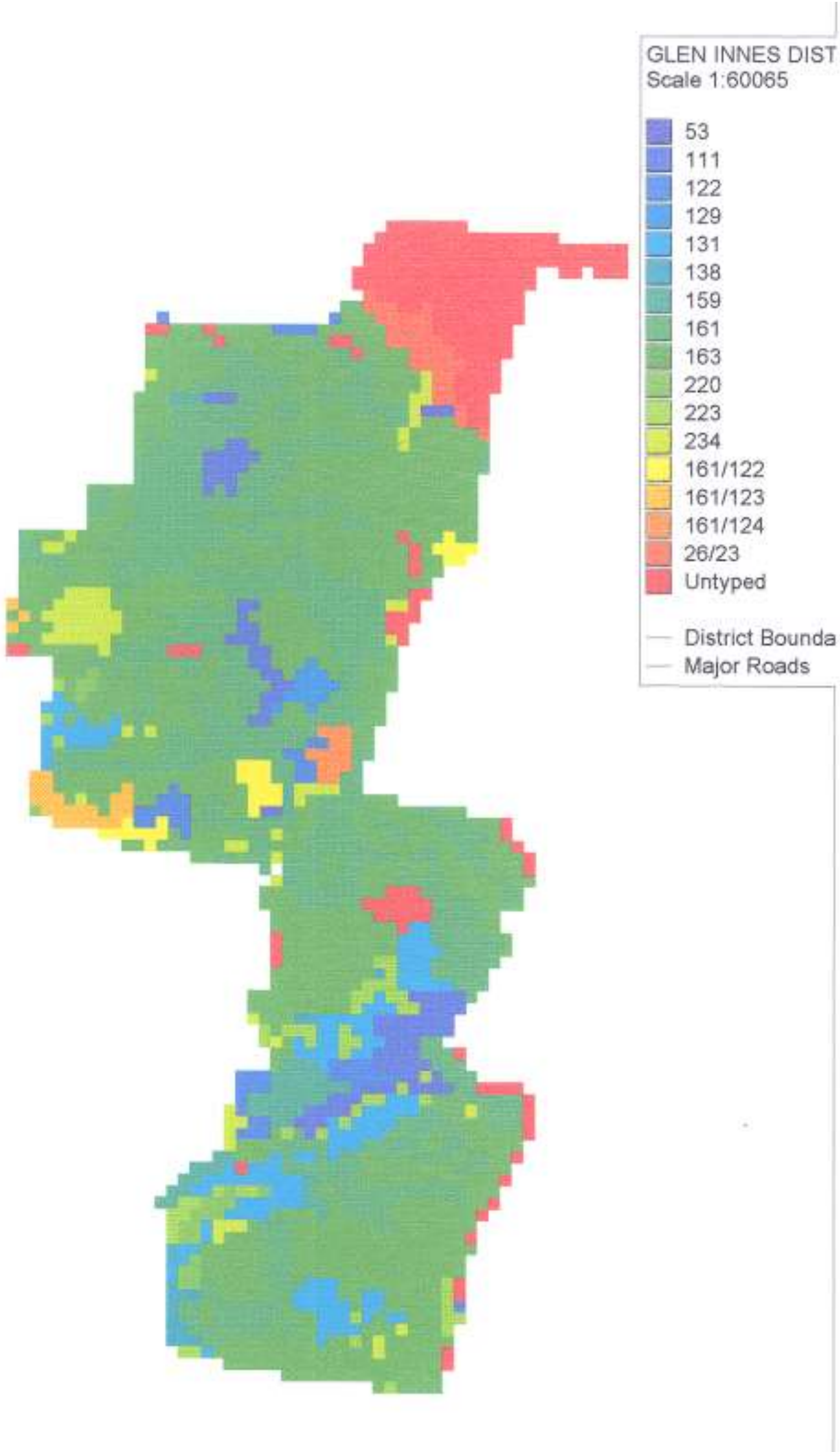


Figure 8: NRAC API forest type map for Boonoo Boonoo National Park. See Figure 8 for code breakdowns.

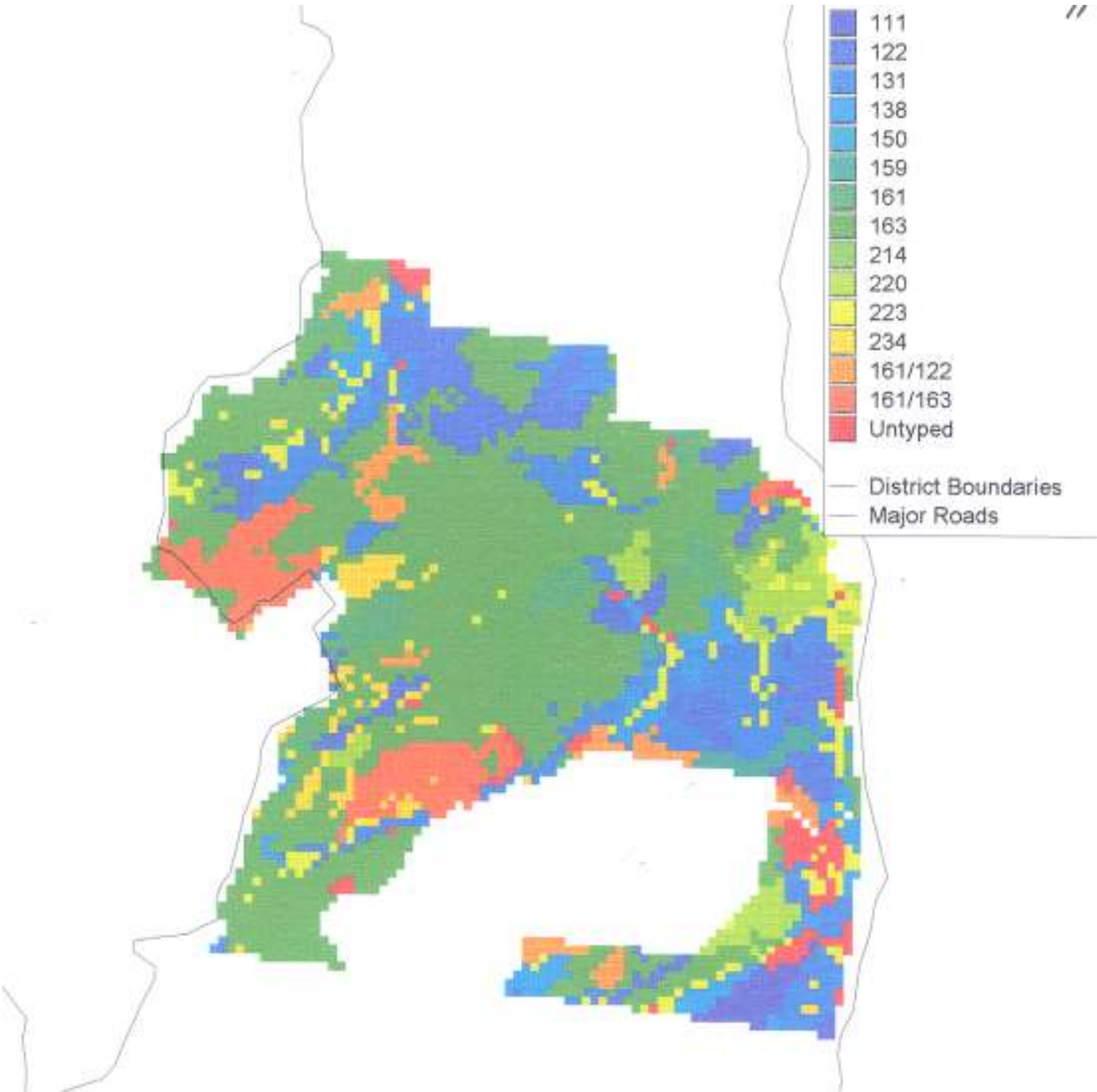


Figure 9: NRAC API forest type map of Bald Rock National Park. Codes for Figures 7 & 8 are: 53 = Brushbox; 111 = Stringybark – Peppermint; 122 = New England Stringybark; 129 = *Angophora floribunda*; 131 = Peppermint – Gum; 138 = Snow Gum Woodland; 150 = Messmate; 159 = Mountain Gum; 161 = Brown Gum; 163 = New England Blackbutt – New England Stringybark; 214 = Wattle; 220 = Cleared; 223 = Heathland – Sedgeland; 234 = Rock Outcrop; 26/23 = Depauperate Regrowth of Rainforest.

1.11 Review of literature concerning granite outcrop vegetation communities

1.11.1 The outcrop environment

Inselbergs, or granitic outcrops form a major landscape component of Bald Rock and Boonoo Boonoo National Parks. Bald Rock itself is the largest granitic monolith in the southern hemisphere and is the second largest rock in Australia. A vast literature on the forested systems of eastern Australia exists and is readily available from numerous sources. However, information regarding the dynamics of communities on outcrops is scantily presented across a number of mainly overseas journals, and hence is not available generally to land managers. This is despite the fact that many of the rare and threatened flora species in north eastern New South Wales are restricted to such habitats. As such it is appropriate that a literature review concerning these environments should be collated and presented briefly within this report. This present review is taken from Hunter (1999).

Spatially, granitic outcrops frequently occur as clusters with exposures separated by a few kilometres or less, and much greater distances separating the clusters in turn from one another (Murdy 1968). This 'island-like' environment has ramifications for the distribution of plants and, potentially, the genetic divergence of their component populations. In addition outcrops, along with many other specialised systems (e.g. cliffs), are harsh and stochastic environments compared to others with the same macroclimate (Phillips 1981; Phillips 1982; Houle & Phillips 1989b; Dorrstock *et al.* 1996). In general it is not the average climate, as expressed in its many variables (e.g. mean daily temperature or yearly average rainfall), but the rarer extremes that limit plant survival. Granitic outcrops are systems in which the extremes of climate are encountered more frequently, and often with greater intensity (Dorrstock *et al.* 1996). The microclimate of granitic outcrop systems is diverse over very small distances (Hambler 1964; Uno & Collins 1987). Many extreme variations in microclimate may be persistent for extended periods (Hambler 1964; Porembski *et al.* 1996), however most occur only temporarily (Hambler 1964; Burbank & Phillips 1983). Thus there are 'stresses' that impede the establishment and persistence of plants on granite outcrops (Uno & Collins 1987). In turn, these same 'stresses' may also aid the rapid evolution of the component flora, both in terms of co-evolution of adaptive life history traits and in the divergence of individual populations.

The most noticeable feature of granitic outcrop environments is the lack of true soil development (Platt 1951). Plants often persist in a thin layer of organic dust overlain by coarse granite shingle (Gillham 1961). The skeletal soil, composed primarily of organic matter, is very acidic, commonly between pH 4 and 5 (Hambler 1964; Jones 1964; Rundel 1975; Phillips 1981; Dorrstock *et al.* 1996). Such a low pH significantly affects the availability and/or toxicity of many nutrients (Meyer *et al.* 1960). An increase in soil depth has also been correlated with a higher average pH and a greater cation exchange capacity (Shure & Ragsdale 1977). One of the most pertinent effects of poor soil development for plants, is the lack of water retention. A relatively minor increase in soil depth can dramatically prolong water retention capabilities (Burbank & Platt 1964; Houle & Phillips 1989a). These thin soils rapidly dry out after rain and have little or no moisture available for extended periods (Murdy *et al.* 1970; Chapman & Jones 1975: Uno & Collins 1987; Baskin & Baskin 1988). The low water retention of soils is accentuated by heat absorption of granite, high incident radiation and winds, little cooling from evapotranspiration and high runoff (Phillips 1981; Phillips 1982; Walters 1982; Baskin & Baskin 1988; Houle & Phillips 1989a; Ware 1990; Dorrstock *et al.* 1996). It is estimated that 45 to 47% of rainfall is shed from outcrops after individual storms and that depending on the granitic outcrop characteristics, up to 95% runoff can be expected (Walters 1982; Moran & Hopper 1983; Lawler *et al.* 1997; Wyatt 1997). Such a high incidence of runoff means that at the least, the available moisture afforded to the vegetation on outcrops is almost half that of the surrounding vegetation matrix, if not a great deal less. This also means that the vegetation immediately surrounding large outcrops may receive up to double the effective rainfall of the general vegetation of the region. Conversely on outcrops, extended waterlogged conditions often occur depending on the topography of the available soil pans. Plants often have to contend with waterlogged situations followed by times of intense drought, within a matter of days. Few species are able to cope with such alternating submergence and desiccation (McVaugh 1943).

The overall macroclimate of a region is further modified on exposed granitic surfaces in terms of temperature. Temperatures are often 8-18°C higher than that of the ambient air

(Winterringer & Vestal 1956; Shure & Ragsdale 1977). Platt (1951) recorded surface temperatures of 63°C in summer with temperatures of 55-60°C being very common for 4-5 hrs of the day (Erickson *et al.* 1973; Phillips 1982; Walters 1982; Uno & Collins 1987; Reinhard & Ware 1989; Porembski *et al.* 1995; Dorrstock *et al.* 1996; Porembski *et al.* 1996). The low temperatures are also extreme, and the diurnal variations that are met by plants on outcrops are high (Jones 1964). Mares (1997) reported air temperature changes of up to 38°C over a 24-hour period on a granitic outcrop.

Variation in microclimate can be dramatic within a single granitic outcrop, due to aspect, slope, structural vegetation type and cover and topographic and micro-topographic variation (Ashton & Webb 1977). Hambler (1964) showed that the soil temperatures on a single vegetated patch on a granitic outcrop varied from 50°C in ephemeral flush vegetation to 35°C within the adjacent *Andropogonetum* patch. Uno and Collins (1987) showed that in an open herbfield the soil temperatures could be up to 6°C cooler under herbs than on unvegetated adjacent soil. Saplings and trees tend to stabilize the microclimate and contribute to the establishment of more mesic conditions (Phillips 1982; Burbank & Phillips 1983). Compared with large outcrops, small sized rock outcrops have less pronounced variation in microclimate (Porembski *et al.* 1996). The density of vegetation and the amount of exposed granite that surrounds a vegetation patch can dramatically ameliorate, or accentuate the extremes of environmental conditions (Houle & Delwaide 1991).

The wet and, more commonly, the dry extremes accentuate the severity of living conditions for outcrop taxa (Winterringer & Vestal 1956). Evaporation is rapid and drought is common. High temperatures, winds and incident radiation accentuate this. The majority of the rainfall that does occur is lost as surface runoff. In winter, cold temperatures and winds are just as detrimental to the survival of species (Hopper 1981; Phillips 1981). Such harsh conditions are met frequently and fluctuate greatly both seasonally and diurnally. Such abrupt changes are a strain physiologically on taxa (Oosting & Anderson 1937) and constitute extremely limiting environments (Maycock & Fahselt 1992). Granitic outcrops are environments that are commonly inhospitable to mesic invaders (Fleischmann *et al.* 1996) and constitute edaphic and micro-climatic deserts (Houle & Delwaide 1991; Porembski *et al.* 1994; Gr★ger & Barthlott 1996;

Porembski *et al.* 1996), even within macro-climates of high rainfall (Dorrstock *et al.* 1996). It is believed that coping with seasonal or unpredictable drought is the most significant survival strategy faced by the granitic outcrop flora (Kirkpatrick *et al.* 1988; Houle & Phillips 1989b; Groger & Barthlott 1996; Hopper 1999).

The patterns shown by disjunct, relict and introduced species are likely to be different to those of endemics. Burgman (1987) showed that granite outcrops in Western Australia were important sites for relictual and recently evolved taxa. Some notable records are of disjunctions over 1 500 km (Porembski *et al.* 1994). Within perhumid areas, outcrops provide opportunities for disjunct occurrences of arid adapted species (Erickson *et al*. 1973; Porembski *et al.* 1994; Ibisch *et al*. 1995; Porembski *et al*. 1996). Outcrops also provide, through their diverse range of microhabitats and low competition niches, for other relictual species to persist in fluctuating environments beyond their main range (Erickson *et al.* 1973; Abbot 1984; Hopper *et al.* 1997; Main 1997a; Burke *et al.* 1998; Hopper 1999). Main (1997a) believed that outcrops provided opportunities for the maintenance of a co-operative of refugees. It has been hypothesised that within fire prone environments, such as those within Bald Rock and Boonoo Boonoo National Parks, granite outcrops also provide places for relictual taxa that have not evolved to cope with this factor (Moran & Hopper 1983; Craven & Jones 1991; Binns 1992; Fuls *et al.* 1992; Gr★ger & Barthlott 1996; Beard 1997; Hopper *et al.* 1997; Lawler *et al.* 1998).

Uno and Collins (1987) showed that many outcrop species could be found off outcrops in disturbed habitats. Hopper (*pers. comm.* 1998) has also found that some granitic outcrop endemics may become weeds in other areas when transplanted from granitic outcrops in Western Australia. Such observations led Wyatt (1997) to postulate that some ‘weedy’ taxa may have originally been restricted to granitic outcrops and have since spread more recently to sites disturbed by human activities.

Hopper *et al.* (1997) presented results of multivariate analyses on the distribution of orchid taxa on granitic outcrops. They remarked on the fact that closely adjacent rocks were widely separated in the classification yet some geographically separated rocks had similar orchid floras. It is evident that even the most prominent taxa exist in small isolated populations in which there is little migration (Wyatt 1984). Larger populations on outcrops are often found to be, on closer inspection, subdivided into a number of smaller stands isolated from each other by areas of sheet granite (Moran & Hopper 1983). In addition to the lack of some of the more prominent taxa, there is also the inclusion of a number of taxa with very low constance (Porembski 1995; D★rrstock *et al.* 1996).

1.11.2 Adaptations and lifeform traits of granitic outcrop vegetation

Species have adapted to tolerate the harsh physiological conditions on granitic outcrops in a multitude of ways. The means by which species are able to endure this environment, the success of such adaptations or whether there has been time to evolve such adaptations has implications for the potential richness and diversity of these habitats. Basic requirements of outcrop species are tolerances of high temperatures, desiccation and high light. In addition to physiological adaptations, species that are more or less restricted to outcrops exist in a mosaic of small isolated populations that may be separated by great distances, and therefore the effectiveness of cross-pollination and dispersal may be limited.

Outcrop plants often show gross morphological characters that aid drought tolerance, such as root systems that can penetrate small fissures and hoary and narrow leaves (Erickson *et al.* 1973; Uno & Collins 1987). Other common morphological characteristics include succulence (Fleischmann *et al.* 1996) and storage organs. Survival via underground storage organs is a method of drought avoidance commonly noted (Pate & Dixon 1982; Houle & Phillips 1989b; Hopper *et al.* 1997; Hopper 1999). Pate and Dixon (1982) discovered that species from granitic outcrops in Western Australia commonly had storage organs with a high nitrogen content allowing almost total desiccation during aestivation. These adaptations were thought to be unique response to the outcrop habitat.

Chapman and Jones (1975) found that even ubiquitous taxa shared by outcrops and the surrounding vegetation could be physiologically and chemically differentiated, with outcrop forms being more drought tolerant. The growth and photosynthetic rates of outcrop endemics have been shown to be maximal in high light environments (Baskin & Baskin 1988: Houle & Delwaide 1991). Research has proven implicitly that outcrop taxa have a much higher drought tolerance than species from the surrounding communities (Ashton & Webb 1977; Ware 1991).

Other plants on outcrops have evolved dormancy and germination cues that enable them to avoid drought periods rather than persist through them. Baskin and Baskin (1982) discovered that 85—90% of freshly matured *Arenaria* seeds from outcrops were innately dormant and that the 10—15% that germinated only did so at temperatures lower than those that occur in the habitat at the time of seed dispersal in summer. Similarly, Wyatt (1983) found that seeds of *Sedum* required a period of physiological after-ripening and were therefore restricted to autumn germination. Dorrstock *et al.* (1996) also found that dormancy prevented germination of many species within the last weeks of the rainy season on outcrops of the Ivory Coast. Dormancy was only broken in this system by a period of high temperatures followed by rain thereby preventing germination after sporadic rains in the wrong season. Such dormancy and germination characteristics are usually coincident with an annual life history that is the most common lifeform on outcrops (Erickson *et al.* 1973; Ornduff 1987; Uno & Collins 1987; Baskin & Baskin 1988; Porembski *et al.* 1994; Ibisch *et al.* 1995; Dorrstock *et al.* 1996; Hopper *et al.* 1997; Wyatt 1997). Long term dormancy of up to 100 years has been found in some outcrop species (Keever 1957). Avoidance of drought can also be achieved by survival during periodic drying out. Many species on rock outcrops have been termed ‘resurrection’ plants such as species of *Borya*, *Cheilanthes* and *Pleurosorus* on Western Australian outcrops (Pate & Dixon 1982; Hopper 1999).

Wyatt (1981; 1983) has shown plant species on granitic outcrops often demonstrate a syndrome of ant pollination. It has also been noted that a number of primarily outcrop-restricted species self-pollinate (Wyatt 1984; Ornduff 1987; Dorrstock *et al.* 1996; Hopper *et al*. 1997; Wyatt 1997; Hopper 1999). Dorrstock *et al.* (1996) found that 57% of plant species were entomophilous in the outcrop system they investigated. Hopper (1981; 1999) found that a number of granite outcrop woody perennials in Western Australian are potentially bird pollinated.

Anemochory appears to be a common diaspore dispersal method (Porembski *et al*. 1994; Porembski *et al.* 1996). Dorrstock *et al.* (1996) found that up to 75% of species on the Ivory Coast granitic outcrops where anemochorous, although 77% were polychorous. Wyatt (1997) believed that in general diaspore dispersal was highly localized and was affected primarily by wind and water. Hunter *et al.* (1998) postulated that reptiles could effect dispersal of some outcrop taxa but that this was likely to be very localized.

Species on granitic outcrops also contend with low nutrient soils of high acidity. This has led to the occurrence of a high number of carnivorous species (Dorrstock *et al.* 1996; Hopper 1999). Dorrstock *et al.* (1996) believed that the nutrient deficiencies of the soil also favoured the production of very small diaspores produced in large numbers. The fire refugial aspects of outcrops have also permitted the persistence or evolution of obligate seeder life history traits that often are contrast with features of the surrounding flora (Gillham 1961; Erickson *et al.* 1973; Ashton & Webb 1977; Fuls *et al.* 1992; Binns 1995a; Groger & Barthlott 1996; Beard 1997; Hopper *et al.* 1997; Heinze *et al.* 1998; Hunter 1998a; Lawler *et al.* 1998; Hopper 1999).

It is clear that the lifeforms characteristic to of floras of granitic outcrops are those most commonly associated with arid environments, and that many physiological and gross morphological features of these taxa are adaptations to drought. Some adaptations also pertain to the 'island-like' nature of the granitic outcrop systems, particularly in terms of pollination and dispersal.

1.11.3 Evolutionary dynamics on granitic outcrops

Granitic outcrops are ancient landscapes. They are arid environments, often in contrast to more mesic surroundings. Many of the taxa on outcrops are relicts or at their distributional limit. In addition, populations are often small, inbreeding and prone to extinction. Such conditions provide opportunities for the investigation of living collections of discrete, yet integrated, natural evolutionary experiments (Bussell & James 1997).

Many narrow endemics have evolved and species characteristic of this habitat share many common adaptations. Wyatt and Fowler (1977) proposed an island-hopping model to account for the discrepancy between the apparent antiquity of the flora and the relatively recent origin of specific outcrops. The habitat and flora are much older than the age of any one exposure. While individual outcrops have not persisted indefinitely, collectively outcrops of hard crystalline rocks have been available for occupation throughout angiosperm history (Burbank & Platt 1964; Murdy 1968; Axelrod 1972). Outcrops are exposed gradually in a patch like manner resulting in a series of discontinuous basement sites (Axelrod 1972). Main (1997a) believed that the evolution of many characteristic outcrop groups probably began in the Tertiary along with the development of sclerophylly. Outcrops have thus facilitated genetic divergence and speciation (Hopper *et al.* 1997).

Outcrops are believed to be sites with low levels of competition due to the harsh environment (McVaugh 1943; Baskin & Baskin 1988; Ware 1990; Ware & Pinion 1990; Porembski *et al.* 1994). Where species are at the edge of their range they may become saxicolous as the outcrop habitat may afford protection under unfavourable regional conditions and can offer a refuge from competition (Davis 1951; Murdy 1968; Baskin & Baskin 1988; Burke *et al.* 1998). Catastrophic selection on the marginal population could result in narrow edaphic endemics (Davis 1951; Baskin & Baskin 1988). Davis (1951), however, believed that evolution of this kind even at the species level was not progressive and that such species could do little but maintain themselves and that extinction would be inevitable.

Species that are largely or entirely restricted to granitic outcrops are prone to further selection due to having small populations existing in isolation (Murdy 1968; Chapman & Jones 1971; Axelrod 1972; Sampson *et al.* 1988; Bussell & James 1997). A few intensive genetic investigations have occurred regarding rock outcrop restricted species within Australia. Moran and Hopper (1983) showed that the genetic diversity within populations of *Eucalyptus caesia* was remarkably low. However the level of population differentiation was the highest reported for a tree species. The diversity estimates were more typical of an inbreeding annual rather than a tree species. In a study of the genetic variation within *Eucalyptus crucis*, Sampson *et al*. (1988) found that the heterozygosity of populations was low compared with other tree species. The level of population differentiation was as expected for small isolated populations undergoing genetic fixation from genetic drift. Bussell and James (1997) in summarising much of their work on *Isotoma petraea*, concluded that outcrops preserve a record of change both within single populations and across population systems. They are windows on evolutionary processes.

In contrast to the edaphic narrow endemism that has occurred on a number of granitic outcrops, research indicates that some widespread ruderals may have had their origin on granitic outcrops. These xeric sites can be regarded as perpetual pioneer areas somewhat similar to disturbed localities (Axelrod 1972; Wyatt & Fowler 1977). Outcrop endemics have occasionally been found off outcrops in disturbed habitats where there is high light and low competition. Some ‘weedy’ species of early successional sites may have originated on outcrops and spread more recently to sites disturbed by human activities (Porembski 1995; Porembski *et al* 1996; Hopper 1999).

Methodology

2.1 Survey design

The survey was carried out in a randomly stratified way in order to sample and replicate the major environmental changes. The compilation of 100 quadrats specified by the contract constitute the first half of the survey. The quadrats were divided proportionately between combinations of three major environmental variables. Specialised communities are often missed in stratified sampling strategies. Often this is due to the their small area of occurrence or they were not known from the area under investigation. Additional sites were placed in specialised communities that were not included in the *a priori* sampling strategy or to stratified classes that were not replicated in the sampling design.

As only 100 quadrats were available for distribution only a small number of variables could be chosen as with the addition of each variable there is a marked reduction in replication. Altitude was also chosen as an environmental variable. Two altitudinal bands were chosen above 900 m (900-1250 m) and below 900 m (450-900 m). This altitude was selected as it corresponds to the rough cut off point of the Northern Tablelands and North Coast Botanical Districts. As forest type mapping had already been done via air photo interpretation over most of the reserve these groups were used as a basis of a second environmental variable. It was thought that these broad community groups could be a defacto for other environmental variables. Landform was selected as the third environmental variable. These broad community groups were approved by the steering committee and were used here for stratification purposes (Table 1).

The area in hectares was then used to proportionately distribute the 100 quadrats across the 15 classes. The number of plots allocated to each class was directly proportional to the area it occupied. The square root of the number of hectares was used so that proportionately less effort was given to larger areas. This enabled a more equitable distribution of sites.

Were a variable had enough sites other variations in aspect were considered. The basic stratification was modified in the field when the information used was found to be inaccurate.

Table 1: Environmental attributes and the classes within them used for stratifying sample sites. 15 environmental sub-classes were sampled.

Environmental Attribute	Class	Number of subclasses
Altitude	450-900 m	7
	900-1250 m	8
Total		15
Landform	Plateau	3
	Hill Slopes	5
	Lower Slopes	2
	Creek Lines	4
	Rock Outcrops	1
Total		15
Forest association	Moist Open Forest (MOF)	3
	Dry Open Forest (DOF)	8
	Rainforest (RF)	1
	Woodland (WO)	3
Total		15

2.2 Site and species information

Topological information was also collected along with measurements of altitude, slope, aspect and horizontal elevation. Altitude was taken directly from topographic maps. Slope and horizontal elevation were measured using a 'SUUNTO Optical Reading Clinometer'. Horizontal elevation was measured at eight compass bearings. Aspect was measured using a compass with reference to magnetic north. Information on soil, fires and other disturbances was also collected in a form amenable to the site survey data sheets supplied by the Glen Innes District of the National Parks and Wildlife Service (Appendix A). Site location was derived from a Magellan Trailblazer XL GPS with reference to topographic maps.

Vegetation structure was derived using the system developed by Walker and Hopkins (1990). This method uses growth form, height and crown cover of the dominant taxa in each of the strata layers that are identifiable. Individual taxon data for each quadrat was recorded using the species data forms supplied by the Glen Innes District of the National Parks and Wildlife Service (Appendix A). Species were scored in accordance with a modified Braun-Blanquet (1982) cover abundance six ranking scale. Cover codes are as follows:

Cover Code	**Projected Canopy Cover**
1	<5% few individuals
2	<5% any number of individuals
3	6-25%
4	26-50%
5	51-75%
6	>75%

These methods will enable cross comparison of species records with other major vegetation surveys carried out by the New South Wales National Parks and Wildlife Service.

2.3 Vouchering

The importance of vouchering is discussed by Hosking *et al.* (1996) who conclude that without vouchers one may as well not publish results. As Hosking *et al.* (1996) state, current taxonomic knowledge is continually changing, and what was once one species may be split into ten or vise-versa. Vouchers can be checked with up to date descriptions and nomenclature changes as they are published.

It is unreasonable and impossible to collect all taxa from all sites. During this survey where possible at least one sample of each taxon was collected. All taxa that could not be identified accurately without doubt in the field were sampled from each site and labled according to the site they were taken. Opportunistic sitings of taxa were also collected if they were not found in any of the previous survey sites.

A single complete as practicle set of taxa were prepared on field cards and retained by the Glen Innes District of the New South Wales National Parks and Wildlife Service. Additional good quality material of many taxa were also retained as vouchers and sent to the Coffs Harbour Botanic Gardens Regional Herbarium then to the National Herbarium of New South Wales (NSW) as a second choice and further duplicates were sent to NCW Beadle Herbarium (NE) and other recognised herbaria if available.

2.4 Data management

'Paradox 7 for Windows' (1995) a relational database, was used for data management, validation, storage and retrieval. 'Parent' tables were created with verified information that was used for data entry in 'Child' tables allowing consistency in data entry (for example the spelling of species names (Campbell 1984; McKenzie 1991; McKenzie *et al.* 1991)). Three 'parent' tables were created to store information with six 'child' tables used for referential integrity, validation and data entry. The three primary tables stored information relating to the taxa found the quadrats placed. The region number and site number were the relational fields used to link the three main tables. These three record values are unique and duplicate values were not accepted by the database. The system was designed to minimise the number of keystrokes, and allow for subsequent specimen determinations and results of analyses to be incorporated later without disruption. Field data collected during a single field trip were added either at night in the field on a 'note book' computer or immediately on the days after returning from the field on the main computer. Thus, discrepancies could be sorted out while the relevant survey sites were fresh in the mind.

Sorted data was exported to EXCEL spreadsheets prior to analysis. All site and species attributes are presented in EXCEL spreadsheets and included in the electronic form of this document that is held with the Glen Innes District of the New South Wales National Parks and Wildlife Service.

2.5 Multivariate Analysis

Initial exploratory analysis of sites was conducted using classification and ordination techniques available in PATN: Pattern Analysis Package (Belbin 1995ab). PATN was developed for manipulation, analysis and display of patterns in multivariate biological data (Belbin 1995a). Both classification and ordination were performed on data as each technique is complimentary and the use of both highlights anomalies produced by the other (Gauch 1982). Ordination will detect natural clusters if they are present and highlight overall trends clarifying relationships alluded to with classification (Belbin 1991; Belbin 1995a). However, strong discontinuities in survey data can affect the way ordination techniques display continuous variation (Faith 1991). Classification techniques will impose groups on continuous data even if they are not present (Belbin 1991; Faith 1991; Belbin 1995a). In such situations 'chaining' may occur whereby samples grow by accretion one by one rather than by fusion with other clusters (Goodall 1980). Even in such situations utility can be found in imposed divisions (Gauch 1982). Classification is useful in detecting outliers that may affect ordination procedures (strong discontinuity). This technique also aids in the detection of smaller groupings or trends within the data that may be difficult to see from an ordination where groupings may be less obvious (Faith 1991).

Site classification was achieved using the Kulczynski association measure that has proven to be a superior measure of association with ecological data (Faith et al. 1987; Belbin 1995b). Agglomerative hierarchical clustering using flexible UPGMA (Unweighted Pair Group arithMetic Averaging) was used for group joining, this optimises the hierarchy and not the groups. UPGMA gives equal weight to objects not groups in the fusion process thereby groups are weighted proportionally to the number of objects contained (Belbin 1995b). This method has been widely tested and is the most frequently used classification technique (Gauch 1982; Belbin 1995b) and it provides the best fit between the association measure and the distances implied from the dendrogram (Belbin 1991). Flexible UPGMA enables the value of β, which ranges from –0.1 to 1.0 to be changed, this controls the amount of space dilation during the fusion process (Belbin 1991; Belbin 1995b). A β value of –0.1 was used to enable slight dilation to occur; this has been shown to better recover known partitions (Belbin 1995b).

Semi- Strong- Hybrid Multidimensional Scaling (SSH) was used as the ordination technique. Multidimensional scaling (MDS) moves objects around in a space defined by the number of dimensions chosen and the dissimilarities among sites in terms of their composition (Faith 1991; Belbin 1991). SSH calculates the level of stress, which is the miss-match between distances between points and the best estimate of the same values (Belbin 1995b). Subsequently all points in the initial ordination are moved slightly to reduce stress, this process is iterated a specified number of times or until a minimum stress is achieved (Orloci 1978; Belbin 1995b). MDS has been shown to be a robust method (Minchin 1987; Faith 1991). SSH has the advantage of being designed to cope with unimodal responses of taxa replacing the assumption of linearity used by many other ordination procedures (see e.g. Noy-Meir & Whittaker 1978; Orloci 1978; ter Braak & Prentice 1988; Faith 1991; Belbin 1995a).

The number of groups to be recognised can be based on a number of a priori methods. The point at which a leveling of a scree plot of dissimilarity and number of fusion points occurs can be an indication of the optimal cut off point. At such a point, many clusters are formed at essentially the same linkage distance. Binns (1995b) described understorey communities using the same analyses procedures within the same area at a dissimilarity of 0.8.

'Canonical Correspondence Analysis' (CCA) via CANOCO (ter Braak 1987—1992) was used for exploration of site attributes and their affects on site ordination. CCA is a multivariate direct gradient analysis technique for the analysis of patterns of variation in community composition that can be explained by environmental variables. The technique is based on the reciprocal averaging algorithm of Correspondence Analysis (CA). In CCA the axis of the ordination is constrained to be linear combinations of the environmental variables (i.e. direct gradient analysis), which enables the analysis to handle complex environmental gradients. A major advantage of this type of analysis is it assumes a unimodal Gaussian response of taxa which is more ecologically realistic (see e.g. Gauch 1982, ter Braak 1986; Sparrow 1990; Austin 1991; Faith 1991), but it is also robust to significant departures from this (Gauch 1982; ter Braak 1986; Palmer 1993).

Forward selection of variables was used for data reduction, ranking of variable importance and significance testing (ter Braak & Verdonschot 1995). This was achieved by using the forward selection module on CANOCO. Here the variation explained by each variable is partitioned and a model of significant variables is constructed, i.e. all environmental variables are ranked based on the fit of each variable separately. The significance of the effect of each variable is tested by a Monte Carlo permutation test (in this case 99 iterations). A variable was added if its significance was at the 5% level or less. As each variable is selected, the remaining variables are reassessed based on the fit that each variable gives in conjunction with the variables already selected (ter Braak &

Verdonschot 1995). Forward selection ceases when the significance based on the Monte Carlo tests is greater than 5%. The overall significance of the CCA ordinations was tested by Monte Carlo permutation (99 iterations) of residuals of the taxa after fitting co-variables and environmental variables (ter Braak 1992).

2.6 Significant vascular plant taxa within the reserve

Three main sources of information were used initially to assess the significance, in terms of rarity, of any taxa found within the reserve. The national list of rare or threatened Australian plants (ROTAP) (Briggs & Leigh 1996) along with the New South Wales Threatened Species Conservation Act 1995 (TSC Act) was used as a primary indicator of national and state significance. The regional significance of taxa was assessed with reference to the publication Significant Vascular Plants of Upper North East New South Wales (Sheringham & Westaway 1995; and 1998 unpublished update). Additionally, local botanical knowledge as expressed in the many published and unpublished survey reports and the personal experience of the author was used as a final source of information.

2.7 Analysis of evenness

The distribution of abundances amongst species in communities is a basic feature that is best measured by evenness (Smith & Wilson 1996). When a species is present in equal abundance a high evenness is the result, but, if species differ widely in their abundances then the community has low evenness. Evenness is essentially one of two components of species diversity, richness being the other (Hill 1973; Pielou 1977; Smith & Wilson 1996).

A number of evenness indices have been proposed, many of which are measures aligned to diversity (Smith & Wilson 1996). Camargo (1993) proposed a measure of evenness called Evar. Smith and Wilson (1996) conducted tests on a number of evenness indices and concluded that Evar was the best index of evenness for general use. This index is independent of species richness and is symmetric to degrees of abundance. In addition Evar provides a good Molinari shape (i.e. responds well to changes in evenness) and although it has a few minor problems it is the only index with no severe problems (Smith

& Wilson 1996). Evar is based on the variance in abundance over species and is calculated by the following formula:

$$E_{\text{var}} = 1 - \frac{2}{\pi} \arctan\left\{ \sum_{s=1}^{s} \left(\ell n(\chi_t) - \sum_{t=1}^{s} \ell n(\chi_t) / S \right)^2 \right\} / S$$

This variance is taken over log abundances, to examine the proportional difference, and to ensure the index is independent of the units used. The variance is then converted to a 0-1 range, with 0 being the minimum evenness and 1 the maximum (Smith & Wilson 1996).

2.8 Observations and experiments on fire and outcrops

Fire responses of species found within the reserve have been determined as far as practically from records contained in previously published literature and the results of these are presented even when they are potentially contradictory.

The following experimental design is incorporated here from the work of Hunter (1999). This research has been included in this document as it was a trail that was carried out within Bald Rock National Park and at present this work is not readily available in a published format.

2.8.1 Opportunistic observations and qualitative autecological methodology

During the survey period many large and intensive fires occurred during November 1994 and February 1995 throughout Bald Rock National Park. This enabled fire responses to be recorded for taxa and some autecological information to be gathered. Qualitative information on changes in structure and floristics after fire was gathered at Bald Rock and Girraween National Parks. Populations of *Muehlenbeckia costata* was followed across its range for two years between 1994 and 1996. Although no quadrats were formally placed prior to fire, sites had been visited prior to wildfire in planning stratification methods and inspection of access trails, and notes were taken during these visits on dominant species on outcrops. These notes, and the changes recorded subsequently, constitute important qualitative information on changes in structure and floristics after fire.

2.8.2 Seed germination experiments

Muehlenbeckia costata (Polygonaceae) is dioecious, with stems procumbent and weakly climbing. The stems may reach up to 5 m in length radiating from a central rootstock. The leaves are ovate, oblong to almost triangular, 3-14 cm long, 1-9 cm wide with a cordate base and crenulate margins. The nuts are trigonous with a hard, black and rugose coat. The perianth is initially green, but as the nut matures it becomes orange and fleshy and elongates and swells to enclose the nut, becoming the diaspore.

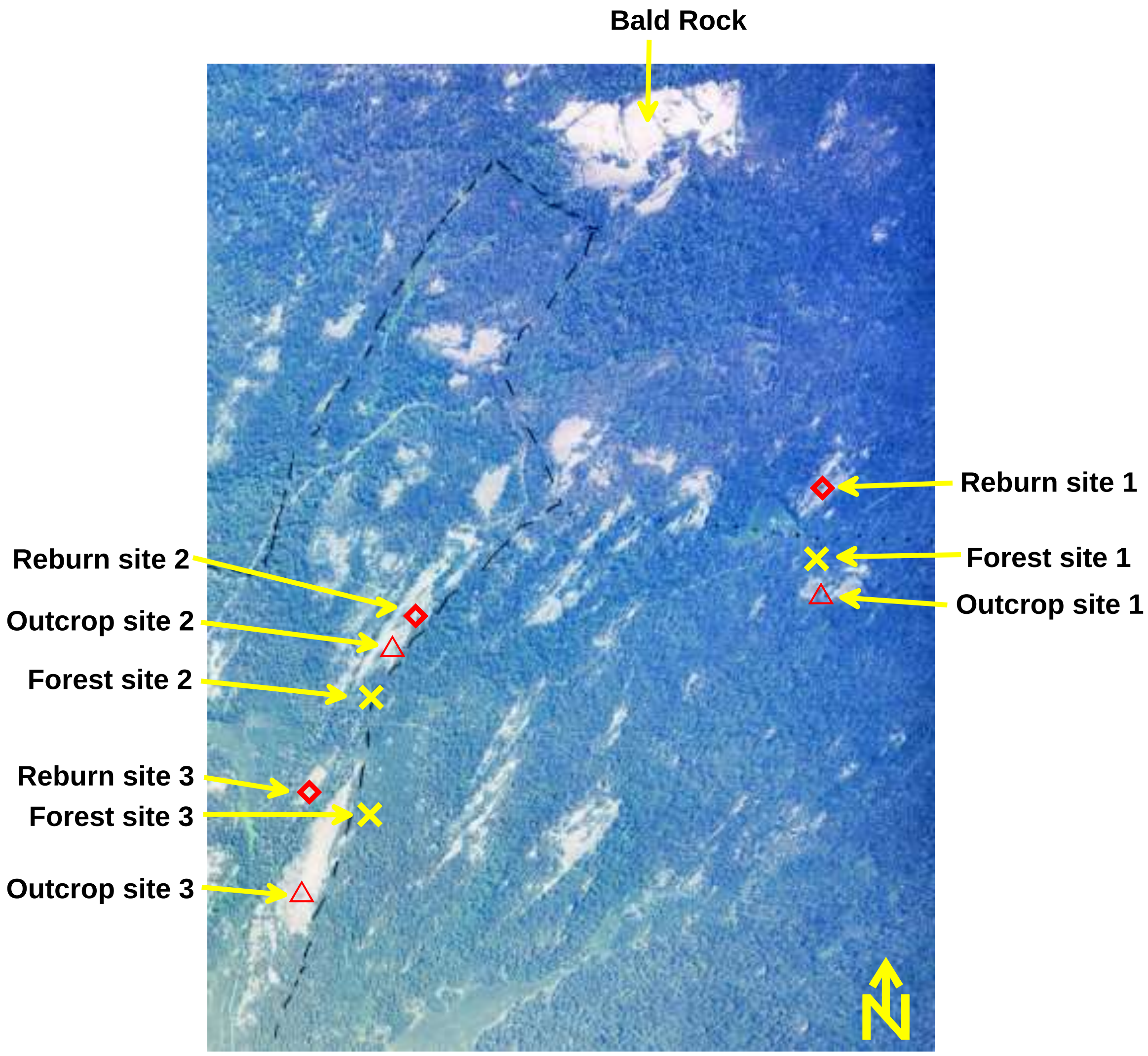
Diaspores were collected from taxa in the field and each subjected to 24 separate treatments. Heat treatments were; no treatment, 60°C, 80°C, 100°C and 120°C (each for ten minutes). Other treatments included smoking with native fuel, scarification via sandpaper, fungicidal treatment with Benlate 0.5g/l, phosphate buffering (pH 4.2) and the associate controls. Germination trays were randomized in incubators. All diaspores were incubated on a 12 hr day and 12 hr night light cycle and temperature variation of 20°C at night and 30°C by day. Numbers of germinated seeds were checked once a week for 8 weeks.

Muehlenbeckia costata seeds were collected from mature plants with additional small amounts of seed gained from neighboring soil. A total of 25 *M. costata* seeds were placed in each treatment tray (600 seeds) with an additional 200 seeds used for viability tests.

The viability of seeds was ascertained using 1% 2,3.5-triphenyltetrazolium chloride (Tetrazolium) and confirmed using 0.05% indigocarmine. A viable embryo stains red by Tetrazolium the false positives (dead embryos) stain with indigocarmine (Kearns & Inouye 1993).

2.8.3 Experimental before and after fire trials

The experimental design was limited to ground vegetation as larger fires would be unmanageable and trees are only a minor component of outcrop floras. To enable direct comparisons with the surrounding flora only ground vegetation (i.e. not trees) was burnt in these communities as well. As outcrop species are thought to respond to increased light and removal of competition one of the treatments in the experimental design included removal of above ground biomass. Thereby a test is provided that will differentiate between the changes noted due to fire and those due to increased light and removal of competition.



Aerial photograph scale 1:25 000

Figure 10: Location of fire experimental sites within Bald Rock National Park. Black dashed line represents approximate New South Wales and Queensland State border.

Three separate fire experiments were conducted between December 1995 and January 1996. Habitats chosen for investigation included granitic outcrops that had no evidence of previous fires, outcrops that had been burnt one year previously (December 1994) and adjacent areas of forest (Figure 9.1 & 9.2). Each of the fire trials incorporated a before and after control incident design (BACI) (Underwood 1992) whereby data was collected before the applied treatment and afterwards once a month for 12 months.

Experiment 1

Three separate outcrops were chosen for investigation (Figure 9). On each outcrop, six 2 m by 2 m plots were randomly placed within a vegetated patch. Three experimental treatments; clearing, burning and control were duplicated within the six plots by random selection (Figure 10). All above ground biomass was removed from the cleared sites beyond the boundaries of the plot. Plots that were to be burnt had all above ground biomass alighted by drip torches to the point where no above ground biomass was observable. Control plots were left unmodified (Figure 10).

Experiment 2

Three separate outcrops were chosen (Figure 9) that had had their standing biomass burnt during the fires of December 1994. Within each of these outcrops, 2 m by 2m plots were randomly placed and two were allocated to each of two treatments, burning and control. The same procedures as Experiment 1 were used.

Experiment 3

Three forested areas were selected in close proximity to the Experiment 1 sites (Figure 8). Within each site, four 2 m by 2 m plots were randomly placed and two were allocated to each of two treatments, burning and control. The same procedures as given in Experiment 1 were used.

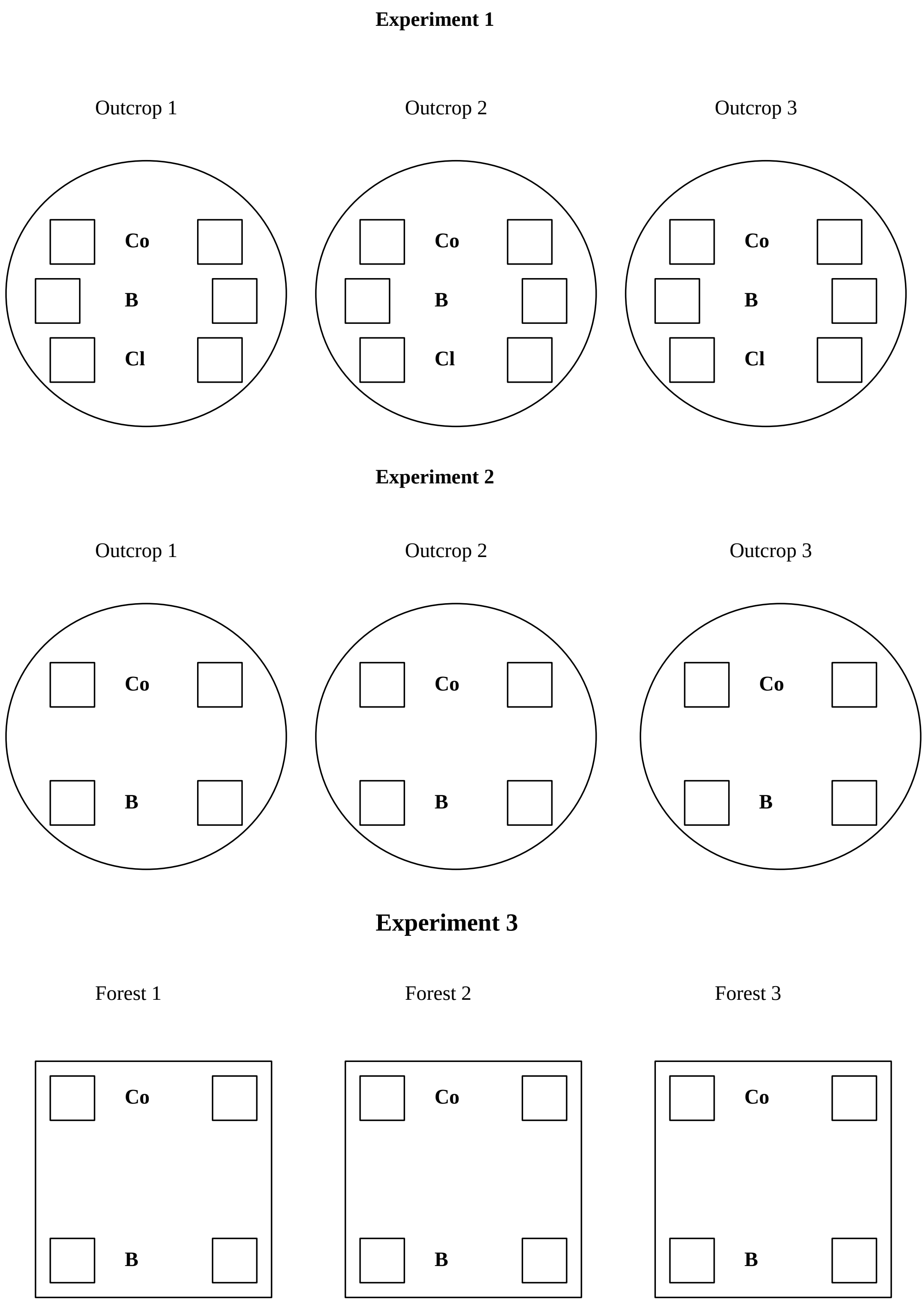


Figure 11: Graphic representation of experimental design. Experiment 1 includes three treatments times two on three separate unburnt granitic outcrops. Experiment 2 includes two treatments times two on three separate previously burnt outcrops. Experiment 3 includes two treatments times two within three adjacent forest patches. Co = Control treatment; B = Burning treatment; Cl = Clearing treatment.

Each of the 42 experimental plots was 2 m by 2 m in area. The corners of each plot were marked by of 1.5 m tall wooden stakes. A 2 m by 2 m 'grid' of durable cord was created, consisting of 16 squares each measuring 50 cm by 50 cm. This grid was hooked over each of the four corner posts (Figure 11) and moved, up or down, depending on the height of the plants. Every plant species present within each plot was given two scores out of sixteen: a relative abundance score, based on presence or absence of primary rooting in each of the sixteen sub-squares, and a cover score, based on presence or absence of projective foliage cover. The size of each plot enabled the whole plot to be viewed equitably with little distortion, allowing accurate scores to be recorded for each species.

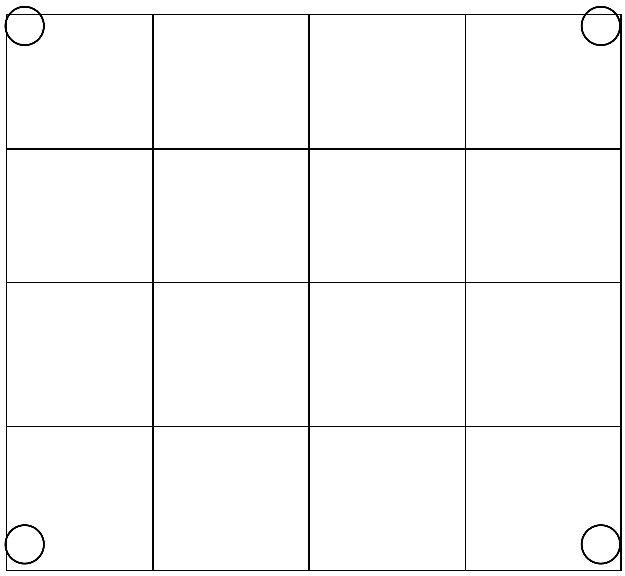


Figure 12: Diagram indicating Grid made to fit over corner posts of experimental plots enabling cover and frequency counts to be made for each species found.

The 42 experimental plots were surveyed once before treatments were applied and thereafter once a month, when possible, for a period of one year. During May of 1996, extensive rains and flooding occurred in the area making access impossible. In both September and November of 1996 extensive fires occurred in the general vicinity of the experiment making access to plots dangerous.

Richness and diversity were calculated for each plot (42 actual plots) at each monthly recording session (402 temporal plots in total). Richness is the number of species in each plot and diversity was measured by the Simpson diversity measure. Diversity measures differ primarily in the degree to which they emphasize species richness versus species evenness. In temporal comparisons the number of species is often of less importance, compared to, relative abundance, due to competitive displacement or extinction. When changes in relative abundance is of importance Simpson's *D* is an appropriate measure of diversity as it emphasises evenness (Huston 1994). Krebs (1985) considered that such a method summarises most of the biological information on diversity. The relative cover score out of 16 was used in all calculations as a direct substitute for abundance. Univariate analyses were conducted using ANOVA techniques and direct comparison of plotted scores. Multivariate analyses were performed using PATN and CANOCO (see previous sections for details of these procedures.

2.9 Coleman curves

Coleman curves represent the means of repeated sampling of all pooled samples. The smoothed Colman curves thus represent the statistical expectation for the corresponding acummunaltion curve. Coleman curves are different from accumulation curves which record the total number of species found with addition sampling (species area curves) as they are produced by repeated resampling of the species pool at random. Sampling is done without replacement within each resampling. This repeated randomised sampling produces a smooth rarefaction curve. Here the algorithym of Incidence-Based Coverage Estimator of species richness was used (ICE) to generate the data for estimating the potential total species richness (Lee and Chao 1994). During these simulations 200 random samplings were used.

Results

3.1 Site stratification

The basic stratification as outlined in the methods was completed. Some modification was necessary as some forest types were not as suggested by the information on the E-RMS. Furthermore, certain combinations did not exist. In total, the 175 stratified sites were sampled over a period of 20 field days (Figure 12) during January and August of 1994; May, July and August of 1995, October of 1997; December of 1998; January of 1999 and January of 2000.

3.2 Floristics

A total of 898 vascular plant taxa were recorded during the collation of existing site data and subsequent extra sampling (Appendix B). Approximately 6% (52) of all taxa recorded were introduced. From the survey sites 656 taxa were recorded, the remaining 242 taxa were recorded from previous surveys within the boundaries of the present reserve and were not found during this investigation. This represents 14% of the total New South Wales Flora and 28% of the flora of north eastern New South Wales. The total number of taxa found within the reserve is of significance (Table 2) as with the exception of Gibraltar Range/Washpool all other surveys with greater richness are of entire management areas of 100000s of ha. Furthermore this survey, unlike the others of greater richness was conducted over an area of a single geological rock type. This richness is likely to increase significantly after stage two is completed.

The 898 taxa occurred in 135 families and 429 genera. The families with the greatest number of taxa are Poaceae (95), Fabaceae (81), Asteraceae (70), Myrtaceae (65), Cyperaceae (40), Orchidaceae (31), Proteaceae (25), Epacridaceae (22), Rutaceae (19), Dilleniaceae (15), Euphorbiaceae (15), Apiaceae (14) and Lamiaceae (13). The richest genera are: *Eucalyptus* (32), *Acacia* (25), *Hibbertia* (15), *Senecio* (13), *Pultenaea* (10), *Austrodanthonia* (9), *Juncus* (9), *Dianella* (9), *Leptospermum* (9), *Wahlenbergia* (9), *Austrostipa* (8), *Leucopogon* (8), *Pultenaea* (8), *Brachyscome* (7), *Lomandra* (7) and *Persoonia* (7).

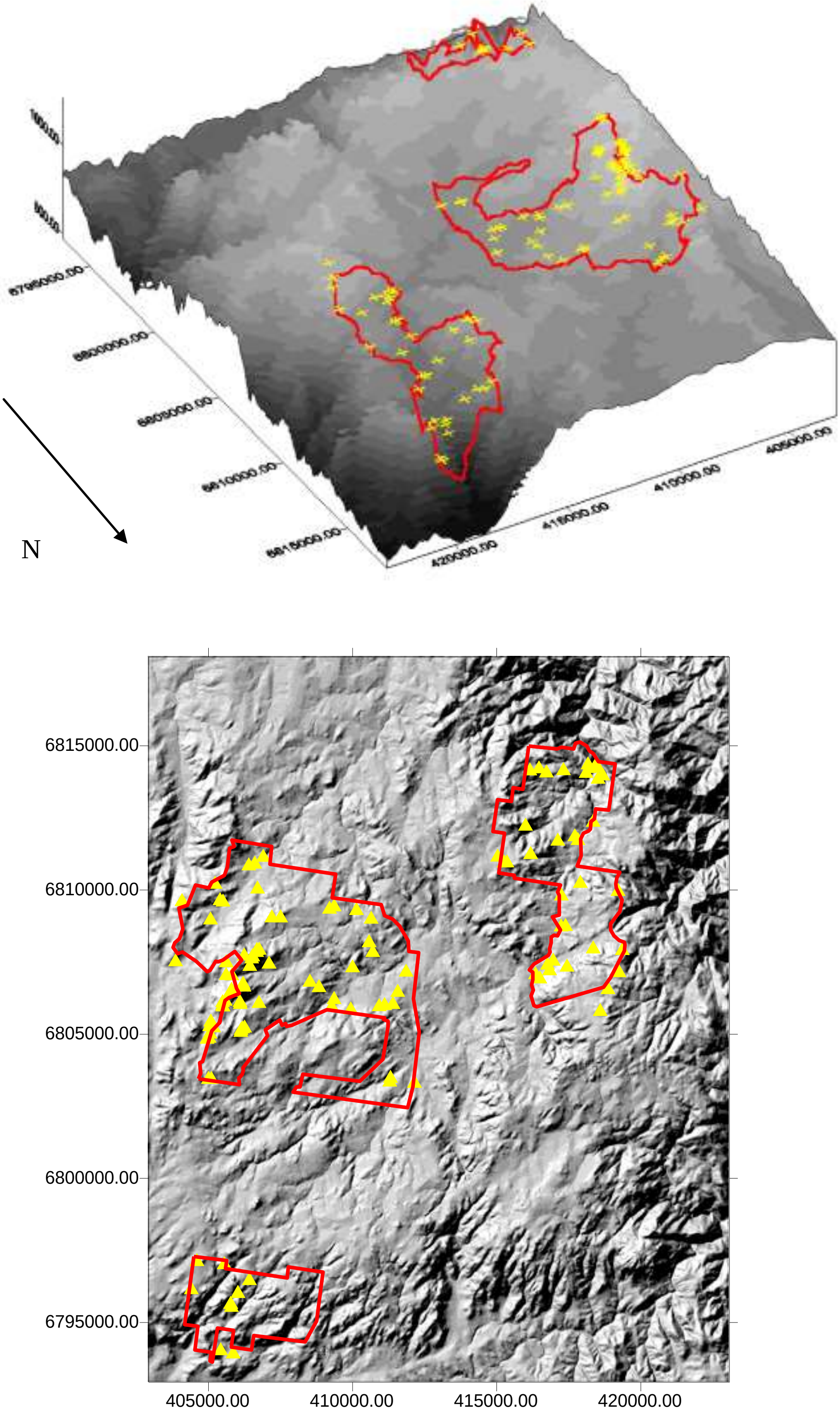


Figure 13: Distribution of the 114 sites surveyed during part 1 of the Bald Rock and Boonoo Boonoo National Park Vegetation Survey. The red line demarcates the boundaries of the part of relevance to part 1 of the survey. Sites are yellow triangles.

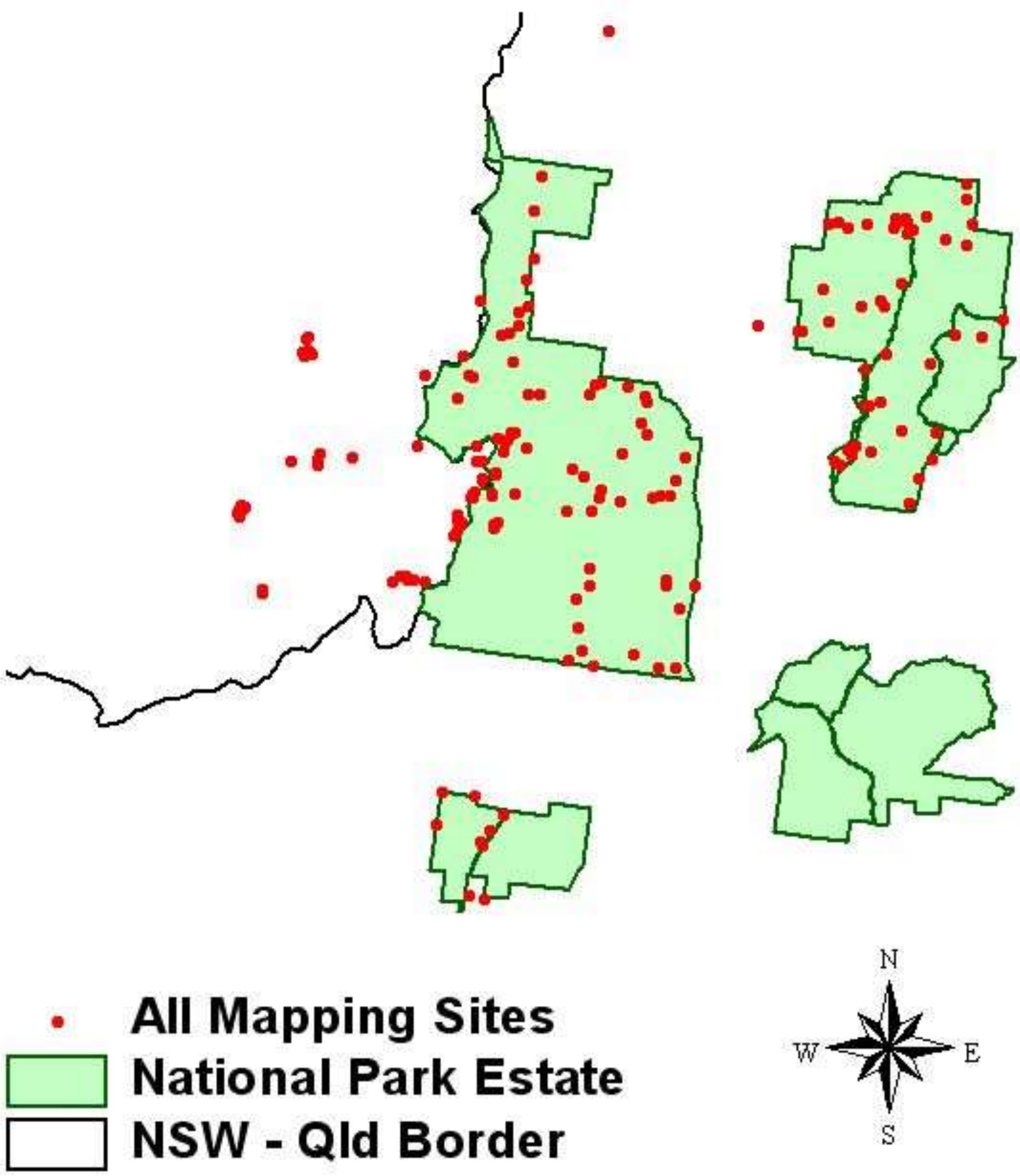


Figure 14: Mapped placement of all sites considered during the mapping of Bald Rock and Boonoo Boonoo National Parks. An additional 61 sites were incorporated into stage 2 mapping compared to stage 1 (previous figure).

Table 2. Comparison of species richness for other recently surveyed areas in the north-east of New South Wales.

Number of Taxa	Introduced Species	Number of Sites	Mean Richness	*EPB&C – TSC –* RoTAP	Regional Diversity Index	Area Covered by Survey
1069	10%	151	52/0.1 ha	37	220	New England NP (Clarke *et al.* 2000). 151 20 x 50 m sites + extensive checklist over 30 yrs.
946	10%		36/0.1 ha	1	203	Myall Lakes NP (Hunter & Alexander 2000). Compilation of 300+ survey sites.
943	11%	215	?	35	207	Werrikimbe (Hunter 2006). Formal + informal sites & checklists.
926	6%	264	42/0.1 ha	19	214	Capoompeta & Washpool Additions NPs (Hunter 2001a).
896	**5%**	**88**	**50/0.1 ha**	**26**	**208**	**Bald Rock & Boonoo Boonoo NP (*ibid.*) 20 x 50 m sites.**
878	2%	120	36/0.1 ha	42	198	Gibraltar Range & part of Washpool NP (Sheringham & Hunter 2002). 20 x 50 m sites.
826	9%	180		21	184	Nymboida NP (Benwell 2000). 20 x 50 m sites.
752	5%	201	60/0.1 ha	34	168	Torrington SP (Clarke *et al.* 1998). 0.1 ha sites. 152 species from previous records.
740	7%	94	43/0.1 ha	17	193	Mann River (Hunter 2002).
666	5%	101	40/0.1 ha	9	158	Part of Guy Fawkes National Park (Hunter & Alexander 1999b). 20 x 50 m sites
507	31%	87	38/0.04	8	143	Warrabah NP (Hosking & James 1998). Also 20 x 20 m sites Meanders over many seasons and years.
503	10%	105	37/0.04 ha	?	53	1:100 000 Ashford Map Sheet (Le Brocque & Benson 1995). 20 x 20 m sites (290 taxa) and all additional records (213 extra taxa).
502	11%	69	40/0.04 ha	19	155	Bolivia Hill Nature Reserve (Hunter 2002d). 20 x 20 m sites.
495	9%	71	41/0.04 ha	18	150	Warra NP (Hunter 2001b). 20 x 20 m sites, and additional 32 x 32 m nested quadrats.
657	8%	170	36/0.04 ha	11	144	Mt Kaputar NP (Hunter & Alexander 2000a). 20 x 20 m sites.
503	20%	171	20/0.09 ha		108	Kinchega National Park (Westbrooke *et al.* 2001). 30 x 20 m sites.
503	10%	105	37/0.04 ha	?	53	1:100 000 Ashford Map Sheet (Le Brocque & Benson 1995). 20 x 20 m sites (290 taxa) and all additional records (213 extra taxa).
477	9%	140	35/0.04 ha	10	142	Ironbark NR & *Bornhardtia* VCA (Hunter & Hunter 2003). 20 x 20 m sites.

Number of Taxa	Introduced Species	Number of Sites	Mean Richness	*EPB&C – TSC –* RoTAP	Regional Diversity Index	Area Covered by Survey
460	9%	48	38/0.04 ha	17	130	Severn River NR (Hunter 2000f) 20 x 20 m sites.
448	11%	124	22/0.04 ha	2	105	Narran Lake Nature Reserve (Hunter 2006). 20 x 20 m sites.
450	11%	164	25/0.04	5	101	Dthiniia Dthinnawan Nature Reserve (Hunter 2006). 20 x 20 m sites.
441	10%	75	51/0.04 ha	17	112	Kings Plains NP (Hunter 2000h). 20 x 20 m sites.
437	10%	40	31/0.04	1	121	Cataract NP & NR *ibid*. 20 x 20 m sites.
434	21%	50	36/0.04 ha	9	123	Arakoola NR (Hunter 2000d). 20 x 20 m sites.
424	11%	40	43/0/1 ha	11	124	Single NP (Clarke *et al.* 2000). 20 x 20 m sites. Lachlan Copeland *pers. comm.*
422	14%	125	25/0.09 ha	?	85	Peery National Park (Westbrooke *et al.* 2002). 30 x 30 m sites.
417	4%	40	38/0.1 ha	10	120	Basket Swamp NP (Hunter 2002).
410	35%	None	NA	?	140	Attunga State Forest (Hosking & James 1998). Meanders over many seasons and years.
407	17%	101	40/0.04 ha	5	116	Kwiambal National Park (Hunter 1998d). 20 x 20 m sites.
371	13%	132	37/0.04 ha	?	80	Goobang National Park (Porteners 1997). 20 x 20 m sites.
367	8%	48	41/0.04 ha	7	113	Bluff River NR (Hunter 2002d). 20 x 20 m sites
365	2%	40	52/0.1 ha	5	124	Demon Nature Reserve (Hunter *et al.* 1999). 32 x 32 m nested quadrats.
345	4%	38	?/0/04 ha	1	103	The Basin Nature Reserve. (Hunter & Copeland 2002, *unpublished*). 20 x 20 m plots.
342	4%	28	33/0.1 ha	3	135	Burnt Down Scrub Nature Reserve (Hunter 2000). 20 x 20 m sites.
341	8%	28	?/0.04 ha	3	110	Watson's Creek Nature Reserve (Copeland 2002, *unpublished*). 20 x 20 m sites.
330	11%	50	?/0.04 ha	1		Coolah Tops NP (Binns 1997). 20 x 20 m plots
324	8%	36	33/0.4 ha	2	97	Maryland NP (Hunter 2006.). 20 x 20 m plots.
320	12%	77	34/0.4 ha	1	109	Melville Range NR (Hunter 2006) . 20 x 20 m plots.
309	9%	23	?/0.04 ha	?	112	Stoney Batter Nature Reserve (Copeland 2002, *unpublished*). 20 x 20 m sites.
240	8%	42	28/0.04 ha	1	51	Culgoa National Park (Hunter 2005). 20 x 20 m sites.

Number of Taxa	Introduced Species	Number of Sites	Mean Richness	*EPB&C – TSC –* RoTAP	Regional Diversity Index	Area Covered by Survey
237	10%	21	34/0.04 ha	1	88	Boronga, Boomi & Boomi West Nature Reserves (Hunter 2006). 20 x 20 m sites.
227	4%	184	?	?	44	Nombinnie NP & Round Hill NR (Cohn 1995). 30 x 30 m sites.
211	13%	15	37/0.04 ha	0	90	Curry's Gap NR (Hunter 2002). 20 x 20 m sites
210	15%	25	35/0.04 ha	1	74	Planchonella NR (Hunter 2006). 20 x 20 m sites.
205	8%	43	30/0.04 ha	2	62	Ngulin NR (*ibid.*). 20 x 20 m sites.
203	20	20	38/0.04 ha	0	101	Yina Nature Reserve. (Hunter 2003). 20 x 20 m sites.
200	?	?	?	?	47	Macquarie Marshes Nature Reserve (NSW NPWS).
199	11%	45	21/0.04 ha	2	55	Budelah NR (Hunter 2006). 20 x 20 m sites.
185	5%	40	12/0.04 ha	1	44	Ledknapper Nature Reserve (Hunter & Fallavollita 2003). 20 x 20 m sites.
181	11%	22	35/0.04	1	74	Imbota Nature Reserve (Hunter 2003). 20 x 20 m sites.
175	14%	14	36/0.04 ha	1	85	Gamilaroi Nature Reserve (Hunter 2006). 20 x 20 m sites.
174	9%	59	15/0.04 ha	1	40	Thilta Karra section Paroo Darling NP (Hunter & Fallavollita 2003). 20 x 20 m sites
170	3%	15	30/0.04 ha	1	79	Mt McKenzie NR (Hunter 2002). 20 x 20 m sites.
161	12%	15	25/0.04 ha	0	63	Midkin Nature Reserve (Hunter 2006). 20 x 20 m sites.
155	17%	22	37/0.1 ha	2	49	Kirramingly Nature Reserve (Clarke *et al.* 1998). 33 x 33 m nested sites.
134	5%	21	26/0.04 ha	5	72	Aberbaldie NR (Hunter 2005). 20 x 20 m sites.
129	14%	20	22/0.04 ha	1	49	Brigalow Park & Claremont Nature Reserves (Hunter 2006). 20 x 20 m sites.
112	4%	15	26/0.04 ha	1	51	Gibraltar NR (Hunter 2002). 20 x 20 m sites.
107	8%	15	25/0.04 ha	0	39	Careunga Nature Reserve (Hunter 2006). 20 x 20 m sites.
90	2%	7	?	?	25	Derra Derra Ridge, Bingara (Benson *et al.* 1996). 20 x 20 m sites.

3.3 Community definition

The scree plot analysis indicates that the point of inflection lies near the 0.8 dissimilarity level thereby recognising 10 groups of species assemblages (Figure 13). This level of inference for community definition is the same as used by other investigators in the same bioregion after similar scaled investigations (e.g. Binns 1995; Hunter 1998; Hunter & Alexander 1999). The ten vegetation communities recognised are displayed in a summary dendrogram (Figure 8) that highlights three major larger groupings or floristic elements. These three larger assemblages appear to be related to an inferred moisture gradient based on the taxa associated with each. The ordination scattergram (Figure 14) with the ten classified groups displayed highlights the three major disjunctions in floristics. An eleventh community is recognised based on the stratified survey of granitic outcrops by Hunter (1999).

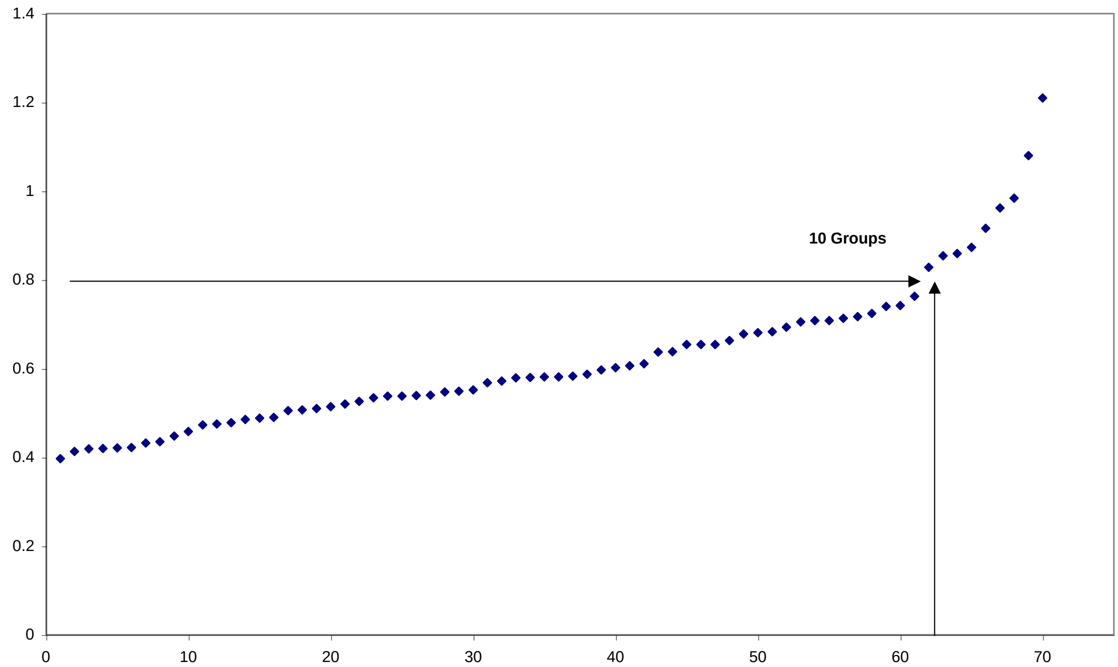


Figure 15: Scree plot of Kulczynski association measure and the flexible UPGMA fusion strategy results. The line of demarcation represents the cut off point for recognition of floristic groups (*c.* 0.8 dissimilarity, 9 communities). Note the groups are recognised near the point of inflection of the curve.

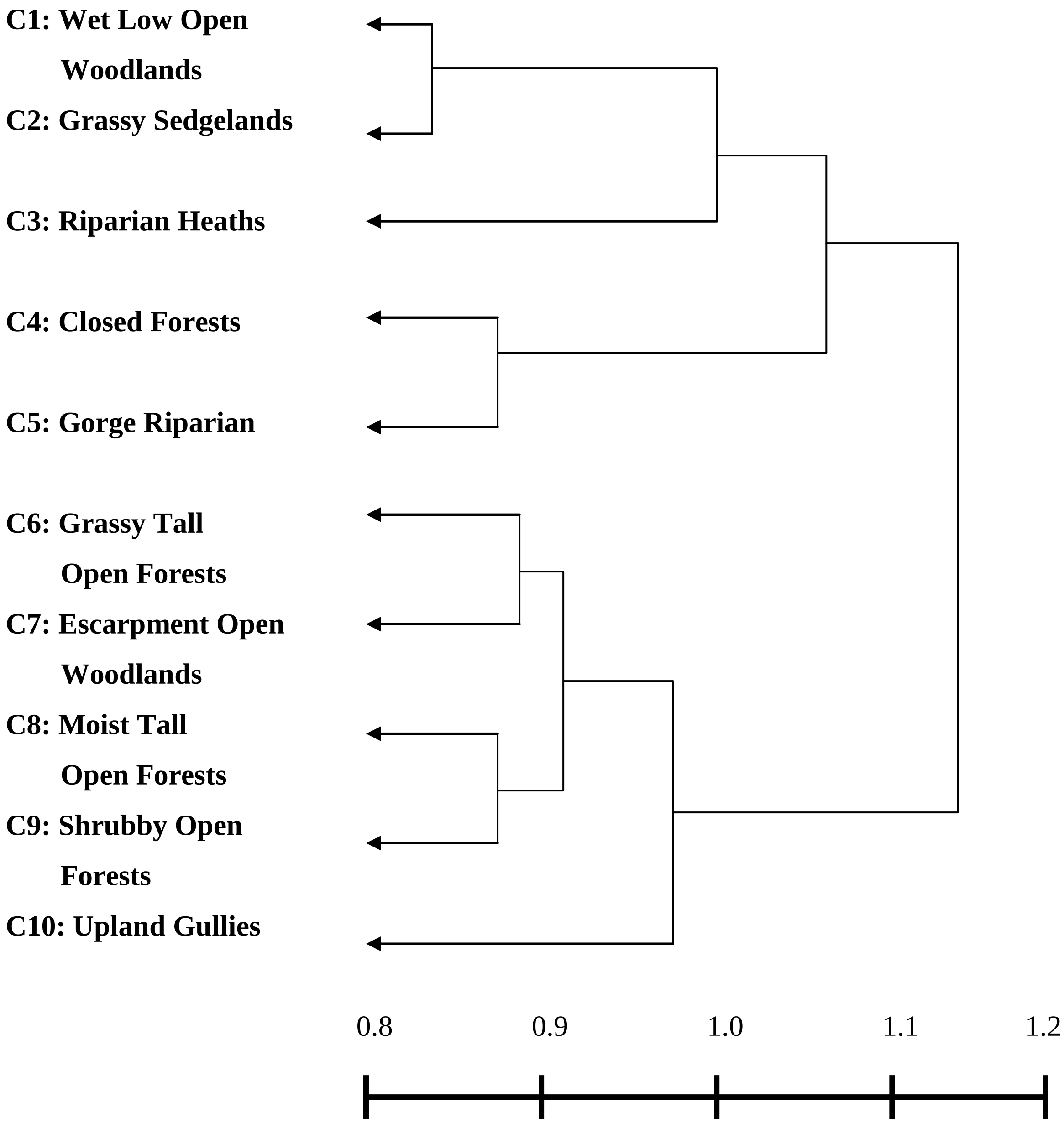


Figure 16: Summary dendrogram of full floristic dataset of non-outcrop of sites using the Kulczynski association and flexible UPGMA fusion strategy and a beta value of –0.1. Communities have been defined at a dissimilarity level of *c.* 0.8.

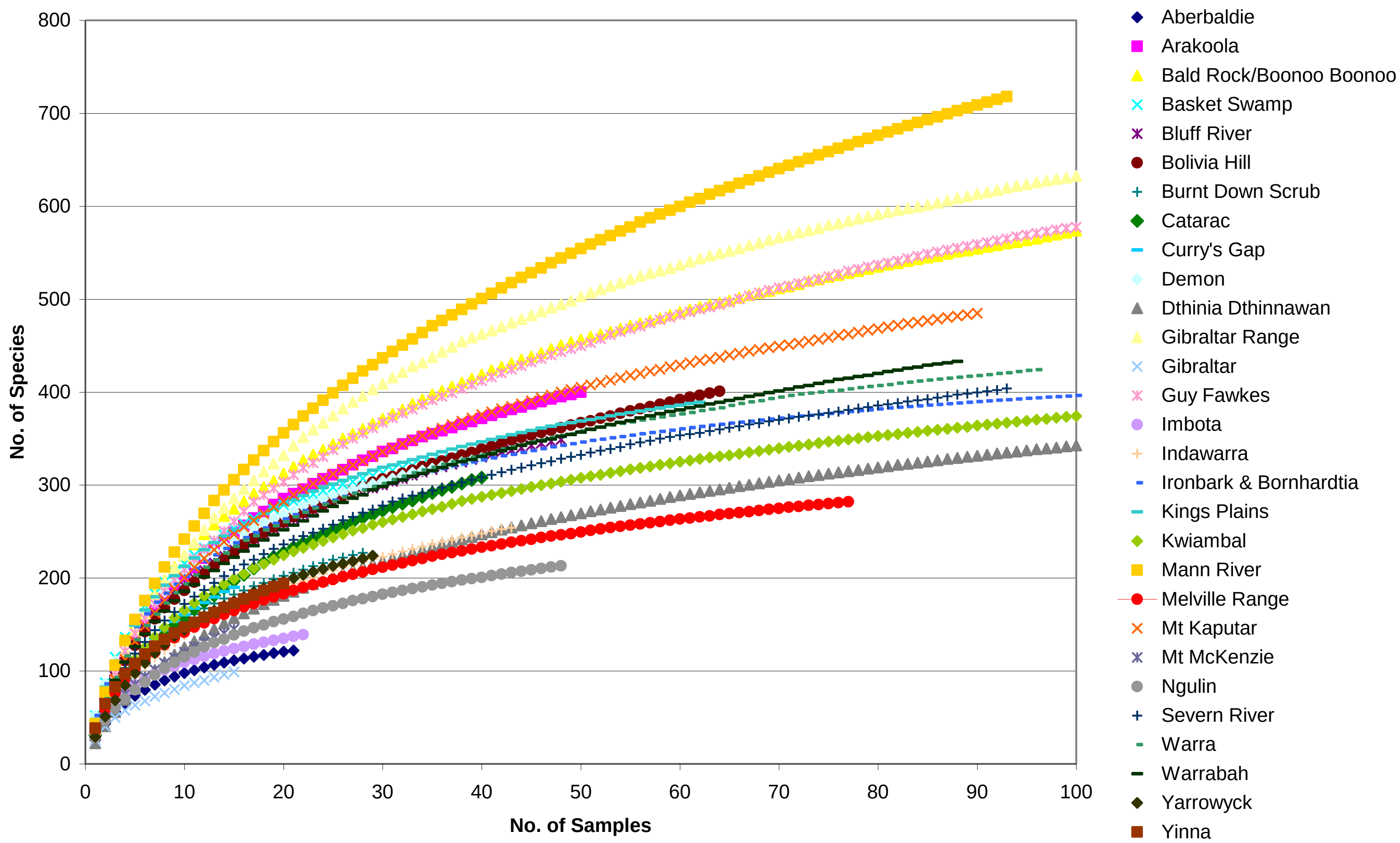


Figure 17: Species accumulation curves for selected sampled areas in northern New South Wales (NWS & NT).

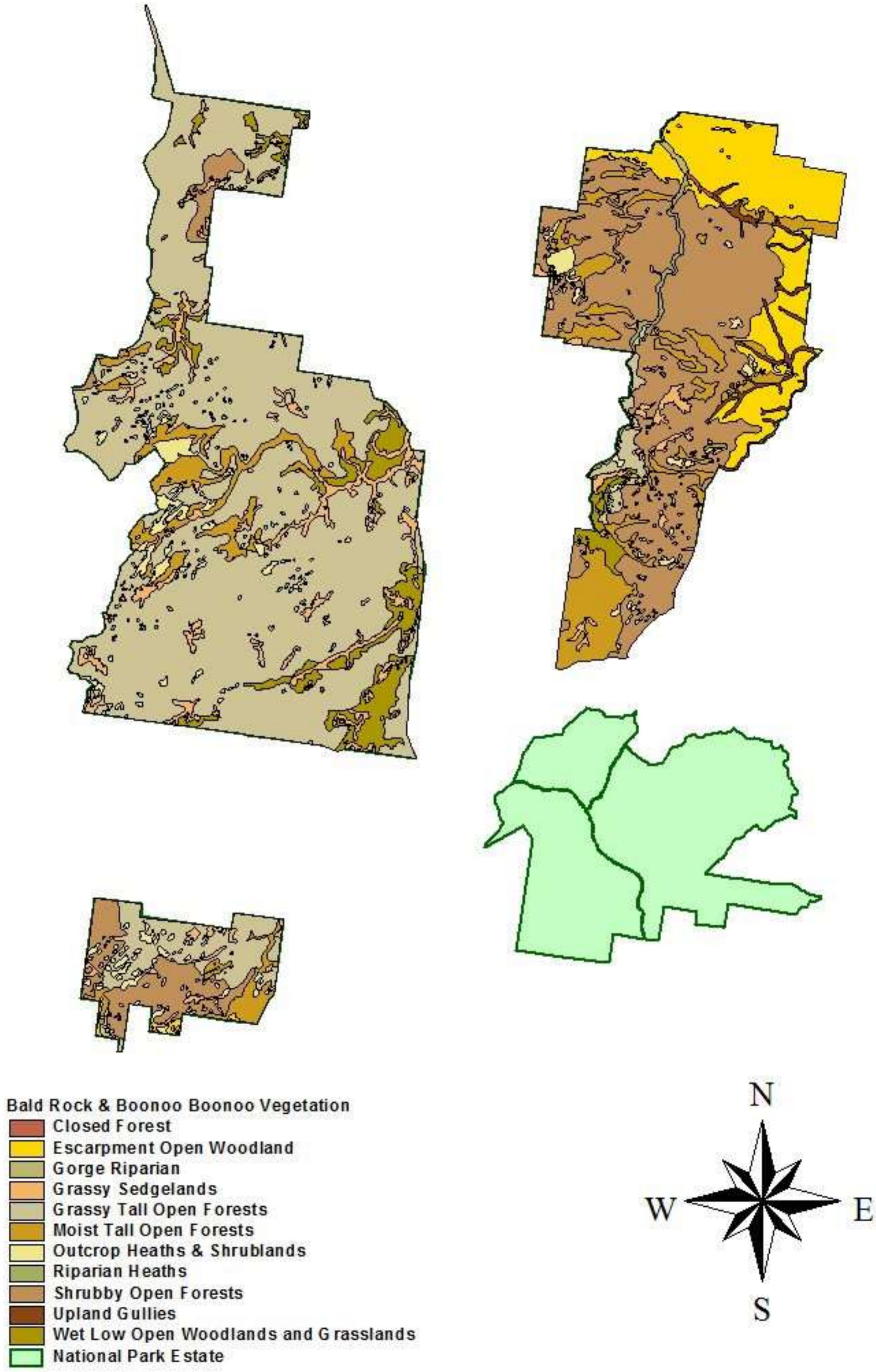


Figure 18: Mapped vegetation of Bald Rock and Boonoo Boonoo National Parks.

3.4 Description of plant communities

Most of the communities within Bald Rock and Boonoo Boonoo National Parks are Tall Open Forests with either a predominantly shrubby or grassy understorey. Woodlands do occur but are of restricted distribution primarily within the minor occurrences of gorge and escarpment country or fringing open and poorly drained sites. Closed forests are rare and only exist at the bottom of Boonoo Boonoo Falls within the sections of the park surveyed. Sedgelands, wetter grasslands and wet heaths are common at level ground at the base of undulating hills, around the margins of creeks and rivers and occasionally in poorly drained sites high up on the plateau country. Heaths and shrublands associated with granite inselbergs are widespread, common and are at their best development within these parks. Eleven communities in total were defined and these are mapped and described below.

3.4.1 Community 1: Wet Low Open Woodlands

Wattle-leaved Peppermint (*Eucalyptus acaciiformis*) – White Sally (*Eucalyptus pauciflora*) Low Open Woodland.

Sample sites (10): 1, 2, 3, 37, 38, 89, 99, 100, 101, 106.

Number of hectares: 697 **Proportion of reserves:** 4.9%

Landform: Restricted to the margins of low-lying periodically waterlogged sites at higher altitudes.

Distribution: found both in Boonoo Boonoo and Bald Rock National Parks, primarily along major creeks and rivers with broad open valleys and also fringing the margins of small sedgelands.

Structure: Upper 1-25 m tall, 15-30% cover; middle 1-5 m tall, 30-80% cover; ground <1 m tall, 40-100% cover.

No. of taxa: 117 **No. of taxa per plot:** 46-64 (52 av.).

Common natives: Listed in decreasing order of importance (frequency and cover).

Trees: *Eucalyptus acaciiformis, Eucalyptus pauciflora, Eucalyptus eugenioides, Eucalyptus radiata* subsp. *sejuncta, Eucalyptus campanulata, Eucalyptus banksii, Banksia integrifolia, Allocasuarina littoralis, Eucalyptus nova-anglica.*

Shrubs: *Epacris microphylla* subsp. *microphylla, Callistemon pityoides, Leptospermum gregarium, Leptospermum arachnoides, Hakea microcarpa, Dillwynia phylicoides, Baeckea omissa, Leptospermum variabile, Pimelea linifolia, Leucopogon lanceolatus, Callistemon flavovirens, Bursaria spinosa* subsp. *obovata.*

Climbers & trailers: *Desmodium varians, Rubus parvifolius.*

Ground cover: *Themeda triandra, Imperata cylindrica, Oplismenus imbecillus, Gonocarpus micranthus, Entolasia marginata, Viola hederacea, Stylidium graminifolium, Sporobolus elongates, Juncus remotiflorus, Hypericum gramineum, Chrysocephalum apiculatum, Tricoryne elatior, Hydrocotyle peduncularis, Geranium solanderi* var. *grande, Euchiton sphaericus, Echinopogon caespitosus, Dichelachne parva, Austrostipa rudis* subsp. *rudis, Arthropodium milleflorum, Ajuga australis.*

Introduced taxa: *Hypochaeris radicata, Conyza bonariensis, Conyza albida, Taraxacum officinale, Conyza chilensis, Centaurium erythraea, Andropogon virginicus, Aira cupaniana, Paspalum dilatatum, Gnaphalium americanum, Axonopus affinis.*

Percent of species introduced: 9%.

Variability: each patch is quite divergent in terms of associated species and this probably relates to the small and isolated nature of each occurrence and past disturbance regimes. The community can be variable in structure and may contain a somewhat dense understorey of shrubs or be open and grassy and this relates primarily to the degree of waterlogging and proximity to water sources such as creek channels. However, the sites all share a very open and low woodland appearance.

Condition: generally poor to reasonable. This community has been the most highly effected by past disturbances such as clearing and grazing. Many trails exist that pass through this community. Many weeds exits in this community and it has the third largest incidence of weeds of all communities within these reserves and these weeds are some of the most invasive and hardest to remove.

Taxa of conservation importance: none apparent.

Notes: similar communities are described as occurring in waterlogged areas as far south as Gloucester/Chichester and Coolah Tops (Binns 1995a; Binns 1997) and Maryland National Park (Hunter 2006). However this type of association appears to be at or near their northern geographic limit within these reserves. Binns (1995b) considered that there were two forms of *E. dalrympleana* subsp. *heptantha* on the Northern Tablelands but these were probably ecotypes of no true taxonomic status. Binns believed there was a 'swamp form' of this taxon that occurred in areas of impeded drainage often with *E.*

pauciflora. Such a situation occurs within these reserves. Communities containing *E. pauciflora* are varied across the Northern Tablelands and it appears this taxon may link many somewhat distinct assemblages. Beadle (1981) describes the distribution of *E. pauciflora* as following valleys where cold air drainage and frosts occur; the soils are not waterlogged but are perennially wet. It appears that *E. pauciflora* is restricted to the slopes of valleys where cold air may collect but is replaced in waterlogged soils by *E. acaciiformis* and on drier hillsides by other species. Clarke (1998) describes a community with a similar association as being constrained to well drained valley slopes and alluvial flats at altitudes less than 1000 m within Boonoo Boonoo National Park. This however cannot be reconciled with the findings of this survey and the literature (e.g. Beadle 1981) that shows clearly in classification, canonical ordination and distribution that these assemblages are restricted to poorly drained sites at altitudes primarily above 1000 m.

Conservation status: assemblages such as these are isolated and small throughout the whole Northern Tablelands and are hence there is great variability between sites with many species of low constance. As such each occurrence is likely to be of conservation significance. Communities based on the overstorey dominants of *E. pauciflora* and *E. dalrympleana* are considered poorly conserved. Occurrences of similar assemblages are known to be reserved in the Western Washpool National Park (Hunter 1999), Basket Swamp National Park, Bolivia Hill Nature Reserve and the Demon Nature Reserve. Therefore, although these areas are restricted within the reserve they are of high conservation significance. *Eucalyptus nova-anglica* and *E. pauciflora* communities on sediments are listed as **endangered**.

Management considerations: only a small area of this community occurs within the reserve and subsequently active management may be more appropriate. Of particular concern is that most of the trail networks throughout the reserve pass through this fringing community and hence disturbance is constant. Weed invasion will thus always be an issue in this association as introductions from vehicles will be constant. Trails must always be kept to a high standard and not be allowed to deteriorate, particularly in the more waterlogged situations. Invasive weeds are an issue in this community and these will need constant management. Damage from stray cattle is still occuring in some areas. Pig rutting is a major cause of disturbance and weed introduction within this community and as such pig trapping and shooting will need to be a constant management practice.

Figure 19: Photographs of Community 1. Above = Site 44, below = Site 56 both from Bald Rock.

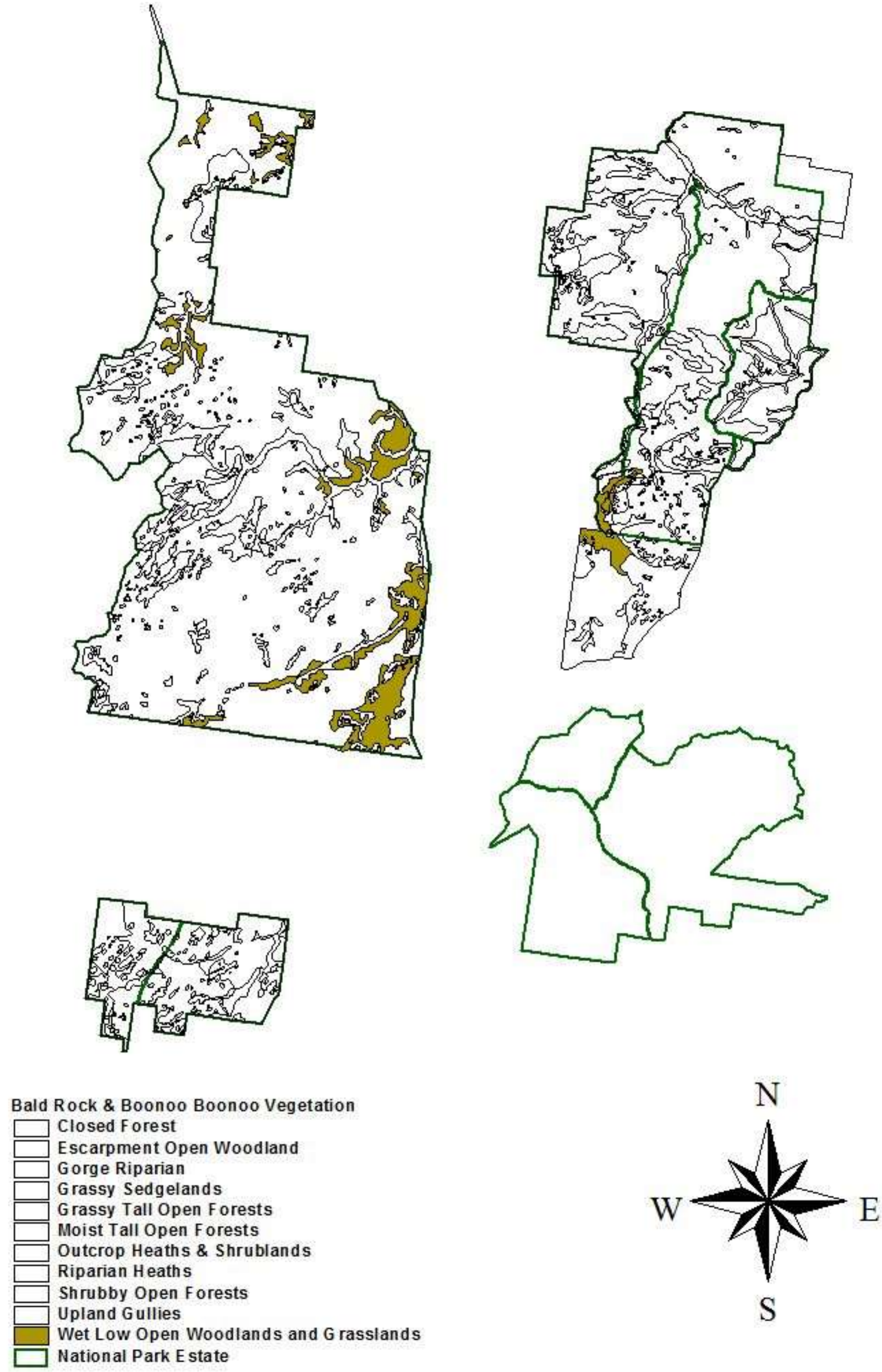


Figure 20: Mapped distribution of Community 1.

3.4.2 Community 2: Grassy Sedgelands

Kangaroo Grass (*Themeda triandra*) – Narrow Cord Rush (*Baloskion stenocoleum*) Grassy Sedgelands

Sample sites (8): 17, 19, 21, 29, 49, 86, 87, 108.

Number of hectares: 706 **Proportion of reserves:** 5%

Landform: restricted to low lying periodically or permanently waterlogged sites at higher altitudes.

Distribution: found throughout both reserves as small isolated patches at sites of impeded drainage within the upper catchments of creeks or as elongated occurrences along broad open valleys following drainage lines and their major tributaries.

Structure: Upper not always present 10-20 m tall, 10% cover; ground <1 m tall, 100% cover.

No. of taxa: 87 **No. of taxa per plot:** 29-38 (33 av.).

Common natives: Listed in decreasing order of importance (frequency and cover).

Trees: *Eucalyptus dalrympleana* subsp. *heptantha*, *Eucalyptus pauciflora, Eucalyptus brunnea, Allocasuarina littoralis.*

Shrubs: *Epacris microphylla* subsp. *microphylla, Pimelea linifolia, Hakea microcarpa, Baeckea omissa, Callistemon pityoides, Leptospermum arachnoides, Hibbertia acicularis, Boronia parviflora, Epacris obtusifolia, Banksia cunninghamii* subsp. *neo-anglica, Leptospermum gregarium, Grevillea juniperinum.*

Climbers & trailers: None apparent.

Ground cover: *Themeda triandra, Xyris complanata, Baloskion stenocoleum, Goodenia bellidifolia* subsp. *bellidifolia, Gonocarpus micranthus, Entolasia stricta, Hypericum gramineum, Thelionema grande, Selaginella uliginosa, Haemodorum planifolium, Geranium solanderi* subsp. *grande, Ranunculus lappaceus, Philothrix deusta, Lomandra longifolia, Drosera binata, Austrostipa rudis* subsp. *rudis, Viola hederacea, Viola betonicifolia, Poa sieberiana, Craspedia canens, Baloskion fimbriatum*.

Introduced taxa: *Andropogon virginicus, Conyza albida.*

Percent of species introduced: 2%.

Variability: this community had a number of species with high constance and many that were poorly associated. These communities are isolated, small and generally of limited distribution and as such although a number of species will almost always be present and dominant the other associated taxa are likely to be highly variable. The community as defined here may be visually separated into grass and cyperoid dominated areas. This internal variability within individual occurrences and this is primarily due to the proximity to water sources and therefore the effective period of inundation. Clarke (1998) further subdivided this association into four zones that were banded based on proximity to creek channels within Boonoo Boonoo National Park. This community intergrades with Community 1 along its margins. Described as Community 1: *Epacris microphylla – Leptospermum arachnoides/Themeda triandra – Gonocarpus micranthus* and Community 3: *Baeckea omissa – Epacris microphylla/Lepidosperma limicola – Baloskion stenocoleum* (the former occurring in drier areas and the latter in wetter locations) by Hunter & Bell (2007) in their region wide analysis of montane bogs. These bogs are the most northerly occurring Australian bogs and are at their climatic and distributional limit and are highly significant in these terms. These communities would conform to the , montane peatlands and swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and the Australian Alps bioregions have been listed as an **endangered** ecological community (TSC 1995; 17 December 2004).

Condition: across the two reserves this assemblage is generally considered to be in very good condition. However, some sites are particularly disturbed by pig rutting and by stray cattle, the signs of which were commonly noted. Furthermore, in areas of past habitation and grazing such as around the Boonoo Boonoo hut and down to the river and also in the upper reaches of Boonoo Boonoo River within Bald Rock National Park this community has a high incidence of invasive weedy taxa.

Taxa of conservation importance: *Thelionema grande*.

Notes: few completely comparable examples of this assemblage can be found within the literature. Similar associations are restricted to higher altitudes on the tablelands particularly on the eastern margin of the divide generally restricted to eastern flowing catchments from here south to the Sara River south east of Glen Innes (Hunter & Bell 2007).

Conservation status: communities such as these are usually highly divergent across relatively small distances and as such most occurrences are somewhat unique. Hunter & Bell (2007) in their region wide analysis have shown that this assemblage can be found within Capoompeta NP, Western Washpool NP, Mann River NR and Warra NP. Similar small isolated occurrences are likely to occur within most reserves on the escarpment and associated tablelands areas such down to Barrington Tops.

Management considerations: this community is prone to disturbance particularly from stray cattle and rutting from pigs. Service trails pass along side and across many examples of this community type. Most occurrences of this community within Bald Rock National Park have an associated trail running alongside them. Closure or at least minimal use of some of these trials may need to be considered. Such trails will need to be kept at a high standard and the effects of runoff in terms of erosion and weed invasion. Disturbances and weed invasion are likely to be greater after fires. Control of weeds and introduced pests will be a constant management issues. This community is also threatened by influxes of nutrients and climate change.

Figure 21: Photographs of Community 2. Above = Site 29 within Boonoo Boonoo, below = Site 49 within Bald Rock.

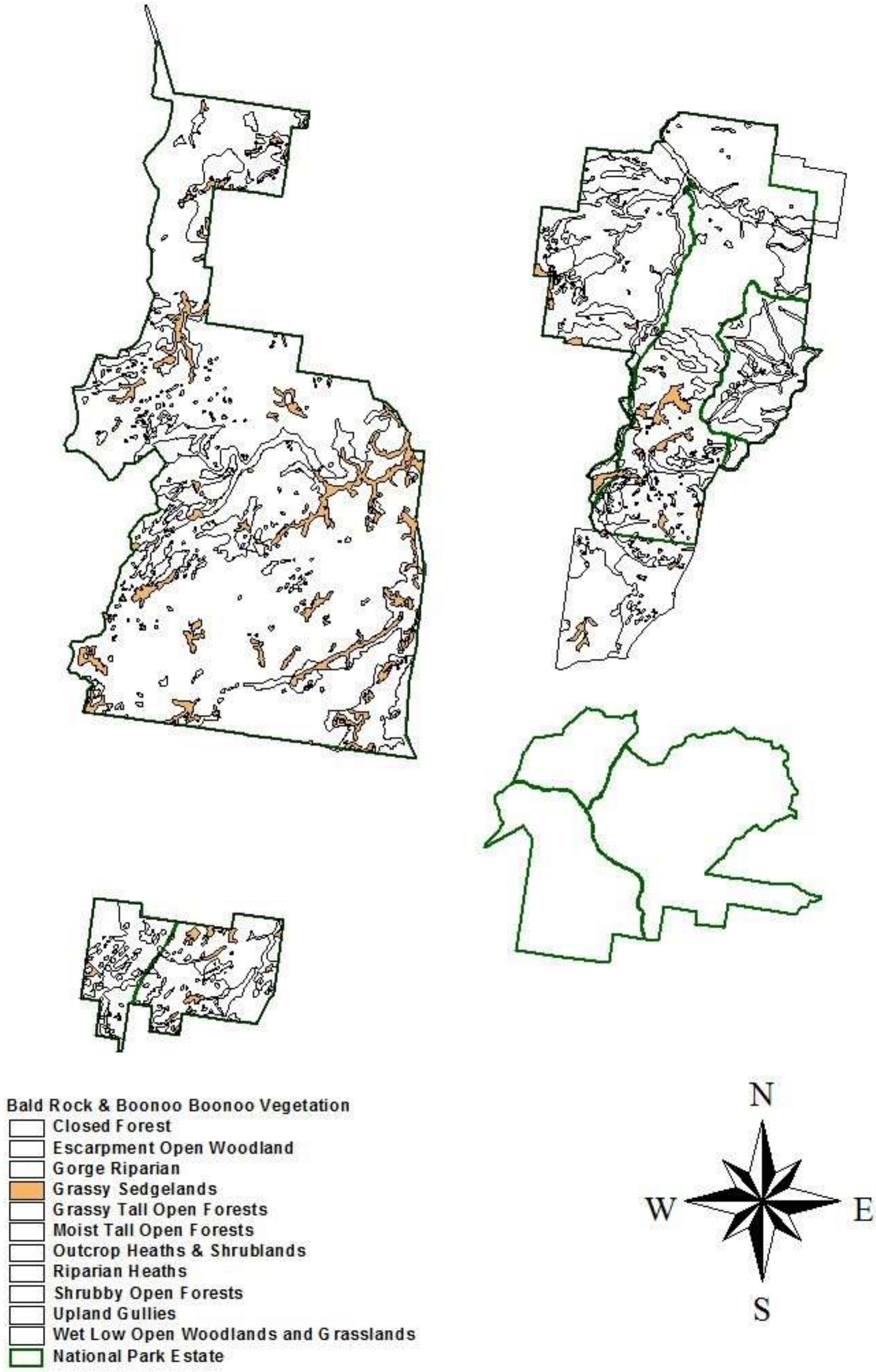


Figure 22: Mapped distribution of Community 2.

3.4.3 Community 3: Riparian Heaths

Burgan (*Kunzea parvifolia*) – Lemon Bottlebrush (*Callistemon pallidus*) – Rock Oak (*Allocasuarina rupicola*) Riparian Heath.

Sample sites (2): 12, 28.

Number of hectares: 60 **Proportion of reserves:** 0.4%

Landform: the open rocky banks of Boonoo Boonoo River.

Distribution: this community type only occurs along the rocky margins of the Boonoo Boonoo River at higher altitudes.

Structure: upper layer 5-8 m tall, *c.* 10% cover; middle layer 1-3 m tall, 20-40% cover; ground layer <0.5 m tall, *c.* 20% cover.

No. of taxa: 119 **No. of taxa per plot:** 62-78 (70 av.).

Common natives: Listed in decreasing order of importance (frequency and cover).

Trees: *Callitris endlicheri*.

Shrubs: *Kunzea parvifolia, Callistemon pallidus, Allocasuarina rupicola, Leptospermum polygalifolium* subsp. *montanum, Leptospermum gregarium, Calytrix tetragona, Prostanthera nivea, Philotheca myoporoides* subsp. *epilosum, Notelaea linearis, Mirbelia confertiflora, Leucopogon neoanglicus, Leptospermum variabile, Leptospermum novae-angliae, Homoranthus lunatus, Boronia anemonifolia, Baeckea omissa*.

Climbers & trailers: none apparent.

Ground cover: *Lomandra longifolia, Schoenus melanostachys, Entolasia stricta, Schoenus apogon, Digitaria ramularis, Dichelachne sieberiana, Actinotus gibbonsii, Trachymene incisa, Themeda triandra, Rhynchospora brownii, Philydrium lanuginosum, Panicum simile, Mitrasacme paludosa, Lobelia gibbosa, Lepyrodia anarthria, Lepidosperma gunnii, Laxmannia compacta, Hypericum gramineum, Gonocarpus oreophilus, Gonocarpus micranthus, Gleichenia dicarpa, Entolasia marginata, Drosera spatulata, Dichelachne crinita, Cyperus gracilis, Cheilanthes sieberi, Carex lobolepis, Brachyscome stuartii, Agrostis avenacea, Actinotus helianthi.*

Introduced taxa: *Conyza albida, Juncus bufonius, Taraxacum officinale, Hypochaeris radicata, Gnaphalium americanum, Aira cupaniana.*

Percent of species introduced: 4%.

Variability: This assemblage is highly stochastic and most species will have a low constance. The structure also is variable and in places will be densely shrubby and in others shrubs are only a minor component.

Condition: Generally very good. This community highly disturbed in some sites due to the popular use of the river by visitors. Some banks are eroded.

Taxa of conservation importance: *Allocasuarina rupicola, Homoranthus lunatus, Actinotus gibbonsii, Prostanthera petraea*, *Callitris oblonga* subsp. *parva*.

Notes: the community intergrades in some places with community 11 due to the outcrop nature of some of the riverbanks. It also intergrades with Community 9 where the rocky substratum becomes less prominent and the riverbed widens out and has patches with deeper soils.

Conservation status: this community as circumscribed here is likely to be limited to Boonoo Boonoo National Park though similar communities do occur within Basket Swamp NP and Warra NP. Due to its restricted occurrence and the limited distribution of a number of its associated taxa this community is vulnerable and of considerable conservation significance.

Management considerations: this community has a very high edge to area ratio and as such will be prone to disturbances of all kinds, particularly from fire. Many drivable access points to small campsites exist along the river. These trails should be closed and easy access to the river should be minimised. A high number of restricted and threatened species are associated with this community. This in itself presents significant management problems. Of particularly note is the picnic area at Morgans Gully, within a hundred meters of this site several TSC Act and RoTAP species populations exist. Damage to plants within this area will need monitoring as many of these threatened species are prone to death due to trampling. A number of these threatened species are fire avoiders and even small fires escaping from the picnic area may threaten the survival of some populations. Weed invasion while not significant at present, probably due to the rocky nature of the substrate, may become an issue in the future and thus will need periodic monitoring.

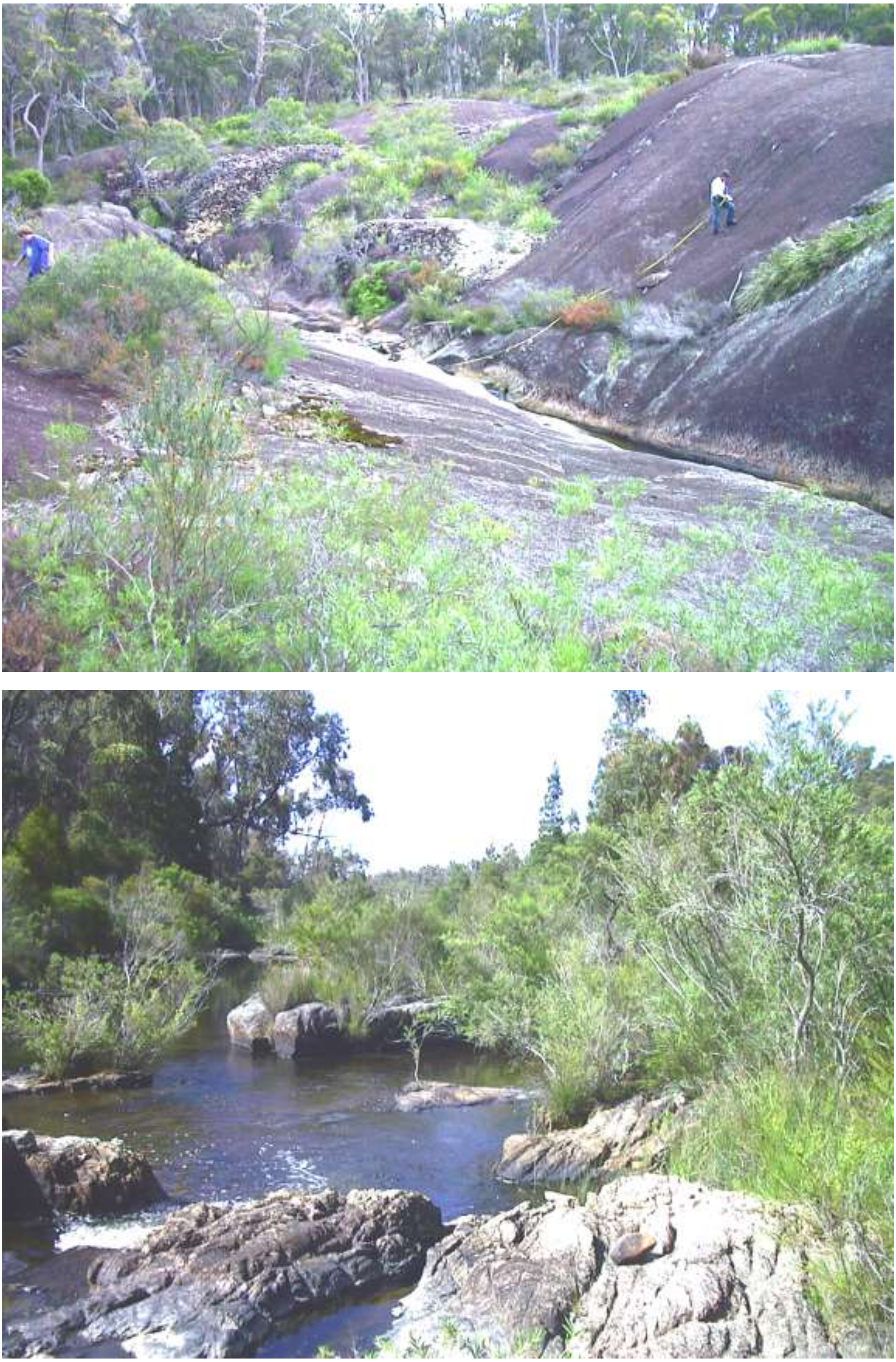


Figure 23: Photographs of Community 3. Above = Site 12 (Morgans Gully), below = Site 28, both from the Boonoo Boonoo River within Boonoo Boonoo.

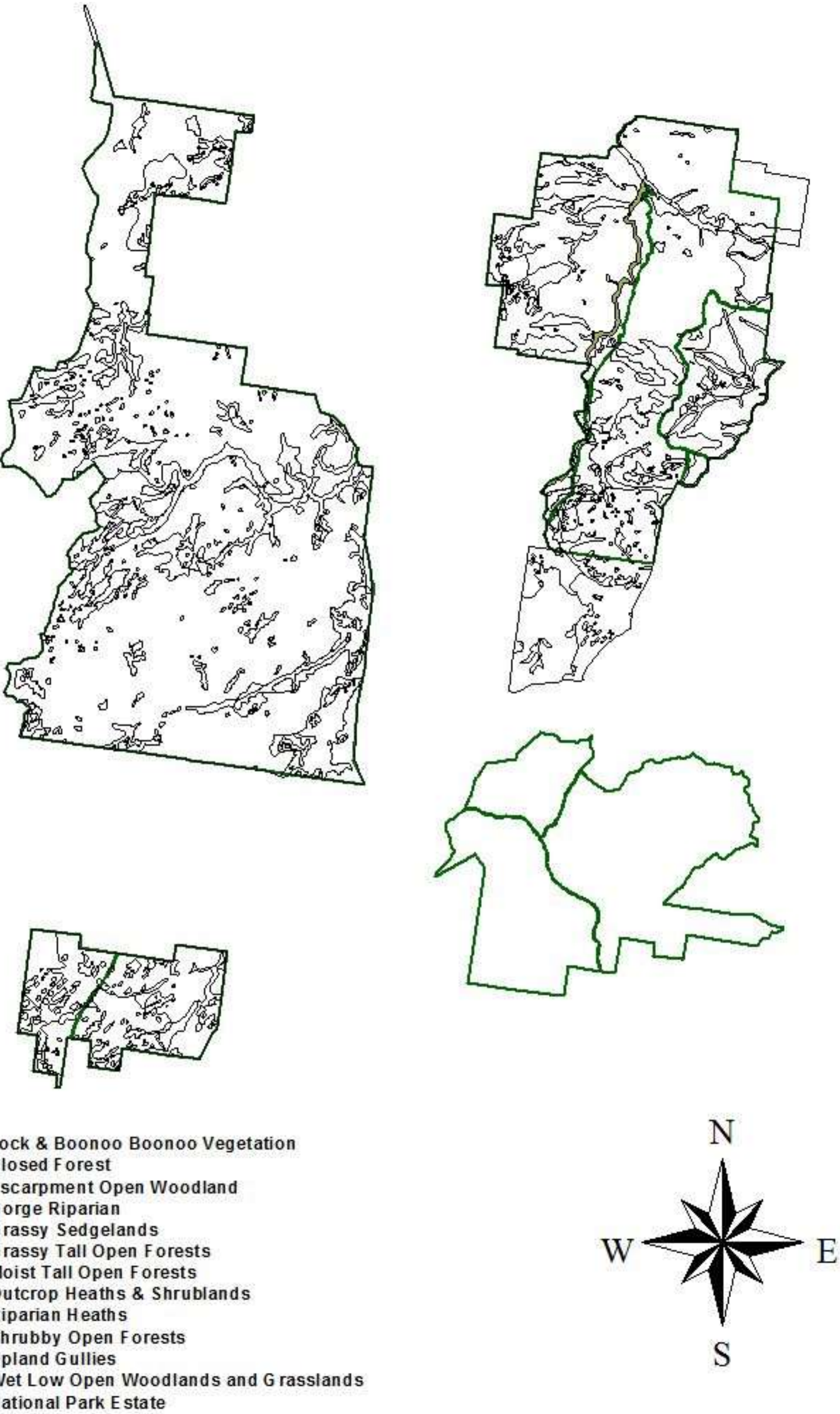


Figure 24: Mapped distribution of Community 3.

3.4.4 Community 4: Closed Forests

Brush Box (*Lophostemon confertus*) – Creek Sandpaper Fig (*Ficus coronata*) Closed Forest.

Sample sites (1): 7.

Number of hectares: 7 **Proportion of reserves:** <0.1%

Landform: Deeply incised gullies.

Distribution: Restricted to one site at the base of Boonoo Boonoo Falls.

Structure: No distinct layering however some broad groupings can be distinguished. Upper layer 20-25 m, 30% cover; middle layer 8-12 m tall, 80% cover.

No. of taxa: 36 **No. of taxa per plot:** 36.

Common natives: Listed in decreasing order of importance (frequency and cover).

Trees: *Lophostemon confertus, Ficus coronata, Diospyros australis, Cryptocarya rigida, Pennantia cunninghamii, Pararchidendron pruinosum, Ficus obliqua, Alectryon subdentatus, Alectryon subcinereus, Rhodamnia argentea.*

Shrubs: *Neolitsea australiensis, Citriobatus pauciflorus, Omalanthus populifolius*.

Climbers & trailers: *Stephania japonica* subsp. *discolor, Smilax australis, Sarcopetalum harveyanum, Parsonsia velutina, Parsonsia straminea, Parsonsia purpurascens, Morinda jasminoides, Grammitis billardieri, Tinospora smilacina, Geitonoplesium cymosum, Dictymia brownii, Cissus antarctica*.

Ground cover: *Calochlaena dubia, Blechnum cartilagineum, Asplenium australasicum, Pellaea falcata* var. *nana, Gymnostachys anceps, Davallia pyxidata, Cordyline petiolaris, Adiantum hispidulum, Adiantum aethiopicum.*

Introduced taxa: *Ageratina adenophora*.

Percent of species introduced: 3%.

Variability: only one site was sampled in this community and hence the natural variability of this association cannot be assessed based on the results presented here.

Condition: good, little disturbance appears to have occurred however some is associated with tracks and trails associated with visitors climbing to the bottom of the Falls. The more open areas have bad infestations of Crofton Weed.

Taxa of conservation importance: *Acronychia laevis*.

Notes: this community was considered by Gilmour (1993) to be floristically a dry rainforest but with an unusual combination of species that made it difficult to place within Floyds (1991) rainforest associations of New South Wales. Gilmour (1993) tentatively placed this community within the *Drypetes-Araucaria* Alliance and potentially within the *Ficus-Streblus-Dendrocnide-Cassine* Sub-alliance. This alliance is commonly restricted to sites protected from fire with a marked spring or summer drought (Floyd 1990).

Conservation status: the patch size is only a little over 1 ha in size and contains an unusual combination of species (Gilmour 1993). It is likely that this assemblage is rather unique and of considerable conservation significant.

Management considerations: Braiding of trails has occurred due to visitors using different paths to the bottom of the Boonoo Boonoo Falls. While a distinct trail may increase visitor usage it may also reduce damage associated with people using many different paths to the bottom. The service may wish to consider the construction of a defined trail.

Figure 25: Photograph of Community 4.

Figure 26: Photographs of Community 4. Both = Site 7. Bottom of Boonoo Boonoo Falls, Boonoo Boonoo.

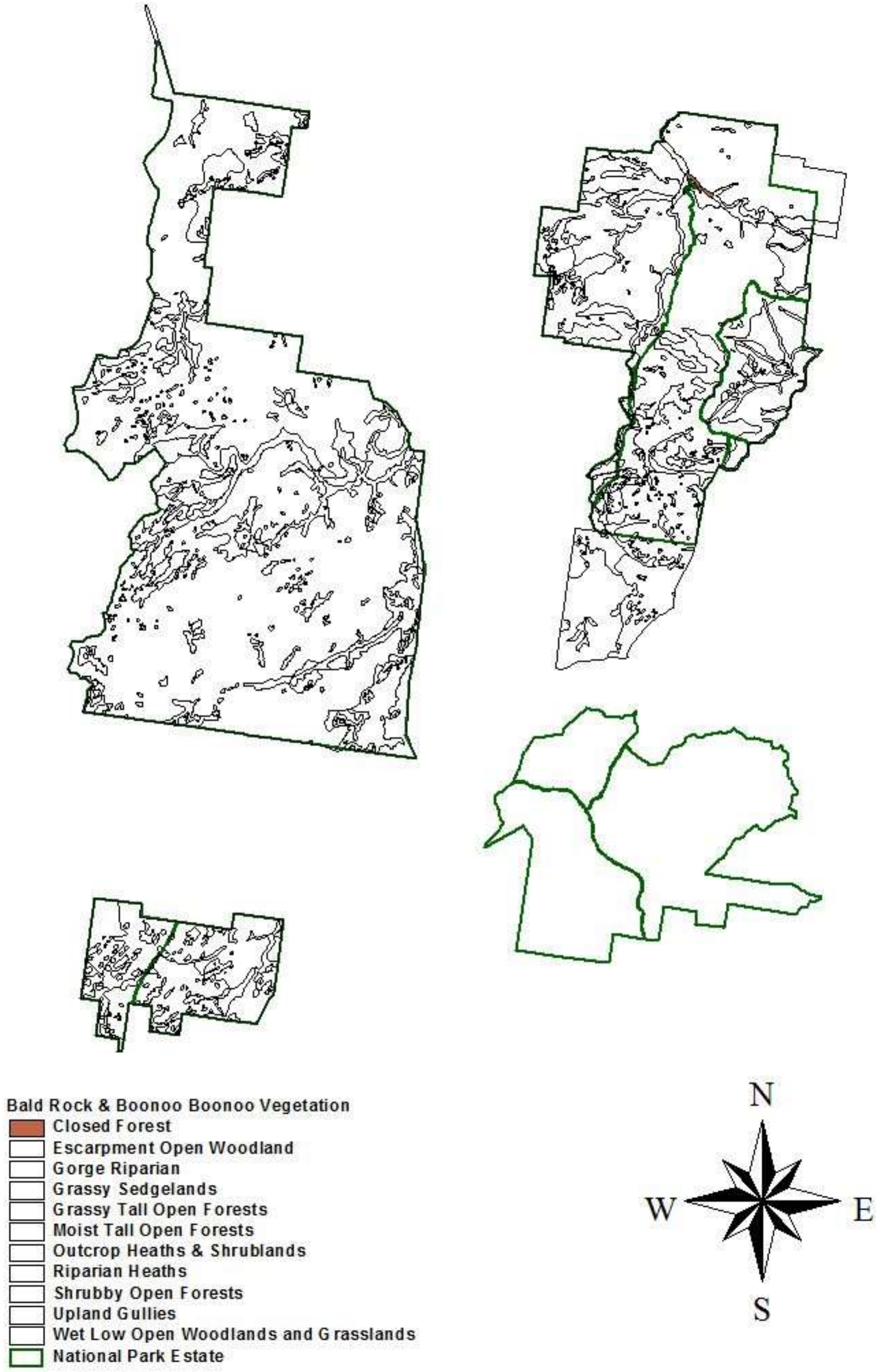


Figure 27: Mapped distribution of Community 4.

3.4.5 Community 5: Gully Riparian

Tea-tree (*Leptospermum brachyandrum*) Gully Riparian.

Sample sites (1): 8.

Number of hectares: 16 **Proportion of reserves:** <0.1%

Landform: River sides at the base of the gorge.

Distribution: Restricted to the margins of the Boonoo Boonoo River at the base of the falls.

Structure: Upper layer 80-10 m, 5% cover; middle layer 2-4 m, 15% cover; ground layer <1 m tall, *c.* 15% cover.

No. of taxa: 49 **No. of taxa per plot:** 49.

Common natives: Listed in decreasing order of importance (frequency and cover).

Trees: *Angophora subvelutina, Toona ciliata, Lophostemon confertus, Ficus rubiginosa, Ficus coronata, Alectryon subdentatus, Alangium villosum, Casuarina cunninghamii.*

Shrubs: *Leptospermum brachyandrum, Calytrix tetragona, Callistemon viminalis, Leucopogon neoanglicus, Alchornea ilicifolia, Acacia floribunda.*

Climbers & trailers: *Pyrrosia rupestris, Geitonoplesium cymosum, Stephania japonica, Parsonsia straminea, Dendrobium linguiforme.*

Ground cover: *Lomandra longifolia, Psilotum nudum, Plectranthus graveolens, Oplismenus undulatifolius, Juncus usitatus, Entolasia stricta, Austrodanthonia fulva, Wahlenbergia stricta, Vernonia cinerea, Sporobolus creber, Rumex brownii, Opercularia aspera, Lepidosperma laterale, Euchiton involucratus, Echinopogon caespitosus, Doodia aspera, Digitaria breviglumis, Dianella caerulea* var. *producta, Cyperus imbecillis, Arthropodium milleflorum, Aristida vagans, Aristida ramosa, Aristida jerichoensis, Ajuga australis, Adiantum hispidulum.*

Introduced taxa: *Ageratina adenophora, Hypochaeris radicata, Gnaphalium americanum, Conyza albida, Andropogon virginicus.*

Percent of species introduced: 12%.

Variability: only one site was sampled in this community and hence the natural variability of this association cannot be assessed based on the results presented here. However, based on its limited occurrence and riparian nature this community is likely to be highly variable. The presence of dry closed forest species is dependent on the protection afforded by the site, more exposed areas had a reduction in these taxa but still had a number of vine species. Just below this site *Casuarina cunninghamii* become prominent.

Condition: Good.

Taxa of conservation importance:

Notes: although riverine communities such as these are known throughout the north-east they are likely to be rather divergent from this assemblage as species are usually of low constance.

Conservation status: although *Casuarina cunninghamii* communities are considered to be well reserved within the east, those within gorge country on granite of limited distribution. This along with the unique assemblage shown here would indicate that this assemblage is of conservation significance and of very limited distribution.

Management considerations: these areas are relatively inaccessible and likely to be little disturbed in the future. However, weed invasion is likely to be a problem in the future and the level of weeds is considered to be high at present.

Figure 28: Photographs of Community 5. Both = Site 8. Bottom of Boonoo Boonoo Falls, Boonoo Boonoo.

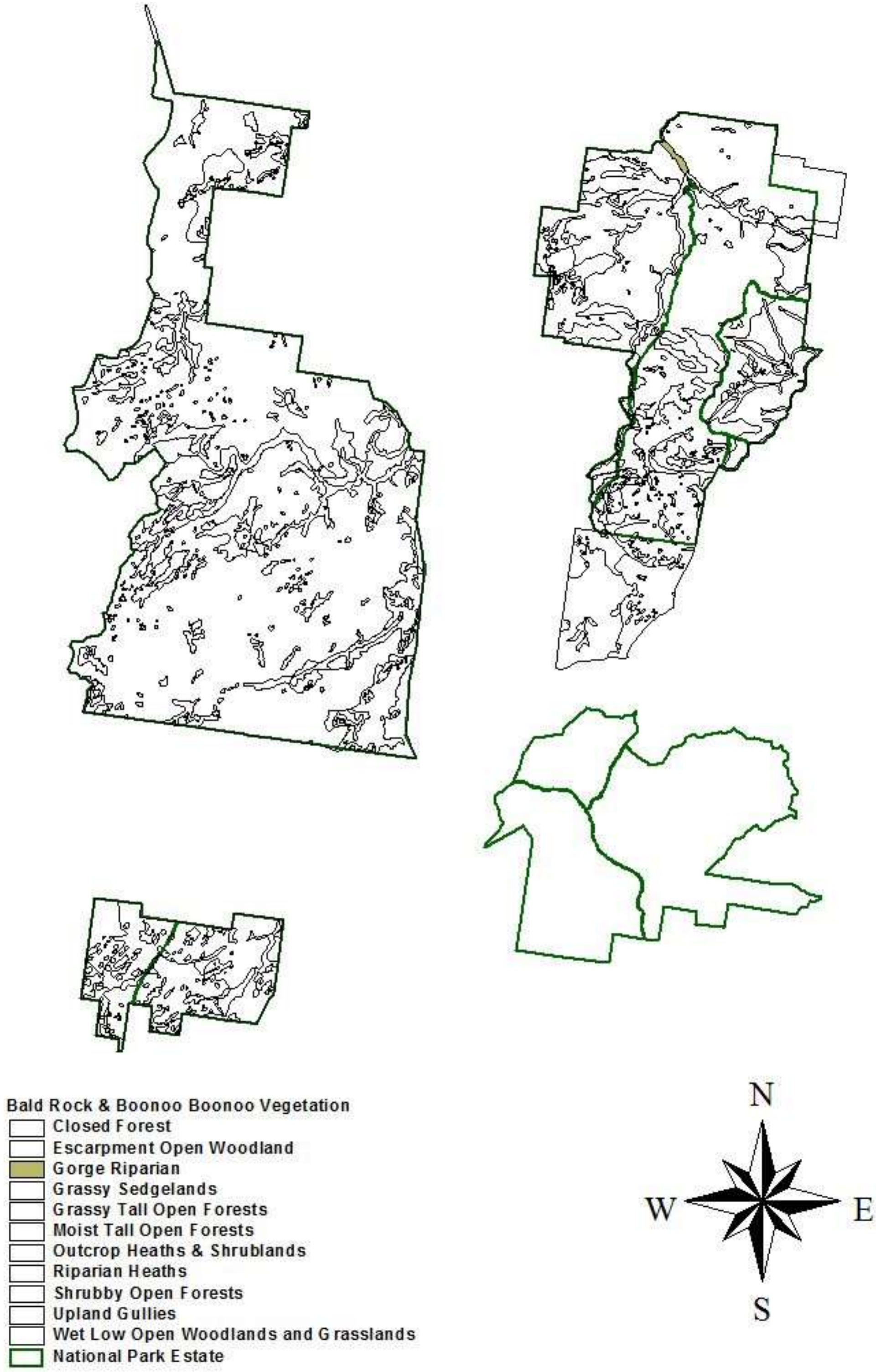


Figure 29: Mapped distribution of Community 5.

3.4.6 Community 6: Grassy Tall Open Forests

New England Blackbutt (*Eucalyptus campanulata*) – Mountain Gum (*Eucalyptus brunnea*) Grassy Tall Open Forest.

Sample sites (38): 4, 9, 11, 14, 25, 26, 35, 36, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50, 51, 53, 56, 57, 58, 59, 62, 88, 103, 104, 105, 109, 110, 112, 113, 114, 117, 118, 119.

Number of hectares: 6,417 **Proportion of reserves:** 45%

Landform: On undulating to hilly country within plateau areas generally above 800 m but more common above 900 m altitude on deeper less rocky soils.

Distribution: Found throughout both reserves but primarily restricted to nearby the Boonoo Boonoo River in Boonoo Boonoo National Park yet more widespread in Bald Rock National Park.

Structure: Upper layer 20-40 m tall, 20-50% cover; middle layer 5-15 m tall, 10-60% cover (not always present); lower middle layer 1-4 m tall, 20-60% cover (usually not present if previous layer is present); ground layer <1 m, 60-100% cover.

No. of taxa: 273 **No. of taxa per plot:** 37-71 (53 av.).

Common natives: Listed in decreasing order of importance (frequency and cover).

Trees: *Eucalyptus campanulata, Banksia integrifolia, Eucalyptus brunnea, Allocasuarina littoralis, Eucalyptus eugenioides, Eucalyptus radiata* subsp. *sejuncta, Eucalyptus pauciflora, Eucalyptus dalrympleana* subsp. *sejuncta, Eucalyptus acaciiformis, Eucalyptus tindaliae, Angophora subvelutina, Eucalyptus dorrigoensis, Eucalyptus saligna, Eucalyptus propinqua.*

Shrubs: *Hibbertia obtusifolia, Leucopogon lanceolatus, Monotoca scoparia, Melichrus procumbens, Dillwynia phylicoides, Persoonia tenuifolia, Acacia irrorata, Lomatia silaifolia, Platysace ericoides.*

Climbers & trailers: *Hardenbergia violacea, Desmodium varians, Rubus parvifolius, Glycine clandestina, Glycine tabacina, Eustrephus latifolius, Smilax australis, Desmodium rhytidophyllum, Clematis glycinoides, Tylophora woollsii*.

Ground cover: *Sorghum leiocladum, Themeda triandra, Imperata cylindrica, Pteridium esculentum, Stylidium graminifolium, Poranthera microphylla, Dianella caerulea* var. *caerulea, Goodenia bellidifolia* subsp. *bellidifolia, Poa sieberiana, Opercularia aspera, Brachyscome nova-anglica, Viola betonicifolia, Pratia purpurascens, Vernonia cinerea* subsp. *cinerea, Microlaena stipoides, Hypericum gramineum, Gonocarpus tetragynus, Geranium solanderi* subsp. *solanderi, Dichelachne crinita, Trachymene incisa, Senecio diaschides, Entolasia stricta, Echinopogon caespitosus* var. *caespitosus, Dichelachne micrantha, Lomandra multiflora, Chrysocephalum apiculatum, Tricoryne elatior.*

Introduced taxa: *Hypochaeris radicata, Conyza albida, Taraxacum officinale, Conyza bonariensis, Sonchus oleraceus, Medicago arabica, Gomphocarpus fruticosus, Centaurium erythraea, Aira cupaniana, Verbena bonariensis, Secale cereale, Conyza chilensis, Cirsium vulgare.*

Percent of species introduced: 5%.

Variability: this community is widespread yet usually has a distinct suite of species that are often associated. Often the community is very open with a sparse understorey. *Allocasuarina* is common as a low tree layer and shrubs are usually scattered and often primarily include *Leucopogon lanceolatus*. *Poa*, *Imperata*, *Lomandra* and Pteridium dominate the herb layer. Sometimes the shrub component may be more prominent and include legumes such as *Daviesia* or *Acacia* that have germinated on mass due to recent fires that heated the soil sufficiently to germinate seeds.

Condition: generally good. Many areas have been affected by a high regularity of fires. Signs of recent cattle grazing were common.

Taxa of conservation importance: *Eucalytpus dorrigoensis, Tylophora woollsii*.

Notes: Clarke (1998) describes a somewhat similar community for Boonoo Boonoo National Park and lists it as occurring on well drained slopes and ridges at altitudes less than 1000 m. The observations made during this survey would indicate that this community is more widespread and occurs commonly at higher altitudes up to 1100 and is not restricted to well drained slopes or ridges. Binns (1995d) describes a very synonymous community in Maryland State Forest where it extensive on granite in low relief drainage lines and lower slopes. Divergent but a somewhat floristically similar community is described by Elsol (1991) as occurring as far north as Toowoomba. In the surveys of State Forests conducted in the north east of New South Wales (King 1985; Binns 1991; Binns 1992; Moore & Floyd 1994; Binns 1995b, Binns 1995d; Chapman & Binns 1995) somewhat synonymous communities have been described as occurring from the Kempsey and Wauchope areas north to Tenterfield, Urbenville and Grafton. The NSW NPWS (1996b) describe Unit 75 which seems similar to Community 6 and its occurrence is mapped as extensive between Forest Lands State Forest south to the upper Sara River. Binns (1992) and Binns (1995b) describe similar communities as being common in the Tenterfield and Glen Innes districts on lower slopes and along gullies in undulating topography particularly around 900 m altitude. Moore & Floyd (1994) describe overstorey communities such as this but with a mesomorphic closed forest understorey or in re-invasion areas of once cleared closed forest in the Grafton Forestry District. Beadle (1981) also describes how the understorey of similar communities is dramatically changed by fire. Closed forest taxa are eliminated by fire and are replaced by *Acacia irrorata* and *Allocasuarina torulosa*. If fires are repeated in close succession only an understorey of grasses dominated by *Imperata* and *Themeda* remains which is how the community occurs within these reserves. These comments are corroborated by Binns (1995b) who observed the replaced of mesomorphic closed forest taxa with an understorey of grasses. Fire has been frequent within this association in the reserve.

Conservation status: based on overstorey dominants this community can be fitted within a range of other communities and forest types within the literature. In general these types of associations were considered to be poorly conserved across their range but since the many recent additions these associations are probably now well conserved across their range. Similar assemblages are or are likely to be reserved within Basket Swamp National Park, Demon Nature Reserve, Mann River Nature Reserve, Forest Lands National Park, Washpool National Park Western Additions and Guy Fawkes River National Park. The association as it occurs here is probably widespread from Glen Innes to nearly Toowoomba.

Management considerations: this community is extensive and occurs throughout both reserves. It has a minimal weed component and therefore does not warrant much active weed management. The community is probably most affected by frequent fires that are likely to come from neighbouring properties.

Figure 30: Photographs of Community 6. Above = Site 53, below = Site 58. Both within Bald Rock.

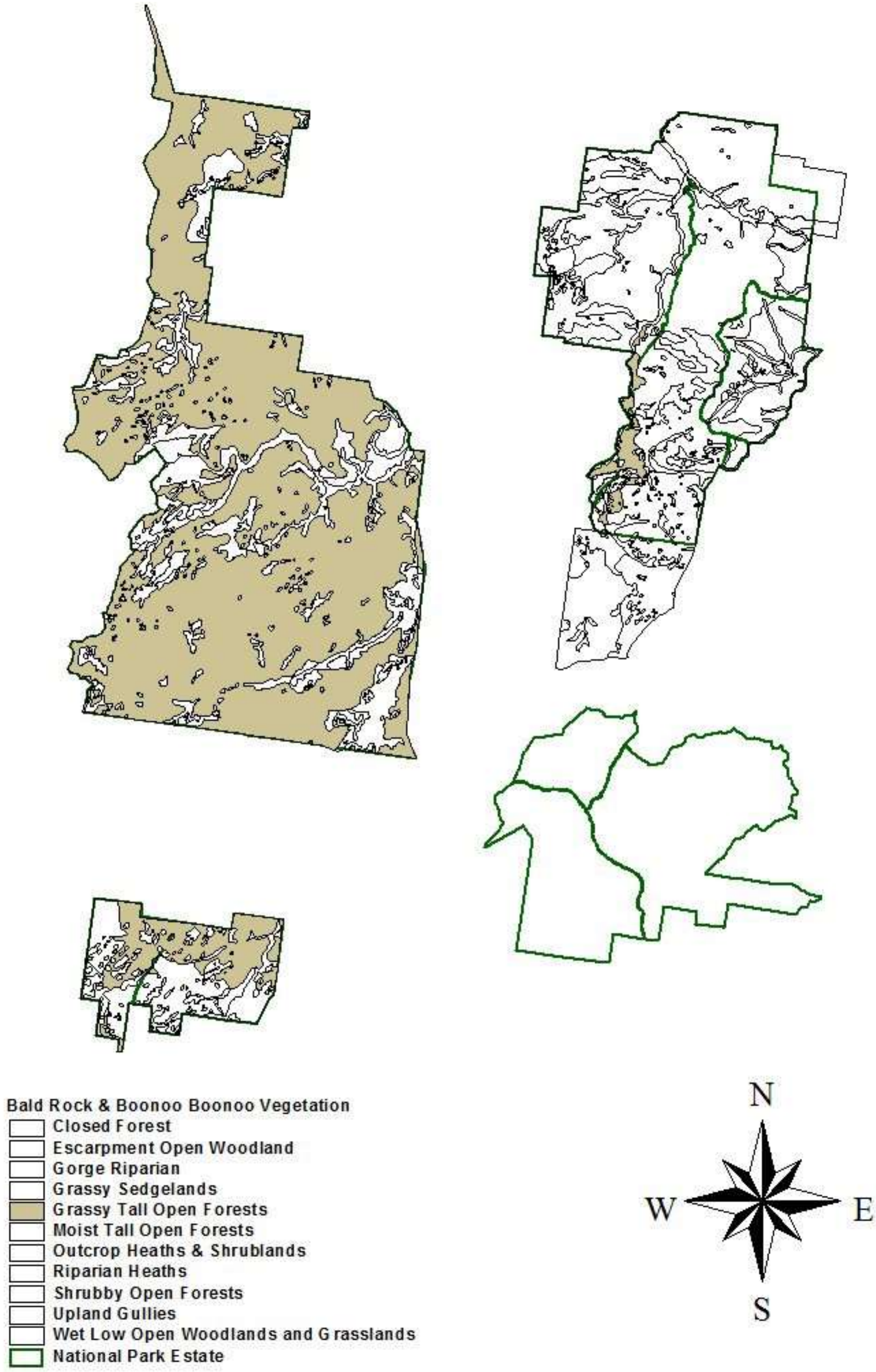


Figure 31: Mapped distribution of Community 6.

3.4.7 Community 7: Escarpment Open Woodlands

Broad-leaved Apple (*Angophora subvelutina*) – Grey Gum (*Eucalyptus biturbinata*) Open Woodland.

Sample sites (9): 10, 27, 34, 68, 90, 93, 94, 96, 98.

Number of hectares: 1,218 **Proportion of reserves:** 8.5%

Landform: Steep slopes within the gorge country.

Distribution: This community is mainly restricted to the steep gorge country below 800 m altitude around Boonoo Boonoo Falls. However, there is also a disjunct occurrence not associated with gorge country in the far south western portion of the Sth Bald Rock National Park section. This locality however is associated with a deep gully and westerly exposed dry position which seems to mirror the environmental attributes of the gorge country within Boonoo Boonoo.

Structure: Upper layer 20-25 m, 30-40% cover; upper middle layer not always present 5-14 m tall, 10-20% cover, lower middle layer 1-5 m tall, 30-70% cover; ground layer <1 m tall, 30-90% cover.

No. of taxa: 119 **No. of taxa per plot:** 42-53 (49 av.).

Common natives: Listed in decreasing order of importance (frequency and cover).

Trees: *Angophora subvelutina, Eucalyptus biturbinata, Banksia integrifolia, Eucalyptus tindaliae, Eucalyptus radiata* subsp. *sejuncta, Eucalyptus eugenioides, Allocasuarina torulosa, Eucalyptus tereticornis, Eucalyptus prava, Eucalyptus campanulata, Corymbia gummifera, Allocasuarina littoralis, Lophostemon confertus.*

Shrubs: *Daviesia elliptica, Acrotriche aggregata, Lomatia silaifolia, Leptospermum polygalifolium* subsp. *transmontanum, Desmodium brachypodum, Trochocarpa laurina, Myoporum montanum, Leucopogon melaleucoides, Jacksonia scoparia, Hibbertia obtusifolia, Acacia macnuttiana, Acacia betchei.*

Climbers & trailers: *Desmodium rhytidophyllum, Rubus parvifolius, Glycine clandestina, Desmodium varians, Hardenbergia violacea, Cissus hypoglauca.*

Ground cover: *Imperata cylindrica, Sorghum leiocladum, Themeda triandra, Pteridium esculentum, Cymbopogon refractus, Poa sieberiana, Dichelachne micrantha, Vernonia cinerea* var. *cinerea, Echinopogon caespitosus* var. *caespitosus, Chrysocephalum apiculatum, viola betonicifolia, Schoenus apogon, Pomax umbellata, Lomandra* *filiformis, Lepidosperma laterale, Gonocarpus tetragynus, Austrodanthonia monticola, Trachymene incisa, Thysanotus tuberosus, Stylidium graminifolium, Senecio diaschides, Lomandra longifolia, Goodenia hederacea, Gahnia aspera, Dianella caerulea* var. *caerulea, Cheilanthes sieberi.*

Introduced taxa: *Hypochaeris radicata, Conyza albida, Taraxacum officinale, Sigesbeckia orientalis* var. *orientalis*.

Percent of species introduced: 3%.

Variability: the major disjunction in species is between the gorge country sites of Boonoo Boonoo National Park and the lower valley sites in the southern section of Bald Rock National Park. However, as indicated by the classification many elements are shared and this is primarily due to the very well drained and dry nature of both areas. Within the gorge country of Boonoo Boonoo National Park much of the variation is due to altitudinal changes and the associated merging with Community 7 at higher altitudes and Community 6 at the base of the gorge or due to the steepness of slope and how shallow and rocky the soils may be. *Allocasuarina torulosa* in more protected sites can become dominant and form a very dense layer.

Condition: generally good. Stray cattle appear to use the gorge country at Boonoo Boonoo National Park frequently and have caused disturbance and weed introductions to a number of areas. Within the southern section of Bald Rock National Park some clearing near the bottom of the park has occurred. Furthermore, in this section a fire trial has recently been put in (1998) that has caused some major disturbance and weed introductions to this limited community.

Taxa of conservation importance: *Acacia macnuttiana, Acacia betchei.*

Notes: a community described in Gilgurry State Forest (Binns 1995b) near the Queensland Border and a community described for Bowman State Forest near the Barrington Tops (Binns 1995a) are almost directly synonymous. It is likely that somewhat synonymous communities to Community 7 are found as far north as Beenleigh in Queensland (McDonald & Whiteman 1979) as far south as the eastern and western slopes of Barrington Tops (Binns 1995a; NSW NPWS 1996b). This and synonymous communities are probably the most extensive vegetation type on steep precipitous slopes at mid altitudes around 500-900 m in the north east of New South Wales. All similarly described communities are simple in structure with a tree layer around 30 m tall, a grass layer and a conspicuous and ubiquitous *Allocasuarina torulosa* sub-canopy. Binns (1992) speculates that a long history of burning by graziers has maintained the consistent grassy understorey.

Conservation status: similar communities as circumscribed here have been considered very poorly conserved to inadequately conserved across their range. However with the recent additions to the reserve network these assemblages may no be considered adequately conserved across north eastern New South Wales. Directly comparable communities from gorge areas are known to be reserved within the Demon Nature Reserve (Hunter *et al.* 1999), Mann River Nature Reserve, Guy Fawkes River National Park (Hunter & Alexander 1999) and in the Washpool National Park Western Additions (Hunter 1998). The dry lower valley of south Bald Rock National Park also shows some affinities to regions such as Torrington (Clarke *et al.* 1998) and similar assemblages may also be reserved in the southern parts of Girraween National Park and also Sundown National Park in Queensland. Despite the apparent adequate reservation status of this community it is of limited extent within both reserves and further additions of this type of community may be worthwhile as these occurrences here are near the northern limit of their distribution.

Management considerations: the fire trial within the southern section of Bald Rock National Park should either be allowed to regenerate or should be upgraded in order to prevent erosion and further disturbance to the lower creek areas of the reserve. The trail as it exists follows within close proximity to a creek most its length in the bottom half of the reserve. Stray cattle will need removal whenever they are noted. Weed invasion is generally low but may increase significantly if the south Bald Rock fire trail is used with any frequency.

Figure 32: Photographs of Community 7. Above = Site 34, below = Site 35. Both within Boonoo Boonoo.

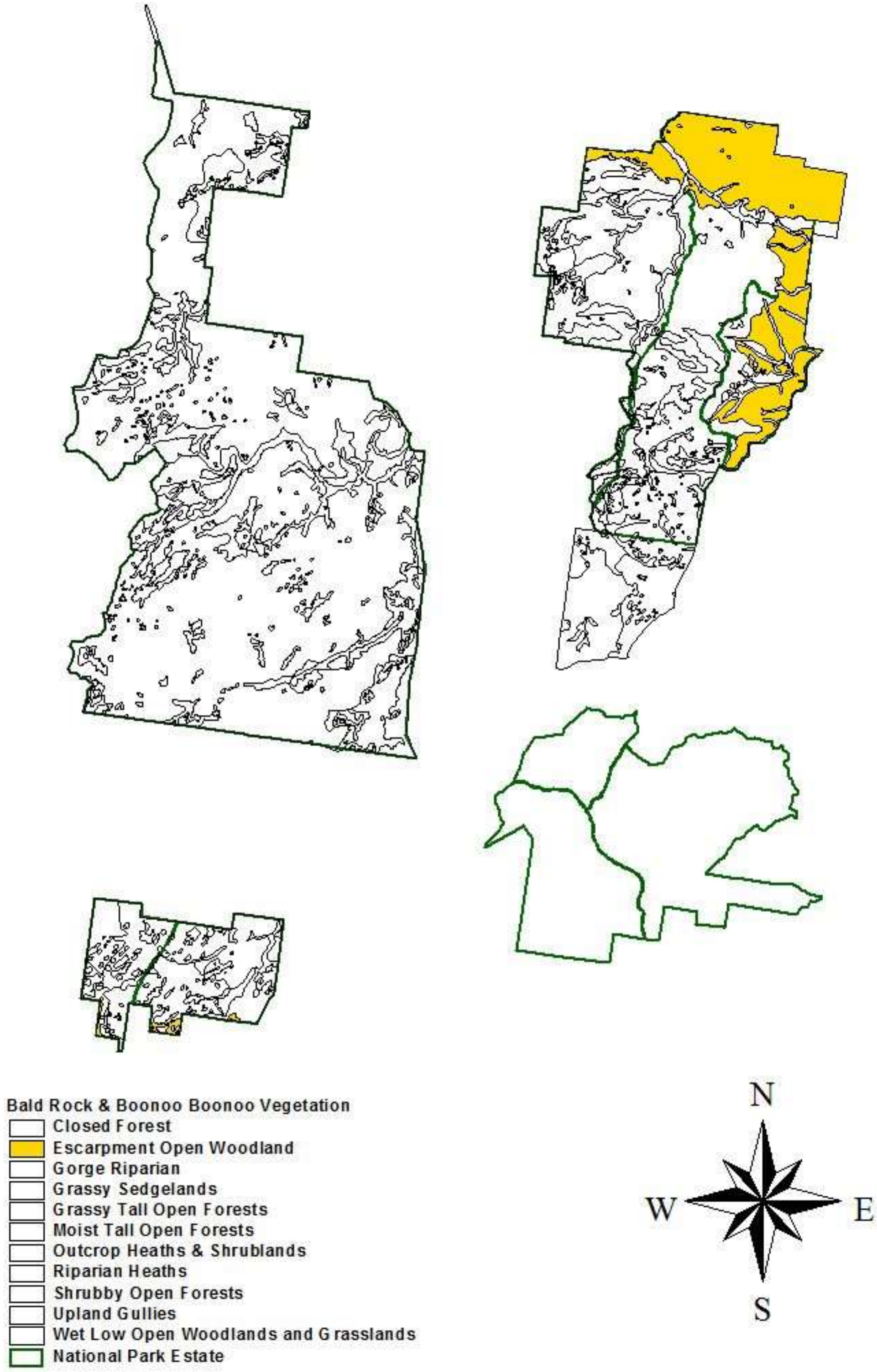


Figure 33: Mapped distribution of Community 7.

3.4.8 Community 8: Moist Tall Open Forests

New England Blackbutt (*Eucalyptus campanulata*) – Mountain Gum (*Eucalyptus brunnea*) – Messmate (*Eucalyptus obliqua*) Tall Open Forest.

Sample sites (9): 5, 6, 13, 24, 30, 55, 66, 69, 107.

Number of hectares: 1,361 **Proportion of reserves:** 9.5%

Landform: Protected creeks and gullies and the base of larger bornhardts.

Distribution: Found within both reserves but generally associated with protected gullies in upland sites (above 1000 m) or associated with the margins of larger outcrops where sites are protected and afforded extra runoff.

Structure: Upper layer 25-40 m tall, 40-80% cover; upper middle layer 6-20 m tall, 10-70% cover; lower middle layer 1-5 m tall, 20-50% cover; ground layer >1 m tall, 60-100% cover.

No. of taxa: 203 **No. of taxa per plot:** 41-73 (55 av.).

Common natives: Listed in decreasing order of importance (frequency and cover).

Trees: *Eucalyptus campanulata, Eucalyptus brunnea, Allocasuarina littoralis, Banksia integrifolia, Eucalyptus obliqua, Eucalyptus radiata* subsp. *sejuncta, Lophostemon confertus, Eucalyptus notabilis, Eucalyptus dorrigoensis.*

Shrubs: *Leucopogon lanceolatus, Maytenus silvestris, Acacia irrorata, Acacia falciformis, Platysace ericoides, Lomatia silaifolia, Acrotriche aggregata, Pultenaea linophylla, Podolobium ilicifolium, Elaeocarpus reticulatus, Persoonia oleoides, Hibbertia obtusifolia, Hakea eriantha, Amperea xiphoclada* subsp. *xiphoclada, Acacia penninervis*.

Climbers & trailers: *Desmodium varians, Smilax australis, Eustrephus latifolius, Trochocarpa laurina, Glycine clandestina, Rubus parvifolius, Hardenbergia violacea, Kennedia rubicunda, Hibbertia scandens, Billardiera scandens, Polyscias sambucifolius, Hibbertia aspera,*

Ground cover: *Poa sieberiana, Gonocarpus oreophilus, Entolasia stricta, Themeda triandra, Pteridium esculentum, Lomandra longifolia, Echinopogon caespitosus* var. *caespitosus, Dianella caerulea* var. *caerulea, Calochlaena dubia, Viola betonicifolia, Microlaena stipoides, Entolasia marginata, Senecio diaschides, Imperata cylindrica, Schoenus melanostachys, Pratia purpurascens, Lepidosperma laterale, Dichondra* *repens, Blechnum cartilagineum, Oxalis chnoodes, Geranium solanderi* var. *solanderi, Deyeuxia parviseta, Poranthera microphylla,*

Introduced taxa: *Hypochaeris radicata, Conyza albida, Aira cupaniana, Gomphocarpus fruiticosus, Cirsium vulgare.*

Percent of species introduced: 3%.

Variability: the variability within this community is largely based on time since fire incursions and the amount of water available. It is best developed in the deeper upland gullies and directly below the larger rock outcrops. However its large edge to area ratio in both situations means that fire can and does regularly incur change the more mesic understorey to a more sclerophyllous type of assemblage. Often tree ferns or Soft Ground Ferns may be dense and prevalent, at times if a hot fire incursion has occurred a dense cohort of legumes may be found or when best developed closed forest taxa occur in the understorey.

Condition: good to fair. Many occurrences of this community type have been severely affected by the large fires in recent decades and the integrity of this community will largely be based on the future fires.

Taxa of conservation importance: *Eucalyptus dorrigoensis, Tylophora woollsii.*

Notes: Community 8 is closely allied to Beadles' (1981) *E. campanulata* Alliance that is described as occurring at higher altitudes from just over the Queensland border to the Barrington Tops area. The extent of similar assemblages based on currently described vegetation communities in the literature, reinforces Beadles (1981) perception of the extent of this Alliance. McDonald & Whiteman (1979) describe an *E. campanulata* community that varies from a tall forest with a partial closed forest understorey to a shorter forest with a shrubbier understorey. McDonald and Whiteman (1979) map a disjunct occurrence of this community in small areas just over the Queensland border from Canangra Creek near the Darlington Range to Tallebundgera Mountain near Lamington. Flora surveys conducted by the State Forests of New South Wales in their management areas (Binns & Chapman 1993; Binns 1995a, b) describe similar assemblages. These are found from the Tenterfield region south to the Carrai Plateau and to Barrington Tops. All described occurrences are at high altitudes above 900 m. Binns (1995b) considered this association as possibly the most widespread community in the Tenterfield area above 900 m on all geological substrates. Clarke *et al* (1998) describe a slightly divergent but very similar community as occurring on the Metasediment pendant in the Torrington area to the west of the region. The NSW NPWS (1996b) describe at least three Units similar to Community 5 and map their distribution from the Forest Lands State Forest south to Yarrowitch. Hunter (1998) and Hunter and Alexander (1998) have mapped similar assemblages within the Washpool National Park Western Additions and the Guy Fawkes River National Park.

Conservation status: of particular note is forest type 152 dominated by *E. obliqua* and *E. brunnea* that was considered a priority for reservation within the region and was surveyed for by Richards (1996). This forest type is most commonly found within Community 9. Richards (1996) describe this forest type as occurring in high rainfall, elevated and cool situations with moist soils. It was estimated that 4194 ha of this community existed. However, Hunter (1998) found extensive areas of this forest type within Washpool National Park Western Additions and by Hunter and Alexander for the Guy Fawkes River National Park. With the addition of this forest type Bald Rock and Boonoo Boonoo it appears that this forest type is more widespread and that the reservation status of this forest type has increased considerably. This assemblage is well reserved across the escarpment areas of north eastern New South Wales and is known to occur within the Demon Nature Reserve, Gibraltar Range National Park, Spirabo National Park, Washpool National Park Western Additions and Guy Fawkes River National Park. Despite this the community is of limited extent within Bald Rock and Boonoo Boonoo National Parks and is threatened by too frequent fire regimes. Furthermore this community type is near the northern limit of its distribution.

Management considerations: this community is of limited extent throughout the reserves and is surrounded by more highly flammable vegetation. The occurrence of this community is largely associated within the larger granite monoliths. Thus this community further protects the larger outcrops (acting as a buffer) from incursions of fire. However, they are usually only a few hundred meters wide and are likely to be overcome by larger fires from the surrounding drier communities. Fires will need to be excluded from these areas in the foreseeable future. Some trails pass through this community type particularly around Bald Rock itself and these cause an opening of the understorey canopy thus increasing the introduction of weeds. Trials would be best placed outside of this assemblages particularly around their margins and could aid in fire prevention.

Figure 34: Photographs of Community 8. Below = Site 13. Above Bald Rock, below on the banks of Boonoo Boonoo.

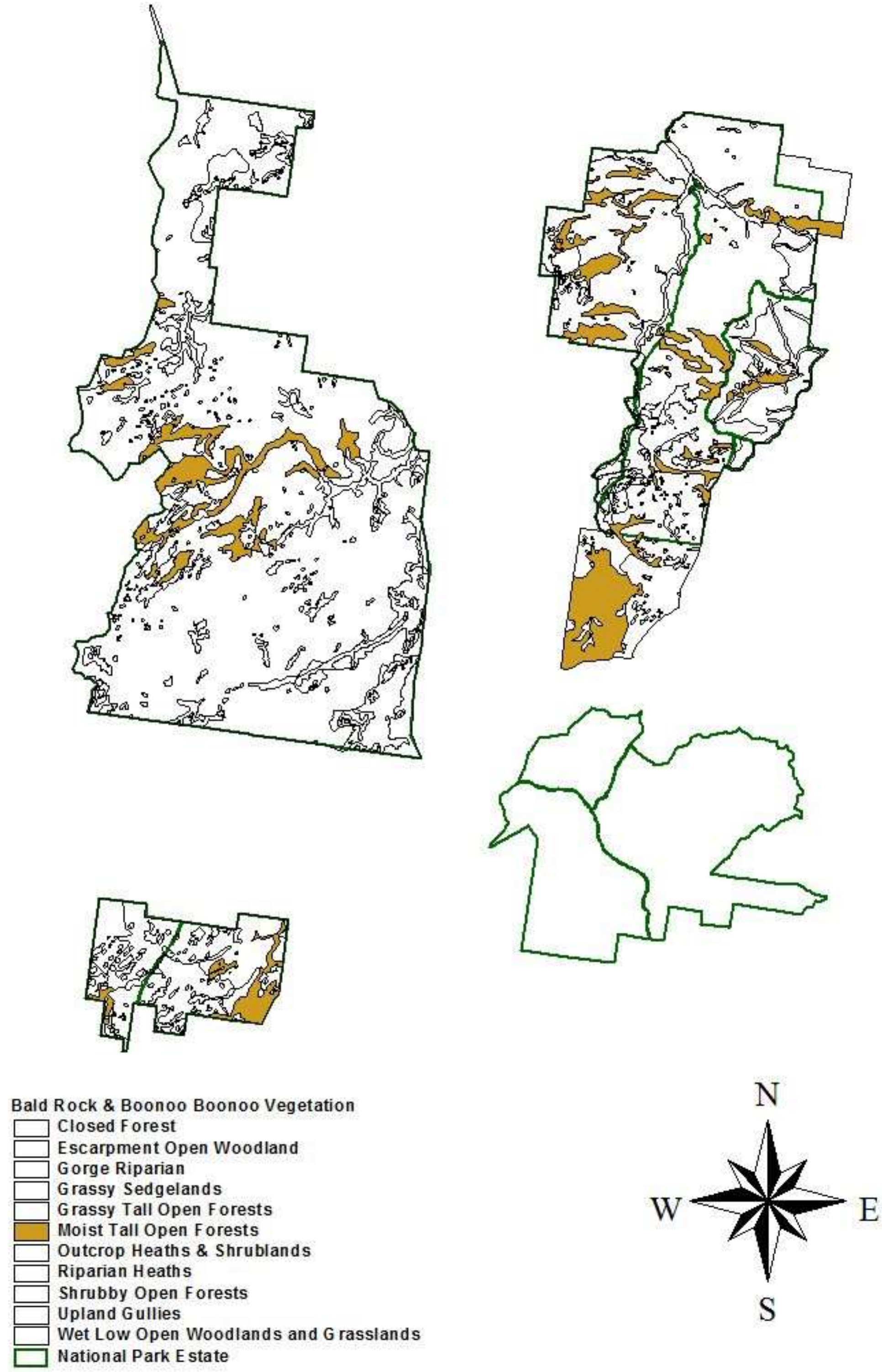


Figure 35: Mapped distribution of Community 8.

3.4.9 Community 9: Shrubby Open Forests

New England Blackbutt (*Eucalyptus campanulata* & *E. andrewsii*) – Large-fruited Stringybark (*Eucalyptus williamsiana*) Shrubby Open Forest.

Sample sites (23): 15, 16, 18, 20, 22, 23, 31, 23, 33, 52, 54, 60, 61, 63, 64, 65, 67, 70, 71, 97, 98, 115, 116.

Number of hectares: 3,120 **Proportion of reserves:** 21.9%

Landform: Primarily higher altitudes with coarser and or shallower soils in hilly to undulating terrain, often interspersed with boulders.

Distribution: Found throughout both reserves but is particularly developed within Boonoo Boonoo National Park and the southern section of Bald Rock National Park at higher altitudes.

Structure: Upper layer 20-40 m tall, 40-60% cover; Tall middle layer not always present 5-15 m tall, 20-60% cover; lower middle layer usually present 1-5 m tall, 10-70% cover; ground layer <1 m tall, 50-100% cover.

No. of taxa: 221 **No. of taxa per plot:** 38-70 (50 av.).

Common natives: Listed in decreasing order of importance (frequency and cover).

Trees: *Eucalyptus campanulata, Allocasuarina littoralis, Eucalyptus williamsiana, Banksia integrifolia, Eucalyptus andrewsii, Eucalyptus notabilis, Eucalypts brunnea, Eucalytpus radiata* subsp. *sejuncta, Eucalyptus cameronii, Corymbia gummifera.*

Shrubs: *Petrophile canescens, Platysace ericoides, Lomatia silaifolia, Leptospermum trinervium, Monotoca scoparia, Hibbertia obtusifolia, Amperea xiphoclada* var. *xiphoclada, Phyllanthus hirtellus, Leucopogon lanceolatus* var. *lanceolatus, Dillwynia phylicoides, Acacia falciformis, Persoonia tenuifolia, Dampiera stricta, Banksia cunninghamii* subsp. *neo-anglica, Podolobium ilicifolium, Melichrus procumbens, Persoonia cornifolia, Maytenus silvestris, Bossiaea neo-anglica, Phyllota phylicoides, Leucopogon melaleucoides, Elaeocarpus reticulatus, Acrotriche aggregata, Daviesia latifolia, Acacia penninervis.*

Climbers & trailers: *Hardenbergia violacea, Smilax australis, Billardiera scandens, Kennedia rubicunda, Glycine clandestina, Eustrephus latifolius, Cassytha pubescens, Desmodium varians, Clematis aristata.*

Ground cover: *Themeda triandra, Pteridium esculentum, Entolasia stricta, Dianella caerulea* var. *caerulea, Patersonia sericea, Goodenia bellidifolia* subsp. *bellidifolia, Goodenia hederacea, Imperata cylindrica, Pomax umbellata, Patersonia glabrata, Gonocarpus tetragynus, Stylidium graminifolium, Lepidosperma laterale, Agrostis avenacea, Gonocarpus oreophilus, Poa sieberiana, Lomandra multiflora, Trachymene incisa, Microlaena stipoides, Dichelachne micrantha, Poranthera microphylla, Brachyscome nova-anglica, Viola betonicifolia, Tricoryne elatior, Thysanotus tuberosus, Brunoniella australis, Austrostipa rudis* subsp. *rudis, Austrostipa ramosissima.*

Introduced taxa: *Hypochaeris radicata*.

Percent of species introduced: 0.01%.

Variability: two major subcomponents are found within this community and these are based solely on occurrence within Boonoo Boonoo or Bald Rock National Park. The occurrences within Bald Rock National Park are within the southern section of the reserve and have a more 'western influence' within the inclusion of species such as *Hibbertia* sp. B, *Acacia betchei* and *Eucalyptus andrewsii* which are commonly associated with communities on the western side of the New England.

Condition: overall very good. The occurrences within Boonoo Boonoo National Park have been burnt with more regularity than may have been normal.

Taxa of conservation importance: *Acacia betchei, Hibbertia* sp. B.

Notes: this community type as described within Boonoo Boonoo National Park is exclusive to coarse grained granite substrates and are probably largely restricted to this region in the north and south to Spirabo National Park. Binns (1995b) was unclear why in some places similar country is dominated by grassy forests and yet others have a heathy understorey (as is seen within these two reserves), but presumed that the differences may be in a lower clay content, shallower soils and a lowered fire frequency may account for these heathy forests. As such the distribution of this community and that of community 6 may be dynamic in nature. Community 9 as it is found in Bald Rock National Park may have more western affinities and similar assemblages as these are probably restricted to areas as far north as this and extend as far west as Torrington.

Conservation status: this community type is further conserved within Basket Swamp National Park, the Demon Nature Reserve, Western Washpool National Park, Girraween National Park and Torrington State Recreation Area. As such this assemblage is probably adequately conserved across its range and extensive areas occur within these reserves.

Management considerations: The main management goal within this community type is an appropriate fire regime. Few other management options will need to be considered at this stage.

Figure 36: Photographs of Community 9. Above = Site 16, below = Site 61. Above within Boonoo Boonoo and below within Bald Rock southern section.

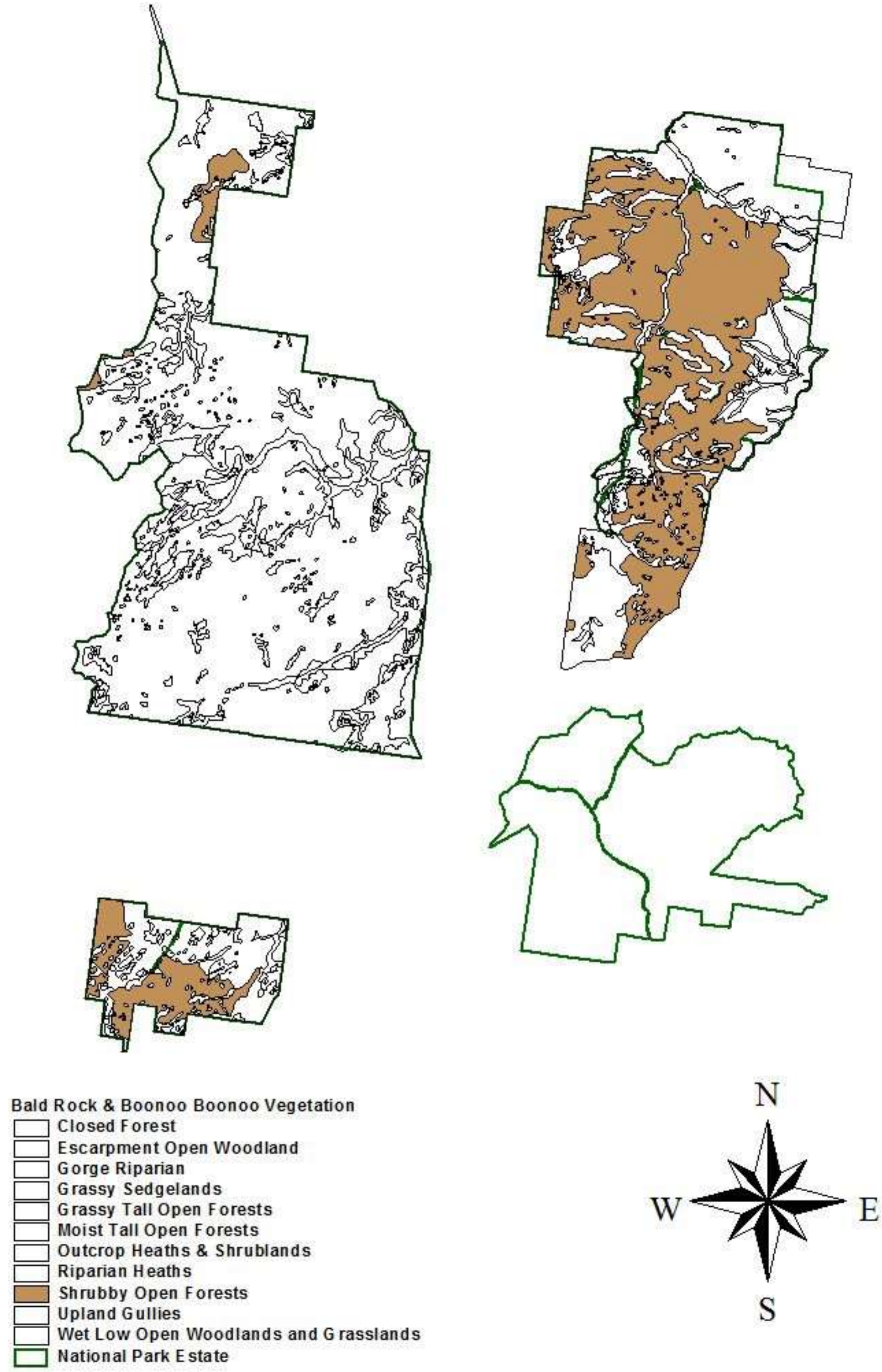


Figure 37: Mapped distribution of Community 9.

3.4.10 Community 10: Upland Gullies

New England Blackbutt (*Eucalyptus campanulata*) – Mountain Gum (*Eucalyptus brunnea*) – Sydney Blue Gum (*Eucalyptus saligna*) Tall Open Forest.

Sample sites (4): 91, 92, 95, 97.

Number of hectares: 128 **Proportion of reserves:** 0.9%

Landform: restricted to protected gullies and lower slopes associated with gullies on the eastern escarpment.

Distribution: found only in the eastern parts of Boonoo Boonoo National Park.

Structure: Upper layer 20-40 m tall, 40-60% cover; Tall middle layer not always present 5-15 m tall, 20-60% cover; lower middle layer usually present 1-5 m tall, 10-70% cover; ground layer <1 m tall, 50-100% cover.

No. of taxa: 99 **No. of taxa per plot:** - (av.).

Common natives: Listed in decreasing order of importance (frequency and cover).

Trees: *Eucalyptus campanulata, Eucalytpus brunnea, Eucalyptus saligna, Eucalyptus caliginosa, Lophostemon confertus, Banksia integrifolia.*

Shrubs: *Acacia falciformis, Podolobium ilicifolium, Leucopogon lanceolatus, Trochocarpa laurina, Persoonia oleoides, Melichrus adpressus, Allocasuarina littoralis, Allocasuarina torulosa, Acacia irrorata.*

Climbers & trailers: *Hardenbergia violacea, Rubus parvifolius, Hibbertia scandens, Desmodium varians, Kennedia rubicunda, Glycine clandestina, Smilax australis, Pandorea pandorana, Clematis aristata.*

Ground cover: *Poa sieberiana, Sorghum leiocladum, Lomandra longifolia, Geranium solanderi, Calochlaena dubia, Gonocarpus oreophilus, Echinopogon caespitosus, Dichondra repens, Dianella caerulea, Themeda triandra, Pteridium esculentum, Brachyscome spathulata, Ranunculus lappaceus, Poranthera microphylla, Oplismenus imbecillus, Lepidosperma laterale, Hydrocotyle laxiflora, Austrostipa rudis, Arthropodium milleflorum, Vernonia cinerea, Senecio prenanthoides, Pratia purpurascens, Plectranthus suaveolens, Platysace ericoides, Plantago varia, Patersonia sericea, Lagenifera stipitata, Hydrocotyle peduncularis, Goodenia bellidifolia, Entolasia stricta, Chrysocephalum apiculatum, Blechnum cartilagineum, Austrodanthonia racemosa, Austrodanthonia monticola, Asperula converta.*

Introduced taxa: *Hypochaeris radicata, Cirsium vulgare, Taraxacum officinale*.

Percent of species introduced: 3%.

Variability: this assemblage was highly variable structurally and floristically due to its linear nature and the impact of past fires which have affected different areas with more or less frequency and/or intensity.

Condition: generally good, though fires may be too frequent.

Taxa of conservation importance: none apparent.

Notes: close to Community 8 which shares much of the same structure and however this community contains more mesic elements particularly with the inclusion of *Lophostemon confertus* and an abundance of vines and twiners. This community is likely to be similar to many upland creek areas along the eastern escarpment as is described for Western Washpool. Synonymous assemblages are likely to occur from south of the Queensland border to the east of Walcha.

Conservation status: currently should be considered reasonably well reserved throughout its range with many of the more recent additions to the eastern escarpment reserve network. .

Management considerations: no major works or attention needs to be paid currently, though a reduction in the frequency of fire may be of importance.

Figure 38: Photographs of Community 10.

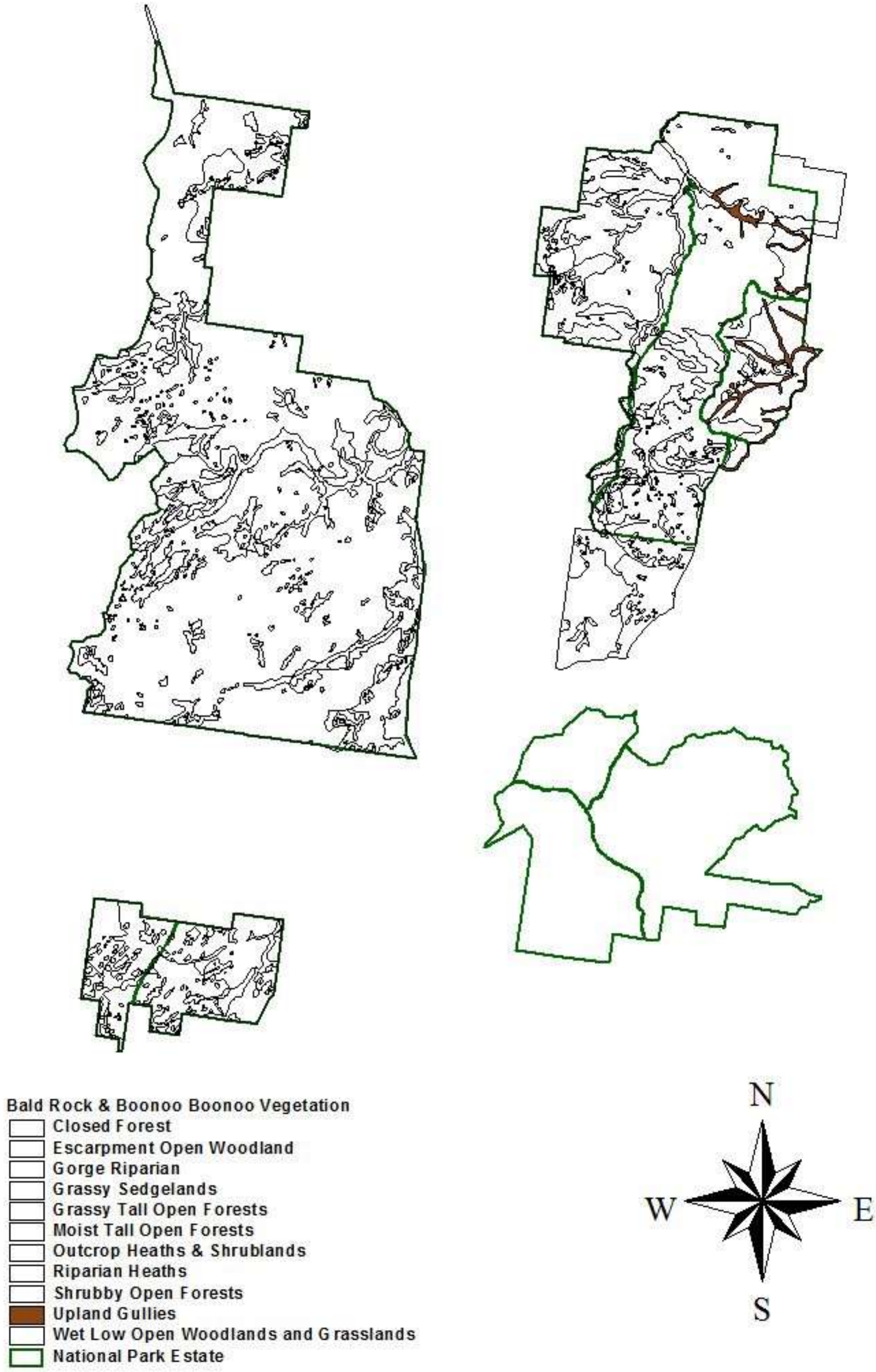


Figure 39: Mapped distribution of Community 10.

3.4.11 Community 11: Outcrop Heaths & Shrublands

Granite Kunzea (*Kunzea bracteolata*) – New England Tea-tree (*Leptospermum novae-angliae*) Heaths & Shrublands.

Sample sites (36): see Hunter & Clarke (1998).

Number of hectares: 530 **Proportion of reserves:** 4%

Landform: Wholly restricted to exposed granite surfaces.

Distribution: Scattered throughout both reserves on all outcrops.

Structure: Closed heaths to open shrublands 1-4 m tall with fringing herbfields and lichen mats.

No. of taxa: 172 **No. of taxa per plot:** 10-42 (24 av.).

Common natives: Listed in decreasing order of importance (frequency and cover).

Trees: *Eucalyptus campanulata, Eucalyptus andrewsii, Eucalyptus prava, Eucalyptus dealbata, Eucalyptus notabilis, Callitris endlicheri, Allocasuarina littoralis, Eucalyptus banksii, Eucalyptus scoparia, Lophostemon confertus.*

Shrubs: *Kunzea bracteolata, Philotheca epilosum, Leptospermum novae-angliae, Leucopogon neoanglicus, Dodonaea viscosa, Acacia latisepala, Leucopogon melaleucoides, Pimelea linifolia, Leptospermum polygalifolium* subsp. *transmontanum, Acacia adunca, Leionema ambiens, Acrotriche aggregata, Callistemon pallidus, Acacia viscidula, Persoonia cornifolia, Leionema rotundifolium, Acacia venulosa, Homoranthus lunatus, Allocasuarina rupicola, Callistemon* sp. Big Red, *Callitris rhomboidea, Exocarpus cupressiformis, Callitris monticola, Prostanthera petraea, Plectranthus suaveolens, Mirbelia speciosa* subsp. *speciosa.*

Climbers & trailers: *Muehlenbeckia costata, Pyrrosia rupestris,*

Ground cover: *Lomandra longifolia, Trachymene incisa, Entolasia stricta, Lepidosperma laterale, Gonocarpus oreophilus, Brachyscome stuartii, Austrodanthonia bipartita, Stypandra glauca, Crassula sieberiana, Stylidium laricifolium, Schoenus apogon, Calandrinia pickeringii, Cheilanthes sieberi, Bulbostylis densa, Actinotus helianthi, Pomax umbellata, Dianella revoluta, Tripogon loliiformis, Paspalidium constrictum, Laxmannia compacta, Isotoma anethifolia, Gonocarpus teucrioides, Thelionema grande, Digitaria breviglumis, .Austrodanthonia racemosa, Gahnia sieberiana.*

Introduced taxa: *Hypochaeris radicata, Conyza bonariensis, Gnaphalium americanum, Sonchus asper, Setaria verticillata, Phytolacca octandra, Verbena bonariensis, Stellaria media, Sonchus oleraceus.*

Percent of species introduced: 5%.

Variability: This community type is highly variable within and between outcrops and few species have a high constance. They are however consistently shrublands or heathlands but do occasionally have herbfields associated with shallower soil pans or the fringes of the shrublands.

Condition:

Taxa of conservation importance: *Kunzea bracteolata, Philotheca myoporoides* subsp. *epilosum, Acacia latisepala, Muehlenbeckia costata, Acacia adunca, Leionema ambiens, Leionema rotundifolium, Callitris rhomboidea, Thelionema grande, Prostanthera petraea, Homoranthus prolixus, Allocasuarina rupicola, Eucalyptus scoparia, Mirbelia confertiflora, Callitris monticola, Plectranthus suaveolens,*

Notes: Hunter & Clarke (1998) when describing this community circumscribed it as the New England Escarpment Shrubby Open Scrubs and Heaths and the occurrences of this element that occurred within Bald Rock and Boonoo Boonoo National Park were further divided it into three assemblages. However, due to the inability to recognise these on aerial photographs and the similar management considerations for all they have been included as one community in this investigation. The three sub-associations described by Hunter (1999) were a *Leptospermum novae-angliae – Acacia latisepala* Heath, a *Leptospermum novae-angliae – Dodonaea viscosa* Heath and a *Kunzea bracteolata – Leucopogon melaleucoides* Heath. This community type is wholly restricted to the region between Stanthorpe to the Malara Plateau. In a broader sense the element as described by Hunter & Clarke (1998) occurs as far south as Cathedral Rocks National Park.

Conservation status: the community as described here is reserved within Girraween National Park and to a minor extent the Demon Nature Reserve. It may be considered adequately reserved, however the actual true extent of the community is only a percentage of the area of exposed granite surfaces and is thus very small. Furthermore, Hunter (2002; 2003; 2004) has shown that due to the dynamic nature of these communities any rock is likely to of conservation significance and that maximising the number of granite outcrops is likely to be of importance.

Management considerations: an appropriate fire regime is the most important consideration for these assemblages. They will require fire frequencies that are in terms of decades to hundreds of years. Of importance also is the likely damage caused by visitors. It has been shown that plants on outcrops are often of substantial age and in low numbers and that lichen and moss mats are equally aged. Trampling can cause significant irreversible damage to these communities. The nutrient status of these communities is very poor and any addition of nutrients from organic rubbish is likely to increase the chances of weed invasion and exclusion of outcrop endemics. Therefore the management of people visiting these systems will need to be considered carefully and access potentially limited to a few major areas. For example it may not be appropriate to create a walking path to Mt Prentice to discourage regular visitation to the bornhardt, thus only those few adventurous visitors who do not need trails.

Figure 40: Photographs of Community 11. This community can be highly variable and may include small herbfields and moss and lichen mats.

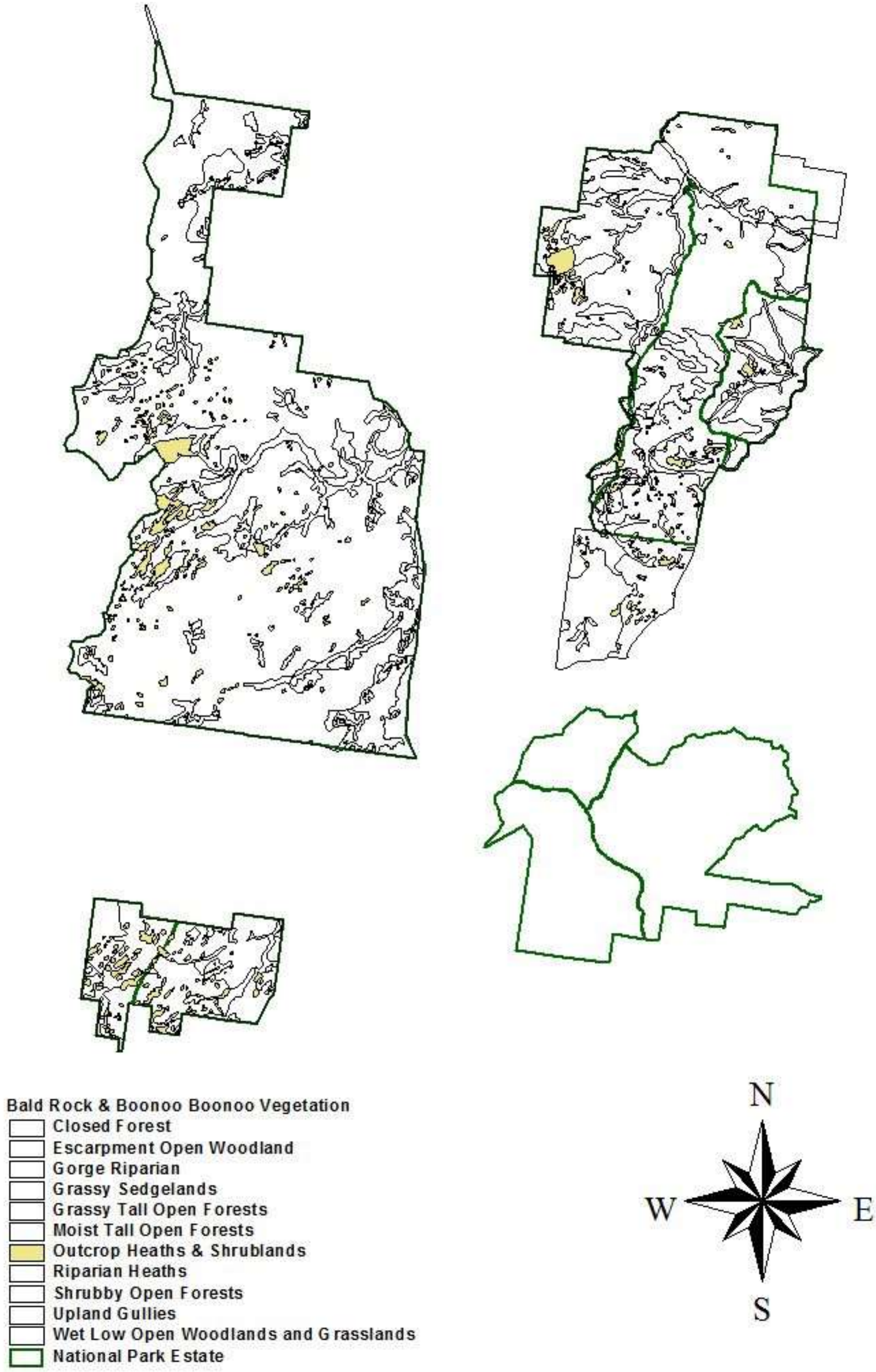


Figure 41: Mapped distribution of Community 11.

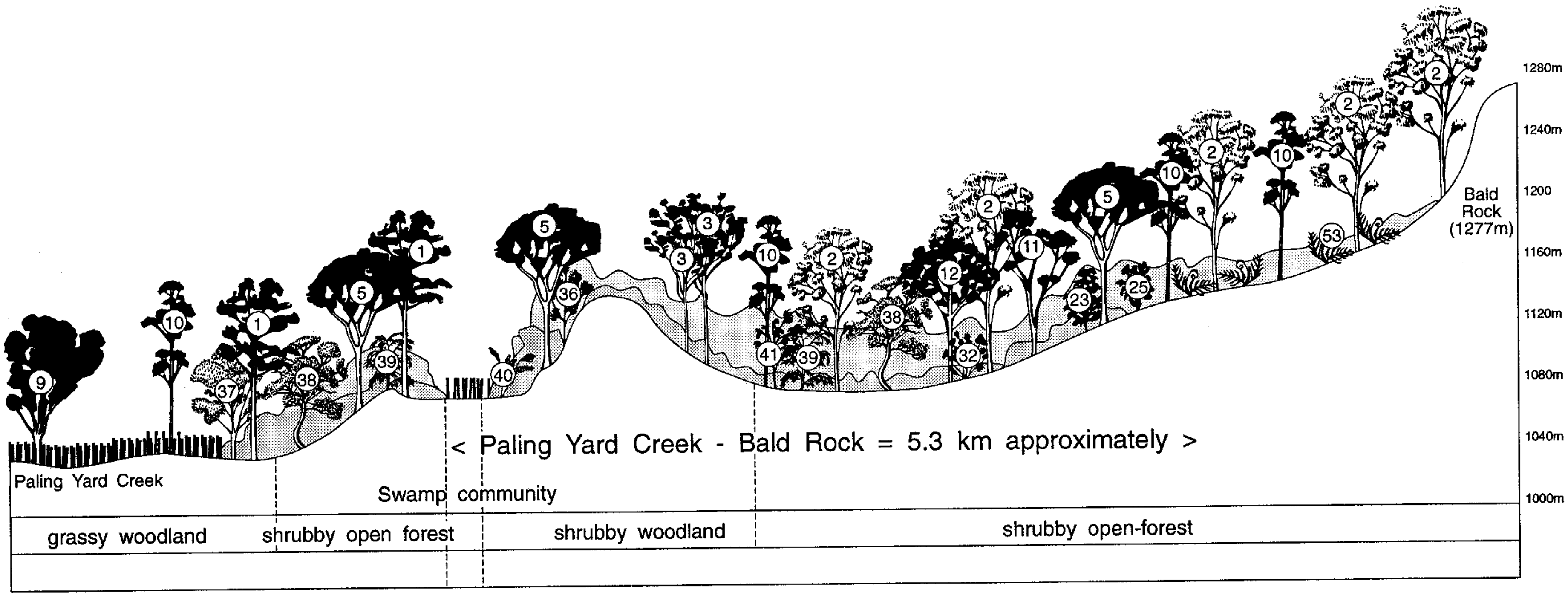


Figure 42: Vegetation patterns of Bald Rock National Park. 1 = *E. brunnea*; 2 = *E. campanulata*; 3 = *E. andrewsii*; 5 = *Eucalyptus caliginosa*; 9 = *E. nova-anglica*; 10 = *E. dalrympleana* subsp. *heptantha*; *E. banksii*; 23 = *Elaeocarpus reticulatus*; 25 = *Leucopogon lanceolatus*; 32 = *Persoonia cornifolia*; 36 = *Acacia adunca*; 37 = *Acacia filicifolia*; 38 = *Banksia integrifolia*; 39 = *Allocasuarina littoralis*; 40 = *Daviesia latifolia*; 41 =*Acacia falciformis*; 53 = *Pteridium esculentum*. Taken from McDonald *et al.* (1995).

3.5 Description of taxa of conservation significance

3.5.1 *Acacia latisepala* Pedley (3RC-).

Taxonomy

Type: *ca.* 1 mile west of Joll's Falls, 5 miles N of Stanthorpe, Oct. 1963, *Pedley 1538* (BRI).

Reference: *Proceedings of the Royal Society of Queensland* 75: 31..

Family: Fabaceae.

Affinities: .

Synonymy: *Racosperma latisepala* (Pedley) Pedley.

Derivation of name: Meaning wide sepals.

Common name: None apparent.

Changes in conservation status: 3RC- (Briggs & Leigh 1996), unchanged since.

Life history

Growth form: Shrub to 8 m tall.

Vegetative spread: None.

Longevity: Unknown but germinates en-mass yet older individuals are usually only as isolated plants. It is likely that this species has a high juvenile to middle age mortality but based on time since fire and the few very tall specimens this species may live for up to 50 years.

Primary juvenile period: 3 years.

Flowers: Spring to late summer.

Fruit/seed: May mature as early as December but may continue to early autumn.

Dispersal, establishment & growth: Via seed. Requires a disturbance such as fire for germination, however fires may need to occur within the right season or dormancy may not be broken. Seed banks are long lived and survive for over 50 years.

Fire response: Obligate seeder but requires dormancy period before germination, which is often on mass if fire temperatures are high enough (Hunter 1999).

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Darling Downs, Northern Tablelands, North Western Slopes.

General distribution: Found in a band from Torrington in the west and through the Granite Belt to Bald Rock.

Distribution within the BRBB: Found only along the western margin of Bald Rock, particularly near the Border Trail.

Habitat

Habitat: Primarily restricted to granite outcrops.

Altitude: 900-1285.

Annual Rainfall: 700-1000.

Abundance: Found in very large numbers in a few localities on granite outcrops after the 1994 fires, but otherwise found in small isolated populations, often as individuals.

BRBB community: Restricted to Community 11.

Substrate: Wholly granite outcrops.

Exposure: Fully exposed sites.

Management

Population size: Probably at present under 500 individuals within the park. Numbers are likely to fluctuate greater over decades due to various firing.

Reserved: Found within the Torrington State Recreation Area, Girraween National Park and Bald Rock National Park.

Threats: Inappropriate fire regimes. Goat grazing.

Management considerations: It would be appropriate to follow the changes in population size in areas where the species germinated 1994. If fires subsequent fires are known to occur on granite outcrops these should be checked the following year for new populations. Although considered as only rare, this species may be less abundant than currently thought due to the very small populations and the fluctuating populations sizes.

Figure 43: Photograph of *Acacia latisepala*.

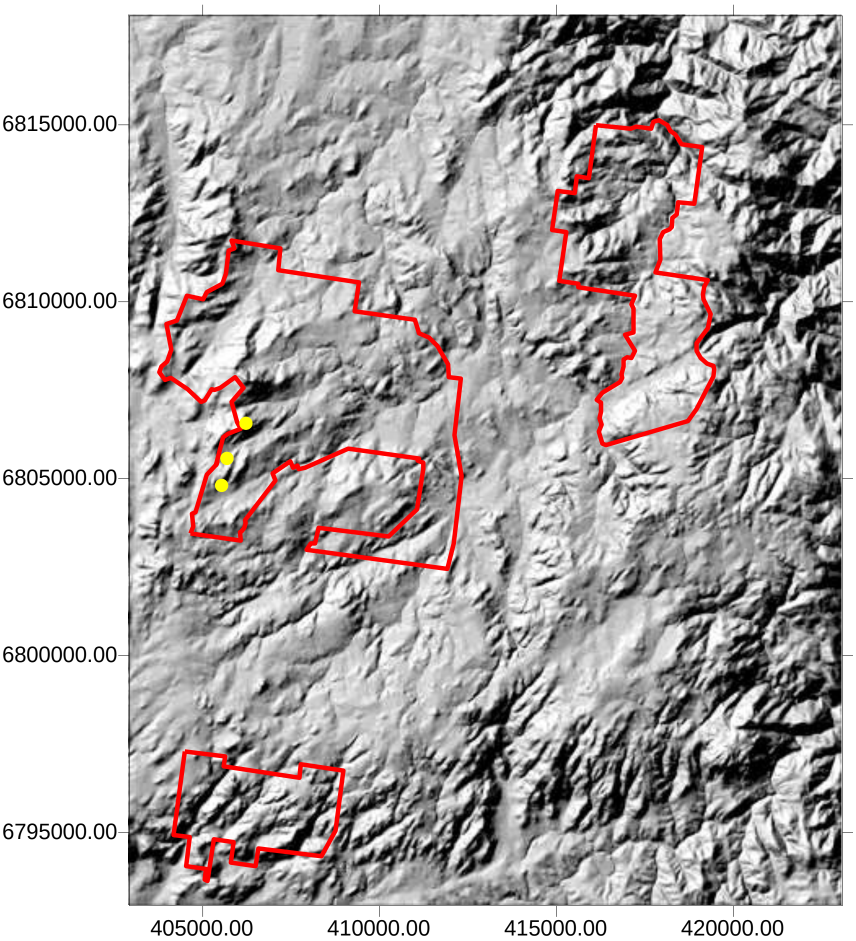


Figure 44: Distribution of *Acacia latisepala*.

3.5.2 *Acacia macnuttiana* Maiden & Blakely (3RC-: TSC Endangered)

Taxonomy

Type: New South Wales: North Western Slopes: Bismuth, near Deepwater, *A. McNutt s.n.*, August 1913 (*holo*: NSW).

Reference: *Journal and Proceedings of the Royal Society of New South Wales* 60: 176 (1926).

Family: Fabaceae

Affinities: *A. macnuttiana* forms a complex of closely related narrow leafed wattles that include *A. betchei, A. floydii, A. neriifolia, A. adunca* and *A. ingramii*. *Acacia macnuttiana* can be separated from these species by the combination of a single gland at the base of the phyllode, curved mucro at the apex, pubescent sepals and peduncle.

Synonymy: None.

Derivation of name: Named in honour of the collector of the type material.

Common name: McNutt's Wattle.

Changes in conservation status: 2KC-; 2VC- (Quinn *et al.* 1995); 2VCi (Briggs & Leigh 1996); TSC Act (1995) Endangered; 2KC- (Sheringham & Westaway 1998 *update*).

Life history

Growth form: Tall shrub usually to 3 m but sometimes to 5 m tall.

Vegetative spread: None.

Longevity: Unknown but at least 15 years.

Primary juvenile period: 3-4 years

Flowers: July to September.

Fruit/seed: Late summer.

Dispersal, establishment & growth: Via seed probably localised.

Fire response: Obligate seeder. Germinates readily after the passage of fire.

Interactions with other organisms: None known.

Distribution

Botanical sub-regions: North Coast, Northern Tablelands and North Western Slopes.

General distribution: Mainly restricted to watercourses from the Pindari Dam on the Severn River through the Torrington State Recreation Area and the Eagle Creek area to Boonoo Boonoo Falls. An unnamed and closely related entity is common in the eastern gorge country of Western Washpool NP and Mann River.

Distribution within the BRBB: Found only at the escarpment above Boonoo Boonoo Falls.

Habitat

Habitat: Usually along creeks on granite

Altitude: 500-1140 m.

Annual Rainfall: 600-900 mm.

Abundance: Found on the escarpment edge above Boonoo Boonoo Falls.

BRBB community: Grassy Tall Open Forests.

Substrate: Granite.

Exposure: Exposed.

Management

Population size: Only a few isolated patches were found however further searches along the escarpment and riverbanks may find additional populations, however it is assumed that the population size within the reserve is rather small.

Reserved: Bald Rock National Park (single record), Boonoo Boonoo National Park, Torrington State Recreation Area, Washpool National Park Western Additions. A record given by Quinn *et al.* (1995) and Sheringham & Westaway (1998) of '33 km along Poverty Point Rd, *J.B.Williams* 10.12.1986' has since been re-determined as *Acacia floydii* by the author. A large number of plants were known from the shores of Pindari Dam before the recent enlargement, all of the hundreds of plants found there have since been inundated, this population however may have been *Acacia acrionastes*. None have been rediscovered in the area, however there is potential for new populations to be found in the Severn River Nature Reserve.

Threats: Inappropriate fire regimes (high frequency). Grazing by stock and goats will eliminate this taxon.

Management considerations: Under threat due to small and disjunct population size. Other likely areas of occurrence along the major watercourses and along the escarpment should be checked and the size of the currently known population size should be established. Too high a frequency of fire is likely to eliminate this species along with long absences of fire. An inter-fire period, long enough to enable seed bank development, probably at least 10 years. Goats and wild stock should be removed from these areas.

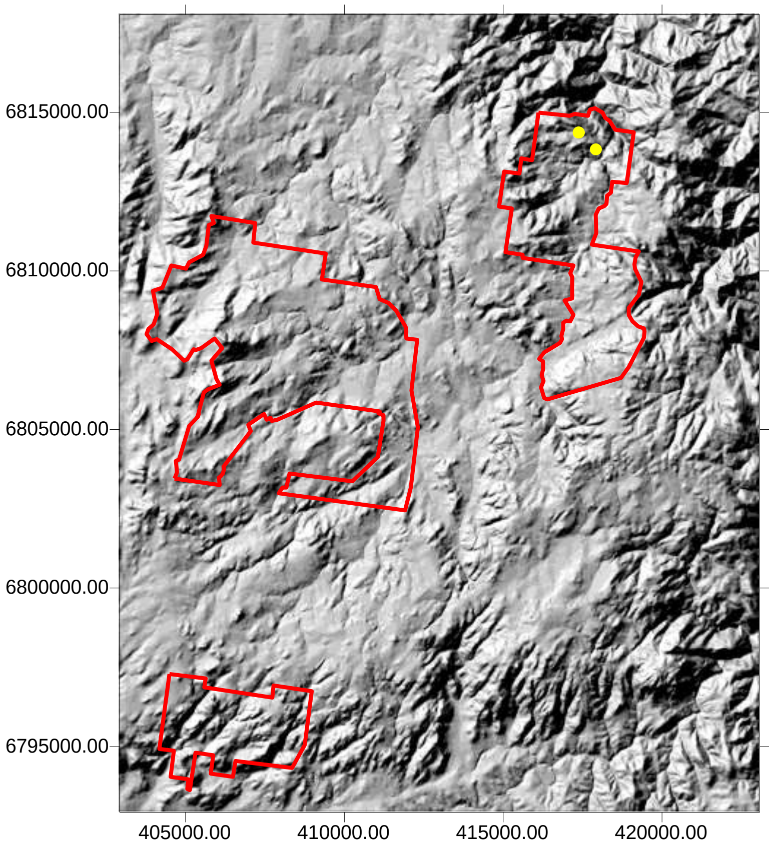


Figure 45: Distribution of *Acacia macnuttiana*.

Figure 46: Photograph of *Acacia macnuttiana*.

3.5.3 *Allocasuarina rupicola* L.A.S. Johnson (2RC-).

Taxonomy

Type: 6.4 km on Boonoo Boonoo Falls rd from Boonoo Boonoo, N.S.W., 25 March 1981, *L.A.S.Johnson 8539* (holo: NSW; iso: BRI, CANB, K, MO).

Reference: *Flora of Australia* 3: 199.

Family: Casuarinaceae.

Affinities: Closely related to *Allocasuarina rigida* but differs in teeth not spreading when fresh.

Synonymy: None.

Derivation of name: *rupis* meaning rock and *cola* meaning dweller, hence rock dweller.

Common name: None apparent.

Changes in conservation status: 2RC- (Briggs & Leigh 1996) unchanged since.

Life history

Growth form: Shrub to 3 m tall.

Vegetative spread: No.

Longevity: Unknown but possibly long lived.

Primary juvenile period: Unknown.

Flowers: Mainly spring and summer.

Fruit/seed: Summer to autumn.

Dispersal, establishment & growth: Via seed.

Fire response: Unkown, but based on its occurrences on rocky banks of the Boonoo Boonoo River and the larger outcrops of the region this species is likely to be an obligate seeder and one that avoids at least frequent fires.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Darling Downs, Northern Tablelands.

General distribution: From Wyberba in Queensland to Boonoo Boonoo.

Distribution within the BRBB: Restricted to the rocky banks of the Boonoo Boonoo River and on the larger granite outcrops such as Mount Prentice.

Habitat

Habitat: Restricted to the clefts in granite outcrops on bornhardts and along rocky creeks.

Altitude: 800-1200.

Annual Rainfall: 800-1200.

Abundance: Fairly common along the Boonoo Boonoo River but otherwise scarce in New South Wales.

BRBB community: Community 4 and Community 11.

Substrate: Exposed granite surfaces.

Exposure: Fully exposed sites.

Management

Population size: Probably a maximum of 1000 individuals throughout the reserves.

Reserved: Girraween and Boonoo Boonoo National Parks.

Threats: Inappropriate fire regimes, disturbance by visitors along the riverbank.

Management considerations: Reducing the impact of visitors to parts of the riverbank. One population at Morgan's Gully was almost completely devastated by what appeared to be human activity.

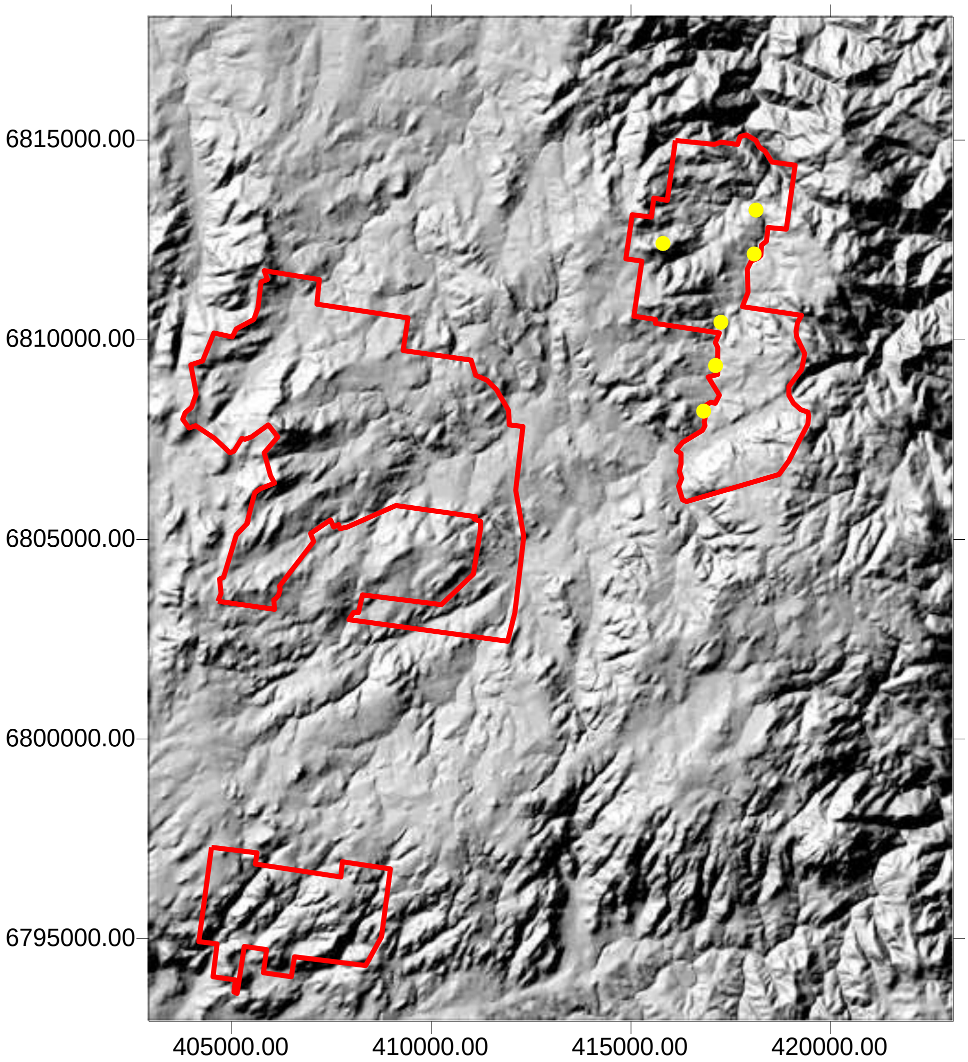


Figure 47 Distribution of *Allocasuarina rupicola*.

3.5.4 *Callistemon flavo-virens* (Cheel) Cheel (3RC-).

Taxonomy

Type: None chosen.

Reference: *Royal Society of New South Wales* 50: 263.

Family: Myrtaceae.

Affinities: Not apparent.

Synonymy: *Callistemon rugulosus* var. *flavo-virens*.

Derivation of name: *flavo* meaning yellow and *veriens* meaning green, in reference to the yellow green flowers.

Common name: Green Bottlebrush.

Changes in conservation status: 3RC- (Briggs & Leigh 1996), unchanged since.

Life history

Growth form: Shrub to 3 m tall.

Vegetative spread: No.

Longevity: Unknown.

Primary juvenile period: Unknown but likely to be 3-5 yrs.

Flowers: Mainly spring to summer.

Fruit/seed: Not stated.

Dispersal, establishment & growth: Via seed.

Fire response: Unknown.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Darling Downs, Northern Tablelands.

General distribution: From Torrington through Stanthorpe and Wallangara to Boonoo Boonoo with a disjunct occurrence at Gibraltar Range.

Distribution within the BRBB: Restricted to the banks of the Boonoo Boonoo River.

Habitat

Habitat: Granite country along creek banks.

Altitude: 800-900 m.

Annual Rainfall: 800-1400 mm.

Abundance: Isolated and restricted populations occur within close proximity to the rocky banks of major waterways.

BRBB community: Community 4.

Substrate: Exposed granite.

Exposure: Fully exposed.

Management

Population size: Unknown but probably of limited numbers within a few hundred.

Reserved: Within Girraween National Park, Boonoo Boonoo National Park, Bluff River Nature Reserve and Gibraltar Range National Park. Potentially in the Torrington State Recreation Area depending on if the variant there, which is taller is part of this complex.

Threats: Disturbance to creek banks, inappropriate fire regimes.

Management considerations: Minimising disturbance to the rocky creek banks of the Boonoo Boonoo River.

Figure 48: Photograph of *Callistemon flavo-virens*.

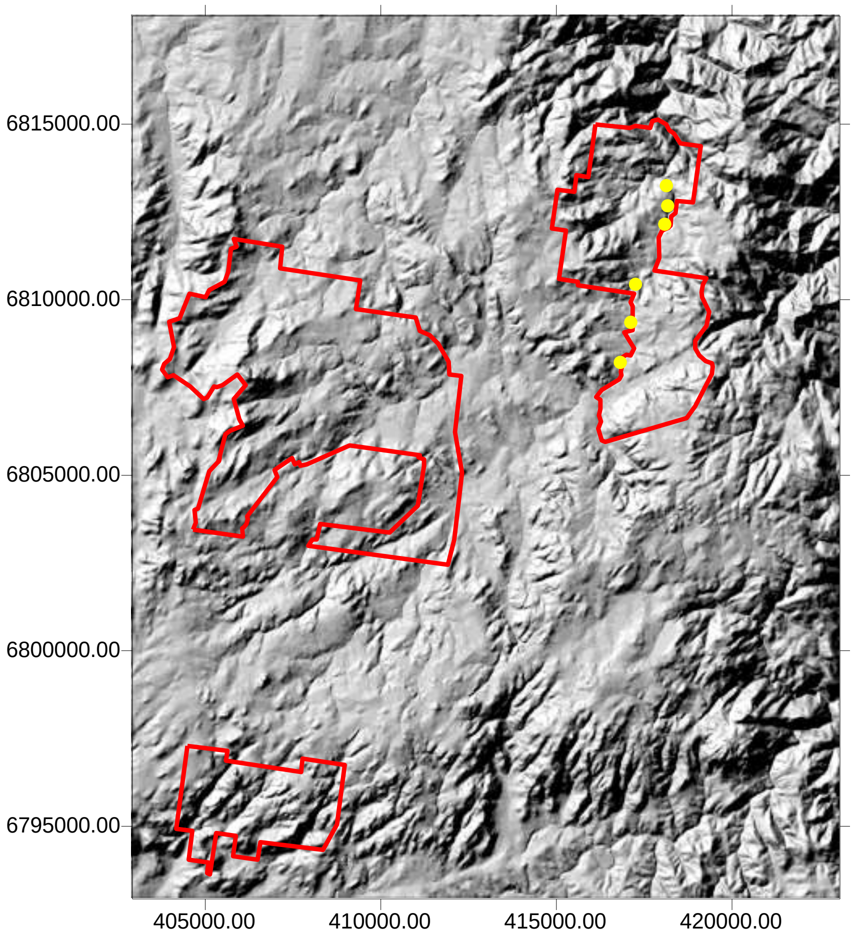


Figure 49: Distribution of *Callistemon flavo-virens*.

3.5.5 *Callitris monticola* J.Garden (3RC-).

Taxonomy

Type: Wallangarra, Queensland, *W. de Beuzeville*, 4.1941 (holo: NSW).

Reference: *Contributions from the New South Wales National Herbarium* 2: 385.

Family: Cupressaceae.

Affinities: Not apparent but possibly close to *Callitris rhomboidea* and *C. oblonga*.

Synonymy: None.

Derivation of name: In reference to the mountain habitat.

Common name: Cypress Pine.

Changes in conservation status: 3RC- (Briggs & Leigh 1996), unchanged since.

Life history

Growth form: Shrub to 2.5 m tall.

Vegetative spread: None.

Longevity: Like other *Callitris* this species is probably long lived.

Primary juvenile period: If like its co-geners it may require a few decades before seed sets.

Flowers: Not applicable.

Fruit/seed: Not applicable.

Dispersal, establishment & growth: Via seed or cone dispersal.

Fire response: Obligate seed that probably has a short lived seed bank but requires a long juvenile period.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Found in the Darling Downs, Moreton, North Coast and Northern Tablelands divisions.

General distribution: From Restricted to the Granite Belt and across the border ranges in northern New South Wales and Southern Queensland with a disjunct population in Gibraltar Range.

Distribution within the BRBB: Apparently restricted to the most western parts of Bald Rock National Park near the Border Trail.

Habitat

Habitat: Restricted to shallow, sandy soils on rocky sandstone, granite or rhyolite outcrops.

Altitude: ?800-1400 m.

Annual Rainfall: ?800-1800.

Abundance: Found usually as only isolated individuals or in very small populations that are usually very disjunct.

BRBB community: Community 11.

Substrate: Variable but restricted to outcrops.

Exposure: Fully exposed.

Management

Population size: Only a handful of individuals have been seen and the population within the reserves is probably less than ten at this stage.

Reserved: Within Girraween National Park, Bald Rock National Park, Main Range National Park, Lamington National Park, Mount Barney National Park, Gibraltar Range National Park, Waihou Flora Reserve.

Threats: Fire is the main threat to these populations.

Management considerations: Further searches may recover additional sightings and exclusion of fire from sites containing this taxon is the main consideration at this stage.

Figure 50: Photograph of *Callitris monticola*.

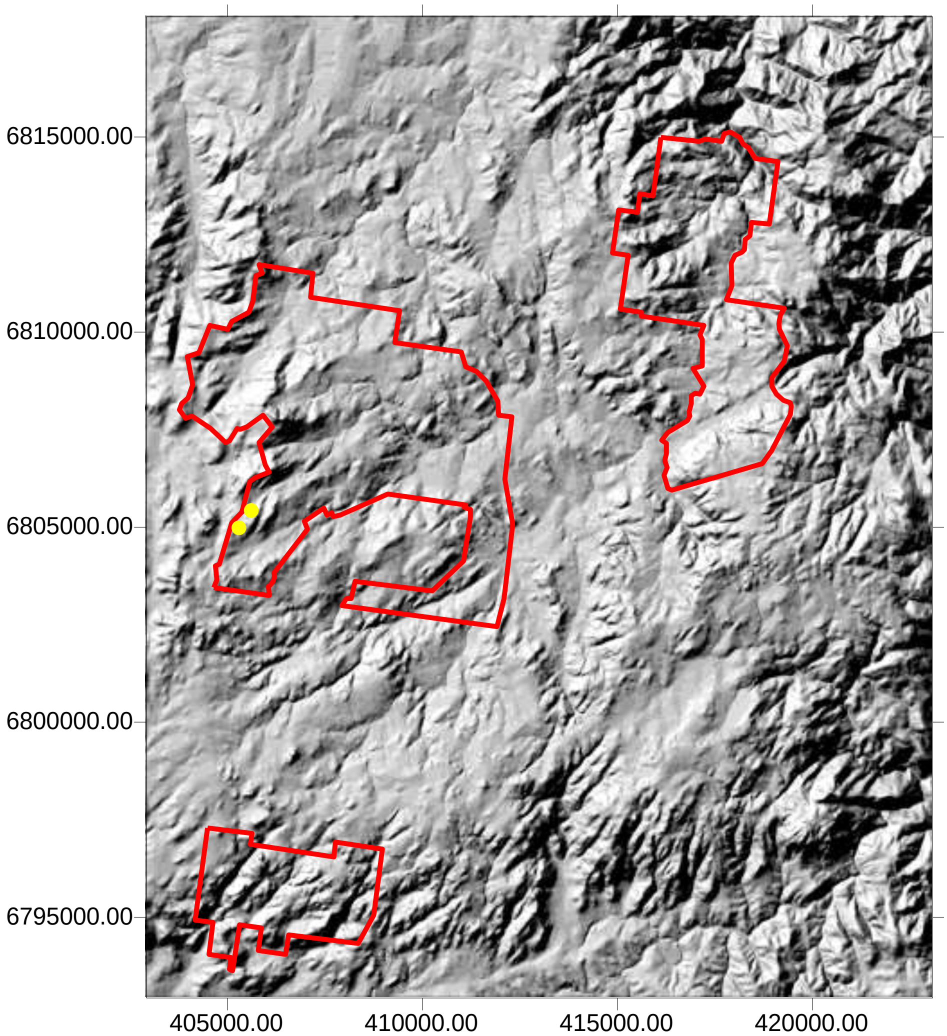


Figure 51: Distribution of *Callitris monticola*.

3.5.6 *Callitris oblonga* subsp. *parva* Hill (3VCa; Schedule 2, Vulnerable *TSC* Act)

Taxonomy

Type: Backwater, NSW, 9 Mar. 1995, *K.D.Hill 4765 & L.Stanberg* (holo: NSW; iso: BRI, CANB, HO, MEL).

Reference: *Flora of Australia* 48: 717: (1998).

Family: Proteaceae.

Affinities: *Callitris oblonga* subsp. *oblonga* and *C. oblonga* subsp. *caragensis*.

Synonymy: none.

Derivation of name: *parvus* meaning small, in reference to the smaller cones and leaf segments as compared to the type subspecies.

Common name: Pygmy Cypress Pine.

Published conservation status: 3VCi (Briggs & Leigh 1988); 3VCa (Nadolny & Benson 1993; Briggs & Leigh 1996); Schedule 2, Vulnerable *TSC* Act; unchanged since.

Life history

Growth form: small tree or tall shrub to 7 m tall.

Vegetative spread: none.

Longevity: fast growing plants known to survive to 28 yrs.

Primary juvenile period: unknown.

Fruit/seed: fruit held on branches until branch dies, then seeds released.

Dispersal, establishment & growth: seeds released from cones when branch dies often after floods or fire, such disturbance decreases competition.

Fire response: obligate seeder.

Interactions with other organisms: none apparent.

Distribution

Botanical sub-regions: Northern Tablelands.

General distribution: found sporadically from Backwater to Boonoo Boonoo.

Habitat

Habitat: in sandy soils over granite around creeks and swamps.

Altitude: 900-1100 m.

Annual rainfall: 800-1200 mm.

Abundance: sporadically distributed taxon.

BRB community: Community 3.

Substrate: alluvial soils overlying granite.

Exposure: exposed to partially protected sites.

Management

Population size: scattered individuals along the Boonoo Boonoo River.

Reserved: Warra NP, Basket Swamp NP, Boonoo Boonoo NP.

Threats: frequent fire regimes, it is generally restricted to sites that are relatively protected from fire (Nadolny & Benson 1993). Rabbit grazing of young shoots, particularly after fires. Trail bikes and other constant disturbance around the banks of the Sara River near the falls. Wild pig rutting. Competition from blackberry.

Figure 52: Photographs of *Callitris oblonga* subsp. *parva.*

3.5.7 *Cryptandra lanosiflora* F.Muell. (3RCa)

Taxonomy

Type: In rupibus tempestati expositis montium Novae Angliae apud flumen Severn; C.St. In regionibus montis Mitchell excelsioribus flumen Clarence versus; Dr. H. Beckler (no type chosen).

Reference: *Fragmenta Phytographiae Australiae* 3: 65.

Family: Rhamnaceae.

Affinities: Uncertain.

Synonymy: None.

Derivation of name: *Lano* meaning woolly, in reference to the woolly flowers.

Common name: Woolly Cryptandra.

Changes in conservation status: 3RCa (Briggs & Leigh 1996), unchanged since.

Life history

Growth form: Branched shrub to 30 cm tall.

Vegetative spread: None.

Longevity: Unknown.

Primary juvenile period: Unknown.

Flowers: Spring to summer.

Fruit/seed: Late summer to autumn.

Dispersal, establishment & growth: Via seed.

Fire response: Unknown but may be an obligate seeder.

Interactions with other organisms: Pollinated by generalist insects, primarily flies.

Distribution

Botanical sub-regions: Darling Downs, Northern Tablelands, North Coast, North Western Slopes.

General distribution: From the Severn River across the Granite Belt and down the eastern escarpment of New South Wales to Werrikimbe.

Distribution within the BRBB: Found within the drier regions of Boonoo Boonoo National Park and the north west portion of the southern section of Bald Rock National Park.

Habitat

Habitat: Usually in heath and heathy forests in exposed sites with shallow sandy or rocky soils.

Altitude: ?700- 1200 m.

Annual Rainfall: ?700-1400 mm.

Abundance: Found usually as small clumped populations, scattered throughout the region.

BRBB community: Community 10.

Substrate: Granite and rhyolitic shallow soils.

Exposure: Fully exposed.

Management

Population size: Only found as a couple of small populations and may only be around 500 individuals within both reserves.

Reserved: Girraween National Park, Bald Rock National Park, Boonoo Boonoo National Park, Gibraltar Range National Park, New England National Park, Werrikimbe National Park, Butterleaf National Park, Mann River Nature Reserve, Western Washpool NP, Warra National Park, Bolivia Hill Nature Reserve and the Torrington State Recreation Area.

Threats: Fires that are too frequent?.

Management considerations: Searches of the dryer heathy forests may highlight further populations.

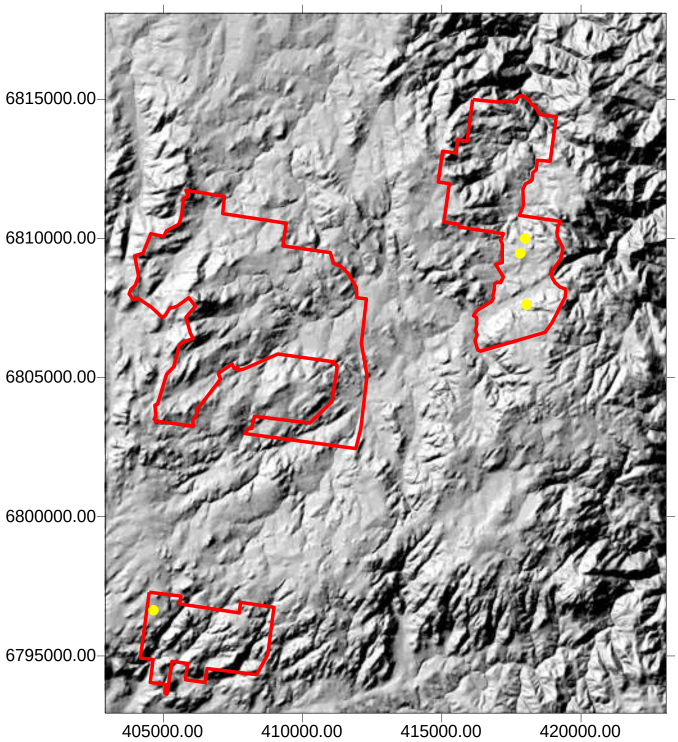


Figure 53: Distribution of *Cryptandra lanosiflora*.

3.7.8 *Daviesia elliptica* Crisp (3RC-).

Taxonomy

Reference: *Australian Systematic Botany* 4: ?.

Family: Fabaceae.

Affinities: *Daviesia latifolia*.

Synonymy: Unknown.

Derivation of name: In reference to the shape of the leaves.

Common name: None apparent.

Changes in conservation status: 3RC- (Briggs & Leigh 1996), unchanged since.

Life history

Growth form: Shrub to 1.5 m tall.

Vegetative spread: None.

Longevity: Unknown.

Primary juvenile period: Unknown but probably 3 years.

Flowers: September to November.

Fruit/seed: ? late summer to autumn.

Dispersal, establishment & growth: Via seed.

Fire response: Known to germinate prolifically to fires of the right temperature. Probably an obligate seeder and has responses similar to many other legumes.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Darling Downs and the Northern Tablelands.

General distribution: North of the Oban River.

Distribution within the BRBB: Found in Boonoo Boonoo National Park particularly within close proximity to the Boonoo Boonoo River and the falls area and also in the old Jenner State Forest section of Bald Rock National Park.

Habitat

Habitat: In dry forests on sandy soils.

Altitude: 800-1000 m.

Annual Rainfall: 1000-12000 mm.

Abundance: Found in very large numbers in scattered localites. Each population appears to be a cohort that has germinated after single wildfire events.

BRBB community: Community 8 and Community 11.

Substrate: Usually deeper sandy soils on granite.

Exposure: Partially shaded.

Management

Population size: The population size is likely to be highly variable over decades and will relate to the frequency and temperature of local fires. At present the population within Boonoo Boonoo is likely to be several thousand.

Reserved: Boonoo Boonoo National Park, Basket Swamp NP, Western Washpool NP, Gibraltar Range NP, Bolivia Hill NR and Mann River NR.

Threats: Fires at an incorrect frequency or temperature.

Management considerations: No hands on management is required at this time, however periodic monitoring of populations for an understanding of their long term dynamics would be beneficial.

Figure 54: Photograph of *Daviesia elliptica*.

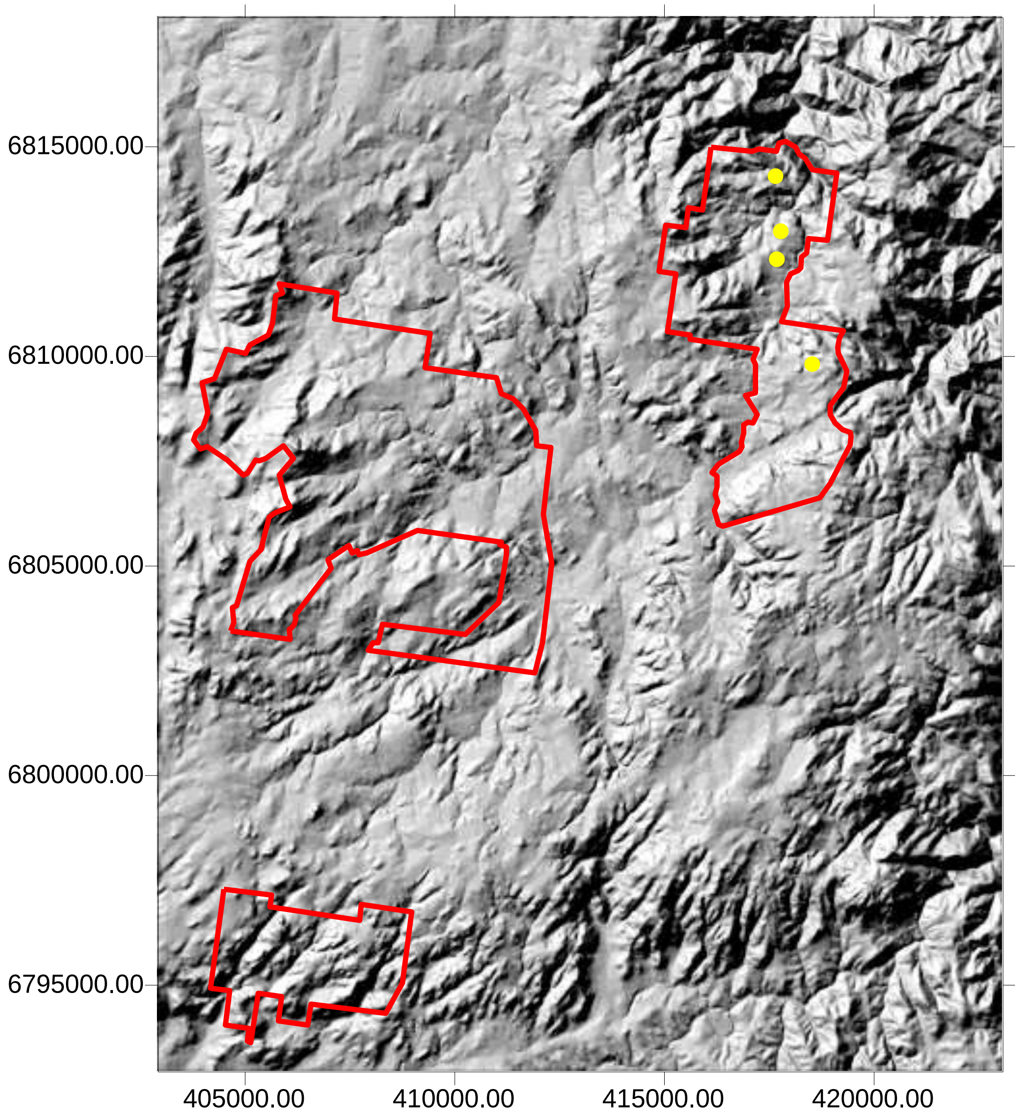


Figure 55: Distribution of *Daviesia elliptica*.

3.5.9 *Dodonaea hirsuta* (Maiden & Betche) Maiden & Betche (3RC-).

Taxonomy

Type: Jennings N.S.W., *J.L. Boorman,* October 1901 (holo: NSW).

Reference: *Proceedings of the Linnean Society of New South Wales* 38: 245.

Family: Sapindaceae.

Affinities: Not apparent.

Synonymy: *Dodonaea peduncularis* var. *hirsuta*.

Derivation of name: In reference to the hairy leaves.

Common name: Hairy Hop Bush.

Changes in conservation status: .3RC- (Briggs & Leigh 1996), unchanged since.

Life history

Growth form: Shrub to 1.5 m tall.

Vegetative spread: None.

Longevity: Not known.

Primary juvenile period: Unknown but probably 3-5 yrs.

Flowers: Within spring to summer.

Fruit/seed: Summer.

Dispersal, establishment & growth: Via fruit, wind dispersed.

Fire response: Obligate seeder. Apparently recruits readily post fire.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Darling Downs, Northern Tablelands and North Western Slopes.

General distribution: From Torrington to Wallangara and to Grafton.

Distribution within the BRBB: The southern section of Boonoo Boonoo in heathy forests.

Habitat

Habitat: Shrubby forests and heathlands on outcrops.

Altitude: 800-1200 m.

Annual Rainfall: 700-1400 m.

Abundance: Often found abundantly but with a disjunct distribution.

BRBB community: Community 11.

Substrate: Sandstone and granite.

Exposure: Usually partially shaded to fully exposed sites.

Management

Population size: Probably only a few hundred within the reserve.

Reserved: Banyabba Nature Reserve, Girraween National Park, Fortis Creek National Park, Torrington State Recreation Area and Kings Plains National Park.

Threats: Inappropriate fire regimes.

Management considerations: Populations are fairly stable and probably do not require hands on management. Further work into the fire responses of this species is warranted.

3.5.10 *Endiandra hayesii* Kosterm. (3VC-; TSC Act Shedule 2, Vulnerable).

Taxonomy

Type: In valley below Minyon Falls (*ca.* 8 miles SW of Mullumbimby, N. Coast, alt. 130 m, Oct. Buds, *Hoogland & Hayes 8498* (holo: BO; iso: A, BRI, K, L, MEL, NSW).

Reference: *Reinwardtia* 8: 81.

Family: Lauraceae.

Affinities: Not apparent.

Synonymy: None.

Derivation of name: Named after botanist Hayes.

Common name: Rusty Rose Walnut.

Changes in conservation status: 3VC- (Briggs & Leigh 1996), unchanged since.

Life history

Growth form: Small to medium sized tree.

Vegetative spread: None.

Longevity: Unknown.

Primary juvenile period: Unknown.

Flowers: Summer.

Fruit/seed: Not known.

Dispersal, establishment & growth: Via fruit.

Fire response: Unknown.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Moreton, North Coast.

General distribution: North of the Clarence River to just over the Queensland Border.

Distribution within the BRBB: Restricted to the bottom of the Boonoo Boonoo Falls.

Habitat

Habitat: In subtropical lowland closed forests on sedimentary of alluvial soils in shetered valleys.

Altitude: 10-500 m.

Annual Rainfall: 1400 mm +.

Abundance: Locally abundant when it is found.

BRBB community: Community 4.

Substrate: Alluvial or sedimentary soils.

Exposure: Protected sites usually within gullies.

Management

Population size: Only a handful of plants were seen and the total population within the reserve may be under 50.

Reserved: Burleigh Heads National Park, Warrie National Park, Big Scrub Flora Reserve, Nightcap National Park, Snows Gully Nature Reserve, Boonoo Boonoo National Park.

Threats: Fire and rock slides.

Management considerations: A survey of total population size at the base of the Boonoo Boonoo Falls is appropriate.

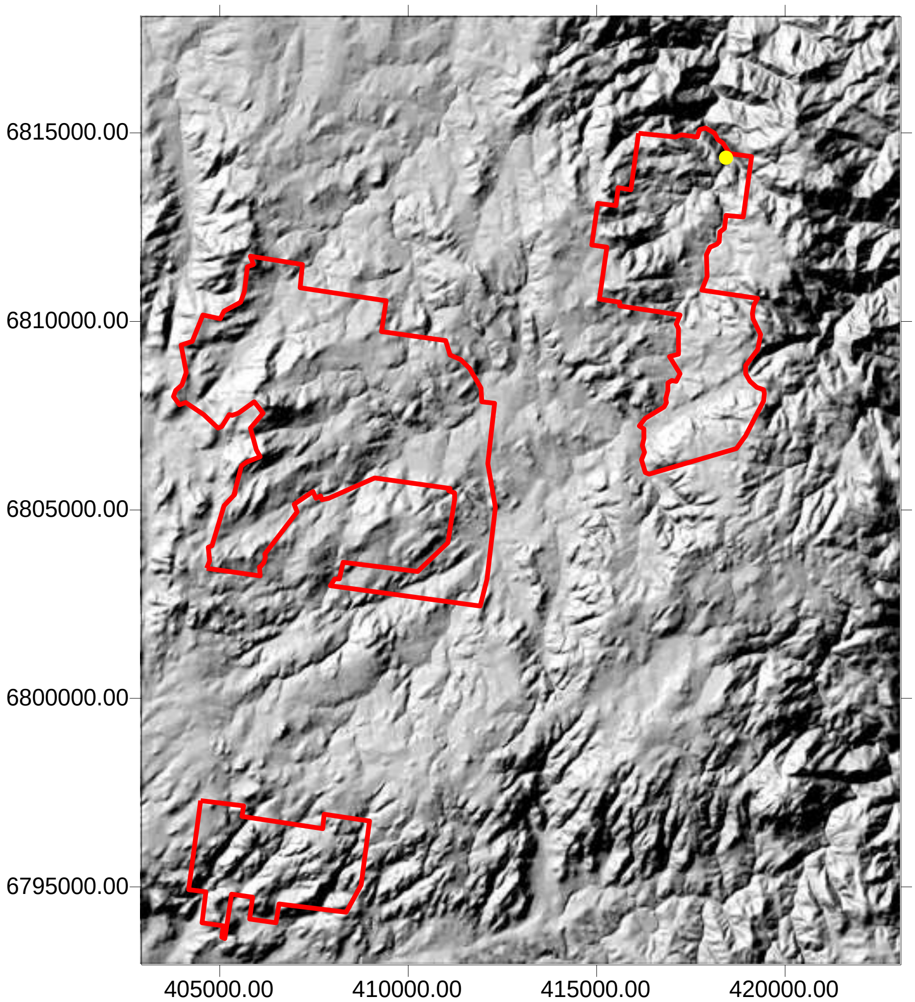


Figure 56: Distribution of *Endiandra hayesii*.

3.5.11 *Eucalyptus dorrigoensis* (Blakely) L.A.S.Johnson & K.D.Hill (3KC-)

Taxonomy

Type: New South Wales: Northern Tablelands: Wild Cattle Creek, Dorrigo, *W.A.W. Beuzeville* Sept. 1931 (*lecto*: NSW).

Reference: *Telopea* 4: 63 (1990).

Family: Myrtaceae.

Affinities: Possibly related to *E. benthamii* but differs in the structure of the outer calyptra.

Synonymy: *Eucalyptus benthamii* subsp. *dorrigoensis* Blakely.

Derivation of name: Named after region of type locality.

Common name: Dorrigo White Gum.

Changes in conservation status: Not considered to be at risk (Johnson & Hill 1990); 2RCa (Binns 1992); 2KC- (Sheringham & Westaway 1995; Quinn *et al.* 1996); 3KC- (Sheringham & Westaway 1998, update).

Life history

Growth form: Smooth barked tree to 40 m tall.

Vegetative spread: None.

Longevity: Unknown.

Primary juvenile period: Unknown.

Flowers: Unknown.

Fruit/seed: Several seasons held on one individual and gradually released.

Dispersal, establishment & growth: Seed dispersed, regenerates well after logging (Chapman & Binns 1995).

Fire response: Long term frequent burning may deplete populations.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: North Coast and Northern Tablelands.

General distribution: From south-east of Tenterfield along the eastern escarpment to the Macleay River.

Distribution within BRBB: Scarce at the higher altitudes in most situations but in particular along most upland creeks and some upland drier slopes.

Habitat

Habitat: Along creeks and drainage depressions on undulating plateau landforms but sometimes on steep slopes (Binns 1992; Hunter 1998). Deep soils in valleys (Chapman & Binns 1995). Found occasionally along creek lines and dry steep slopes within the reserve.

Altitude: 700-1200 m.

Abundance: Widespread and locally dominant in the Glen Innes District (Binns 1992).

BRBB additions community: Community 7 and 9.

Substrate: Metasediments, Acid Volcanics and Granite.

Exposure: Fully exposed to slightly protected sites.

Management

Population size: Small populations are common throughout the reserves especially along creeks although along some ridges this species may form small monospecific stands.

Reserved: Boonoo Boonoo National Park, Demon Nature Reserve, Dorrigo National Park, Guy Fawkes National Park, Guy Fawkes River National Park, Washpool National Park Western Additions and Dorrigo White Gum Flora Reserve.

Threats: Regular grazing and burning may inhibit long-term recruitment (Chapman & Binns 1995).

Management considerations: This species is very common throughout the reserve and many age classes can be found, therefore active management is not considered necessary for this taxon. It is likely that the widespread nature of this species that is obvious from recent surveys should preclude this species from being a ROTAP or at least it should only be given a 3RCa coding.

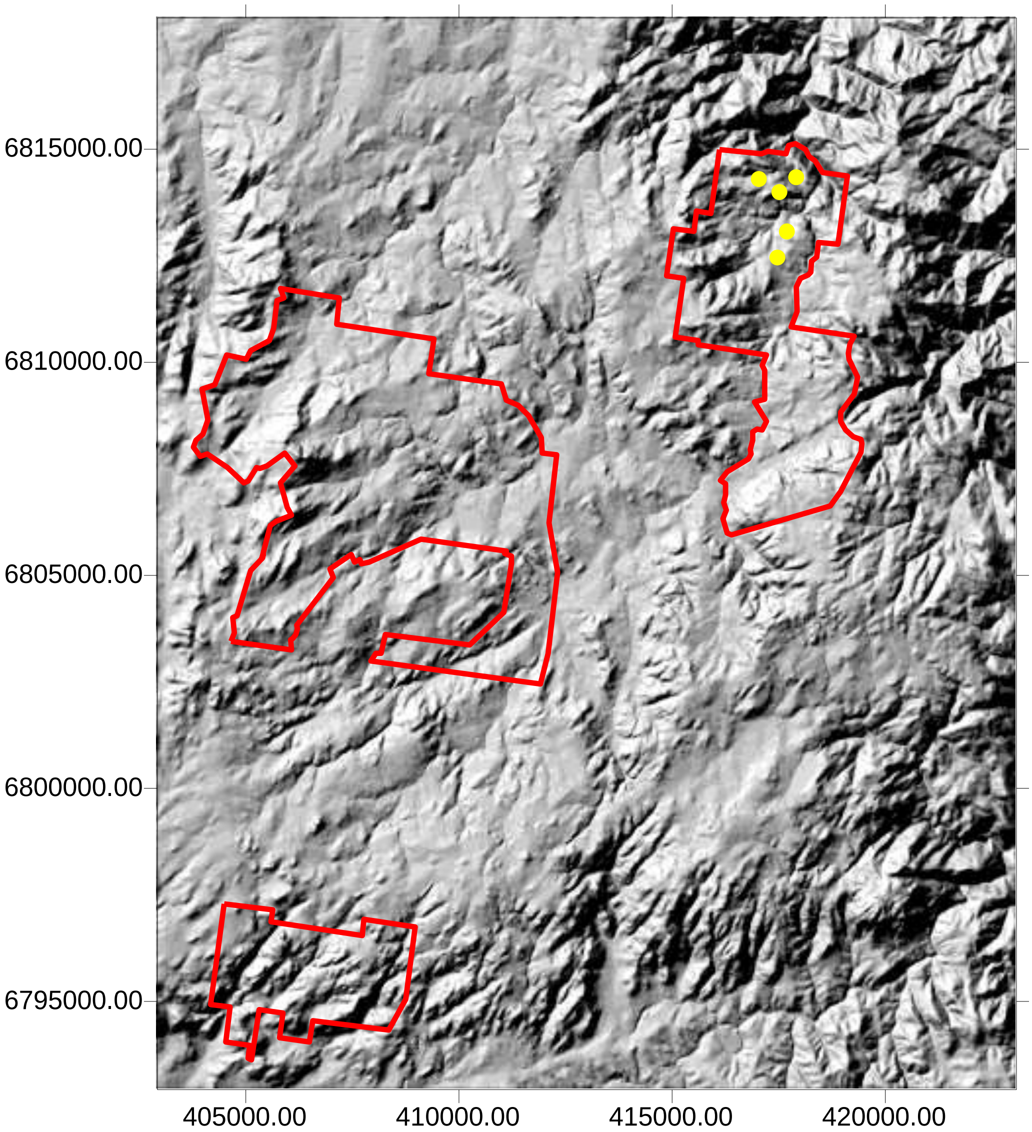


Figure 57: Distribution of *Eucalyptus dorrigoensis*.

3.5.12 *Eucalyptus scoparia* Maiden (2VCi).

Taxonomy

Type: On the tops of the highest hills in fissures of granite rocks around Wallangarra, occurring on both sides of the New South Wales-Queensland Border, *J.L. Boorman*, July, 1904 (holo: NSW).

Reference: *Proceedings of the Linnean Society of New South Wales* 29: 777.

Family: Myrtaceae.

Affinities: Not apparent.

Synonymy: None.

Derivation of name: *Scopulus* meaning pointed rock, cleft or crag, in reference to the habitat.

Common name: Wallangarra White Gum.

Changes in conservation status: 2VCi (Briggs & Leigh 1996), unchanged since. Only a few individuals are known from New South Wales and as such this species may warrant TSC Act Listing.

Life history

Growth form: Tree to 20 m tall.

Vegetative spread: None.

Longevity: Unknown but based on habitat may be long lived, in the order of hundreds of years.

Primary juvenile period: Unknown but likely to be 5 yrs +.

Flowers: Summer.

Fruit/seed: Throughout the year.

Dispersal, establishment & growth: Seed.

Fire response: Not known but likely to be readily killed by fires and have a poor resprouting response.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Darling Downs and the Northern Tablelands.

General distribution: Restricted to the Wallangarra area, once thought to occur in the Malara area but this is now thought to be an erroneous locality.

Distribution within the BRBB: Restricted to the larger granite outcrops near the Queensland Border within Bald Rock National Park.

Habitat

Habitat: Clefts within exposed granite slopes.

Altitude: 900-1300 m.

Annual Rainfall: 800-1200 mm.

Abundance: Found frequently within Girraween National Park but very uncommon in New South Wales.

BRBB community: Community 11.

Substrate: Granite outcrops.

Exposure: Fully exposed sites.

Management

Population size: Within the reserves the population may only be in the order of tens of individuals or less.

Reserved: Within Girraween and Bald Rock National Parks.

Threats: Fires.

Management considerations: Too frequent fires are the greatest threat to this species.

Figure 58: Photograph of *Eucalyptus scoparia*.

3.5.13 *Euphrasia orthocheilia* subsp. *peraspera* W.R.Barker (3RC-).

Taxonomy

Type: Clarence River, *Wilcox,* xi. 1875 (holo: MEL).

Reference: *Journal of the Adelaide Botanic Gardens* 5: 280.

Family: Scrophulariaceae.

Affinities: Not certain.

Synonymy: None.

Derivation of name: *Ortho* meaning strait, *cheilia* meaning lip and *para* meaning throughout. Presumably meaning straight lip on the flower throughout.

Common name: None apparent.

Changes in conservation status: 3RC- (Briggs & Leigh 1996), unchanged since. Currently being considered for inclusion on the TSC Act as vulnerable (John Westaway *pers. comm.*).

Life history

Growth form: Annual herb to 60 cm tall.

Vegetative spread: None apparent.

Longevity: Annual.

Primary juvenile period: < 1 yr.

Flowers: Spring to summer.

Fruit/seed: Summer.

Dispersal, establishment & growth: Seed.

Fire response: Unknown but may be stimulated to flower and seed after fire.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Darling Downs, North Coast and Northern Tablelands.

General distribution: From north of Dorrigo to Torrington.

Distribution within the BRBB: Not found during this survey, but previously found within Boonoo Boonoo.

Habitat

Habitat: In moist open situations.

Altitude: ?800-1200 m.

Annual Rainfall: 900-1800 mm.

Abundance: Not known but probably very infrequent.

BRBB community: Not known but likely to be within Community 7.

Substrate: Various.

Exposure: Open but not fully exposed sites.

Management

Population size: Not known as not found during the current survey. Populations may fluctuate widely depending on seasonal quality and may be missed due to its annual habit.

Reserved: Guy Fawkes National Park, Torrington State Recreation Area, Boonoo Boonoo National Park, Girraween National Park.

Threats: Unknown.

Management considerations: Until populations are found no direct management procedures are required apart from potential searches in appropriate habitat and seasons.

3.5.14 *Hibbertia* sp. B (2KC-).

Taxonomy

Type: Not yet formally described.

Reference: NA.

Family: Dilleniaceae.

Affinities: *Hibbertia obtusifolia* complex.

Synonymy: *Hibbertia obtusifolia*.

Derivation of name: NA.

Common name: Guinea Flower.

Changes in conservation status: 2K (Briggs & Leigh 1996), unchanged since. Clarke and Fullon (1999) state that the taxon requires TSC Act vulnerable listing. However the size of populations within Torrington SRA and Severn River would probably preclude this and the species probably warrants a 3RCa classification.

Life history

Growth form: Erect shrub to 80 cm tall.

Vegetative spread: None.

Longevity: Unknown.

Primary juvenile period: Unknown but probably 2-3 years.

Flowers: Summer.

Fruit/seed: Late summer to autumn.

Dispersal, establishment & growth: Via seed, ant dispersed.

Fire response: Killed by fire, obligate seeder. Post fire seedlings noted by germination experiments by Clarke and Fullon (1999) failed to germinate seeds. Probably has specialised dormancy cues and a long lived seed bank.

Interactions with other organisms: Secondary dispersal by ants.

Distribution

Botanical sub-regions: Northern Tablelands and the North Western Slopes.

General distribution: From the Severn River to southern Bald Rock National Park.

Distribution within the BRBB: Restricted to the southern section of Bald Rock National Park.

Habitat

Habitat: Found only granite outcrops or within the surrounding boulder fields.

Altitude: 700-1100 m.

Annual Rainfall: 700-1000 mm.

Abundance: Found commonly on and around granite boulders in the Severn River and Torrington areas.

BRBB community: Community 10.

Substrate: Granite and rhyolite.

Exposure: Fully exposed sites.

Management

Population size: Within the reserve only a handful of plants were seen, the total population may only be in the lower hundreds.

Reserved: Severn River Nature Reserve, Torrington State Recreation Area and now Bald Rock National Park.

Threats: Inappropriate fire regimes and cattle and goat grazing.

Management considerations: A survey of the total population size and distribution would be beneficial.

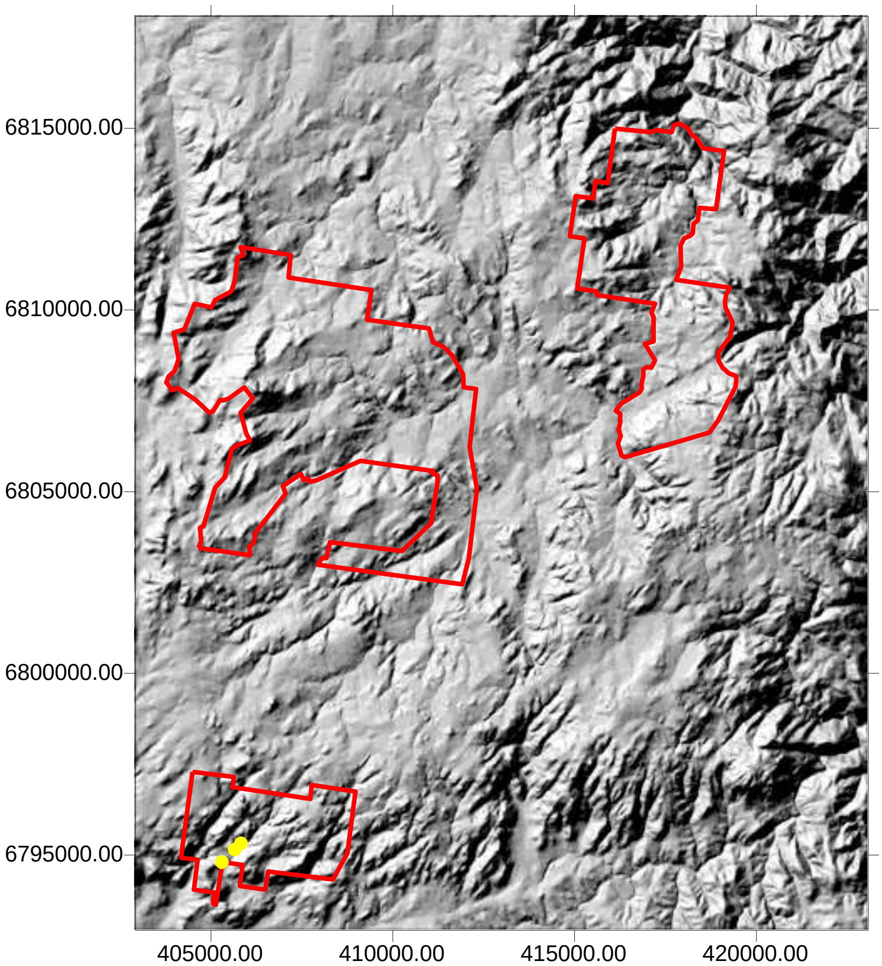


Figure 59: Distribution of *Hibbertia* sp. B.

3.5.15 *Homoranthus lunatus* Craven & S.R.Jones

Taxonomy

Type: Boonoo Boonoo National Park, Cypress Rest Area, 10 m from the bank of the Boonoo Boonoo River, 28.ix. 1990, *Jones 19* (holo: CANB; iso: A, AD, K, L, MEL, NSW).

Reference: *Australian Systematic Botany* 4: 522.

Family: Myrtaceae.

Affinities: Part of the *H. biflorus* complex and closely related to *Homoranthus papillatus*.

Synonymy: None.

Derivation of name: In reference to the lunar shape of the leaves.

Common name: None apparent.

Changes in conservation status: 2RC-t (Briggs & Leigh 1996). Elevated to 2VC- by Hunter 1997.

Life history

Growth form: Low spreading shrub to only 30 cm tall.

Vegetative spread: None.

Longevity: Unknown but probably long lived.

Primary juvenile period: Unknown.

Flowers: July to November.

Fruit/seed: December to February.

Dispersal, establishment & growth: Via fruit. Dispersal is generally immediately below the adult.

Fire response: Obligate seeder.

Interactions with other organisms: Not apparent.

Distribution

Botanical sub-regions: Northern Tablelands.

General distribution: Found in Boonoo Boonoo and Basket Swamp National Parks and a single population at Torrington.

Distribution within the BRBB: Restricted to the rocky banks of the Boonoo Boonoo River and Mount Prentice.

Habitat

Habitat: Exposed granite surfaces in heath.

Altitude: 900-1200 m.

Annual Rainfall: 900-1200 mm.

Abundance: Locally abundant.

BRBB community: Community 4 and 11.

Substrate: Granite sheeting.

Exposure: Fully exposed sites.

Management

Population size: The population size of this and other *Homoranthus* species across the tablelands suffered incredible declines in 1997-1998. These deaths have devastated the populations of *H. lunatus* within the reserve with around 60% of individuals dying both on Mount Prentice and at Morgan's Gully. The current extant population size may be less than 1000 individuals.

Reserved: Only at Boonoo Boonoo and Basket Swamp National Parks. The population at Torrington is within a private holding.

Threats: Fire and trampling from visitors. Long-term climatic cycles?

Management considerations: Trampling of plants at accessible locations may be an issue, particularly around Morgan's Gully and the Cypress Pine Rest Area. Exclusion of fire for the near future may be appropriate.

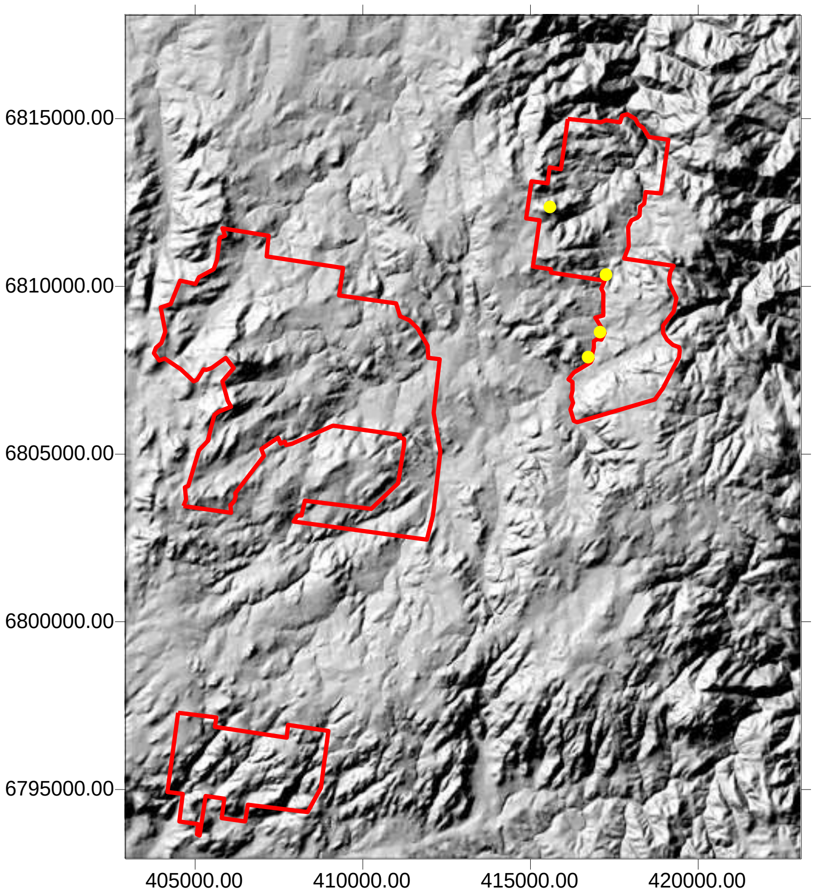


Figure 60: Distribution of *Homoranthus lunatus*.

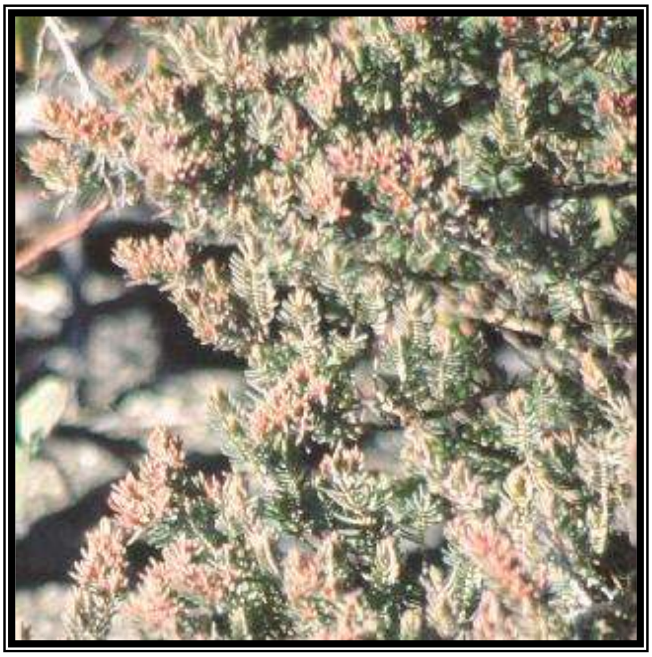


Figure 61: Photograph of *Homoranthus lunatus*.

3.5.16 *Kunzea bracteolata* Maiden & Betche (3RC-).

Taxonomy

Type: New South Wales?: Northern Tablelands?: Wallangara, *J.L. Boorman* Nov. 1904 (*holo*: NSW).

Reference: *Proceedings of the Linnean Society of New South Wales* 30: 363 (1905).

Family: Myrtaceae.

Affinities: Unknown but can easily be distinguished by the prominent bracts at the base of the flowers.

Synonymy: None.

Derivation of name: In reference to the prominent bracts around the inflorescences.

Common name: Granite Kunzea.

Changes in conservation status: 3RC- (Briggs & Leigh 1988) unchanged since, reservation status however is probably adequate.

Life history

Growth form: Dense and diveracate shrub to 3 m tall.

Vegetative spread: None.

Longevity: Unknown but some populations are likely to be many decades old (50 yrs + or much more).

Primary juvenile period: At least 4 years.

Flowers: Spring to Summer.

Fruit/seed: Late Summer to Autumn.

Dispersal, establishment & growth: Via capsule or seed. Establishment cues not known.

Fire response: Obligate seeder but may resprout if fire intensity is low. Clarke and Fullon (1999) state that there is no soil stored seed bank. However replacement of post fire communities eventually with *Kunzea bracteolata* would suggest that soil stored seed is available for some years after the passage of fire.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Northern Tablelands within New South Wales and the Darling Downs within Queensland.

General distribution: From Mount Chaelundi in New South Wales to Girraween National Park within Queensland.

Distribution within BRBB: Restricted to granite outcrops.

Habitat

Habitat: Exposed rock outcrops at high altitudes.

Altitude: 800-1350.

Annual Rainfall: 740-1400.

Abundance: Usually as scattered very small populations.

BRBB community: Community 11.

Substrate: Mainly Granite but also Acid Volcanics.

Exposure: Fully exposed situations at high altitudes.

Management

Population size: Found in small but numerous populations throughout both reserves.

Reserved: Bald Rock National Park, Boonoo Boonoo National Park, Gibraltar Range National Park, Guy Fawkes River National Park, Limpinwood Nature Reserve and Torrington State Recreation Area, Washpool National Park Western Additions, Warra National Park, Butterleaf National Park, Bolivia Hill Nature Reserve, Warra NP within New South Wales and Girraween National Park in Queensland.

Threats: Small population size at any given locality. Frequent fires, this species can be totally removed after the passage of fire (Hunter, *unpublished data*).

Management considerations: Such a small and isolated population is vulnerable to local extinction by inappropriate

Figure 62: Photograph of *Kunzea bracteolata*.

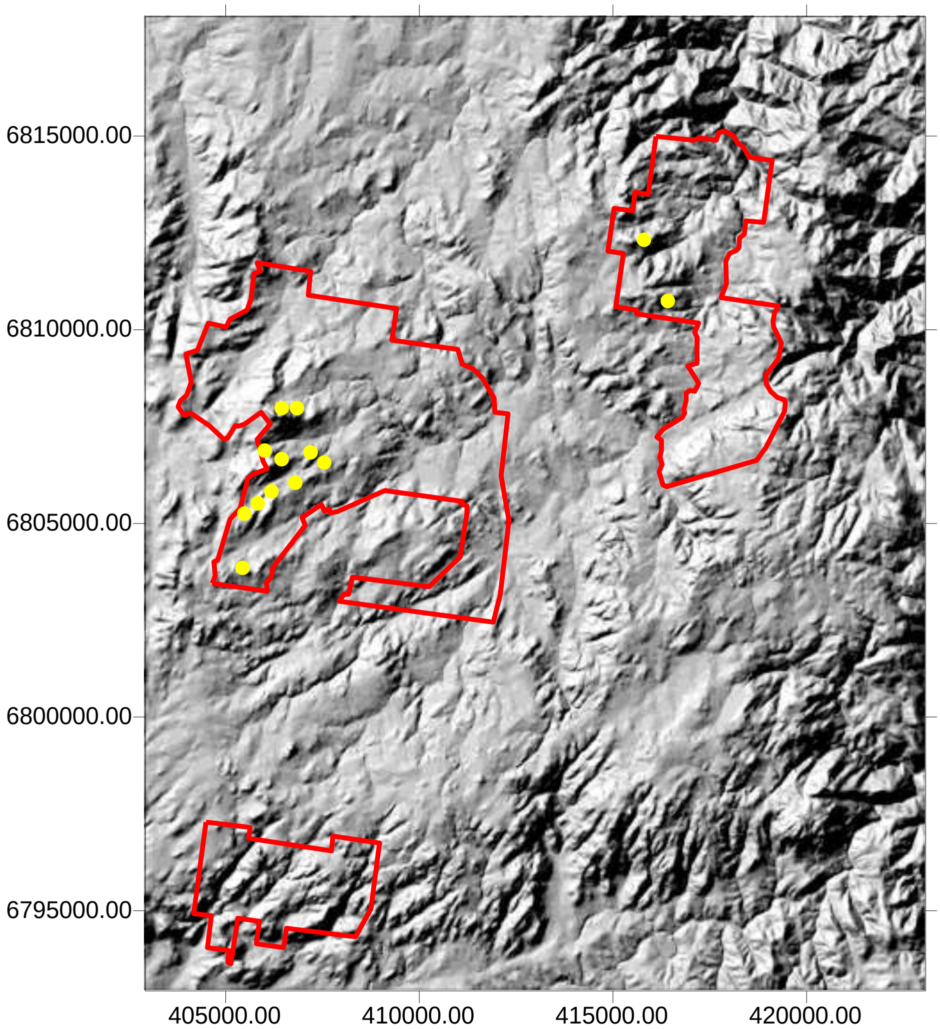


Figure 63: Distribution of *Kunzea bracteolata*.

3.5.17 *Leionema ambiens* (F.Muell.) Paul G.Wilson (3VC-).

Taxonomy

Type: near Timbarra, New South Wales, *C. Stuart 570* (*lecto*: MEL).

Reference: *Nuytsia* 12: 271.

Family: Rutaceae.

Affinities: Uncertain.

Synonymy: *Eriostemon ambiens* and *Phebalium ambiens*.

Derivation of name: *ambien* meaning going around, in reference to the leaf bases that surround the stem.

Common name: None apparent.

Changes in conservation status: 3RC- (Briggs & Leigh 1996). Upgraded to 3VC- by Copeland and Hunter (1999).

Life history

Growth form: Shrub to 2.5 m tall.

Vegetative spread: None.

Longevity: Unknown but likely to be very long lived.

Primary juvenile period: Unknown but likely to be 3-5 years.

Flowers: Spring to summer.

Fruit/seed: Summer.

Dispersal, establishment & growth: Via seed.

Fire response: Obligate seeder. Some post fire recruitment has been noted (Hunter 1999).

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Darling Downs, Northern Tablelands.

General distribution: From Torrington to the Malara Plateau.

Distribution within the BRBB: Restricted to around Mount Prentice in Boonoo Boonoo and to the larger granite outcrops within Bald Rock.

Habitat

Habitat: Restricted to heaths on exposed granite outcrops.

Altitude: 900-1300 m.

Annual Rainfall: 900-1200 mm.

Abundance: May be locally abundant but very disjunct and scattered in distribution.

BRBB community: Community 11.

Substrate: Sheet granite.

Exposure: Fully exposed sites.

Management

Population size: The population within both reserves is likely to be under 1000 individuals and may be under 500.

Reserved: Within Torrington State Recreation Area, Girraween National Park, Bald Rock National Park, Boonoo Boonoo National Park, Warra National Park, Gibraltar Range National Park and the Demon Nature Reserve.

Threats: Inappropriate fire regimes and trampling of soil and roots.

Management considerations: Observations suggest that this species is prone to death by soil compaction from trampling. Fires are also a threat.

Figure 64: Photograph of *Leionema ambiens*.

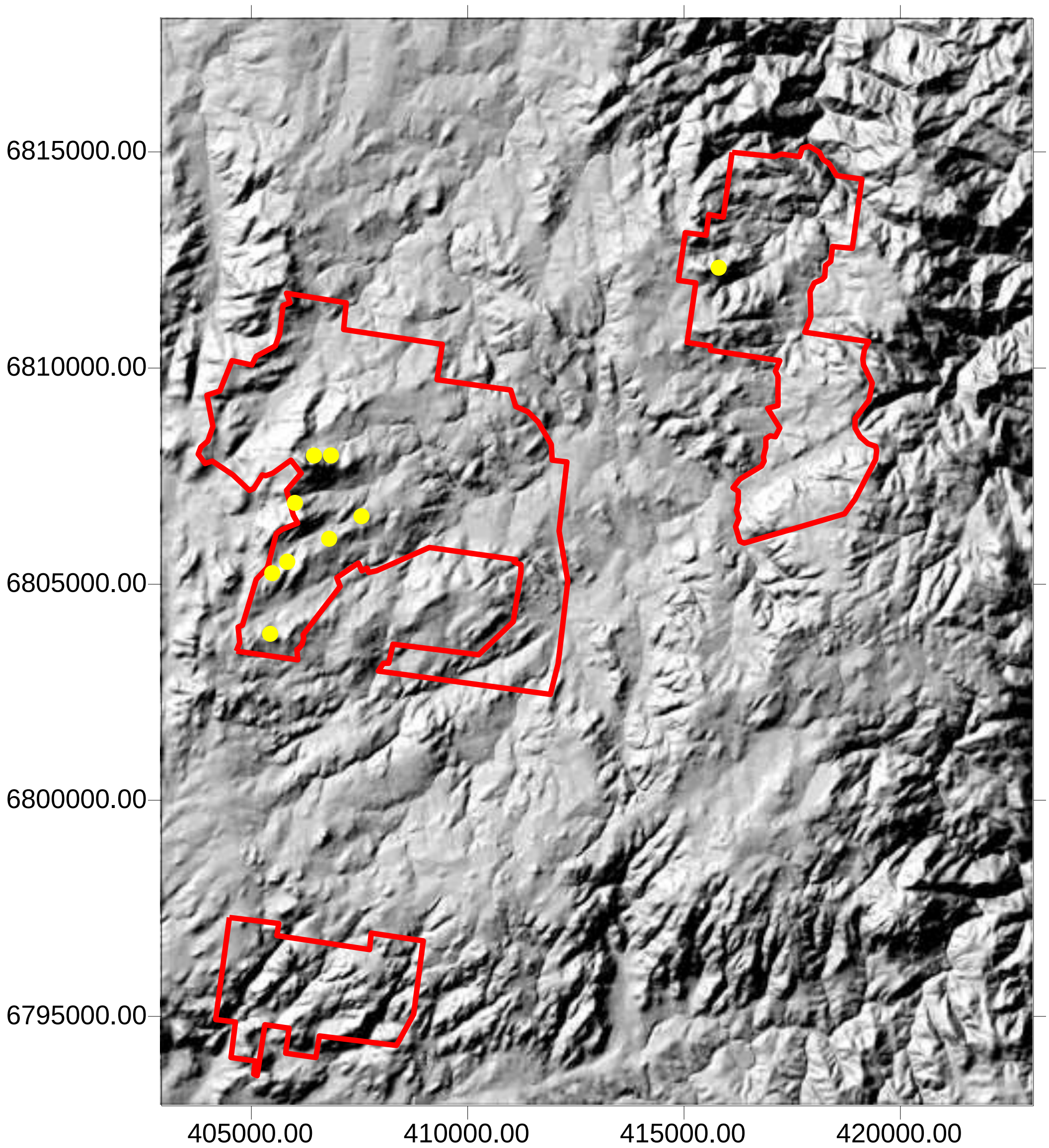


Figure 65: Distribution of *Leionema ambiens*.

3.5.18 *Muehlenbeckia costata* m.s. (3VCa; TSC Act Schedule 2, Vulnerable).

Taxonomy

Type: Not formally described.

Reference: NA.

Family: Polygonaceae

Affinities: *M. rhyticarya*.

Synonymy: None, but informally known as *M.* sp. Mt Norman.

Derivation of name: *Costatus* meaning having more than one primary midrib, presumably in reference to the ribbed stems.

Common name: None apparent.

Changes in conservation status: 3KC- (Briggs and Leigh 1996). Listed as Vulnerable on the TSC Act. Raised to 3VCa by Hunter *et al.* (1998).

Life history

Growth form: Trailing to weakly erect herb to 5 m.

Vegetative spread: None.

Longevity: 1 to possibly 3 years.

Primary juvenile period: 2 months.

Flowers: Continuous for the life span of the individual.

Fruit/seed: Continuous for the life span of the individual.

Dispersal, establishment & growth: Via fruit covered by fleshy sweet calyx. Possibly dispersed by lizards or birds. Seed banks are extremely long lived and fresh seed probably has a dormancy period. Seeds survive temperatures of 120°C for over 10 minutes and subsequently germinate.

Fire response: Fire ephemeral with explosive population growth after fires and quick declines.

Interactions with other organisms: All populations appear to become infested by a rust fungus at around 1 yr of age. The species probably has a low resistance to pathogens due to its increased efforts in reproduction.

Distribution

Botanical sub-regions: Darling Downs, Northern Tablelands and Central Tablelands.

General distribution: From Mount Kaputar to Bald Rock and a disjunct distribution in the Blue Mountains.

Distribution within the BRBB: Restricted to Bald Rock and other large bornhardts near the Queensland Border.

Habitat

Habitat: Wholly restricted to the post fire environment on exposed granite surfaces.

Altitude: 1100-1400 m.

Annual Rainfall: 1000-1400 mm.

Abundance: Boom and bust population strategy.

BRBB community: Community 11.

Substrate: Sheet granite.

Exposure: Fully exposed sites.

Management

Population size: Estimated to be around 600 individuals within Bald Rock National Park post fire and to be around 10 two years post fire (Hunter *et al*. 1998).

Reserved: Mt Kaputar National Park, Girraween National Park, Bald Rock National Park, Butterleaf National Park, Warra National Park and the Blue Mountains National Park.

Threats: Inappropriate fire regimes.

Management considerations: Appropriate fire regimes is the only management criteria at this stage.

Figure 66: Photograph of *Muehlenbeckia costata*.

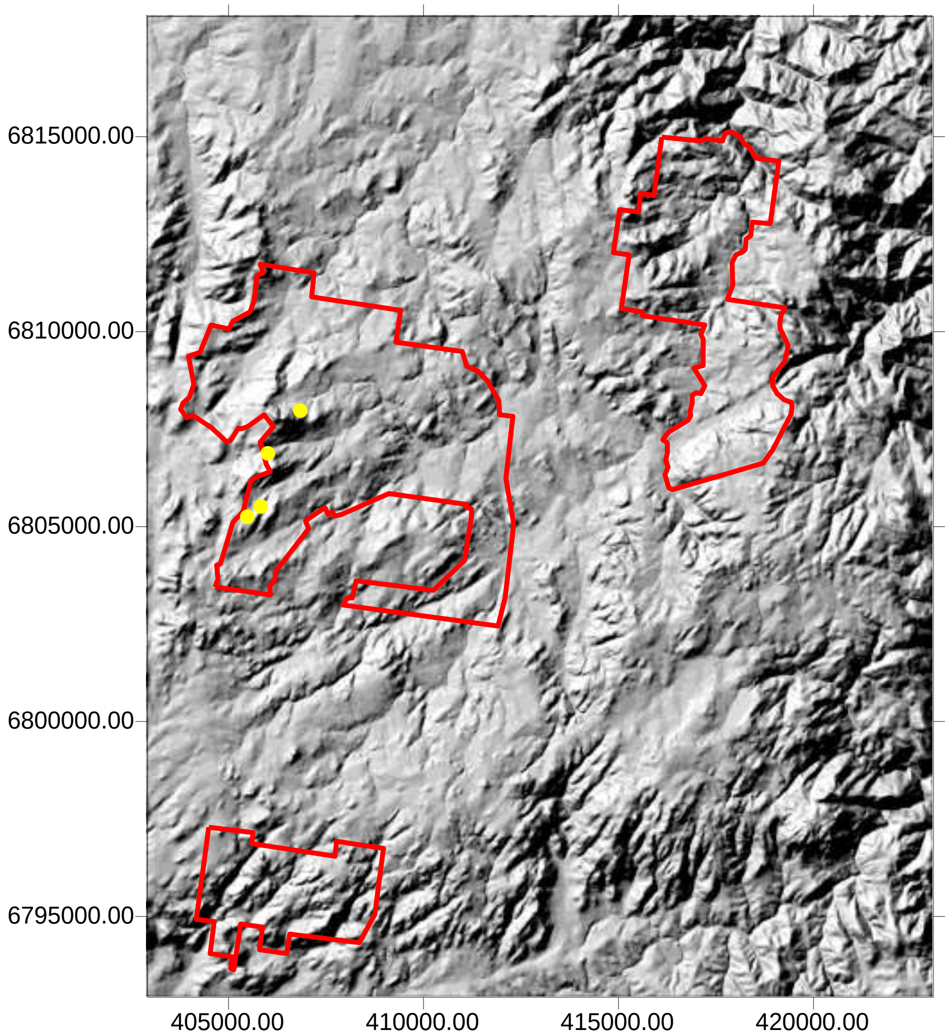


Figure 67: Distribution of *Muehlenbeckia costata*.

3.5.19 *Olearia gravis* (F.Muell.) F.Muell. ex Benth. (3KC-).

Taxonomy

Type: Near Tenterfield, New England, *C. Stuart s.n.* (?MEL).

Family: Asteraceae.

Affinities: Uncertain possibly *O. stellutlata*.

Synonymy: *Aster gravis* F.Muell., *Olearia gravis* S.T.Blake.

Derivation of name: Meaning heavy.

Common name: Daisy Bush.

Changes in conservation status: 3RC (Thomas & McDonald 1989; McDonald *et al.* 1995); 3KC- (Briggs & Leigh 1996).

Life history

Growth form: Densely hairy shrub to 1.6 m tall.

Vegetative spread: No.

Longevity: Not known, but at least 5 years.

Primary juvenile period: Known to flower in the second year.

Flowers: October to December.

Fruit/seed: November to January.

Dispersal, establishment & growth: Dispersed by seed via wind. The species is known to germinate after soil disturbance such as on the side of roads or after road grading (Hunter, *pers. obs.*).

Fire response: Known to germinate after fire, known to resprout.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Northern Tablelands and the North Western Slopes of New South Wales. Darling Downs and Burnett in Queensland.

General distribution: A disjunct and sporadic distribution occurs from Murgon to Girraween National Park in Queensland to Torrington and Kwiambal and also at Gibraltar Range National Park.

Distribution within BRBB: Found during previous surveys within Boonoo Boonoo National Park but also likely to occur in the southern section of Bald Rock National Park.

Habitat

Habitat: Usually restricted to granite outcrops or rocky granite ridges.

Altitude: 300-1100.

Annual Rainfall: 650-1200 mm.

Abundance: This species often has a clumped distribution with many plants growing in close proximity.

Kwiambal community: Community 10.

Substrate: Granite.

Exposure: Fully exposed positions.

Management

Population size: Probably very low as not recorded during this survey.

Reserved: Torrington State Recreation Area, Boonoo Boonoo National Park, Gibraltar Range National Park, Kwiambal NP, Bolivia Hill NR, Severn River NR, King Plains NP in New South Wales. The western portion of Girraween National Park and also Sundown National Park in Queensland.

Threats: Goats have been known to brouse this species.

Management considerations: Basic information on the biology and population size of this species is needed. Accurate estimations of the population size of this species within the park are needed.

Figure 68: Photograph of *Olearia gravis*.

3.5.20 *Persoonia daphnoides* A.Cunn. ex R.Br. (3RC-).

Taxonomy

Type: near Hunter's River, 1827. *A. Cunningham*.

Reference: *Prodromus Florae Novae Hollandiae – Suppl. 1: Proteaceas Novas* 15.

Family: Proteaceae

Affinities: Unknown but probably close to *P. procumbens*.

Synonymy: None.

Derivation of name: Not known but may relate to a resemblance to *Daphne* or its odour.

Common name: Geebung.

Changes in conservation status: 3RC- (Briggs & Leigh 1996), unchanged since.

Life history

Growth form: Prostrate shrub.

Vegetative spread: None.

Longevity: Unknown.

Primary juvenile period: Unknown but probably 2 years.

Flowers: December to January.

Fruit/seed: Autumn.

Dispersal, establishment & growth: Via fruit.

Fire response: Resprouter.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: .

General distribution: From Stanthorpe and Tenterfield area.

Distribution within the BRBB: Found in open grassy forests and woodlands in Bald Rock and Boonoo Boonoo.

Habitat

Habitat: In grassy forests and open woodlands.

Altitude: 950-1200 m.

Annual Rainfall: 900-1400 mm.

Abundance: Found usually as isolated individuals with low specific abundances.

BRBB community: Community 1 and 7.

Substrate: Coarse granite soils.

Exposure: Semi shade to exposed sites.

Management

Population size: The species is widespread but in low numbers and the total population size is likely to under 1000 within both reserves.

Reserved: Girraween National Park, Bald Rock National Park, Boonoo Boonoo National Park and Western Washpool National Park.

Threats: Grazing.

Management considerations: Stray cattle and pigs need to be kept under control.

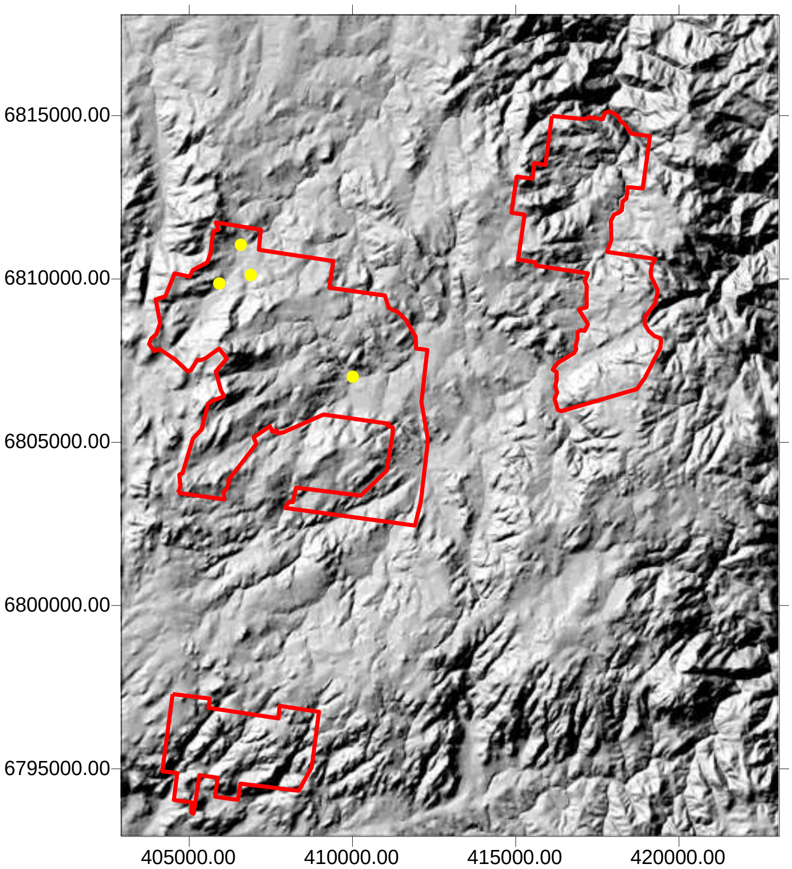


Figure 69: Distribution of *Persoonia daphnoides*.

Figure 70: Photograph of *Persoonia daphnoides*.

3.5.21 *Philotheca epilosa* (Paul G. Wilson) P.I.Forst.

Taxonomy

Type: Wallangarra, Queensland. *J.L. Boorman,* Nov. 1906 (holo: NSW).

Reference: *Muelleria* 11: 120.

Family: Rutaceae.

Affinities: Part of the *P. myoporoides* complex.

Synonymy: *Eriostemon myoporoides* subsp. *epilosus*.

Derivation of name: Meaning lacking hairs, in reference to the flowers.

Common name: None apparent.

Changes in conservation status: 3RC- (Briggs & Leigh 1996). Downgraded to 3RCa by Richards & Hunter (1997).

Life history

Growth form: Shrub to 1 m tall, spreading.

Vegetative spread: None.

Longevity: Unknown.

Primary juvenile period: Unknown but probably 2-3 yrs.

Flowers: Spring to autumn.

Fruit/seed: Autumn to winter.

Dispersal, establishment & growth: Via seed.

Fire response: Obligate seeder. Killed outright by fire but post fire germinations noted.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Darling Downs, Northern Tablelands, North Coast.

General distribution: From north of Glen Innes to just over the border in Queensland.

Distribution within the BRBB: In Bald Rock and Boonoo Boonoo on exposed granite surfaces.

Habitat

Habitat: Found in heaths on granite outcrops.

Altitude: 1000-1300 m.

Annual Rainfall: 1000-1600 mm.

Abundance: Found in small and scattered disjunct populations.

BRBB community: Community 11.

Substrate: Sheet granite.

Exposure: Fully exposed.

Management

Population size: Probably under 1000 individuals within both parks.

Reserved: Found in Girraween National Park, Bald Rock National Park, Boonoo Boonoo National Park, Butterleaf National Park, Demon Nature Reserve, Bolivia Hill Nature Reserve and the Torrington State Recreation Area.

Threats: Inappropriate fire regimes and trampling.

Management considerations: Trampling is likely to kill this species and frequent fires are likely to devastate populations.

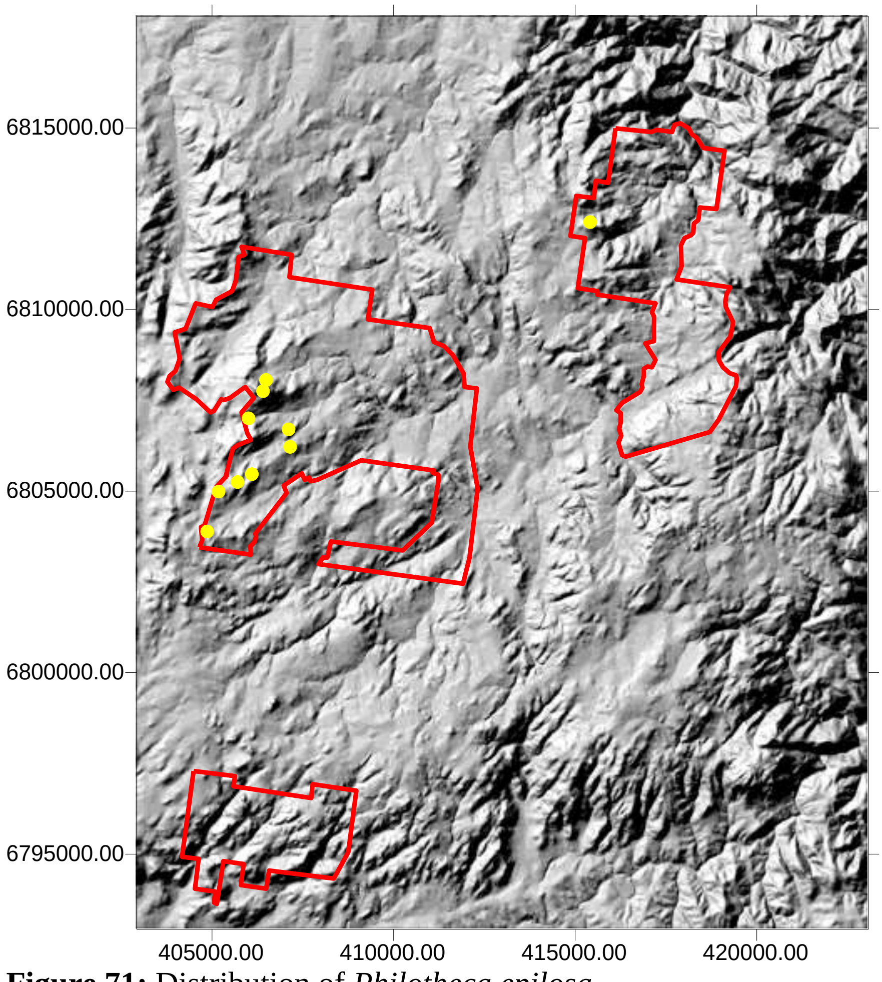


Figure 71: Distribution of *Philotheca epilosa*.

3.5.22 *Plectranthus nitidus* P.I.Forster (2KCi; TSC Act Schedule 1, Endagered).

Taxonomy

Type: Cultivated at Byron Bay from plant collected at upper Terania Creek, Nightcap Range, 20 May 1991, *P. Hardwick* (holo: BRI).

Reference: *Austrobaileya* 3: 736.

Family: Lamiaceae.

Affinities: Shows affinities to *P. apreptus*.

Synonymy: None.

Derivation of name: *Nitidus* meaning shining.

Common name: None apparent.

Changes in conservation status: 2EC (Forster 1992). Changed to 2KCi (Briggs & Leigh 1996), unchanged since. Listed as Endangered on the TSC Act.

Life history

Growth form: Herb to 40 cm tall.

Vegetative spread: None.

Longevity: Unknown.

Primary juvenile period: Unknown.

Flowers: Spring to summer.

Fruit/seed: Summer to autumn.

Dispersal, establishment & growth: Seed.

Fire response: Unknown.

Interactions with other organisms: Unknown.

Distribution

Botanical sub-regions: Moreton and the North Coast.

General distribution: From Horton’s Creek to just over the Queensland Border.

Distribution within the BRBB: Known from the moisture sites within Boonoo Boonoo.

Habitat

Habitat: Rock outcrops in association with wetter forests and closed forests.

Altitude: ?.

Annual Rainfall: ?1000-1600.

Abundance: Only isolated individuals.

BRBB community: Community 6 and 8.

Substrate: Granite and rhyolite.

Exposure: Protected sites.

Management

Population size: Only a handful of individuals were seen.

Reserved: Border Ranges National Park, Horton's Creek Flora Reserve, Lamington and Nightcap National Park.

Threats: Not known but probably inappropriate fire regimes.

Management considerations: Further searches for populations may be warranted.

3.5.23 *Plectranthus suaveolens* S.T.Blake (3KC-).

Taxonomy

Type: Queensland: Moreton: Queen Mary's Falls *prope* Killarney in Queensland a Gresty lecta in Brisbane culta, *Blake 20506* (*holo*: BRI).

Reference: *Contributions from the Queensland Herbarium* 9: 30 (1971).

Family: Lamiaceae.

Affinities: Close to *P. parviflorus* and *P. graveolens* of which some hybrids are found. Often the distinction between *P. parviflorus* and *P. suaveolens* is not clear. This species can be distinguished by the distribution and orientation of its indumentum and its odour.

Synonymy: None.

Derivation of name: Meaning sweet scented.

Common name: Mint Bush.

Changes in conservation status: 3RC- (Thomas & McDonald 1989); 3KC- (Quinn *et al.* 1995) unchanged since this time.

Life history

Growth form: Aromatic shrub to 80 cm tall.

Vegetative spread: None.

Longevity: Unknown.

Primary juvenile period: Unknown.

Flowers: Spring to Summer.

Fruit/seed: Summer.

Dispersal, establishment & growth: Via seed. Freely colonizes disturbed areas, and often becomes weedy when cultivated (Binns 1995).

Fire response: Probably vegetative as a small tuber is often present.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: North Coast and Northern Tablelands of New South Wales and the Darling Downs and Moreton districts of Queensland.

General distribution: From south-east Queensland and north-east New South Wales.

Distribution within BRBB: Relatively common but scattered on rocky outcrop sites usually in the escarpment and gorge areas.

Habitat

Habitat: Usually in rocky or shallow soil sites in exposed situations.

Altitude: 900-1300 m.

Annual rainfall: 800-1100 mm.

Abundance: Populations are widespread but usually with a low number of individuals.

BRBB additions community: Community 8.

Substrate: Mixed but usually Granite, but also Metasediments and Acid Volcanics.

Exposure: Usually fully exposed sites on outcrops.

Management

Population size: Very isolated and small populations are found throughout the reserve making assessments of population sizes difficult.

Reserved: Nymboida National Park, Gibraltar Range National Park, Guy Fawkes National Park, Chaelundi National Park, Mann River Nature Reserve, Numinbah Nature Reserve, Banyabba Nature Reserve, Washpool National Park Western Additions, Guy Fawkes River National Park and the Demon Nature Reserve within New South Wales and Girraween National Park and Queen Mary Falls National Park in Queensland.

Threats: Goat browsing has been seen to occur and mechanical damage from goat camps and trails has occurred in a number of sites.

Management considerations: Eradication of goats in areas with this taxon is of primary concern.

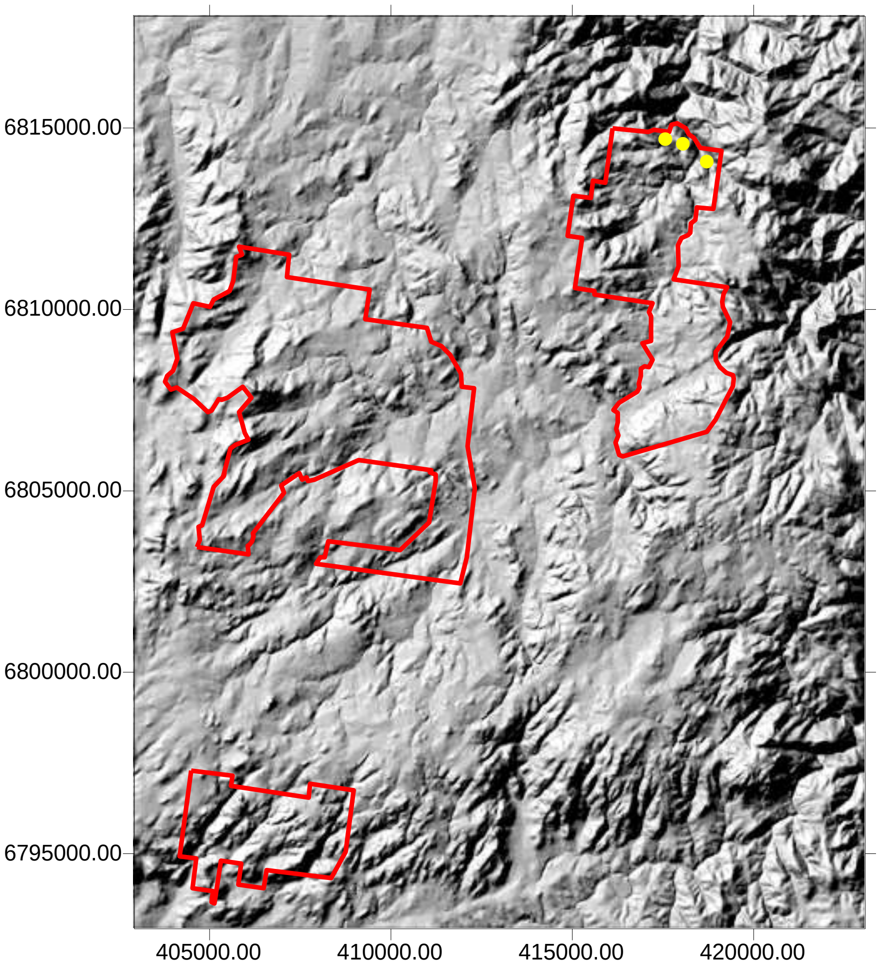


Figure 72: Distribution of *Plectranthus suaveolens*.

3.5.24 *Prostanthera petraea* B.J.Conn (2RC-).

Taxonomy

Type: Bald Rock National Park: Bungoona Walking Track, *B.J.Conn 3668 & E.A.Brown*, 11 Oct 1992 (holo: NSW).

Reference: *Telopea* 11: 252 (2006).

Family: Lamiaceae

Affinities: Uncertain.

Synonymy: NA.

Derivation of name: NA.

Common name: None apparent.

Changes in conservation status: 2RC- (Briggs & Leigh 1996), unchanged since.

Life history

Growth form: Shrub to 3 m tall.

Vegetative spread: None.

Longevity: Not known but probably long lived.

Primary juvenile period: Unknown but probably 3-5 yrs.

Flowers: Spring to summer.

Fruit/seed: Summer to autumn.

Dispersal, establishment & growth: Via seed, potentially a long lived seed bank.

Fire response: Obligate seeder. Post fire recruitment noted.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Darling Downs and Northern Tablelands.

General distribution: From Stanthorpe to Malara.

Distribution within the BRBB: Found on the larger granite outcrops within Bald Rock and Boonoo Boonoo and also along creek and rivers in Boonoo Boonoo.

Habitat

Habitat: Exposed granite sheets and creek margins.

Altitude: 900-1300 m.

Annual Rainfall: 900-1200 mm.

Abundance: Found as very small, scattered populations.

BRBB community: Community 4, 9 and 11.

Substrate: Sheet granite and alluvial soils.

Exposure: Fully exposed sites and some protected sites.

Management

Population size: In total the population within the two parks is probably below 1000 individuals and likely to be below 500.

Reserved: Girraween National Park, Boonoo Boonoo National Park and Demon Nature Reserve.

Threats: Fire.

Management considerations: High fire frequencies is likely to eradicate this species.

Figure 73: Photograph of *Prostanthera petraea*.

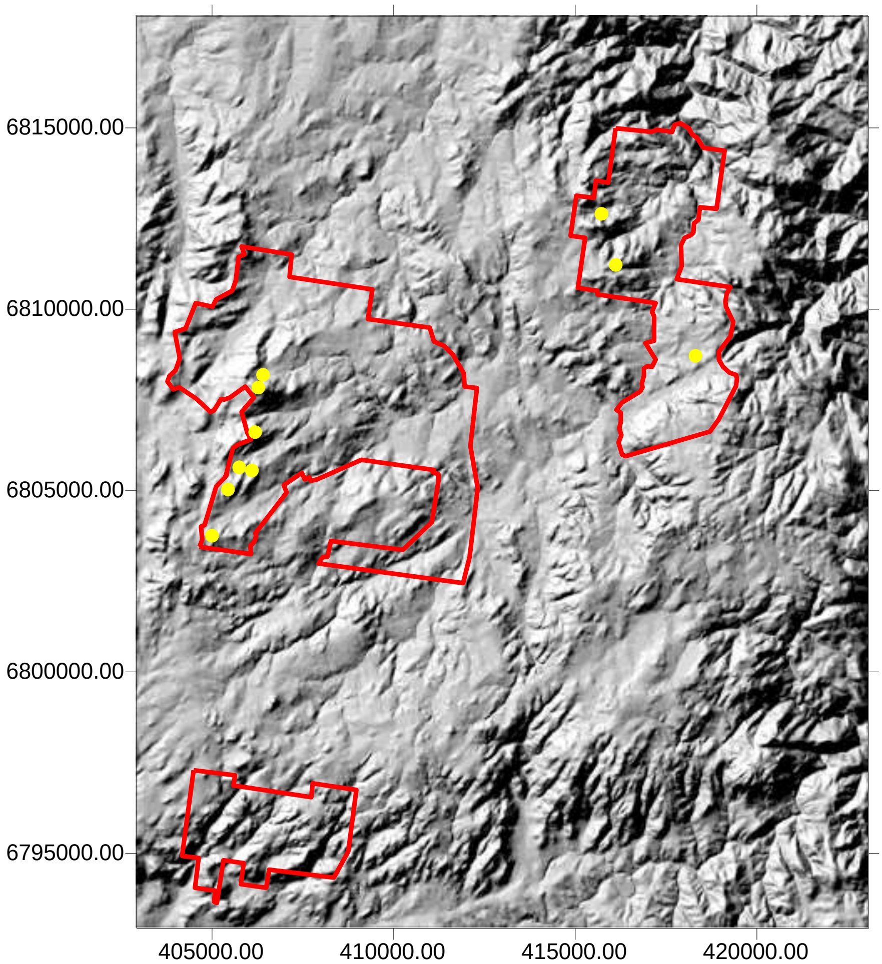


Figure 74: Distribution of *Prostanthera petraea*.

3.5.25 *Pultenaea pycnocephala* Benth. (3RCa).

Taxonomy

Type: Bluff Mountain, New England *C.Stuart*.

Reference: *Flora Australiensis* 2: 114.

Family: Fabaceae.

Affinities: Uncertain.

Synonymy: None.

Derivation of name:.

Common name: None apparent.

Changes in conservation status: 3RCa (Briggs & Leigh 1996), unchanged since.

Life history

Growth form: Shrub to 1.5 m tall.

Vegetative spread: None.

Longevity: Unknown.

Primary juvenile period: Unknown.

Flowers: Spring to summer.

Fruit/seed: Summer to autumn.

Dispersal, establishment & growth: Seed.

Fire response: Unknown probably a resprouter.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Darling Downs, Northern Tablelands.

General distribution: Found from Werrikimbe to just over the Queensland Border.

Distribution within the BRBB: Found within the shrubby forests in Boonoo Boonoo and the southern section of Bald Rock National Park.

Habitat

Habitat: Found in shrubby forests on granite soils.

Altitude: 900-1300 m.

Annual Rainfall: ?900-1600 mm.

Abundance: Found commonly in heathy forests.

BRBB community: Community 10.

Substrate: Granite.

Exposure: Exposed to partial shade.

Management

Population size: Unknown but the plants were common in shrubbier forests and may be in the order of 1000 + individuals.

Reserved: Girraween National Park, Bald Rock National Park, Boonoo Boonoo National Park, Lamington National Park, Gibraltar Range National Park, Guy Fawkes National Park, Chaelundi National Park, Mann River Nature Reserve, and the Demon Nature Reserve.

Threats: Unknown.

Management considerations: Possible fire regimes may be an issue.

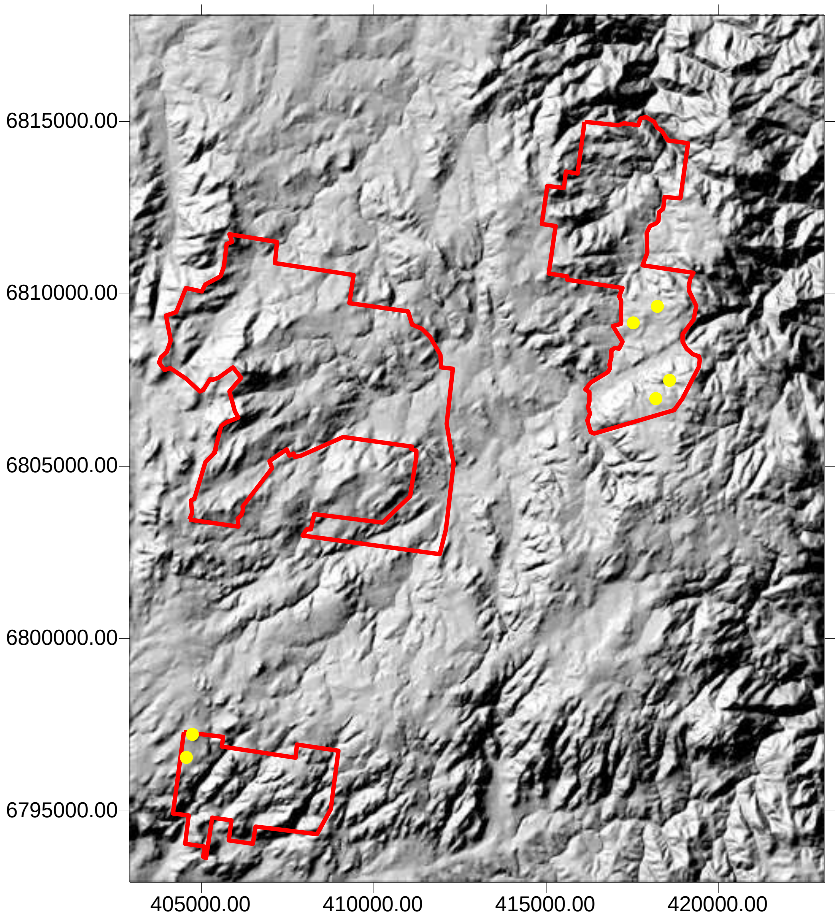


Figure 75: Distribution of *Pultenaea pycnocephala*.

3.5.26 *Thelionema grande* (C.T.White) R.Henderson (3RCa).

Taxonomy

Type: Mt Norman, Queensland, Nov. 1944, *M.S. Clemens* (holo: BRI).

Reference: *Austrobaileya* 2: 110.

Family: Phormiaceae.

Affinities: *Thelionema caespitosa*.

Synonymy: *Stypandra grandis*.

Derivation of name: In reference to the large size, grand.

Common name: Granite Lily.

Changes in conservation status: 3RC- (Briggs & Leigh 1996). Downgraded to 3RCa by Copeland and Hunter (1999).

Life history

Growth form: Herb to 1.3 cm tall.

Vegetative spread: Potentially?

Longevity: Unknown.

Primary juvenile period: Unknown.

Flowers: Spring to summer.

Fruit/seed: Summer.

Dispersal, establishment & growth: Via seed.

Fire response: Resprouter.

Interactions with other organisms: Known to hybridise with *T. caespitosa*.

Distribution

Botanical sub-regions: Darling Downs, Northern Tablelands and North Western Slopes.

General distribution: From Bundarra to just over the Queensland border.

Distribution within the BRBB: Found within sedgeland and on granite outcrops within both reserves.

Habitat

Habitat: Two distinct habitats, within sedgeland near creek channels or where soils are waterlogged and on exposed granite outcrops.

Altitude: 800-1300 m.

Annual Rainfall: 700-1400 mm.

Abundance: Common within either of the two distinct habitats within the area.

BRBB community: Community 2, 4 and 11.

Substrate: Granite.

Exposure: Fully exposed positions.

Management

Population size: Probably over 1000 individuals within the reserves.

Reserved: Girraween National Park, Mt Barney National Park, Bald Rock National Park, Boonoo Boonoo National Park, Gibraltar Range National Park, Ironbark Nature Reserve, Werrikimbe National Park, Torrington State Recreation Area, Bolivia Hill Nature Reserve and Warra National Park.

Threats: Unknown.

Management considerations: Seemingly secure.

Figure 76: Photograph of *Thelionema grande*.

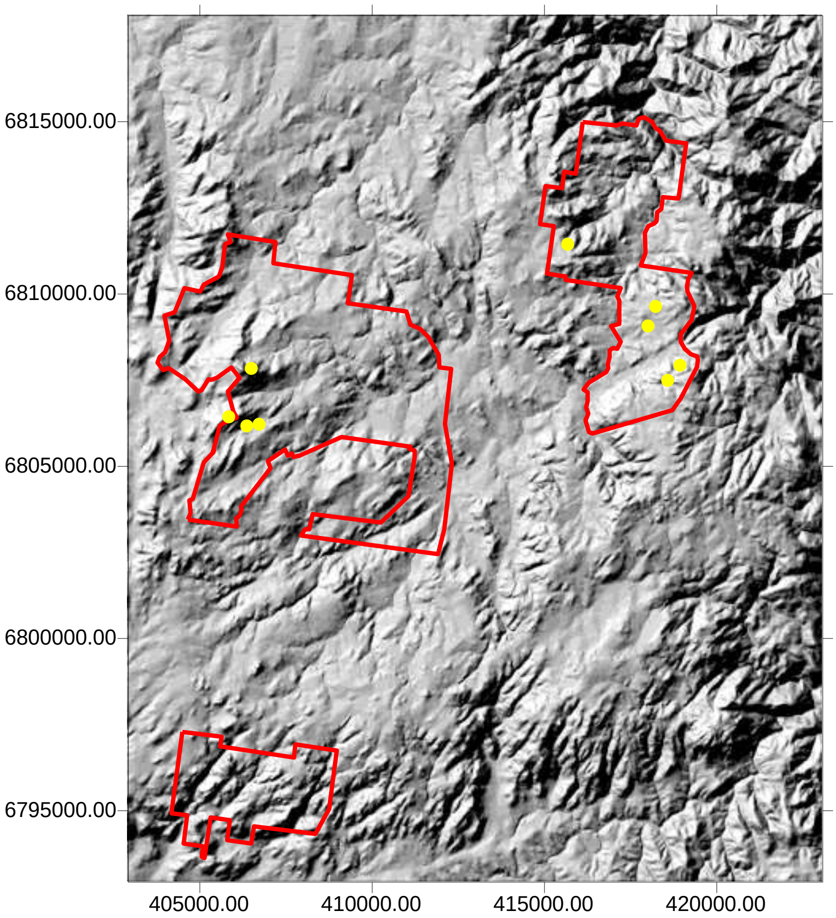


Figure 77: Distribution of *Thelionema grande*.

3.5.28 *Tylophora woollsii* Benth. (2E; TSC Act Schedule 1, Endangered).

Taxonomy

Type: Parramatta, N.S.W., *Woolls* (holo: K; iso: MEL).

Reference: *Flora Australiensis* 4: 335.

Family: Asclepiadaceae.

Affinities: Probably *Tylophora barbata*.

Synonymy: None.

Derivation of name: Named in honour of William Woolls amateur botanist of Parramatta.

Common name: Cryptic Forest Twiner.

Changes in conservation status: 2E (Briggs & Leigh 1996), unchanged since. TSC Act listed as Endangered.

Life history

Growth form: Vine.

Vegetative spread: None.

Longevity: Unknown.

Primary juvenile period: Unknown.

Flowers: May skip a flowering season and may retain undeveloped buds.

Fruit/seed: Fruits fully developed between April and July.

Dispersal, establishment & growth: Seed.

Fire response: Unknown, probably obligate seeder.

Interactions with other organisms: None apparent.

Distribution

Botanical sub-regions: Central Coast, North Coast and Northern Tablelands.

General distribution: Extinct in the central coast and occurs from Dorrigo to Bald Rock.

Distribution within the BRBB: Found only within the gorge country at Boonoo Boonoo and at the base of Bald Rock within Bald Rock.

Habitat

Habitat: Rainforest and wetter sclerophyll forests.

Altitude: ?500-1200 m.

Annual Rainfall: ?.

Abundance: Very scarce only few individuals usually found.

BRBB community: Community 6 and 9.

Substrate: Variable.

Exposure: Very protected sites.

Management

Population size: Possibly around 100 in total.

Reserved: Bald Rock National Park, Boonoo Boonoo National Park, Gibraltar Range National Park, Barrington Tops National Park and Girraween National Park.

Threats: Low population numbers, grazing, inappropriate fire regimes, roadworks and fire trail maintenance, feral animals such as pigs.

Management considerations: Eradication of feral animals and stray domestic stock. Exclusion of fire from sites containing this species. Care taken in fire trail maintenance and weed control in areas likely to contain this species.

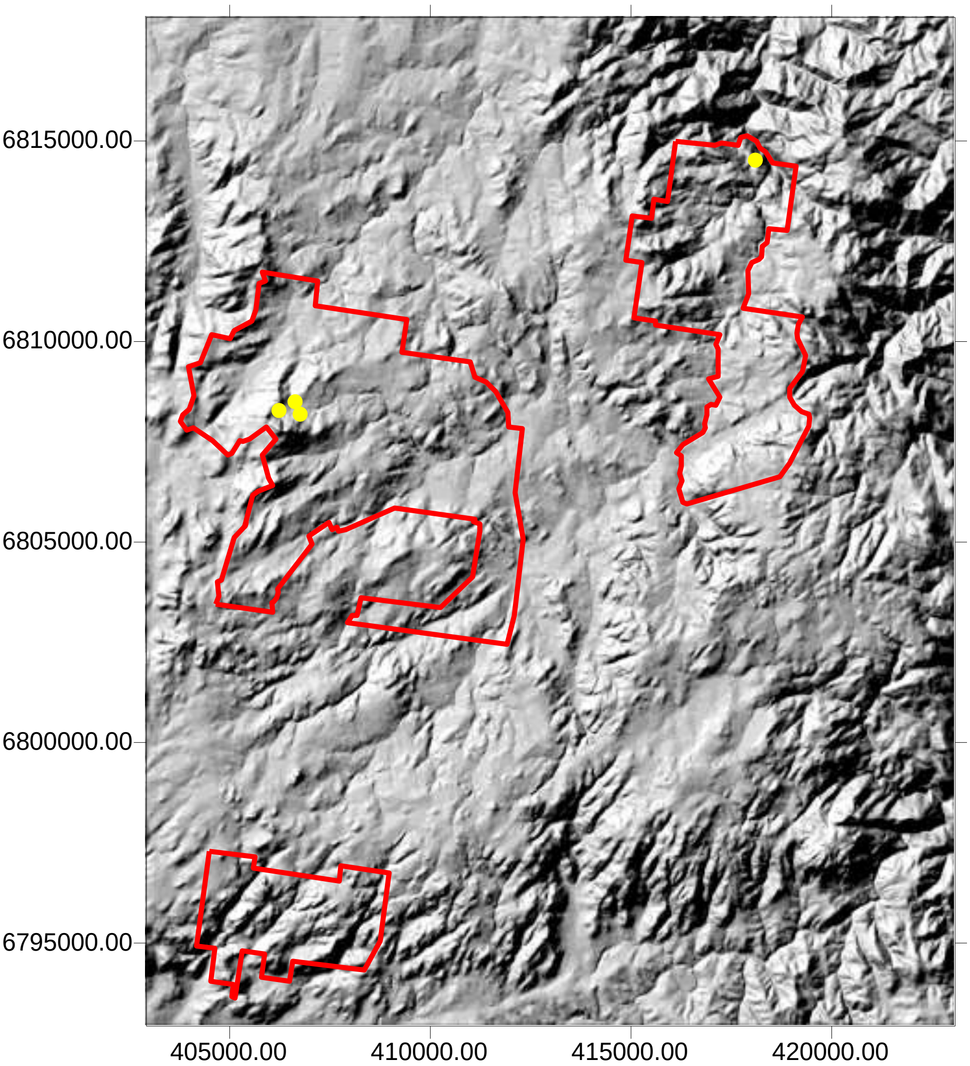


Figure 78: Distribution of *Tylophora woollsii*.

3.5.28 Other taxa of conservation significance: Regionally significant taxa

Acacia leucoclada subsp. *argentifolia* is a tree to 18 m tall. This taxon is considered as possibly regionally uncommon with a possible disjunct distribution within the north-east of New South Wales. It is primarily distributed along the western slopes of New South Wales and has minor occurrences on the North Coast. On the North Coast this taxon has been found primarily north-east of Tenterfield near the Queensland border with one historical collection from south of Maclean.

Acaena agnipila is potentially a regionally uncommon herb. It has been found near Ebor, and near the Bluff River Bridge. It was found during a previous survey in Boonoo Boonoo National Park and the occurrence here is of regional significance.

Acronychia laevis is a closed forest tree that has its southern distributional limit at the base of Boonoo Boonoo Falls and of conservation significance.

Actinotus gibbonsii is a prostrate and spreading herb that is considered to be regionally uncommon in the north-east of New South Wales but common elsewhere in the state. The species has been found sporadically throughout mainly higher parts of the north-east. The species is probably more common than collections indicate. This taxon is often found on rock outcrops particularly after recent fires. Hunter (in prep.) has found this taxon to become almost dominant on many granitic and other outcrops after fire and that population numbers decline gradually as time since fire increases. Many of these areas had not had fires in recent years and the seed bank of this species is probably long lived. The ephemeral nature of this species and its restricted habitat requirements have probably led to the infrequent number of collections made. This taxon may not be a significant species in the north-east.

Aristida acuta is a small grass that is considered to be uncommon and at its distribution limit within the north-east of New South Wales. I was found within Boonoo Boonoo National Park.

Aristida jerichoensis subsp. *subspinulifera* is a small grass considered regionally uncommon. This taxon should be considered as a significant species within the reserve.

Austrodanthonia monticola is a regionally uncommon grass that has its northern distributional limit within Boonoo Boonoo National Park. This species is probably more widespread than collections indicate and it is commonly associated with rocky terrain. However the species is at is distributional limit in this area and as such is regionally significant.

Austrodanthonia penicellata is possibly a regionally uncommon grass it has previously only been surveyed in the Ebor to Guyra area. Only a few sites where found with this taxon. It is likely that this species is regionally uncommon and of conservation significance within the reserves.

Austrostipa setacea is a grass considered to be regionally uncommon. It It has previously been found near Guyra and within Guy Fawkes National Park and Boonoo State Forest. This grass was found within Boonoo Boonoo and Bald Rock National Parks.

Boerhavia dominii is a prostrate herb that is thought to be regionally uncommon. This taxon can be found throughout the state but has been found only near Urbenville, Gilgury, Bald Rock, the Washpool Western Additions and the Demon Nature Reserve. The occurrence of this species within the reserve is of significance.

Bossiaea obcordata is a shrub that may be regionally uncommon. It has previously been found at Mann River Nature Reserve, Washpool National Park Western Additions, along the Sara River and at Boonoo Boonoo National Park. Its occurrence within Boonoo Boonoo may be of regional conservation significance.

Brachyscome tenuiscapa is a disjunct herb. It has previously been found within Warra National Park, Paddys Land Nature Reserve and Boonoo Boonoo National Park. Its occurrence within Boonoo Boonoo is of conservation significance.

Cassinia uncata is a tall shrub and is considered a regionally uncommon taxon. Populations of this species are known from the Backwater area and the Long Point near Guyra. Small populations of this taxon were found within the reserve and this should not change the significant status of this species within the north-east.

Craspedia canens is an annual herb that is thought to be uncommon in the north-east but common elsewhere. This species has been previously recorded from Boonoo Boonoo National Park, the Washpool Western Additions and the Demon Nature Reserve where it was common. The occurrence of this taxon in the reserve is of significance.

Crassula colorata is potentially a regionally uncommon herb. It has previously been found within Limpinwood Nature Reserve, Mount Lindsey Forest Reserve, Guy Fawkes National Park. This species was found in Bald Rock during a previous survey and may be of regional conservation significance.

Daviesia nova-anglica is a shrub that has its northern distributional limit just west of Wilsons Downfall. The occurrence of this species at Boonoo Boonoo National Park is near the species northern distributional limit and thus of regional conservation signi ficance.

Deyeuxia quadriseta is a grass considered to be regionally uncommon and at its northern limit within Boonoo State Forest. As such the occurrence of this species within Boonoo Boonoo National Park is of conservation significance.

Echinopogon mckiei is a grass that has its northern limit within Boonoo Boonoo National Park and thus of conservation significance within the reserve.

Enneapogon nigricans is a regionally uncommon grass that has only previouslybeen recorded in the north east at Rivertree and Ewingar. This species was not found during this survey but was found to be reasonably common during a previous survey. It is possibly that these changes are climatically based.

Epilobium gunnianum is a herb that is regionally uncommon and at its northern limit at London Bridge south east of Glen Innes. This is a new occurrence for this uncommon taxon, is at a new northern limit, and is therefore of conservation significance.

Epilobium hirtigerum is a herb which is regionally uncommon being only known from Deepwater, Thulimbah, Chandlers Peak and Jenner State Forest in the north-east. The occurrence within the reserve is of conservation significance.

Eragrostis lacunaria is a regionally uncommon grass. It ahs previously been found at Woolongbar and within Boonoo Boonoo National Park. The occurrence within Boonoo Boonoo is of conservation significance.

Eragrostis molybdea is a grass that is considered regionally uncommon. This species is known from the Richmond Range State Forest in the north-east and the Washpool National Park Western Additions. This new record within the reserve is of conservation significance.

Eragrostis trachycarpa may be a regionally uncommon grass. It has previsouly been found at Amosfield, on the Mount Lindsey Highway north of Tenterfield, Glen Elgin, Ebor and within Boonoo Boonoo National Park. This species may be of conservation significance.

Eucalyptus acaciiformis is a low tree whose northern distributional limit is north of Tenterfield. The size of the populations of this species at its northern limit are of conservation significance.

Galium binifolium is a herb whose northern distribution limit is within Boonoo Boonoo National Park.

Goodenia bellidifolia subsp. *bellidifolia* is a herb with its northern distributional limit within the Tenterfield district. It was found to be reasonably common in both Bald Rock and Boonoo Boonoo National Park.

Hovea beckleri is a shrub that is that is both regionally rare and thought to have its distributional limit at within Spirabo National Park. This species has previously been collected at Backwater, Dorrigo, Wedding Bells State Forest, Coaldale, Gibraltar Range National Park and Mt Jondol. Many collections in the NE herbarium labeled as this species were of other species. It is possible that this taxon is rarer than herbarium collections indicate. The occurrence within the southern section of Bald Rock National Park is a new northern limit for the distribution of this species and of regional conservation significance both in terms of distributional limits and uncommon distribution.

Indigofera adesmiifolia is a shrub that is both disjunct and regionally uncommon. It has only previously been found north and east of Guyra in the Backwater area. This species was found in a previous survey of their reserves and none was found during this survey. The occurrence of this species within the reserve, if verified, is of regional conservation significant.

Isotoma fluviatilis subsp. *borealis* is a regionally uncommon herb. It has previously been recorded from Copmanhurst, Armidale, Marengo State Forest, Backwater, Ebor and at Cathedral Rocks National Park. The occurrence of this species within the reserve is of conservation significance.

Lasiopetalum ferrugineum var. *ferrugineum* is a shrub that is possibly uncommon in the north-east. This taxon has been previously found within Sherwood Nature Reserve, the Demon Nature Reserve, Waihou Forest Reserve, Conglomerate State Forest, Wombat Creek, Hayards Crossings and the Orara Valley. Only a single juvenile specimen was discovered in a frequently burnt area of the reserve. The occurrence of this species is probably on regional significance.

Lepidosperma neesii is a herb that is thought to be disjunct with a northern limit at Evans Head. This species was found only as isolated populations within Booonoo Boonoo National Park and this record represents a new northern distribution on the Tablelands.

Leptorhynchos squamatus subsp. A is a may potentially have be a regionally uncommon species. It has its northern limit within Boonoo Boonoo National Park and is thus of conservation significance.

Lobelia dentata is a herb that reaches its northern distribution limit within Boonoo Boonoo National Park and thus of conservation significance.

Melichrus adpressus is a shrub that has a disjunct occurrence within Boonoo Boonoo National Park that is also at its southern limit of distribution. This occurrence is of regional conservation significance.

Olearia ramulosa is a shrub that is regionally uncommon within north eastern New South Wales. It has previously been found at Round Mountain and Pheasant Mountain. The occurrence within Bald Rock National Park is of regional conservation significance.

Ozothamnus sp. nov., a potential new species was found during this survey lining a creek at the base of Mount Norman in Boonoo Boonoo National Park. This entity may be equivalent to a potential new taxon at Basket Swamp National Park. The taxonomic status of this species and its relationship to the entity at basket swamp needs clarification. However, at present the entity is likely to be highly restricted and may warrant a vulnerable listing. This population is of conservation significance.

Patersonia fragilis is a herb mainly restricted to swampy sites. This species is considered to be disjunct within northern New South Wales. Populations are known from Bundjalung National Park, New England National Park and the Demon Nature Reserve. This species was found in swampy situations within Boonoo Boonoo National Park.

Podolepis hieracioides is a herb that is possibly regionally uncommon and potentially has its northern limited at Limpinwood Nature Reserve but is a disjunct taxon. This species was found to be uncommon but scattered throughout Bald Rock and Boonoo Boonoo.

Pomaderris vellea is a shrub that is regionally uncommon and possibly disjunct in distribution. Records of this taxon have come from areas such as Surveyors Creek, Mann River Nature Reserve, Nymboida River, Buccarumbi and to Boonoo Boonoo National Park. No plants were seen in the reserve during this survey.

Prostanthera caerulea is a regionally uncommon shrub with its northern distributional limit north of Tenterfield. It has been found previously in both Bald Rock and Boonoo Boonoo National Parks. It is of regional conservation significance.

Pterostylis daintreana is a herb that is thought to be regionally uncommon in the North East of New South Wales. It has previously been found within the Koonym Range, Minyon Falls Forest Reserve, Whain Whian State Forest sand Chaelundi National Park. This species was found during a previous survey in Bald Rock National Park but was not found during this present investigation.

Pultenaea altissima is a regionally uncommon shrub that has its northern distribution limit in the north east. It has previously been found at Backwater within Warra National Park and along the Henry River within the Guy Fawkes River National Park. The occurrence of this species within Boonoo Boonoo represents a new northern limit of this regionally uncommon species and of conservation significance.

Pultenaea dentata is a regionally uncommon shrub that has previously been found within Basket Swamp National Park and Boonoo Boonoo National Park. The occurrence within Boonoo Boonoo is regionally significant.

Pultenaea polifolia is a shrub within its northern distributional limit at Bald Rock National Park. This species has been found within Bald Rock and Boonoo Boonoo and of regional significance.

Trachymene anisocarpa is a herb that is regionally uncommon with its northern limit at Tweed Heads. This genus warrants revision and further taxa may be described from these complexes. The occurrence of this regionally uncommon species within Bald Rock National Park is of conservation significance.

Velleia montana is a regionally rare herb with its northern distributional limit north east of Boonoo Boonoo National Park. It has previously been found at Round Mountain and also within Warra State Forest. This species responds to a post fire environment and is not long lived. It is possible that the lack of records is a reflection of an ephemeral habit. Either way this species is of regional conservation significant being at the northern distributional limit. The species was found within Bald Rock and Boonoo Boonoo National Parks.

Wahlenbergia littoricola is an uncommon and disjunct herb within the north-east of New South Wales. It has only been found at Boonoo Boonoo National Park and the Washpool National Park Western Additions in the north east which is disjunct from its populations on the Central Tablelands of New South Wales.

Wahlenbergia ceracea is a disjunct herb and may the occurrence of this species within the reserves may be of significance.

Wahlenbergia graniticola is a herb that is regionally uncommon. It has previously been found within Boonoo Boonoo National Park within the region. This occurrence is of regional conservation signficance.

Wahlenbergia luteola is a herb whose northern limit was thought to be south of Glen Innes and is uncommon in the north-east. The localities of this taxon within the reserve represent a new northern limit for the taxon and additional localities for this regionally uncommon species. The occurrences within the reserve should be considered regionally significant.

Xyris gracilis subsp. *gracilis* is a herb of swampy ground that has its northern limit on the tablelands at Bald Rock National Park. This species has been found both within Bald Rock and Boonoo Boonoo and is of significance being at the northern limit of distribution.

3.5.29 Significant species recorded within close proximity to the reserves

Nine regionally and nationally significant taxa occur in the general vicinity of the reserve. These taxa may potentially be found within Bald Rock and Boonoo Boonoo after further investigations. The following species are therefore worthy of comment.

Bertya sp. A is known from Girraween National Park and may potentially be found in Bald Rock National Park particularly in the southern section after further searching.

Boronia granitica is a widespread species on granite outcrops predominantly on the western side of the New England. The species occurs within Girraween National Park and potentially may occur in Bald Rock, particularly in the southern section.

Boronia repanda is a species restricted to granite outcrops near Stanthorpe. The species at one point was thought to occur within Jenner State Forest, currently a new edition to Bald Rock National Park, but this is considered to be an erroneous record. Further searches of outcrops in Bald Rock and Boonoo Boonoo it may be found

Derwentia arenaria is an annual herb that is nationally rare. It has been found within Girraween National Park and may be found in either reserve.

Eucalyptus codonocarpa is a mallee eucalypt restricted to outcrops and is nationally rare. It has been found in several disjunct locations along the eastern escarpment of north eastern New South Wales and is common in Girraween National Park and may be found within Bald Rock National Park.

Homoranthus montanus is a species restricted to granite outcrops near Stanthorpe. Further searches of outcrops in Bald Rock and Boonoo Boonoo it may be found.

Homoranthus papillatus is a species restricted to granite outcrops within Girraween National Park. Populations of this species occur on Mount Norman and it is conceivable that with further searches of outcrops in Bald Rock and Boonoo Boonoo it may be found.

Leucopogon cicatricatus is a rare shrub that has a disjunct occurrence on granite and acid volcanic outcrops of south eastern Queensland and northern New South Wales. A single population exists on South Bald Rock within Queensland within only a few hundred meters of Bald Rock National Park. This species may yet be discovered in Bald Rock or Boonoo Boonoo National Parks.

Phebalium rotundifolium is a nationally rare species with an occurrence from Copeton Dam to Girraween. It may be found in along the border trail within Bald Rock National Park or in the southern section of Bald Rock National Park with further searches.

3.6 Introduced taxa

A total of 44 taxa (5%) found during all surveys of Bald Rock and Boonoo Boonoo National Parks were introduced. This is a relatively low number compared to some reserves on the coast or along the western slopes (e.g. Kwiambal 17%). However, this appears to be similar to that found for other reserves along the escarpment with Guy Fawkes also having only 5% of its flora introduced and the Washpool National Park Western Additions with 6%. Several of these taxa were only surveyed once; others however, were very common and at times could be considered ubiquitous for most communities. The most frequent introduced taxa, in terms of abundance and frequency are in decreasing order *Hypochaeris radicata, Conyza albida, Taraxacum officionale, Conyza bonariensis, Aira cupaniana, Andropogon virginicus, Gnaphalium americanum* and *Setaria verticillata.* Almost all of these are the same abundant weeds found in both the Western Washpool and Guy Fawkes River Surveys. Life history, control and distribution information for each of the introduced taxa is given in Appendix C.

3.7 Evenness of communities

The evenness scores for each community are very high. In particular Communities 3, 4 and 5, and to a lesser extent 2, all show extremely high evenness. Communities 3-5 are almost perfectly even, indicating that most species are equally abundant. These communities are all associated with riparian or wet adjacent wet environments. This trend was also noted in Guy Fawkes River National Park (Hunter & Alexander 1999). Of lower evenness are the communities associated with forests and woodlands. The lowest evenness was achieved by Community 11 (rock outcrops), potentially indicating that a few species become very dominant in these habitats with a large number of species being of low abundance.

Table 3: Measured evenness for the eleven defined communities at Bald Rock and Boonoo Boonoo National Parks.

Community	Evenness
Community 1	0.95
Community 2	0.96
Community 3	0.98
Community 4	0.98
Community 5	0.99
Community 6	0.80
Community 7	0.94
Community 8	0.90
Community 9	0.82
Community 10	0.93
Community 11 (Hunter 1999)	0.70

3.8 Fire responses of individual taxa

3.8.1 Known fire responses of species

The following represents a review of the current literature on the fire responses of individual taxa.

Table 4: Known fire responses and traits of taxa found in the Bald Rock and Boonoo Boonoo. NPFR refers to National Fire Register. Fire responses are based on published information, some of which is contradictory. Possible reasons for these contradictions are discussed in section 4.3.

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Acacia adunca	Obligate Seeder	Soil stored seedbank, main stimulation fire, heavy germination after medium to high intensity fire	Seed	In thickets within 1 yr of fire				pers. obs.	
Acacia binervata	Obligate Seeder	Soil stored seedbank	Seed					Killed. Initial coloniser following fire, matures quickly. Viable seed virtually absent from site unburnt 30 yrs, present site burnt 14yrs.	Benson & McDougall (1996), Floyd (1966), Floyd (1976).
Acacia blakei	Variable		Seed						Williams (1998).
Acacia brownii	Resprouter		Seed					Stems killed, resprouts from base	Benson (1981), Benson & McDougall (1996).
Acacia buxifolia	Resprouter		Seed					Regrowth and suckers from	Purdie (1977), Benson & McDougall (1996).

								rootstocks and lateral roots, seedlings recorded less than 1 yr after fire.	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Acacia falciformis	Obligate Seeder	Soil stored seedbank, after medium intensity fire much germination	Seed					pers. obs. Perennial. Facultative resprouter.	NPFR, Williams (1998).
Acacia filicifolia	Resprouter	Soil stored seedbank	Seed	Will germinate after fires				Probably resprouts from root suckers	Benson & McDougall (1996).
Acacia floribunda	Obligate seeder		Seed			<3 yr		Old plants killed young plants resprout from base after high intensity fire	Benson & McDougall (1996), Benson (1981).
Acacia gunnii	Obligate Seeder		Seed						Gill (1975).
Acacia implexa	Resprouter	Reproduction by sexual means, reproducing by seed propagation between 1-5 years.	Seed	Dispersed by expulsion				Stems killed, resprout from base or root suckers. Prominent in soil seedbank in gaps. Present throughout gaps in unburnt Rf communities. Root bud suckers. 20-60% stems killed low intesity fire all killed by high. No protected vegetative buds.	Benson & McDougall (1996), Melick & Ashton (1991), Clarke (1989), Morrison & Renwick (2000).
Acacia irrorata		Can't germinate from	Seed						Floyd (1976).

		depths >5cm. Unheated 5% germ., heated 70 degrees C, 70% germination.							
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Acacia latisepala	Obligate Seeder	Soil stored seedbank, germinates in large numbers after fire	Seed	Will establish in a thick sward	2 yrs			pers. obs.	Hunter (1995).
Acacia leucoclada			Seed						
Acacia longifolia	Obligate Seeder	Soil stored seedbank.	Seed		2 yrs			Killed, flowering within 2 yrs of high intensity fire	Benson & McDougall (1996), Auld & O'Connell (1991), Floyd (1976), NPFR.
Acacia macnuttiana	Obligate Seeder	Main stimulation is the passage of fire	Seed					pers. obs.	
Acacia maidenii	Obligate Seeder	Best germination after 45 days 3-6cm depth. Viable seed at 9-12cm.	Seed					Killed. Site unburnt 30yrs had slightly more viable seed than that burnt 14yrs ago. 100% scorch kills.	Benson & McDougall (1996), Floyd (1976), Fox (1988), NPFR.
Acacia melanoxylon	Variable	Fire stimulated and also opening of canopy. Requires disturbance.	Hard-coated seed, may survive up to 500 years	Humus or soil stored seed, rapid early growth			<50	Facultative resprouter. Obligative Seeder from soil stored seed or plant stored seed.	Barker (1990), Hill (1982), Hill & Read (1984), Jordan et al. (1992), Melick & Ashton (1991), Benson & McDougall (1996).
Acacia myrtifolia	Variable	Mainly after fire	Seed		<3 yr			Will germinate after high intensity fire. Obligate Seeder and facultative resprouter. Soil stored seed. 100% scorch killed.	Benson & McDougall (1996), Auld & O'Connell (1991), Floyd (1976), Keith (1996), Siddiqi et al. (1976), Bradfield (1981), NPFR.

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								Min. temp to break seed dormancy 60-80 degrees C.	
Acacia obtusifolia	Obligate Seeder	May germinate after fire	Seed					Resprouts from base and root suckers. Seedlings may establish on disturbed sites.	NPFR, Benson & McDougall (1996).
Acacia penninervis	Resprouter		Seed						Williams (1998).
Acacia rubida	Resprouter		Seed					From root suckers	Benson & McDougall (1996).
Acacia stricta	Obligate Seeder		Seed					Probably killed.	Benson & McDougall (1996).
Acacia ulicifolia	Variable	No germination at 60 degrees. Optimum 70 deg. C. Variable with population.	Seed		<3 yr			Variable. Killed by fire. Resprouts and root suckers in some populations. Most seedlings flowering within 2.5 years of high intensity fire.	Fox (1988), Benson & McDougall (1996).
Acacia venulosa	Obligate Seeder		Seed						
Acacia viscidula	Resprouter		Seed						
Acaena agnipila			Fruit	Dispersed by attachment to animal fur, clothing etc					Benson & McDougall (2000).
Acaena novae-zelandiae	Resprouter		Fruit	Dispersed by attachment to animal fur, clothing etc				First recorded 3m after fire in wet forest, 4m after fire in grassy forest. Regeneration	Dickinson & Kirkpatrick (1987), Benson & McDougall (2000).

								greater 16-24m than 0-16m after fire.	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Acetosella vulgaris	Resprouter								
Acianthus exsertus	Resprouter		Seed, winged.				Indefinite.		NPFR, Benson & McDougall (2005).
Acmena smithii	Variable	70% fresh seed germinates without treatment 24-120 days, viable < 6 months, dried at room temp > 1y	Fleshy fruit with single large seed	Probably bird-dispersed, adapted for vertebrate dispersal; no soil-stored seedbank, seedlings shade tolerant, found under adult plants but possibly short-lived, no lignotuber on seedlings but produced later, quick growth rate, coloniser	5 years		100-200 years	Some killed by high intensity fire, most resprout from basal and epicormic shoots, < 10% mortality after wildfire	Chesterfield et al. (1991), Melick & Ashton (1991), NPFR, Benson & McDougall (1998), Clarke (1989).
Acrotriche aggregata	Resprouter							pers. obs. Facultative resprouter.	NPFR
Actinotus gibbonsii	Obligate Seeder	Germinates in large numbers following high intensity fires-seeds persist for many years: pers obs		Vigorous growth and may dominate within months after fire: pers obs	< 1yr			Probably killed, (flowering and fruiting within months of high intensity fires: pers obs)	NPFR, Benson & Mcdougall (1993).
Actinotus helianthi	Obligate Seeder	Fire promotes germination of seed		Seeds dispersed by wind.				Killed and re-established from soil-stored seed. Old plants of 'headland' form	Bradstock et al. (1997), Benson (1985), Conroy (1996), Fox & Fox (1986), Clemens & Franklin (1980), Siddiqi et al.

								with thick stems (1cm) may be unaffected.	(1976), NPFR, Benson & McDougall (1993), Clarke (1989).
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Adiantum aethiopicum	Resprouter			Diaspore: spores dispersed by wind. Probably no dormancy mechanism.				Fire sensitive in open situations but tolerant if rhizomes amongst rocks. Resprouts at ground level.	NPFR, Benson & McDougall (1993).
Adiantum formosum	Resprouter							Facultative resprouter.	Benson & McDougall (1993), NPFR.
Adiantum hispidulum	Resprouter							Flush of growth from rhizome after fire	Benson & McDougall (1993), NPFR.
Agiortia cicatricata	Obligate Seeder		Fruit						
Aira cupaniana	Obligate Seeder	1yr after fire	Fruit (indehiscent 1 seeded)	Adhesive to animals & wind dispersed.	<1			Seedlings in burnt and unburnt sites 1yr after fire - not noted before fire.	Lunt (1990), Purdie (1977), NPFR, Benson & McDougall (2005).
Ajuga australis	Resprouter		Fruit (indehiscent 1 seeded)	Erect flowering stems become horizontal at maturity, allowing short distance gravity dispersal of se				Grows rapidly after fire.	Benson & McDougall (1997), Lazarides & Hince (1993).
Alangium villosum	Resprouter								Williams (1998)
Alchornea ilicifolia	Resprouter							Stems killed, resprouts from base or roots.	Benson & McDougall (1995).
Alectryon subcinereus	Resprouter	Germinates readily after removal of the aril.	Fruit.	Seeds dispersed by vertebrates. Tertiary sand coloniser, by seed			30+		Clarke (1989), Benson & McDougall (2001).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
				propagation. No vegetative spread.					
Alectryon subdentatus	Resprouter								Williams (1998).
Allocasuarina littoralis	Variable	90% seed release within 1 week of fire		Will germinate without fire after long periods ie 13-23 yrs. Seeds dispersed by wind.		3 yrs	30+	Generally killed, larger plants killed high intensity fire, smaller resprout stem, dominates long unburnt areas. No protected stem buds, no insulating bark.	Auld (1996), Keith (1996), NPFR, Benson & McDougall (1995), Clarke (1989), Morrison & Renwick (2000).
Allocasuarina rigida	Reprouter								
Allocasuarina rupicola	Reprouter								
Allocasuarina torulosa	Resprouter, epicormic, basal			Survive 100% scorch - basal sprouts, seeds release after fire, will establish in absence of fire.				Will resprout slowly from base after high intensity fire. Stems survive 100% scorch, producing more stems/shoot after high intens. fire than low.	Auld (1996), Kellman (1986), NPFR, Benson & McDougall (1995), Morrison & Redwick (2000).
Alphitonia excelsa	Resprouter	Very slow, 8 months for 70% germ. Fracturing hard coat reduces dormancy. 30-70% viable after 15-20 y	Fruit (Dry indehiscent 1 seeded)	Diaspore: fruit. Coloniser species, although seen on edges can also occur as mature specimens in gully rainforest.				Facultative resprouter. Survive 100% scorch - basal sprouts.	NPFR, Benson & McDougall (2000).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Alyxia ruscifolia	Obligate Seeder				3-May				Williams (1998).
Ammobium alatum					<1				
Amperea xiphoclada	Resprouter					< 1yr		Stems killed, resprout from base. Flowering & fruiting within 1yr of high intensity fire.	Benson (1981), Benson & McDougall (1995).
Amphipogon strictus		Resprouter	Fruit (Dry indehiscent 1 seeded)						Benson & McDougall (2005).
Amyema cambagei	Obligate Seeder				4-Aug				Williams (1998).
Amyema miquelii	Obligate Seeder	Germination occurs only if fruit coat is removed, the embryo is green, & can begin to grow in dark.		Diaspore: fleshy fruit, bird-dispersed mainly by Mistletoe bird, transportation only about 45km.				Killed by high intensity fire.	Reid (1997), Benson & McDougall (1997).
Amyema pendulum	Obligate Seeder			Food plant (crimson rosella, brushtail & ringtail possums, koala, blue butterfly), Host plant (beetl				Killed by canopy scorch/ high intensity fire.	Reid (1997), NPFR, Mallick et al (1997).
Andropogon virginicus	Resprouter		Fruit (Dry indehiscent 1 seeded)	Long distance wind dispersal. Invades burnt or bare aeas.	1	<1		not in slash & burn area, but recorded in tractor disturbed area, up to 1 yr later.	Floyd (1966), Benson & McDougall (2005).
Angophora floribunda	Resprouter	No dormancy mechanism, germinates without special treatment. Growth rate slow. Coloniser, open sites	Seed	No special morphology. Probably wind-dispersed locally ie 20m.			100+	Resprouts from epicormic shoots.	Benson & McDougall (1998), Clarke (1989).

Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Angophora subvelutina	Resprouter		Seed					Facultative resprouter. Resprouts from epicormic shoots.	Benson & McDougall (1998), Williams (1998).
Anthoxanthum odoratum	Resprouter		Fruit (Dry indehiscent 1 seeded)						Benson & McDougall (2005).
Aotus subglauca	Resprouter							pers. obs.	
Aristida acuta	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive fruit, animal dispersed.					
Aristida jerichoensis	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive fruit, animal dispersed.				Suggestion that prescribed burning may encourage less desirable and more fire tolerant grasses like A. jerichoensis	Gill (1981), Benson & McDougall (2005).
Aristida ramosa	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive fruit, animal dispersed.				Facultative root resprouter - fire resistant decreaser.	Purdie & Slatyer (1976).
Aristida vagans	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive fruit, animal dispersed.		<1		Fruiting within 6 m of high intensity fire.	Benson & McDougall (2005).
Aristida warburgii	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive fruit, animal dispersed.		<1		Recruitment mainly after fire. Fruit within 4 m of high intensity fire.	Benson & McDougall (2005).
Arthropodium milleflorum	Resprouter							First recorded 1m after fire in grassy & wet forests. Cover value	Dickson & Kirkpatrick (1987).

								similar in areas burnt by high & low intensity fires.	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Arthropodium minus	Resprouter								
Asperula conferta	Resprouter		Fruit	No particular mechanism for dispersal. Rhizomatous vegetative spread.					Lunt (1990), Benson & McDougall (2000).
Asplenium australasicum	Obligate Seeder				3-May			Probably killed by fire	NPFR, Benson & McDougall (1993).
Asplenium flavellifolium	Resprouter			Diaspore: spores, wind-dispersed. Probably no dormancy mechanism.	1				Williams (1998).
Asplenium polyodon	Resprouter								Williams (1998).
Asterolasia correifolia			Seed, ballistically released.	Seed flap may function as ant-attracting food body.					Benson & McDougall (2001).
Astrotricha longifolia	Resprouter							At ground level. Facultative resprouter. Survive 100% scorch - basal sprouts. 100% scorch kills - soil stored seed.	Benson & McDougall (1993), NPFR.
Austrodanthonia bipartita	Resprouter	Optimum germination >20C, although rainfall is important particularly if seed is over 6 m old to	Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.					Benson & McDougall (2005).

		overcome dormancy.							
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Austrodanthonia caespitosa	Variable	Prolific recruitment, optimal germination at 15C for seed more than 6 m old to overcome dormancy. Germination approx. 26 days.	Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.				Survive 100% scorch - basal sprouts. Significantly more abundant in burnt areas.	Lunt (1990), NPFR, Benson & McDougall (2005).
Austrodanthonia fulva	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.					
Austrodanthonia monticola	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.					Benson & McDougall (2005).
Austrodanthonia penicillata	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.					Benson & McDougall (2005).
Austrodanthonia pilosa	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.				Root resprouter. Fire resistant decrease.	Purdie & Slatyer (1976), NPFR.
Austrodanthonia racemosa	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.					
Austrodanthonia setacea	Resprouter	Total germination 24 days.	Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.				Flowers in response to rain.	Benson & McDougall (2005).
Austrodanthonia tenuior	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.		<1		Fruiting within 6 m of high intensity fire.	Benson & McDougall (2005).
Austrostipa aristiglumis	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed.					Benson & McDougall (2005).
Austrostipa pubescens	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed.					Benson & McDougall (2005).
Austrostipa	Resprouter		Fruit (Dry	Adhesive, animal					

Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
racemosa			indehiscent 1 seeded)	dispersed.					
Austrostipa ramosissima	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed.			Indefinite		Williams (1998), Benson & McDougall (2005).
Austrostipa rudis	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed.					
Austrostipa rudis	Resprouter	Total germination 98 days.	Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed. Possible coloniser of bare sites.					Lunt (1990), NPFR, Benson & McDougall (2005).
Austrostipa scabra	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed.					
Austrostipa setacea	Resprouter	Total germination 50 days.	Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed.					Lunt (1990), Benson & McDougall (2005).
Axonopus affinis	Resprouter		Fruit (Dry indehiscent 1 seeded)	Dispersed in mud on cars.	1		Indefinite		Williams (1998), Benson & McDougall (2005).
Babingtonia densifolia	Resprouter		Seed						
Backhousia myrtifolia	Resprouter	No seed dormancy.	Indihiscent dry capsule.	Recruitment immediate, death under mature plants. Growth rate slow.			>100 yrs	Resprouter from base, but observed resprouting from trunk after high intensity fire.	Benson & McDougall (1998).
Baeckea omissa	Resprouter		Seed						
Baloghia inophylla	Resprouter								Williams (1998).
Baloskion fimbriatum	Resprouter		Fruit (capsule)	Wind			Indefinite	Seed maturation 6-8 months.	Benson & McDougall (2005).
Baloskion stenocoleum	Resprouter		Fruit (capsule)	Wind			Indefinite		
Banksia			Seed					Lignotuber.	Harden (1991).

cunninghamii									
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Banksia integrifolia	Variable		Seed	Gravity. Seeds released on maturity.				Obligate seeder: retains seed on plant, released as soon as follicles mature. Facultative resprouter from epicormic buds.	Fox (1988), Whelan et al. (1982), NPFR, Benson & McDougall (2000).
Banksia marginata	Variable		Seed	Gravity or short distance wind.	5 yrs			100% scorch kills and canopy stored seed. Facultative resprouter. Non-lignotuberous Sydney form killed by fire.	Kirkpatrick (1984), Gill (1981), NPFR, Benson & McDougall (2000).
Banksia spinulosa	Resprouter		Seed	Better recruitement, better survival post autumn than spring fires. Wind and gravity dispersal.	3+			Facultative resprouter. survive 100% scorch - basal sprouts. lignotuberous. Decrease in density 1yr post fire.	Beadle (1940), Hamilton et al. (1991), Clark (1988), Harden (1991), NPFR, Benson & McDougall (2000).
Baumea rubiginosa	Resprouter							Facultative resprouter. Flower abundantly only after fire. Obligate pyrogenic flowering.	Keith (1991), NPFR.
Bertya glandulosa	Obligate Seeder								
Bidens pilosa	Resprouter			Diaspore: fruit, animal dispersed (eg. on human	18wks		1yr	Probably killed, vigorous recruitment from	Benson & McDougall (1994).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
				clothing).				seed after high-intensity fire, most likely from soil-stored seed. Mature fruit within 18wks of high intensity fire.	
Billardiera longiflora	Resprouter								
Billardiera scandens	Resprouter					1.9yr		Resprouts at base or below from surviving rootstocks, seedlings recorded <!yr after fire.	Fox (1988), Purdie (1977), Benson & McDougall (1999).
Blechnum cartilagineum	Resprouter			veg. repro- root stocks & coppice (rhizomes).		< 1yr		Vigorously resprouts from rhizome after high intensity fire, fertile fronds in 5 months from fire	Benson & McDougall (1993), Floyd (1966), NPFR.
Blechnum nudum	Resprouter	Recruitment mainly after fire.		Diaspore: spores, wind-dispersed. Probably no dormancy mechanism.		< 1yr		Resprout from short burnt rhizome trunks	NPFR, Duncan & Isaac (1986), Benson & McDougall (1993).
Blechnum wattsii	Resprouter					< 1yr		Flush of new fronds after fire	Benson & McDougall (1993).
Boerhavia dominii	Obligate Seeder				1-Feb				Williams (1998).
Boronia amabilis	Resprouter								
Boronia anemonifolia	Obligate Seeder								
Boronia anethifolia	Obligate seeder?		Seed	Seed dispersed ballistically from dehiscent 4-lobed					Benson & McDougall (2001).

				fruit.					
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Boronia microphylla	Resprouter		Seed	Seed dispersed ballistically from dehiscent 4-lobed fruit.				Stems killed, resprouts from base.	Benson & McDougall (2001).
Boronia parviflora	Resprouter		Seed	Seed dispersed ballistically from dehiscent 4-lobed fruit. Also myrmecochorous. Recruitment mainly after fire.	>5y	1y	25-60y	Facultative resprouter.	NPFR
Boronia pinnata	Resprouter		Seed	Seed dispersed ballistically from dehiscent 4-lobed fruit. Also myrmecochorous. Soil stored seedbank.				Resprouts from base.	Benson & McDougall (2001).
Boronia polygalifolia	Resprouter?		Seed	Seed dispersed ballistically from dehiscent 4-lobed fruit.				May be apparent after fire, presumably from resprouts.	Benson & McDougall (2001).
Bossiaea neo-anglica	Resprouter		Seed	Soil-stored seedbank.				pers. obs.	
Bossiaea obcordata	Resprouter		Seed	Soil-stored seedbank.		<2 yr		At ground level or below	Benson & McDougall (1996).
Bossiaea rhombifolia	Resprouter		Seed	Soil-stored seedbank.				From base	Benson (1981), Benson & McDougall (1996).
Bossiaea rhombifolia	Resprouter	Seed viability: 100%. Non-dormant fraction 7%.	Seed	Soil-stored seedbank.				Resprouts from base.	Benson (1981), Benson & McDougall (1996).
Bossiaea scortechinii	Resprouter		Seed	Soil-stored seedbank.				pers. obs.	
Bothriochloa macra	Resprouter		Fruit (Dry indehiscent 1	Adhesive, by animals. Wind &				Flowers when competition from	Lunt (1990), Benson & McDougall (2005).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
			seeded)	mud on cars.				other vegetation is reomved by burning , graing or mowing.	
Brachychiton discolor	Resprouter								Williams (1998).
Brachychiton populneus	Resprouter								Williams (1998).
Brachyloma daphnoides	Resprouter			Within 1 yr of fire		1 yr		From ground level or below	Fox (1988), Hunter (1991), Benson & McDougall (1995).
Brachyscome angustifolia	Resprouter								
Brachyscome microcarpa	Resprouter								
Brachyscome nova-anglica	Resprouter								
Brachyscome scapigera	Resprouter								
Brachyscome spathulata	Resprouter								
Brachyscome stuartii	Resprouter								
Brachyscome tenuiscapa	Resprouter								
Breynia cernua	Resprouter	Soil stored seedbank, germinates easily, 1-7wks, and grows quickly. Reprod. sexual, by seed 1-5yrs.	Fruit (Fleshy Red)	Probably bird dispersed; seed, ant-dispersed.		< 1yr		From ground level suckering. Mature fruit within 1yr of high intensity fire. Resprouts below ground.	Fox (1988), Benson & Howell (1994), Benson & McDougall (1995), Clarke (1989).
Briza minor	Obligate Seeder		Fruit (Dry indehiscent 1 seeded)	Diaspore adhesive, animal, wind & water dispersed.				Significantly more abundant in burnt areas.	Lunt (1990).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Brunoniella australis	Resprouter					< 1yr		At ground level, flower within 1 month of fire, probably fire dependent on removal from competition	Benson & McDougall (1993).
Bulbophyllum elisae	Obligate Seeder		Seed				Indefinite		Williams (1998), Benson & McDougall (2005).
Bulbostylis barbata	Obligate Seeder							100% scorch kills - soil stored seed.	NPFR.
Bulbostylis densa	Obligate Seeder								
Bursaria spinosa	Resprouter					16m		Adults resprouted from base. Susceptibility of seedlings unknown.	Benson & McDougall (1999).
Caladenia carnea	Resprouter		Seeds, winged				Indefinite		
Caladenia fuscata	Resprouter		Seeds, winged				Indefinite		Benson & McDougall (2005).
Calandrinia eremaea	Obligate Seeder								
Calandrinia pickeringii	Obligate Seeder							Prolific seedlings in depressions on rock platform after high intensity fire.	Benson & McDougall (1999).
Caldcluvia paniculosa	Obligate Seeder				5-Aug			Killed	Benson & McDougall (1995), Williams (1998).
Callicoma serratifolia	Resprouter	Viable seed present at 9-12cm, most in top 6cm. low soil temp <75 deg C.						Resprout from base after high intensity fire, also germinates after fire from soil stored seed bank	Benson & McDougall (1995), Floyd (1976).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Callistemon flavovirens	Obligate Seeder								
Callistemon pallidus	Resprouter								
Callistemon pityoides	Resprouter	Germinates without treatement, viability 10%, may have some innate dormancy.	Seed	Dispersed localy, no dormancy.					Benson & McDougall (1998).
Callistemon sieberi	Resprouter	Germinates without treatment. No soil-stored seedbank. Probably needs open conditions to germinate.	Seed.					Survives 100% scorch - basal sprouts.	NPFR. Benson & McDougall (1998).
Callistemon viminalis	Resprouter								
Callitris endlicheri	Obligate Seeder	No soil-stored seedbank. 100% mortality when stem cut at ground level.	Winged seed	Probably no dormancy mechanism.				100% scorch will kill. Killed by fire (100% scorch).	Benson & McDougall (1993).
Callitris monticola	Obligate Seeder								
Callitris rhomboidea	Obligate Seeder							Probably killed	Benson & McDougall (1993).
Calochilus campestris	Resprouter		Seed, winged			1	Indefinite	Self pollinating	Benson & McDougall (2005).
Calochilus gracillimus	Resprouter		Seed, winged			1	Indefinite		Williams (1998).
Calochilus robertsonii	Resprouter		Seed, winged			1	Indefinite	Self pollinating	Benson & McDougall (2005).
Calochlaena dubia	Resprouter		Seed, winged			< 1yr	Indefinite	Shoot within 1 month after fire, no spread after high intensity burn but may dominate after low intensity fire may indicate	Benson & McDougall (1993), Benson (1985), NPFR.

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								frequent low intensity fires	
Calotis cuneifolia	Obligate Seeder							Probably killed	Benson & McDougall (1994).
Calotis dentex	Obligate Seeder								
Calytrix tetragona	Variable	Soil-stored seedbank.	Fruit	Wind-dispersed locally, or gravity dispersed.		3.75		Resprouts. Killed after high intensity fire.	Benwell (1998), Myerscough et al (1995), Benson & McDougall (1998)
Carduus tenuiflorus	Obligate Seeder								
Carex appressa	Resprouter								Williams (1998).
Carex breviculmis	Resprouter							First recorded 1m after fire in grassy forest. Fluctuating regeneration response.	Dickinson & Kirkpatrick (1987).
Carex gaudichaudiana	Resprouter								
Carex inversa	Resprouter								Lunt (1990).
Carex lobolepis	Resprouter								
Carex polyantha	Resprouter								
Cassine australis	Resprouter	Germination difficult and slow. 20-30% in 7-26 months.	Fruit (fleshy)	Vertebrate adapted dispersal.			>100	Resprouts from base.	Benson & McDougall (1995).
Cassinia aculeata	Obligate Seeder		Fruit (plumose)	Probably wind-dispersed.				Killed by high intensity fire, no seedlings 1 yr after fire	Benson & McDougall (1994).
Cassinia laevis	Obligate Seeder		Fruit (plumose)	Probably wind-dispersed.					Williams (1998)
Cassinia quinquefaria	Obligate Seeder		Fruit (plumose)	Probably wind-dispersed.					
Cassytha pubescens	Obligate Seeder	Reproduction sexual and vegetative, by seed	Fruit (fleshy)	By animals.					Clarke (1989).

		propagation between 1-5yrs.							
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Casuarina cunninghamiana	Obligate Seeder		Seed (winged)					Killed by fire	Benson & McDougall (1995).
Caustis flexuosa	Obligate Seeder								
Cayratia clematidea	Resprouter	Reproduction sexual, reproducing by seed propagation between 1-5yrs.		Seeds dispersed by animals.					Clarke (1989), Williams (1998).
Celastrus subspicata	Obligate Seeder				2-Jun				Williams (1998).
Cenchrus caliculatus	Obligate Seeder		Fruit (1 seeded indihiscent)	Burrs attach to animals, clothing, bags & float on water.	1				Benson & McDougall (2005).
Centaurium erythraea	Obligate Seeder			Diaspore: mobile seed, possibly animal and water dispersed.	1				Williams (1998).
Centaurium tenuiflorum	Obligate Seeder			Diaspore: mobile.	<1		<1	Regenerate from seed.	Lunt (1990).
Cheilanthes distans	Resprouter							Facultative resprouter.	NPFR, Williams (1998).
Cheilanthes sieberi	Resprouter			Diaspore: spores, wind-dispersed. Probably no dormancy mechanism.	1-Feb			Facultative resprouter.	NPFR, Benson & McDougall (1993).
Chenopodium melanocarpum	Obligate Seeder								
Chenopodium pumilio	Obligate Seeder								
Chiloglottis diphylla	Resprouter		Seed, winged			1	Indefinite		Benson & McDougall (2005).
Chloanthes	Obligate Seeder	In high numbers after fire	Seed		< 1yr			pers. obs.	

parviflora		even after long periods of absence							
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Choretrum candollei	Resprouter		Fruit.	Hemi-parasite on roots of other plants.		<4y		Survives high intensity fire, resprouts from base.	Benson & McDougall (2001).
Chrysocephalum apiculatum	Variable	Germination promoted by light, strong after ripening requirement (dormancy).		Dormancy broken by high temperature but not cold-stratification or gibberellic acid.				Resprouter. Minor Obligate seeder regeneration. 100% scorch kills. Soil stored seed.	Lunt (1990), Lunt (1994), NPFR.
Chrysocephalum semipapposum	Resprouter				1			Resprouts from rootstock suckers and lateral roots, no seedlings 1 yr after fire	Purdie & Slatyer (1976), Purdie (1977), NPFR. Benson & McDougall (1994).
Cirsium vulgare	Obligate Seeder	Seedlings in burnt and unburnt sites 1yr after fire. Appears after disturbance, probably soil-stored		Seed dispersed by wind. Diaspore: fruit, wind-dispersed. Also animal and water dispersed.	1		2	Post burn seed coloniser. Obligate seed regenerator - therophyte. Possibly resprouted after high intensity fire, flower buds within 26 wks. Seedlings recorded <1yr after fire, prob. post-fire dispersa	Floyd (1966), Purdier & Slatyer (1976), Chesterfield et al. (1991), Dickinson & Kirkpatrick (1987), Bill (1981), NPFR, Purdie (1977).
Cissus antarctica	Obligate Seeder			Seeds dispersed by birds or wind.				Perennial. Not recorded in tractor cleared areas to 1yr later.	Floyd (1966), Williams (1998).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Cissus hypoglauca	Resprouter	Reproduction sexual, reproduction by seed propagation between 1-5 yrs.		Seeds dispersed by animals.				Survives 100% scorch - basal sprouts.	NPFR, Clarke (1989), Williams (1998).
Citriobatus pauciflorus	Resprouter								Williams (1998).
Claoxylon australe	Obligate Seeder				3-May				
Clematis aristata	Variable		Fruit (achene)	Wind dispersed.		38w		Obligate seeder. Resprouted after high intensity fire. Survives 100% scorch - rootsuckers.	NPFR, Benson & McDougall (2000).
Clematis glycinoides	Obligate Seeder		Fruit (achene)						
Clerodendrum tomentosum	Resprouter								Williams (1998).
Comesperma ericinum	Resprouter							Probably killed after high intensity fire.	Benson & McDougall (1999).
Comesperma sphaerocarpum	Resprouter					<5m		Resprouts from base after high intensity fire.	Benson & McDougall (1999).
Comesperma sylvestre	Resprouter								
Comesperma volubile	Variable							Obligate seeder and facultative and obligate resprouter. Absent from plots burnt in autumn.	Hamilton et al. (1991), Clark (1988), NPFR.
Commelina cyanea	Resprouter	Reproduction both sexual and vegetative means, reproducing by seed propagation in first year.		Seeds dispersed by expulsion.			<5	Obligate seeder and basal resprouter. Survives 100%	NPFR, Williams (1998).

								leaf scorch.	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Conospermum taxifolium	Obligate Seeder	Seeds with 100% dormancy, persistent seed bank, half life 2 yrs.		Diaspore a nut shed a maturity. Recruits mainly after fire. Vigorous coloniser.	4		-60	Soil stored. Fire sensitive.Vigorous resprouter but also killed by fire and reistablishes by seed ?dependent of fire intensity.	Bradstock et al. (1997), Benson (1985), Benson & McDougall (2000).
Conyza albida	Obligate Seeder			Diaspore: fruit. Wind-dispersed locally & wide-spread, readily colonising disturbed sites.	<1		1-Feb	Killed. Seedlings recorded <1yr after fire, probably recruiting from wind-blown seed.	Purdie (1977), Benson & McDougall (1994).
Conyza bonariensis	Obligate seeder	Coloniser of disturbed sites.		Diaspore: fruit, wind-dispersed locally and probably long distance.	<1		1	100% scorch kills - no seed stored in burnt area. Probably killed, fruit within 15wks of high intensity fire. Possibly resprouts after low intensity fire.	Benson & McDougall (1994).
Conyza canadensis	Resprouter			Diaspore: fruit, wind-dispersed.	<1		1	Resprouts at ground level or below.	Benson & McDougall (1994).
Coprosma quadrifida	Resprouter			Fleshy fruit.					Barker (1990), Benson & McDougall (2000).
Correa reflexa	Obligate seeder		Seed	Ballistically from dehiscent 1-4 lobed fruits. Also myrmecochorous. No vegetative spread. Soil stored seedbank.					Benson & McDougall (2001).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Corymbia gummifera	Resprouter		Seed	Locally dispersed by gravity.		3		Resprouts from epicormic buds or lignotuber.	Williams (1998).
Corymbia intermedia	Resprouter		Seed						
Craspedia variabilis	Obligate Seeder			Diaspore: fruit, probably wind-dispersed.				Maximum recruitment may take place if burning occurs very frequently, ie., every 1-2yrs.	Lunt (1994).
Crassula sieberiana	Obligate Seeder	Seedlings in burnt and unburnt areas 1yr after fire.		Diaspore: seed, mobile. Growing in winter.	< 1yr			Probably killed, seedlings recorded <1yr after fire, flowering within 7m after high intensity fire.	Purdie (1977), NPFR, Purdie (1977), Benson & McDougall (1995).
Croton verreauxii		Germination sporadic, variable, 5-20 weeks.		Diaspore: seeds, dispersed explosively.			30+	Killed.	Benson & McDougall (1995).
Crowea exalata			Seed	Seed dispersed ballistically from dehiscent 1-5 lobed fruits.					Benson & McDougall (2001).
Cryptandra amara	Resprouter			Diaspore: seed with food body ant-adapted for dispersal.				Stems killed, resprouts from base.	Benson & McDougall (2000).
Cryptandra lanosiflora	Obligate Seeder								
Cryptandra scortechinii	Obligate Seeder				3-May				Williams (1998).
Cryptocarya rigida		Fresh seed after flesh removed. Short viability germination 4-8 wks.						Very rare in Sydney.	Benson & McDougall (1997).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Cryptostylis subulata	Resprouter		Seed, winged			2	Indefinite		Benson & McDougall (2005).
Cyathea australis	Resprouter	Soil stored spores.						Resprouts from apex. basal sprouts, and outgrowth of large apical bud. Substantial recruitment between 28-48yrs post fire in a regenerating SE Aust. forest.	Benson & McDougall (1993), Hamilton et al. (1991), Keith (1996), Gill (1981), NPFR.
Cymbopogon refractus	Resprouter		Fruit (dry indihiscent 1 seeded)	Diaspore adhesive , animal dispersed & wind.	1	<1		Fruiting within 7 m of high intensity fire.	Williams (1998), Benson & McDougall (2005).
Cynodon dactylon	Resprouter	Reproduction sexual and vegetative. Reproducing by seed propagation between 1-5yrs.	Fruit (dry indihiscent 1 seeded)	Dispersed by wind & mud on cars, animal, water & vegetatively.	1		Indefinite		Clarke (1989), Williams (1998), Benson & McDougall (2005).
Cyperus gracilis	Obligate Seeder								
Cyperus imbecillis	Resprouter								
Dampiera purpurea	Resprouter							Resprouts from base, stems killed.	Benson & McDougall (1997).
Dampiera stricta	Obligate Resprouter	Reproduction sexual, by seed propagation between 1-5yrs.		Seeds dispersed by expulsion.				Significantly less abundant in multiple burn areas.	Bradstock et al. (1997), Clark (1988), Hamilton et al. (1991), Benwell (1998), Benson & McDougall (1997), Clarke (1989).
Daucus glochidiatus	Obligate Seeder				<1 yr			Seedlings recorded < 1yr after fire	Benson & McDougall (1993), Purdie & Slayter (1976), Purdie (1977), NPFR.
Davallia solida	Obligate Seeder				4-Aug			Probably killed	Benson & McDougall (1993).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Daviesia latifolia	Variable	Soil stored seedbank		Within 2 yrs of fire		>2 yr		(Killed by high intensity fire: pers. obs.) Resprouts from base	Floyd (1976), NPFR, Benson & McDougall (1996).
Daviesia umbellulata	Obligate Seeder	Soil stored seedbank						pers. obs.	
Denhamia celastroides	Resprouter								Williams (1998).
Derwentia arcuata	Resprouter								
Desmodium brachypodum	Resprouter	Soil stored seedbank						pers. obs.	
Desmodium rhytidophyllum	Variable	Soil stored seedbank.				<1 yr		Killed or respouting and flowering and fruiting within 13 wks of high intensity fire	Fox (1988), Benson & McDougall (1996), NPFR.
Desmodium varians	Resprouter	Probably soil-stored seedbank.		Diaspore: 1-seeded segments, shed at maturity. Adhesive.		<1 yr		Flowering within 11 wks of high intensity fire. Resprouted.	Lunt (1990), NPFR, Benson & McDougall (1996).
Deyeuxia decipiens	Resprouter		Fruit (dry indihiscent 1 seeded)			<1	Indefinite	Flowers abundantly only after fire.	Keith (1991), Keith (1996), NPFR, Benson & McDougall (2005).
Deyeuxia gunniana	Resprouter		Fruit (dry indihiscent 1 seeded)						Benson & McDougall (2005).
Deyeuxia imbricata	Resprouter		Fruit (dry indihiscent 1 seeded)						Benson & McDougall (2005).
Deyeuxia parviseta	Resprouter		Fruit (dry indihiscent 1 seeded)						
Deyeuxia	Resprouter	Total germination approx.	Fruit (dry			<1		Recruitment	Lunt (1990), Benson &

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
quadriseta		36 days.	indihiscent 1 seeded)					mainly after fire. Some fruiting 44 weeds after high intensity fire.	McDougall (2005).
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Deyeuxia reflexa	Resprouter		Fruit (dry indihiscent 1 seeded)						
Dianella caerulea	Resprouter		Fruit (Blue Berry)	Vertebrates. Only 20% of flowers produced fruit.					Roche et al. (1997), Benson & McDougall (2005).
Dianella caerulea	Resprouter		Fruit (White to Blue Berry)	Vertebrates.					Roche et al. (1997), Benson & McDougall (2005).
Dianella caerulea	Resprouter	Germination triggered by seasonal temperature & humidity. Requiers no pre-treatment but is slow to terminate.	Fruit (Blue Berry)	Birds for fruit & seeds for ants.		1		Flowers 10-12 m after high intensity fire.	Roche et al. (1997), Benson & McDougall (2005).
Dianella longifolia	Resprouter		Fruit (White to Blue Berry)	Vertebrates			Indefinite		Benson & McDougall (2005).
Dianella longifolia	Resprouter	Germination takes 4 m, germinates well without fermentation.	Fruit (White to Blue Berry)	Vertebrates					Roche et al. (1997), Benson & McDougall (2005).
Dianella nervosa	Resprouter		Fruit (Blue Berry)	Vertebrates					
Dianella revoluta	Resprouter		Fruit (Blue Berry)	Vertebrates					
Dianella revoluta	Resprouter	Germination takes approx. 2 yrs. Seeds should be smoked for 1 hr. Viability of fresh seed 80%.	Fruit (Blue Berry)	Vertebrates		2			Benson & McDougall (2005).
Dianella tasmanica	Resprouter	Germination takes approx. 83 days, germinates without fermentation.	Fruit (Blue Berry)	Vertebrates				Appeared 1st month after fire in wet forest. Initially good	Dickinson & Kirkpatrick (1987), Roche et al. (1997), Benson & McDougall (2005).

								grwoth rate, then declines.	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Dichelachne crinita	Resprouter	Total germination 34 days.	Fruit (dry indihiscent 1 seeded)	Seeds dispersed by wind.		<1	<5	Regenerates after crown fire and partial burn by resprouting below ground. Resprouting within 11 m after high intensity fire.	Lunt (1990), NPFR, Clarke (1989), Benson & McDougall (2005).
Dichelachne inaequiglumis	Resprouter		Fruit (dry indihiscent 1 seeded)						Benson & McDougall (2005).
Dichelachne micrantha	Resprouter		Fruit (dry indihiscent 1 seeded)		1				NPFR, Williams (1998), Benson & McDougall (2005).
Dichelachne parva	Resprouter		Fruit (dry indihiscent 1 seeded)						Benson & McDougall (2005).
Dichelachne rara	Resprouter		Fruit (dry indihiscent 1 seeded)			<1		Flowering within 10 m of high intensity fire.	NPFR, Benson & McDougall (2005).
Dichelachne sieberiana	Resprouter		Fruit (dry indihiscent 1 seeded)				<5		Benson & McDougall (2005).
Dichondra repens	Variable	Reproduction both sexual and vegetative means. Reproducing by seed propagation in the first year.		Stolons. Diaspore: seed, no special dispersal morphology. Dispersed in mud on cars.	1		<5	Resprouter (7091), Obligate Seeder (NPFR). Did not flower within 9m of intense autumn fire. Probably resprouts from stolons.	Lunt (1990), NPFR, Benson & McDougall (1995), Clarke (1989).
Dichondra sp. A	Resprouter				1				

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Dichopogon fimbriatus	Resprouter								
Dictymia brownii	Obligate Seeder							Probably killed	Benson & McDougall (1993), NPFR.
Digitaria breviglumis	Resprouter		Fruit (dry indihiscent 1 seeded)						
Digitaria diffusa	Resprouter		Fruit (dry indihiscent 1 seeded)	Diaspore adhesive, animal dispersed.			Indefinite		Benson & McDougall (2005).
Digitaria ramularis	Resprouter		Fruit (dry indihiscent 1 seeded)						Benson & McDougall (2005).
Dillwynia phylicoides	Obligate Seeder							Killed	Fox (1988), Benson & McDougall (1996).
Dillwynia retorta	Obligate Seeder			Within 1 yr of fire				Killed. Fire sensitive. Above-ground abundance declined with time since fire.	Benson & McDougall (1996), Morrison et al. (1995), Auld (1996), Benson (1985).
Dillwynia sericea	Obligate Seeder			Only from seeds after fire.					Russell & Parsons (1978).
Dillwynia sieberi	Obligate Seeder	Soil stored seedbank						Killed	Benson & McDougall (1996).
Diospyros australis	Resprouter								Williams (1998).
Dipodium punctatum	Resprouter		Seed			2	Indefinite		Williams (1998), Benson & McDougall (2005).
Dipodium variegatum	Resprouter		Seed			1	Indefinite		Benson & McDougall (2005).
Diuris abbreviata	Resprouter		Seed, winged				Indefinite		Williams (1998).
Diuris punctata	Resprouter		Seed, winged				Indefinite		
Diuris punctata	Resprouter		Seed, winged				Indefinite		Benson & McDougall (2005).
Diuris tricolor	Resprouter		Seed				Indefinite		

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Dockrillia linguiformis	Obligate Seeder		Seed				Indefinite	May resprout if only lightly scorched.	Williams (1998), Benson & McDougall (2005).
Dockrillia pugioniformis	Obligate Seeder		Seed				Indefinite		Benson & McDougall (2005).
Dodonaea hirsuta	Obligate Seeder								
Dodonaea triquetra	Obligate Seeder	Reproduction sexual, reproducing by seed propagation between 1-5yrs.		Seeds dispersed by wind.			<5	Regeneration from seed in soil.	Clarke (1989).
Dodonaea viscosa	Resprouter	Fire not obligatory. Recruitment promoted by fire.						Facultative resprouter. Adults moderately high mortality after fire.	Hodgkinson (1979), Hodgkinson & Griffen (1982), Hodgkinson & Oxley (1990), Gill (1981), NPFR.
Doodia aspera	Resprouter							24.6kg/ha dry wt. 1yr after slash burn - not recorded up to 1yr after tractor cleared.	Floyd (1966).
Drosera auriculata	Resprouter	Germination in 14 days without special treatment.		Diaspore: seed.		< 1yr		May flower within 2 m of fire and may be enhanced	Juniper et al. (1989), Benson & McDougall (1995).
Drosera binata	Resprouter					< 1yr		Stems killed resprout from base, fire needed to induce vigorous growth and flowering, flower in absence but sparsely. Flowering 1 m after high	Gill (1981), Benson & McDougall (1995), Keith (1996), NPFR, Keith (1991).

								intensity fire	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Drosera burmannii		Seedling recruitment not fire related.		Diaspore: seed.			3-6m	Probably killed.	Benson & McDougall (1995).
Drosera peltata	Resprouter	Germinate in 14 days without special treatment. Coloniser.		Diaspore: seed. No special dispersal morphology.		1-2yr		Resprouts, secondary juvenile period 2 years. Flowered March-April after January fire.	Benson & McDougall (1995).
Drosera spatulata	Resprouter					1 yr		Facultative resprouter. 100% scorch kills. Soil stored seed.	Benson & McDougall (1995), NPFR.
Echinopogon caespitosus	Resprouter		Fruit (dry indihiscent 1 seeded)	Diaspore adhesive.	1	<1		Found after high intensity fire.	Williams (1998), Benson & McDougall (2005).
Echinopogon mckiei	Resprouter		Fruit (dry indihiscent 1 seeded)	Diaspore adhesive, animal dispersed.					
Echinopogon ovatus	Resprouter		Fruit (dry indihiscent 1 seeded)	Diaspore adhesive, animal dispersed.				Survive 100% scorch. Root suckers.	NPFR, Benson & McDougall (2005).
Einadia hastata	Obligate Seeder				1				Williams (1998).
Elaeocarpus holopetalus	Obligate Seeder	May take years						Probably killed	Benson & McDougall (1995).
Elaeocarpus obovatus	Resprouter	Slow and difficult to germinate, can take 1-18 months.		Diaspore: fruit. Bird dispersed.			100+	Possibly killed.	Benson & McDougall (1995), Williams (1998).
Elaeocarpus reticulatus	Resprouter							After high intensity fire but seedlings may be killed	Benson & McDougall (1995), Chesterfield et al. (1991), NPFR.
Eleocharis sphacelata	Resprouter								
Elymus scaber	Resprouter								Lunt (1990).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Empodisma minus	Resprouter			No special dispersal mechanism.		1	Indefinite	Recruitment mainly after fire.	Benson & McDougall (2005).
Enneapogon nigricans	Resprouter	Total germination approx. 8 days.	Fruit (dry indihiscent 1 seeded)					Flowers in response to rain.	Benson & McDougall (2005).
Entolasia marginata	Resprouter		Fruit (dry indihiscent 1 seeded)				Indefinite	Fruit produced within 7 m of high intensity fire.	Benson & McDougall (2005).
Entolasia stricta	Resprouter		Fruit (dry indihiscent 1 seeded)	Vigorous growth after fire. No special dispersal mechanism.		< 1yr	Indefinite	Survives 100% scorch - root suckers & basal shoots. Soil stored seed and clonal increaser. Recruitment mainly after fire. Fruit within 5 m of high intensity fire.	Bradsotck et al. (1997), Lumley & Spencer (1990), Clark (1988), NPFR, Benson & McDougall (2005).
Epacris microphylla	Variable	From soil stored seed			2 yr			Seedlings after high intensity fire. Obligate Seeder (I, KE). Facultative resprouter (BG), basal sprouts. Survives 100% scorch.	Benson & McDougall (1995), Keith (1996), Clemens & Franklin (1980), NPFR.
Epacris obtusifolia	Obligate Seeder	From soil stored seed						Seedlings within 10 ms of high intensity fire	Benson & McDougall (1995).
Epacris pulchella								Fire sensitive.	Benson (1985).
Epilobium billardierianum	Variable					<3m		Obligate seeder (NPFR-P).	NPFR, Benson & McDougall (1999).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								Resprouted after high intensity fire (P.Kubiak pers.comm)	
Eragrostis curvula	Resprouter		Fruit (dry indihiscent 1 seeded)	In mud on cars. No particular mechanism for dispersal.				Seedling sgrow rapidly after summer rain. Spring burning promotes rapid growth to full maturity in early summer.	Benson & McDougall (2005).
Eragrostis lacunaria	Resprouter		Fruit (dry indihiscent 1 seeded)						
Eragrostis leptostachya	Resprouter		Fruit (dry indihiscent 1 seeded)					Flowering within 2 m of high intensity fire.	Benson & McDougall (2005).
Eragrostis molybdea	Resprouter		Fruit (dry indihiscent 1 seeded)	No paricular mechanism for dispersal. Possible coloniser of bare sites.				Reprouts from base.	Benson & McDougall (2005).
Eragrostis parviflora	Obligate Seeder		Fruit (dry indihiscent 1 seeded)	No particular mechanism for dispersal. In mud on cars.	<1		<1	Flowers in response to rain.	Benson & McDougall (2005).
Eragrostis trachycarpa	Resprouter		Fruit (dry indihiscent 1 seeded)						Benson & McDougall (2005).
Eremophila debilis	Resprouter		Fruit					Resprouter from thick root stocks.	Benson & McDougall (1997).
Eucalyptus acaciiformis	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					Williams (1998).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Eucalyptus acmenoides	Resprouter	No dormancy.	Seed	Locally dispersed by wind, gravity, no dormancy.			100+	Resprouts from base by epicormic buds.	Benson & McDougall (1998).
Eucalyptus andrewsii	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Eucalyptus banksii	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Eucalyptus biturbinata	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					Williams (1998).
Eucalyptus bridgesiana	Resprouter	Seeds require light for germination, optimum temperature 25 degrees C.	Seed	Dispersed locally by wind and gravity. No dormancy mechanism.			<200	Resprouts from epicormic buds.	Benson & McDougall (1998).
Eucalyptus brunnea	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Eucalyptus caliginosa	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					Williams (1998).
Eucalyptus cameronii	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					Williams (1998).
Eucalyptus campanulata	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.				Resprouter - lignotuber and coppice.	Gill (1981).
Eucalyptus codonocarpa	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Eucalyptus dalrympleana	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					Williams (1998).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Eucalyptus dealbata	Resprouter	No dormancy mechanism.	Seed	Dispersed locally.					Benson & McDougall (1998).
Eucalyptus dorrigoensis	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Eucalyptus laevopinea	Resprouter	No dormancy.	Seed	Dispersed locally.			100+	Resprouter - lignotuber and coppice.	Gill (1981), Benson & McDougall (1998).
Eucalyptus melliodora	Resprouter	No dormancy.	Seed	Dispersed locally.			100+	Seedlings remarkable tolerance for being burnt.	Gill (1997), Leigh & Holgate (1979).
Eucalyptus microcorys	Resprouter	No dormancy.	Seed	Dispersed locally.			100+	Epicormic resprouter, lignotuber and coppice. Survives 100% scorch. Heavy flowering every 3-4 yrs.	Siddiqi et al. (1976), Gill (1982), NPFR, Benson & McDougall (1998).
Eucalyptus notabilis	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Eucalyptus nova-anglica	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					Williams (1998).
Eucalyptus obliqua	Resprouter	No dormancy. Seeds require light for germination.	Seed	Requires disturbance for regeneration but may regrow from coppice as well as seed. Seed released en mass after fire.			100+	Epicormic, lignotuber and coppice. 66% seeds in woody friut killed by fire. Lignotubers developed in seedlings 9-12 weeks old. Treefalls release domrant	Gill (1997), Ashton (1986), Hamilton et al. (1991), Leigh & Holgate (1979), Keith (1996), Dickinson & Kirkpatrick (1987), Jordan et al. (1992), Ashton (1986), Wilkinson & Hennings (1993), Gill (1981), NPFR, Benson & McDougall (1998).

								lignotubers.	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Eucalyptus oreades	Variable	No dormancy. Recruitment in open areas, fire not necessary, but better after fire. Successive fires make suppressed trees produce seed earlier.	Seed	Dispersed locally by wind or gravity.	25		100-150	One of the very few eucalypts very sensitive to fire. Feeble rsprouting from epicormic buds.	Benson & McDougall (1998).
Eucalyptus pauciflora	Resprouter	Seeds require cool moist conditions for germination.	Seed	Lignotuberous seedlings. Disapore: seed. Dispersed locally by wind or gravity. No dormancy.			<400	Resprouter - coppice from lignotuber, epicormic to survive 100% scorch. Burning/grazing combination can substantially increase mortality of this plant.	Gill (1997), Keith (1997), Noble (1984), Leigh & Holgate (1979), Keith (1996), Gill (1981), NPFR, Benson & McDougall (1998).
Eucalyptus prava	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity. No dormancy mechanism.					
Eucalyptus propinqua	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity. No dormancy mechanism.			100+	Lignotuber and coppice. Seedlings with lignotubers.	Gill (1981), Benson & McDougall (1998).
Eucalyptus radiata	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity. No dormancy mechanism.				Resprouter - lignotuber and coppice. Epicormics to survive 100% scorch.	Gill (1997), Gill & Ashton (1968), Gill (1981), NPFR.

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Eucalyptus saligna	Resprouter	No dormancy. Seed germinates without treatment.	Seed	Dispersed locally by wind or gravity. No dormancy mechanism. Average seed dispersed 35.3 m.			200+	Resprouter - coppice and lignotuber. 96% have lignotuber. Seedlings have lignotuber.	Eldridge et al. (1993), Burgess & Bell (1983), Gill (1997), Gill (1981), Benson & McDougall (1998).
Eucalyptus scoparia	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Eucalyptus tereticornis	Resprouter	No dormancy. Recruitment not fire related. Germination requries light, optimal temperature 25-30C.	Seed	Dispersed locally by wind or gravity.				Resprouts strongly from epicormic buds.	Benson & McDougall (1998), Williams (1998).
Eucalyptus tindaliae	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Eucalyptus viminalis	Resprouter	No soil-stored seedbank.	Seed	Wind-dispersed locally. No dormancy.			100+	Resprouts from lignotuber and weakly from epicormic buds, mortality following high intensity fire 12.1%. Seed retained on tree for 1 yr.	Gill (1981), Strasser et al. (1996), Benson & McDougall (1998).
Eucalyptus williamsiana	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Eucalyptus youmanii	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Euchiton gymnocephalus	Obligate Seeder		Fruit	Coloniser.					NPFR.

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Euchiton involucratus	Obligate Seeder			Seedlings recorded 1 yr after fire				Obligate seeder. Therophyte. Seedlings 1yr after fire in burnt and unburnt areas.	Benson & McDougall (1994), Purdie & Slayter (1976), Purdie (1977), NPFR.
Euchiton sphaericus	Obligate Seeder		Fruit	Coloniser.	<1			Probably killed by fire	NPFR, Benson & McDougall (1994).
Euroschinus falcata				Seeds dispersed by animals.			30+		Clarke (1989).
Eustrephus latifolius	Resprouter		Seed	Bird dispersed.		3 m		Facultative resprouter.	NPFR, Williams (1998), Benson & McDougall (2005).
Exocarpos cupressiformis	Resprouter	Hard seed is difficult to germinate.	Fruit.	Limited root suckering. Hemi-parasite on roots of other plants, commonly eucalypts but also other species.			Indefinite.	Facultative resprouter. Fire resistant increaser. Survives 100% scorch by root suckers and basal sprouts. Resprouts with numerous suckers from lateral roots and from rootstock. Seedlings recorded <1y after fire.	NPFR; Benson & McDougall (2001).
Exocarpos strictus	Resprouter		Fruit.	Often forming dense thickets, presumably from root suckers. Hemi-parasite on roots of other plants.			Indefinite.	Resprouts from base.	Benson & McDougall (2001).
Ficus coronata	Resprouter		Inflorescene					Probably no soil stored seedbank, no dormancy	Benson & McDougall (1997), Melick & Ashton (1991), NPFR.

								mechanism.	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Ficus obliqua	Resprouter		Inflorescence						Williams (1998).
Ficus rubiginosa	Resprouter		Inflorescence						Williams (1998).
Fimbristylis dichotoma	Resprouter							Resprouter.	Benwell (1998).
Gahnia aspera	Resprouter								
Gahnia sieberiana	Resprouter							Facultative resprouter. Non-clonal decreaser.	Keith (1996), Benwell (1998), NPFR.
Galium binifolium	Obligate Seeder		Seed	With no special morphology for dispersal.					NPFR, Benson & McDougall (2000).
Galium gaudichaudii	Obligate Seeder			No particular mechanism for dispersal. Vegetative spread by weak development of nodal roots up to 5 cm from rootstock.				100% scorch kills. Possibly resprouts.	NPFR, Benson & McDougall (2000).
Galium migrans	Obligate Seeder								
Galium propinquum	Resprouter		Seed	Seed with tiny hooks presumably for dispersal by attachment to animals. Vegetative spread.				Facultative resprouter.	NPFR, Benson & McDougall (2000).
Geitonoplesium cymosum	Resprouter		Seed	Dispersed by birds & other animals.		<1		Resprouts from base.	Williams (1998), Benson & McDougall (2005).
Genoplesium fimbriatum	Resprouter		Seed, winged			<1	Indefinite		Benson & McDougall (2005).
Geranium potentilloides	Obligate Seeder			Diaspore: probably seed, possibly animal					NPFR.

				dispersed.					
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Geranium solanderi	Obligate Seeder				1-Feb				
Geranium solanderi	Obligate Seeder				1-Feb				Williams (1998).
Gleichenia dicarpa	Resprouter							At ground level or below. Facultative resprouter - basal sprouts. Survives 100% scorch.	Benson & McDougall (1993), NPFR.
Glochidion ferdinandi	Resprouter	Seeds germinate in 1-4 months.	Seed	Seed with dry aril, bird dispersed. Possible dormancy mechanism.			60+	Stems killed, resprouts from base. A few resprouting from the trunk after high intensity fire, fruit mature in <5 months.	Benson & McDougall (1995).
Glossogyne tannensis	Resprouter							Probably resprouts from ground level after low intensity fires: pers obs	
Glycine clandestina	Resprouter	Rare in non-heated soil. Seed viability 100%, non-dormant fraction 4%.		Soil stored seed. Diaspore: hard-coated seed. No particular morphology for dispersal.			<5	pers.obs. Has persistent root stock. Probably resprouts. Regeneration from seed in soil (Clarke).	Floyd (1966), Auld & O'Connell (1991), Jarrett & Petrie (1929), NPFR. Benson & McDougall (1996), Clarke (1989).
Glycine microphylla	Resprouter								
Glycine tabacina	Resprouter	Soil-stored seedbank.		No particular mechanism for dispersal.				pers.obs. Resprouter from basal sprouts.	Stewart (1996), NPFR. Benson & McDougall (1996).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								Survives 100% scorch. Probably resprouts from above ground level (taxon B).	
Gomphocarpus fruticosus	Obligate Seeder								
Gompholobium huegelii	Resprouter							Probably resprouts	Benson & McDougall (1996).
Gonocarpus oreophilus	Resprouter								
Gonocarpus tetragynus	Variable	Seedlings <1yr after fire (Purdie, 1977). May occur on disturbed sites.		Diaspore: fruit. No particular dispersal mechanism. Episodic recruitment mainly after fire.		2		Obligate Seeder (NPFR-CH, W?.) Facultative resprouter - regrowth & suckers from root stocks and lateral roots. Soil stored seed. Seedlings recorded <1yr after fire.	NPFR, Benson & McDougall (1997).
Gonocarpus teucrioides	Variable	Reproduction by sexual means in the first year.		Episodic recruitment mainly after fire. Seeds dispersed by wind.			<5	Soil stored seed. Resprouts from base.	Benson (1985), Keith (1996), Benson & McDougall (1997), NPFR, Clarke (1989).
Goodenia bellidifolia	Resprouter								
Goodenia hederacea	Variable	Mucialginous rim may be mechanism for absorbing water to secure germination.		Diaspore: seed, no particular mechanism for dispersal.	1			Regrowth and suckers from rootstocks and lateral roots, but fire appeared to retard vegetative multiplication.	Purdie (1977), Benson & McDougall (1997).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								Seedlings recorded <1yr after fire. Resprouting plants reached maturity in about 2 yrs.	
Grammitis billardieri	Obligate Seeder							Probably killed	Benson & McDougall (1993).
Gratiola peruviana	Resprouter								NPFR, Williams (1998).
Grevillea juniperina			Seed						
Grevillea linearifolia	Obligate Seeder	Soil stored seedbank. Untreated 5-13%, smoke, heat & scarification increase germination. 1/2 life 10	Seed	Has elaiosome.				Germination mainly 30-40 days after treatment. Persistent seed bank, high dormancy initially.	Benson & McDougall (2000).
Guioa semiglauca	Resprouter								Williams (1998).
Gymnoschoenus sphaerocephalus	Resprouter								
Gymnostachys anceps	Obligate Seeder				2-Apr				Williams (1998).
Haemodorum planifolium	Resprouter							Survives 100% scorch - basal sprouts.	Clemens & Franklin (1980), NPFR.
Hakea eriantha	Obligate Seeder		Seed (winged)						NPFR, Williams (1998).
Hakea florulenta			Seed (winged)						
Hakea laevipes	Obligate Seeder		Seed (winged)						
Hakea macrorrhyncha	Obligate Seeder		Seed (winged)						
Hakea microcarpa	Resprouter	Seed viability 81.2%. Waterlogging inhibits	Seed (winged)	Gravity or short distance wind-				Resprouts from lignotuber.	Benson & McDougall (2000).

		germination.		dispersed.					
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Hakea salicifolia	Obligate seeder		Seed (winged)	Gravity or short distance wind-dispersed.	6.5y		?20-30y	Killed by fire, re-establishes from canopy-stored seedbank.	Benson & McDougall (2000).
Haloragis heterophylla	Resprouter			No particular mechanism for dispersal.	1			Multiplied vegetatively after autumn fire. Probably killed (7114).	Lunt (1990), Benson & McDougall (1997), Benson & McDougall (1997).
Hardenbergia violacea	Variable	Seed viability 99%, non-dormant fration 5%. Coloniser of disturbed sites.		Seedlings recored 1 yr after fire and will establish in charcoal beds. Diaspore: seeds, ant-adapted.	1	>1 yr		From base or below (will survive annual fires: pers. obs.). Regrowth from surviving rootstocks, seedlings recorded <1yr after fire. Regeneration from seed in soil (Clarke)	Fox (1988), Floyd (1966), Auld & O'Connell (1991), Purdie (1977), NPFR, Benson & McDougall (1996), Clarke (1989).
Hedycarya angustifolia	Variable	3-6wks general (A. Bofeldt, pers.comm.)	Seed	Bird dispersed. In pellets of Currawongs & Bulbuls. Dispersed vegetatively by rhizomes.		2		Obligate Seeder (NPFR - CT). Killed by fire. Resprouted after high intensity fire.	Chesterfield et al. (1991), Melick & Ashton (1991), Gill (1981), Benson & McDougall (1997), NPFR, Benson & McDougall (2005).
Helichrysum boormanii	Obligate Seeder		Fruit						
Helichrysum collinum	Variable		Fruit	Wind dispersed.				Obligate seeder (NPFR-P). Survives 100% scorch - basal	Purdie (1977), Purdie & Slayter (1976), NPFR.

								sprouts. Facultative root resprouter. Fire resistant decreaser.	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Helichrysum elatum	Obligate Seeder	Germinates readily after fire	Fruit		1 yr			Will germinate readily after fire and seed within high intensity fire: pers obs	Benson & McDouall (1994).
Helichrysum rutidolepis	Resprouter		Fruit					Facultative resprouter. Multiplied vegetatively after autumn fire.	Lunt (1990), NPFR.
Helichrysum scorpioides	Resprouter		Fruit		<1 yr			Flower in 16 wks and fruit 23 wks after high intensity fire	Benson & McDouall (1994), Dickinson & Kirkpatrick (1987), Lunt (1994), NPFR.
Hemarthria uncinata			Fruit (dry indihiscent 1 seeded)						
Hibbertia acicularis	Variable	Soil stored seedbank	Seed		2			Killed by fire. Obligate seeder - soil stored. Facultative resprouter. Non-clonal decreaser.	Fox (1988), Benson & McDougall (1995), Benwell (1998), NPFR.
Hibbertia aspera	Resprouter		Seed			1 yr		Stems killed, resprout from base	Benson & McDougall (1995).
Hibbertia cistoidea	Resprouter		Seed						
Hibbertia dentata	Resprouter		Seed			1 yr		Resprout from base and	Benson & McDouall (1995), NPFR.

								flowering within 10 m after fire, some seedlings 10 m after fire	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Hibbertia linearis	Obligate Seeder		Seed	within 7 m	<2 yr			Killed by high intensity, seedlings within 7 m flowering 18 m after fire	Benson & McDouall (1995).
Hibbertia obtusifolia	Variable	Within 1yr after fire (7020).	Seed	Seedlings within 1 yr				Resprout from suckers of roots and lateral root stock. Soil seedbank. Fire resistant increaser.	Benson & McDougall (1995), Fox & Fox (1986), Purdie & Slayter (1976), Siddiqi et al. (1976), Purdie (1977), Benwell (1998), NPFR.
Hibbertia pedunculata	Resprouter		Seed						
Hibbertia riparia	Resprouter		Seed	Ant-adapted food body. No particular dispersal mechanism.			60+	From base	Benson & McDougall (1995), Benson & McDougall (1995).
Hibbertia rufa			Seed						
Hibbertia scandens	Resprouter	Also soil stored seed germination. Reproduction by sexual means, by seed propagation between 1-5 yrs	Seed	Seeds dispersed by expulsion.				From base after high intensity fire	Benson & McDougall (1995), Fox & Fox (1986), NPFR, Clarke (1989).
Hibbertia sericea			Seed						
Hibbertia serpyllifolia	Resprouter	Also soil stored seed germination	Seed			2 yr		Facultative resprouter - basal sprouts.	Benson & McDougall (1995), Bradstock et al. (1997), NPFR.
Hibbertia sp. B	Obligate Seeder		Seed						
Hibbertia vestita	Resprouter		Seed					Facultative resprouter. Non-	Benwell (1998), NPFR.

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								clonal decreaser. Soil seedbank.	
Hibbertia villosa	Resprouter		Seed						
Hibiscus heterophyllus	Resprouter	Germination stimulated by disturbance. 1-6 weeks. Coloniser.	Seed					Killed, vigorous recruitment from seed stimulated by fire.	Benson & McDougall (1997), Williams (1998).
Hirschfeldia incana				Winter-spring growing.			<5		
Homoranthus lunatus	Obligate Seeder								
Homoranthus papillatus	Obligate Seeder								
Hovea heterophylla	Resprouter								
Hovea pannosa	Obligate Seeder								
Hovea pedunculata	Resprouter								
Hybanthus monopetalus	Obligate Seeder							100% scorch kills - soil stored seed.	NPFR.
Hydrocotyle laxiflora	Obligate Seeder				1				NPFR, Williams (1998).
Hydrocotyle peduncularis	Obligate Seeder				1				Williams (1998).
Hymenophyllum cupressiforme	Obligate Seeder		Spores					Spores. Epiphytic fern. widley distributed pre fire, not recorded after wildfire.	Chesterfield et al. (1991), NPFR.
Hyparrhenia hirta	Resprouter		Fruit (dry indihiscent 1 seeded)	Wind & vehicles.				Encouraged by regular burning.	Benson & McDougall (2005).
Hypericum gramineum	Resprouter	Will recruit heavily after fire	Seed	Probably wind-dispersed.		1 yr		Will fruit within 3m after high intensity fire.	Benson & McDougall (1995), Lunt (1990), Purdie & SLatyer (1976),

								Facultative root resprouter. Fire resistant decreaser. Also obligate seeder.	Dickinson & Kirkpatrick (1987), NPFR, Benson & McDougall (1995).
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Hypericum japonicum	Resprouter								
Hypochaeris glabra	Obligate Seeder								
Hypochaeris radicata	Variable	decreased after burning. Seedlings up within 1yr of fire.	Seed	Dispersed by wind.			<5	Obligate seeder - minor regeneration. Post burn seed coloniser. Facultative root resprouter. Fire resistant decreaser.	Lunt (1990), Hamilton et al. (1991), Purdie & Slatyer (1976), Dickinson & Kirkpatrick (1987), Purdie (1977), NPFR, Clarke (1989).
Hypolepis glandulifera	Obligate Seeder		Spores					Probably killed	Benson & McDougall (1993), NPFR.
Hypoxis hygrometrica	Resprouter							Facultative resprouter	NPFR, Williams (1998).
Imperata cylindrica	Resprouter	No germination after application of smoke for 1 hr. May become dormant after low intensity fire.	Fruit (dry indihiscent 1 seeded)	Wind.	1	<1	Indefinite	Survives 100% scorch - root suckers. Absent from infrequently burnt sites. Stimulated by fire. Flowers prolifically within weeks of burning. Can be eliminated by regular mowing.	Benson & McDougall (1993), Nieuwenhuis (1987), Gill (1981), NPFR, Benson & McDougall (2005).
Indigofera adesmiifolia	Obligate Seeder		Seed	Hard-coated? No particular					Williams (1998).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
				mechanism for dispersal.					
Indigofera australis	Resprouter	Soil-stored seedbank.		Seedlings <1 yr after fire. Diaspore: hard-coated seed. No particular mechanism for dispersal.				From suckers, rootstocks and lateral roots. Fire resistant increaser. Seedlings recorded <1yr after fire.	Fox (1988), Benson & McDougall (1996), Gill (1975), Leigh & Holgate (1979), Purdie & Slatyer (1987), Purdie (1977), NPFR, Benson & McDougall (1996).
Isachne globosa	Resprouter		Fruit (dry indihiscent 1 seeded)		1				Williams (1998), Benson & McDougall (2005).
Isotoma anethifolia	Resprouter		Seed						
Isotoma axillaris	Resprouter		Seed		1			Probably from base after fire.	Benson & McDougall (1997).
Isotoma fluviatilis			Seed						
Jacksonia scoparia	Resprouter	Soil stored seedbank						Root suckers. Size of stem may influence survival after low intensity fire. 20-60% stems killed by low intesity fire, all killed by high. Fewer stems after high intensity than low intensity fire. No new shoots unless upper part of stem killed.	Benson & McDougall (1996), Floyd (1966), Morrison & Renwick (2000).
Joycea pallida	Resprouter	Total germination 67 days if smoked.	Fruit (dry indihiscent 1 seeded)			<1	Indefinite		Benson & McDougall (2005).
Juncus bufonius	Obligate Seeder							Significantly more	Lunt (1990), NPFR.

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								abundant in burnt areas.	
Juncus continuus	Resprouter								
Juncus firmus	Resprouter								
Juncus pauciflorus	Resprouter							Obligate resprouter.	NPFR.
Juncus remotiflorus	Resprouter								
Juncus usitatus	Resprouter							Obligate resprouter.	NPFR, Williams (1998).
Kennedia rubicunda	Obligate Seeder	Soil stored seedbank. Reproduction sexual, by seed propagation betweem 1-5yrs.	Seed	vigorous recruitment after high intensity fire. Seeds dispersed by expulsion.			<5	Killed. Obligate seeder (NPFR-I, Clarke). Facultative resprouter (NPFR-A, 7048). 100% scorch kills - soil stored seed.	Fox (1988), Benson & McDougall (1996), Auld & O'Connell (1991), FLoyd (1976), NPFR, Clarke (1989).
Kunzea bracteolata	Obligate Seeder								
Kunzea ericoides	Resprouter	No soil stored seedbank. Germinates abundantly after clearing.	Seed	Dispersed by wind and water.			70+	Resprouts from lignotuber. Soil stored seed.	Melick & Ashton (1991), NPFR, Benson & McDougall (1998).
Kunzea obovata	Resprouter								
Kunzea parvifolia	Resprouter		Seed	Colonises open sites.					Benson & McDougall (1998).
Lachnagrostis aemula			Fruit (dry indihiscent 1 seeded)	Adhesion & wind.					Benson & McDougall (2005).
Lachnagrostis filiformis	Obligate Seeder		Fruit (dry indihiscent 1 seeded)		<1		<1	Facultative resprouter. Notrecorded in seedbank before fire. Regenerated from seed after	Williams (1998), Lunt (1990), NPFR.

								intense autumn fire (flowered within 9m).	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Lagenifera stipitata	Resprouter		Fruit	No special dispersal morphology.		< 1yr		Stems killed, resprouts from ground level, flowers 9 wks after high intensity fire and 12 wks fruiting. Seeds shed within 12 weeks of high intensity fire.	Benson & McDougall (1994), NPFR, Benson & McDougall (1994).
Lasiopetalum ferrugineum	Obligate Seeder								
Lastreopsis decomposita			Spores						
Laxmannia compacta	Resprouter								
Laxmannia gracilis	Resprouter								
Leionema ambiens	Obligate Seeder								
Leionema rotundifolium	Obligate Seeder								
Lepidosperma elatius	Resprouter								
Lepidosperma gunnii	Resprouter								
Lepidosperma laterale	Resprouter	Reproduction by sexual means, reproducing by seed propagation in 1st year.		Seeds dispersed by wind.	1		<5	Facultative resprouter (NPFR-VE), obligate resprouter (NPFR - H, M, WO, CH.) Facultative and obligate	Hamilton et al. (1991),Dickinson & Kirkpatrick (1987), Gill (1989, NPFR, Dickinson & Kirkpatrick (1987), Hamilton et al. (1991), Clarke (1989).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								resprouter. First recorded 1m after fire.	
Lepidosperma limicola	Resprouter							Facultative resprouter - underground stocks. Relatively rare before hot spring fire, luxuriant growth after fire.	Siddiqi et al. (1976), NPFR.
Lepidosperma neesii	Resprouter								
Lepidosperma tortuosum	Resprouter								
Leptomeria drupacea	Resprouter		Fruit.						Benson & McDougall (2001).
Leptorhynchos squamatus	Variable							Resprouter. Obligate Seeder: minor regeneration - most vegetative.	Lunt (1990).
Leptospermum arachnoides	Resprouter	Recruitment mainly after fire.	Seed	Dispersed locally by gravity and wind.		<2.5	60+	Survives 100% scorch - basal sprouts.	NPFR, Benson & McDougall (1998).
Leptospermum brachyandrum	Resprouter	No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.					
Leptospermum brevipes	Resprouter	No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.				100+	Williams (1998).
Leptospermum gregarium	Resprouter	No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.					
Leptospermum	Resprouter	No soil stored seedbank.	Seed	Dispersed locally					Williams (1998).

minutifolium				by gravity and wind.					
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Leptospermum novae-angliae	Variable	No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.					Williams (1998).
Leptospermum polygalifolium	Resprouter	No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.					
Leptospermum trinervium	Resprouter	Soil stored seedbank.	Seed	Dispersed locally by gravity and wind.		1	30-60	Non-clonal decreaser. Some stems survive 100% scorch. Produced fewer stems after high intensity fire than low. Not usually produce new shoots unless upper part of stem killed.	Benwell (1998), Morrison & Renwick (2000).
Leptospermum variabile	Resprouter	No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.					
Lepyrodia anarthria	Resprouter					1	Indefinite	Rhizomes contain large reserves of starch.	NPFR, Benson & McDougall (2005).
Lepyrodia scariosa	Resprouter			No special morphology for dispersal.			Indefinite	Survives 100% scorch - root suckers. Rhizomes. Soil seedbank, capability for vegetative spread. Recruitment mainly after fire. Rhizomes contain	Bradstock et al. (1997), Siddiqi et al. (1976), NPFR, Benson & McDougall (2005).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								large reserves or starch. Flowering more abundant after fire.	
Lespedeza juncea	Resprouter	Stimulated by fire				<1 yr			Benson & McDougall (1996).
Leucopogon biflorus	Resprouter		Fruit						
Leucopogon juniperinus			Fruit						
Leucopogon lanceolatus	Resprouter		Fruit			< 2yr		From ground level after fire, flowering within 20 m of fire	Benson & McDougall (1995).
Leucopogon melaleucoides	Resprouter		Fruit						
Leucopogon microphyllus			Fruit	Dispersal: ant-adapted food body.			May-20	Killed by high intensity fire, regenerates from soil-storedseed seedlings, flowering within 2yrs. Regrowth from rootstock reported.	B.Wiecek (1993), Benson & McDougall (1995).
Leucopogon muticus	Resprouter		Fruit			1 yr		May resprout from after low to medium intensity fire and flower following winter	Benson & McDougall (1995).
Leucopogon neoanglicus	Obligate Seeder	Soil stored seedbank which lasts for many years	Fruit	Will recruit in the absence of fire				pers. obs.	
Leucopogon virgatus	Resprouter		Fruit	No seedlings within 1 yr of fire				Soil level or below. Facultative resprouter. Basal	Fox (1988), Gill (1975), Fox & Fox (1986), Purdie & Slatyer (1976), Purdie

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								sprouts. Soil seedbank. Non-clonal decreaser. Fire resistant decreaser.	(1977), Benwell (1998), NPFR, Benson & McDougall (1995).
Lindsaea linearis	Resprouter							At ground level or below	Benson & McDougall (1993).
Lindsaea microphylla	Resprouter							At ground level or below	Benson & McDougall (1993).
Lissanthe strigosa	Resprouter		Fruit			< 1yr		From base, may flower in 9 m of fire	Benson & McDougall (1995).
Lobelia dentata				Recruitment episodic, mainly fire related.				Conspicuous after fire, apparently resprouting from very deeply-buried fleshy rhizome. Some plants flowering within 5m after high intensity fire. Plants shedding seeds in <1yr. Plant not in unburnt ar	Benson & McDougall (1997).
Lobelia gibbosa	Obligate seeder							Possibly resprouter (7114). Obligate resprouter (NPFR-W).	Benson & McDougall (1997), NPFR.
Lobelia gracilis	Obligate Seeder								
Logania albiflora	Resprouter							Resprouts from base after high intensity fire.	Benson & McDougall (1997).
Lomandra	Resprouter		Seed						

confertifolia									
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Lomandra cylindrica	Resprouter		Seed	Ant adapted elaiosome.		1	Indefinite		Benson & McDougall (2005).
Lomandra filiformis	Resprouter		Seed	Ant adapted elaiosome.				Survives 100% scorch. Facultative resprouter.	NPFR, Benson & McDougall (2005).
Lomandra longifolia	Resprouter	Reproduction sexual, reproducing by seed propagation beween 1-5 yrs.	Seed	Ant adapted elaiosome.		1		Obligate Seeder (E). Facultative and obligate resprouter. Clonal decreaser. Survives 100% scorch - root suckers. Fire resistant increaser. Clonal decreaser.	Hamilton et al. (1991), Fox et al. (1979), Leigh & Holgate (1979), Dickinson & Kirkpatrick (1987), Purdie (1977), Benwell (1998), NPFR, Clarke (1989), Benson & McDougall (2005).
Lomandra multiflora	Resprouter	Seed viability 96%. Smoke increases germination.	Seed	Ant adapted elaiosome.		2yrs	1	Facultative and obligate resprouter. Fire resistant increaser. Obligate root resprouter. veg. regeneration. Absent from infrequently burnt sites.	Nieuwenhuis (1987), Purdie & Slatyer (1976), Purdie (1977), Roche et al. (1997), NPFR, Benson & McDougall (2005).
Lomatia fraseri	Resprouter								Williams (1998).
Lomatia silaifolia	Resprouter	No dormancy mechanism. Germination related to seed mass, viable seed > 7mg.	Seed	Wind-dispersed. Recruitment mainly after fire.		1y	>60y	Stems killed, resprouts from lignotuber within 2 months. Survives 100% scorch - basal sprouts. Flowers	Bradstock (1990), Beadle (1940), Keith (1996), Gill (1997), NPFR, Benson & McDougall (2000), Benson & McDougall (2000).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								abundantly only in first year after fire has destroyed previous shoot system, predominantly in second summer after flowering.	
Lophostemon confertus	Resprouter	Germination without treatment.	Seed				100-200	Survives 100% scorch - basal sprouts.	NPFR, Benson & McDougall (1998).
Luzula flaccida	Obligate Seeder								
Lycopodiella lateralis	Resprouter		Spores						
Lycopodium deuterodensum	Resprouter		Spores						
Lythrum salicaria			Seed						
Maclura cochinchinensis	Resprouter	Reproduction sexual, reproducing by seed propagation between 1-5yrs.	Seed	By expulsion.			30+	Vigorous suckering after clearing or fire.	Benson & McDougall (1997), Clarke (1989).
Marsdenia rostrata	Resprouter		Seed	Seeds dispersed by expulsion.			<5	Facultative resprouter. Survives 100% scorch - basal sprouts. Prolific after fire.	Melick & Ashton (1991), NPFR, Clarke (1989).
Maytenus silvestris	Resprouter	Germinates easily, 3-10 weeks.	Seed	Ant-adapted food-body for dispersal.			30+	Stems killed, resprouts from base. May form dense colonies of suckers.	Benson & McDougall (1995).
Medicago arabica	Obligate Seeder								
Melichrus procumbens	Resprouter							From ground level or below.	Benson & McDougall (1995), NPFR.

								Survives 100% scorch - basal sprouts.	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Melichrus urceolatus	Resprouter			No seedlings within 1 yr of fire. Diaspore: fruit, adaptation for dispersal by ingestion.				From rootstock. Facultative root resprouter. Fire resistant decreaser.	Gill (1975), Purdie & Slatyer (1976), Purdie (1977), NPFR, Benson & McDougall (1995).
Mentha diemenica	Obligate Seeder								
Mentha satureioides	Resprouter			Diaspore: seed. No particular morphology for dispersal.	1			Probably resprouts from rhizome.	Benson & McDougall (1997).
Micrantheum hexandrum	Obligate Seeder	From long lived soil stored seedbank		Seedlings prolifically within 6 m of fire where none recorded before				pers. obs.	
Microlaena stipoides	Resprouter	Total germination 25 days. Little dormancy. Germination slow if if under 10C and develope slowly.	Fruit (dry indihiscent 1 seeded).	No particular mechanism for dispersal.		<1		Flowers at anytime of the year.	Williams (1998), Benson & McDougall (2005).
Micromyrtus sessilis	Obligate Seeder								
Microtis unifolia	Resprouter	Readily germinates & can colonise new sites especially after disturbance.	Seed, winged			1	Indefinite	Flowering diminishes the longer since fire.	Williams (1998), Benson & McDougall (2005).
Mirbelia confertiflora	Obligate Seeder		Seed						
Mirbelia pungens	Obligate Seeder		Seed						
Mirbelia speciosa	Obligate Seeder	Soil stored seedbank	Seed					Killed	Benson & McDougall (1996).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Mitrasacme polymorpha	Obligate Seeder				2-Mar			Absent from infrequently burnt sites.	Benson & McDougall (1993), Nieuwenhuis (1987).
Monotoca scoparia	Resprouter			No seedlings within < 1 yr after fire. Diaspore: fruit, adapted for dispersal by ingestion.		< 2yr		Stems killed, resprout from soil level or below, may flower within 17 m of fire.	Benson & McDougall (1995), Fox & FOx (1986), Leigh & Hogate (1979), Purdie & Slatyer (1976), Purdie (1977), Benwell (1998), NPFR.
Morinda jasminoides	Resprouter		Fruit (orange, fleshy)	Vertebrate adapted dispersal. Fruit eaten by fruit bat & reported from Currawong pellets.		<2y			Benson & McDougall (2000).
Muehlenbeckia costata	Obligate Seeder	Prolifically after fire, fire ephemeral, from long lived soil stored seeds		Much growth and dominating communities within 6 m of fire	< 1yr		2-5yr	Fire ephemeral will fruit prolifically within 2-3 m of fire and continuously for lifespan, may resprout with a quick succession fire but will reduce biomass and seed set	Hunter (1995), Richards & Hunter (1997).
Muehlenbeckia rhyticarya	Obligate Seeder	Prolifically after fire, from long lived soil stored seedbank		Much growth within 6 m of fire	< 1yr			pers. obs.	
Muellerina eucalyptoides	Resprouter			Bird and bat dispersal.				Resprouter after low - medium intensity fire, with host canopy <100% scorched.	Benson & McDougall (1997), Williams (1998).
Murdannia graminea	Resprouter								

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Myoporum montanum	Resprouter								Williams (1998).
Myriophyllum aquaticum								No males in Australia - unknown consequences if introduced.	Benson & McDougall (1997).
Neolitsea australiensis	Resprouter								Williams (1998).
Notelaea linearis	Resprouter								
Notelaea longifolia	Resprouter	Reproduction sexual, reproducing by seed propagation between 1-5 yrs.	Seed	Dispersed by animals.		<2	30+	Survives fire by suckering. Resprouted after high intensity fire.	Benson & Howell (1994), Benson & McDougall (1999), Clarke (1989).
Notelaea microcarpa	Resprouter								
Notelaea ovata	Resprouter								Benson & McDougall (1999).
Notelaea sp. A.	Resprouter								
Notelaea venosa	Resprouter							Facultative resprouter.	NPFR.
Notodanthonia longifolia	Resprouter		Fruit (dry indihiscent 1 seeded)						Benson & McDougall (2005).
Notothixos subaureus	Obligate Seeder				3-Jun				Williams (1998).
Nyssanthes diffusa	Obligate Seeder				1-Feb				Williams (1998).
Olax stricta	Resprouter					3.5yr		Stems killed, resprouts at base or below.	Fox (1988), Benson & McDougall (1999).
Olearia elliptica	Obligate Seeder		Fruit						
Olearia gravis	Obligate Seeder		Fruit						
Olearia microphylla	Obligate Seeder		Fruit					Moderate intensity fire probably kills but	Benson & McDougall (1994).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								will flower soon after moderate to high intensity fire, very high fire will probably kill most of the viable soil-stored seed	
Olearia oppositifolia	Obligate Seeder		Fruit						
Olearia ramulosa	Obligate Seeder		Fruit						
Omalanthus nutans		Germination with fresh seed. Grows quickly in disturbed sites.	Seed	Bird-dispersed. Fruit reported from regurgitated pellets of Currawongs.	3		20-30	Some plants resprouting and scattered seedlings noted after high intensity fire.	Benson & McDougall (1995).
Opercularia aspera	Variable	Reproduction sexual, reproducing by seed propagation in the first year.	Seed	Ant-adapted food body for dispersal. Coloniser. Plants taller on better soils. Seeds dispersed by wind.		<33w	<5	Obligate seeder after hot fire. Soil stored seed. Resprouted after high intensity fire.	Benson & McDougall (2000), Fox & Fox (1986), Clemens & Franklin (1980), NPFR, Clarke (1989).
Opercularia diphylla	?Resprouter			Soil stored seedbank.				100% scorch kills, soil stored seed. Probably resprouts (herbarium specimen).	NPFR, Benson & McDougall (2000).
Opercularia hispida	Resprouter		Seed	No particular morphology for dispersal.				Survives 100% scorch - basal sprouts.	NPFR, Benson & McDougall (2000).
Oplismenus aemulus	Obligate Seeder		Fruit (dry indihiscent 1 seeded).	No specieal dispersal morphology. Coliser of bare	1	<1	Indefinite	Flowering 5 m after high intensity fire.	Williams (1998), Benson & McDougall (2005).

				shady sites.					
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Oplismenus imbecillis	Obligate Seeder		Fruit (dry indihiscent 1 seeded).	Bird dispersed. Coloniser of bare sites.	1		Indefinite	Flowers at anytime of the year.	Williams (1998), Benson & McDougall (2005).
Oxalis chnoodes	Resprouter								
Oxalis exilis	Resprouter								
Oxalis perennans	Variable.							Resprouter. Minor Obligate seeder. Seedlings not flowered within 9m of autumn fire.	Lunt (1990).
Oxylobium arborescens	Resprouter		Seed						
Ozothamnus diosmifolius	Resprouter		Fruit					Killed by high intensity fire, few resprout from base, stem resprouter under lower fire intensity, scattered germinations	Benson & McDougall (1994), Williams (1998).
Ozothamnus obcordatus	Obligate Seeder		Fruit						Williams (1998).
Pandorea pandorana	Variable	Reproducing by seed propagation between 1-5 years of age.		Seeds dispersed by wind.		< 1yr		Killed and known to resprout after high intensity fire, few plants flowering after 26-29 wks	Fox (1988), Benson & Howell (1994), NPFR, Clarke (1989), Williams (1998).
Panicum effusum	Resprouter		Inflorescence	Wind dispersed. In mud on cars. Coloniser of disturbed sites.	1				Williams (1998), Benson & McDougall (2005).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Panicum simile	Resprouter		Inflorescence			<1		Fruit within 4 m of high intensity fire.	Benson & McDougall (2005).
Parsonsia eucalyptophylla	Resprouter								
Parsonsia purpurascens	Obligate Seeder				2-Apr				Williams(1998).
Parsonsia straminea	Obligate Seeder				2-Apr			Probably killed	Benson & McDougall (1993), NPFR, Williams (1998).
Parsonsia velutina	Obligate Seeder				2-Apr				Williams (1998).
Paspalidium constrictum	Resprouter		Inflorescence						
Paspalidium gracile	Resprouter		Inflorescence						Benson & McDougall (2005).
Paspalum dilatatum	Resprouter		Inflorescence	Adhesive for dispersal. In mud on cars.		<1	Indefinite	Fruit within 4 m of high intensity fire.	Benson & McDougall (2005).
Paspalum urvillei	Resprouter		Inflorescence	In horse dung.		<1		Fruit within 9 weeks after high intensity fire.	Benson & McDougall (2005).
Passiflora aurantia	Resprouter								
Patersonia glabrata	Resprouter							Non-clonal decreaser. Soil seed bank.	Benwell (1998), Roche et al. (1997).
Patersonia sericea	Resprouter							Transient seedbank. Non-clonal decreaser. No veg. spread.	Clark (1988), Bradstock et al. (1997), Lumley & Spencer (1990).
Pavonia hastata	Resprouter								Williams (1998).
Pelargonium australe	Resprouter	Reproduction sexual, by seed propagation in first year.	Fruit	Seeds dispersed by wind.			<5		NPFR, Clarke (1989).
Pellaea falcata	Resprouter		Spores						Williams (1998).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Pellaea nana	Resprouter		Spores	Wind-dispersed. Probably no dormancy mechanism.					Williams (1998).
Pennantia cunninghamii				Bird dispersed.				Probably killed.	Benson & McDougall (1997).
Pennisetum alopecuroides	Resprouter		Fruit (dry indihiscent 1 seeded)	Wind dispersal & adhesion.	1				Williams (1998), Benson & McDougall (2005).
Persoonia cornifolia	Resprouter		Fruit						
Persoonia daphnoides			Fruit						
Persoonia fastigiata	Obligate Seeder		Fruit						
Persoonia microphylla		Triggers unknown.	Fruit	Probably dispersed by large birds e.g. Currawongs, and possibly large mammals, kangaroos, possums.					Benson & McDougall (2000).
Persoonia oleoides	Resprouter		Fruit						
Persoonia sericea	Resprouter		Fruit						
Persoonia tenuifolia	Resprouter		Fruit						NPFR.
Persoonia virgata			Fruit						
Petrophile canescens	Resprouter		Fruit (nut)	Gravity dispersed locally				Stems killed, resprouts from base. Canopy seedbank. Non-clonal decreaser.	Benwell (1998), Benson & McDougall (2000).
Phalaris aquatica	Resprouter		Fruit (dry indihiscent 1	No particular morphology for					Benson & McDougall (2005).

			seeded)	dispersal. In mud on cars.					
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Phebalium glandulosum	Obligate Seeder								
Phebalium squamulosum	Obligate Seeder								
Philotheca epilosa	Obligate Seeder								
Philydrum lanuginosum	Resprouter		Seed			<1	Short lived	Fruiting within 5 m of high intensity fire.	Benson & McDougall (2005).
Phyllanthus gunnii	Variable		Seed	Explosive				Resprouter from base (3453, 4264). Obligate Seeder (NPFR-W).	Benson & Howell (1994), Benson & McDougall (1995), NPFR.
Phyllanthus hirtellus	Resprouter		Seed	Explosive		< 1yr		(Will withstand yearly burning: pers. obs.) From base, fruits within 10 m of high intensity fire	Benson & McDougall (1995), Benwell (1998), NPFR.
Phyllanthus similis			Seed	Explosive					
Phyllanthus virgatus	Resprouter	From soil stored seedbank	Seed	Explosive		< 1yr		Will resprout and flower within 6 m of fire	pers. obs.
Phyllota phylicoides	Resprouter		Seed						
Phytolacca octandra	Obligate Seeder				2			Weed promoted by fire. Seedlings grew vigorously after high intensity fire, fruiting 5m after fire.	Chesterfield et al. (1991), Floyd (1976), Gill (1981), NPFR, Benson & McDougall (1999).
Pittosporum undulatum	Variable	Reproduction sexual, reproducing by seed		Seeds dispersed by animals.			30+	Obligate seeder, killed by fire. Fire	Benson & Howell (1994), Hill (1982), Chesterfield et

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
		propagation after 5yrs.						sensitive: thin bark & incapacity to coppice. Survives fire by suckering. Crown fire: obligate seeder. Partial burn: resprouts above ground.	al. (1991), Melick & Ashton (1991), NPFR, Clarke (1989).
Plantago debilis	Resprouter								Williams (1998).
Plantago major	Resprouter								
Plantago varia	Resprouter							Facultative resprouter. Recorded 1 month after fire in grassy forest.	NPFR, Dickinson & Kirkpatrick (1987).
Platycerium bifurcatum	Obligate Seeder							Probably killed, (can survive a high degree of scorch: pers obs)	Benson & McDougall (1993).
Platysace ericoides	Variable					1 yr		Stems killed and resprouts or killed outright	Benson & McDougall (1993), Fox (1988).
Plectranthus graveolens	Resprouter								
Plectranthus parviflorus	Resprouter							Killed after high intensity fire. Soil stored seedbank.	Benson & McDougall (1997).
Plectranthus suaveolens	Resprouter								
Poa labillardieri	Resprouter	Total germination approx. 39 days.	Fruit (dry indihiscent 1 seeded)	No particular morphology for dispersal.		<1		Flowers at anytime of the year. Flowering within 10 m of high intensity fire.	Benson & McDougall (2005).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Poa queenslandica	Resprouter		Fruit (dry indihiscent 1 seeded)			<1		Flowers anytime in response to seasonal conditions.	Benson & McDougall (2005).
Poa sieberiana	Resprouter		Fruit (dry indihiscent 1 seeded)					Facultative resprouter. No mortality when grazed and burnt.	Lunt (1990), Leigh & Holgate (1979), Keith (1996), NPFR.
Podolepis arachnoidea			Fruit						
Podolepis hieracioides			Fruit						
Podolepis jaceoides	Resprouter		Fruit					Perennial.	Lunt (1990).
Podolepis neglecta	Resprouter		Fruit						
Podolobium ilicifolium	Resprouter		Seed					Stems killed, from base. 100% scorch kills, soil stored seed.	Fox (1988), Benson & McDougall (1996), NPFR.
Polygala japonica								Possibly resprouts.	Benson & McDougall (1999).
Polymeria calycina	Resprouter					< 2yr		Resprout after high intensity fire, fruit within 13 m	Benson & McDougall (1995).
Polyscias elegans		Reproducing by seed propagation after 5 years.		Seeds dispersed by animals.			30+		Clarke (1989).
Pomaderris andromedifolia	Obligate Seeder		Seed				10-25y	Probably killed.	Benson & McDougall (2000).
Pomaderris lanigera	Obligate Seeder		Seed	Coloniser species in absence of fire.			10-25y	Probably killed.	Benson & McDougall (2000).
Pomaderris ligustrina			Seed						Benson & McDougall (2000).
Pomaderris nitidula	Resprouter		Seed						Williams (1998).
Pomax umbellata	Obligate Seeder	Reproduction by sexual	Seed	Ejected	<1y		<5	Soil stored seed -	Benson & McDougall

Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
		means, reproducing by seed propagation in the first year.		ballistically when ripe capsules touched (?and by wind). Coloniser. Soil stored seedbank.				no veg. regeneration in dry heath. 100% scorch kills.	(2000), Benwell (1998), NPFR, Clarke (1989).
Poranthera microphylla	Obligate Seeder	Readily after fire from soil stored seedbank		Within 5 m of fire. Diaspore: seed. Both ballistic & ant-adapted dispersal mech. Coloniser.	< 1yr		1	(Will have an initial flush after fire which is reduced soon after: pers. obs.) Flowers profusely after high intensity fire. Killed. Seedlings recorded <1yr after fire.	Benson & McDougall (1995), Purdie & Slatyer (1976), Bradfield (1981), NPFR, Fox (1988), Purdie (1977).
Potamogeton tricarinatus		Germination in autumn-winter in the Northern Tablelands.	Fruit (nutlets)						Benson & McDougall (2005).
Pratia purpurascens	Resprouter	Reproduction both sexual and vegetative, reproducing by seed propagation in first year.		Seeds dispersed by expulsion.			<5	Resprouter after high intensity fire.	Benson & McDougall (1997), Clarke (1989).
Prostanthera caerulea			Seed						
Prostanthera nivea	Obligate Seeder		Seed						
Prostanthera saxicola	Obligate Seeder		Seed						
Prostanthera petraea	Obligate Seeder	Readily germinates from soil stored seedbank after fire	Seed		> 3yr			Will germinate prolifically after fire, does not germinate readily in the absence of fire: pers. obs.	

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Prunella vulgaris	Obligate Seeder	Germinates in spring.		Seeds dispersed by water, animals and humans.	1			Probably killed by high intensity fire, seedlings flowering and fruiting within 1 year.	Benson & McDougall (1997).
Pseudognaphalium luteoalbum		Coloniser.		Wind-dispersed locally.	<1		1	Probably killed.	Benson & McDougall (1994).
Psychotria loniceroides			Fruit (fleshy)	Vertebrate adapted for dispersal.					Benson & McDougall (2000).
Pteridium esculentum	Resprouter	Dormant rhizome buds may remain dormant for at least 10 years.	Spores	Wind-dispersed. Probably no dormancy mechanism.		< 1yr		Resprouts rapidly, maybe indicative of fire, survives annual burning, may become dominant after low intensity burn but not spread after high, biomass increase 1 yr after spring fire, autumn fire not	Fox (1988), Benson (1985), Barker (1990), Hamilton et al. (1991), Fox et al. (1979), Keith (1996), Dickinson & Kirkpatrick (1987), Cremer & Mount (1965), NPFR, Benson & McDougall (1993).
Pteris comans			Spores	Dispersed by wind. Probably no dormancy mechanism.					
Pteris tremula	Obligate Seeder	Spores retain viability 10-15 years. Establishes during wet periods and grows quickly.	Spores	Wind-dispersed. Probably no dormancy mechanism.			2-5y	Spores. Probably killed.	NPFR, Benson & McDougall (1993).
Pterostylis cycnocephala	Resprouter		Seed				Indefinite		Benson & McDougall (2005).
Pterostylis daintreana	Resprouter		Seed			<1	Indefinite	Fruiting within 31 weeks of high	Benson & McDougall (2005).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								intensity fire.	
Pterostylis longifolia	Resprouter		Seed			<1	Indefinite	Flowering 24-33 weeks after high intensity fire.	Williams (1998), Benson & McDougall (2005).
Pterostylis obtusa	Resprouter		Seed				Indefinite		Williams (1998), Benson & McDougall (2005).
Pultenaea altissima			Seed						
Pultenaea dentata			Seed						
Pultenaea flexilis	Obligate Seeder	Prolific after fire from soil stored seedbank	Seed					Killed	Benson & McDougall (1996).
Pultenaea hartmannii	Obligate Seeder		Seed						
Pultenaea linophylla	Obligate Seeder	Soil stored seedbank	Seed					Killed	Benson & McDougall (1996).
Pultenaea polifolia		Seed viability 90-100%, non-dormant fraction 10-19-59%.	Seed	Seed hard-coated seed.				Probably killed.	Auld & O'Connell (1991), Benson & McDougall (1996).
Pultenaea pycnocephala	Obligate Seeder	Soil stored seedbank	Seed					pers. obs.	
Pultenaea retusa	Obligate Seeder		Seed					Killed	Benson & McDougall (1996), NPFR.
Pultenaea stuartiana	Obligate Seeder		Seed						
Pultenaea villosa			Seed						
Pyrrosia rupestris	Obligate Seeder		Spores					Probably killed. Spores.	Benson & McDougall (1993), Chesterfield et al. (1991), NPFR.
Quintinia sieberi	Resprouter							Stems killed, resprouts from base	Benson & McDougall (1995).
Ranunculus inundatus			Fruit (achene)						Benson & McDougall (2000).
Ranunculus lappaceus	Resprouter		Fruit (achene)	Morphology for dispersal by					Benson & McDougall (2000).

Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
				adhesion.					
Rhodanthe anthemoides	Obligate Seeder				1-Feb				Williams (1998).
Rhytidosporum procumbens	Resprouter							One plant resprouted and flowered <10m after high intensity fire, but most plantswere seedlings.	Benson & McDougall (1999).
Ripogonum album			Berry (black)						Benson & McDougall (2005).
Rosa rubiginosa	Obligate Seeder		Fruit (fleshy Red)	Bird dispersed. Coloniser of previously cleared land.					Benson & McDougall (2000).
Rostellularia adscendens	Obligate Seeder				1				Williams (1998).
Rubus fruticosus	Obligate Seeder		Infructesence						
Rubus moluccanus			Infructescence	Fleshy edible fruits, vertebrate adapted dispersal.					Benson & McDougall (2000).
Rubus parvifolius	Resprouter		Infructescence	Attractive fleshy edible fruits, vertebrate adapted dispersal. Vegetative spread.			Indef.	Probably resprouts.	Benson & McDougall (2000).
Rubus ulmifolius			Infructescence	Animal dispersed. Vegetative spread by layering of arched canes.					Benson & McDougall (2000).
Rumex brownii	Resprouter					<5m		Resprouted after high intensity fire.	Benson & McDougall (1999).
Sacciolepis indica	Obligate Seeder		Fruit (dry indihiscent 1		<1		<1		Benson & McDougall (2005).

			seeded)						
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Sarcochilus falcatus	Obligate Seeder		Seed						Williams (1998).
Sarcopetalum harveyanum	Resprouter	Reproduction by both sexual and vegetative means, by seed propagation in 1st year.		Seeds dispersed by animals.			<5	Resprouts from base after high intensity fire. Survives 100% scorch - basal sprouts.	Benson & McDougall (1997), NPFR, Clarke (1989).
Schizaea bifida	Resprouter							From underground rhizome	Benson & McDougall (1993).
Schizaea dichotoma	Resprouter							From at or below ground level	Benson & McDougall (1993), Fox (1988).
Schizomeria ovata	Resprouter							From base after high intensity fire	Benson & McDougall (1995), Williams (1998).
Schoenus apogon	Variable							Variable, obligate seeder and facultative and obligate seeder. Secondary juv. period <9m after intense autumn fire. 1st recorded 3m after fire in wet forest, 1m after fire in grassy forest.	NPFR, Dickinson & Kirkpatrick (1987), Lunt (1990).
Schoenus melanostachys	Resprouter							Obligate resprouter.	NPFR.
Schoenus turbinatus	Resprouter								
Scirpus polystachyus	Resprouter								
Scleranthus	Obligate Seeder			No particular					

biflorus				dispersal morphology.					
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Scleria mackaviensis	Obligate Seeder								
Scutellaria humilis	Obligate Seeder								
Secale cereale	Obligate Seeder				<1		<1		Benson & McDougall (2005).
Senecio amygdalifolius	Obligate Seeder		Fruit (achene)						
Senecio bathurstianus	Obligate Seeder		Fruit (achene)						
Senecio bipinnatisectus	Obligate Seeder		Fruit (achene)						
Senecio biserratus	Obligate Seeder		Fruit (achene)	Wind-dispersed.	<1		1		
Senecio diaschides	Obligate Seeder	Many after fire	Fruit (achene)	Wind-dispersed.				Killed, many seedlings after fire. Seedlings grow vigorously after fire.	Benson & McDougall (1994), NPFR, Benson & McDougall (1994).
Senecio hispidulus	Obligate Seeder		Fruit (achene)						
Senecio lautus	Obligate Seeder	Germination 80%.	Fruit (achene)	Probably wind-dispersed.	<1				Williams (1998).
Senecio linearifolius	Obligate Seeder	Germination 75%.	Fruit (achene)	Wind-dispersed, possibly also water-dispersed. Possibly colonises disturbed sites.	<1		<5	Killed by crown fire or partial burn: regeneration from soil-stored seed.	Gill (1981), NPFR, Clarke (1989).
Senecio minimus	Variable		Fruit (achene)	More easily in bare soil.				Obligate seeder (C,I). Resprouter. Roots and shoots survive & resprout next season.	Dickinson & Kirkpatrick (1987), Cremer & Mount (1965), Gill (1981), NPFR.
Senecio prenanthoides	Obligate Seeder		Fruit (achene)	Probably wind-dispersed.					

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Senecio quadridentatus	Obligate Seeder	Germination fire related. Germination 95%.	Fruit (achene)	Probably wind-dispersed. Recruitment fire-related.	< 1yr			Killed, recruitment fire related. Therophyte. Seedlings recorded <1yr after fire.	Harden (1992), Benson & McDougall (1994), Purdie & Slatyer (1976), Purdie (1977), Gill (1981), NPFR.
Senecio tenuiflorus	Obligate Seeder		Fruit (achene)						
Setaria verticillata	Obligate Seeder		Fruit (dry indihiscent 1 seeded)	Retrosely barbed seeds readily adhere to clothing and animal coats, aiding dispersal.	<1		<1		Lazarides & Hince (1993), Benson & McDougall (2005).
Sigesbeckia orientalis	Obligate Seeder	Vigorous immediately after fire			< 1yr			Killed, germinates vigorously from soil stored seed emmediately after fire, will flower within 11 wks to 4 m and may fruit within 16 wks	Benson & McDougall (1994), NPFR.
Sisyrinchium sp. A	Obligate Seeder				1				Williams (1998).
Smilax australis	Resprouter	Reproduction sexual, reproducing by seed propagation between 1-5yrs.	Fruit (black berry)	Seeds dispersed by animals, vertebrates & ants.				Survives 100% scorch - basal sprouts. Prolific flowering after fire. Flowers all year round. Vigorous growth after high intensity fire.	Melick & Ashton (1991), NPFR, Jones (1983), Clarke (1989), Benson & McDougall (2005).
Smilax glyciphylla	Resprouter		Fruit (black berry)	Dispersed by Pied Currawong, also ant adapted.		1		Survives 100% scorch - basal sprouts.	NPFR, Benson & McDougall (2005).
Solanum	Obligate Seeder								

campanulatum									
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Solanum cinereum	Obligate Seeder								
Solanum elegans	Obligate Seeder								
Solanum nobile	Obligate Seeder								
Solanum prinophyllum	Obligate Seeder				2-Apr				Williams (1998).
Solanum stelligerum	Obligate Seeder	Reproduction sexual, reproducing by seed propagation between 1-5yrs.		Seeds dispersed by animals.				Regeneration from seed in soil.	Clarke (1989), Williams (1998).
Solenogyne bellioides	Resprouter							Probably resprouts from ground level or below	Benson & McDougall (1994).
Sonchus asper	Obligate Seeder	Within first year after fire.						Therophyte. Successful post-burn seed coloniser.	Purdie & Slatyer (1976), Dickinson & Kirkpatrick (1987), Purdie (1977), NPFR.
Sonchus oleraceus	Obligate Seeder.			Seeds dispersed by wind.	1				Lunt (1990), Clarke (1989).
Sorghum leiocladum	Resprouter		Fruit (dry indihiscent 1 seeded)		1				Williams (1998), Benson & McDougall (2005).
Spiranthes sinensis	Resprouter		Seed				<5	Self pollinating.	Williams (1998), Benson & McDougall (2005).
Sporobolus creber	Resprouter		Fruit (dry indihiscent 1 seeded)	No particular morphology for dispesal.	1	<1		Flowering within 4 m of high intensity fire.	Williams (1998), Benson & McDougall (2005).
Sporobolus elongatus	Resprouter		Fruit (dry indihiscent 1 seeded)	No particular morphology for dispersal.	1				Williams (1998), Benson & McDougall (2005).
Stackhousia monogyna	Variable							Obligate Seeder (CH, BU). Facultative resprouter (W,	Lunt (1990), NPFR, Williams (1998).

								WO, E?). 100% scorch kills - soil seed storage.	
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Stackhousia viminea	Obligate Seeder				1-Feb				Keith (1996), NPFR.
Stellaria flaccida	Obligate Seeder		Seed	Stem fragments that take root. Coloniser.	1			Probably killed.	Melick & Ashton (1991), Jarrett & Petrie (1929), NPFR, Benson & McDougall (1995).
Stellaria media	Obligate Seeder				1				
Stephania japonica	Resprouter	Reproduction both sexual and vegetative, by seed propagation in first year.		Seeds dispersed by animals.			<5	Facultative resprouter - from base after high intensity fire.	Benson & McDougall (1997), NPFR, Clarke (1989).
Streblus brunonianus	Resprouter								Williams (1998).
Stylidium graminifolium	Variable							Obligate Seeder (E). Obligate and facultative resprouter. Root resprouter. Fire resistant decreaser. Non-clonal decreaser. Soil seed bank.	Leigh & Holgate (1979), Purdie & Slatyer (1976), Kirkpatrick (1984), Puride (1977), Purdie (1977), Benwell (1998), NPFR.
Stylidium laricifolium	Obligate Seeder								
Stypandra glauca	Resprouter	Viability of fresh seed 71%.	Seed					Facultative resprouter. Survives 100% scorch - basal sprouts.	NPFR. Roche et al. (1997).
Styphelia triflora	Obligate Seeder			Within 15 m of high intensity fire				Killed	Benson & McDougall (1995).
Styphelia viridis	Obligate Seeder	From soil stored seed						Killed	Fox (1988), Van Steenis

									(1934).
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Swainsona fraseri	Obligate Seeder								
Swainsona reticulata	Obligate Seeder								
Synoum glandulosum	Resprouter	w/o treatment. Seedling growth slow.		?Bird dispersal.				Facultative resprouter, from base after high intensity fire. Lignotuber in <5yrs.	Benson & McDougall (1997), NPFR, Williams (1998).
Syzygium australe	Resprouter	Germination period 15-35 days. Viability only 1-3 m.	Fruit (Red)	Bird & water.			100-200	Lignotuber absent in seedlings.	Benson & McDougall (1998), Williams (1998).
Taraxacum officinale			Fruit (achene)	Wind-dispersed many kilometres.				Probably resprouted. Flowering within 11 wks and fruiting within 25 wks of high intensity fire.	Benson & McDougall (1994).
Tasmannia stipitata	Resprouter								
Tetrarrhena juncea	Resprouter		Fruit (dry indihiscent 1 seeded)					Flowers most of the year.	Benson & McDougall (2005).
Tetrastigma nitens	Resprouter								Williams (1998).
Tetratheca thymifolia	Variable							Soil stored obligate seeder. Seedling regenerator. Facultative resprouter. Clonal increaser.	Fox & Fox (1986), Bradstock et al. (1997), Benwell (1998), NPFR.
Thelionema caespitosum	Resprouter		Seed			2		Flowering & fruiting 2 yrs after high intensity fire.	Benson & McDougall (2005).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Thelionema grande	Resprouter		Seed						
Thelychiton gracilicaulis	Resprouter		Seed				Indefinite		Benson & McDougall (2005).
Thelychiton kingianus	Obligate Seeder		Seed						Williams (1998).
Thelychiton tarberi	Resprouter		Seed						Williams (1998), Benson & McDougall (2005).
Thelymitra ixioides	Resprouter		Seed				Indefinite	Self compatable.	Benson & McDougall (2005).
Thelymitra pauciflora	Resprouter		Seed			1	Indefinite	Flowers open on hot, sunny, humid days. Self compatable.	Benson & McDougall (2005).
Themeda triandra	Resprouter	Primary dormancy usually breaks slowly with storage up to 12 m ormore. To break dormancy, seeds need cold 4C for at least 1 month. Total germination 100 days.	Fruit (dry indihiscent 1 seeded)	Dispersal by adhesion, also by gravity. Coloniser of bare clay banks & slopes.	1	1	Indefinite	Non-clonal decreaser. Soil seedbank. Survives 100% scorch - root suckers. Flowers in response to rain & temperature. Flowers c. 12 after high intensity fire.	Benson & McDougall (1994), Rowley & Brooker (1987), Lunt (1990), NPFR, Benson & McDougall (2005).
Thysanotus tuberosus	Variable							Obligate seeder (E?). Facultative resprouter (I, WO). Obligate resprouter (W, P). Common in areas burnt severly 2 years ago.	Bradfield (1981), Fox (1974), Benwell (1998), NPFR.
Toona ciliata	Obligate Seeder				8-Dec			Fire sensitive	Conroy (1996), Williams (1998).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Trachymene incisa	Resprouter				1				Williams (1998).
Trachymene sp. nov.	Respouter							Swollen stems usually protected between rocks: pers obs	
Tricoryne elatior	Resprouter	fresh seed : 0% germination. 76% initial viability.						Facultative resprouter. Veg. regrowth. Survives 100% scorch - basal sprouts. soil stored seed.	Lunt (1991), Clancy (1981), Roche et al. (1997), Benwell (1998), NPFR, Williams (1998).
Trifolium campestre	Obligate Seeder				1		<1		Lunt (1990).
Trifolium repens	Obligate Seeder	Usually germinates in autumn.		No particular morphology for dispersal. Dispersed in mud on cars, & by wind, animals & humans.					
Tripogon loliiformis	Obligate Seeder								
Trochocarpa laurina	Resprouter	Needs long period of dormancy						From base after high intensity fire, from stem and branches after low intensity fire	Floyd (1989), Benson & McDougall (1995).
Urtica incisa	Resprouter							Prolific after fire, eg. Tasmania.	Gill (1981), Melick & Aston (1991).
Utricularia dichotoma	Resprouter	Recruitment mainly after fire.						Facultative resprouter. 100% scorch kills (BW) - soil stored seed. Carnivorous herb.	Benson & McDougall (1997), NPFR.

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
Velleia paradoxa	Resprouter							Veg. regeneration.	Lunt (1990).
Verbascum thapsus	Obligate Seeder				2				Williams (1998).
Verbena bonariensis	Obligate Seeder				1				Williams (1998).
Veronica calycina	Resprouter								Williams (1998).
Viola betonicifolia	Resprouter				1				Williams (1998).
Viola hederacea	Variable	Reproduction sexual and vegetative, reproducing by seed propagation in the first year.		Seeds dispersed by expulsion. Vegetative dispersal by landslip.			<5	Facultative resprouter from rhizomes. Obligate seeder. 100% scorch kills - soil stored seed.	Hamilton et al. (1991), Bradfield (1981), Jarrett & Petrie (1929), NPFR, Clarke (1989).
Vulpia bromoides	Obligate Seeder		Fruit (dry indihiscent 1 seeded)	Adhesive for dispersal. In mud on cars.	1	<1	<1	Increased 100-fold after an autumn fire. Significantly different mean number of plants between burnt & unburnt areas. Flowering within 10 m after high intensity fire.	Lunt (1990), Benson & McDougall (2005).
Wahlenbergia ceracea				Diaspore: seed.					
Wahlenbergia communis	Obligate Seeder	Soil-stored seedbank. Coloniser.		Diaspore: seed. Wind-dispersed. No particular dispersal morphology.	3-6m			Killed, flowers within 15 wks, flower and fruit 10 months high intensity fire	Benson & McDougall (1995), NPFR, Fox (1988), Benson & McDougall (1995).
Wahlenbergia gracilis	Variable			Seeds dispersed by expulsion.	< 1yr			Probably killed by high intensity fire, flowering within 4 m and fruiting	Benson & McDougall (1995), NPFR, Clarke (1989).

Species	Response	Germination	Diaspore	Disp. & Estab.	Longev.	1 Juv	2 Juv	Notes	Refs
								within 6 m of fire. Regenerates after crown fire & partial burn by resprouting above ground.	
Wahlenbergia graniticola	Obligate Seeder	Vigorous to regular fire			< 1yr			Will respond to regular burning	Benson & McDougall (1995).
Wahlenbergia luteola	Obligate Seeder			Diaspore: seed, mobile.					
Wahlenbergia stricta	Obligate Seeder				1				Williams (1998).
Wurmbea biglandulosa	Resprouter								
Wurmbea dioica	Resprouter							Regenerative strategy uncertain. Perennial. Flowered during spring/summer 9m after intense autumn fire.	Lunt (1990).
Xanthorrhoea acaulis	Resprouter								Williams (1998).
Xanthorrhoea glauca	Resprouter								
Xanthorrhoea johnsonii	Resprouter								Williams (1998), Benson & McDougall (2005).
Xanthorrhoea macronema	Resprouter							Flowers abundantly only after fire.	Gill (1981), Benson & McDougall (2005).
Xanthosia pilosa	Variable							Different forms will either resprout or are killed outright	Benson & McDougall (1993).
Xerochrysum	Obligate Seeder	Disturbance related, fire or	Fruit	Wind-dispersed.	1			Probably killed.	Benson & McDougall

bracteatum		other							(1994), Williams (1998).
Species	**Response**	**Germination**	**Diaspore**	**Disp. & Estab.**	**Longev.**	**1 Juv**	**2 Juv**	**Notes**	**Refs**
Xyris complanata	Resprouter		Seed			1	Indefinite	Flowers usually remain open from 10 am till 4 pm.	
Xyris gracilis	Resprouter		Seed			1	Indefinite		
Xyris operculata	Resprouter		Seed			1	Indefinite	Recruitment mainly after fire.	Benson & McDougall (2005).
Zieria cytisoides	Obligate Seeder		Seed	Seed dispersed ballistically from dehiscent segmented fruit.					
Zieria fraseri	Obligate Seeder		Seed	Seed dispersed ballistically from dehiscent segmented fruit.					Benson & McDougall (2001).
Zieria smithii	Obligate Seeder		Seed	Seed dispersed ballistically from dehiscent segmented fruit. Also myrmecochorous.				Obligate seeder after hot fire.	Fox & Fox (1986), Benson & McDougall (2001).

3.8.2 Autecological observations of *Muehlenbeckia costata*

Muehlenbeckia costata populations were only found on granitic outcrops burnt in the 1994 fires at altitudes above 1100 m. Populations occurred within Bald Rock and Girraween National Parks (BR). Prior to these fires no individuals had ever been recorded in Bald Rock National Park. Adjacent unburnt patches on the same outcrops had no germination of this species. In addition, this species was only found on the largest of the rocky outcrops within any region, and these outcrops were mostly over 10 ha in area. When *M. costata* was found on smaller outcrops, these were satellite outcrops in close proximity to the larger outcrops bearing populations. In no instance has a single germination ever been seen in localities off outcrops.

In early February 1995, only four months after the passage of wildfire, individuals of *M. costata* had already spread 2 m in all directions from the central root and were flowering. Flowering was noted in all individuals and fruiting in all female plants on all occasions, including during all monthly visits to populations within Bald Rock National Park, and it is assumed that flowering and fruiting are continuous from about three months after germination until senescence. Individuals of this species were found to extend up to 5 m from the central rootstock in any direction and clamber up the stems of nearby plants to a height of 4 m. A single plant is able to dominate an area 10 m in diameter and 4 m vertically when mature.

By June of 1996, most plants in all localities had senesced, almost two years after original germination. Individuals that had not died were present only as small *c.* 20 cm long shoots, resprouting at the central taproot. Persistent plants were still flowering, but a heavy infestation of a rust fungus was noted on all plants immediately prior to, and during, the senescence of plants.

3.8.3 Seed germination of *Muehlenbeckia costata*

Viability tests indicated that 63% of *Muehlenbeckia costata* were viable. A total of 34 seeds (6%) of *M. costata* germinated. Due to the low number of germinations the results of treatments were pooled into two treatments ‘smoked’ and ‘non-smoked’. Twenty-nine seeds germinated after being treated with smoke (17 after scarification and heating to 80°C) with only five seeds germinating without smoke treatment all of which were also unscarified and not heat treated. However, the null hypothesis that germinations were not different could not be rejected as the differences were found to be insignificant ($P = 0.072$; *t* test). Plants growing from those seeds that germinated flowered within 3 months after radicle appearance (plants 5 cm in length) and continued to flower until senescence at around 18 months.

3.8.4 Multivariate analyses on species composition

The floristic species composition of outcrops before and after treatment and on previously unburned, cleared and reburned plots is significantly different from that of any of the forest plots. The first division on the dendrogram is between forest plots and outcrop plots. This is then followed by a less distinct separation between the two experiments conducted on outcrops. Temporal plots from each site and treatment clustered together within the analyses.

The ordination analysis and scatter plot clearly show the forest sites distinctly allied to each other and separated from the outcrop sites. Although there is evidence to suggest that the two experiments conducted on outcrops were separated in the ordination, this is less distinct. Some widely separated sites (outliers) within the scatter plot are evident and all are from the reburned fire trials on outcrops indicating that this experiment led to some major changes in floristic composition and abundance over the period of the trial. The results of the ordination corroborate those of the dendrogram indicating that the results are robust.

Overall, Monte Carlo significance testing (999 iterations) of the first canonical axis and the overall test on trace are highly significant ($P<0.001$) for all three CCA's. The first canonical axis accounts for 77.9%, 64.7% and 55.6% for Experiment 1, Experiment 2 and Experiment 3 respectively. Site locality was the strongest explanatory component of species composition and cover, along with two treatments of more minor explanatory power in each of the CCA's conducted on the three experiments (Figure 9.9). The correlation of site locality and composition is more clearly discernible in Experiment 2 than Experiment 1 and more effective in outcrop sites in general than forest sites (i.e. as indicated by the clumping of sites along the locality vectors).

The treatments of ‘control’ and ‘burning’ were significantly correlated with the CCA ordination of Experiment 1. The treatments of ‘clearing’ and time-since-fire (TimeFire) were insignificant in this analysis. The ‘burning’ treatment was more effective within plots on Outcrop 2. ‘Control’ plots were more distinct from cleared or burnt plots within Outcrop 3.

In addition to site locality, the ‘control’ treatment and the recorded time-since-fire (TimeFire) were significant in explaining ordination position, however the ‘burning’ treatment was insignificant. Both ‘control’ and time-since-fire (TimeFire) were more positively correlated with Site 3.

The CCA ordination of the forest plots indicates that the treatment of ‘burning’ and, less significantly, time-since-fire (TimeFire) were important in site distribution. Unlike the outcrop plots however, the ‘control’ treatment was insignificant in analyses of forest plots.

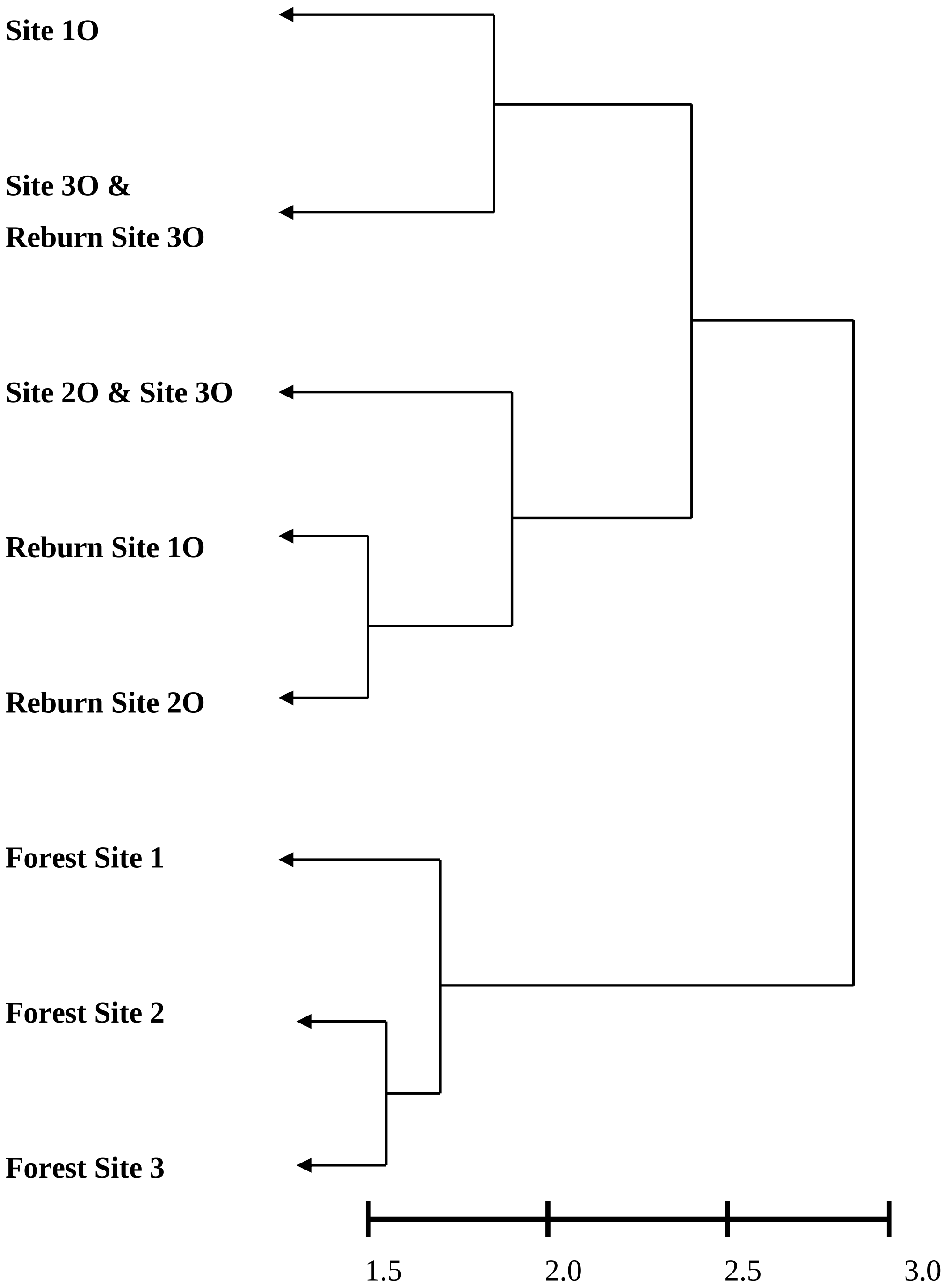


Figure 79: Summary dendrogram of eight floristic groups based on Kulczynski association and flexible UPGMA fusion classification of all temporal fire experimental plots (402 in total). The full dendrogram is given in Appendix G.

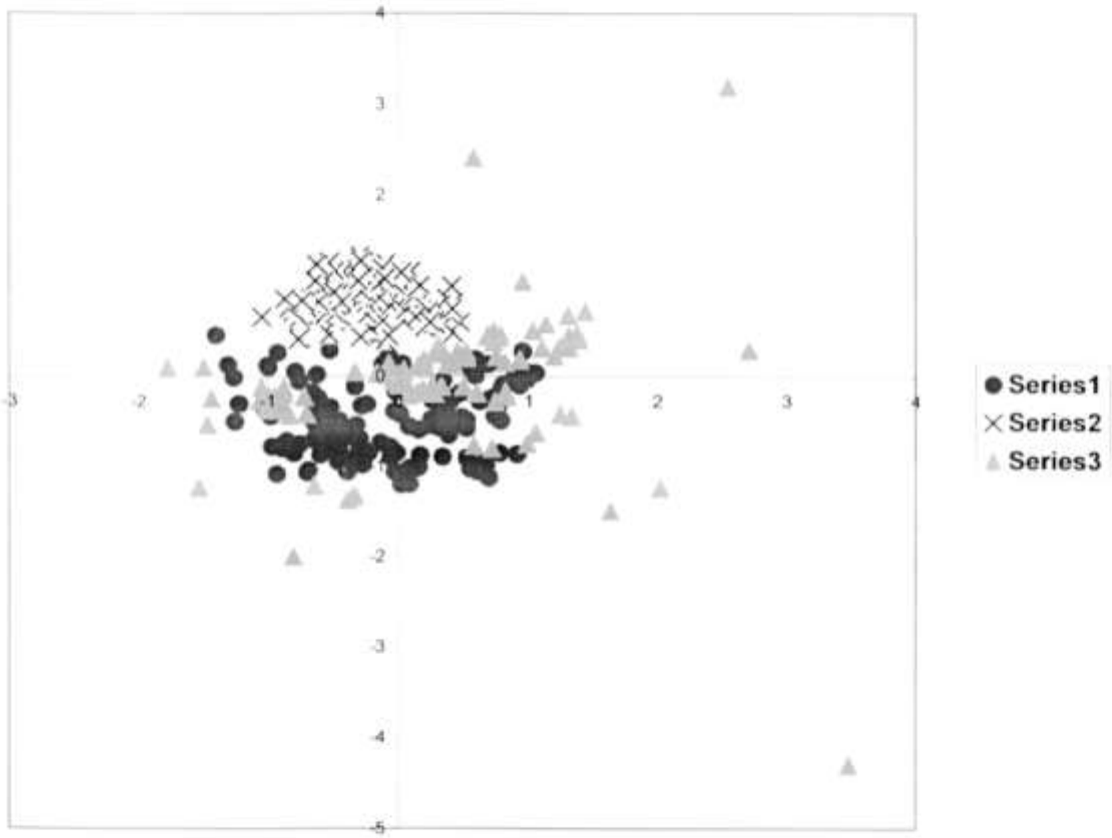


Figure 80: Ordination scatter plot of all temporal plots (402) based on full floristics and analysis by Flexible UPGMA association measure and Semi-Strong-Hybrid Multi-dimensional Scaling. Series 1 = burned outcrop plots; series 2 = burned forest plots; series 3 = reburned outcrop plots.

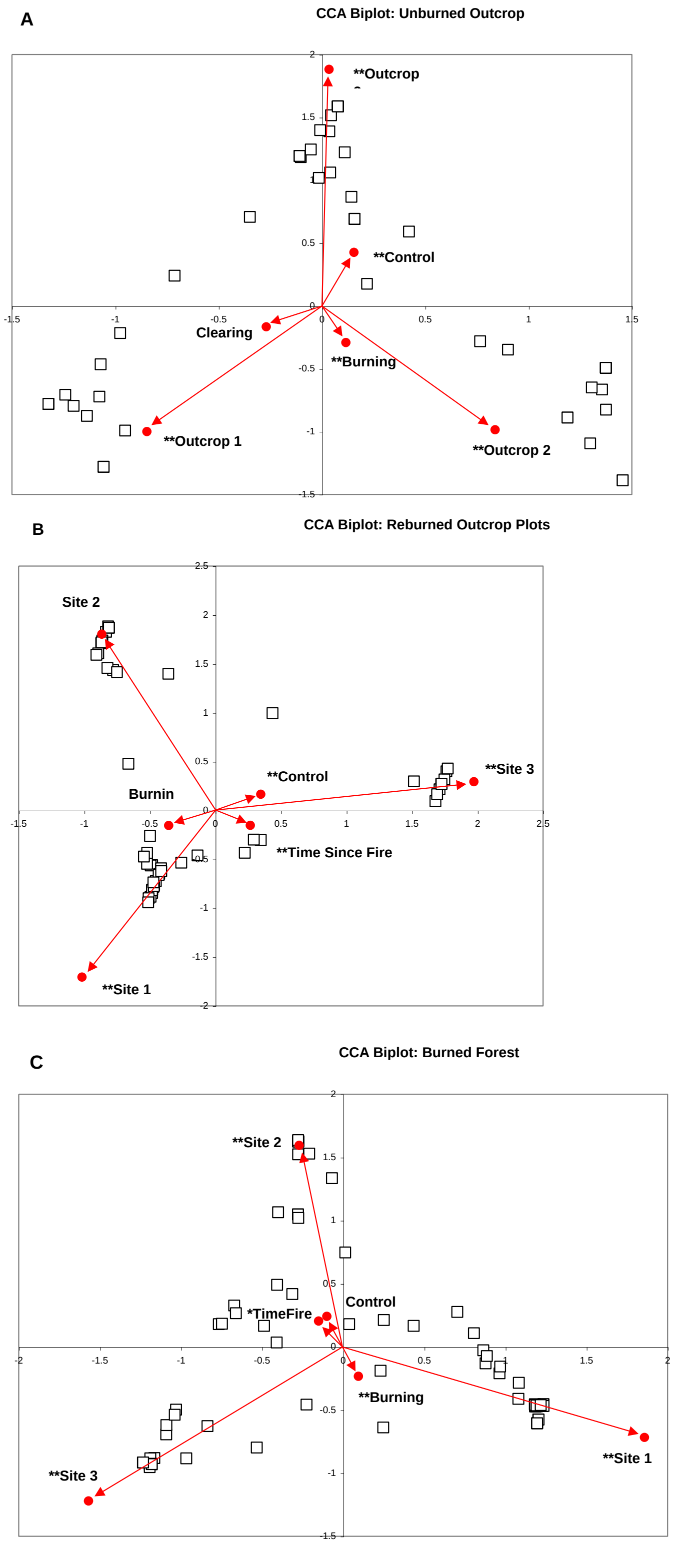


Figure 81: Biplots of CCA results of the significant variables chosen by forward selection and Monte Carlo significance testing against sites (squares). Significance of variables based on Monte Carlo simulations are; **P<0.001, *P<0.01, no * variable insignificant. A) unburned outcrop plots. B) reburned outcrop plots. C) burned forest plots. The length of the lines indicates the strength of the relationships.

3.8.5 Univariate analyses on richness and diversity

ANOVA analyses performed on species richness and diversity before and at the end of the experimental trials (Po – Px) were insignificant and are therefore not presented. Species richness declines across most replicates in all experiments initially after burning. The initial drop in species richness is most marked in Experiments 1 and 2 (outcrop plots) and in particular in Experiment 2 (outcrops previously burned the year before). The difference between the initial and end species richness in burning treatments is mixed and non-significant, however in most treatments richness returns to a level comparable to pre-treatments. Species diversity as measured by Simpson's *D* in most instances does not return to the pre-burning treatment diversity in Experiments 1 and 2 (outcrop plots) but appears to be more variable in Experiment 3 (forest plots). Species accumulation occurs in most plots over time after burning. This is most pronounced in Experiment 3 (forest plots).

Clearing as a treatment only occurred in Experiment 1. Although non-significant, most plots decreased in richness by a small amount over the period of the trial. A sudden initial decrease in richness after treatment was not as apparent as in the burning trial. Although species richness overall decreased in most plots, some species accumulation still occurred over time. Species diversity changed throughout the period of the experiment in this treatment.

The species richness of control treatments changed over time in most plots. This was less pronounced in Experiment 1 but more so in Experiment 2 and clearly so in Experiment 3. In Experiment 1, species diversity is highly variable over time, in contrast to species richness. Variability in species diversity although less pronounced also occurs in Experiments 2 and 3. Species accumulation increased in most control treatment plots over time, however this was less pronounced in Experiment 1, where at least half of the plots had no increase in species numbers.

3.8.6 Regeneration strategies between habitats

Species have two major responses to fires, namely obligate resprouting or obligate seeding (Gill & Bradstock 1992). Resprouting species are believed to be more commonly associated with fire prone environments and obligate seeders with environments with a low fire frequency (Gill & Bradstock 1992). The responses of species to fire in terms of these two responses were collected via anecdotal observations and during the fire trials. This information is held in an unpublished interactive identification database (DELTA) (Dallwitz 1980; Dallwitz *et al.* 1993) of granitic occurring species created by the author. There is a substantially greater percentage of obligate seeders in the flora of granitic outcrops as compared to the flora that surrounds outcrops.

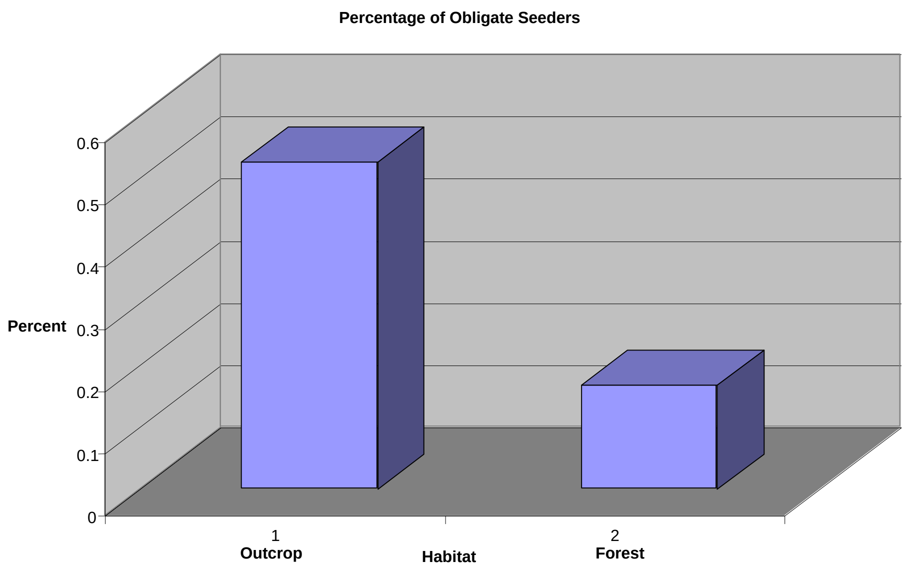


Figure 82: Overall percentage of obligate seeders represented in the outcrop and forest floras sampled during the fire trials at Bald Rock National Park.

Discussion

4.1 Floristic and environmental relations

A total of 898 taxa (*c.* 17% of the state flora) were found within the reserve. This is of great significance as there is only one rock type that describes both parks. Additionally, apart from the current survey of Gibraltar Range and Washpool National Parks, all other surveys with greater species recovery are surveys of entire management areas. The current number of taxa could be increased significantly in the second stage of the survey. Site richness was comparatively high with most sites considered species rich. Most 0.1 ha plots had 50 and 60 taxa. A number of sites had a richness of over 70 taxa. This is in contrast to the results of Clarke (1998) who surveyed 0.1 ha sites within Boonoo Boonoo National Park yet only recovered an average of 38 species per plot. The differences are probably due to the lack of experience of the team members who were all undergraduate students. The richness found during this current investigation is similar to the results of Clarke *et al.* (1998) for the Torrington region and Hunter (1999) for forests along the eastern escarpment. However it is above the richness of similar communities surveyed by Binns (1994) in nearby areas, Hunter (1998) in the Washpool National Park Western Additions and much higher that found by Hunter and Alexander (1999) for Guy Fawkes River National Park. These differences may in fact be rock type mediated. As both Torrington and Bald Rock and Boonoo Boonoo are wholly granite areas but the other regions are predominantly metasediments and acid volcanics. Region wide analysis could clear this matter.

The significant environmental correlations highlight many of the general trends that occur throughout the north east. The strongest factor is a moisture or drainage gradient that affects the overall floristics. This is one of the most noticeable affects along the eastern escarpment and is often colinear with Altitude. Other significant environmental factors included slope, soil depth and protection as indicated by protection from higher lands. Clearing was also an important factor effecting the association of species in some assemblages.

Analyses of evenness has highlighted that the disjunct communities, in particular Community 3-5 have a high to almost perfect evenness score indicating that no species dominate these assemblages. This suggests that each occurrence is likely to have different dominants. The more widespread communities are also dominated by species that are common to all parts as indicated by the lower evenness scores. This same pattern was shown in similar communities within the Guy Fawkes River National Park by Hunter and Alexander (1999).

4.2 Comparison with previous work

A very large number of floristic surveys and predictive analyses have been performed for communities within the north east and on areas covered by the current reserve boundaries. Some of the more recent full floristic surveys and analyses are very comparable to the results presented here. Communities predicted by forest type, aerial photography interpretation and predictive analyses are less comparable to what was actually found within the reserve. In particular these models and API investigations have neglected to recognise specialised and highly disjunct communities that are the most significant communities in terms of rare taxa and overall floristic conservation significance.

Clarke (1998) undertook an investigation to sample a broad range of sites that were representative of the southern section of Boonoo Boonoo National Park and to produce a classification of the vegetation based on numerical analysis. Despite the intent, the classification presented by Clarke (1998) lacks a true local and regional context that makes the communities unrealistic in terms of those described here. Five vegetation types are described, one of which was subjectively defined. Many of the specialised communities, as with many large scale investigations were ignored, such as the riparian habitat and outcrops. Two of the communities were stated as occurring predominantly below 1000 m, yet only a few hectares below 1000 m exist within the southern section of Boonoo Boonoo. Overall the investigation is of little comparative use due to its limited size and limited area of study; but does supply some useful records and distributional information.

Gilmour (1993) sampled and described the closed forest community below the Boonoo Boonoo Falls and placed this community in context of other closed forest remnants in the Clarence Valley. The community as described by Gilmour (1993) is completely compatible with the results obtained during this investigation. The community as found within the reserve however does not fit clearly into Floyds (1990) rainforest communities of New South Wales. Broadly though it has affinities with dry closed forests and is therefore broadly similar to other communities described for deep gorge country along the escarpment. A similar pattern of highly unique species associations that do not conform to published types was found within the gorge country of Guy Fawkes River National Park by Hunter and Alexander (1999).

Forest typing has occurred a number of times within both reserves but the most recent of which is that completed for NRAC (1996). However due the emphasis on a few dominant trees this method of classification usually poorly corresponds within communities defined by numerical analysis. Fourteen communities were mapped for Bald Rock and Boonoo Boonoo National Parks. Broadly all of these could be considered to occur within the two reserves however, their distribution does not match the map produced for this report. As with broad scale mapping in general small and highly significant communities not dominated by trees are completely ignored and in areas where this may occur over larger areas the regions are generally classed as untyped.

Forest type 152 dominated by *E. obliqua* and *E. brunnea* was considered a priority for reservation within the region and was surveyed for by Richards (1996). This forest type was found within Community 9 and is worthy of comment here, particularly since it was not recognised to occur in the mapping carried out by NRAC in 1998. Richards (1996) describe this forest type as occurring in high rainfall, elevated and cool situations with moist soils. Richards (1996) did not find this forest type in areas predicted and considered the area of this community reserved was an overestimate. However, Hunter (1998) found this forest type within a large proportion of the Washpool National Park Western Additions and Hunter & Alexander (1999) has also found it within Guy Fawkes River National Park. Based on this it is likely that this forest type is more widespread and that the reservation status of this forest type has increased considerably

4.3 Fire

Fire is a natural component of many communities within Australia, particularly for the south east. A lot of research has been conducted over recent years into the effects of fire regimes (in terms of frequency, intensity and seasonality) on individual species and communities as a whole. Most of this research has centred on temperate communities such as coastal forests and heaths, tablelands and alpine areas. This research is often habitat and site specific and the usefulness of the findings to other areas, even somewhat synonymous ones, is debatable. Table 5 shows the responses of many of the Bald Rock and Boonoo Boonoo National Parks species to the effects of fire. Several of these recorded responses are anecdotal and/or contradictory. The contradictory nature of these observations may be based on miss-classification of functional type, the taxa in question being a complex of yet undefined entities or as some recent research suggests plant age (Hansen *et al.* 1991), seed age and dormancy requirements (Roche *et al.* 1997: Hunter *et al.* 1998) and local population differences (Benwell 1998; Hunter 1999). Such differences may exist in nearby or the same sites. The application of fire regimes at the community level based on the culmination of the responses of individual taxa, is of debatable use. However, from the literature and the responses of individual taxa broad general statements can be formulated for many communities. These suggestions should then be modified to suite the local variation in responses, as data that is more specific becomes available. This can only be achieved by constant monitoring.

4.3.1 Closed forest and fire

Community 5 is a closed forest community and Community 6 has many closed forest affinities in its representative taxa and both are refugial in nature. They are at present confined to creeks in protected gullies. Even with both combined the total area is only few hectares. Fire frequency on the surrounding gorge woodlands has probably limiting the expansion of these communities into the surrounding areas. There is at present some room for expansion of closed forest territory and if this is an objective then fire frequencies will need to be lowered around these communities in order to promote expansion. Fires should be excluded from closed forest communities indefinitely and from around their margins as much as possible.

4.3.2 Fire and granite outcrops

Both cluster analysis and ordination of the 402 temporal fire plots show the flora within outcrop plots is distinct from those of the surrounding forests. This difference is found even after burning and clearing treatments. The distinctiveness of the flora in Experiment 3 from forest plots was evident even with fires occurring in two consecutive years (one natural and one experimental). However, published evidence suggests that under a continuous frequent burning regime the flora of outcrops may lose their distinctiveness. For example, Binns (1992) found that a high frequency of fire on granitic outcrops, in the same region, caused heaths that were dominated by outcrop endemic taxa to be reduced to grasslands and herbfields dominated by ubiquitous species such as *Lomandra longifolia* and *Imperata cylindrica*. Hunter *et al.* (1999) has made similar anecdotal observations at Demon.

Of particular note in the dendrogram and scatter plot, is the groupings of temporal plots in analyses, despite the treatments imposed. This result is complemented in the CCA biplots that show site locality as the most significant and strongest explanatory variable. It can be concluded that, regardless of treatment, initial floristic composition is the most important factor in structuring the composition after the imposition of each treatment. In addition, as site was the most important factor in each analysis, and plots from each site largely grouped together, the surrounding species pool is also of considerable importance. Responses to the treatments imposed were individualistic and based on the surrounding species pool available at each site (outcrop or forest area) and the initial composition of each plot. Similar results have been obtained in many Australian systems and illustrate the ‘initial floristic composition’ model (Engler 1954), where the initial species composition after a disturbance determines the subsequent composition (Purdie 1977; Noble & Slatyer 1981; Clark 1988; Williams & Gill 1995). This is a surprising result as all sites are within relatively close proximity, being within only a few kilometres of each other and subsequently within the same Element and community.

The individual treatments (burning, clearing, control and time-since-fire) varied in the strength and significance of their effects at different localities. This indicates an individualistic response to the treatments at each site that is due to initial species composition, thus reinforcing the above observations. Formulating strategies or responses of communities with unsurveyed floristic composition are almost impossible, regardless of their overall affinities or structure. On the other hand if initial species composition is known and sufficient information exists on species responses to treatments (such information does not exist at present), reliable predictions may occur.

In Experiment 1 treatment of clearing had no significant effect, with control and burning being significant. This may be due to mixed responses of species to being severely pruned with some dying and others recovering by resprouting. Comparatively little overall change occurred in the composition of the control plots making them significantly different from the other treatments. Time-since-fire (TimeFire) was insignificant in Experiment 1 probably due to the overriding effects of the treatment burn. Control and time-since-fire were significant treatments in Experiment 2 with the burning treatment being insignificant. This is probably due to sites being burned only one year previously and therefore, reburning sites had little effect except in reinforcing the overall changes due to the initial fire. The scatter of plots in the CCA biplot of Experiment 3 (forest plots) is greater and less clumped than in the Experiment 1 or 2, indicating that although initial site composition is of overriding importance, it is comparatively less important than in the outcrop plots (Experiment 1 & 2). The scatter of plots may have been affected by the overall greater effect of fire on forest plots as indicated by both time-since-fire (TimeFire) and burning both being significant in analyses.

No significant results were obtained among analyses of the difference between the initial and subsequent species richness and diversity. Therefore the null hypothesis of no difference in germination responses could not be rejected. The differences tested were insignificant due to the highly individualistic and stochastic responses of the plots to each treatment. Although control plots were less stochastic overall, changes occurred with no consistency between replicate plots in their responses. Within Experiment 1 species accumulation was low over time indicating little species replacement after treatment and over time. The control plots in Experiment 1 had at least half of the plots with no species replacement at all and yet the species diversity changed in all, indicating little change in composition and also richness, but many changes in dominance. Grubb (1986) found this to be commonplace in communities and termed such changes in abundances 'drifting clouds of abundance'. Conversely, the control plots of both Experiment 2 and 3 showed changes both in species richness over time and in species replacement in almost all plots, with dominance changing in all (measured by species diversity).

It is likely that the small size of the experiment reduced the likelihood of a significant result (Bellehumeur *et al.* 1997). Regardless, it is of note that no consistency was found in any of the treatments over time, with even control plots showing changes in species number, abundance and composition over time, albeit inconsistently. Such results reinforce those found for multivariate analyses in indicating the highly individualistic changes and responses of plots over time. This is likely to be due to the highly stochastic composition and dominance of species at individual sites. Even though there was no consistent increase or decrease in richness and diversity over time between or within treatments, species richness and diversity was maintained consistently close to the pre-treatment level. This indicates that some inherent structure exists at each site for a predetermined level of richness and diversity. This may once again be due to the interaction of species present that are largely the same before and after treatments (initial floristic composition model).

It is apparent that there is a great inherent variability in responses that are based on initial composition and individual site characteristics. Such inherent variability has been found consistently in studies of granitic outcrops and their component floras at all levels. Such responses would enable the maintenance of a high level of biodiversity and richness on a habitat (beta diversity) and landscape (gamma diversity) scale. Richness and diversity however, would be limited on the local scale (alpha diversity) by initial composition and the available species pool.

The results presented here are in marked contrast to a number of anecdotal observations made by other researchers (Binns 1992; Hunter *et al.* 1999) and those presented here that indicate marked changes in composition. Such inconsistencies may not be contradictory. The small scale and size of experimental plots, there placement and the intensity and temperature of the fires may easily account for such differences. Bradstock and Auld (1995) have shown that low-intensity fires may be detrimental, as the heat may be insufficient to stimulate the germination of buried and dormant seeds. Even after the very large 1994 fires discussed here, a number of vegetation patches did not change dramatically in their composition even when they occurred on the same outcrop as patches that did.

Autecological observations, both qualitative and experimental, provide sufficient evidence that a fire-ephemeral flora exists on granitic outcrops within Bald Rock National Park, at least in some localities. Similar findings have occurred within the outcrop flora of Western Australia where it is believed that up to 30% of species only appear after fire (Stephen Hopper, *pers. comm.*, Nov 1998). Fire-ephemeral species have been noted in many communities and occur across a range of plant families (Gill 1993). The appearance of herbaceous fire-ephemeral species has been noted around the world (Thanos & Rundel 1995) and in other heath and shrubland communities within Australia (Gill & Groves 1981; Gill 1993). Certain lifeform traits are thought to be associated with fire-ephemeral taxa which have evolved in fire prone environments: I) germination stimulated by the passage of fire, II) individual plants have a short life span, III) a large biomass produced in a short period of time, IV) flowering occurring shortly after germination, and V) non-persistent populations in the absence of fire. Many of the taxa found on granitic outcrops after fire possess such characteristics (Section 9.3.1).

Muehlenbeckia costata may be considered a fire-ephemeral species. A single plant may dominate an area of 10 m in diameter and 5 m in height in as little as 1 year. The population size as given by Hunter *et al.* (1998) changed from zero to 1200 to zero individuals in a matter of three years within Bald Rock and Girraween National Park. A large number of seeds are produced over the life span of *M. costata*. A single plant may yield many hundreds of nuts at any one time, and production is continuous throughout the one to three year life of the plant. Much of the seed is viable. If such a large seed 'rain' is normal for this species, a limiting factor of population size must be the local dispersal distance. If dispersal was efficient, a larger number of burnt outcrops, including many of the smaller outcrops, should have had populations of this species and populations would be able to re-invade areas where it has become locally extinct. This was not the case. Such localised dispersal is typical of species in poorly connected systems (Gaston & Lawton 1990; Green 1994; Dieckmann *et al*. 1999). *Muehlenbeckia costata* has adaptations that allow the diaspore to be dispersed by vertebrates (fleshy, sweet, coloured expanded calyx), but which also allow it to withstand high temperatures associated with fires (thick, hard-walled nut). Germination was observed to occur after heat treatment of 120°C for ten minutes providing evidence that the nut can survived high temperatures associated with fires.

It may be expected that fire promoted taxa would occur in areas with a frequent occurrence of fire. However, granitic outcrops, especially if large, have been considered refuge areas for taxa that are not fire adapted (Gillham 1961; Ashton & Webb 1977; Craven & Jones 1991; Erickson *et al.* 1991; Fuls *et al*. 1992; Binns 1995a; Groger & Barthlott 1996; Beard 1997; Hopper *et al.* 1997; Heinze *et al.* 1998; Hunter 1998a; Lawler *et al.* 1998; Hopper 1999). Fire occurs much less frequently on granitic outcrops than in the surrounding areas. Even in the 1994 fires which burnt 90% of Girraween National Park, up to half of the outcrop vegetation patches were unaffected, including many small outcrops of about 1 ha in size (*pers. obs.*). Many of the vegetation patches on the New England Batholith are of a substantial age, and humus development is considerable. Some of the larger outcrops are refugial areas for rainforest taxa such as *Quintinia sieberi, Rapanea* spp., *Notelaea* spp., *Tasmannia glaucophylla* and *Trochocarpa laurina* (at South Bald Rock). Ashton and Webb (1977), working in south-eastern Australia, considered the intervals between fires on granitic outcrops, within a matrix of fire prone vegetation, would still be in the order of several centuries. Erickson *et al.* (1991) considered that inter-fire intervals on outcrops in the fire prone Western Australian south west were also very large as evidenced by the very thick trunks and relative size of shrubs. The floras of outcrops have a higher proportion of obligate seeders than many other temperate Australian communities (Gillham 1961; Ashton & Webb 1977; Craven & Jones 1991; Erickson *et al.* 1991; Fuls *et al*. 1992; Binns 1995a; Gr★ger & Barthlott 1996; Beard 1997;

Hopper *et al.* 1997; Heinze *et al.* 1998; Hunter 1998a; Lawler *et al.* 1998; Hopper 1999) implying a low fire frequency (Figure 9.14).

Such observations suggest that fires are indeed much less frequent on outcrops and that even within fire prone environments they are likely to have fire intervals many times greater than the surrounding forested or woodland vegetation and in fact the surrounding vegetation may act as a buffer displacing the worst effects of fire. At the base of most large granitic outcrops is a circle of mesic vegetation that is supported by the almost double precipitation derived from the runoff of rain from the outcrops. These more mesic forests may in fact act as a small buffer surrounding each outcrop preventing all but the more intense fires from being carried onto the larger outcrops. Outcrops are unlikely to evolve a fire promoted flora. Only the most intense fires are likely to affect areas on the larger outcrops where many of the fire promoted taxa occur. It is therefore paradoxical that fire promoted taxa are not only restricted to granitic outcrops but are in many cases restricted to only the largest outcrops.

Species are not independent entities and commonly share adaptations through a common ancestry. It is, therefore, important to examine the phylogenetic distribution of traits (Harvey & Pagel 1991). Brandbyge (1992) for instance states that species of *Muehlenbeckia* are ‘weedy’, rapidly build up a large biomass, and are characteristically found in open, rocky, sun exposed habitats. Mallinson *et al.* (1998) has also found that often post disturbance recruitment with a long dormancy of propagules in the soil seed bank are common in *Muehlenbeckia* from various habitats. It appears therefore, that the ecology of many species of *Muehlenbeckia*, apart from the apparent fire promotion, shares the life form traits listed here as fire-ephemeral characteristics. These traits are probable adaptations that, in general, allow *Muehlenbeckia* species to survive, and be promoted by, disturbance such as occurs on forest margins, in landslides and along road verges (Henty 1978; Wilson 1990; Brandbyge 1992). It is likely that *M. costata* is phylogenetically predisposed to growing on rocky outcrops and is promoted by disturbance. Granitic outcrop communities are potentially some of the least disturbed and fire, although relatively infrequent, is the only large disturbance apart from possibly severe drought, with any regularity.

The germination responses after fire are likely more a consequence of fire being a disturbance factor than to species evolving fire specific strategies due to a fire prone environment. Fires provide open high light conditions and extremely low competition sites with abundant free nutrients especially when they occur in communities intolerant of fire such as on granitic outcrops. The species studied here, in addition to fire-ephemeral characteristics, all share other strategies. All are primarily low growing prostrate or procumbent plants with flat well-displayed and often large leaves. Fire ephemeral species on outcrops are poor competitors that are obligately restricted to high light environments (Platt 1951; Baskin & Baskin 1988; Sampson *et al.* 1988; Ware 1991). The traits shown by these supposed fire-ephemeral species on outcrops suggest that they are competition evaders that demand extreme high light environments. The same may also be true for other plants that occur on outcrops only after disturbances other than fire (Murdy 1966).

Trials showed that despite high viability, only a few germinations occurred in germination trials, and although there was more germination in smoked treatments of the trials this was statistically insignificant. Similar poor, or no germination, results have been obtained on treatments of outcrop plant seed by Clarke and Fullon (1999). Previous studies have shown that endemics of granite outcrops require cold treatment for effective seed germination and that aging is necessary (Chapman & Jones 1971). Roche *et al.* (1997) showed that there was a great heterogeneity in germination strategies in Australian species but that some taxa positively responded to seed aging before smoke treatments. Chapman and Jones (1971) postulated that it would be deleterious for outcrop species to germinate immediately, as there will be competition from those already established and it is likely the climate will be unfavourable in such unpredictable environments. These species spread widely and dominate large areas rapidly; seeds that germinated immediately are likely to be unsuccessful. Not all *Muehlenbeckia* seed was fresh, but included a small portion of seed having been sieved from the surrounding soil. This seed bank seed alone could explain the low germination rate encountered in this trial.

Auld and Bradstock (1996) have shown in forested areas that temperatures can reach 60°C in the top 0.5 cm of soil and that this is sufficient to break the dormancy of many fire induced legumes. Such soil temperatures are frequent on outcrops even without fire (Chapter 1), yet sporadic germinations of the species discussed in the preceding sections do not occur. Twenty-six of the 29 seeds that germinated in the *M. costata* germination trial did so when treated to temperatures of over 80°C (up to 120°C).

Such anecdotal and qualitative evidence suggests that fire-induced germination of ephemeral taxa on outcrops is reliant on seeds being of sufficient age and fire temperatures being above 60°C. Implicit in this scenario is that seeds must be able to remain dormant in the seed bank for decades or even centuries and that only high temperature fires will induce germination.

The frequency of large and extensive fires such as those that occurred in 1994 is low and it is, therefore, not surprising that so few collections and sightings have been made of *Muehlenbeckia costata*. The development of management strategies for the promotion of these species is problematical. General fuel reduction burning for asset protection in the surrounding forest and woodland systems is common in and near these reserves. Such strategies are likely to decrease the likelihood of extreme fires that are needed to promote germination on the larger outcrops. Direct ignition of outcrops is labour intensive and the required combination of environmental factors for promoting these fire-ephemeral species is unknown. Certainly fires of the wrong intensity or at the wrong time of the year could be harmful (Bradstock & Auld 1995). The experimental results suggest that the responses of patches of vegetation on outcrops are highly individualistic and framed by the initial species composition and source pools both in the seed bank and as above ground extant individuals. These communities, particularly on high altitude granitic outcrops, have evolved with a frequency of fire that is much reduced compared with the surrounding vegetated matrix. Also the recorded history of the district does not shed much light on past fire frequency. Therefore, an increase in the frequency of fires on outcrops may have undesirable effects on outcrop communities, particularly as the majority of species may be fire evaders. Thus, fire management for conservation of granitic outcrop floras is problematical and will need separate consideration from fire management regimes for the region in general.

Fire is a natural component of many communities within Australia. Much research has been conducted into the effects of fire regimes (frequency, intensity and seasonality) on individual species and on communities as a whole. The research is often habitat and site specific and the usefulness of the findings to other areas (even somewhat similar ones) is debatable. Outcrop communities are generally collectively lumped with other shrubland or heath communities although this allocation is often inappropriate from a management perspective. For instance 'heaths' in general are thought to regenerate well after fire, having a high proportion of resprouting species. Russell and Parsons (1978) showed that 73% of shrub species in 'heaths' at Wilson's Promontory were able to regenerate from resprouting. These researchers showed that fire intervals of 10 years were likely to cause only minor changes in floristics and that an inter-fire periods greater than this would cause a decline in species richness. Similar results have been achieved in heaths in coastal areas of New South Wales (Cary & Morrison 1995). The granitic outcrop 'heaths' do not respond in the same way as other structurally similar communities. Even where the same taxa are shared with communities their responses may be different. Observations of species responses to fire may be site specific (Benwell 1998). Lawler *et al.* (1998) provides, evidence to suggest that there is a decreased ability of *Eucalyptus mitchelliana* to respond to fires on exposed granite sites compared with nearby stands away from rocks. This does not mean that fire should be permanently excluded from outcrops but that the inter-fire periods should be on a much longer time scale than for surrounding heathlands.

4.3.3 Fire and areas of impeded drainage

Only a small number of areas exist with impeded drainage and these predominantly have a sedgeland/grassland community (Community 2). Research in sedgelands conducted within Gibraltar Range National Park suggests that composition is little changed by time since fire and richness does not decrease (Williams 1995). Williams (1995) suggests that although fires as frequent as six years apart can be tolerated but 10 yrs is probably more appropriate. This will not be the case for other areas of impeded drainage. Community 1 surrounds many areas containing Community 2. Community one is likely to cope best with a variable fire regime but one in which smaller fires occur within a 10-25 year period.

The rocky granite banks of the Boonoo Boonoo River however, probably require a completely different regime from other waterlogged sites. These communities have a number of rare obligate seeders that probably are fire avoiders and have a fire regime similar to that of the granite outcrops discussed above.

4.3.4 Tall Open Forests and fire

The understorey of alliances described by Beadle (1981) that are similar to Tall Open Forest communities found within the reserve that are circumscribed by Community 9 and in some instances Community 7. Such assemblages are usually characterised as being mesomorphic with many closed forest taxa and a herb layer dominated by *Calochlaena dubia*. Closed forest taxa are eliminated by fire and are replaced by *Acacia irrorata* and *Allocasuarina torulosa* (Beadle 1981). If fires are repeated in close succession only an understorey of grasses dominated by *Imperata* and *Themeda* remains (Figure 90). These comments are corroborated by Binns (1991; 1995b) who observed the replacement of mesomorphic closed forest taxa with an understorey of grasses. Moore and Floyd (1994) describe the replacement series in forests such as these in the Grafton Forestry District. In the absence of fire for 20 years or more, there is a range of wet sclerophyll understorey communities with a more or less sparse shrub layer and a ground cover of *Poa* spp., *Sorghum leiocladum*, *Doodia aspera* and *Blechnum cartilagineum*. With an increasing frequency of fires, only a simple layer of resistant grasses and forbs (*Imperata cylindrica*, *Themeda triandra* and *Pteridium esculentum*) remain (Moore & Floyd 1994). Fires of low intensity have been common in the area and probably have not sufficient heat to stimulate the germination of hard seeds (Moore & Floyd 1994). It is therefore likely that many areas within the current reserves have had a fire regime of high frequency and low intensity that has decreased the diversity of understorey types and allowed all to converge to a less diverse range of 'disclimax' communities (Moore & Floyd 1994). This is achieved by the elimination of the once mesomorphic, and in some areas shrubby understorey, intensities of fire that do not break the dormancy of many seeds and the promotion of a less diverse fire tolerant open grassy understorey. Even within the wetter parts of the Upland Forests many open grassy areas exist, other parts have the understorey dominated by *Calochlaena dubia*, *Xanthorrhoea glauca*, and Tree Fern taxa all of which are fire resistant.

Mesomorphic taxa will limit the regeneration capacity of eucalypt species but they are removed by fire. Mixed forests are probably the norm for communities such as these therefore a fire regime that encourages the development of a mesomorphic understorey but will periodically allow regeneration of eucalypt species is appropriate. Binns (1991) describes relationships within wet sclerophyll forests and suggests a major fire event in the order of 100-300 years is probably applicable in these communities. Although the grassy understorey is in the main probably artificial, it may be important biodiversity wise to maintain some areas in this state. It is suggested (if a return to a more ‘natural’ state is a management goal) that fires should be excluded from these communities for a period up to 200 yrs and that some smaller areas are retained as they are for completeness.

This however is unlikely to be true for Community 10 and parts of Community 7. Community 10 is dominated in the understorey by heathy species. Such communities elsewhere require a variable fire regime that has occasional hot fires generally within an 8 to 25 year period. Community 7 in many areas may be a derived system. Its total distribution may have expanded over recent decades due to frequent fires that have removed the mesic understorey that would have expanded from Community 9 in some places but also removed the shrubby understorey that characterises Community 10. In other words it is possible that in the past Community 7 may have occupied much less area but has expanded into both Community 9 and 10 due to an increase in fire frequencies.

4.3.5 General comments

Fire research has often emphasized species richness as a management goal. In most situations, overall richness is achieved by maintaining communities at an intermediate stage of development by constant and moderate disturbance. However, as Gill (1977) comments, managers should consider recommending protection of older stands of vegetation from fire so that chronosequences remain. Variability and adaptability in fire regimes is the goal suggested by recent research (Bradstock *et al.* 1995; Conroy

1996; Benson 1999). It is suggested that rigorously imposed fire regimes based on blocks in the landscape is unachievable. Single wildfire events can severely disrupt imposed fire regimes. It is suggested that overall, the results of wildfires should be incorporated in an adaptive a regime that creates a variability in chronosequences (Bradstock *et al.* 1995) and that some mature systems be maintained even though richness will decline. This will require that the extent and affects of fire both natural and human induced are constantly monitored and updated. This approach should be modified in communities that are highly restricted or have known frequency thresholds, in such communities management of fire regimes will need to be more direct. The extremes of the frequency scale of fires should be based on the population extinction risk of taxa of importance rather than richness and density (i.e. diversity) (Bradstock *et al.* 1995).

It is suggested that a subset of the floristic plots placed be resurveyed periodically to assess the changes in the communities. At a minimum three plots should be chosen from each of the 11 communities defined were applicable and that these should be surveyed at least once every three years. Manipulated fire experiments would be of most benefit as an addition to the perpetually monitored sites.

Table 5: Suggested fire regimes for each of the 11 defined communities. The suggestions made here are only broadly applicable and much variability should occur within them but they should ultimately be constrained by the ability of the flora within each to recovery between fires i.e. primary and secondary juvenile periods.

Community	Suggest fire regimes
Community 1	10-30 year cycles in general.
Community 2	Probably similar to above but care should be taken not to increase the dominance of weedy species which may increase under some fire regimes.
Community 3	Exclude fire for the majority, but allow some to encroach into small areas. No two fires in any one area within a 15 yr period.
Community 4	Exclude fires.
Community 5	Exclude fires.
Community 6	Fire regimes within this community should be highly variable. Areas close to Community 9 should have a much reduced regime > 100 yrs. Other parts probably should have regimes from 15-100 yr cycles.
Community 7	10-30 cycles. Usually affected by more low intensity fires
Community 8	100-300 yr periods.
Community 9	15-50 yr cycles with much variability and some high intensity fires.
Community 10	100-300 yr periods.
Community 11	Exclude fires from most areas allow some irregular hot fires to incur but probably cycles of 100-300 yrs are likely with only small areas being burnt with greater regularity.

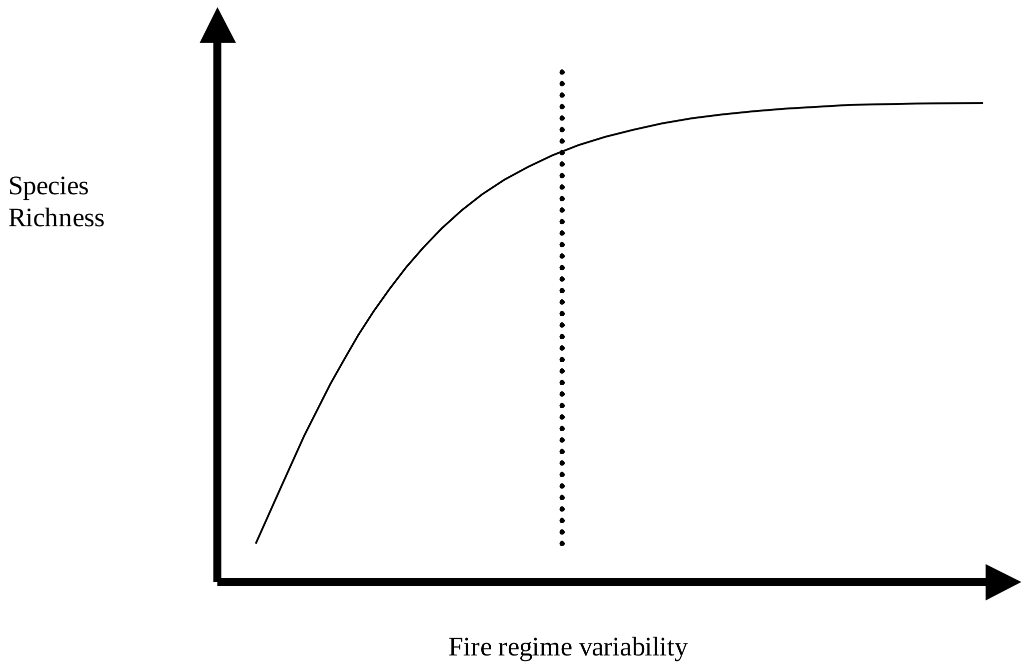


Figure 83: Taken from Bradstock *et al.* (1995). A variability of fire regime beyond a certain threshold is likely to maintain richness at an optimum.

4.4. Conservation status of taxa and communities

4.4.1 Communities

Specht *et al.* (1995) discusses the reservation status of communities within New South Wales. This work is a starting point for investigations into the conservation status of Australian communities. It does, however, have a number of limitations. The analysis is based on survey sites existing at the time of compilation. The analyses incorporated in this work were necessarily of a large scale and therefore many unique assemblages are lumped together with larger more widespread associations. Furthermore, the reservation status is based on the area reserved and the number of reserves that have a vegetation type. These criteria do not take into account representativeness across the range of a community or the quality of the stands. Benson (1999) states that only 7.5% of the Northern Tablelands is represented in conservation reserves. One of the major features of the district is that it forms a major east west corridor and forms a hub from which major regional corridors extend from the Tableland to the Border Ranges (Morgan & Terrey 1999).

The significance of the communities within Bald Rock and Boonoo Boonoo National Park are variable. The Tall Open Forests and Woodlands associated with Communities 6 to 10 are very indicative of their type and synonymous types are found along most of the eastern escarpment from Barrington Tops to just over the Queensland Border. These some of these communities were until recently probably inadequately conserved, however in the last few years a number of new reserves have conserved very similar assemblages across the most of their range. The most significant feature of these assemblages is that they are probably at or near the northern limit of their distribution as circumscribed here.

Community 1 though potentially widespread across the Northern Tablelands is significant, despite much of it being disturbed in the past. Assemblages such as these have been greatly cleared and disturbed across their whole range (Benson 1999) and are usually little reserved even with the many recent service acquisitions.

Other assemblages within the two parts are very restricted, highly variable across their range, generally poorly conserved and easily disturbed, particularly by cattle or human induced drainage. Communities 2 and 3 are highly restricted with unique combinations of species. These communities are of highly significant conservation importance. In particular Community 3 has a high number of rare or threatened species that or more or less endemic to the region.

Much work regarding Community 11 has been undertaken by Hunter (1999). This work has shown that the granite outcrops of Bald Rock and Boonoo Boonoo National Parks contain the greatest level of endemism and uniqueness compared to all other outcrop systems in the whole New England (Figure !!!). This research also shows that the outcrop systems of this region are unlike those elsewhere on the tablelands but that they do share broad affinities with other outcrop systems along the eastern escarpment. Hunter (2000; 2002; 2004) has shown that due to the very high species turnover between outcrops and the highly idiosyncratic distribution of component species any outcrop no matter how small is likely to contain a comparably unique assemblage of species. Any outcrop may also contain a number of unique species that may not be found anywhere nearby. Hence the preservation of such large expanses of granite outcrops within this region is highly significant.

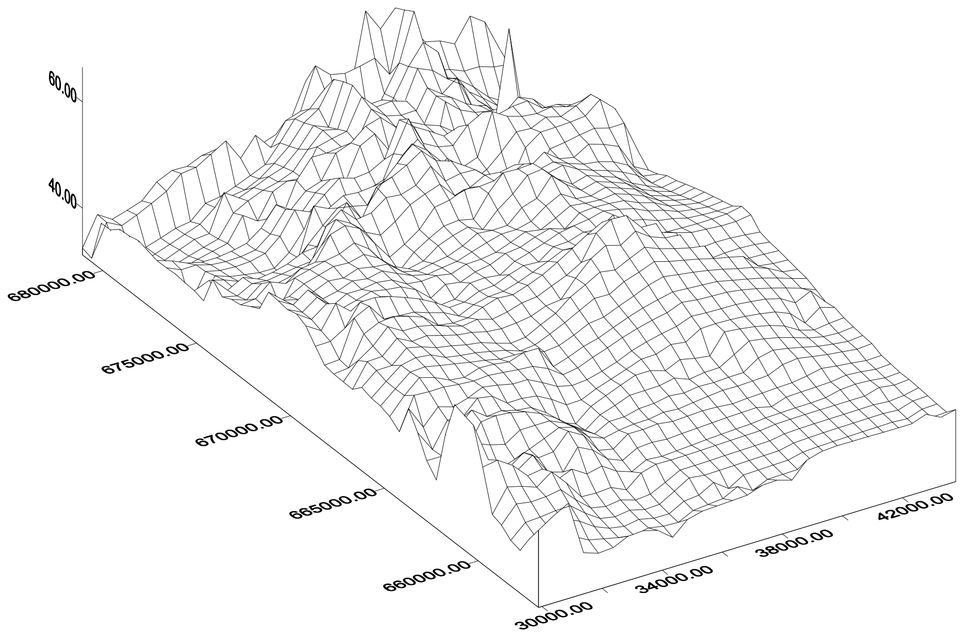


Figure 84: Diagram taken from Hunter (2002). The diagram is based on the insularity of outcrops from the surrounding forests. Higher the level the more different outcrops are from the surrounding vegetation. The diagram takes in the entire New England and the top right corresponds to Bald Rock and Boonoo Boonoo, indicating that the outcrops here are the most divergent from there systems and contain the greatest number of outcrop endemic species.

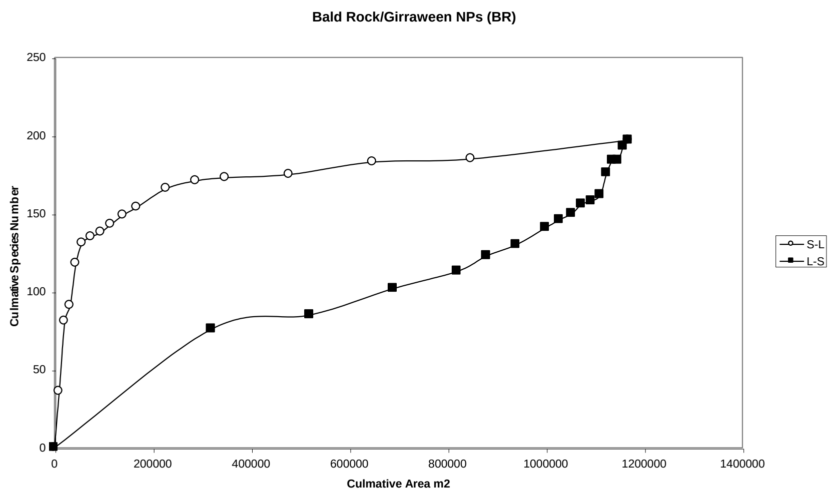


Figure 85: Cumulative species-area curves for the outcrops at Bald Rock. Circles = outcrops ranked smallest-to-largest. Squares = ranked largest-to-smallest. This diagram shows how a collection of smaller outcrops contain a greater number of

species than a collection of larger outcrops of the same area. Taken from Hunter (2000).

Morgan and Terrey (1999) presented a bioregional investigation of the entire New England and the results of their investigation into the Tenterfield district are given in Figure 90. Such investigations are of relevance to the broader vegetation types. Thus and other large scale investigations that have occurred in the past such as NRAC, NFBS and RACAC are limited by their concentrated efforts on forested systems. If only the more common forested systems were looked at in this investigation the results would have suggested that little was of importance in terms of reservation in these two National Parks, i.e. Communities 6-11 or not especially of great significance in themselves.

Overall it appears the more significant vegetation communities are those associated with small isolated systems as described by Communities 1, 2, 3, 4, 5, 6 and 11. These communities are easily disturbed and are hard to regenerate once disturbed. They have a higher concentration of specialised and rare species in terms of numbers and the areas they are contained in. Yet they appear to have a greater proportion of incedental disturbances. Most trials and tracks pass across or along the margins of many of these systems. Visitor usage of the river and outcrops areas and even the base of the falls is higher than that the forested areas. However the forested areas are more widespread, both locally and regionally and are far more resilient to disturbances.

In recent years a number of communities have been listed as endangered on the NSW *TSC* Act (1995), two of these are synonymous with parts of the whole of two communities described here. Parts of Community 1 may fall within the determination of *Eucalyptus nova-anglica* communities on sediments and Community 2 falls within the endangered determination of upland swamps.

4.4.2 Species

There are at least 27 ROTAP taxa within the two reserves. This number may yet increase within subsequent surveying. A further 51 species are considered to be regionally significant. Only 16 rare or threatened species were found within the Washpool Additions by Hunter (1998) and only eight were found within Guy Fawkes River National Park by Hunter and Alexander (1999). Most of the rare taxa found within the reserves are associated with exposed granite surfaces either in association with the larger granite outcrops or along the banks of the Boonoo Boonoo River. As such many appear to be fire avoiders. The two reserves appear to form a 'hotspot' for many restricted species and as such they are great conservation significance. Boonoo Boonoo National Park in particular has a large number of regionally rare species, many of which are at the northern distributional limit within the reserve.

4.4.3 Management considerations

Due to the large number of rare or threatened species a number of management options may need to be considered and these could include:

- Targeted surveys to establish the population sizes of rare species.
- Targeted searches for species not yet found, but which are likely to occur.
- Research into appropriate fire regimes.
- Following of population fluctuations in species where this may be an issue such as *Muehlenbeckia costata* and *Acacia latisepala*.
- Reduced access to parts of the Boonoo Boonoo River, or at least reducing the ease of access to many areas. In some places it may be beneficial to mark as sensitive areas, for example Morgan's Gully.
- Signposting outcrop vegetation as sensitive to trampling, possibly at the visitor area at the camping area at the base of Bald Rock.
- Regeneration of low lying cleared areas.

PROVINCE 15: STANTHORPE PLATEAU: MAJOR ECOSYSTEMS

Distribution	Drier sites in west and southwest; 600-950m above sea level, sub-dominant.	Upland valleys, mainly west of Great Divide; 650-850m above sea level; co-dominant.	Upland hills, mainly west of Divide; 850-1100m above sea level; co-dominant.	Highest areas mainly on Divide and to east; 1000-1200m above sea level; co-dominant.	Upland valleys in southeast; 900-1000m above sea level; minor.	Lowlands in north and northeast; 600-800m above sea level; minor.
Land Profile						
Geology	Fine-grained Carboniferous sediments and adamellites.	Adamellite	Adamellite	Adamellite	Adamellite	Adamellite; some fine-grained Carboniferous sediments.
Landform and Soils	Mountainous to hilly; shallow loams or siliceous sands.	Undulating valley areas; yellow and gleyed podzolics.	Hills usually with extensive rock pavement; siliceous sands.	Hilly to undulating crests of ranges and upland areas; yellow and gleyed podzolics, some sands.	Low hills and undulating valleys; yellow and gleyed podzolics.	Low hills and undulating slopes; yellow and gley podzolics, minor shallow loams and sands.
Natural Vegetation	*E. dealbata*, *E. youmanii*, and *E. caleyi* woodland. In the south-west, small areas of *E. laevopinea* on some peaks, and low microphyll thickets on sheltered slopes.	*E. blakelyi*, *E. conica*, *E. nova-anglica* woodland.	*E. andrewsii* open forest.	*E. campanulata*-*E. deanei* open forest with *E. caliginosa* and in east *E. obliqua*. Dry heath and *E. codonocarpa* mallee, with *E. youmanii* and *E. andrewsii* on rocky hilltops; sedgelands in valleys. Small areas of *E. scoparia* and *E. camphora* in central south.	*E. pauciflora*, *E. nova anglica* and *E.acaciiformis* on lower areas with occasional *E. dalrympleana* ssp. *heptantha*. *E. caliginosa* on rises.	*E. caliginosa* and *E. tereticornis* open forest. *Angophora* ssp. usually present. *E. viminalis*, *E. blakelyi* and *E. melliodora* on lower slopes.
Condition	Sediments largely undeveloped. Adamellites partly cleared. Dieback slight.	Largely developed although numerous very small remnants remain. Horticulture widespread. Dieback slight to moderate.	Largely undeveloped, but being fragmented by valley clearing.	Developed in north, largely cleared in east. Large areas remain in south and southeast. Dieback limited and slight to moderate.	Largely cleared with developed native pastures dominant. Extensive sown pastures. Dieback slight to moderate.	Largely cleared with developed native pastures. Dieback slight to moderate.
Representation in Conservation Reserves	Moderate areas of sediment in Sundown National Park. Small areas of adamellite in Girraween National Park.	Small areas in Girraween National Park.	Large areas in Girraween National Park.	Large areas in Girraween National Park and Bald Rock National Park. Minor in Boonoo Boonoo National Park.	Small areas in Bald Rock National Park, minor areas in Boonoo Boonoo National Park.	None
Comments	Extensive areas in Multiple Use Zone	Minor areas in Multiple Use Zone.	Large areas in Multiple Use Zones.	Large areas in Multiple Use Zones.	Sall areas in Multiple Use Zones.	Extensive disturbed areas in Multiple Use Zones.

Figure 84: Conservation and management considerations for the Tenterfield district that includes Bald Rock and Boonoo Boonoo National Parks. Taken from Morgan and Terry (1999).

4.5 Introduced taxa

In most instances, introduced plants require some form of disturbance or modification of the environment, such as an increase in nutrients, to become established. Within the reserve there are only 5% of the flora was found to be introduced in origin. This is comparable to that found for the Torrington Recreation Area (5%) and other parts of the eastern escarpment such as Washpool Western Additions (Hunter 1998) and Guy Fawkes River (Alexander & Hunter 1999), but significantly different from the recent survey of the proposed Kwiambal National Park (17%). Most of the exotic taxa are associated with tracks, disturbed creek margins, and areas frequented by goats and cattle. Community 3 has a very high percentage of introduced species and this is likely due to past clearing and management practices. A few taxa are found in relatively undisturbed areas. Exotic taxa can be segregated into; those that are a serous problem and are invasive, those that are confined to disturbed areas (e.g. *Cirsium*) and those that are ubiquitous and therefore would be a problem to remove in the long term.

4.5.1 Riparian zones

Increased nutrients from fertilizer application on neighbouring land and the naturally richer soils and soil moister can also favour exotic species. Some of the most troublesome weeds along the creek banks are *Sigesbeckia orientalis, Gomphocarpus fruiticosus, Bidens, Maclura* spp., *Juncus bufonius* and *Rubus chloocladus*. However, it is notable that compared to many other riparian systems, those in Boonoo Boonoo have a very low percentage of weedy species.

It should be noted however that invasions from upstream outside the boundaries of the reserve are difficult or impossible to manage from the perspective of the park managers. In the short term many species can be rapidly replaced due to seeds from upstream, these weed invasions should be controlled to reduce their incidence and subsequent build up of seed banks.

4.5.2 Fire trails

Exotic taxa occur along boundaries and tracks but they will usually be restricted to a short distance from the disturbed area. The movement of vehicles along tracks encourages the spread of weeds. This is particularly true if vehicles have to move through heavily infested areas prior to reaching the desired trails. This is particularly important in terms of species such as *Andropogon virginicus* that may invade from one patch of Community 2 to another on vehicle tyres and can be washed down the many creeks into new patches. There are a number of tracks within the reserve of which many are important for fire management purposes. Some tracks may be of little use however and probably should not be maintained or at least only used infrequently. The trail through the centre of south Bald Rock National Park which has recently been pushed through may warrant closure or at minimum upgrading. This trail has been pushed through and along one of the main creeks from its start to its finish within the reserve. This is likely to cause a great deal of weed introductions to this creek system and an increase erosion and siltation. If trails are to be upgraded at any time then modification of creek crossings may need to occur on major trails or at major crossings. Periodic weed spraying or pulling may need to occur seasonally along the major roads and fire trails within the reserves.

4.5.3 Management priorities for weeds

Priorities will need to be established in order to develop an effective weed management system. In particular major source areas should be reduced and those weeds likely to spread should be given highest priority. Although the incidence of weeds in the reserve is considered only to be minor, broad priorities may include:

- Finding major weed infestations and reducing these source populations, particularly along major creek lines that are disturbed by traffic.
- Weed invasions into areas of vegetation of regional significance or restricted distribution in the reserve, for example the Closed Forests and Sedgelands.
- Invasive or noxious weeds should be eradicated as soon as possible.

- Closing of non-essential access tracks or using them only infrequently, in particular the trail through the centre of the southern section of Bald Rock may need attention or closure.
- Keeping well used trails in good condition particularly on creek crossings.
- Co-ordination of weed programs with local authorities.
- Removal of feral goats and wild cattle.

The control of exotic plants within a national park is a complex issue. Application of herbicides can be inappropriate as native vegetation or animals in streams may be affected. The effects on native vegetation needs to be minimised. Many weeds while a problem due to their widespread occurrence in natural areas may be left as a low priority for management. Some examples include *Hypochaeris radicata* and *Stellaria* spp. that are in general ubiquitous to most communities in the north east and would be impossible to eradicate.

4.6 General conclusions

Bald Rock and Boonoo Boonoo National Parks are highly significant conservation reserves as they represent comparatively little disturbed habitat. They conserve some of the major and widespread communities found along the eastern escarpment that in general are at the northern limit of their geographic distribution. Many of the communities within the reserves are unique and probably restricted to the study area and nearby holdings. A large number of rare species can be found within the two reserves and this area may represent one of the highest concentrations of restricted species in the north east. Some of these species may need targeted searches and such searches for some rare species that have as yet not been found may be fruitful.

Much of the stability of the vegetation communities and the rare species found within the reserves will depend on the management of appropriate fire regimes and potentially the management of what may be increasing numbers of visitors. A high variability of fire regimes should occur as this will maximise richness across the landscape. There is potential for an increase in the area occupied by some communities if the fire regimes around them are lowered. Monitoring of selected sample sites within each community should be made on a continuing basis and manipulated fire experiments would be an asset.

At present weeds are only a minor problem within the reserves. A few however will need targeted eradication, particularly within Community 3. Trails will in general need to be maintained at a high standard and seasonal eradication weeds along their margins may need to occur. Reduced usage of some trails may be appropriate and usage should be reduced in wet weather.

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Appendix A: Site Record Forms.

PAWD: Vegetation Survey Form

Date: _____________ Recorder: _________________________________Site No: ___________________

Film No: ___________ Photo No: _____________________ Quadrat Size:________________________

General Location: ____

Map Name: _____________________ Scale: _____________________
AMG Ref: _____________________E _________________________N
Lat:______________________’S Long: _________________________’E

Landform Pattern: ____
Physiography:(circle)
Crest Upper Slope Mid-slope Lower Slope Flat Open Depression

Altitude: _____________________metres
Slope: _____________________degrees
Aspect: _____________________degrees (magnetic)
Horizontal Elevation: N_____NE_____E_____SE_____S_____SW_____W_____NW_____

Map Geology: ________________________________ Lithology: ________________________________

Soil: (circle)
Drainage: Waterlogged Damp Moist Well drained
Texture: _____________________________________
Colour: _____________________________________
Depth: Deep (>1m) Shallow (0.3-1m) Skeletal (<0.3m)

Fire History (how determined)____

Other Disturbance: (circle) clearing logging grazing erosion feral animals
other
(state):____

Vegetation Structure: (Walker & Hopkins, 1990)

Stratum	Height (m)	% Cover	Dominant Species

Structural Formation Class: ____
Comments:____

____

____

____

____

Appendix A: Site Record Forms.

Floristic Composition: Site No:

No.	Species	C/A	Canopy Spp	Data	No.	Species	C/A	Canopy Spp	Data
1					31				
2					32				
3					33				
4					34				
5					35				
6					36				
7					37				
8					38				
9					39				
10					40				
11					41				
12					42				
13					43				
14					44				
15					45				
16					46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				

C/A: Cover Abundance Scale -Modified Braun Blanquet
Data: to be marked when entered into computer database

1 = cover less than 5% of site and uncommon
2 = cover less than 5% of site and common
3 = cover of 6-20% of site
4 = cover of 21-50% of site
5 = cover of 51-75% of site
6 = cover of 76-100% of site

Appendix B: Taxon list with recognised authorities and common names.

Flora of Bald Rock and Boonoo Boonoo National Parks

by

Dr John T. Hunter

Fern & Fern Allie

Adiantaceae
Adiantum aethiopicum L. ....Common Maidenhair
Adiantum formosum R.Br. ....Giant Maidenhair
Adiantum hispidulum Sw. ....Rough Maidenhair
Cheilanthes distans (R.Br.) Mett. ....Hairy Rock Fern
Cheilanthes sieberi Kunze
subsp. *sieberi* ....Narrow Rock Fern
Pellaea falcata (R.Br.) Fée ....Sickle Fern
Pellaea nana (Hook.) Bostock ....Sickle Fern

Aspleniaceae
Asplenium australasicum (J.Sm.) Hook. ....Bird's Nest Fern
Asplenium flabellifolium Cav. ....Necklace Fern
Asplenium polyodon G.Forst ....Spleenwort

Blechnaceae
Blechnum cartilagineum Sweet ....Gristle Fern
Blechnum minus (R.Br.) Ettingsh. ....Soft Water Fern
Blechnum nudum (Labill.) Mett. ex Luerss. ....Fishbone Water Fern
Blechnum wattsii Tindale ....Hard Water Fern
Doodia aspera R.Br. ....Prickly Rasp Fern
Doodia australis (Parris) Parris ....Common Rasp Fern

Colchicaceae
Wurmbea biglandulosa (R.Br.) T.D.Macfarl. ....Early Nancy
Wurmbea dioica (R.Br.) F.Muell.
subsp. *dioca* ....Early Nancy

Cyatheaceae
Cyathea australis (R.Br.) Domin ....Rough Treefern

Davalliaceae
Davallia solida
var. *pyxidata* (Cav.) Noot. ....Hare's Foot Fern

Dennstaedtiaceae
Calochlaena dubia (R.Br.) M.D.Turner & R.A.White ....Common Ground Fern
Hypolepis glandulifera Brownsey & Chinnock ....Ground Fern
Pteridium esculentum (G.Forst.) Cockayne ....Bracken Fern

Dryopteridaceae
Lastreopsis decomposita (R.Br.) Tindale ....Ground Fern

Gleicheniaceae
Gleichenia dicarpa R.Br. ....Coral Fern
Sticherus flabellatus (R.Br.) H.St.John ....Umbrella Fern

Hymenophyllaceae
Hymenophyllum cupressiforme Labill. ....Common Filmy Fern

Lindsaeaceae
Lindsaea linearis Sweet ....Screw Fern
Lindsaea microphylla Sweet ....Lacy Wedge Fern

Lycopodiaceae
Lycopodiella lateralis (R.Br.) B.Ollg. ....Slender Club-moss
Lycopodium deuterodensum Herter...Bushy Club-moss

Ophioglossaceae
Botrychium australe R.Br. ....Parsley Fern

Osmundaceae
Todea barbara (L.) T.Moore ....King Fern

Polypodiaceae
Dictymia brownii (Wikstr.) Copel. ....Stiff Strap Fern
Grammitis billardieri Willd. ....Finger Fern
Platycerium bifurcatum (Cav.) C.Chr.
subsp. *bifurcatum* ....Elkhorn
Pyrrosia confluens
var. *dielsii* (C.Chr.) Hovenkamp ....Horsehoe Felt Fern
Pyrrosia rupestris (R.Br.) Ching ....Rock Felt Fern

Psilotaceae
Psilotum nudum (L.) P.Beauv. ....Skeleton Fork Fern

Pteridaceae
Pteris comans G.Forst. ....Hairy Bracken
Pteris tremula R.Br. ....Tender Brake

Schizaeaceae
Schizaea bifida Willd. ....Forked Comb Fern
Schizaea dichotoma (L.) Sm. ....Branched Comb Fern

Selaginaceae
Selaginella uliginosa (Labill.) Spring...Selaginella

Thelypteridaceae
Christella dentata (Forssk.) Brownsey & Jermy ....Christella

<u>Gymnosperm</u>

Cupressaceae
Callitris endlicheri (Parl.) F.M.Bailey ....Black Cypress Pine
Callitris monticola J.Garden..Steelhead
Callitris oblonga
subsp. *parva* K.D.Hill ....Pigmy Cypress Pine
Callitris rhomboidea R.Br. ex Rich. ....Port Jackson Pine

<u>Monocotyledon</u>

Anthericaceae
Arthropodium milleflorum (DC.) J.F.Macbr. ....Vanilla Lily

Anthericaceae
Arthropodium minus R.Br. ....Small Vanilla Lily
Dichopogon fimbriatus (R.Br.) J.F.Macbr...Nodding Chocolate Lily
Laxmannia compacta Conran & P.I.Forst. ....Wire Lily
Laxmannia gracilis R.Br. ....Wire Lily
Thysanotus tuberosus R.Br.
subsp. *tuberosus* ....Common Fringe-lily
Tricoryne elatior R.Br. ....Yellow Autumn-lily

Araceae
Gymnostachys anceps R.Br. ....Settler's Flax

Asteliaceae
Cordyline petiolaris (Domin) Pedley ....Broad-leaved Palm Lily

Burmanniaceae
Burmannia disticha L. ....Burmannia

Centrolepidaceae
Centrolepis fascicularis Labill. ....Centrolepis

Commelinaceae
Commelina cyanea R.Br..Scurvy Weed
Murdannia graminea (R.Br.) G.Bruckn. ....Chocolate Lily

Cyperaceae
Baumea articulata (R.Br.) S.T.Blake ....Jointed Twig-rush
Baumea juncea (R.Br.) Palla ....Baumea
Baumea planifolia (Benth.) K.L.Wilson...Baumea
Baumea rubiginosa (Forst.) Boeck...Baumea
Bulbostylis barbata (Rottb.) C.B.Clarke ....Sedge
Bulbostylis densa (Wall.) Hand.-Mazz...Sedge
Carex appressa R.Br. ....Sedge
Carex breviculmis R.Br. ....Sedge
Carex gaudichaudiana Kunth ....Sedge
Carex inversa R.Br..Knob Sedge
Carex lobolepis F.Muell. ....Sedge
Carex polyantha F.Muell...Sedge
Caustis flexuosa R.Br. ....Curly Wig
Chorizandra cymbaria R.Br. ....Sedge
Cyperus enervis R.Br..Sedge
Cyperus gracilis R.Br. ....Sedge
Cyperus imbecillis R.Br..Sedge
Eleocharis sphacelata R.Br. ....Tall Spike Rush
Fimbristylis dichotoma (L.) Vahl ....Common Fringe Rush
Gahnia aspera (R.Br.) Spreng..Rough Saw Sedge
Gahnia sieberiana Kunth ....Red-fruit Saw Sedge
Gahnia subaequiglumis S.T.Blake ....Saw Sedge
Gymnoschoenus sphaerocephalus (R.Br.) Hook.f...Button Grass
Isolepis inundata R.Br..Swamp Club Rush
Isolepis subtilissima Boeck. ....Salaisoi
Lepidosperma elatius Labill. ....Tall Sword Sedge
Lepidosperma gunnii Boeck...Little Sword Sedge
Lepidosperma laterale R.Br. ....Variable Saw Sedge
Lepidosperma limicola N.A.Wakef. ....Razor Sword Sedge
Lepidosperma neesii Kunth ....Stiff Rapier Sedge
Lepidosperma tortuosum F.Muell. ....Tortuous Rapier Sedge
Philothrix deusta (R.Br.) K.L.Wilson ....Beak Rush
Rhynchospora brownii Roem. & Schult. ....Grassy Beak Rush

Schoenoplectus mucronatus (L.) Palla ex A.Kern. ....Rush
Schoenus apogon Roem. & Schult. ....Common Bog Rush
Schoenus latelaminatus Kuk ....Medusa Bog Rush
Schoenus melanostachys R.Br. ....Club Rush
Schoenus turbinatus (R.Br.) Poir. ex Roem. & Schult. ....Rush
Scirpus polystachyus F.Muell. ....Large-head Club-rush
Scleria mackaviensis Boeck. ....White Head Sedge

Dioscoreaceae
Dioscorea transversa R.Br. ....Native Yam

Haemodoraceae
Haemodorum austroqueenslandicum Domin ....Bloodroot
Haemodorum planifolium R.Br. ....Bloodroot

Hypoxidaceae
Hypoxis hygrometrica Labill. ....

Iridaceae
Patersonia fragilis (Labill.) Asch. & Greaebn. ....Swamp Iris
Patersonia glabrata R.Br. ....Native Iris
Patersonia sericea R.Br. ....Silky Purple Flag
**Sisyrinchium* sp. A..Scourweed

Juncaceae
**Juncus articulatus* L. ....Jointed Rush
**Juncus bufonius* L...Toad Rush
Juncus caespiticius E.Mey. ....Rush
Juncus continuus L.A.S.Johnson ....Rush
Juncus firmus L.A.S.Johnson ....Rush
Juncus pauciflorus R.Br. ....Rush
Juncus prismatocarpus R.Br. ....Branching Rush
Juncus remotiflorus L.A.S.Johnson ....Rush
Juncus usitatus L.A.S.Johnson ....Common Rush
Luzula flaccida (Buchenau) Edgar ....Grass Rush

Lomandraceae
Lomandra confertifolia
subsp. *pallida* A.T.Lee ....Mat-rush
Lomandra cylindrica A.T.Lee ....Round-leaved Mat-rush
Lomandra filiformis (Thunb.) Britten
subsp. *filiformis* ....Wattle-leaved Mattrush
Lomandra longifolia Labill. ....Spiny-headed Mat-rush
Lomandra multiflora (R.Br.) Britten
subsp. *multiflora* ....Many-flowered Mat-rush
Lomandra spicata A.T.Lee ....Mat-rush

Luzuriagaceae
Eustrephus latifolius R.Br. ex Ker Gawl. ....Wombat Berry
Geitonoplesium cymosum (R.Br.) A.Cunn. ex R.Br. ....Scrambling Lily

Orchidaceae
Acianthus exsertus R.Br. ....Mosquito Orchid
Bulbophyllum elisae (F.Muell.) F.Muell. ex Benth. ....Pineapple Orchid
Caladenia carnea R.Br.
var. *carnea* ....Pink Fairy
Caladenia fuscata (Rchb.f.) M.A.Clem. & D.L.Jones ....Caladenia
Calochilus campestris R.Br. ....Copper Beard Orchid
Calochilus gracillimus Rupp ....Slender Beard Orchid
Calochilus robertsonii Benth. ....Purplish Beard Orchid

Chiloglottis diphylla R.Br. ....Bird Orchid
Cryptostylis subulata (Labill.) Rchb.f. ....Large Tongue-orchid
Dipodium punctatum (Sm.) R.Br. ....Hyacinth Orchid
Dipodium variegatum D.L.Jones & M.A.Clem. ....Hyacinth Orchid
Diuris abbreviata Benth. ....Lemon Doubletail
Diuris abbreviata F.Muell. ex Benth. ....Lemon Doubletail
Diuris punctata Sm.
var. *punctata* ....Purple Donkey Orchid
Diuris tricolour Fitzg. ....Donkey Orchid
Dockrillia linguiformis (Sw.) Brieger ....Tongue Orchid
Dockrillia pugioniformis (A.Cunn.) Rauschert ....Dagger Orchid
Genoplesium fimbriatum (R.Br.) D.L.Jones & M.A.Clem. ....Fringed Midge Orchid
Microtis unifolia (G.Forst.) Rchb.f. ....Common Onion Orchid
Pterostylis cycnocephala R.Br. ....Swan Greenhood
Pterostylis daintreana F.Muell. ex Benth. ....Greenhood
Pterostylis longifolia R.Br. ....Tall Greenhood
Pterostylis obtusa R.Br. ....Greenhood
Sarcochilus falcatus R.Br. ....Orange Blossom Orchid
Spiranthes sinensis
subsp. *australis* (R.Br.) Kitam. ....Ladies' Tresses
Taeniophyllum muelleri Lindl. ex Benth. ....Orchid
Thelychiton gracilicaulis (F.Muell.) M.A.Clem. & D.L.Jones ....Spotted Orchid
Thelychiton kingianus (Bidwill ex Lindl.) M.A.Clem. & D.L.Jones ....Pink Rock Orchid
Thelychiton tarberi (M.A.Clem. & D.L.Jones) M.A.Clem. & D.L.Jones ....Rock Lily
Thelymitra ixioides Sw.
var. *ixioides* ....Dotted Sun Orchid
Thelymitra pauciflora R.Br. ....Slender Sun Orchid

Philydraceae
Philydrum lanuginosum Banks & Sol. ex Gaertn. ....Frogsmouth

Phormiaceae
Dianella caerulea
var. *assera* R.J.F.Hend. ....Blue Flax Lily
var. *caerulea* ....Rough Flax Lily
var. *producta* R.J.F.Hend. ....Rough Flax Lily
Dianella longifolia R.Br.
var. *longifolia* ....Pale Flax Lily
var. *stenophylla* Domin ....Pale Flax Lily
Dianella nervosa R.J.F.Hend. ....Blue Flax Lily
Dianella revoluta R.Br.
var. *revoluta* ....Spreading Flax Lily
var. *vinosa* R.J.F.Hend. ....Spreading Flax Lily
Dianella tasmanica Hook.f. ....Tasman Flax Lily
Stypandra glauca R.Br. ....Nodding Blue Lily
Thelionema caespitosum (R.Br.) R.J.F.Hend. ....Tufted Blue Lily
Thelionema grande (C.T.White) R.J.F.Hend. ....Granite Tufted Blue Lily

Poaceae
**Aira cupaniana* Guss. ....Silvery Hairgrass
*Amphipogon strictus*R.Br.
var. *strictus* ....Greybeard Grass
**Andropogon virginicus* L. ....Whiskey Grass
**Anthoxanthum odoratum* L. ....Sweet Vernal Grass
Aristida acuta S.T.Blake ....Speargrass
Aristida jerichoensis
subsp. *subspinulifera* Henrard ....Jericho Wiregrass
Aristida ramosa R.Br. ....Purple Wiregrass
Aristida vagans Cav. ....Threeawn Speargrass
Aristida warburgii Mez ....Speargrass

Austrodanthonia bipartita (Link) H.P.Linder....................Wallaby Grass
Austrodanthonia caespitosa (Gaudich.) H.P.Linder....................Ringed Wallaby Grass
Austrodanthonia fulva (Vickery) H.P.Linder....................Wallaby Grass
Austrodanthonia monticola (Vickery) H.P.Linder....................Wallaby Grass
Austrodanthonia penicillata (Labill.) H.P.Linder....................Slender Wallaby Grass
Austrodanthonia pilosa
var. *pilosa* (R.Br.) H.P.Linder....................Smooth-flowered Wallaby Grass
Austrodanthonia racemosa (R.Br.) H.P.Linder
var. *racemosa*....................Wallaby Grass
Austrodanthonia setacea (R.Br.) H.P.Linder....................Small-flowered Wallaby Grass
Austrodanthonia tenuior (Steud.) H.P.Linder....................Wallaby Grass
Austrostipa aristiglumis (F.Muell.) S.W.L.Jacobs & J.Everett....................Plains Grass
Austrostipa pubescens (R.Br.) S.W.L.Jacobs & J.Everett....................Hairy Speargrass
Austrostipa racemosa (R.Br.) H.P.Linder
var. *racemosa*....................Speargrass
Austrostipa ramosissima (Trin.) S.W.L.Jacobs & J.Everett....................Stout Bamboo Grass
Austrostipa rudis
subsp. *nervosa* (Vickery) S.W.L.Jacobs & J.Everett....................Speargrass
Austrostipa rudis (Spreng.) S.W.L.Jacobs & J.Everett
subsp. *rudis*....................Speargrass
Austrostipa scabra (Lindl.) S.W.L.Jacobs & J.Everett....................Rough Speargrass
Austrostipa setacea (R.Br.) S.W.L.Jacobs & J.Everett....................Corkscrew Grass
**Axonopus affinis* Chase....................Narrow-leaved Carpet Grass
Bothriochloa macra (Steud.) S.T.Blake....................Red Grass
**Briza minor* L.....................Shivery Grass
Cenchrus caliculatus Cav.....................Hillside Burrgrass
Cymbopogon refractus (R.Br.) A.Camus....................Barbed Wire Grass
Cynodon dactylon (L.) Pers.....................Couch
Deyeuxia decipiens (R.Br.) Vickery....................Bent
Deyeuxia gunniana (Nees) Benth.....................Bent
Deyeuxia imbricata Vickery....................Bent
Deyeuxia parviseta Vickery....................Bent
Deyeuxia quadriseta (Labill.) Benth.....................Bent
Deyeuxia reflexa Vickery....................Bent
Dichelachne crinita (L.f.) Hook.f.....................Longhair Plumegrass
Dichelachne inaequiglumis (Hack. ex Cheeseman) Edgar & Connor....................Plumegrass
Dichelachne micrantha (Cav.) Domin....................Short-haired Plumegrass
Dichelachne parva B.K.Simon....................Plumegrass
Dichelachne rara (R.Br.) Vickery....................Plumegrass
Dichelachne sieberiana Trin. & Rupr.....................Plumegrass
Digitaria breviglumis (Domin) Henrard....................Finger Panic Grass
Digitaria diffusa Vickery....................Panic Grass
Digitaria ramularis (Trin.) Henrard....................Finger Panic Grass
Echinopogon caespitosus C.E.Hubb.
var. *caespitosus*....................Tufted Hedgehog Grass
Echinopogon mckiei C.E.Hubb.....................McKie's Hedgehog Grass
Echinopogon ovatus (G.Forst.) P.Beauv.....................Forest Hedgehog Grass
Elymus scaber (R.Br.) A.Love....................Wheatgrass
Enneapogon nigricans (R.Br.) P.Beauv.....................Niggerheads
Entolasia marginata (R.Br.) Hughes....................Bordered Panic
Entolasia stricta (R.Br.) Hughes....................Wiry Panic
**Eragrostis curvula* (Schrad.) Nees....................African Lovegrass
Eragrostis lacunaria F.Muell. ex Benth.....................Purple Lovegrass
Eragrostis leptostachya (R.Br.) Steud.....................Paddock Lovegrass
Eragrostis molybdea Vickery....................Granite Lovegrass
Eragrostis parviflora (R.Br.) Trin.....................Weeping Lovegrass
Eragrostis trachycarpa (Benth.) Domin....................Lovegrass
Hemarthria uncinata R.Br.....................Matgrass
Hierochloe rariflora Hook.f.....................Scented Holygrass
**Hyparrhenia hirta* (L.) Stapf....................Coolatai Grass

Imperata cylindrica
var. *major* (Nees) C.E.Hubb..Blady Grass
Isachne globosa (Thunb.) Kuntze ....Swamp Millet
Joycea pallida (R.Br.) S.W.L.Jacobs ....Red-anther Wallaby Grass
Lachnagrostis aemula (R.Br.) Trinius...Blown Grass
Lachnagrostis filiformis (Forst.) Trinius ....Blown Grass
Microlaena stipoides (Labill.) Druce
var. *stipoides* ....Weeping Meadow Grass
Notodanthonia longifolia (R.Br.) H.P.Linder..Long-leaved Wallaby Grass
Oplismenus aemulus (R.Br.) Roem. & Schult. ....Creeping Beard Grass
Oplismenus imbecillis (R.Br.) Roem. & Schult. ....Small Beard Grass
Panicum effusum R.Br...Hairy Panic
Panicum simile Domin ....Two Colour Panic
Paspalidium constrictum (Domin) C.E.Hubb...Knottybutt Grass
Paspalidium gracile (R.Br.) Hughes ....Slender Panic
**Paspalum dilatatum* Poir. ....Paspalum
**Paspalum urvillei* Steud. ....Vasey Grass
Pennisetum alopecuroides (L.) Spreng...Swamp Foxtail
Pentapogon quadrifidus (Labill.) Baill...Fiveawn Speargrass
**Phalaris aquatica* L...Phalaris
Poa labillardieri Steud. ....Tussock
Poa queenslandica C.E.Hubb..Poa
Poa sieberiana Labill. ....Snow Grass
Rhytidosperma nudiflorum (P.Morris) Connor & Edgar ....Wallaby Grass
Sacciolepis indica (L.) Chase ....Indian Cupscale Grass
**Secale cereale* L. ....Cereal Rye, Ryecorn
**Setaria verticillata* (L.) P.Beauv. ....Whorled Pigeon Grass
Sorghum leiocladum (Hack.) C.E.Hubb. ....Wild Sorghum
Sporobolus creber De Nardi..Slender Rat's Tail Grass
Sporobolus elongatus R.Br...Slender Rat's Tail Grass
Tetrarrhena juncea R.Br. ....Wiry Rice Grass
Themeda triandra Forssk. ....Kangaroo Grass
Tripogon loliiformis (F.Muell.) C.E.Hubb. ....Five Minute Grass
**Vulpia bromoides* (L.) Gray ....Squirrel Tail Fescue

Potamogetonaceae
Potamogeton tricarinatus F.Muell. & A.Benn. ex A.Benn. ....Floating Pondweed

Restionaceae
Baloskion fimbriatum
(L.A.S.Johnson & O.D.Evans) B.G.Briggs & L.A.S.Johnson ....Rush
Baloskion stenocoleum
(L.A.S.Johnson & O.D.Evans) B.G.Briggs & L.A.S.Johnson ....Rush
Empodisma minus (Hook.f.) L.A.S.Johnson & D.F.Cutler ....Rush
Lepyrodia anarthria F.Muell...Scale Rush
Lepyrodia scariosa R.Br. ....Scale Rush

Ripogonaceae
Ripogonum album R.Br. ....White Supplejack
Ripogonum brevifolium Conran & Clifford..Small-leaved Supplejack

Smilaceae
Smilax australis R.Br..Sarsaparilla
Smilax glyciphylla Sm. ....Sweet Sarsaparilla

Xanthorrhoeaceae
Xanthorrhoea acaulis (A.T.Lee) D.J.Bedford..Grasstree
Xanthorrhoea glauca D.J.Bedford ....Grasstree
Xanthorrhoea johnsonii A.T.Lee...Grasstree
Xanthorrhoea macronema F.Muell. ex Benth. ....Grasstree

Xyridaceae
Xyris complanata R.Br. ....Xyris
Xyris gracilis R.Br.
subsp. *gracilis* ....Xyris
Xyris operculata Labill. ....Xyris

Dicotyledon

Acanthaceae
Brunoniella australis (Cav.) Bremek. ....Blue Trumpet
Rostellularia adscendens (R.Br.) R.M.Barker
subsp. *adscendens* ....Pink Justicia

Alangiaceae
Alangium villosum
subsp. *polyosmoides* (F.Muell.) Bloemb. ....Muskwood

Amaranthaceae
Nyssanthes diffusa R.Br. ....Barb-wire Weed

Anacardiaceae
Euroschinus falcata Hook.f.
var. *falcata* ....Ribbonwood

Apiaceae
Actinotus gibbonsii F.Muell. ....Gibbon's Flannel Flower
Actinotus helianthi Labill. ....Flannel Flower
Centella asiatica (L.) Urb. ....Pennywort
Daucus glochidiatus (Labill.) Fisch., C.A.Mey. & Ave-Lall. ....Native Carrot
Eryngium paludosum (Moore & Betche) P.W.Michael..................................Long Eryngium
Hydrocotyle digitata A.R.Bean & Henwood..Pennywort
Hydrocotyle laxiflora DC. ....Stinking Pennywort
Hydrocotyle pedicellosa F.Muell. ex Benth. ....Pennywort
Hydrocotyle peduncularis R.Br. ex A.Rich. ....Small-leaved Pennywort
Platysace ericoides (Sieber ex Spreng.) C.Norman ....Platysace
Trachymene anisocarpa (Turcz.) B.L.Burtt ....Native Parsnip
Trachymene incisa Rudge
subsp. *incisa* ....Native Parsnip
Trachymene sp. nov. ....Native Parsnip
Xanthosia pilosa Rudge...Hairy Xanthosia

Apocynaceae
Alyxia ruscifolia R.Br. ....Prickly Alyxia
Parsonsia eucalyptophylla F.Muell. ....Gargaloo
Parsonsia purpurascens J.B.Williams ....Black Silkpod
Parsonsia straminea (R.Br.) F.Muell. ....Common Silkpod
Parsonsia velutina R.Br. ....Silkpod

Araliaceae
Astrotricha longifolia Benth. ....Star-hair
Cephalaralia cephalobotrys (F.Muell.) Harms ....Climbing Panax
Polyscias elegans (C.Moore & F.Muell.) Harms ....Celery Wood
Polyscias sambucifolia (Sieber ex DC.) Harms..Elderberry Panax

Asclepiadaceae
**Gomphocarpus fruticosus* (L.) R.Br. ex Spreng. ....Narrow-leaved Cotton Bush
Hoya australis R.Br. ex Traill
subsp. *australis*..Native Hoya
Marsdenia rostrata R.Br. ....Common Milk Vine

Tylophora woollsii Benth. ....Vine

Asteraceae

**Ageratina adenophora* (Spreng.) R.King & H.Robinson ....Crofton Weed
Ammobium alatum R.Br. ....Winged Everlasting
**Bidens pilosa* L. ....Cobbler's Pegs
Brachyscome angustifolia A.Cunn. ex DC.
var. *angustifolia* ....Daisy
Brachyscome microcarpa F.Muell. ....Small Fruited Daisy Bush
Brachyscome nova-anglica G.L.R.Davis ....New England Daisy
Brachyscome scapigera (Sieber ex Spreng.) DC. ....Daisy
Brachyscome spathulata Gaudich. ....Daisy
Brachyscome stuartii Benth. ....Granite Daisy
Brachyscome tenuiscapa
var. *pubescens* (Benth.) G.L.R.Davis ....Daisy
Calotis cuneifolia R.Br. ....Purple Burr-daisy
Calotis dentex R.Br. ....Burr-daisy
**Carduus tenuiflorus* S.Curtis ....Winged Slender Thistle
Cassinia aculeata (Labill.) R.Br. ....Dolly Bush
Cassinia hewsoniae Orchard ....Hewson’s Cough Bush
Cassinia laevis R.Br. ....Cough Bush
Cassinia quinquefaria R.Br. ....Rosemary Cassinia
Centipeda minima
var. *lanuginosa* (DC.) Domin ....Centipeda
Chrysocephalum apiculatum (Labill.) Steetz ....Common Everlasting
Chrysocephalum semipapposum (Labill.) Steetz ....Yellow Buttons
**Cirsium vulgare* (Savi) Ten. ....Spear Thistle
**Conyza albida* Willd. ex Spreng. ....Tall Fleabane
**Conyza bonariensis* (L.) Cronq. ....Flaxleaf Fleabane
**Conyza canadensis* (L.) Cronq.
var. *canadensis* ....Canadian Fleabane
**Conyza chilensis* Spreng. ....Fleabane
**Conyza parva* Cronq. ....Fleabane
**Coreopsis lanceolata* L. ....Coreopsis
Craspedia canens J.Everett & Doust. ....Common Billy Buttons
Craspedia variabilis Everett & Doust ....Billy Buttons
Euchiton gymnocephalus (DC.) Holub ....Creeping Cudweed
Euchiton involucratus (G.Forst.) Holub ....Star Cudweed
Euchiton sphaericus (Willd.) Holub ....Cudweed
**Gamochaeta americanum* (Mill.) Wedd. ....Cudweed
**Gamochaeta spicata* (Lam.) Cabrera ....Spiked Cudweed
Glossogyne tannensis (Spreng.) Garn.-Jones ....Cobbler's Tack
Helichrysum boormanii Maiden & Betche ....Boorman’s Everlasting
Helichrysum collinum DC. ....Everlasting
Helichrysum elatum A.Cunn. ex DC. ....White Everlasting
Helichrysum rutidolepis DC. ....Pale Everlasting
Helichrysum scorpioides Labill. ....Button Everlasting
**Hypochaeris glabra* L. ....Smooth Catsear
**Hypochaeris radicata* L. ....Catsear
Lagenifera stipitata (Labill.) Druce ....Blue Bottle-daisy
Leptorhynchos squamatus (Labill.) Less
subsp. A. ....Scaly Buttons
Leucochrysum albicans (A.Cunn.) Paul G.Wilson ....Grey Daisy-bush
Olearia elliptica DC. ....Daisy Bush
Olearia gravis (F.Muell.) Benth. ....Daisy Bush
Olearia microphylla (Vent.) Maiden & Betche ....Small-leaved Daisy Bush
Olearia oppositifolia (F.Muell.) Lander ....Daisy Bush
Olearia ramulosa (Labill.) Benth. ....Daisy Bush
Ozothamnus diosmifolius (Vent.) DC. ....White Dogwood

Ozothamnus obcordatus
subsp. *major* (Benth.) P.Short .... Daisy Bush
Picris evae Lack .... Hawkweed
Picris hieracioides L. .... Hawkweed Picris
Podolepis arachnoidea (Hook.) Druce .... Clustered Copper-wire Daisy
Podolepis hieracioides F.Muell. .... Copper-wire Daisy
Podolepis jaceoides (Sims) Voss .... Showy Copper-wire Daisy
Podolepis neglecta G.L.R.Davis .... Copper-wire Daisy
Pseudognaphalium luteoalbum (L.) Hilliard & B.L.Burtt .... Jersey Cudweed
Rhodanthe anthemoides (Spreng.) Paul G. Wilson .... Daisy
**Scolymus maculatus* L. .... Spotted Thistle
Senecio amygdalifolius F.Muell. .... Forest Fireweed
Senecio bathurstianus (DC.) Sch.Bip. .... Hill Fireweed
Senecio bipinnatisectus Belcher .... Fireweed
Senecio biserratus Belcher .... Fireweed
Senecio diaschides W.H.Drury .... Fireweed
Senecio hispidulus A.Rich.
var. *hispidulus* .... Hill Fireweed
Senecio lautus
subsp. *dissectifolius* Ali .... Variable Groundsel
Senecio linearifolius A.Rich. .... Fireweed Groundsel
Senecio minimus Poir. .... Groundsel
Senecio pinnatifolius
var. *serratus* I.Thomps. .... Groundsel
Senecio prenanthoides A.Rich. .... Fireweed
Senecio quadridentatus Labill. .... Cotton Fireweed
Senecio tenuiflorus (DC.) Sieber ex Sch.Bip. .... Fireweed
Sigesbeckia orientalis L.
subsp. *orientalis* .... Indian Weed
Solenogyne bellioides Cass. .... Daisy
**Sonchus asper*
subsp. *glaucescens* (Jordan) Ball .... Prickly Sowthistle
**Sonchus oleraceus* L. .... Common Sowthistle
**Taraxacum officinale* L. .... Dandelion
Vernonia cinerea (L.) Less.
var. *cinerea* .... Vernonia
Xerochrysum bracteatum (Vent.) Tzvelev .... Golden Everlasting

Baueraceae
Bauera rubioides Banks ex Andr.
var. *rubioides* .... Black-eyed Susan

Bignoniaceae
Pandorea pandorana (Andrews) Steenis .... Wonga Wonga Vine

Boraginaceae
Austrocynoglossum latifolium (R.Br.) R.Mill .... Hounds Tongue

Brassicaceae
**Hirschfeldia incana* (L.) Lagr.-Fossat .... Buchan Weed

Campanulaceae
Wahlenbergia ceracea Loth. .... Waxy Bluebell
Wahlenbergia communis Carolin .... Tufted Bluebell
Wahlenbergia gracilis (Forster f.) A. DC. .... Sprawling Bluebell
Wahlenbergia graniticola Carolin .... Granite Bluebell
Wahlenbergia littoricola P.J.Sm. .... Bluebell
Wahlenbergia luteola P.J.Sm. .... Bluebell
Wahlenbergia planiflora
subsp. *longipila* Carolin ex P.J.Sm. .... Bluebell

subsp. planiflora .... Bluebell
Wahlenbergia stricta
subsp. *alterna* P.J.Sm. .... Tall Bluebell

Caryophyllaceae
**Cerastium balearicum* Herm. .... Mouse-ear Chickweed
Scleranthus biflorus (G.Forst. & Forst.f.) Hook.f. .... Knawel
Stellaria flaccida Hook. .... Chickweed
**Stellaria media* (L.) Cirillo .... Common Chickweed

Casuarinaceae
Allocasuarina littoralis (Salisb.) L.A.S.Johnson .... Black She-oak
Allocasuarina rigida (Miq.) L.A.S.Johnson
subsp. *rigida* .... Rock She-oak
Allocasuarina rupicola L.A.S.Johnson .... She-oak
Allocasuarina torulosa (Aiton) L.A.S.Johnson .... Forest She-oak
Casuarina cunninghamiana Miq. .... River Oak

Celastraceae
Cassine australis (Vent.) Kuntze
var. *australis* .... Red Olive Plum
Celastrus subspicata Hook. .... Large Staff Vine
Denhamia celastroides (F.Muell.) Jessup .... Denhamia
Denhamia pittosporoides F.Muell. .... Veiny Denhamia
Maytenus bilocularis Lander & L.A.S.Johnson .... Orangebark
Maytenus silvestris Lander & L.A.S.Johnson .... Narrow-leaved Orangebark

Chenopodiaceae
Chenopodium melanocarpum (J.M.Black) J.M.Black .... Black Crumbweed
Chenopodium pumilio R.Br. .... Goosefoot
Einadia hastata (R.Br.) A.J.Scott .... Berry Saltbush

Chloanthaceae
Chloanthes parviflora Walp. .... Chloanthes

Clusiaceae
Hypericum gramineum Forst.f. .... Small St. John's Wort
Hypericum japonicum Thunb. .... St. John's Wort

Convolvulaceae
Dichondra repens Forst. & Forst.f. .... Kidney Weed
Dichondra sp. A .... Kidney Weed
Polymeria calycina R.Br. .... Polymeria
Polymeria pusilla R.Br. .... Polymeria

Crassulaceae
Crassula colorata
var. *acuminata* (Reader) Toelken .... Stonecrop
Crassula sieberiana (Schult. & Schult.f.) Druce .... Australian Stonecrop

Cucurbitaceae
Zehneria cunninghamii F.Muell. .... Wild Cucumber

Cunoniaceae
Caldcluvia paniculosa (F.Muell.) Hoogland .... Soft Corkwood
Callicoma serratifolia Andrews .... Callicoma
Schizomeria ovata D.Don .... Crabapple

Dilleniaceae
Hibbertia acicularis (Labill.) F.Muell. .... Sharp Guinea Flower

Hibbertia aspera
subsp. *pilosifolia* Toelken ....Guinea Flower
Hibbertia cistoidea (Hook.) C.T.White..Guinea Flower
Hibbertia dentata R.Br. ex DC...Twining Guinea Flower
Hibbertia linearis R.Br. ex DC. ....Guinea Flower
Hibbertia obtusifolia DC. ....Grey Guinea Flower
Hibbertia pedunculata R.Br. ex DC. ....Guinea Flower
Hibbertia riparia (R.Br. ex. DC.) Hoogl. ....Common Guinea Flower
Hibbertia rufa N.A.Wakef. ....Guinea Flower
Hibbertia scandens (Willd.) K.D.Konig & J.Sims ....Climbing Guinea Flower
Hibbertia sericea (R.Br. ex DC.) Benth. ....Guinea Flower
Hibbertia serpyllifolia R.Br. ex DC. ....Guinea Flower
Hibbertia sp. B ....Guinea Flower
Hibbertia vestita A.Cunn. ex Benth. ....Guinea Flower
Hibbertia villosa B.J.Conn ....Hairy Guinea Flower

Droseraceae
Drosera auriculata Backh. & Planchon ....Sundew
Drosera binata Labill. ....Sundew
Drosera burmannii Vahl ....Burman's Sundew
Drosera peltata Thunb. ....Sundew
Drosera spatulata Labill. ....Sundew

Ebenaceae
Diospyros australis (R.Br.) Hiern ....Black Plum
Diospyros pentamera (Woolls & F.Muell.) F.Muell. ....Myrtle Ebony

Elaeocarpaceae
Elaeocarpus holopetalus F.Muell...Black Olive Berry
Elaeocarpus obovatus G.Don..Hard Quandong
Elaeocarpus reticulatus Sm...Blueberry Ash

Epacridaceae
Acrotriche aggregata R.Br. ....Acrotriche
Brachyloma daphnoides
subsp. *glabrum* (Blakely) J.T.Hunter ....Red-Flowered Daphne Heath
Epacris breviflora Stapf. ....Drumstick Heath
Epacris microphylla R.Br.
var. *microphylla* ....Coral Heath
Epacris obtusifolia Sm. ....Blunt-leaved Heath
Epacris pulchella Cav. ....Heath
Leucopogon biflorus R.Br. ....Twin-flowered Beard Heath
Leucopogon juniperinus R.Br..Beard Heath
Leucopogon lanceolatus (Sm.) R.Br.
var. *lanceolatus* ....Lance-leaf Beard Heath
Leucopogon melaleucoides A.Cunn. ex DC. ....Melaleuca Beard Heath
Leucopogon microphyllus
var. *microphyllus* (Cav.) R.Br. ....Small-leaved Beard Heath
Leucopogon muticus R.Br. ....Twisted Beard Heath
Leucopogon neoanglicus F.Muell. ex Benth. ....New England Beard Heath
Leucopogon virgatus (Labill.) R.Br. ....Beard Heath
Lissanthe strigosa (Sm.) R.Br. ....Peach Heath
Melichrus adpressus A.Cunn. ex DC. ....Large Nectar-heath
Melichrus procumbens (Cav.) Druce...Jam Tarts
Melichrus urceolatus R.Br. ....Urn Heath
Monotoca scoparia (Sm.) R.Br. ....Heath
Styphelia triflora Andrews ....Five-corners
Styphelia viridis Andrews...Five-corners
Trochocarpa laurina (Rudge) R.Br. ....Tree Heath

Eriocaulaceae
Eriocaulon scariosum Sm. ....Eriocaulon

Escalloniaceae
Quintinia sieberi A.DC. ....Possumwood

Euphorbiaceae
Alchornea ilicifolia (J.Sm.) Muell.Arg...Native Holly
Amperea xiphoclada (Sieber ex Spreng.) Druce
var. *xiphoclada*..Broom Spurge
Baloghia inophylla (G.Forst.) P.S.Green...Brush Bloodwood
Bertya glandulosa Gruning ....Spurge
Breynia cernua (Poir.) Muell.Arg. ....Coffee Bush
Claoxylon australe Baill...Brittlewood
Croton verreauxii Baillon..Green Cascarilla
Glochidion ferdinandi (Muell.Arg.) Bailey
var. *ferdinandi*...Cheese Tree
Micrantheum hexandrum Hook.f. ....Micrantheum
Omalanthus nutans (G.Forst.) Guill. ....Bleeding Heart
Phyllanthus gunnii Hook.f...Shrubby Spurge
Phyllanthus hirtellus (F.Muell.) Muell.Arg...Spurge
Phyllanthus similis Muell.Arg...Spurge
Phyllanthus virgatus G.Forst...Wiry Spurge
Poranthera microphylla Brongn. ....Small Poranthera

Fabaceae
Acacia binervata DC. ....Two-veined Hickory
Acacia blakei
subsp. *diphylla* (Tindale) Pedley...Hairy Wattle
Acacia brownii (Poir.) Steud. ....Heath Wattle
Acacia buxifolia A.Cunn.
subsp. *buxifolia* ....Box-leaved Wattle
Acacia falciformis DC. ....Broad-leaved Hickory
Acacia filicifolia Cheel & M.B.Welch ....Fern-leaved Wattle
Acacia floribunda (Vent.) Willd..White Sally
Acacia gunnii Benth. ....Ploughshare Wattle
Acacia implexa Benth...Hickory Wattle
Acacia irrorata Sieber ex Spreng...Green Wattle
Acacia latisepala Pedley ....Wattle
Acacia leucoclada Tindale
subsp. *leucoclada* ....Wattle
Acacia longifolia (Andrews) Willd.
subsp. *longifolia* ....Sydney Golden Wattle
Acacia macnuttiana Maiden & Blakely ....McNutt’s Wattle
Acacia maidenii F.Muell. ....Maiden's Wattle
Acacia melanoxylon R.Br..Blackwood
Acacia myrtifolia (Sm.) Willd. ....Red-stemmed Wattle
Acacia obtusifolia A.Cunn. ....Thick-leaved Wattle
Acacia penninervis Sieber ex DC.
var. *penninervis*..Mountain Hickory
Acacia rubida A.Cunn..Red-leaved Wattle
Acacia stricta (Andrews) Willd..Straight Wattle
Acacia ulicifolia (Salisb.) Court ....Prickly Moses
Acacia venulosa Benth. ....Veined Wattle
Acacia viscidula Benth...Sticky Wattle
Aotus subglauca Blakely & McKie
var. *subglauca* ....Aotus
Bossiaea neo-anglica F.Muell...New England Bossiaea
Bossiaea obcordata (Vent.) Druce ....Bossiaea
Bossiaea rhombifolia Sieber ex DC. ....Round-leaved Bossiaea

Bossiaea scortechinii F.Muell. ....Scortechini's Bossiaea
Crotalaria montana Roth
var. *montana*..Rattlepod
Daviesia elliptica Sm. ....Bitter Pea
Daviesia latifolia R.Br...Bitter Pea
Daviesia nova-anglica Crisp ....New England Bitter Pea
Daviesia umbellulata Sm. ....Bitter Pea
Desmodium brachypodum A.Gray ....Large Tick Trefoil
Desmodium rhytidophyllum F.Muell. ex Benth...Hairy Tick Trefoil
Desmodium varians (Labill.) Endl. ....Slender Tick Trefoil
Dillwynia phylicoides A.Cunn..Heath Parrot Pea
Dillwynia retorta (J.C.Wendl.) Druce ....Bacon & Egg Pea
Dillwynia sericea A.Cunn. ....Bacon & Egg Pea
Dillwynia sieberi Steud. ....Bacon & Egg Pea
Glycine clandestina Wendl...Twining Glycine
Glycine microphylla (Benth.) Tindale ....Small-leaved Glycine
Glycine tabacina (Labill.) Benth. ....Variable Glycine
Gompholobium huegelii Benth..Pale Wedge Pea
Hardenbergia violacea (Schneev.) Stearn..False Sarsaparilla
Hovea beckeri F.Muell. ....Becker's Hovea
Hovea heterophylla A.Cunn. ex Hook.f. ....Hovea
Hovea pannosa Hook. ....Hovea
Hovea pedunculata I.Thomps..Hovea
Hovea purpurea Sweet ....Hairy Hovea
Indigofera adesmiifolia A.Gray...Indigo
Indigofera australis Willd. ....Australian Indigo
Jacksonia scoparia R.Br. ex Sm. ....Dogwood
Kennedia rubicunda (Schneev.) Vent...Red Kennedy Pea
Lespedeza juncea
subsp. *sericea* (Thunb.) Steenis..Lespedeza
Lotus australis Andrews...Australian Trefoil
**Lotus corniculatus* L..Birds-foot Trefoil
**Medicago arabica* (L.) Huds. ....Spotted Burr Medic
Mirbelia confertiflora Pedley ....Pea
Mirbelia pungens A.Cunn. ex G.Don. ....Pea
Mirbelia speciosa Sieber ex DC.
subsp. *speciosa* ....Pea
Oxylobium arborescens R.Br. ....Tall Shaggy Pea
Pararchidendron pruinosum (Benth.) Nielsen
var. *pruinosum* ....Snow Wood
Phyllota phylicoides (Sieber ex DC.) Benth. ....Heath Phyllota
Podolobium ilicifolium (Andrews) Crisp & P.H.Weston ....Prickly Shaggy Pea
Pultenaea altissima F.Muell. ....Bush Pea
Pultenaea dentata Labill. ....Bush Pea
Pultenaea flexilis Sm. ....Bush Pea
Pultenaea hartmannii F.Muell. ....Hartman's Bush Pea
Pultenaea linophylla Schrad. & J.C.Wendl. ....Bush Pea
Pultenaea polifolia A.Cunn. ....Bush Pea
Pultenaea pycnocephala F.Muell. ex Benth. ....Hard-head Bush Pea
Pultenaea retusa Sm...Blunt-leaf Bush Pea
Pultenaea stuartiana H.B.Will. ....Bush Pea
Pultenaea villosa Willd. ....Hairy Bush Pea
Sphaerolobium vimineum Sm. ....Sphaerolobium
Swainsona fraseri Benth..Fraser's Darling Pea
Swainsona reticulata J.M.Black ....Variable Swainsona
Tephrosia grandiflora (L.'Her ex Aiton) Pers...Tephrosia
**Trifolium campestre* Schreb. ....Hop Clover
**Trifolium repens* L..White Clover
Zornia dyctiocarpa DC.
subsp. *dyctiocarpa*...Zornia

Gentianaceae
Centaurium erythraea Rafn..Common Centaury
**Centaurium tenuiflorum* (Hoffm. & Link) Fritsch ....Centaury

Geraniaceae
Geranium neglectum Carolin..Geranium
Geranium potentilloides L.'Her. ex DC.
var. *potentilloides*..Geranium
Geranium solanderi
var. *grande* Carolin ....Native Geranium
Geranium solanderi Carolin
var. *solanderi* ....Native Geranium
Pelargonium australe Willd. ....Native Storksbill

Goodeniaceae
Dampiera purpurea R.Br. ....Grey Dampiera
Dampiera stricta (Sm.) R.Br. ....Blue Dampiera
Goodenia bellidifolia Sm.
subsp. *argentea* Carolin ....Goodenia
subsp. *bellidifolia*...Goodenia
Goodenia hederacea Sm.
subsp. *hederacea*...Ivy Goodenia
Velleia montana Hook.f...Velleia
Velleia paradoxa R.Br...Velleia

Haloragaceae
Gonocarpus micranthus
subsp. *ramosissimus* Orchard..Swamp Raspwort
Gonocarpus oreophilus Orchard ....Forest Raspwort
Gonocarpus tetragynus Labill. ....Poverty Raspwort
Gonocarpus teucrioides DC. ....Raspwort
Haloragis heterophylla Brongn...Variable Haloragis
**Myriophyllum aquaticum* (Vell. Conc.) Verdc. ....Parrot's Feather
Myriophyllum pedunculatum Hook.f. ....Water-milfoil
Myriophyllum striatum Orchard ....Water-milfoil
Myriophyllum variifolium Hook.f...Water-milfoil

Icacinaceae
Pennantia cunninghamii Miers ....Brown Beech

Lamiaceae
Ajuga australis R.Br...Australian Bugal
Mentha diemenica Spreng. ....Pennyroyal Mint
Mentha satureioides R.Br..Mintbush
Plectranthus graveolens R.Br...Cockspur Flower
Plectranthus nitidus P.I.Forster..Mintbush
Plectranthus parviflorus Willd..Cockspur Flower
Plectranthus suaveolens S.T.Blake ....Cockspur Flower
Prostanthera caerulea R.Br. ....Mint-bush
Prostanthera nivea A.Cunn. ex Benth...Snowy Mint-bush
Prostanthera saxicola R.Br. ....Rock Mint-bush
Prostanthera petraea B.J.Conn ....Mint-bush
**Prunella vulgaris* L. ....Self-heal
Scutellaria humilis R.Br. ....Dwarf Skullcap

Lauraceae
Cassytha pubescens R.Br. ....Hairy Devil's Twine
Cryptocarya rigida Meissn...Forest Maple
Endiandra hayesii Kosterm. ....Rusty Rose Walnut

Neolitsea australiensis Kosterm. ....Green Bolly Gum

Lentibulariaceae
Utricularia dichotoma Labill..Fairy Aprons
Utricularia lateriflora R.Br. ....Small Bladderwort

Lobeliaceae
Isotoma anethifolia Summerh. ....Isotome
Isotoma axillaris Lindl. ....Showy Isotome
Isotoma fluviatilis
subsp. *borealis* McComb...Swamp Isotome

Lobeliaceae
Lobelia dentata Cav. ....Lobelia
Lobelia gibbosa Labill...Tall Lobelia
Lobelia gracilis Andrews ....Trailing Lobelia
Pratia purpurascens (R.Br.) F.Wimmer...Whiteroot

Loganiaceae
Logania albiflora (Andrews) Druce ....Narrow-leaved Logania
Logania pusilla R.Br. ....Logania
Mitrasacme paludosa R.Br...Mitrasacme
Mitrasacme polymorpha R.Br. ....Mitrasacme

Loranthaceae
Amyema cambagei (Blakely) Danser..Needle-leaf Mistletoe
Amyema miquelii (Lehm. ex Miq.) Tiegh...Drooping Mistletoe
Amyema pendulum (Sieber ex Spreng.) Tiegh..Drooping Mistletoe
Muellerina eucalyptoides (DC.) Barlow...Mistletoe

Lythraceae
Lythrum salicaria L. ....Purple Loosestrife

Malvaceae
Hibiscus heterophyllus Vent.
subsp. *heterophyllus* ....Native Rosella
**Pavonia hastata* Cav. ....Pink Pavonia

Meliaceae
Synoum glandulosum (Sm.) A.Juss. ....Scentless Rosewood
Toona ciliata M.Roemer ....Red Cedar

Menispermaceae
Sarcopetalum harveyanum F.Muell. ....Pearl Vine
Stephania japonica
var. *discolor* (Blume) Forman ....Snake Vine
Tinospora smilacina Benth...Tinospora

Menyanthaceae
Nymphoides geminata (R.Br.) Kuntze...Marshwort

Monimiaceae
Hedycarya angustifolia A.Cunn. ....Native Mulberry

Moraceae
Ficus coronata Spin & Colla..Creek Sandpaper Fig
Ficus obliqua G.Forst. ....Small-leaved Fig
Ficus rubiginosa Desf. ex Vent.
forma *rubiginosa* ....Port Jackson Fig
Maclura cochinchinensis (Lour.) Corner ....Cockspur Thorn

Streblus brunonianus (Endl.) F.Muell. ....Whalebone Tree

Myoporaceae
Eremophila debilis (Andrews) Chinnock ....Winter Apple
Myoporum montanum R.Br. ....Western Boobialla

Myrsinaceae
Myrsine howittiana (F.Muell. ex Mez) Jackes ....Brush Muttonwood
Myrsine variabilis R.Br. ....Muttonwood

Myrtaceae
Acmena smithii (Poir.) Merr. & L.M.Perry ....Lilly Pilly
Angophora floribunda (Sm.) Sweet...Rough-barked Apple
Angophora subvelutina F.Muell. ....Broad-leaved Apple
Babingtonia densifolia (Sm.) F.Muell. ....Babingtonia
Backhousia myrtifolia Hook. f. & Harvey..Grey Myrtle
Baeckea omissa A.R.Bean...Forgotten Baeckea
Callistemon flavovirens (Cheel) Cheel..Green Bottlebrush
Callistemon pallidus (Bonpl.) DC. ....Lemon Bottlebrush
Callistemon pityoides F.Muell...Alpine Bottlebrush
Callistemon sieberi DC. ....River Bottlebrush
Callistemon viminalis (Sol. ex Gaertn.) G.Don ex Loudon ....Weeping Bottlebrush
Calytrix tetragona Labill. ....Fringe Myrtle
Corymbia gummifera (Sol. ex Gaertn.) K.D.Hill & L.A.S.Johnson ....Red Bloodwood
Corymbia intermedia (R.T.Baker) K.D.Hill & L.A.S.Johnson ....Pink Bloodwood
Eucalyptus acaciiformis H.Deane & Maiden ....Wattle-leaved Peppermint
Eucalyptus acmenoides Schauer..White Mahogany
Eucalyptus andrewsii Maiden ....New England Blackbutt
Eucalyptus banksii Maiden..Tenterfield Woollybutt
Eucalyptus biturbinata L.A.S.Johnson & K.D.Hill..A Grey Gum
Eucalyptus bridgesiana R.T.Baker..Apple Box
Eucalyptus brunnea L.A.S.Johnson & K.D.Hill..Round-leaved Gum
Eucalyptus caliginosa Blakely & McKie ....Broad-leaved Stringybark
Eucalyptus cameronii Blakely & McKie...Diehard Stringybark
Eucalyptus campanulata R.T.Baker & H.G.Sm. ....New England Blackbutt
Eucalyptus codonocarpa Blakely & McKie...Granite Eucalyptus
Eucalyptus dalrympleana
subsp. *heptantha* L.A.S.Johnson ....Mountain Gum
Eucalyptus dealbata A.Cunn. ex Schauer ....Tumbledown Red Gum
Eucalyptus dorrigoensis L.A.S.Johnson & K.D.Hill......................................Dorrigo White Gum
Eucalyptus laevopinea R.T.Baker ....Silver-top Stringybark
Eucalyptus melliodora A.Cunn. ex Schauer...Yellow Box
Eucalyptus microcorys F.Muell..Tallowwood
Eucalyptus notabilis Maiden ....Mountain Mahogany
Eucalyptus nova-anglica H.Deane & Maiden ....New England Peppermint
Eucalyptus obliqua L'Her. ....Messmate
Eucalyptus oreades R.T.Baker ....Blue Mountain Ash
Eucalyptus pauciflora Sieber ex Spreng...Snow Gum
Eucalyptus prava L.A.S.Johnson & K.D.Hill ....Orange Gum
Eucalyptus propinqua H.Deane & Maiden ....Small-fruited Grey Gum
Eucalyptus radiata
subsp. *sejuncta* L.A.S.Johnson & K.D.Hill......................................Narrow-leaved Peppermint
Eucalyptus saligna Sm. ....Sydney Blue Gum
Eucalyptus scoparia Maiden ....Wallangarra Gum
Eucalyptus tereticornis Sm..Forest Red Gum
Eucalyptus tindaliae Blakely...Stringybark
Eucalyptus viminalis F.Muell. ....Manna Gum
Eucalyptus williamsiana L.A.S.Johnson & K.D.Hill ....William’s Stringybark
Eucalyptus youmanii Blakely & McKie ....Youman's Stringybark
Homoranthus lunatus Craven & S.R.Jones ....Crescent-leafed Heath Myrtle

Kunzea bracteolata Maiden & Betche ....Granite Kunzea
Kunzea ericoides (A.Rich.) Joy Thomps. ....Burgan
Kunzea obovata Byrnes..Kunzea
Kunzea parvifolia Schauer ....Violet Kunzea
Leptospermum arachnoides Gaertn. ....Spider Tea-tree
Leptospermum brachyandrum (F.Muell.) Druce ....Tea-tree
Leptospermum brevipes F.Muell. ....Grey Tea-tree
Leptospermum gregarium Joy Thomps. ....Swamp Tea-tree
Leptospermum minutifolium C.T.White ....Small-leaved Tea-tree
Leptospermum novae-angliae Joy Thomps. ....New England Tea-tree
Leptospermum polygalifolium
subsp. *montanum* Joy Thomps. ....Creek Tea-tree
subsp. *transmontanum* Joy Thomps. ....Creek Tea-tree
Leptospermum trinervium (Sm.) Joy Thomps. ....Paperbark Tea-tree
Leptospermum variabile Joy Thomps. ....Variable Tea-tree
Lophostemon confertus Peter G.Wilson & J.T.Waterh.....................................Brush Box
Micromyrtus sessilis J.W.Green ....Micromyrtus
Rhodamnia argentea Benth. ....White Myrtle
Syzygium australe (Wendl. ex Link) B.Hyland ....Brush Cherry

Nyctaginaceae
Boerhavia dominii Meikle & Hewson..Tarvine

Olacaceae
Olax stricta R.Br. ....Olax

Oleaceae
Notelaea linearis Benth...Narrow-leaved Mock Olive
Notelaea longifolia Vent. ....Large Mock-Olive
Notelaea microcarpa R.Br. ....Native Olive
Notelaea ovata R.Br. ....Mock Olive
Notelaea sp. A ....Apple Mock Olive
Notelaea venosa F.Muell...Veined Mock-Olive

Onagraceae
Epilobium billardierianum
subsp. cinereum (Rich) Raven & Engelhorn ....Hairy Willow Herb
subsp. *hydrophilum* Raven & Engelhorn ....Variable Willow Herb
Epilobium gunnianum Hausskn. ....Willow Herb
Epilobium hirtigerum A.Cunn. ....Willow Herb

Oxalidaceae
Oxalis chnoodes Lourteig ....Wood Sorrel
Oxalis exilis A.Cunn. ....Wood Sorrel
Oxalis perennans Haw. ....Wood Sorrel

Passifloraceae
Passiflora aurantia G.Forst.
var. *aurantia* ....Blunt-leaved Passionfruit

Peperomiaceae
Peperomia blanda
var. *floribunda* (Miq.) H.Huber ....Pepper Plant
Peperomia tetraphylla (G.Forst.) Hook. & Arn. ....Four-leaved Pepper Plant

Phytolaccaceae
**Phytolacca octandra* L. ....Inkweed

Pittosporaceae
Billardiera longiflora Labill. ....Purple Appleberry

Billardiera scandens Sm.
var. *scandens* .... Apple Dumplings
Bursaria spinosa Cav.
var. *spinosa* .... Native Blackthorn
Citriobatus pauciflorus Ettingsh. .... Orange Thorn
Pittosporum undulatum Vent. .... Sweet Pittosporum
Rhytidosporum procumbens (Hook.) F.Muell. .... Rhytidosporum

Plantaginaceae
Plantago debilis R.Br. .... Small Plantain
**Plantago major* L. .... Large Plantain
Plantago varia R.Br. .... Variable Plantain

Polygalaceae
Comesperma ericinum DC. .... Heath Milkwort
Comesperma sphaerocarpum Steetz .... Grass Comesperma
Comesperma sylvestre Lindl. .... Milkwort
Comesperma volubile Labill. .... Climbing Milkwort
Polygala japonica Houtt. .... Polygala

Polygonaceae
**Acetosella vulgaris* Fourr. .... Sheep Sorrel
Muehlenbeckia costata m.s. .... Climbing Fire Lignum
Muehlenbeckia rhyticarya F.Muell. ex Benth. .... Trailing Lignum
Persicaria hydropiper (L.) Spach .... Waterpepper
Rumex brownii Campd. .... Swamp Dock

Portulacaceae
Calandrinia eremaea Ewart .... Small Purslane
Calandrinia pickeringii A.Gray .... Pickering's Purslane

Proteaceae
Banksia cunninghamii Sieber ex Rchb.
subsp. A. .... New England Banksia
Banksia integrifolia
subsp. *monticola* K.R.Thiele .... Mountain Banksia
Banksia marginata Cav. .... Banksia
Banksia spinulosa
var. *collina* (R.Br.) A.S.George .... Hairpin Banksia
Conospermum taxifolium C.F.Gaertn. .... Coneseeds
Grevillea juniperina
subsp. *allojohnsonii* Makinson .... Grevillea
Grevillea linearifolia (Cav.) Druce .... Grevillea
Hakea eriantha R.Br. .... Tall Hakea
Hakea florulenta Meisn. .... Hakea
Hakea laevipes
subsp. *graniticola* Haegi .... Granite Hakea
Hakea macrorhyncha R.T.Baker .... Hakea
Hakea microcarpa R.Br .... Small-fruited Hakea
Hakea salicifolia (Vent.) B.L.Burtt.
subsp. *salicifolia* .... Willow-leaved Hakea
Lomatia fraseri R.Br. .... Silky Lomatia
Lomatia silaifolia (Sm.) R.Br. .... Crinkle Bush
Orites excelsa R.Br. .... Prickly Ash
Persoonia cornifolia A.Cunn. ex R.Br. .... Common Geebung
Persoonia daphnoides A.Cunn. ex R.Br. .... Daphne Geebung
Persoonia fastigiata R.Br. .... Geebung
Persoonia microphylla R.Br. .... Geebung
Persoonia oleoides L.A.S.Johnson & P.H.Weston .... Geebung
Persoonia sericea R.Br. .... Silky Geebung

Persoonia tenuifolia R.Br. .... Geebung
Persoonia virgata R.Br. .... Geebung
Petrophile canescens A.Cunn. ex R.Br. .... Prickly Conesticks

Ranunculaceae
Clematis aristata R.Br. ex Ker Gawl. .... Traveller's Joy
Clematis glycinoides DC. .... Headache Vine
Ranunculus inundatus R.Br. ex DC. .... River Buttercup
Ranunculus lappaceus Sm. .... Common Buttercup

Rhamnaceae
Alphitonia excelsa (Fenzl) Benth. .... Red Ash
Cryptandra amara Sm.
var. *amara* .... Common Cryptandra
Cryptandra lanosiflora F.Muell. .... Woolly Cryptandra
Cryptandra scortechinii F.Muell. .... Clustered Cryptandra
Pomaderris andromedifolia A.Cunn.
subsp. *andromedifolia* .... Pomaderris
Pomaderris lanigera (Andrews) Sims .... Pomaderris
Pomaderris ligustrina Sieber ex DC. .... Rusty Cryptandra
Pomaderris nitidula (Benth.) N.A.Wakef. .... Shining Pomaderris

Rosaceae
Acaena agnipila Gand. .... Bidgee Widgee
Acaena novae-zelandiae Kirk .... Bidgee Widgee
**Rosa rubiginosa* L. .... Sweet Briar
**Rubus fruticosus* L. .... Blackberry
Rubus moluccanus
var. *trilobus* A.R.Bean .... Molucca Bramble
Rubus parvifolius L. .... Small-leaved Bramble
**Rubus ulmifolius* Schott .... Blackberry

Rubiaceae
Asperula conferta Hook.f. .... Common Woodruff
Coprosma quadrifida (Labill.) Robinson .... Prickly Currant Bush
Galium binifolium N.A.Wakef. .... Bedstraw
Galium gaudichaudii DC. .... Rough Bedstraw
Galium migrans Ehrend. & McGillivray .... Bedstraw
Galium propinquum A.Cunn. .... Bedstraw
Morinda jasminoides A.Cunn. .... Jasmin Morinda
Opercularia aspera Gaertn. .... Coarse Stinkweed
Opercularia diphylla Gaertn. .... Stinkweed
Opercularia hispida Spreng. .... Hairy Stinkweed
Pomax umbellata (Gaertn.) Sol. ex A.Rich. .... Pomax
Psychotria loniceroides Sieber ex DC. .... Hairy Psychotria

Rutaceae
Acronychia laevis Forst. & Forst.f. .... Glossy Acronychia
Asterolasia correifolia (A.Juss.) Benth. .... Star Bush
Boronia amabilis S.T.Blake .... Boronia
Boronia anemonifolia
subsp. *variabilis* P.G.Neish .... Boronia
Boronia anethifolia A.Cunn. ex Endl. .... Boronia
Boronia microphylla Sieber ex Rchb. .... Small-leaved Boronia
Boronia parviflora Sm. .... Swamp Boronia
Boronia pinnata Sm. .... Boronia
Boronia polygalifolia Sm. .... Dwarf Boronia
Correa reflexa (Labill.) Vent.
var. *reflexa* .... Green Correa

Crowea exalata F.Muell.
subsp. *exalata* .... Crowea
Leionema ambiens (F.Muell.) Paul G.Wilson .... Forest Leionema
Leionema rotundifolium (Endl.) Paul G.Wilson .... Round-leaved Leionema
Phebalium glandulosum Hook.
subsp. *glandulosum* .... Desert Phebalium
Phebalium squamulosum Vent. .... Scaly Phebalium
Philotheca epilosa (Paul G.Wilson) P.I.Forst. .... Philotheca
Zieria cytisoides Sm. .... Downy Zieria
Zieria fraseri
subsp. *compacta* .... Smooth Zieria
Zieria smithii Andrews .... Sandfly Zieria

Santalaceae
Choretrum candollei F.Muell. .... White Sour Bush
Exocarpos cupressiformis Labill. .... Cherry Ballart
Exocarpos strictus R.Br. .... Dwarf Cherry
Leptomeria drupacea (Labill.) Druce .... Leptomeria

Sapindaceae
Alectryon subcinereus (A.Gray) Radlk. .... Wild Quince
Alectryon subdentatus (F.Muell. ex Benth.) Radlk.
forma *subdentatus* .... Alectryon
Dodonaea hirsuta (Maiden & Betche) Maiden & Betche .... Hairy Hop Bush
Dodonaea triquetra J.C.Wendl. .... Hop Bush
Dodonaea viscosa Jacq. .... Hop Bush
Guioa semiglauca (F.Muell.) Radlk. .... Guioa

Scrophulariaceae
Derwentia arcuata B.G.Briggs & Ehrend. .... Derwentia
Gratiola peruviana L. .... Brooklime
**Verbascum thapsus* L.
subsp. *thapsus* .... Aaron's Rod
Veronica calycina R.Br. .... Hairy Speedwell
Veronica plebeia R.Br. .... Trailing Speedwell

Solanaceae
Solanum campanulatum R.Br. .... Nightshide
Solanum cinereum R.Br. .... Narrawa Burr
Solanum elegans Dunal ex Poir. .... Spiny Kangaroo Apple
Solanum nobile A.R.Bean .... Nightshade
Solanum prinophyllum Dunal .... Forest Nightshade
Solanum stelligerum Sm. .... Devil's Needles

Stackhousiaceae
Stackhousia monogyna Labill. .... Creamy Candles
Stackhousia viminea Sm. .... Slender Stackhousia

Sterculiaceae
Brachychiton discolor F.Muell. .... Lacebark Tree
Brachychiton populneus (Schott & Endl.) R.Br.
subsp. *populneus* .... Kurrajong
Lasiopetalum ferrugineum Sm. ex Andrews
var. *ferrugineum* .... Lasiopetalum
Rulingia dasyphylla (Andrews) Sweet .... Rulingia

Stylidiaceae
Stylidium graminifolium Sm. ex Willd. .... Grass Triggerplant
Stylidium laricifolium A.Rich. .... Tree Triggerplant

Thymelaeaceae
Pimelea glauca R.Br. ....Rice Flower
Pimelea ligustrina Labill. ....Rice Flower
Pimelea linifolia
subsp. *collina* (R.Br.) Threlfall ....Rice Flower
Pimelea strigosa Gand. ....Rice Flower

Tremandraceae
Tetratheca thymifolia Sm. ....Black-eyed Susan

Ulmaceae
Aphananthe philippinensis Planch. ....Rough-leaved Elm

Urticaceae
Australina pusilla Gaudich. ....Australina
Dendrocnide excelsa (Wedd.) Chew ....Giant Stinging Tree
Dendrocnide photinophylla (Kunth) Chew ....Shiny-leaved Stinging Tree
Urtica incisa Poir. ....Stinging Nettle

Verbenaceae
Clerodendrum tomentosum R.Br. ....Hairy Clerodendrum
**Verbena bonariensis* L. ....Purpletop
Verbena officonalis L. ....Common Verbena

Violaceae
Hybanthus monopetalus (Schult.) Domin ....Slender Violet-bush
Viola betonicifolia Sm. ....Long-leaf Violet
Viola caleyana G.Don ....Violet
Viola hederacea Labill. ....Ivy-leaf Violet
Notothixos subaureus Oliv. ....Golden Mistletoe

Vitaceae
Cayratia clematidea (F.Muell.) Domin ....Slender Grape
Cissus antarctica Vent. ....Water Vine
Cissus hypoglauca A.Gray ....Giant Water Vine
Tetrastigma nitens (F.Muell.) Planch. ....Shiny-leaved Grape

Winteraceae
Tasmannia stipitata (Vickery) A.C.Sm. ....Northern Pepperbush

Appendix C: Introduced taxa: their life history, control and distribution. The distribution of these taxa within the defined communities are given within the description of each community in section 3.5. A priority scale of invasiveness is suggested with 1 being of highest priority for eradication due to high invasiveness in natural habitats to 5 either ubiquitous or non invasive.

Acetosella vulgaris

Family: Polygonaceae.

Synonymy: *Rumex acetosella*, *A. angiocarpa.*

Common name: Sheep Sorrel, Sorrel.

Priority: 4.

Habit: Slender erect herb, 10-50 cm high with creeping underground stems.

Life cycle: A vigorous winter to spring growing plant.

Origin & distribution: Probably native of Europe, now widespread especially in temperate regions. NC, CC, SC, NT, CT, ST, NWS, CWS, SWS, SWP in NSW. Qld, Vic., Tas., SA and WA.

Dispersal: Nut 1-1.5 mm long and vegetatively from pieces of the underground stems.

Habitat: Often on soils of an acid nature often in old gardens or areas of habitation, usually in higher rainfall areas.

Properties: Leaves can poison stock they contain oxalate and cause kidney trouble.

Control & management: Control not easy with 2,4-D but can use dicamba.

Ageratina adenophora

Family: .Asteraceae

Synonymy: .*Eupatorium adenophorum, E. glandulosum, E. pasdadense.*

Common name: .Crofton Weed, Catweed, Hemp Agrimony.

Habit: .A many-stemmed, perennial herb 1-2m high, reproducing by seed and vegetatively from a short, pale yellow rootstock.

Life cycle: .Seeds germinate in light, December to September. Peak of germination February and March. Seedlings fully established within 8 weeks of germination. Buds appear in late winter, flowering September. Seeds mature and are shed between October and mid-January.

Origin & distribution: .Native of Central America. NC, CC; Qld., SA.

Dispersal: .Seed dispersed by wind and water. Also in produce, sand, gravel, mud stuck to animals, machinery, footwear, clothing. Bent over or broken stems take root where they contact the soil.

Priority: .2

Habitat: .Humid subtropics, principally in creek beds, forest clearings, in areas with steep (greater than 20 degrees) frost free slopes where rainfall exceeds 1500mm per year.

Properties: .Reduces crop yield. Fatal to horses. Light is necessary for germination.

Control & management: Boomspray dense infestations on slopes with dicamba and MCPA. Treat scattered plants with granular formulations of the herbicides. Biological control has been investigated, but found unsuitable to Australia.

Aira cupaniana

Family: Poaceae.

Synonymy:

Common name: Silvery Hairgrass.

Priority: 3.

Habit: Slender annual, erect or occasionally geniculate at the base to 0.5 m tall.

Life cycle: Flowers spring-early summer. Seeds in spring and winter growing. Can form monospecific stands following favourable autumn and winter rains.

Origin & distribution: Native to the Mediterranean. Found in all divisions except NFWP and SFWP, within all states except the NT.

Dispersal: Via cariopsis.

Habitat: Grows in pastures, disturbed grassland or open woodland on all soil types.

Properties:

Control & management: Burning will increase population numbers.

Andropogon virginicus

Family: .Poaceae

Synonymy: .

Common name: Whisky Grass, Broomsedge.

Habit: .Rather coarse perennial grass, growing in clumps and reproducing by seed and from the crown.

Life cycle: .Seeds germinate in autumn, develop slowly over winter. Stems develop late spring, flowering early summer – autumn.

Origin & distribution: .Native of the Americas. NC, CC, SC, NT, CT, ST; Qld.

Dispersal: .Awned seeds distributed in wool, fur, clothing etc. Also in mud on machinery and vehicles.

Priority: .2

Habitat: .Sub-humid to humid subtropical areas on a wide range of soils. Principally a weed of disturbed areas.

Properties: .Dried stalks may prevent a fire hazard.

Control & management: Spotspray seedlings with paraquat or glyphosate.

Anagallis arvensis

Family: Primulaceae.

Synonymy:

Common name: Scarlet Pimpernel, Blue Pimpernel.

Habit: Small perennial or annual herb to 30 cm tall.

Life cycle:

Origin & distribution: Native of Europe, Asia, North Africa; NC, CC, SC, NT, CT, ST, NWS, CWS, NWP, SWP, NFWP; Qld; Vic.; Tas.; SA; WA.

Dispersal:

Priority: 3.

Habitat: Usually in damp places in gardens, wasteland, roadsides, creek banks and irrigated and natural grasslands.

Properties: Has poisoned horses, sheep, cattle, birds and tested to be toxic to dogs and rabbits.

Control & management: MCPA or 2,4-D are partially effective on seedlings; Ioxynil will kill the plant, hand weeding.

Anthoxanthum odoratum

Family: Poaceae

Synonymy:

Common name: Sweat Vernal Grass

Priority: 3.

Habit: Tufted perennial to 1 m high.

Life cycle: Flowers spring to summer.

Origin & distribution: Native to Europe and temperate Asia. NC, CC, SC, NT, CT, ST, NWS, SWS in NSW. All states except the NT.

Dispersal: Cariopsis.

Habitat: Widespread in mown or grazed areas..

Properties: Contains coumarin which gives it its characteristic fragrance.

Control & management: -.

Axonopus affinis

Family: Poaceae.

Synonymy:

Common name: Narrow-leaved Carpet Grass, Mat Grass.

Priority: 4.

Habit: Glabrous rhizomatous and stoloniferous perennial to 0.5 m tall often forming dense mats.

Life cycle: Flowers during warmer months.

Origin & distribution: Native of America. NC, CC, SC, NT, ST and SWP in NSW. Qld.

Dispersal: Via cariopsis.

Habitat: Lawns, naturalized in run down pastures on alluvial soils. A serious weed of wetter regions.

Properties:

Control & management: Difficult to eradicate once established. Spot spraying with kerosene or diesel distillate. Glyphosate.

Bidens pilosa

Family: Asteraceae.

Synonymy:

Common name: Cobbler’s Pegs, Stick-tights, Pitch-forks.

Priority: 3.

Habit: Erect annual forb 60 cm to 1 m with angular branches.

Life cycle: Germinates spring & summer after rain, flowers throughout year but mainly late summer-autumn.

Origin & distribution: Native of tropical South America; now spread throughout warm regions of world; widespread north of Milton NSW and ACT. Qld, Vic., NT, SA, WA.

Dispersal: Seeds which readily attach to fur/clothing by the 2 barbed spines.

Habitat: Gardens, cultivated land, waste areas, roadsides; usually on loam or clay loam soils (Western NSW).

Properties: One report indicates it may taint milk.

Control & management: Spray with 2,4–D or MCPA.

Briza minor

Family: Poaceae

Synonymy:

Common name: Shivery Grass.

Priority: 3.

Habit: Annual to 0.6 m.

Life cycle: Flowers spring.

Origin & distribution: Native to Europe. NC, CC, SC, NT, CT, ST, NWS, CWS, SWS, NWP, SWP. All states except NT.

Dispersal: Via cariopsis. Sometimes found in pasture seed.

Habitat: Weed of disturbed areas, cultivation and waste ground.

Properties: -.

Control & management: -.

Centaurium erythraea

Family: Gentianaceae.

Synonymy:

Common name: Century.

Priority: 3.

Habit: Erect herb with basal rosette to 40 cm tall.

Life cycle: Flowers spring to summer.

Origin & distribution: Native to Europe. All division except SFWP in NSW. All mainland states except NT.

Dispersal: Capsule.

Habitat: Widespread in settled areas.

Properties:

Control & management: Chipping but make sure tap root removed. Spot spraying. Fire is known to increase population sizes.

Cerastium balearicum

Family: Caryophyllaceae.

Synonymy: NA.

Common name: Mouse-ear Chickweed.

Priority: 5.

Habit: Annual herb.

Life cycle: Flowers spring.

Origin & distribution: Native of Europe. NT, CT, ST, CWS in NSW. SA.

Dispersal: Cylindrical capsule.

Habitat: Uncommon weed of disturbed ground.

Properties:

Control & management: Chipping and spot spraying.

Cirsium vulgare

Family: Asteraceae.

Synonymy: *Carduus lanceolatus*, *Carduus vulgaris*, *Cnicus lanceolatus*.

Common name: Spear thistle, Bull thistle, Scotch thistle (NZ), swamp thistle.

Priority: 2.

Habit: Erect biennial to 1.5 m high.

Life cycle: Seeds germinate mostly after autumn rains; winter development of root system; rosette grows through summer to next spring of the second year when it flowers August - April; plant dies end of summer-early autumn; grows after spring and summer rains.

Origin & distribution: Native to Europe, western Asia and North Africa. In all states except NT. All divisions NSW. Vic., Tas., SA, WA.

Dispersal: Seed – wind, water, mud, vehicles, and in feed.

Habitat: Weed of old cultivated land, run-down pastures and newly cleared brigalow country in Qld.

Properties: Noxious weed (all Vic; Tas, parts NSW and WA); smothers pastures; stock avoid grazing amongst plants; seeds short dormancy; low wind dispersal potential; rarely eaten by stock but infections are transmitted to animal by the spines of spear thistle; positive response to increased fertility.

Control & management: Spray with 2,4-D or MCPA (but old plants are fairly resistant) in the rosette to early flowering stages, or cut annual plant at base just as flower buds are opening and remove root; in cleared brigalow it often disappears after 2 years being replaced by other plants.

Conyza albida

Family: Asteraceae.

Synonymy:

Common name: Tall Fleabane.

Priority: 2.

Habit: Robust erect spreading annual herb to 2 m high.

Life cycle: Flowers summer to autumn (mainly December – ?August)

Origin & distribution: Native of North America. NC CC SC NT CT ST NWS CWS SWS SWP. Qld, Vic., SA, WA.

Dispersal: Achenes.

Habitat: Cultivated areas, pastures, wasteland.

Properties:

Control & management: Spraying with 2,4-D o MCPA plus dicamba.

Conyza bonariensis

Family: Asteraceae.

Synonymy: *Erigeron bonariensis*

Common name: Flax-leaf Fleabane.

Priority: 2.

Habit: Annual herb up to 1-2 m high.

Life cycle: Active growth starts spring-early autumn; seed production over long period; flowers throughout year.

Origin & distribution: Native of South America. All divisions in NSW. All states.

Dispersal: Seed by wind.

Habitat: Most soil types and plant communities particularly in disturbed soil eg roadsides, cultivation and lawns.

Properties: Suspected of poisoning stock; may irritate skin.

Control & management: Spraying with 2,4-D o MCPA plus dicamba. Pulling by hand probably an easy way for removing individuals.

Conyza parva

Family: Asteraceae.

Synonymy:

Common name: Fleabane, Ragweed.

Priority: 2.

Habit: Erect annual herb to 50 cm tall.

Life cycle: Flowers summer to autumn.

Origin & distribution: Native of South America. NC, CC, SC, NT, ST, SWS in NSW. Qld, Vic. And WA.

Dispersal: Achene with a pappus.

Habitat: Mainly in sandy soil usually in disturbed sites such as roadsides.

Properties:

Control & management: Susceptible to MCPA and 2,4-D at strength of 0.2%. Sometimes use in addition to dicamba.

Crepis capillaris

Family: Asteraceae.

Priority: 3

Synonymy:

Common name: Smooth Hawksbeard.

Habit: Annual or short-lived perennial herb to 75 cm.

Life cycle: Flowers summer.

Origin & distribution: Native of Europe; NC, CC, NT, CT, ST, NWS, NWP; Tas

Dispersal: Achene & pappus.

Habitat: Roadside & disturbed areas.

Properties:

Control & management:

Eragrostis curvula

Family: Poaceae.

Synonymy:

Common name: African Lovegrass.

Priority: 1.

Habit: Tufted perennial to 120 cm tall.

Life cycle: Seeds germinate in autumn or spring if sufficient moisture. Seedlings grow slowly for the first 6 weeks and then increases. Growth ceases in winter.

Origin & distribution: Native to South Africa.

Dispersal: By mud, machinery, vehicles, road making and transportation of contaminated soil.

Habitat: Semi-arid to subtropical grasslands, mainly on acid soils. Found usually on disturbed soils.

Properties: Highly persistent.

Control & management: Remove seedlings from the sward by hoeing or with chemicals. Spot spray with amitrole T, glyphosate.

Gamochaeta americanum

Family: Asteraceae.

Synonymy: *Gnaphalium*

Common name: Cudweed.

Priority: 4.

Habit: Slender herb to 35 cm tall with a basal rosette.

Life cycle: Flowers mainly October to January.

Origin & distribution: Native of Central and Southern America. NC, CC, SC, NT, CT, ST in NSW. Qld.

Dispersal: Achenes.

Habitat: Grows in disturbed areas such as roadsides in damp sheltered situations.

Properties:

Control & management: Readily controlled by spraying with 2,4-D at 0.2% strength or by chipping and hand pulling.

Gamochaeta spicata

Family: Asteraceae

Synonymy: *Gnaphalium coarctatum*

Common name: Cudweed

Habit: Annual or biennial herb 7-40cm high.

Life cycle: Flowers mainly December-January.

Origin & distribution: Native to America. NC, CC, SC, NT, NWS, CWS, SWS; LHI, Qld., Vic., NI.

Dispersal:

Priority: 4.

Habitat:

Properties: Colonises disturbed ground.

Control & management:

Gomphocarpus fruticosus

Family: Asclepiadaceae.

Synonymy: *Asclepias arborescens, Asclepias fruticosa*.

Common name: Narrow Leaf Cotton Bush, Duck Bush.

Priority: 2.

Habit: Perennial erect shrub 0.6-2 m high.

Life cycle: Plants seeds germinate during warmer months so long as moisture is available; will germinate at any time however peak germination periods during late spring and early autumn; rapid initial seedling growth; seedlings can resprout from root or crown if injured; slow growth or dormant in winter; new shoot development in spring; flowers after 1st growth season; flowers October – April.

Origin & distribution: Native of South Africa and Ethiopia; naturalized in warmer regions of world; found throughout NSW, Qld, Vic, SA, WA.

Dispersal: Large quantities of seeds dispersed by wind and water; suckers.

Habitat: Humid tropics and subtropics, mainly on better soils; can thrive on low fertility soils; roadsides, wastelands, run-down pastures, old cultivation paddocks; prefers areas of moderate rainfall or moist soils along stream banks; also in areas regularly burned.

Properties: Poisonous to stock producing gastro-enteritits and severe congestion of the alimentary canal of an unknown toxic principal; noxious weed; exudes milky sap from all parts when damaged; capable of competing with undisturbed native vegetation; allelopathy restricts germination of other species; seeds especially long lived.

Control & management: Hand pulling, grubbing, ploughing, tractor-mounted blade for larger shrubs, slash & mow in winter and use herbicides before flowering (dicamba or seedlings MSMA, glyphosate & triclopyr for adults) and to actively growing plants from September to December.

Hyparrhenia hirta

Family: Poaceae.

Synonymy:

Common name: Coolatai Grass.

Priority: 1

Habit: Densely tufted perennial to 1.2 m tall.

Life cycle:

Origin & distribution: Native to the Mediterranean. Common from the coast to the western plains. Also known from all mainland states except Victoria.

Dispersal: Seed.

Habitat: Common on roadsides.

Properties: Very invasive, even in pristine areas.

Control & management: This species is a serious weed and poses a great threat to communities within Kwiambal. The species has been found in all communities within the proposed park but is particularly bad at the Limestone Caves. It is also a serious problem along the roadsides and previously cleared lands within the park. No methods are listed for eradication of this species. Monitoring of this species is required and immediate action should be taken to control this species. Tracks leading through non-infested areas should be travelled on less frequently.

Hypochaeris glabra

Family: Asteraceae.

Synonymy:

Common Name: Smooth Catsear, Flatweed, Glabrous Catsear.

Habitat: Glabrous annual forb with basal rosette and simple or branched flowering stems 10-40 cm high.

Life Cycle: Flowers in spring to autumn.

Priority: 4.

Origin & Distribution: Native of Europe, Asia and Africa. All divisions in NSW. All states.

Dispersal: Achenes dispersed by wind.

Habitat: Found in many plant communities, common in woodlands and pastures as well as disturbed sites.

Properties:

Control & Management:

Hypochaeris radicata

Family: Asteraceae.

Synonymy:

Common name: Catsear, Flatweed, False Dandelion.

Habit: Perennial rosette herb 30-60 cm high with taproot; may act as an annual (western NSW).

Life cycle: Flowers spring-autumn but mainly spring & summer.

Origin & distribution: Native of Europe; widespread - in all divisions NSW except NWP; all states.

Dispersal: seed

Priority: 5.

Habitat: Common weed in almost all situations, gravelly waste to pastures & lawns, roadsides, disturbed habitats.

Properties:

Control & management: Killed by spraying with 2,4-D (0.1-0.2%) or MCPA; hand weeding below crown in early spring.

Juncus articulatus

Family: Juncaceae

Synonymy:

Common name: Jointed Rush

Priority: 2.

Habit: tufted or shortly rhizomatous perennial to 60 cm, often rooting at the nodes.

Life cycle: Growth and flowering mainly in spring to summer.

Origin & distribution: Native to Europe, Asia, North Africa, and North America. NC, CC, SC, NT, CT, ST, NWS, CW, SWS, NWP, SWP in NSW. Qld, Vic., Tas., S.A. & W.A.

Dispersal: Numerous seeds in a capsule.

Habitat: Widespread in damp situations. .

Properties: Obstructs flow by growing along channel margins and drains. Will persist in dry conditions.

Control & management: Mowing in spring then spraying when 30 cm high with 2.2kg/ha 2,4-D is recommended for most *Juncus* sp.

Juncus bufonius

Family: Juncaceae

Synonymy: *Juncus plebeius*

Common name: Toad Rush

Priority: 2.

Habit: Slender tufted annual with terete culms to 30 cm long.

Life cycle: Flowers spring to summer. Germinates in autumn or winter and continues to grow while moist conditions last. After flowering plants die off in the onset of dry weather.

Origin & distribution: Native to temperate regions. All divisions except NWP and SFWP in NSW. All states.

Dispersal: Numerous seeds in a capsule.

Habitat: Mostly in disturbed habitats and damp situations around swamp margins, along drainage lines, roadside drains and dams.

Properties:

Control & management: Cogeners controlled by mowing in spring and spraying regrowth with 2,4-D. Glyphosate, dicamba plus MCPA, and 2,2-DPA may be equally affective.

Lactuca serriola

Family: Asteraceae.

Synonymy:

Priority: 3

Common name: Prickly lettuce, Milk thistle, Compass Plant (leaves orient N–S)

Habit: Biennial herb 1-2 m high.

Life cycle: Grows from seed or rootstock spring-early summer; growth continues provided sufficient water available; flowers September-April.

Origin & distribution: Native of Europe and Asia; weed in all divisions, all states.

Dispersal: Achenes.

Habitat: Common widespread weed of gardens, roadsides, wasteland, cultivation, degraded pastures and along channel banks.

Properties: Grazing of young plants and regrowth prior to prickle development on stems and leaves has resulted in poisoning of stock overseas. It is thought to cause lung problems in cattle and is mildly narcotic.

Control & management: –

Medicago spp.

Family: Fabaceae.

Synonymy: NA.

Common name: Burr Medic.

Priority: 5.

Habit: Decumbent or ascending herb with branches to 40 cm long and 3 foliolate leaves.

Life cycle: Primary juvenile period less than 1 year. Longevity less than 1 year.

Origin & distribution: Native of Mediterranean. NC, CC, SC, CT, ST, NWS, CWS, SWS, NWP, SWP, SFWP, SFWP; All states.

Dispersal: In mud on cars. High proportion of hard seeds survive beyond next growing season.

Habitat: Pastures, lawns, waste places. Annual rainfall 600 – 14000 mm. Recorded on saline sites in western NSW. Full sun.

Properties:

Control & management: .

Myriophyllum aquaticum

Family: Haloragaceae.

Synonymy: *Enydria aquatica; Myriophyllum proserpinacoides; Myriophyllum brasiliense*.

Common name: Parrot's Feather, Brazilian Water-milfoil, Thread-of-life.

Priority: 2.

Habit: Stoloniferous perennial aquatic and semi-aquatic herb, rooting freely from the lower nodes.

Life cycle: In Australian no male plants are known and therefore no seeds produced. Female plants flower throughout most of the year in warm coastal situations. Vegetative growth is most vigorous during summer months and once fully established in an area surface cover does not vary greatly from season to season.

Origin & distribution: Native to central South America. NC, CC, NT in NSW. Qld, Vic., Tas., WA, SA.

Dispersal: Spreads by stem fragments which produce roots. New stems develop from buds when fragments come to rest.

Habitat: Grows in freshwater, static or moving, to 2 m depth. Rooting in mud or gravel. Grows best in water containing high nitrogen levels. Tolerant of a wide temperature range. Principally in warm-temperate and subtropical regions.

Properties: Declared noxious weed in WA. Densely interwoven stems can impede water movement causing flooding in some areas. Growth rate reduced during winter.

Control & management: For temporary control hand pull, subsurface cut and use drag-lines. Minimize movement of stem fragments. In small areas cover with black plastic for several weeks. Herbicides give affective control in most situations but dichlobenil and diphenamid can be detoxified by plant over a period of time. Fine droplet spot spray with glyphosate chlorsulfuron or low volatile esters of 2,4-D.

Paspalum dilatatum

Family: Poaceae.

Synonymy:

Common name: Paspalum, Dallas Grass, Water Couch, Golden Crown Grass.

Priority: 4.

Habit: Tufted perennial to 2 m tall.

Life cycle: Flowers summer and autumn.

Origin & distribution: Native of South America. All division of NSW. All states except NT.

Dispersal: Seed.

Habitat: A pasture species also found in lawns and disturbed areas. Usually in drainage lines and creek banks.

Properties: Has an underground rootstock. Ergot infested seeds are poisonous and can cause dermatitis on humans.

Control & management: Can be controlled by diesel or kerosene. May be cut below the crown. This species is widespread and fairly ubiquitous, management would probably be ineffectual particularly on riversides.

Plantago lanceolata

Family: Plantaginaceae.

Synonymy:

Common name: Lamb's Tongues, Common Plantain, Ribwort, Ribgrass, Buckhorn Plantain.

Habit: Annual or biennial herb with a well developed and persistent tap root.

Life cycle: Flowers mainly September to April.

Origin & distribution: Native to Europe and north and central Asia. NC, CC, SC, NT, CT, ST, NWS, CWS, SWS, SWP in NSW. All states except NT.

Dispersal: Capsule.

Habitat: Grows in disturbed sites such as roadsides and waste places.

Properties: Important cause of hay fever and a host for some plant diseases.

Control & management: Chipping and hand pulling, Spot spraying.

Paspalum urvillei Stued.

Family: Poaceae

Synonymy:

Common name: Vasey Grass.

Priority: 2.

Habit: Erect tufted perennial to 2.5 m high.

Life cycle: Flowers summer.

Origin & distribution: Native to South America. NC, CC, NT, CWS, SWS, NWP, SWP in NSW. Qld & Vic.

Dispersal: Via cariopsis, sometimes found in other seed.

Habitat: Disturbed areas on low nutrient soils in damp situations. Common to bush tracks. Weed of Roadsides.

Properties:

Control & management: Spraying with sodium chlorate or 2,2 - DPA.

Pavonia hastata

Family: Malvaceae.

Synonymy:

Common name:

Priority: 2.

Habit: Spreading shrub to 1.5 m tall.

Life cycle: Flowers in summer.

Origin & distribution: Native of South America; NC, CC, NT, NWS, CWS, SWS, SWP; Qld.

Dispersal:

Habitat: Waste areas and hillsides.

Properties:

Control & management: Isolated plants should be grubbed and burnt before flowering and the area checked frequently for seedlings. Several herbicides are effective for treating individual plants and small patches. 2,4 – D MCPA, Amitrole T, Dicamba (with or with 2,4-D or MCPA), glyphosate, triclopyr and terbutryn. Some control of non arable areas is achieved by burning to destroy old bushes and encourage seed germination, followed by heavy grazing with sheep to kill seedlings.

Phalaris arundinacea

Family: Poaceae

Synonymy:

Common name: Reed Canary Grass.

Priority: 2.

Habit: Robust tufted and rhizomatous perennial to 2 m high.

Life cycle: Flowers spring.

Origin & distribution: Native to Africa, America, Asia, Europe. NC, CC, SC, NT, CT, ST, in NSW. Vic., Tas., WA.

Dispersal: Seed falling with lemna, palea and sterile florets.

Habitat: Swampy ground, creek banks, channel and drain banks, floodways and will invade most native sedgelands.

Properties: Causes problems in small drainage channels. Planted as pasture species on swampy grounds.

Control & management: -.

Prunella vulgaris

Family: Lamiaceae.

Synonymy:

Common name: Self-heal.

Priority: 4.

Habit: Perennial herb with decumbent branches to 50 cm long often with a short rhizome.

Life cycle: Flowers November to April.

Origin & distribution: Native of Europe. NC, CC, SC, NT, CT, ST, CWS, SWS, SWP in NSW. Qld, Vic., Tas. SA.

Dispersal: Via seed.

Habitat: Grows in disturbed areas particularly along roadsides, especially in moist sites.

Properties:

Control & management: Chipping and hand pulling.

Phytolacca octandra

Family: Phytolaccaceae.

Synonymy:

Common name: Inkweed, Red-ink Weed, Red-ink Plant, Dye Berry, Pokeweed.

Priority: 2.

Habit: An erect much branched perennial herb to 2 m tall.

Life cycle: Short lived perennial herb dying after 2 or 3 years.

Origin & distribution: Native of tropical America. NC, CC, SC, NT, CT, NWS, CWS, NWP, SWP of NSW. All mainland states.

Dispersal: Seed, birds often eat berries and distribute them.

Habitat: Very common in rainforest, disturbed sites of higher rainfall, often invades natural communities.

Properties: Suspected of poisoning stock.

Control & management: Spraying with 3,4-D or pulling.

Plantago major

Family: Plantaginaceae.

Synonymy:

Common name: Lamb's Tongues, Common Plantain, Ribwort, Ribgrass, Buckhorn Plantain.

Habit: Annual or biennial herb with a well developed and persistent tap root.

Life cycle: Flowers mainly September to April.

Origin & distribution: Native to Europe and north and central Asia. NC, CC, SC, NT, CT, ST, NWS, CWS, SWS, SWP in NSW. All states except NT.

Priority: 3.

Dispersal: Capsule.

Habitat: Grows in disturbed sites such as roadsides and waste places.

Properties: Important cause of hay fever and a host for some plant diseases.

Control & management: Chipping and hand pulling, Spot spraying.

Rosa rubiginosa

Family: Rosaceae.

Synonymy: *Rosa eglanteria*.

Common name: Sweet Briar.

Habit: Erect or scrambling deciduous perennial shrub to 3m high.

Life cycle: Abundant seed, few seedlings survive, seeds germinate all year round, suckers from crown, flowers at 3 years old.

Origin & distribution: Native of Europe and Western Asia to northern India; CC, SC, NT, CT, ST, NWS, SWS, NWP, SWP; all states.

Dispersal: Seed dispersed by birds and mammals eating the fruit and possibly by water.

Priority: 2.

Habitat:

Properties: Spread increased by reduced grazing pressure and reduced competition, dense stands can harbor rabbits.

Control & management: Removal of established plants by hand or with Briarmatic unit when soil is moist, spraying base of canes with ester 2,4,5-T in flowering or early fruiting. Tordon at full leaf to ripe fruit stage. Misting with picloram; hexazinone applied to crowns with spot gun.

Rubus discolor

Family: Rosaceae.

Synonymy: *Rubus procerus*.

Common name: Blackberry.

Priority: 1.

Habit: Scrambling semi-deciduous shrub to 2 m, with primo-canes erect and arching rooting at the apex.

Life cycle: As above.

Origin & distribution: Native to Europe. NC, CC, SC, CT, ST, NWS in NSW. Vic., SA, WA.

Dispersal: Spread by birds when fruit is succulent. Arching canes can root and the thickets can be spread vegetatively.

Habitat: Mainly in areas with fertile soils, common on roadsides, stream banks and can be invasive in native bush.

Properties: May overcrowd and eliminate native species.

Control & management: Bulldoze large plants then rip to bring large roots out to surface dry, spray or pull emerging seedlings. Imazapyr or triclopyr during the early flowering period can be effective but the plants need to be thoroughly wetted. Dead canes should be left for 6 months and then burnt.

Setaria cereale

Family: Poaceae.

Synonymy: *Setaria geniculata* var. *pauciseta*.

Common name: Slender Pigeon Grass.

Priority: 3.

Habit: Tufted perennial to 1.2 m high.

Life cycle: Flowers summer.

Origin & distribution: Native of America. NC, CC, SC, NT, CT, ST, NWS, CWS, SWS, SWP in NSW. All mainland states except NT.

Dispersal: Via cariopsis.

Habitat: Roadsides and often disturbed areas.

Properties:

Control & management: Chipping and removal of plant material.

Setaria verticellata

Family: Poaceae.

Synonymy:

Common name: Pale Pigeon Grass.

Priority: 3.

Habit: Tufted annual to 1.3 m tall.

Life cycle: Flowers in summer.

Origin & distribution: Native of warm temperate areas of the Northern hemisphere. Known from the coast to the western slopes within New South Wales. All mainland states except NT.

Dispersal: Seed.

Habitat: In cultivated and disturbed areas.

Properties:

Control & management: Regeneration of pasture lands should aid in the control of this species.

Sisyrinchium sp. A

Family: Iridaceae.

Synonymy: *Sisyrinchium micranthum auct. non.* Cav.

Common name: Scourweed.

Priority: 3.

Habit: Tufted annual herb to 20 cm tall.

Life cycle: Flowers October to December.

Origin & distribution: Native of South America. NC, CC, SC, NT, CT, ST, NWS, CWS in NSW. Qld, Vic., WA.

Dispersal: Black seeds.

Habitat: Often grows in disturbed areas.

Properties: May be toxic if eaten.

Control & management: Chipping.

Solanum nigrum

Family: Solanaceae.

Synonymy: *Solanum opacum*.

Common name: Black-berry Nightshade, Black Nightshade, Nightshade, Potato Bush, Tomato Bush, Wild Currents.

Priority: 3.

Habit: Annual or short-lived perennial herb.

Life cycle:

Origin & distribution: Native of Europe; all divisions; all states.

Dispersal:

Habitat: Mainly areas of high soil fertility and rainfall, associated with waste or cultivations but sometimes well away from habitation.

Properties: Toxicity of berries varies, toxic when unripe.

Control & management: Susceptible to MCPA and 2,4-D.

Stellaria media

Family: Caryophyllaceae.

Synonymy:

Common name: Common Chickweed.

Priority: 3.

Habit: Annual or biennial with weak stems rooting at nodes.

Life cycle: Winter-spring annual.

Origin & distribution: Native of Europe; all divisions except NFWP; Qld; Vic.; Tas.; SA; WA.

Dispersal: Seed.

Habitat: Weed of cultivation; sometimes riverflats; shaded crevices and valleys on rocky hillsides.

Properties:

Control & management: Hand weeding, mecaprop and various herbicides.

Sonchus asper subsp. *glaucescens*

Family: Asteraceae.

Synonymy:

Common name: Rough Sow thistle, Prickly Sow thistle, Spiny Sow thistle, Rough Milk Thistle.

Habit: Erect annual or over wintering herb 20-150 cm high, with woody taproot.

Life cycle: Grows in cooler seasons and die after flowering October-December if favourable conditions do not persist; otherwise they grow throughout the year and flower at any time.

Origin & distribution: Native of Europe; all divisions except NWS NWP; all states.

Dispersal: Achene - readily dispersed.

Priority: 3.

Habitat: Weed of most habitats, particularly roadsides, cultivation, gardens, wasteland.

Properties: May causing photosensitization in cattle.

Control & management: Cultivation followed by hand weeding or hoeing of scattered plants; mow waste places before seeds form.

Sonchus oleraceus

Family: Asteraceae.

Synonymy:

Common name: Common Sow thistle, Milk thistle.

Habit: Erect succulent annual or over wintering herb 1-1.5 m high, taproot, with milky sap.

Life cycle: grow in cooler seasons and die after flowering if favorable conditions do not persist; otherwise they may grow throughout the year and flower at any time.

Origin & distribution: Native of Europe & central Asia (Eurasia); all divisions, all states.

Dispersal: Achene - readily dispersed.

Priority: 3.

Habitat: widespread weed of cultivation, pastures & disturbed areas; most soil types most communities.

Properties: Suspected of causing photosensitization in cattle

Control & management: Readily controlled by spraying with 2,4-D (1.1 kg/ha) or MCPA; normally can be controlled by cultivation and pulling isolated plants before seed set.

Stellaria media

Family: Caryophyllaceae.

Synonymy:

Common name: Common Chickweed.

Habit: Annual or biennial with weak stems rooting at nodes.

Life cycle: Winter-spring annual.

Origin & distribution: Native of Europe; all divisions except NFWP; Qld; Vic.; Tas.; SA; WA.

Dispersal: Seed.

Priority: 4.

Habitat: Weed of cultivation; sometimes river flats; shaded crevices and valleys on rocky hillsides.

Properties:

Control & management: Hand weeding, mecoprop and various herbicides.

Tagetes minuta

Family: Asteraceae

Synonymy:

Common name: Stinking Roger

Habit: Annual with stiff, erect stems to 2m high.

Life cycle:

Origin & distribution: Native of South America. Plentiful throughout coastal areas of NSW and Qld.

Dispersal:

Priority: 3

Habitat:

Properties: Occurs in damp, disturbed sites.

Control & management: Is susceptible to MCPA and 2,4-D at a strength of 0.2%.

Taraxacum officinale

Family: Asteraceae.

Synonymy:

Common name: Dandelion, Common Dandelion.

Habit: Prostrate perennial herb 15-30 cm and basal rosette of leaves, scapes 5-40 cm high.

Life cycle: Flowers most of year, in spring in western NSW; reproduces by seeds and new shoots from roots.

Origin & distribution: Native of Europe; NC, CC, SC, NT, CT, ST, NWS, SWS, NWP, SWP; all states except NT.

Dispersal: Achene

Habitat: Widespread weed of lawns, roadsides, wasteland, cultivated land and pastures; found where there is adequate moisture available throughout year; favours cool climates.

Priority: 4.

Properties: Not known to be poisonous; medicinal properties

Control & management: Spot spraying with selective herbicides and rotary hoe in arable land or cut crown below soil surface when hand pulling; very difficult to eradicate once established.

Tradescantia zebrina

Family: Commelinaceae.

Synonymy: *Zebrina pendula*, *Tradescantia pendula*.

Common name: Wandering Jew.

Priority: 3.

Habit: Creeping succulent herb with stems rooting at nodes and ascending at flowering tips.

Life cycle: Flowers spring to summer.

Origin & distribution: Native of Mexico and central America. NC, CC, NWS in NSW. Qld.

Dispersal:

Habitat: Cultivated as an ornamental occasionally naturalized in closed forest.

Properties:

Control & management: Hand pulling is effective.

Trifolium repens and other *Trifolium* spp.

Family: Fabaceae.

Synonymy:

Common name: White Clover.

Priority: 4.

Habit: Prostrate perennial herb with branches to 30 cm long.

Life cycle:

Origin & distribution: Native to Europe, Middle East and North Africa. NC, CC, SC, NT, CT, ST, NWS, SWS in NSW. Qld, Vic., Tas, SA, WA.

Dispersal: Via fruit often attached to animals.

Habitat: Frequently cultivated often on roadsides and waste places.

Properties: Can form roots at stem nodes.

Control & management: Spraying with mecoprop or 2,4.5-T amine at 0.2% or MCPA plus dicamba. Sulphate of ammonia crystals.

Urtica urens

Family: Urticaceae

Synonymy:

Common name: Stinging Nettles, Dwarf Nettle.

Habit: Usually upright herbs under 30cm high, sometimes up to 70cm. Either annual or perennial.

Life cycle:

Origin & distribution: Native of Europe.

Dispersal:

Priority: 3

Habitat:

Properties: Weed of disturbed areas, pasture and cultivation. Leaves and stems are scattered with transparent, rigid, stinging hairs.

Control & management: Young plants can be killed by spraying with 0.2% 2,4-D.

Verbascum thapsus

Family: Scrophulariaceae.

Synonymy:

Common name: Great Mullein, Blanket Weed, Aaron's Rod, Flannel Leaf, Velvet Mullein.

Habit: Erect, densely hairy biennial herb to 2.5 m tall.

Life cycle: Seeds germinate in autumn and spring; flowers January to March; die in autumn; seeds mostly viable and long lived.

Origin & distribution: Native of Eurasia; CC, SC, NT, CT, ST, NWS, CWS, SWP, NFWP; Qld; Vic.; Tas; SA.

Dispersal: Only be seeds.

Habitat: Temperate regions of moderate summer temperatures and more than 500 mm annual rainfall, on dry well drained soils, sites of lower fertility and high pH; disturbed land, woodlands an pastures.

Properties: Doesn't persist when soil fertility raised.

Priority: 3.

Control & management: Removal of individual plants with as much taproot as possible, glyphosate can be applied at rosette stage.

Verbena bonariensis

Family: Verbenaceae.

Synonymy:

Common name: Purpletop, Cluster-flower Verbena, Cluster-flower Vervain, Blue Top.

Priority: 2.

Habit: Rigid hairy perennial herb to 2 m tall.

Life cycle: Flowers mainly from October to June.

Origin & distribution: Native of South America. NC, CC, SC, NT, CT, ST, NWS, CWS, SWS, NWP, SWP in NSW. Qld, Vic., SA.

Dispersal: Prolific seeder and very persistent.

Habitat: An invasive weed in wasteland and neglected areas, often on roadsides and waterlogged areas.

Properties:

Control & management: Young plants susceptible to 2,4-D at 0.2%. Older plants are resistant. Chipping and removal of flowering material.

Vulpia bromoides

Family: Poaceae.

Synonymy:

Common name: Squirrel Tail Fescue, Silvery Grass, Brome Fescue, Rat's Tail Fescue.

Habit: Tufted annual to 40 cm tall.

Life cycle: Flowers in spring.

Origin & distribution: Native of the Mediterranean. Known from most areas in New South Wales and in all states except the Northern Territory.

Dispersal: Seed.

Habitat: Usually in disturbed areas.

Properties: Prefers high winter rainfall when in can become prolific.

Control & management: Regeneration of cultivated areas should help control populations.

Appendix D: Original dendrogram from Kulczynski association and flexible UPGMA.

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          0.3970      0.5596       0.7222      0.8848      1.0474       1.2100
               |           |            |           |           |            |
clb00001(    1)________________________
clb00038(   38)_______________________|____
clb00037(   37)___________________________|______
clb00017(   17)_______________________          |
clb00019(   19)___                   |          |
clb00029(   29)__|_____              |          |
clb00021(   21)_______|__________    |          |
clb00049(   49)_________________|____|__________|____________
clb00002(    2)_________________________                    |
clb00003(    3)________________________|___________________ |
clb00012(   12)___________________________                | |
clb00028(   28)__________________________|________________|_|_______
clb00007(    7)______________________________________              |
clb00008(    8)_____________________________________|______________|__________
clb00004(    4)____________                                                  |
clb00036(   36)___________|____                                              |
clb00011(   11)_____          |                                              |
clb00025(   25)____|____      |                                              |
clb00035(   35)________|______|__________                                    |
clb00039(   39)____________             |                                    |
clb00044(   44)___________|_________    |                                    |
clb00040(   40)________________    |    |                                    |
clb00041(   41)__             |    |    |                                    |
clb00050(   50)_|______       |    |    |                                    |
clb00047(   47)_______|___    |    |    |                                    |
clb00057(   57)__________|____|__  |    |                                    |
clb00056(   56)_______          |  |    |                                    |
clb00058(   58)______|__________|__|____|__                                  |
clb00014(   14)_______                    |                                  |
clb00026(   26)______|____                |                                  |
clb00045(   45)___       |                |                                  |
clb00046(   46)_ |       |                |                                  |
clb00048(   48)|_|_______|______          |                                  |
clb00042(   42)____           |           |                                  |
clb00043(   43)___|________   |           |                                  |
clb00053(   53)_________  |    |          |                                  |
clb00062(   62)________|_ |    |          |                                  |
clb00059(   59)_________|_|___ |          |                                  |
clb00051(   51)______________|_|__________|_________                         |
clb00009(   09)________________                    |                         |
clb00027(   27)_______________|__________          |                         |
clb00010(   10)____________             |          |                         |
clb00034(   34)___________|_________    |          |                         |
clb00068(   68)____________________|____|__________|____                     |
clb00005(    5)_______                                 |                     |
clb00024(   24)______|_______                          |                     |
clb00030(   30)_____________|________                  |                     |
clb00066(   66)_____________________|_                 |                     |
clb00055(   55)____________________  |                 |                     |
clb00069(   69)___________________|__|______           |                     |
clb00006(    6)_________________________   |           |                     |
clb00013(   13)________________________|___|_______    |                     |
clb00015(   15)___                                |    |                     |
clb00018(   18)__|_____________                   |    |                     |
clb00071(   71)_______________|_____              |    |                     |
clb00016(   16)_________           |              |    |                     |
clb00020(   20)________|_______    |              |    |                     |
clb00022(   22)___            |    |              |    |                     |
clb00023(   23)__|____________|____|__            |    |                     |
clb00031(   31)______________        |            |    |                     |
clb00032(   32)________    |         |            |    |                     |
clb00033(   33)_______|____|_________|__          |    |                     |
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clb00052(   52)________________        |           |    |                     |
clb00063(   63)______         |        |           |    |                     |
clb00065(   65)_____|______   |        |           |    |                     |
clb00070(   70)____________|__|_       |           |    |                     |
clb00054(   54)________________|___    |           |    |                     |
clb00060(   60)____               |    |           |    |                     |
clb00061(   61)___|_________      |    |           |    |                     |
clb00064(   64)__________  |      |    |           |    |                     |
clb00067(   67)_________|_|______|____|___________|____|_____________________|
               |            |            |            |            |            |
            0.3970       0.5596       0.7222       0.8848       1.0474       1.2100
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Appendix E: Locality and site information for all sites surveyed during this project. Details of sites conducted by Hunter (1999) are also included; in total 174 sites.

Site	Altitude	Date	Easting	Northing	Notes
BR10OA	1125	4/07/1995	405040	6805330	
BR10OB	1130	4/07/1995	405080	6805490	recent fire affecting edge of the quadrat
BR11OA	1240	5/07/1995	403730	6803590	
BR11OB	1210	5/07/1995	403590	6803650	
BR11OC	1190	4/07/1995	403470	6803680	
BR11OD	1185	5/07/1995	403520	6803690	recent fire in one small corner
BR11OE	1160	5/07/1995	403340	6803670	
BR11OF	1195	5/07/1995	403560	6803570	
BR12OA	1285	6/07/1995	406750	6806130	recent fire affecting all of quadrat, some rabbit grazing
BR12OB	1285	6/07/1995	406090	6806170	fire affecting all of the quadrat
BR13OA	1200	6/07/1995	406230	6806700	recent fire affecting all of the quadrat
BR14OA	1160	6/07/1995	405810	6807090	fire affecting all but small proportion of the quadrat
BR14OB	1155	6/07/1995	405610	6807100	fire affecting all of the quadrat
BR15OA	1180	11/08/1995	400550	6810800	fire affecting all of the quadrat
BR15OB	1190	11/08/1995	400570	6810830	
BR15OC	1185	11/08/1995	400610	6810420	fire affecting most of the quadrat
BR15OD	1190	11/08/1995	400670	6810350	small corner of quad burnt
BR15OE	1210	11/08/1995	400690	6810330	
BR16OA	1150	12/08/1995	400420	6810360	fire affecting 1 third of the quad
BR16OB	1145	12/08/1995	400470	6810270	half quad burnt
BR17OA	1230	12/08/1995	398450	6805550	whole quadrat burnt
BR17OB	1210	12/08/1995	398500	6805460	
BR17OC	1200	12/08/1995	398600	6805630	
BR17OD	1210	12/08/1995	398550	6805700	

Site	Altitude	Date	Easting	Northing	Notes
BR17OE	1190	12/08/1995	398580	6805780	fire affecting half of quadrat
BR17OF	1170	12/08/1995	398700	6805750	
BR18OA	1070	12/08/1995	410000	6807370	all of quad burnt
BR18OB	1060	12/08/1995	400920	6807350	most of the quad burnt
BR18OC	1070	12/08/1995	401900	6807230	fire affecting most of quadrat
BR18OD	1090	12/08/1995	400050	6807140	
BR18OE	1060	12/08/1995	400870	6807150	three quarters of quadrat burnt
BR18OF	1050	12/08/1995	400900	6807020	fire affecting most of quadrat
BR19OA	1210	13/08/1995	399190	6803180	
BR1OA	1105	26/08/1994	406100	6806100	
BR2OA	1110	26/08/1994	407100	6807500	
BR5OA	1155	31/05/1995	406760	6807980	some rubbish from walkers
BR5OB	1165	31/05/1995	406680	6807970	some rubbish from walkers
BR5OC	1250	31/05/1995	406530	6807750	
BR5OD	1270	31/05/1995	406240	6807780	
BR5OE	1245	31/05/1995	406500	6807680	
BR5OF	1250	31/05/1995	406530	6807750	some rubbish from walkers, walking track and fire from 6 m previous affecting most of the quadrat
BR5OG	1200	31/05/1995	406670	6807900	some rubbish from walkers and fire from 6 months ago affecting one corner
BR6OA	1170	3/07/1995	405790	6806520	recent fire last october
BR6OB	1180	3/07/1995	405800	6806590	recent fire last october
BR7OA	1220	3/07/1995	405580	6806210	recent fire last october affecting most of the quadrat except some large shrubs
BR7OB	1200	3/07/1995	405490	6806160	recent fire last october affecting most of the quadrat
BR7OC	1180	3/07/1995	405480	6806040	recent fire last october affecting the outer edge of this quadrat
BR7OD	1190	3/07/1995	405510	6806010	recent fire last october affecting most of the quadrat
BR8OA	1150	4/07/1995	406180	6805250	recent fire last october affecting most of the quadrat
BR8OB	1135	4/07/1995	406250	6805280	recent fire affecting all of the quadrat
BR8OC	1150	4/07/1995	406120	6805130	recent fire affecting one corner of the quadrat
BR8OD	1160	4/07/1995	406130	6805200	recent fire affecting most of the quadrat

Site	Altitude	Date	Easting	Northing	Notes
BR9OA	1135	4/07/1995	404950	6804890	
BR9OB	1140	4/07/1995	405020	6804930	
BR9OC	1150	4/07/1995	405050	6805070	
BR9OD	1130	4/07/1995	405180	6805290	light recent fire affecting some of the quadrat
BRB1A	940	14/12/1998	416345	6807129	New Southern Boundary of BBNP 300 m west of cross road. Fire 20 + yrs
BRB2A	960	14/12/1998	416494	6806983	South west boundary of BBNP open falt 100 m west of access rd. Pig rootying. Loam brown soil.
BRB3A	940	14/12/1998	416835	6807262	Southern end of BBNP opposite gate to hut. No evidenc of fire. Brown Loam.
BRB4A	940	14/12/1998	417234	6808785	Past 2nd Ford beyond Morgans Gully. Falls acces Rd (100 m off). Undulating to hilly. 5 yrs + since fire. Past logging. Few dead trees in upper stratum.
BRB5A	1030	14/12/1998	419357	6807967	Midway down eastern boundary of southern block of BBNP. Hilly. 5 yrs + since fire. Sandy Loam, Dark Grey to Brown.
BRB6A	980	14/12/1999	418347	6808023	Midway down hut link rd, below centre of southern Block of BBNP. Hilly to undulating. Sandy Loam, Dark Brown. 5 yrs + since fire.
BRB7A	580	15/12/1998	418490	6814300	Gully at base of Boonoo Boonoo Falls. Gorge. Skeletal Brown soil. No evidence of fire.
BRB8A	540	15/12/1998	418450	6814400	Base of BB Falls - slightly downstream. Skeletal soil. No evidence of fire. Extensive rock platforms. River valley floor.
BRB9A	800	15/12/1998	418170	6814407	Saddle. Sandy Loam, Grey Brown. c. 5 yrs since fire.
BRB10A	900	15/12/1998	418209	6814279	Ridge north west of BB Falls. Ridge. Sandy loam, Grey brown. 5 yrs +.
BRB11A	940	15/12/1998	416763	6807459	Morgan Gully, undulating. Sandy loam, Grey brown. 4 yrs + since fire. Old fence, logging.
BRB12A	930	15/12/1998	416962	6807599	Morgans Gully, near race. Not fire evident. Some mining.
BRB13A	840	16/12/1998	417819	6811781	River terrace, western side of BB River 1 km past yard BBNP. Loamy sand, brown. Burnt within 2 yrs.
BRB14A	860	16/12/1998	417711	6811912	1 km NW of yards, 400 m west of river BBNP. Undulating. Burnt within 2 yrs. Sandy loam.
BRB15A	920	16/12/1998	417120	6811763	1 km west of yards, 600 m west of river BBNP. Sandy loam, light brown. 8 yrs since fire. Grazing, cattle droppings. Patch that missed fire 2 yrs previous. Saddle.

Site	Altitude	Date	Easting	Northing	Notes
BRB16A	1000	16/12/1998	416178	6811297	1 km SW of Mt Prentice above branch of Swamp Ck. Ridge. Fire within 2 yrs.
BRB17A	1000	16/12/1998	415356	6811007	Swamp Sth of Mt Prentice, head of Branch Swamp Ck. Swamp, Loam, dark brown. Not recently burnt, ca. 5 yrs since fire. Some grazing by feral animals.
BRB18A	1000	16/12/1998	415256	6811007	1 km south of Mt Prentice BBNP. 100 m east of site 17. Undulating. Loamy sand, grey brown. Light fire within 2 yrs. Some cattle grazing.
BRB19A	1000	16/12/1998	414032	6811207	200 m south of Mt Prentice BBNP. Swamp. Loam, dark brown. No evidence of recent fire, burnt to margins 2 yrs previous.
BRB20A	1030	16/12/1998	416001	6812279	Eastern ridge, Mt Prentice BBNP. Spur. Sandy loam, brown grey. Burnt within 2 yrs. Cattle droppings.
BRB21A	1080	17/12/1998	418859	6806616	South east cnr of park. Undulating. Peaty, dark brown. Indeterminant fire history. Cattle grazing.
BRB22A	1100	17/12/1998	418591	6805855	Sth east cnr of BBNP. Fire within 6 yrs. Pig diggings. Coarse sandy light brown. Ridge top.
BRB23A	1075	17/12/1998	419247	6807200	Sth east BBNP. Sandy light brown. 5-6 yrs since fire. Pig diggings.
BRB24A	950	17/12/1998	419210	6810019	Eastern eadge of BBNP, top end of bottom block. Lower sloping ridge. Sandy dark brown. 2 yrs since fire. Cattle grazing.
BRB25A	910	17/12/1998	417242	6809859	1 km Sth of yards. Sandy loam, grey brown. 4 yrs since fire with parts 2 yrs since.
BRB26A	800	17/12/1998	418516	6813906	Near picnic area BB Falls. Gulley. 2 yrs since fire. Sandy loam, brown.
BRB27A	780	17/12/1998	418678	6814024	Eastern side of Picnic area BB Falls. Coarse sandy, dark brown. 2 yrs since fire.
BRB28A	870	17/12/1998	418350	6812416	Opposite link rd at Crk. Rocky outcrop creek bank. Sandy light brown. Fire indeterminant. Riparian. Some camping nearby.
BRB29A	940	17/12/1998	417388	6808803	Top end of Sth BBNP. Undulating. Fire indeterminant. Peaty, dark brown.
BRB30A	960	18/12/1998	416151	6814196	Top left corner of BBNP near creek. Ridge. ca. 4 yrs since fire. Cattle grazing. Sandy loam, dark brown.
BRB31A	920	18/12/1998	416466	6814266	Top left corner of BBNP. Sandy loam grey brown. 5 yrs since fire.
BRB32A	920	18/12/1998	416725	6814126	Near fire trail at top Cnr of BBNP. Ridge top. Sandy loam, grey. 5 yrs since fire.
BRB33A	890	18/12/1998	417317	6814207	Near fire trail top end of BBNP. sandy loam grey brown. 5 yrs since fire. Cattle grazing and pig rutting.
BRB34A	890	18/12/1998	418100	6814113	Sandy brown grey soil. 5 yrs since fire. Cattle grazing.

Site	Altitude	Date	Easting	Northing	Notes
BRB35A	970	18/12/1998	417439	6807392	Behind BB hut. Sandy loam, grey brown. 10 yrs since fire. Walking track nearby.
BRB36A	990	4/01/1999	411567	6806517	Near airstrip Trail. Undulating. 5 yrs since fire.
BRB37A	990	4/01/1999	411111	6806061	Near airstrip trail. 5 yrs since fire. Much pig damage.
BRB38A	990	4/01/1999	410920	6806023	Near airstrip trail and Carrols Crk trail intersection. Flat. 5 yrs since fire. Sandy grey brown.
BRB39A	990	4/01/1999	409936	6805908	Airstrip trail, just past Carrols Crk junction. Sandy brown. 5 yrs since fire.
BRB40A	980	4/01/1998	409276	6806001	Near junction airstrip trail and Donut trail. 5 yrs since fire. Sandy loam, brown.
BRB41A	990	4/01/1998	409357	6806268	Just off airstrip trail towards border. Sandy loam, brown. 5 yrs since fire.
BRB42A	1060	4/01/1999	408834	6806683	Airstrip trail towards border. Sandy loam, dark brown. 5 yrs since fire.
BRB43A	1060	4/01/1999	408521	6806870	Airstrip trail near border. Sandy grey brown. 5 yrs since fire.
BRB44A	970	5/01/1999	411854	6807217	Top end of Bald Rock - near Carroll's Ck Fire Trail. Sandy loam, brown. Alluvial plain. 5 yrs since fire.
BRB45A	1000	5/01/1999	410573	6808240	Just off Carroll's Crk Fire Trail (Bald Rock). Undulating. Sandy grey brown. 5 yrs since fire.
BRB46A	1030	5/01/1999	410645	6809052	Just off Carrol's Ck Fire Trail. Coarse sandy, dark brown black. 5 yrs since fire.
BRB47A	1010	5/01/1999	410132	6809355	Off main road to BR. Fine sandy loam, dark brown. 5 yrs since fire.
BRB48A	1050	5/01/1999	409362	6809479	Just off main road to BR, picnic area. Sandy brown. 5 yrs since fire.
BRB49A	990	5/01/1999	406603	6810965	Near junction of Bookookoorara Fire Trail and Fairy Valley Fire Trail. Undulating. Sandy loam, dark brown. 5 yrs since fire.
BRB50A	990	5/01/1999	406397	6810904	Fairy Valley Fire Trail. Sandy loam, dark brown. 5 yrs since fire. Numerous pig diggings.
BRB51A	1080	5/01/1999	405230	6810266	Qld - NSW Border Trail. Sandy loam, brown. 5 yrs since fire.
BRB52A	1100	5/01/1999	404082	6809666	Border Trail. Fine sandy dark brown. 5 yrs since fire.
BRB53A	1110	5/01/1999	403857	6807578	Border Trail. Sandy loam, dark brown. 5 yrs.
BRB54A	1140	5/01/1999	405613	6807546	Off border trail. Sandy loam, dark brown. 5 yrs since fire.
BRB55A	1120	5/01/1999	406433	6807418	Trail towards picnic area, base of BR. Sandy loam, dark brown. Fence.
BRB56A	950	6/01/1999	412147	6803367	Just off Ressurection Trail bottom RH corner of main park. Sandy loam, dark brown. 5 yrs.
BRB57A	970	6/01/1999	411316	6803538	Just off Ressurection FT. Coarse sand, grey brown. 5 yrs since fire.

Site	Altitude	Date	Easting	Northing	Notes
BRB58A	970	6/01/1999	411288	6803408	Just off Resurrection FT. Sandy light brown. 5 yrs since fire.
BRB59A	1200	6/01/1999	405548	6797073	Top left hand side of sth section of BRNP. Sandy loam, dark brown. 5 yrs since fire. Cattle grazing.
BRB60A	1190	6/01/1999	404597	6797182	Top left hand crnr of sth section BRNP. Sandy loam, dark brown. 5 yrs since fire.
BRB61A	980	6/01/1999	404404	6796208	Left hand edge of sth sectio of BRNP. Undulating. Sandy loam, brown grey. 5 yrs since fire.
BRB62A	1070	6/01/1999	406419	6796525	Centre of sth section of BRNP. Sandy loam, dark brown. 5 yrs since fire.
BRB63A	1030	6/01/1999	406021	6796078	Centre of Sth section of BRNP. Sandy loam, grey brown. 5 yrs since fire.
BRB64A	1000	6/01/1999	405795	6795595	Centre of sth section of BRNP. Fine sandy dark brown. 5 yrs since fire.
BRB65A	980	6/01/1999	405770	6795697	Centre of sth section of BRNP. Fine sandy, grey. 5 yrs since fire.
BRB66A	960	6/01/1999	405771	6795697	Centre of sth section BRNP. Sandy loam, dark brown. 5 yrs since fire.
BRB67A	900	6/01/1999	405422	6794090	Bottom of middle of trial through sthn section of BRNP. Sandy grey. 5 yrs since fire.
BRB68A	900	6/01/1999	405856	6793981	Bottom end of sth section of BRNP. Fine sandy grey brown. 5 yrs since fire.
BRB69A	1130	1/04/1993	403100	6803500	Sandy. Fire within 7 years.
BRB70A	1130	1/04/1993	404100	6803500	Sandy. fire within 8 yrs.
BRB71A	1040	1/04/1993	409200	6809400	2.5 km from BR parking area on access rd. Fire within 5 yrs.
BRB73A	1020	8/09/1994	410700	6807900	
BRB73B	1000	24/08/1994	411400	6806100	
BRB75C	990	26/08/1994	406200	6806800	
BRB76D	1080	6/09/1994	405400	6809700	
BRB77E	1050	6/09/1994	405500	6809650	
BRB78F	1015	6/09/1994	405070	6809030	
BRB79G	1030	7/09/1994	407500	6809100	
BRB80H	990	7/09/1994	406700	6810100	
BRB81I	990	7/09/1994	406900	6811200	
BRB82J	1100	8/09/1994	407500	6809100	Grazing mainly by pig ruttings.
BRB83K	1120	8/09/1994	407200	6809100	Some heavier than usual Macropod grazing.
BRB84L	1190	13/08/1995	399240	6803290	2 past fires affecting quadrat none recent
BRB85M	890	9/09/1994	417900	6810300	

Site	Altitude	Date	Easting	Northing	Notes
BRB86A	1040	21/10/1997	409000	6809100	200m S of Bald Rock Rd, 2.5km W of turnoff from Mt. Lindsay Hwy. Moderate fire 3 years ago. Moderate logging 30 years ago. Moderate grazing 25 years ago.
BRB87A	950	21/10/1997	417700	6808898	400m E of Boonoo Boonoo Falls Rd, 2.3km NE of Roper Ck Crossing, Boonoo Boonoo NP. Fire 6 years ago. Moderate logging 30 years ago. grazing 20 years ago.
BRB88A	1030	20/10/1997	410700	6808899	250m S of junction of Bald Rock Rd and Carrolls Ck Trail, Bald Rock NP. Intense fire 3 years ago. Moderate logging, 30 +/-10 years ago. Slight grazing 20 +/- 10 years ago.
BRB89A	965	21/10/1997	411700	6802700	550m W of Mt. Lindsay Hwy, 1.3km S of Resurrection Ck, Bald Rock NP. Fire 6 years ago. Grazing 20 years ago. Moderate weeds.
BRB90A	900	8/01/2000	420298	6815399	Soil brown, coarse sandy loam.
BRB91A	970	8/01/2000	420308	6814981	Soil dark brown, clay loam.
BRB92A	940	8/01/2000	420463	6814216	Soil black/brown, clay loam.
BRB93A	950	8/01/2000	419083	6814433	Soil dark chocolate brown, coarse sandy loam.
BRB94A	900	8/01/2000	419660	6813782	Soil grey black, coarse sandy loam.
BRB95A	940	8/01/2000	420278	6813569	Soil grey black, coarse sandy loam.
BRB96A	870	8/01/2000	421399	6811350	Soil chocolate brown, coarse sandy loam.
BRB97A	960	8/01/2000	419926	6810906	Soil grey brown, coarse sandy loam.
BRB98A	850	8/01/2000	420769	6810811	Soil grey brown, coarse sand.
BRB99A	1010	9/01/2000	411606	6800954	Soil grey brown, coarse sandy loam.
BRB100A	990	9/01/2000	411082	6800927	Soil dark chocolate brown, clay.
BRB101A	990	9/01/2000	410316	6801342	Soil light cream brown, coarse sandy loam.
BRB102A	1010	9/01/2000	409568	6820000	Soil grey brown, coarse sand.
BRB103A	1040	9/01/2000	408389	6801151	Soil grey brown, coarse sandy loam.
BRB104A	1070	9/01/2000	409144	6801002	Soil brown, sandy loam.
BRB105A	1050	9/01/2000	408772	6801442	Soil grey brown, sandy loam.
BRB106A	1000	9/01/2000	408684	6802118	Soil grey brown, coarse sand. Pigs.
BRB107A	1010	9/01/2000	408343	6805624	Soil brown, coarse sandy loam.
BRB108A	1010	9/01/2000	408609	6802980	Soil grey brown, coarse sand.
BRB109A	1030	9/01/2000	409000	6803414	Soil cream brown, very coarse sand.
BRB110A	1045	9/01/2000	408990	6803891	Soil chocolate brown, loam.

Site	Altitude	Date	Easting	Northing	Notes
BRB111A	1080	9/01/2000	408992	6864493	Soil light brown, coarse sandy loam.
BRB112A	1000	9/01/2000	409082	6805632	Soil grey brown, coarse sandy loam, Pigs.
BRB113A	1010	10/01/2000	407167	6811745	Soil grey brown, coarse sandy loam, Pigs.
BRB114A	980	10/01/2000	407127	6812554	Soil grey brown, coarse sand.
BRB115A	980	10/01/2000	407352	6813161	Soil dark brown to black, very coarse sandy loam.
BRB116A	1000	10/01/2000	407365	6814610	Soil cream brown, very coarse sandy loam.
BRB117A	990	10/01/2000	407583	6815628	Soil brown loam.
BRB118A	990	10/01/2000	406887	6811566	Soil brown, fine sandy loam. Pigs.
BRB119A	980	10/01/2000	405772	6811920	Soil dark brown, clay loam.

Appendix F: Known uses and notes for plants found within Bald Rock and Boonoo Boonoo National Parks.

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Acacia binervata				Timber, Fibre.		Ornamental.	Lazarides & Hince (1993).
Acacia floribunda						Ornamental.	Lazarides & Hince (1993).
Acacia implexa	Poison.	Lazarides & Hince (1993).	Poison?	Fodder, Gum, Timber, Fuel, Honey.	C3. Drought tolerant. Intolerant of waterlogging, salinity and wind.		Clarke (1989), Lazarides & Hince (1993).
Acacia longifolia	Pods can be roasted & seeds eaten.	Lazarides & Hince (1993).	Suspected poison.	Timber.		Timber has been used to make tool handles. Gums, timber, honey (pollen), weed, ornamental, fibre.	Cunningham et al. (1981). Lazarides & Hince (1993).
Acacia melanoxylon	Timber. Bark & twigs if thrown into water will stupefy fish.	Lazarides & Hince (1993).		Gum, Timber.			Lazarides & Hince (1993).
Acacia penninervis	The bark can stupefy fish.						
Acacia stricta	Seeds are edible.						
Acaena agnipila				Weed.		Wind pollinated.	Lazarides & Hince (1993), Benson & McDougall (2000).
Acaena novae-zelandiae	Leaves once used as a substitute for tea.	Lazarides & Hince (1993).		Weed. Fruit burrs troublesome to humans and stock.		Wind pollinated. Spreading by stolons.	Lazarides & Hince (1993), Benson & McDougall (2000).
Acetosella vulgaris			Poison?	Possibly grazed by stock. Suspected of poisoning stock.		The leaves can be eaten raw or cooked or made into a soup.	Cunningham et al. (1981).
Acianthus exsertus	Tuber edible.					Possibly pollinated by tiny flies.	Benson & McDougall (2005).

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Acmena smithii	Fruits are edible, with a taste of cinnamon & clovers, can be made into a vinegar.	Clarke (1989). Lazarides & Hince (1993).			C3. Intolerant of wind, drought, waterlogging and salinity.	Tertiary sand coloniser; food plant for Topknot Pigeon, Wonga Pigeon, King Parrot, Crimson Rosella, Pied Currawong, Rose-crowned Fruit-dove, Satin Bowerbird, Superb Fruit-dove, Grey-headed Flying Fox, moth larvae. Timber, wind barrier, floral display.	Clarke (1989), Lazarides & Hince (1993), Benson & McDougall (1998).
Acrotriche aggregata	Fruits are edible.						
Actinotus gibbonsii				Fodder.			Lazarides & Hince (1993).
Actinotus helianthi					C3. Seedlings shade intolerant, sun tolerant.	Tertiary sand coloniser, propagation by seed, garden plant, floral display.	Clarke (1989).
Ageratina adenophora			Poison.	Fodder.		Weed.	Lazarides & Hince (1993).
Aira cupaniana				Fodder.			Lazarides & Hince (1993).
Ajuga australis				Fodder.		Ornamental.	Lazarides & Hince (1993).
Alectryon subcinereus	Recorded as being used as a traditional food plant. Garden plant attracting birds & mammals.	Clarke (1989).			C3. Intolerant of wind, drought, waterlogging and salinity.	Food plant of Eastern Flat butterfly Netrocoryne repandra repandra. Fruit eaten by Green Catbird.	Clarke (1989).
Allocasuarina littoralis	Timber.	Lazarides & Hince (1993).			C3. Wind tolerant, drought	Tertiary sand coloniser, a wind barrier, propagation by seed.	Clarke (1989), Lazarides & Hince (1993).

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
					tolerant, tolerant of salinity.	Used for firewood. Honey (pollen), ornamental.	
Allocasuarina torulosa						Timber, fuel, honey (pollen), ornamental.	Lazarides & Hince (1993).
Alphitonia excelsa	Timber, poison, medicinal, honey, miscellaneous. Leaves used to wrap meat.	Lazarides & Hince (1993).		Fodder.		Food plant for several butterfly larvae, fruit eaten by various birds and fruit bat. Pollination by honeybee and native bees.	Benson & McDougall (2000).
Alyxia ruscifolia			Poison.				Lazarides & Hince (1993).
Ammobium alatum						Weed.	Lazarides & Hince (1993).
Amphipogon strictus				Fodder.			Lazarides & Hince (1993).
Amyema cambagei	Fruits eaten.	Cunningham et al. (1981).		Readily grazed if lopped.		Weed.	Cunningham et al. (1981), Lazarides & Hince (1993).
Amyema miquelii	Fruits eaten.	Cunningham et al. (1981).		Readily grazed if lopped.		Weed.	Cunningham et al. (1981), Lazarides & Hince (1993).
Amyema pendulum	Fruits eaten.			Fodder.		Food, weed.	Lazarides & HInce (1993).
Andropogon virginicus				Low value fodder.		Weed.	Lazarides & Hince (1993).
Angophora floribunda				Fodder.	C3. Drought tolerant. Intolerant of wind, waterlogging and salinity.	Tertiary sand coloniser, by seed propagation. Garden & shade plant. Bee attractant. Firewood, timber.	Clarke (1989), Lazarides & Hince (1993).
Angophora subvelutina				Honey.			Lazarides & Hince (1993).

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Anthoxanthum odoratum				Fodder.		Containc coumarin, fragrant, bitter-tasting.	Lazarides & Hince (1993).
Aristida ramosa				Unpalatable to stock, except when young.			Cunningham et al. (1981), Lazarides & Hince (1993).
Aristida vagans				Useful drought fodder.		Seed eaten by finches.	Lazarides & Hince (1993), Benson & McDougall (2005).
Arthropodium milleflorum	Roots eaten raw or roasted.			Fodder, moderate forage.			Lazarides & Hince (1993).
Arthropodium minus				Fodder. Moderate winter-spring forage.			Lazarides & Hince (1993).
Asperula conferta				Fodder. Drought resistant forage plant providing green fodder rapidly after summer rains.		Palatable to rabbits.	Lazarides & Hince (1993), Benson & McDougall (2000).
Asplenium flavellifolium				Contains HCN, but unlikely to cause stock poisoning.			Cunningham et al. (1981).
Austrodanthonia bipartita				Fodder.		Produces high quality fodder during cooler months which is encouraged by moderate grazing.	Lazarides & Hince (1993), Benson & McDougall (2005).
Austrodanthonia caespitosa				Produces large quantities of very palatable forage.		Seed eaten by Stubble Quail.	Cunningham et al. (1981), Lazarides & Hince (1993), Benson & McDougall (2005).
Austrodanthonia penicillata				Fodder.			Lazarides & Hince (1993).
Austrodanthonia				Palatable to stock.			Cunningham et al.

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
setacea							(1981), Lazarides & Hince (1993).
Austrostipa aristiglumis				Palatable, provides good quality forage. Sharp seeds can injure stock.			Cunningham et al. (1981).
Austrostipa setacea				Readily eaten in young stages, particularly by cattle.			Cunningham et al. (1981).
Axonopus affinis				Fodder.		Cattle don't eat it.	Lazarides & Hince (1993), Benson & McDougall (2005).
Banksia integrifolia	Recorded as being used as a traditional food plant.						
Banksia marginata	Nectar can be sucked.	Lazarides & Hince (1993).				The timber is soft, porous and reddish, and warps badly on drying. Gums, timber, honey, ornamental.	Cunningham et al. (1981), Lazarides & Hince (1993).
Banksia spinulosa	Nectar can be eaten.					Honey, ornamental.	Lazarides & Hince (1993).
Bidens pilosa						Honey, weed, medicinal. Seed burrs troublesome to clothing and wool. Medicinal uses in South Africa.	Lazarides & Hince (1993).
Billardiera longiflora	Fruit is edible if seeds removed.						
Billardiera scandens	Fruit edible raw & tastes like stewed apples when ripe.						
Blechnum cartilagineum	Edible rhizome (dried then roasted & bruised).						
Blechnum nudum						Gums, ornamental.	Lazarides & Hince

							(1993).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Boerhavia dominii	Outer flesh of the roots edible.	Lazarides & Hince (1993).				Weed.	Lazarides & Hince (1993).
Boronia pinnata	Ornamental.	Benson & McDougall (2001).			Frost tolerant.	Probably pollinated by honeybees and native bees, with flies playing a minor role. Larvae of longicorn beetle Uracanthus triangularis feeds on stem.	Benson & McDougall (2001).
Bossiaea obcordata						Honey (pollen).	Lazarides & Hince (1993).
Bothriochloa macra				Fodder.		Valuable coloniser of disturbed and degenerated areas. Seeding stems ovoided by stock, widespread in overgrazed paddocks.	Lazarides & Hince (1993), Benson & McDougall (2005).
Brachychiton discolor	Food, timber.	Lazarides & Hince (1993).				Ornamental.	Lazarides & Hince (1993).
Brachychiton populneus	Young roots can be boiled & taste like turnips. Seeds are edible & can make a beverage. Leaves also edible.						
Breynia cernua					C3. Wind tolerant, drought intolerant, intolerant of waterlogging and salinity.	Tertiary sand coloniser. Cosmopolitan species, on the back dune. Shelter.	Clarke (1989), Lazarides & Hince (1993).
Briza minor				Sparingly grazed by stock.			Cunningham et al. (1981), Lazarides & Hince (1993).

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Brunoniella australis				Fodder.		Reported good sheep herbage.	Lazarides & Hince (1993).
Bulbostylis barbata	Food. The root is edible.			Fodder.			Lazarides & Hince (1993).
Bursaria spinosa	Medicinal. Used for production of Aesculin (suntan lotions).						
Calandrinia eremaea	Eaten as greens. Seeds are also edible.			Palatable to stock, contributes to water requirements of animals.			Cunningham et al. (1981), Lazarides & Hince (1993).
Callistemon sieberi						Seed eaten by Crimson Rosella.	Benson & McDougall (1998).
Callistemon viminalis						Honey, ornamental.	Lazarides & Hince (1993).
Callitris endlicheri				Antihelminthic for horses.		Gums, timber, fuel, medicinal, shelter.	Lazarides & Hince (1993).
Callitris rhomboidea						Gums, ornamental.	Lazarides & Hince (1993).
Calochilus campestris						Olso pollinated by sexual deception of Scolis Wasps.	Benson & McDougall (2005).
Calochilus robertsonii						Sometimes insect pollinated.	Benson & McDougall (2005).
Calotis cuneifolia				Useful forage. Barbed seeds prolific and troublesome to sheep and fleece.		Honey, weed.	Lazarides & Hince (1993).
Calotis dentex						Weed.	Lazarides & Hince (1993).
Calytrix tetragona	The fruit is edible.					Visited by honeybees, nativve bees, flies & beetles and small wasps.	Benson & McDougall (1998).
Carduus tenuiflorus				Flowerheads and		Proclaimed noxious	Lazarides & Hince

				rosette leaves grazed.		weed in Vic, Tas, SA and part of WA.	(1993).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Carex appressa	The leaves were used by aborigines for weaving baskets and other such articles.	Cunningham et al. (1981), Lazarides & Hince (1993).		Fodder.		Shelter. Controls creek bank erosion, harbours rabbits.	Lazarides & Hince (1993).
Carex inversa				Supplies limited amount of fair quality forage.		Weed.	Cunningham et al. (1981), Lazarides & Hince (1993).
Cassinia aculeata			Causes dermatitis in humans.			Weed.	Lazarides & Hince (1993).
Cassinia laevis			Poison?	Fodder.		Weed. Suspected cause of coughing and eye irritation of people in close proximity.	Lazarides & Hince (1993).
Cassytha pubescens	Flesh surrounding the small fruit is edible.				C3.		Clarke (1989).
Casuarina cunninghamiana				Fodder.		Timber used for ornamental turnery and fuel. Gums, Honey (pollen), shelter, ornamental.	Cunningham et al. (1981), Lazarides & Hince (1993).
Cayratia clematidea	Food.	Lazarides & Hince (1993).			C3. Intolerant of wind, drought, waterlogging and salinity.	tertiary sand coloniser.	Clarke (1989).
Cenchrus caliculatus				Fodder.			Lazarides & Hince (1993).
Centaurium erythraea						Weed.	Lazarides & Hince (1993).
Centaurium tenuiflorum				Fodder, moderate in palatability.		Weed.	Lazarides & Hince (1993).
Cerastium balearicum						Weed.	Lazarides & Hince (1993).

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Cheilanthes distans			Poison?				Cunningham et al. (1981), Lazarides & Hince (1993).
Cheilanthes sieberi			Poison?				Lazarides & Hince (1993).
Chenopodium melanocarpum			Poison?	Fodder.			Lazarides & Hince (1993).
Chenopodium pumilio			Poison.	Eaten sparingly in times of fodder shortage. Cause of sheep deaths.		Weed.	Cunningham et al. (1981), Lazarides & Hince (1993).
Chiloglottis diphylla	Tuber edible.					Pollination by sexual deception of Thynnine Wasps	Benson & McDougall (2005).
Choretrum candollei						Probably hybridizes with C. pauciflora. Foodplant of moth caterpillar Chelepteryx chelepteryx.	Benson & McDougall (2001).
Cirsium vulgare						Honey, weed, miscellaneous. Fleshy roots laced with strychnine formerly sold as rabbit bait. Noxious in Vic, Tas, SA, part of NT.	Lazarides & Hince (1993).
Cissus antarctica	Fruit is edible & can be made into a jam.						
Cissus hypoglauca	Edible fruit.	Clarke (1989).			C3. Intolerant of wind, drought, waterlogging and salinity.	Tertiary sand coloniser. Bird attractant.	Clarke (1989).
Clematis aristata			Poison?			Tuberous roots to 30 cm deep branching	Lazarides & Hince (1993), Benson &

						underground may give rise to seperate plants. Moth larvae Phrissogonus laticostata on flowr	McDougall (2000).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Clematis glycinoides			Poison?			Medicinal, ornamental.	Lazarides & Hince (1993).
Commelina cyanea					C3.	Used as a cooked green vegetable by early settlers to combat scurvey.	Clarke (1989), Cunningham et al. (1981), Lazarides & Hince (1993).
Conyza albida					C3. Wind tolerant, drought tolerant, intolerant of waterlogging.	Secondary sand coloniser, floral display. Cosmopolitan species, on the foredune & backdune. Honey (pollen), weed.	Clarke (1989), Lazarides & Hince (1993).
Conyza bonariensis						Weed.	Lazarides & Hince (1993).
Conyza canadensis						Weed.	Lazarides & Hince (1993).
Conyza chilensis						Weed.	Lazarides & Hince (1993).
Conyza parva						Weed.	Lazarides & Hince (1993).
Coprosma quadrifida	Fruit is edible, and can be made into puddings.					Berries eaten by Yellow-faced Honeyeater Lichenostomus chrysops. Larval food plant of hawk moth Cizara ardenia.	Benson & McDougall (2000).
Coreopsis lanceolata						Weed, ornamental.	Lazarides & Hince (1993).
Correa reflexa						Leaves and roots eaten	Benson &

						by wombat. Pollen eaten by Red Wattlebird, Crescent Honeyeater, New Holland Honeyeater, Tawny-crowned Honeyeater & Eastern Spinebill.	McDougall (2001).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Corymbia gummifera				Wood resistant to termites.		Blossoms eaten by Grey-headed & Little Flying Fox. New Holland, White Cheeked Honeyeaters, Yellow Glider use Nectar.	Benson & McDougall (1998).
Crassula colorata				Palatable to stock.			Cunningham et al. (1981), Lazarides & Hince (1993).
Crassula sieberiana				Fodder, palatable to stock but limited in value due to its small size or inaccessible habitats.			Cunningham et al. (1981), Lazarides & Hince (1993).
Crowea exalata						Ornamental.	Lazarides & Hince (1993).
Cryptandra amara						Possibly pollinated by native bees, flies and butterflies.	Benson & McDougall (2000).
Cryptocarya rigida				Timber.			Lazarides & Hince (1993).
Cryptostylis subulata	Roots & tubers eaten raw or roasted.					Pollinated by pseudocopulation with Ichneumonid Wasps.	Benson & McDougall (2005).
Cyathea australis	Food. New shoots eaten if					Gums, ornamental.	Lazarides & Hince

	roasted.						(1993).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Cymbopogon refractus	Medicinal.	Lazarides & Hince (1993).		Heavily grazed when young, unpalatable when mature.		Shelter.	Cunningham et al. (1981), Lazarides & Hince (1993).
Cynodon dactylon			Poison.	Grazed without ill effect. Some forms contain HCN.	C3. Wind tolerant.	Secondary sand coloniser. Tertiary sand coloniser, by transplants. Pollen known to cause asthma in humans. Food plant of Australian Shelduck, Plumed Whistling Duck, Freckled Duck & butterfly larvae.	Clarke (1989), Cunningham et al. (1981), Lazarides & Hince (1993), Benson & McDougall (2005).
Cyperus gracilis						Weed.	Lazarides & Hince (1993).
Dampiera stricta					C3.	Tertiary sand coloniser, propagation by seed, Garden plant. Cosmopolitan species, on backdune.	Clarke (1989).
Daucus glochidiatus	Tuber edible.			Fodder.		Weed.	Lazarides & Hince (1993).
Daviesia latifolia						Food, medicinal.	Lazarides & Hince (1993).
Dendrocnide excelsa	Medicinal.	Lazarides & Hince (1993).	Poison.	Timber, Fibre.			Lazarides & Hince (1993).
Dendrocnide photinophylla	Fibre.	Lazarides & Hince (1993).	Poison.	Fibre.			Lazarides & Hince (1993).
Desmodium brachypodum			Poison?				Lazarides & Hince (1993).
Desmodium varians				Fodder.			Lazarides & Hince (1993).
Dianella caerulea	Fruits & roots edible. Stems					Buzz pollinated by bees.	Benson &

	can be pounded to make a fibre.						McDougall (2005).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Dianella caerulea	Fruits & roots edible. Stems can be pounded to make a fibre.					Food plant of butterfly larvae.	Benson & McDougall (2005).
Dianella caerulea	Fruits & roots edible. Stems can be pounded to make a fibre.					Probably pollinated by native bees.	Benson & McDougall (2005).
Dianella longifolia	Fruits & roots edible. Stems can be pounded to make a fibre.						
Dianella longifolia	Fruits & roots edible. Stems can be pounded to make a fibre. LEaves used to make baskets.	Benson & McDougall (2005).					
Dianella nervosa	Fruits & roots edible. Stems can be pounded to make a fibre.						
Dianella revoluta	Fruits & roots edible. Stems can be pounded to make a fibre.						
Dianella revoluta	Fruits & roots edible. Stems can be pounded to make a fibre.					Pollinated by native bees.	Benson & McDougall (2005).
Dianella tasmanica	Fruits & roots edible. Stems can be pounded to make a fibre.						
Dichelachne crinita				Fodder.	C3. Intolerant of waterlogging and salinity.	Secondary sand coloniser. Tertiary sand coloniser, by transplants, propagation by seed. Cosmopolitan species, on the backdune.	Clarke (1989), Lazarides & Hince (1993).
Dichelachne				Fodder.			Lazarides & Hince

micrantha							(1993).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Dichondra repens				Fodder.	C3. Wind intolerant, drought intolerant, tolerant of waterlogging, intolerant of salinity.	Tertiary sand coloniser. Gums, weed.	Clarke (1989), Lazarides & Hince (1993).
Dichopogon fimbriatus	Tubers eaten raw.			Readily grazed in the early stages of growth.			Cunningham et al. (1981).
Dillwynia sericea						Ornamental.	Lazarides & Hince (1993).
Dioscorea transversa	Food, medicinal. Roots eaten raw, larger ones roasted.	Lazarides & Hince (1993).					
Diospyros australis	Fruit is edible, but only when fully ripe.						
Diospyros pentamera						Timber.	Lazarides & Hince (1993).
Dipodium punctatum	Roots eaten raw or roasted.						
Dipodium variegatum	Roots eaten raw or roasted.						
Diuris punctata				Grazed by stock. Infrequent occurrence makes it unimportant pastorally.		Probably pollinated by small bees, & syrpiid flies & beetles.	Cunningham et al. (1981), Benson & McDougall (2005).
Diuris punctata	Tubers of some Diuris species were eaten by aborigines.	Cribb & Cribb (1974), Cunningham et al. (1981).		Eaten by stock and rarely found in well grazed areas.		Probably pollinated by small bees, & syrpiid flies & beetles.	Cunningham et al. (1981).
Diuris tricolor						Probably pollinated by small bees, & syrpiid flies & beetles.	

Dockrillia linguiformis						Leaves eaten by Swamp Wallaby. Pollinated by insects.	Benson & McDougall (2005).
Dockrillia pugioniformis						Pollinated by bees.	Benson & McDougall (2005).
Dodonaea triquetra					C3. Drought tolerant. Intolerant of waterlogging, wind and salinity.	Tertiary sand coloniser, by seed propagation.	Clarke (1989).
Dodonaea viscosa	Timber.	Lazarides & Hince (1993).		Fodder.		Food, gums, honey (pollen), shelter, ornamental.	Lazarides & Hince (1993).
Drosera auriculata			Poison?			Ornamental.	Lazarides & Hince (1993).
Drosera peltata			Poison?			Ornamental.	Lazarides & Hince (1993).
Drosera spatulata			Poison?			Ornamental.	Lazarides & Hince (1993).
Echinopogon caespitosus				Grazed by stock.		Food plant for butterfly larvae.	Benson & McDougall (2005).
Echinopogon ovatus			Poison	Fodder, low forage value.		Young plants poisonous to stock.	Lazarides & Hince (1993), Benson & McDougall (2005).
Einadia hastata	Edible fruit.						
Elaeocarpus obovatus						Timber.	Lazarides & Hince (1993).
Elaeocarpus reticulatus						Timber, ornamental.	Lazarides & Hince (1993).
Eleocharis sphacelata	Tubers may be roasted & eaten.			Whilst green it is well regarded as forage for stock. Dense stands capable of			Cunningham et al. (1981), Lazarides & Hince (1993).

				fattening cattle and sheep.			
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Elymus scaber				Fodder.			Lazarides & Hince (1993).
Enneapogon nigricans				Fodder. Susceptible to overgrazing.			Cunningham et al. (1981), Lazarides & Hince (1993).
Entolasia marginata				Fodder, low palatability.		Seed eaten by Finches	Lazarides & Hince (1993), Benson & McDougall (2005).
Entolasia stricta				Fodder, low palatability.			Lazarides & Hince (1993).
Epilobium billardierianum						Weed.	Lazarides & Hince (1993).
Epilobium hirtigerum				Fodder.		Weed.	Lazarides & Hince (1993).
Eragrostis curvula				Fodder.			Lazarides & Hince (1993).
Eragrostis lacunaria				Reasonable feed for sheep.			Cunningham et al. (1981), Lazarides & Hince (1993).
Eragrostis leptostachya				Fodder.			Lazarides & Hince (1993).
Eragrostis molybdea				Useful forage alternative to Aristida jerichoensis.			Cunningham et al. (1981).
Eragrostis parviflora				Moderately palatable when young.			Cunningham et al. (1981), Lazarides & Hince (1993).
Eragrostis trachycarpa			Photosensitisation			Suspected of causing photosensitisation in sheep.	Benson & McDougall (2005).
Eremophila debilis	Fruit is edible, but slightly bitter.						

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Eucalyptus acmenoides				Timber, Honey.		Blossoms eatern by Grey-headed & Little Red Flying Fox. Host plant of Longicorn beetles.	Lazarides & Hince (1993), Benson & McDougall (1998).
Eucalyptus andrewsii				Timber, Honey.			Lazarides & Hince (1993).
Eucalyptus biturbinata				Timber.			Lazarides & Hince (1993).
Eucalyptus bridgesiana				Gums, Honey.		Seed eaten by Gang Gans. Crimson Rosella eats seed. Little Lorikeet eats Nectar.	Lazarides & Hince (1993), Benson & McDougall (1998).
Eucalyptus caliginosa				Timber, Fuel, Honey.			Lazarides & Hince (1993).
Eucalyptus cameronii				Timber.			Lazarides & Hince (1993).
Eucalyptus dealbata				Valued for Honey and Pollen.		Blossoms eaten by Grey-headed Flying Fox.	Benson & McDougall (1998).
Eucalyptus laevopinea				Timber, Honey.			Lazarides & Hince (1993).
Eucalyptus melliodora				Gum, Fuel, Honey.		Pollinated by insects. Prolific flowering every 2nd yr. Irregular flowering related to rainfall. Blossoms eaten Grey Headed Flying Fox. Seed by Gang Gang & Crimson Rosella. Important food for Fuscous & Regent Honeyeaters.	Lazarides & Hince (1993), Benson & McDougall (1998).
Eucalyptus microcorys				Gum, Timber, Honey.		Blossoms eaten by Grey Headed Flying Fox.	Lazarides & Hince (1993), Benson &

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
						Moderately palatable to Koala.	McDougall (1998).
Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Eucalyptus nova-anglica				Gum, Timber.			Lazarides & Hince (1993).
Eucalyptus obliqua				Gums, timber, pulp, honey. Timber marketed as 'Tasmanian oak'.		Ants are predators to seed. Browsed by Koala. Provides hollows for arboreal mammals.	Lazarides & Hince (1993), Benson & McDougall (1998).
Eucalyptus oreades				Timber, Honey.			Lazarides & Hince (1993).
Eucalyptus pauciflora				Gum, Timber, Honey, Fuel.		Ornamental.	Lazarides & Hince (1993).
Eucalyptus propinqua				Timber, Honey.		Blossoms eaten by Grey Headed Flying Fox.	Lazarides & Hince (1993), Benson & McDougall (1998).
Eucalyptus saligna				Gum, Timber, Honey.		Seed eaten by Crimson Rosella. Blossoms eaten by Grey Headed Flying Fox. Browsed by Koala. Susceptible to damage from root compaction by cattle & horses.	Lazarides & Hince (1993), Benson & McDougall (1998).
Eucalyptus tereticornis	Medicinal.			Gum, Timber, Fuel, Honey.		Ornamental. Blossoms eaten by Grey Headed & Little Red Flying Fox. Staple of Koala.	Lazarides & Hince (1993), Benson & McDougall (1998).
Eucalyptus tindaliae				Timber.			Lazarides & Hince (1993).
Eucalyptus viminalis	Edible manna. Medicinal.	Lazarides & Hince (1993).		Gum, Timber, Pulp, Honey.		Food for Koala. Greater Glider may eat young foliage. Crested Shrike-tit, Yellow-bellied Glider & small dasyurids forage for invertebrates in	Lazarides & Hince (1993), Benson & McDougall (1998).

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
						shedding bark.	
Eucalyptus youmanii	Medicinal.			Gum, Timber, Honey.			Lazarides & Hince (1993).
Euroschinus falcata					Wind tolerant, drought intolerant, intolerant of waterlogging, intolerant of salinity.	Tertiary sand coloniser, propagation by seed, bird attractant, mammal attractant. Grows on the back dune.	Clarke (1989).
Eustrephus latifolius	Tubers are sweet and edible.					Pollinated by honeybees, small beetles.	Benson & McDougall (2005).
Exocarpos cupressiformis	Succulent yellow to red pedicel of fruit edible. Food, timber, gums, ornamental.	Cunningham et al. (1981), Benson & McDougall (2001).	Foliage reputed to be poisonous to stock and horses.			Small fly (Diptera) feeds on flowers. Fruit eaten by Black-faced Cuckoo-shrike. Seed eaten by Aust. King Parrot, Crimson Rosella. Host to parasitic shrub Viscum articulatum. Host plant of Cerambycid beetle. Food plant of various butterfly & moth larvae.	Lazarides & Hince (1993), Benson & McDougall (2001).
Exocarpos strictus	Succulent whitish to reddish pedicel of fruit is edible.	Benson & McDougall (2001).				Host to parasitic shrub Viscum articulatum. Food plant of butterfly larvae Delius aganippe.	Benson & McDougall (2001).
Ficus coronata	Leaves used as a sandpaper.	Lazarides & Hince (1993).		Fodder.			Lazarides & Hince (1993).
Ficus obliqua				Fodder.			Lazarides & Hince (1993).
Ficus rubiginosa	Fruit can be eaten raw or made into a jelly.						

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Fimbristylis dichotoma				Must be utilised while green for forage.			Cunningham et al. (1981), Lazarides & Hince (1993).
Gahnia aspera	Red-brown seeds were pounded by the aborigines to produce a flour. The roots are also edible.	Cribb & Cribb (1974), Cunningham et al. (1981), Lazarides & Hince (1993).		Fodder, of little forage value.			Lazarides & Hince (1993).
Gahnia sieberiana	Food. The leaf base is edible.						
Geitonoplesium cymosum	Young tender shoots taste like asparagus.						
Genoplesium fimbriatum						Probably pollinated by small flies.	Benson & McDougall (2005).
Geranium potentilloides	Roots can be roasted & eaten.						
Geranium solanderi	Roots can be roasted & eaten.						
Glycine clandestina	The root can be eaten.			Fodder.	C3.	Secondary sand coloniser. Cosmopolitan species, on the fore dune and backdune.	Clarke (1989), Lazarides & Hince (1993).
Glycine tabacina	Taproot has liquorice flavour and was chewed by Aborigines.	Lazarides & Hince (1993).	Poison?	Fodder.			Lazarides & Hince (1993).
Gomphocarpus fruticosus			Poison.			Ornamental.	Lazarides & Hince (1993).
Gonocarpus teucrioides						Grows on sandstone and sand, on backdune.	Clarke (1989).
Grevillea juniperina						Honey, ornamental.	Lazarides & Hince (1993).
Grevillea linearifolia						Insect pollinated, native and honey bees.	Benson & McDougall (2000).
Guioa semiglauca						Honey.	Lazarides & Hince (1993).

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Hardenbergia violacea	Food.	Lazarides & Hince (1993).	Poison.	Fodder.	C3. Wind intolerant, drought tolerant, intolerant of waterlogging and salinity.	Tertiary sand coloniser, propagation by seed, garden plant, floral display. Cosmopolitan species, on backdune. Food, ornamental.	Clarke (1989), Lazarides & Hince (1993).
Helichrysum rutidolepis				Fodder. Moderately palatable. Suspected cause of tainted cream.			Lazarides & Hince (1993).
Hemarthria uncinata				Fodder, of limited forage value.		Shelter.	Lazarides & Hince (1993).
Hibbertia acicularis						Ornamental.	Lazarides & Hince (1993).
Hibbertia obtusifolia			Poison?	Fodder.			Lazarides & Hince (1993).
Hibbertia riparia						Ornamental.	Lazarides & Hince (1993).
Hibbertia scandens					C3. Wind tolerant, drought intolerant, intolerant of waterlogging and salinity.	Secondary sand coloniser. Tertiary sand coloniser, propagation by cuttings and seed, garden plant, floral display.	Clarke (1989).
Hibbertia sericea						Ornamental.	Lazarides & Hince (1993).
Hibiscus heterophyllus	Roots, shoots & leaves of young plants can be eaten raw. The fruit is also edible.	Lazarides & Hince (1993).				Food, ornamental. Buds and young shoots edible raw or as a jam.	Lazarides & Hince (1993).
Hierochloe rariflora				Fodder.			Lazarides & Hince (1993).
Hirschfeldia incana				Edible to stock		Persistent weed of	Cunningham et al.

				when young. May taint meat and milk.		disturbed ground.	(1981), Lazarides & Hince (1993).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Hoya australis			Poison?			Ornamental.	Lazarides & Hince (1993).
Hyparrhenia hirta				Fodder.		Can be used for fodder if constantly managed by generally unpalatable with age reducing productivity of pastures. Aggressive coloniser.	Lazarides & Hince (1993).
Hypericum gramineum			Poison.	Fodder. Causes enteritis in sheep.			Lazarides & Hince (1993).
Hypochaeris glabra				Fodder.			Lazarides & Hince (1993).
Hypochaeris radicata				Fodder.	C3. Wind tolerant, drought tolerant, intolerant of waterlogging, intolerant of salinity.	Secondary & tertiary sand coloniser. Cosmopolitan species, on the backdune. Honey, weed.	Clarke (1989), Lazarides & Hince (1993).
Hypoxis hygrometrica	Food. Tubers eaten.	Lazarides & Hince (1993).					
Imperata cylindrica				Fodder, grazed when young.		Food plant for butterfly larvae.	Lazarides & Hince (1993).
Indigofera australis	Poison.	Lazarides & Hince (1993).	Poison?	Fodder. Contains HCN; toxic when flowering and suspected cattle poison.		Ornamental.	Lazarides & Hince (1993).
Isachne globosa				Highly palatable fodder.			Lazarides & Hince (1993).
Isotoma anethifolia			Poison.				Lazarides & Hince

							(1993).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Isotoma axillaris			Poison.			Ornamental.	Lazarides & Hince (1993).
Jacksonia scoparia				Honey.		Ornamental. Indicator of poor soils.	Lazarides & Hince (1993).
Juncus articulatus			Poison.	Cyanogenic reactions from this species in stock. Not known to be grazed.			Cunningham et al. (1981), Lazarides & Hince (1993).
Juncus bufonius				Grazed by stock. Not highly regarded as a forage plant.			Cunningham et al. (1981), Lazarides & Hince (1993).
Kennedia rubicunda				Fodder.	C3. Wind intolerant, drought tolerant, intolerant of waterlogging and salinity.	Secondary sand coloniser. Tertiary sand coloniser, propagation by seed, garden plant. Bird attractant, floral display. Cosmop. spp	Clarke (1989), Lazarides & Hince (1993).
Kunzea ericoides				Unpalatable to stock.		Ornamental. Seed eaten by Crimson Rosella.	Lazarides & Hince (1993).
Kunzea parvifolia						Ornamental.	Lazarides & Hince (1993).
Lachnagrostis filiformis				Fodder.		Detached seed heads cause acute fire hazard.	Lazarides & Hince (1993).
Lepidosperma laterale					C3. Wind intolerant, drought intolerant, intolerant of salinity and waterlogging.	Tertiary sand coloniser, propagation by transplants and seed.	Clarke (1989).
Leptospermum						Host specific gall.	Hunter (1997)

novae-angliae							
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Leptospermum trinervium						Native bees, honeybees, flies, beetles, wasps, butterflies & moths pollinate.	Benson & McDougall (1998).
Lepyrodia scariosa						Honeybees gather pollen.	Benson & McDougall (2005).
Leucopogon lanceolatus	Fruits are edible.						
Lissanthe strigosa	Fruit edible.					Host specific gall.	Hunter (1997)
Lomandra confertifolia						Food plant of butterflies.	Benson & McDougall (2005).
Lomandra filiformis						Food plant for butterflies.	Benson & McDougall (2005).
Lomandra longifolia	Leaf bases edible & taste like peas. Leaves used for baskets. Flowers edible.		Poison?	Not observed to be grazed by stock, but suspected of causing a type of paralysis in stock.	C3. Tolerant of wind, drought and salinity. Intolerant of waterlogging.	Secondary & tertiary sand coloniser. Wind barrier. Propagation by transplants and seed. Bee & mammal attractant.	Clarke (1989), Cunningham et al. (1981), Lazarides & Hince (1993).
Lomandra multiflora			Poison?	Suspected of poisoning sheep.		Food for butterflies.	Cunningham et al. (1981), Lazarides & Hince (1993), Benson & McDougall (2005).
Lomatia silaifolia						Partially self-compatible, probably insect-pollinated, possibly by large flies, mostly visited by beetles and ants.	Benson & McDougall (2000).
Lophostemon confertus				Gum, Timber, Fuel, Honey, Shelter.		Ornamental. Blossoms eaten by Grey Headed Flying Fox.	Lazarides & Hince (1993), Benson & McDougall (1998).
Lotus australis	The seeds are edible.		Poison.	Fodder. Drought			Lazarides & Hince

				resistant and palatable. HCN toxic to sheep and cattle, especially actively growing plants, pods and seeds.			(1993).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Lotus corniculatus						Weed.	Lazarides & Hince (1993).
Lythrum salicaria	Medicinal.					Ornamental. Reported to have astringent properties.	Lazarides & Hince (1993).
Maclura cochinchinensis			Poison?		C3. Intolerant of wind, drought, waterlogging and salinity.	Tertiary sand coloniser. Cosmopolitan species, on the backdune. Ornamental.	Clarke (1989), Lazarides & Hince (1993).
Marsdenia rostrata			Poison.	Fodder, mostly unpalatable.	C3. Wind intolerant, drought intolerant, tolerant of waterlogging, tolerant of salinity.	Tertiary sand coloniser.	Clarke (1989), Lazarides & Hince (1993).
Medicago arabica				Fodder.			Lazarides & Hince (1993).
Mentha satureioides	Medicinal.	Lazarides & Hince (1993).	Poison?	Honey.			Lazarides & Hince (1993).
Microlaena stipoides						One of the few Australian native grasses that provide forage during the critical winter early spring period. Valuable for stock in dry times.	Benson & McDougall (2005).

						Food plant for butterfly larvae. Finches eat seeds.	
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Microtis unifolia	Tubers of some species of Microtis were eaten by aborigines.	Cribb & Cribb (1974), Cunningham et al. (1981).				Pollinated by worker ants.	Benson & McDougall (2005).
Mirbelia pungens						Ornamental.	Lazarides & Hince (1993).
Monotoca scoparia	Fruits are edible.						
Morinda jasminoides	Fruits edible when ripe.					Larval food of hawk moths Macroglossum hirundo subsp. errans & Cizara ardenia. Pollen collected by honeybee.	Benson & McDougall (2000).
Murdannia graminea	Roots baked then eaten.						
Myoporum montanum	Fruits are edible.	Lazarides & Hince (1993).	Poison.	Honey.		Ornamental.	Lazarides & Hince (1993).
Myriophyllum aquaticum				Food.		Ornamental.	Lazarides & Hince (1993).
Myriophyllum variifolium			Poison.	Tested mildly HCN positive, but not palatable to stock.			Lazarides & Hince (1993).
Notelaea longifolia					C3. Intolerant of wind, drought, waterlogging and salinity.	Tertiary sand coloniser, by seed propagation. Bird attractant. Cosmopolitan species, on the backdune.	Clarke (1989).
Notelaea microcarpa				Fodder.			Lazarides & Hince (1993).
Nymphoides geminata	Tubers roasted & eaten.					Ornamental.	Lazarides & Hince (1993).
Nyssanthes diffusa						Minor weed of usually wet wastelands.	Lazarides & Hince (1993).

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Olax stricta						Possibly eaten by rabbits.	Benson & McDougall (1999).
Olearia ramulosa				Low palatability fodder.			Lazarides & Hince (1993).
Opercularia aspera					C3. Intolerant of wind, drought, waterlogging and salinity.	Tertiary sand coloniser. Cosmopolitan species, on the backdune. Eaten by rabbits.	Clarke (1989), Benson & McDougall (2000).
Oplismenus aemulus				Fodder.			Lazarides & Hince (1993).
Oxalis exilis						Ornamental.	Lazarides & Hince (1993).
Oxalis perennans						Ornamental.	Lazarides & Hince (1993).
Pandorea pandorana	Long wiry branches used as spear shafts by Aborigines.	Lazarides & Hince (1993).		Moderately palatable fodder.	C3. Wind intolerant, drought intolerant, intolerant of waterlogging and salinity.	Tertiary sand coloniser, propagation by seed, garden plant, floral display. Cosmopolitan species, on the backdune.	Clarke (1989), Lazarides & Hince (1993).
Panicum effusum	Seeds utilised to make bread.		Poison?	Palatable when young. Over consumption can cause photo-sensitisation and 'yellow bighead' in sheep. Susceptible to close grazing.		Seed eaten by Stubble Quail.	Cunningham et al. (1981), Lazarides & Hince (1993).
Panicum simile				Fodder.			Lazarides & Hince (1993).
Parsonsia eucalyptophylla			Poison?	Often eaten by sheep and cattle as drought fodder.			Lazarides & Hince (1993).

Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
				Suspected sheep poison at certain times.			
Parsonsia straminea			Poison?			May cause severe chemical burns.	Lazarides & Hince (1993); Hunter (1997).
Paspalidium constrictum				Very palatable to stock. Susceptible to preferential grazing.	Drought resistant.		Cunningham et al. (1981), Lazarides & Hince (1993).
Paspalidium gracile	Seeds are edible.			Hardy and readily grazed.			Cunningham et al. (1981), Lazarides & Hince (1993).
Paspalum dilatatum			Poison.	Heavy producer of palatable fodder. Ingested fungus may poison livestock.	Withstands heavy grazing and drought. Frost tender.	Fungus attacks seed, causing ergot. Sticky exudate harmful to humans. Pollen known to cause allergies in humans. Food plant of Pacific Black Duck & butterfly larvae.	Cunningham et al. (1981), Lazarides & Hince (1993), Benson & McDougall (2005).
Paspalum urvillei						Food plant of butterfly larvae.	Benson & McDougall (2005).
Patersonia glabrata	Rhizome edible.						
Pavonia hastata						Ornamental.	Lazarides & Hince (1993).
Pelargonium australe				Fodder.	C3. Wind tolerant.	Secondary sand coloniser, propagation by seed. Garden plant, floral display. Grows on sand dunes only, on fore dune.	Clarke (1989), Lazarides & Hince (1993),
Pentapogon quadrifidus				Fodder, low in forage value.			Lazarides & Hince (1993).
Persicaria	Salks can be roasted, peeled						

hydropiper	& eaten. Leaves can also be eaten but are hot.						
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Persoonia cornifolia	Fruit is edible.						
Persoonia daphnoides	Fruit is edible.						
Persoonia fastigiata	Fruit is edible.						
Persoonia microphylla	Fruit is edible.						
Persoonia oleoides	Fruit is edible.						
Persoonia sericea	Fruit is edible.						
Persoonia tenuifolia	Fruit is edible.						
Persoonia virgata	Fruit is edible.						
Phalaris aquatica			Poison.	Sown in irrigation pastures. May cause stock poisoning, especially in sheep: 'Phalaris Staggers'.		Pollen known to cause allergies in humans.	Cunningham et al. (1981), Lazarides & Hince (1993), Benson & McDougall (2005).
Philydrum lanuginosum			Poison?	Fodder.			Lazarides & Hince (1993).
Phyllota phylicoides				Honey.			Lazarides & Hince (1993).
Phytolacca octandra			Poison?	Suspected of poisoning stock.			Cunningham et al. (1981), Lazarides & Hince (1993).
Pimelea glauca			Poison.				Lazarides & Hince (1993).
Pimelea strigosa			Poison?				Lazarides & Hince (1993).
Pittosporum undulatum					C3. Intolerant of wind, drought, waterlogging and salinity.	Tertiary sand coloniser, propagation by seed, garden & shade plant. Gums, weed.	Clarke (1989), Lazarides & Hince (1993).

Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Plantago debilis	Leaves are edible.						
Plantago varia	Leaves are edible.						
Plectranthus parviflorus	Medicinal.	Lazarides & Hince (1993).				Ornamental.	Lazarides & Hince (1993).
Poa labillardieri				New growth utilised by stock.			Cunningham et al. (1981), Lazarides & Hince (1993).
Poa sieberiana				Fodder.			Lazarides & Hince (1993).
Podolepis arachnoidea				Fodder.			Lazarides & Hince (1993).
Podolepis jaceoides	Roots roasted.			Fodder.			Lazarides & Hince (1993).
Polyscias elegans					C3. Wind intolerant, drought intolerant, intolerant of waterlogging and salinity.	Tertiary sand coloniser by seed propagation. Timber, fuel, ornamental.	Clarke (1989), Lazarides & Hince (1993).
Pomaderris andromedifolia						Food plant of butterfly larvae Hypochrysops byzos byzos	Benson & McDougall (2000).
Pomaderris lanigera						Flowers visited by weevils and small flies. Food plant of butterfly larvae Hypochrysops byzos byzos.	Benson & McDougall (2000).
Pomax umbellata			Poison?	Fodder. Reputedly cyanogenetic, but rarely grazed. Considered to be a potential producer of hydrocyanic acid.	C3. Drought tolerant. Intolerant of wind, waterlogging and salinity.	Tertiary sand coloniser. Cosmopolitan species, on the backdune.	Clarke (1989), Lazarides & Hince (1993), Benson & McDougall (2000).

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Poranthera microphylla			Poison?	HCN positive; suspected of deaths in sheep and cattle.			Lazarides & Hince (1993).
Pratia purpurascens					C3. Intolerant of wind, drought and salinity. Tolerant of waterlogging.	Tertiary sand coloniser, propagation by transplants. Garden plant. Cosmopolitan species, on the backdune. Weed.	Clarke (1989), Lazarides & Hince (1993).
Prostanthera nivea						Ornamental.	Lazarides & Hince (1993).
Pseudognaphalium luteoalbum	Medicinal. Used for making a medicinal drink.	Lazarides & Hince (1993).		Fodder, lightly grazed.			Lazarides & Hince (1993).
Psychotria loniceroides	Fruits eaten when ripe.					Larval food plant for hawk moth Macroglossum hirundo subsp. errans.	Benson & McDougall (2000).
Pteridium esculentum	Food, medicinal. Rhizomes & young fronds contain starch which is chewed out and beaten to a paste. Rhizomes roasted. Carbohydrate content better than potatoes.	Lazarides & Hince (1993).	Poison.	Causes poisoning of horses and cattle. Gums.			Lazarides & Hince (1993).
Pterostylis cycnocephala	Tubers eaten.					Pollinated by pseudocopulation by fungus gnats & mosquitoes.	Benson & McDougall (2005).
Pterostylis daintreana	Tubers eaten.					Pollinated by pseudocopulation by fungus gnats & mosquitoes.	Benson & McDougall (2005).
Pterostylis longifolia	Tubers eaten.					Pollinated by pseudocopulation by fungus gnats &	Benson & McDougall (2005).

						mosquitoes.	
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Pterostylis obtusa	Tubers eaten.					Pollinated by pseudocopulation by fungus gnats & mosquitoes.	Benson & McDougall (2005).
Pultenaea flexilis				Honey.			Lazarides & Hince (1993).
Pultenaea villosa				Honey.			Lazarides & Hince (1993).
Ranunculus inundatus				Fodder.		Stoloniferous.	Lazarides & Hince (1993), Benson & McDougall (2000).
Ranunculus lappaceus				Not keenly sought after by stock. More suited to cattle than sheep.			Cunningham et al. (1981), Lazarides & Hince (1993).
Rosa rubiginosa	Rose hips can be eaten, may be made into ajam. Petals can be used in jams & salads.	Cunningham et al. (1981), Lazarides & Hince (1993).		Foliage grazed by stock.		Weed. Declared noxious in ACT, Vic, Tas, part NT.	Cunningham et al. (1981), Lazarides & Hince (1993).
Rostellularia adscendens				Moderately palatable fodder.		Ornamental.	Lazarides & Hince (1993).
Rubus fruticosus				Fruit eaten by numerous animals and birds.		Fruits collected for making jams and pies. Ornamental, weed. Declared noxious in Qld, ACT, Vic, Tas, SA, WA.	Cunningham et al. (1981), Lazarides & Hince (1993).
Rubus parvifolius	Fruits eaten raw or made into a jam.	Lazarides & Hince (1993).				Adult jewel beetles Alcinous nodosus during early summer on leaves, larvae feed in stems and later pupate in hollowed out chamber.	Lazarides & Hince (1993).

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Rubus ulmifolius	Fruit edible and sweet but insipid.	Benson & McDougall (2000).				Weed.	Lazarides & Hince (1993).
Rumex brownii	Leaves and midrib can be steamed or boiled & used as a substitute for silver beet. Thick yellow taproot can be ground, roasted & used as a coffee substitute.		Poison.			Weed.	Lazarides & Hince (1993).
Sacciolepis indica				Fodder of low forage value.			Lazarides & Hince (1993).
Sarcopetalum harveyanum					C3. Intolerant of wind, drought, waterlogging and salinity.	Tertiary sand coloniser. Cosmopolitan species, on the backdune.	Clarke (1989).
Schizomeria ovata	Edible fruit, which can make a good jam.						
Schoenus apogon				Fodder.			Lazarides & Hince (1993).
Scolymus maculatus						Weed, declared noxious in parts of NT.	Lazarides & Hince (1993).
Secale cereale				Fodder.		Food (rye), weed, shelter.	Lazarides & Hince (1993).
Senecio linearifolius					C3. Wind intolerant, drought intolerant, intolerant of waterlogging and salinity.	Tertiary sand coloniser. Cosmopolitan species, on the backdune. Weed.	Clarke (1989), Lazarides & Hince (1993).
Senecio quadridentatus			Poison.	Fodder.	Drought resistant.	Weed.	Lazarides & Hince (1993).
Setaria verticillata				Quite palatable to stcok when young.		Weed.	Cunningham et al. (1981), Lazarides & Hince (1993).

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Sigesbeckia orientalis	Medicinal	Lazarides & Hince (1993).		Lighlty grazed fodder.		Used for treatment of skin disorders.	Lazarides & Hince (1993).
Smilax australis	Leaf infusions used medicinally. Fruits edible & peppery. Woody stems used as fire sticks to ignite fire when rubbed together.	Lazarides & Hince (1993).			C3. Intolerant of wind, drought, waterlogging and salinity.	Tertiary sand coloniser. Medicinal, ornamental.	Clarke (1989), Lazarides & Hince (1993).
Smilax glyciphylla	Fruit and leaves eaten. Lease used as a substitute for sarsaparilla.	Benson & McDougall (2005).				Medicinal, ornamental. Leaf infusions used medicinally.	Lazarides & Hince (1993).
Solanum cinereum			Poison?	Fodder. Berries suspected poisonous to sheep and horses.			Lazarides & Hince (1993).
Solanum stelligerum	Recorded as being used as a traditional food plant. Fruit eaten by coastal Aborigines.	Clarke (1989), Lazarides & Hince (1993).			C3. Intolerant of wind, drought, waterlogging and salinity.	Tertiary sand coloniser. Floral display.	Clarke (1989).
Sonchus asper	Eaten as a green.			Fodder.			Lazarides & Hince (1993).
Sonchus oleraceus	Food. Eaten as a vegetable.	Lazarides & Hince (1993).	Poison?	Fodder. Suspected cause of photo-sensitisation in cattle. Readily grazed by stock.	C3. Wind intolerant , drought intolerant, intolerant of waterlogging and salinity.	Cosmopolitan species, on the backdune. Juice used medicinally. Weed.	Clarke (1989), Lazarides & Hince (1993).
Sorghum leiocladum				Fodder.			Lazarides & Hince (1993).
Spiranthes sinensis	Tubers eaten.					Pollinated by small native bees.	Benson & McDougall (2005).
Sporobolus elongatus				Fodder.			Lazarides & Hince (1993).
Stackhousia				Fodder.			Lazarides & Hince

monogyna							(1993).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Stellaria media				Food.		Edible as a vegetable, either cooked or raw.	Cunningham et al. (1981), Lazarides & Hince (1993).
Stephania japonica			Poison?	Suspected stock poison.	C3. Wind tolerant. Intolerant of drought, waterlogging and salinity.	Tertiary sand coloniser. Grows on sand dunes, headlands and in swamps, on fore dune and backdune.	Clarke (1989), Lazarides & Hince (1993).
Stypandra glauca			May be toxic to livestock if eaten when flowering.			Ornamental.	Lazarides & Hince (1993), Benson & McDougall (2005).
Styphelia triflora	Fruit edible.						
Syzygium australe				Food, Timber.		Ornamental. Fruit eaten by Grey Headed Flying Fox. Silvereye, Brown Pigeon, Wonga Pigeon, Satin Bowerbird also eat fruit.	Lazarides & Hince (1993), Benson & McDougall (1998).
Taraxacum officinale				Honey.			Lazarides & Hince (1993)
Tetrarrhena juncea	Seeds pounded into a flour & eaten.			Fodder		Food plant of butterfly larvae.	Lazarides & Hince (1993), Benson & McDougall (2005).
Thelionema caespitosum						Pollinated by native bees.	Benson & McDougall (2005).
Thelychiton gracilicaulis						Probably pollinated by Trigona bees.	Benson & McDougall (2005).
Thelychiton tarberi						Pollinated by Trigona bees.	Benson & McDougall (2005).
Thelymitra ixioides	Tubers eaten.					Pollinated by native bees & hoverflies.	Benson & McDougall (2005).
Thelymitra pauciflora	Tubers eaten.						

Themeda triandra				Very palatable, heavily grazed in eastern NSW. Sparingly grazed in Western NSW. Young growth utilised		Food plant of butterfly larvae. Will not tolerate continuous grazing. Very palatable when young but only moderate nutritive value. Provides much roughage to offset effects of highly improved grasslands.	Cunningham et al. (1981), Lazarides & Hince (1993), Benson & McDougall (2005).
Thysanotus tuberosus				Leaves are readily eaten by stock. Amount of forage produced is negligible.			Lazarides & Hince (1993).
Trachymene incisa	Edible tap root eaten raw or roasted.						
Trachymene sp. nov.	Edible tap root eaten raw or roasted.						
Tricoryne elatior				Eaten by stock but lacks bulk.			Cunningham et al. (1981), Lazarides & Hince (1993).
Trifolium campestre				Fodder.			Lazarides & Hince (1993).
Trifolium repens				Fodder, honey.			Lazarides & Hince (1993).
Tripogon loliiformis				Should be utilised quickly. Quite palatable.			Cunningham et al. (1981), Lazarides & Hince (1993).
Urtica incisa	Young shoots edible when boiled.	Lazarides & Hince (1993).	Painfall when contacted.				Cunningham et al. (1981), Lazarides & Hince (1993).
Velleia paradoxa			Poisonous?	Honey.			Lazarides & Hince (1993).
Verbena bonariensis			Poisonous?	Fodder.			Lazarides & Hince

							(1993).
Name	**Use**	**Use Refs.**	**Toxicity**	**Agri. Use**	**Physiol.**	**Notes**	**Gen. Refs.**
Verbena officonalis	Medicinal.	Lazarides & Hince (1993).	Poisonous?	Fodder.			Lazarides & Hince (1993).
Viola hederacea					C3. Tolerant of waterlogging. Intolerant of wind, drought and salinity.	Tertiary sand coloniser. Propagation by cuttings, transplants and seed. Garden plant, floral display.	Clarke (1989).
Vulpia bromoides				Generally ignored by sheep in good seasons. Can produce growth when other species fail.			Cunningham et al. (1981), Lazarides & Hince (1993).
Wahlenbergia communis				Fodder, palatable to stock.			Lazarides & Hince (1993).
Wahlenbergia gracilis				Palatable forage in cooler months.	C3. Wind intolerant, drought intolerant, intolerant of waterlogging and salinity.	Tertiary sand coloniser. Garden plant, floral display. Cosmopolitan species, on the backdune.	Clarke (1989), Lazarides & Hince (1993).
Wahlenbergia stricta				Readily grazed, cool season plant.			Lazarides & Hince (1993).
Wurmbea dioica	Corms & roots eaten.	Lazarides & Hince (1993).	Poison.	Contains toxic alkaloid colchicine and implicated in stock deaths.			Lazarides & Hince (1993).
Xanthorrhoea glauca	Aboriginal people collected nectar for food, dryied flower stalks for fishing spears and fire making, trunk a source of resin.			Honey.			

Name	Use	Use Refs.	Toxicity	Agri. Use	Physiol.	Notes	Gen. Refs.
Xanthorrhoea johnsonii	Aboriginal people collected nectar for food, dried flower stalks for fishing spears and fire making, trunk a source of resin.			Honey.		Blossoms eaten by Grey Headed Flying Fox.	Benson & McDougall (2005).
Xanthorrhoea macronema	Aboriginal people collected nectar for food, dried flower stalks for fishing spears and fire making, trunk a source of resin.			Honey.		Blossoms eaten by Grey Headed Flying Fox.	Benson & McDougall (2005).
Zieria smithii						Probably pollinated by native bees, flies and honeybees Apis mellifera, with small butterflies, wasps and bugs playing a lesser role. Food plant of butterfly larvae Papilio aegus aegus. White wax scale may be Gascardia destructor, Coccidae, Hemiptera.	Benson & McDougall (2001).

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