Vegetation and Floristics of Butterleaf National Park, Butterleaf State Conservation Area and the Bezzants Lease

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A Report to the New South Wales National Parks and Wildlife Service & the Nature Conservation Trust of NSW

Summary

The vegetation of the Butterleaf National Park and State Conservation Area and Bezzant's Lease is described and mapped (scale 1:25 000). Nine communities and three sub-associations are defined based on classification (Kulczynski association). These eight communities and three sub-associations were mapped based on ground truthing, air photo interpretation and landform. The communities described and their status is:

Floristic Community	Area	Reservation Status
C1a: Eucalyptus radiata – E. campanulata – E. obliqua	1,875 ha	Not listed as a community of concern though likely a unique association within the area.
C1b: Eucalyptus obliqua – E. brunnea – E. saligna	263 ha	Not listed as a community of concern.
C1c: Eucalyptus campanulata – E. obliqua – E. saligna	250 ha	Not listed as a community of concern.
C2: Eucalyptus acaciiformis – Angophora floribunda	8.7 ha	Likely to be included as an **Endangered Ecological Community** within the Montane Peatlands and Swamps determination of the *TSC* Act.
C3: Eucalyptus caliginosa – E. bridgesiana – E. laevopinea	433 ha	Not listed as a community of concern though likely a unique association within the area.
C4: Eucalyptus nova-anglica – E. acaciiformis – E. subtilior	39.8 ha	Would fall within the **Endangered Ecological Community** New England Peppermint Woodland on the *TSC* and *EPBC* Acts.
C5: Leucopogon neo-anglicus – Kunzea obovata – Leptospermum novae-angliae	138 ha	Not listed as a community of concern. Currently adequately reserved across its range.
C6: Eucalyptus campanulata – E. radiata – E. williamsiana	3,071 ha	Not listed as a community of concern though a highly disjunct and rare association.
C7: Callicoma serratifolia – Orites excelsa	34.7 ha	Not listed as a community of concern.
C8: Baeckea omissa – Epacris microphylla	76.2 ha	Included as an **Endangered Ecological Community** within the Montane Peatlands and Swamps determination of the *TSC* Act.
C9: Leptospermum novae-angliae – Leptospermum polygalifolium	10.5 ha	Not listed as a community of concern, though a rare assemblage within the landscape, especially in good condition.

A total of 516 vascular plant taxa were found from 99 families and 276 genera. *Muehlenbeckia costata* and *Chiloglottis platyptera* are currently listed as vulnerable

on the *EPBC* Act, no other species of state or federal significance were found though seven other RoTAP species were noted which include: *Agiortia cicatricata, Brachyloma cicatricata, Callistemon pungens, Cryptandra lanosiflora, Eucalyptus codonocarpa, Eucalyptus retinens, Hibbertia villosa, Philotheca epilosa*. *Acacia mitchellii, Actinotus gibbonsii, Callitris rhomboidea, Isotoma axillaris, Tmesipteris parva, Trachymene* sp. nov. were also considered to be of regional conservation significance.

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Introduction

1.1 Objectives

Dr John T. Hunter prepared this report of the vegetation of the Butterleaf National Park and State Conservation Area and Bezzants Lease. Aims included the collation of existing information from previous floristic surveys and that the survey of 60, 20 x 20 m stratified full vascular plant floristic sites is carried out in order to complete a comprehensive investigation of the vegetation and flora of Timbarra National Park. This report represents the findings of this study. The collated 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 conservation areas.
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, *EPB&C* Act 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 classification.
8. Provide management recommendations.

Methodology

2.1 Survey design

The survey was carried out in a stratified random way in order to sample and replicate the major environmental changes. As the reserve is small and only a small number of sites were allocated for survey purposes only a limited number of strata could be used. Rock type and aspect were used to stratify sites within the landscape.

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 equidistant 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 Northern Plains Region of the National Parks and Wildlife Service (Appendix A). Site location was derived from a Garmin GPSMap60CS with reference to topographic maps. Datum used was AMG94.

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 Area 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 Data management

'Paradox 12 for Windows' (Corel 2006) 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 and 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 Narrabri office of the New South Wales National Parks and Wildlife Service and Information and Assessment Section Dubo (along with copies of all field datasheets).

2.4 Analysis of regional diversity

Regional diversity is calculated by assuming an exponential species-area curve relationship exists. The regional diversity index is calculated by D=S/logA, where S is the number of taxa in a region of A hectares. This is done for comparative purposes.

2.5 Multivariate Analysis

Initial exploratory analysis of sites was conducted using classification and ordination techniques available in PATN: Pattern Analysis Package (Belbin 2004). 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).

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.

2.6 Significant vascular plant taxa within the conservation areas

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 federal *Environmental Protection & Biodiversity Conservation Act* (EPBC Act) and the New South Wales *Threatened Species Conservation* Act 1995 (TSC Act) were used as a primary indicator of national and state significance. The regional significance of taxa was assessed with reference to other flora survey publications. Finally, local botanical knowledge as expressed in unpublished survey reports and the personal experience of the author and other botanists was used as a source of information.

Results

3.1 Site stratification

Twenty-five full floristic survey sites had previously been placed within the reserve as contained with the YETTI database or those conducted by the author within the area on a previous occasion (Sept. 2007). A total of 60 new sites were surveyed within the study area over five days in March 2011.

3.2 Floristics

A total of 516 vascular plant taxa were recorded during the collation of site data and opportunistic sampling (5% exotic). The 517 taxa occurred in 99 families and 276 genera. The families with the greatest number of taxa are: Asteraceae (55), Poaceae (47), Fabaceae (43), Myrtaceae (39), Cyperaceae (24), Orchidaceae (18) and Proteaceae (15). The richest genera are: *Eucalyptus* (21), *Acacia* (16), *Hibbertia* (9), *Senecio* (8), *Leptospermum* (7), *Wahlenbergia* (7).

Table 1: Comparison of selected attributes between floristic surveys conducted within the Northern Tablelands, Western Slopes, Plains and Far Western Plains.

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).
878	2%	120	36/0.1 ha	42	198	Gibraltar Range & part of Washpool NP (Sheringham & Hunter 2002). 20 x 50 m sites.
840	5%	88	50/0.1 ha	26	205	Bald Rock & Boonoo Boonoo NP (Hunter 2003) 20 x 50 m sites.
674	25%	87	38/0.04	6	187	Warrabah National Park (Hunter 2008). Also 61, 20 x 20 m sites, 26 31 x 31 m sites. Meanders over many seasons and years.
826	9%	180		21	184	Nymboida NP (Benwell 2000). 20 x 50 m sites.
779	16%	133	30/0.04 ha	12	178	Warrumbungle National Park (Hunter 2008) 20 x 20 m sites.
752	5%	201	60/0.1 ha	34	168	Torrington State Conservation Area (Clarke *et al.* 1998). 152 species from previous records.
481	15	42	36/0.04 ha	11	159	Goonoowiggal Nature Reserve (Hunter 2008). 20 x 20 m sites.
666	5%	101	40/0.1 ha	9	158	Part of Guy Fawkes National Park (Hunter & Alexander 1999b). 20 x 50 m sites
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 National Park (Hunter & Alexander 2000a). 20 x 20 m sites.
477	9%	140	35/0.04 ha	10	142	Ironbark Nature Reserve & *Bornhardtia* VCA (Hunter & Hunter 2003). 20 x 20 m sites.
771	12.5%	540	33/0.04 ha	8	140	Pilliga NR, Pilliga East SCA, Ukerbarley & Willala AA (Hunter 2011). 20 x 20 m sites.
410	35%	None	NA	?	140	Attunga State Forest (Hosking & James 1998). Meanders over many seasons and years.
516	**5%**	**75**	**32/0.04**	**10**	**136**	**Butterleaf NP & SCA & Bezzants Lease (*ibid*). 20 x 20 m sites & 32 x 32 m sites.**
342	4%	28	33/0.1 ha	3	135	Burnt Down Scrub Nature Reserve (Hunter 2000). 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
502	17%	155	40/0.04 ha	5	132	Kwiambal National Park, 2008 update (2008). 20 x 20 m sites.
460	9%	48	38/0.04 ha	17	130	Severn River Nature Reserve (Hunter 2000f) 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.*
365	2%	40	52/0.1 ha	5	124	Demon Nature Reserve (Hunter *et al.* 1999). 32 x 32 m nested quadrats.
434	21%	50	36/0.04 ha	9	123	Arakoola Nature Reserve (Hunter 2000d). 20 x 20 m sites.
437	10%	40	31/0.04	1	121	Cataract NP & NR (Hunter 2007). 20 x 20 m sites.
417	4%	40	38/0.1 ha	10	120	Basket Swamp NP (Hunter 2002).
530	9%	147	26/0.04 ha	4	113	Dewson's Lease, Cubbo & Etoo [Pilliga NP, NR, SCA] (Hunter 2010). 20 x 20 m sites.
441	10%	75	51/0.04 ha	17	112	Kings Plains National Park (Hunter 2000h). 20 x 20 m sites.
309	9%	23	?/0.04 ha	?	112	Stoney Batter Nature Reserve (Copeland 2002, *unpublished*). 20 x 20 m sites.
516	13%	183	32/0.04 ha	3	111	Timmallallie NP, Yarrigan NP & Dandry Gorge AA (Hunter 2010). 20 x 20 m sites.
360	4%	44	29/0.04 ha	7	111	Timbarra NP (Hunter 2011). 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.
503	20%	171	20/0.09 ha	0	108	Kinchega National Park (Westbrooke *et al.* 2001). 30 x 20 m sites.
409	12%	71	29/0.04 ha	1	108	Bullala National Park (Hunter 2009). 20 x 20 m sites.
345	4%	38	?/0/04 ha	1	103	The Basin Nature Reserve. (Hunter & Copeland 2002, *unpublished*). 20 x 20 m plots.
362	14%	52	40/0.04 ha	0	105	Berrygill Aboriginal Area (Hunter 2009). 20 x 20 m sites.
464	11%	202	25/0.04 ha	5	103	Dthiniia Dthinnawan Nature Reserve (Hunter 2008). 20 x 20 m sites.
388	15%	67	30/0.04 ha	0	103	Terry Hie Hie Aboriginal Area (Hunter 2009). 20 x 20 m sites.
315	13%	46	48/0.04 ha	1	103	Munro South, Gwydir River NP (Hunter 2011). 20 x 20 m sites overstorey only sites.
310	16.5%	24	49/0.04 ha	1	103	*Euroka* (Hunter 2010). 20 x 20 m sites.
280	10%	32	48/0.04 ha	1	94	Sepoy, section of Gwydir River NP (Hunter 2009). 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
331	15%	37	35/0.04 ha	2	93	Beresford Park/Carinya sections of Mt Kaputar NP (Hunter 2008). 20 x 20 m sites.
209	23%	14	48/0.04. ha	3	93	Barayamal National Park (Hunter 2008). 20 x 20 m sites.
218	25%	14	22/0.04 ha	3	91	Little Llangothlin Nature Reserve (Hunter 2011). 20 x 20 m sites.
358	11%	65	29/0.04 ha	2	89	Trinkey State Conservation Area (Hunter 2008). 20 x 20 m sites
325	11%	50	22/0.04 ha	2	89	Narran Lake Nature Reserve (Hunter *et al.* 2001). 20 x 20 m sites.
216	2%	21	41/0.04 ha	0	89	Horton Falls National Park (Hunter 2009) 20 x 20 m sites.
237	10%	21	34/0.04 ha	1	88	Boronga, Boomi & Boomi West Nature Reserves (Hunter 2006). 20 x 20 m sites.
299	15%	41	46/0.04 ha	0	87	Courallie Aboriginal Area (Hunter 2009). 20 x 20 m sites.
287	4%	53	30/0.04 ha	4	86	Deriah Aboriginal Area (Hunter 2008). 20 x 20 m sites.
422	14%	125	25/0.09 ha	?	85	Peery National Park (Westbrooke *et al.* 2002). 30 x 30 m sites.
175	14%	14	36/0.04 ha	1	85	Gamilaroi Nature Reserve (Hunter 2006). 20 x 20 m sites.
225	7%	26	31/0.04 ha	1	83	Stonehenge section of Warialda CCA (Hunter 2009). 20 x 20 m sites.
262	14%	29	39/0.04 ha	0	81	Wondoba State Conservation Area. 20 x 20 m sites.
371	13%	132	37/0.04 ha	?	80	Goobang National Park (Porteners 1997). 20 x 20 m sites.
247	18%	33	30/0.03 ha	0	80	The Mission Aboriginal Area (Hunter 2009). 20 x 20 m sites.
170	3%	15	30/0.04 ha	1	79	Mt McKenzie NR (Hunter 2002). 20 x 20 m sites.
248	12%	27	33/0.04 ha	0	76	Rusden section of Mt Kaputar National Park (Hunter 2008). 20 x 20 m sites.
207	18%	20	33/0.04	1	76	Molroy section of Bingara SCA (Hunter 2009). 17 20 x 20 m sites. 3 overstorey sites.
229	11%	22	37/0.04 ha	1	75	Leard State Conservation Area (Hunter 2008). 20 x 20 m sites.
210	15%	25	35/0.04 ha	1	74	Planchonella Nature Reserve (Hunter 2006). 20 x 20 m sites.
183	18%	11	33/0.04 ha	0	73	Gunyerwarildi National Park (Hunter 2008). 20 x 20 m sites.
238	16%	26	38/0.04 ha	0	72	Campbell and Montrose AA (Hunter 2009). 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
186	8%	19	28/0.04 ha	1	72	'Marrawah' (Hunter 2007) 20 x 20 m sites.
134	5%	21	26/0.04 ha	5	72	Aberbaldie NR (Hunter 2005). 20 x 20 m sites.
209	17%	15	35/0.04 ha	0	71	Irrigappa AA (Hunter 2009). 20 x 20 m sites.
185	8%	20	21/0.04 ha	0	71	'Sandy Wells' (Hunter 2007). 20 x 20 m sites.
241	13%	37	26/0.04 ha	0	68	Biddon State Conservation Area (Hunter 2008). 20 x 20 m sites.
202	6%	20	30/0.04 ha	1	68	Garrawilla National Park (Hunter 2008). 20 x 20 m sites.
167	6%	21	32/0.04 ha	1	68	Nullamanna National Park (Hunter 2008). 20 x20 m sites.
235	15%	31	26/0.04 ha	1	67	Bobbiwaa State Conservation Area (Hunter 2008). 20 x 20 m sites.
211	11%	26	35/0.04 ha	1	67	Derra Derra section of the Bingara SCA (Hunter 2009). 20 x 20 m sites.
224	14%	31	33/0.04 ha	2	67	Kelvin Aboriginal Area (Hunter 2008). 20 x 20 m sites.
240	10%	40	32/0.04 ha	2	66	Playgan section of Mt Kaputar NP (Hunter 2008). 20 x 20 m sites.
217	13%	31	24/0.04 ha	0	66	Moema National Park (Hunter 2007). 20 x 20 m sites.
170	22%	18	36/0.04 ha	0	66	Dowe National Park (Hunter 2010). 20 x 20 m sites.
176	6%	14	34/0.04 ha	1	65	Montawaa section of Mt Kaputar National Park (Hunter 2008). 20 x 20 m sites.
167	6%	10	32/0.04 ha	2	63	Formosa section of Mt Kaputar National Park (Hunter 2008). 20 x 20 m sites.
161	12%	15	25/0.04 ha	0	63	Midkin Nature Reserve (Hunter 2006). 20 x 20 m sites.
131	10%	9	33/0.04 ha	0	62	Bullawa Creek State Conservation Area (Hunter 2008). 20 x 20 m sites.
163	9%	16	24/0.04 ha	0	61	Couradda Community Conservation Area (Hunter 2008). 20 x 20 m sites.
192	7%	30	24/0.04 ha	0	59	Killarney State Conservation Area (Hunter 2008). 20 x 20 m.
170	12%	23	33/0.04 ha	0	59	Somerton National Park (Hunter 2008). 20 x 20 m sites.
166	10%	19	31/0.04 ha	1	56	Tinkrameanah National Park (Hunter (2008). 20 x 20 m sites.
199	11%	45	21/0.04 ha	2	55	Budelah Nature Reserve (Hunter 2006). 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
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).
240	8%	42	28/0.04 ha	1	51	Culgoa National Park (Hunter 2005). 20 x 20 m sites.
112	4%	15	26/0.04 ha	1	51	Gibraltar NR (Hunter 2002). 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.
129	14%	20	22/0.04 ha	1	49	Brigalow Park & Claremont Nature Reserves (Hunter 2006). 20 x 20 m sites.
235	26%	200	18/0.09 ha	?	48	Mungo National Park (Westbrooke & Miller 1995). 30 x 30 m sites.
200	?	?	?	?	47	Macquarie Marshes Nature Reserve (NSW NPWS).
127	1%	16	32/0.04 ha	1	46	Weetalibah Nature Reserve (Porteners 1998). 20 x 20 m sites.
215	20%	92	?	?	45	Mallee Cliffs National Park (Morcom & Westbrooke 1990). 10 x 20 m sites.
185	5%	40	12/0.04 ha	1	44	Ledknapper Nature Reserve (Hunter & Fallavollita 2003). 20 x 20 m sites.
227	4%	184	?	?	44	Nombinnie NP & Round Hill NR (Cohn 1995). 30 x 30 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
139	1%	30	31/0.04 ha	0	39	Binnaway Nature Reserve (Porteners 1998). 20 x 20 m sites.
133	7%	30	14/0.04 ha	0	39	'Goonama' (Hunter 2007). 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	27/0.04 ha	1	25	Derra Derra Ridge, Bingara (Benson *et al.* 1996). 20 x 20 m sites.

3.3 Community definition

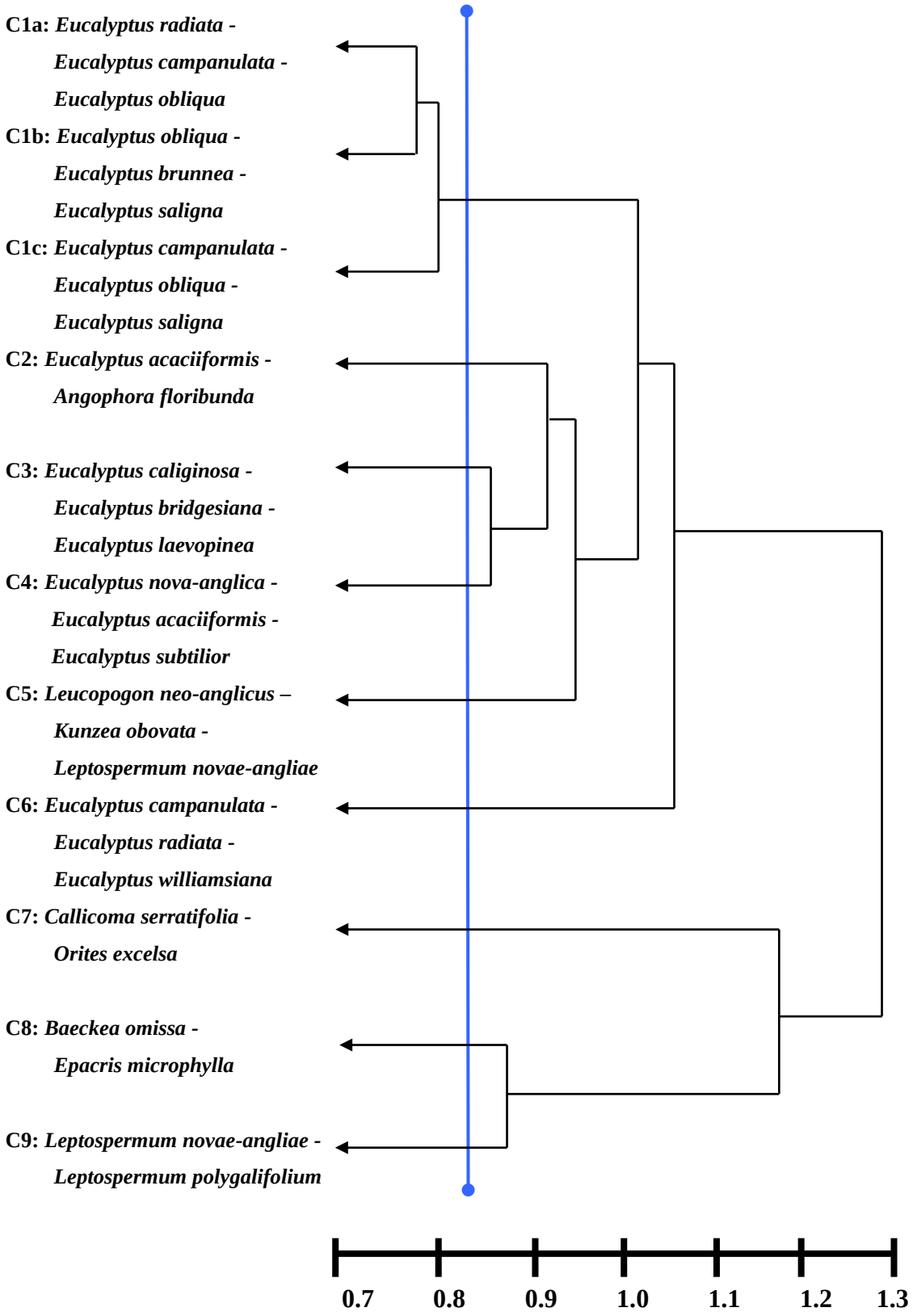

Figure 1: Summary dendrogram .Communities are defined at a dissociation of *c.* 0.85.

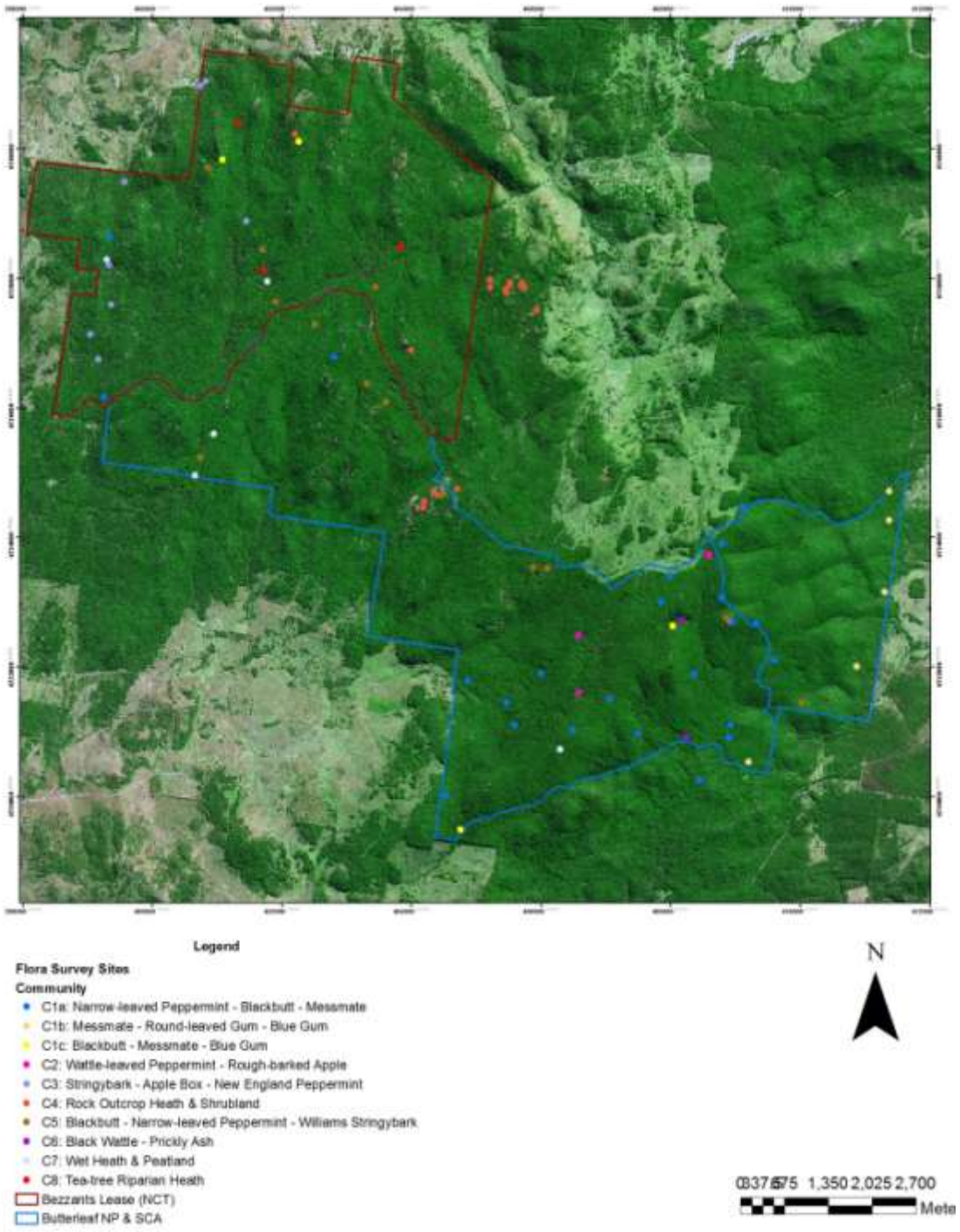

Figure 2: Location of sites within each community at Butterleaf & Bezzants Lease.

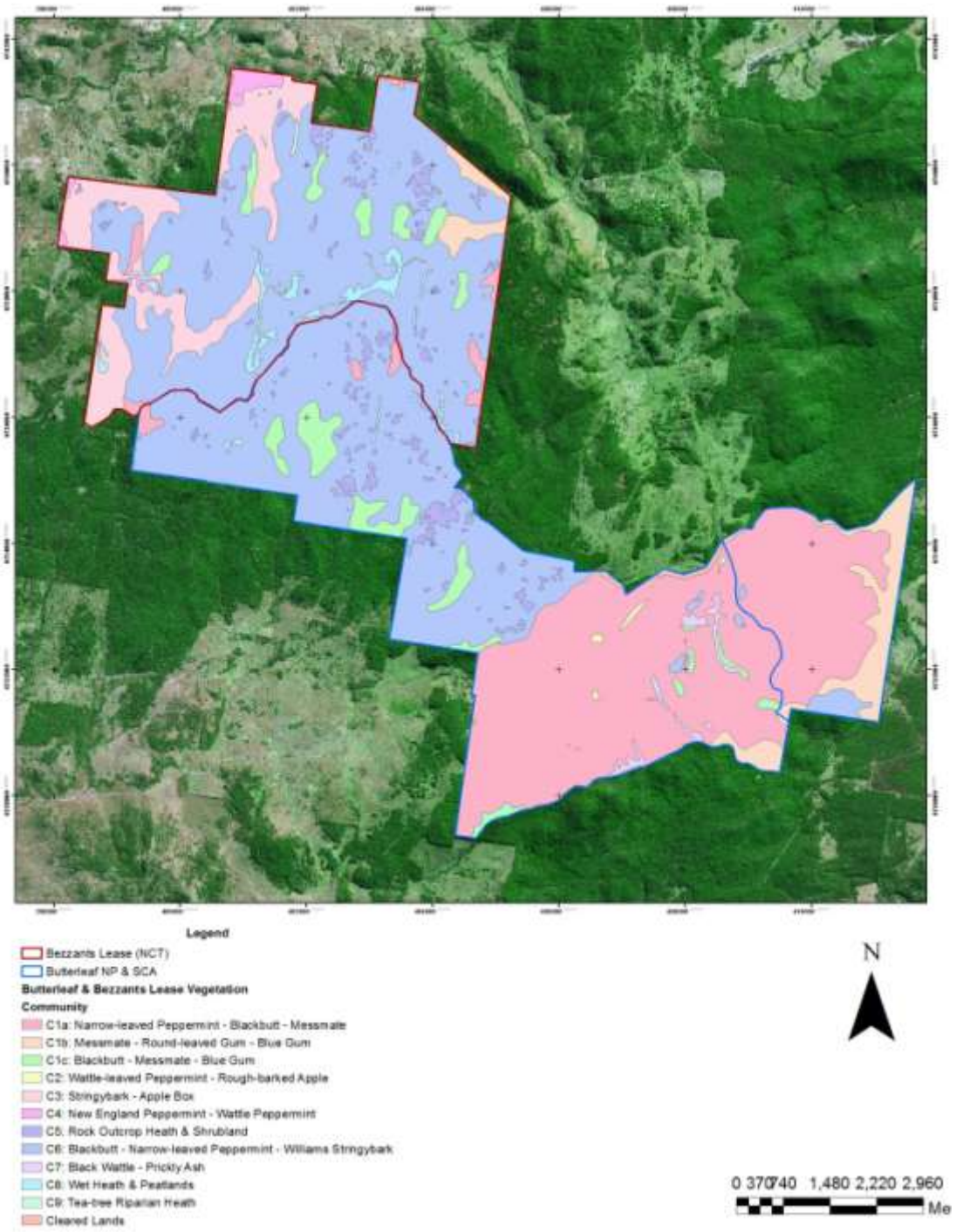

Figure 3: Mapped distribution of all communities within Butterleaf & Bezzants Lease.

3.4 Description of plant communities

3.4.1 Community 1: Messmate – Blackbutt – Peppermint Forest

Eucalyptus obliqua (Messmate Stringybark) – *Eucalyptus campanulata* (Blackbutt) - *Eucalyptus radiata* subsp. *sejuncta* (Narrow-leaved Peppermint) Woodland

Sample sites (33): 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 22, 24, 27, 29, 31, 33, 38, 42, 46, 49, 55, 56, 57, 64, 65.

No. of taxa: 253 **No. of taxa per plot:** 18-**36**-51.

Number of hectares: 2,387 **Proportion of reserves:** 38%

Dominant overstorey: *Eucalyptus obliqua, Eucalyptus campanulata, Eucalyptus radiata* subsp. *sejuncta, Eucalyptus saligna, Eucalyptus nobilis*.

Dominant shrubs: *Leucopogon lanceolatus, Bursaria spinosa.*

Dominant understorey: *Poa sieberiana, Lomandra longifolia, Pteridium esculentum, Microlaena stipoides, Pratia purpurascens, Hydrocotyle geraniifolia, Hydrocotyle laxiflora*

3.4.1.1 Community 1a: Peppermint – Blackbutt – Messmate Forest

Eucalyptus radiata subsp. *sejuncta* (Narrow-leaved Peppermint) – *Eucalyptus campanulata* (New England Blackbutt) – *Eucalyptus obliqua* (Messmate Stringybark) Forest

Sample sites (24): 3, 4, 5, 6, 7, 8, 9, 10, 11, 18, 19, 20, 22, 24, 27, 29, 31, 33, 38, 42, 54, 56, 57, 65.

Number of hectares: 1,875 **Proportion of reserve:** 30%

Environmental relationships: found on upper to lower slopes usually on moist shallow to deep soils. Soil colour is chocolate brown, dark brown to black or red brown. Soil texture is clay loam to sandy loam or more rarely coarse sandy loam. Generally found on higher nutrient soils within the study area or protected areas on granite.

Distribution within reserve: found primarily within Butterleaf SCA and the eastern parts of Butterleaf NP but some scattered occurrences also occur in other parts of the study area.

Structure: a grassy to shrubby woodland or forest.

- Tree-layer: (10) 18-35 (-40) m tall. 35-50% cover.
- Tall shrub layer: 4-10 m tall. 40% cover. Only rarely present.
- Low shrub layer. 1.5-4 m tall. 10-40 (-60)% cover. Sometimes absent.
- Understorey layer: < 1 m tall. 30-90% cover.

No. of taxa: 205 **No. of taxa per plot:** 18-**36**-51.

Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).

Trees: *Eucalyptus radiata* subsp. *sejuncta, Eucalyptus campanulata, Eucalyptus obliqua, Eucalyptus nobilis, Eucalyptus cameronii, Eucalyptus saligna, Eucalyptus eugenioides, Eucalyptus retinens, Eucalyptus bridgesiana, Eucalyptus brunnea, Callicoma serratifolia, Eucalyptus caliginosa*.

Shrubs: *Lomatia silaifolia, Leucopogon lanceolatus, Bursaria spinosa, Hibbertia obtusifolia, Podolobium ilicifolium, Bursaria longisepala, Acacia floribunda*.

Climbers & trailers: *Smilax australis, Clematis glycinoides, Glycine clandestina, Eustrephus latifolius, Desmodium varians, Hibbertia scandens, Rubus parviflorus,*

Hardenbergia violacea, Billardiera scandens, Desmodium gunnii, Clematis aristata, Glycine tabacina, Pyrrosia rupestris, Kennedia rubicunda, Glycine microphylla, Hibbertia dentata.

Ground cover: *Poa sieberiana, Lomandra longifolia, Pteridium esculentum, Microlaena stipoides, Pratia purpurascens, Hydrocotyle geraniifolia, Entolasia stricta, Geraniums solanderi* subsp. *solanderi, Hydrocotyle laxiflora, Dichondra repens, Viola hederacea, Imperata cylindrica, Hydrocotyle peduncularis, Poranthera microphylla, Gonocarpus teucrioides, Themeda triandra, Platysace ericoides, Gonocarpus tetragynus, Viola betonicifolia, Coronidium scorpioides, Hypolepis glandulifera, Galium propinquum, Hypericum gramineum, Cyathea australis, Podolepis neglecta, Galium migrans, Echinopogon caespitosus, Austrostipa rudis, Sticherus lobatus, Goodenia hederacea, Euchiton sphaericus, Dianella caerulea, Chrysocephalum apiculatum, Brachyscome nova-anglica, Senecio diaschides, Plantago debilis, Lepidosperma laterale, Lagenifera stipitata, Gonocarpus humilis, Galium binifolium, Dianella revoluta, Caladenia carnea, Blechnum cartilagineum*.

Introduced taxa: *Hypochaeris radicata, Cirsium vulgare, Gamochaeta spicata, Conyza sumatrensis, Conyza bonariensis, Rapistrum rugosum, Phytolacca Americana, Medicago polymorpha.*

Percent of species introduced: 4%

Taxa of conservation importance: *Eucalyptus retinens*.

Notes & conservation status: this is the most common sub-assemblage on soils of a higher nutrient status within the study area. This sub-assemblage would fall within Beadle (1981) *Eucalyptus radiata* alliance. This alliance occurs generally within rainfalls around 1000 mm a year and forms woodlands and forests between altitudes of 300-1100 m altitude. It is generally found on soils that are intermediate in fertility. Assemblages similar to this one are not within the literature. This combination of *Eucalyptus radiata* with such a high dominance associated with *Eucalyptus campanulata* and *Eucalyptus obliqua* is rather unique and probably should be considered a restricted assemblage type on the Northern Tablelands. It is the dominant association on the higher nutrient soils within the study area but does not appear to occur in any of the neighbouring reserves. As with community 1b and 1c fires are likely to homogenised the understorey and promoted a uniform herbaceous dominated understorey throughout most occurrences of this community. Many stands appear to be of a dense and even age nature and could be due to severe past fire events.

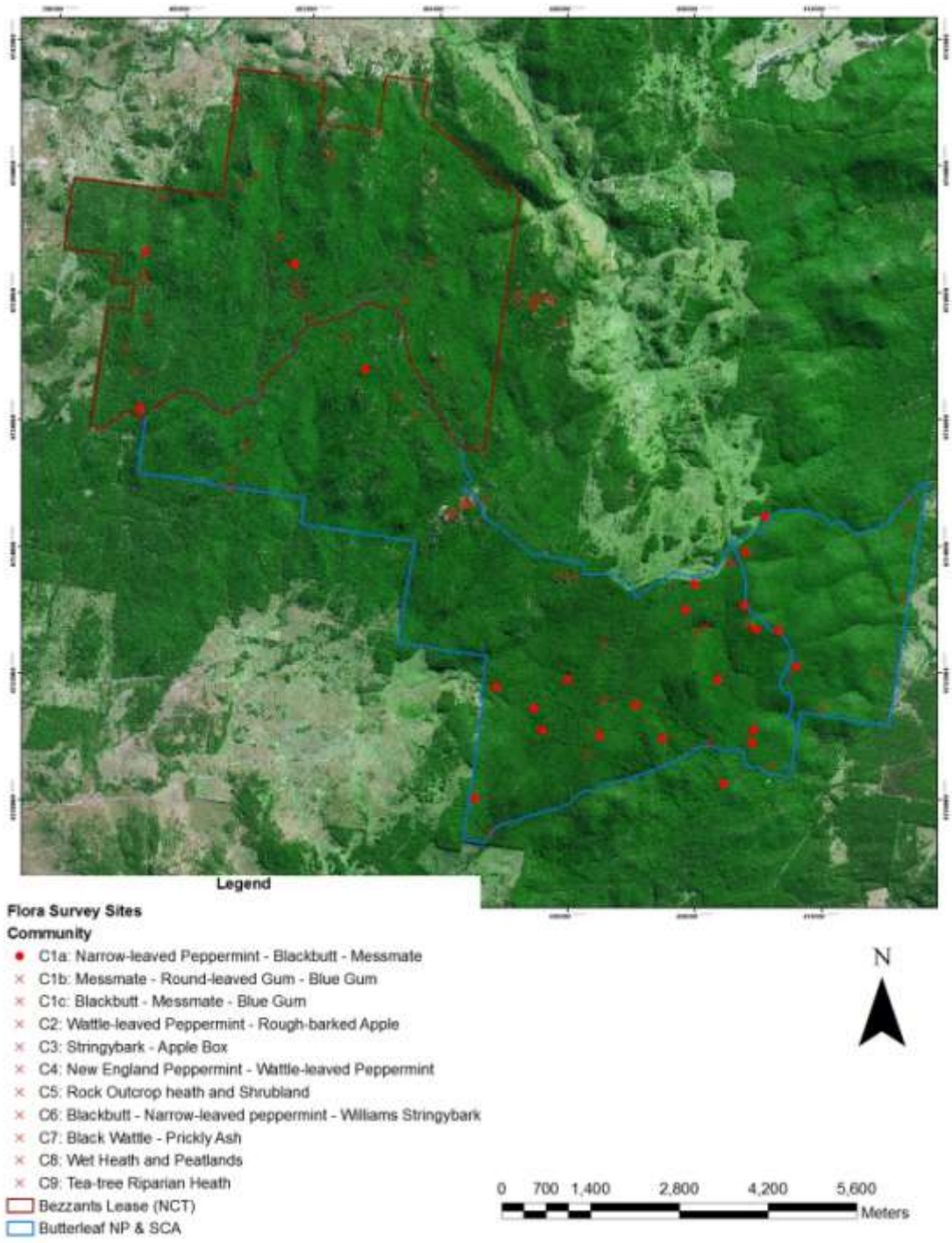

Figure 4: Placement of sites within Community 1a at Butterleaf & Bezzants Lease.

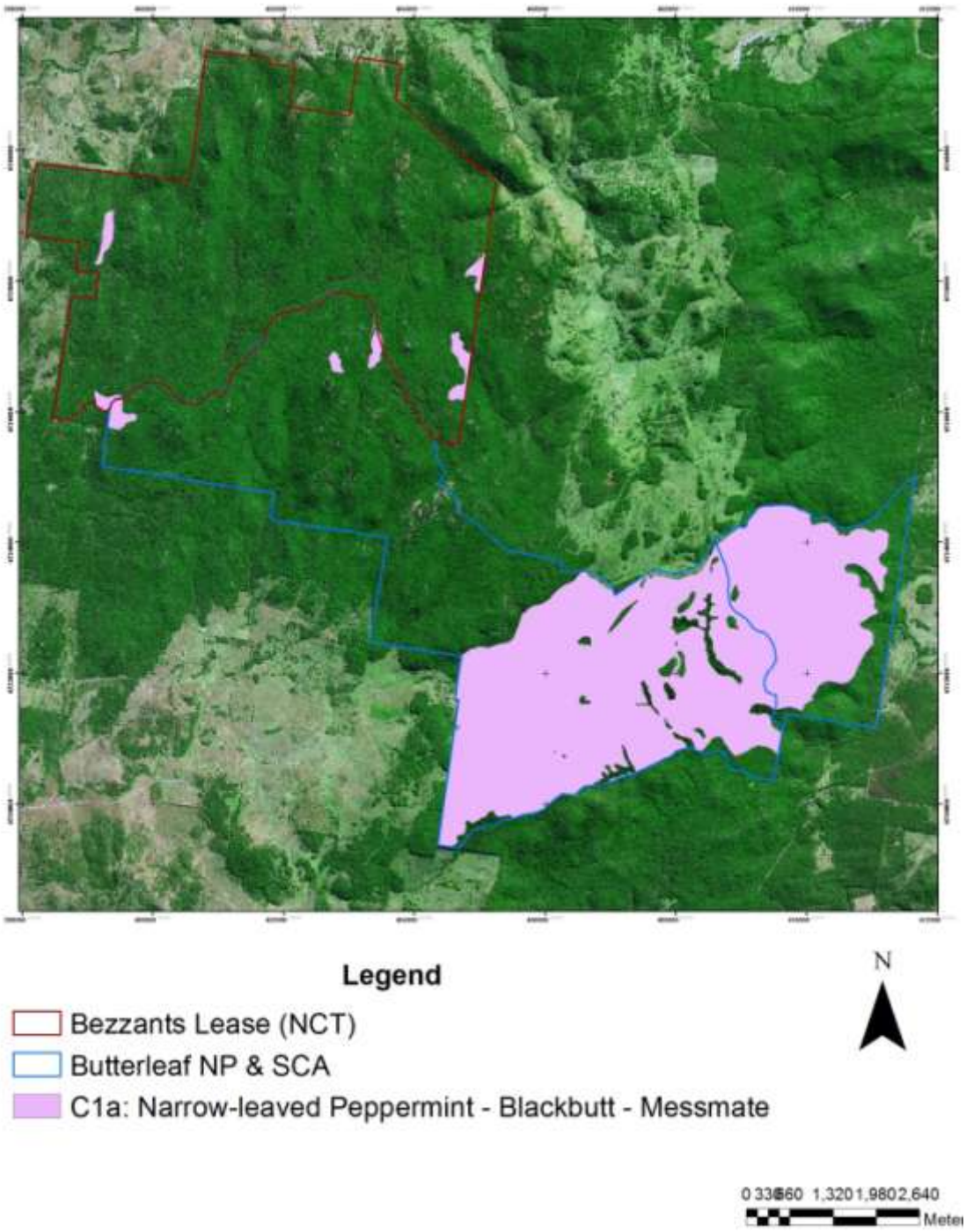

Figure 5: Mapped distribution of Community 1a.

Plate 1: Photographs of Community 1a; above Site 11, below Site 18.

Plate 2: Photographs of Community 1a; above Site 22, below Site 24.

Plate 3: Photographs of Community 1a; above Site 27, below Site 33.

Plate 4: Photographs of Community 1a; above Site 56, below Site 65.

3.4.1.2 Community 1b: Messmate – Round-leaved Gum – Blue Gum Forest

Eucalyptus obliqua (Messmate Stringybark) – *Eucalyptus brunnea* (Round-leaved Gum) – *Eucalyptus saligna* (Sydney Blue Gum) Forest

Sample sites (5): 12, 13, 14, 15, 17.

Number of hectares: 263 **Proportion of reserve:** 4.2%

Environmental relationships: found on lower slopes and open depressions on moist to deep soils with a chocolate brown red chocolate brown to dark brown black soils that are sandy loam or clay loam in texture. Generally found lower elevation sites associated within metasediments or on granite in broad eastern facing valleys.

Distribution within reserve: restricted to the eastern portions of both Butterleaf NP and SCA and Bezzants Lease.

Structure: a tall open forest.

- Tree-layer: 25-40 m tall. 40-45% cover.
- Tall shrub layer: 4-12 m tall. 15% cover. Rarely present.
- Low shrub layer: 1-6 m tall. 10-25% cover. Usually present.
- Understorey layer: < 1 m tall. 90% cover.

No. of taxa: 105 **No. of taxa per plot:** 42-**43**-45.

Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).

Trees: *Eucalyptus obliqua, Eucalyptus brunnea, Eucalyptus saligna, Eucalyptus campanulata, Banksia integrifolia*.

Shrubs: *Leucopogon lanceolatus, Acacia filicifolia, Polyscias sambucifolia, Bursaria spinosa, Notelaea longifolia, Myrsine variabilis, Maytenus bilocularis*.

Climbers & trailers: *Rubus parvifolius, Hardenbergia violacea, Hibbertia scandens, Geitonoplesium cymosum, Desmodium varians, Eustrephus latifolius, Clematis glycinoides, Glycine clandestina, Clematis aristata, Cayratia clematidea.*

Ground cover: *Poa sieberiana, Pteridium esculentum, Microlaena stipoides, Hydrocotyle laxiflora, Echinopogon caespitosus, Imperata cylindrica, Echinopogon mckiei, Poa labillardieri, Hydrocotyle geraniifolia, Gonocarpus teucrioides, Poa queenslandica, Lomandra longifolia, Geraniums solanderi* subsp. *solanderi, Viola hederacea, Galium migrans, Austrostipa rudis, Acaena novae-zelandiae, Ranunculus*

lappaceus, Mentha diemenica, Pratia purpurascens, Plectranthus graveolens, Euchiton gymnocephalus, Wahlenbergia communis, Viola betonicifolia, Veronica plebeia, Vernonia cinerea, Rumex brownii, Poranthera microphylla, Pellaea nana, Panicum queenslandicum, Oplismenus imbecillis, Oplismenus aemulus, Echinopogon ovatus, Dichelachne micrantha, Deyeuxia gunniana, Coronidium scorpioides, Blechnum cartilagineum, Adiantum aethiopicum.

Introduced taxa: *Hypochaeris radicata, Cirsium vulgare, Bidens pilosa, Bidens subalternans, Hypochaeris microcephala* var. *albiflora.*

Percent of species introduced: 5%

Taxa of conservation importance: none apparent.

Notes & conservation status: As with sub-assemblage 1c this sub-assemblage is part of Beadles' (1981) *E. campanulata* Alliance that is described as occurring at higher altitudes from just over the Queensland border to the Barrington Tops area. Hunter (1998) presents an *E. campanulata, E. cameronii* and *E. obliqua* Tall Open Forest that occupies over 30% of the Washpool National Park Western Additions that is broadly synonymous with this association. *Eucalyptus obliqua* generally occurs along the higher rainfall eastern areas of the tablelands and is associated with soils of a higher nutrient status. *Eucalyptus obliqua* is generally restricted to altitudes between 900-1400 m here in the north of the state and prefers rainfalls between 750 and 1200 mm. *Eucalyptus obliqua* dominated communities generally, if fires were more infrequent, contain a higher proportion of mesophyll shrubs but as Beadle (1981) puts it most areas are 'mutilated by fire' and dominated by a herbaceous grassy layer.

Management considerations: a longer absence of fires in these areas would be beneficial.

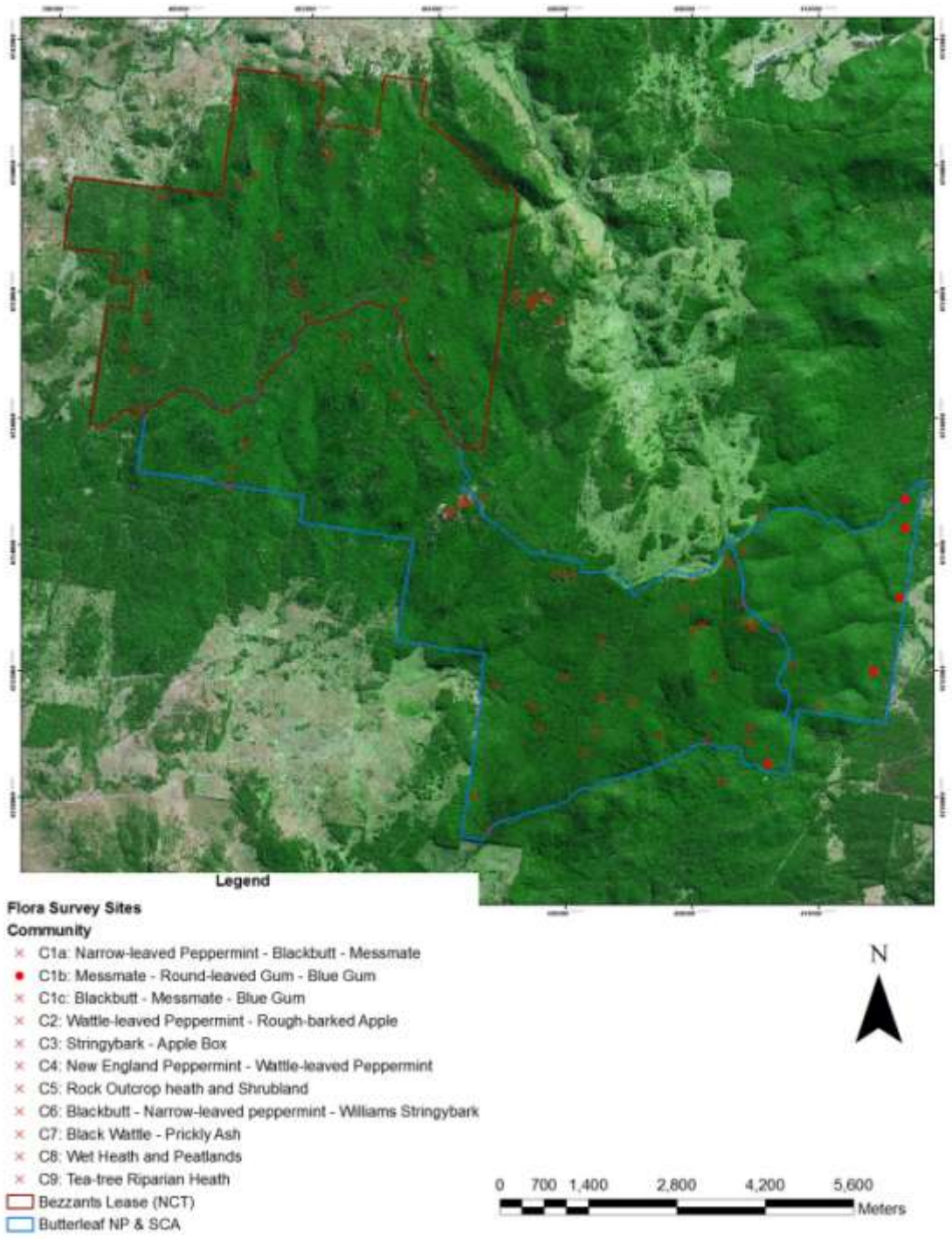

Figure 6: Placement of sites within Community 1b at Butterleaf and Bezzants Lease.

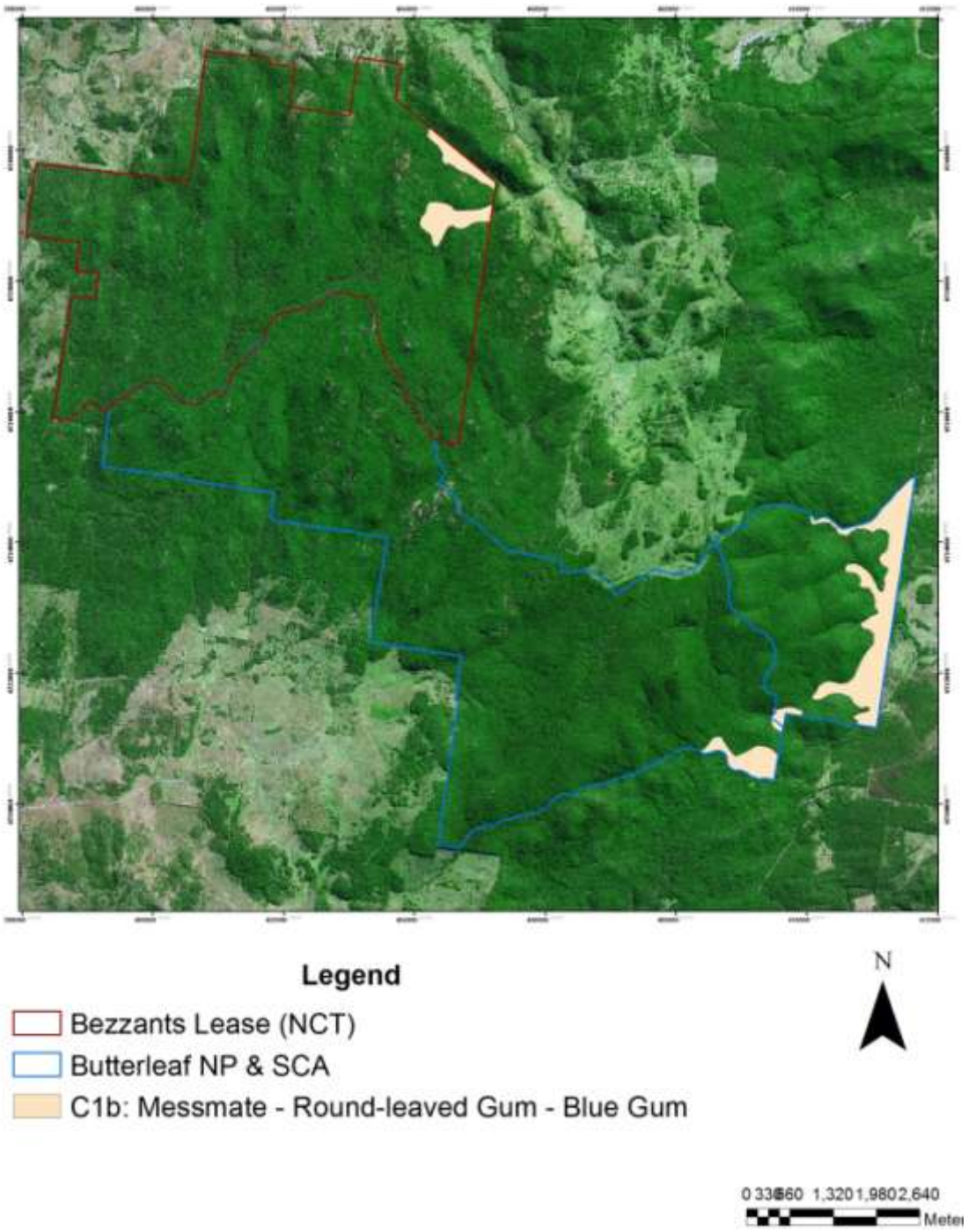

Figure 7: Mapped distribution of Community 1b.

Plate 5: Photographs of Community 1b; above Site 12 and below Site 17.

3.4.1.3 Community 1c: Blackbutt – Messmate – Blue Gum Forest

Eucalyptus campanulata (New England Blackbutt) – *Eucalyptus obliqua* (Messmate Stringybark) – *Eucalyptus saligna* (Sydney Blue Gum) Forest

Sample sites (4): 2, 46, 49, 55.

Number of hectares: 250 **Proportion of reserve:** 4%

Environmental relationships: found on upper to lower slopes in protected valleys with well drained to moist, shallow to deep soils with a sandy loam texture and chocolate brown in colour.

Distribution within reserve: disjunct throughout all parts of the study area but at higher altitudes in protected valleys, generally those facing south or south east or east on granite and metasediments.

Structure: a tall forest.

- Tree-layer: 30-40 m tall. 40% cover.
- Tall shrub layer: 5-15 m tall. 40% cover. Usually absent.
- Low shrub layer: 1-2 m tall. 20% cover. Usually absent.
- Understorey layer: < 1 m tall. 50-90% cover.

No. of taxa: 79 **No. of taxa per plot:** 20-**28**-48.

Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).

Trees: *Eucalyptus campanulata, Banksia integrifolia, Eucalyptus obliqua, Eucalyptus saligna, Eucalyptus subtilior, Eucalyptus radiata* subsp. *sejuncta, Eucalyptus nobilis, Callicoma serratifolia*.

Shrubs: *Leucopogon lanceolatus, Notelaea longifolia, Bursaria spinosa, Acacia irrorata, Coprosma quadrifida, Myrsine howittiana, Lomatia silaifolia, Hibbertia acicularis, Cassinia leptocephala, Acacia longifolia, Acacia filicifolia*.

Climbers & trailers: *Smilax australis, Eustrephus latifolius, Rubus parvifolius, Pyrrosia rupestris, Hibbertia scandens, Hibbertia dentata, Hardenbergia violacea, Glycine clandestina, Desmodium varians, Clematis aristata, Billardiera scandens, Tylophora paniculata, Rubus nebulosus, Rubus moluccanus, Pandorea pandorana, Davallia solida.*

Ground cover: *Calochlaena dubia, Pteridium esculentum, Lomandra longifolia, Pratia purpurascens, Poa labillardieri, Viola hederacea, Microlaena stipoides, Schoenus melanostachys, Hydrocotyle geraniifolia, Entolasia stricta, Blechnum cartilagineum, Dichondra repens, Cyathea australis, Solanum campanulatum, Platysace ericoides, Plantago debilis, Gonocarpus teucrioides, Geranium potentilloides, Doodia aspera, Viola betonicifolia, Veronica plebeia, Veronica notabilis, Veronica calycina, Solanum prinophyllum, Sigesbeckia orientalis, Senecio prenanthoides, Pterostylis decurva, Lagenifera stipitata, Hypericum japonicum, Galium binifolium, Euchiton gymnocephalus, Dianella caerulea, Coronidium elatum, Chiloglottis trilabra, Austrostipa rudis, Acaena nova-zelandiae.*

Introduced taxa: *Senecio madagascariensis, Hypochaeris radicata, Cirsium vulgare.*

Percent of species introduced: 4%

Taxa of conservation importance: none apparent.

Notes & conservation status: although this sub-assemblage occurs on a variety of soil types it could generally be considered a poor soil variant of other community 1 sub-assemblages that is able to occur due to the highly protected nature of its occurrences. Probably broadly similar to Community 7 within Capoompeta and Western Washpool (Hunter 2000) which was found on metasediments, acid volcanics and granite rock types in moister protected situations at high altitudes. Both the understorey shrub and herb components are largely due to times since fire. closely allied to Beadles' (1981) *E. campanulata* Alliance which is described as occurring at higher altitudes from just over the Queensland border to the Barrington Tops area. McDonald & 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 Capoompeta

south to Yarrowitch. Broadly synonymous assemblages are common along the eastern parts of the tablelands. This community at present should be considered adequately reserved across its range.

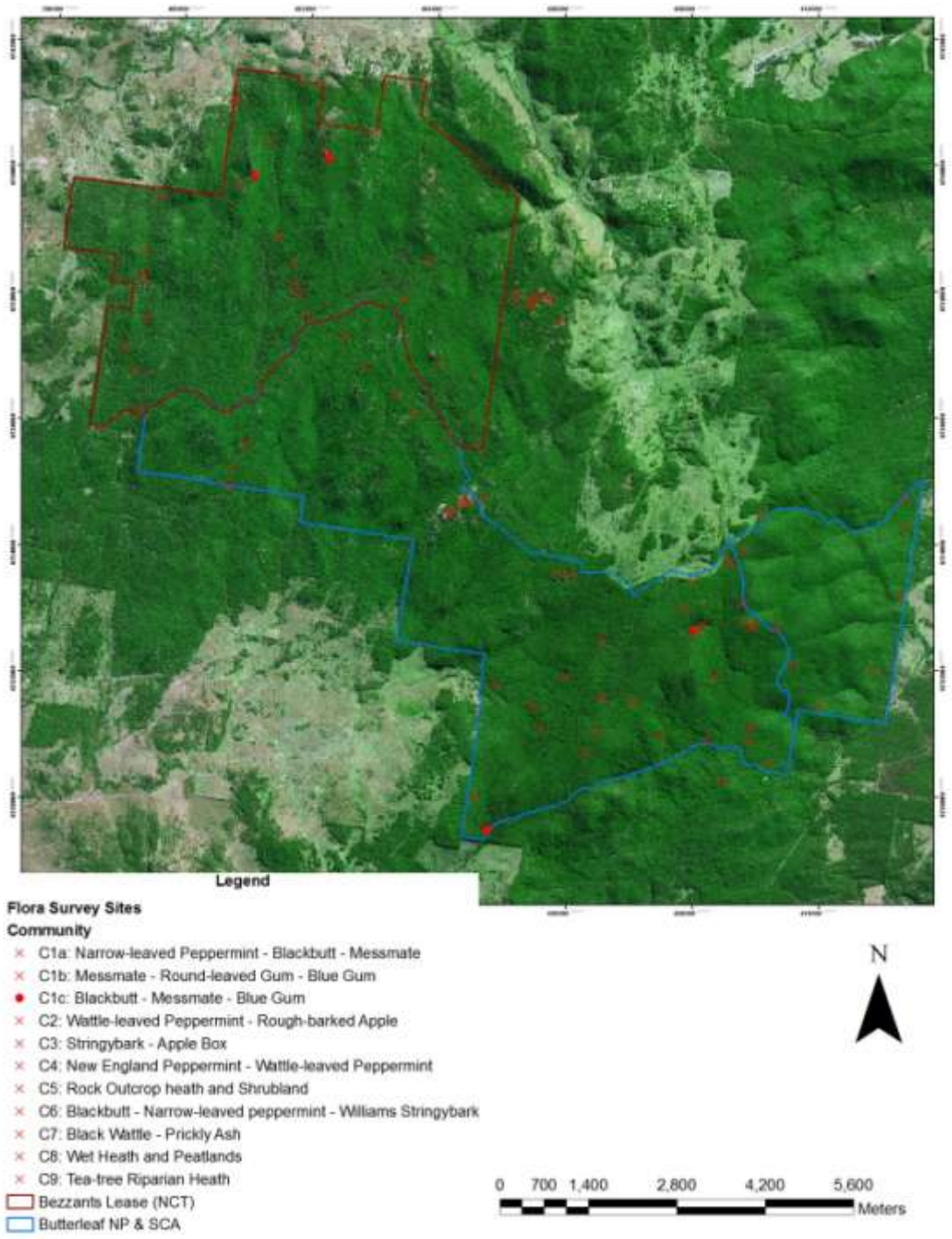

Figure 8: Placement of sites within Community 1c at Butterleaf & Bezzants Lease.

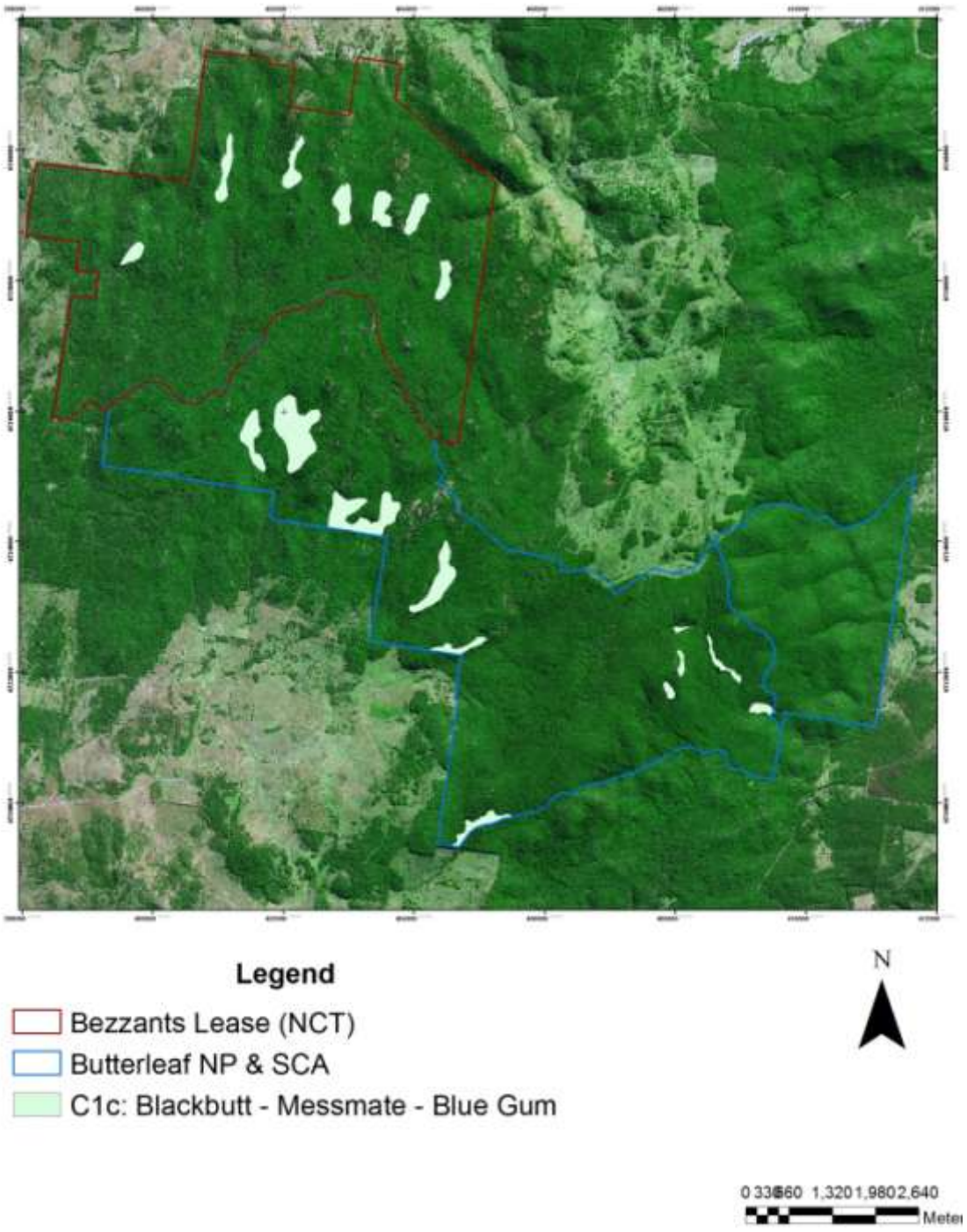

Figure 9: Mapped distribution of Community 1c.

Plate 6: Photographs of Community 1c; above Site 46, below Site 47.

3.4.2 Community 2: Wattle-leaved Peppermint – Rough-barked Apple Woodland & Forest

Eucalyptus acaciiformis (Wattle-leaved Peppermint) – *Angophora floribunda* (Rough-barked Apple) Wet Woodland & Forest

Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions Endangered Ecological Community.
http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10936

Sample sites (3): 25, 26, 51.

Number of hectares: 8.7 **Proportion of reserve:** 0.1%

Environmental relationships: found on open depressions on waterlogged deep soils that are clay loam, sandy clay loam or peaty clay in texture and dark brown to black in colour.

Distribution within reserve: restricted to the eastern parts of Butterleaf National Park. Likely to occur in more areas than currently mapped.

Structure: a low open woodland or forest.

- Tree-layer: 10-25 m tall. 30-40% cover.
- Shrub layer: 2-5 m tall. 50-70% cover.
- Understorey layer: < 1 m tall. 70-100% cover.

No. of taxa: 67 **No. of taxa per plot:** 16-**26**-31.

Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).

Trees: *Eucalyptus acaciiformis, Banksia integrifolia, Angophora floribunda, Acacia melanoxylon*.

Shrubs: *Leptospermum polygalifolium* subsp. *monta5num, Callistemon pityoides, Callistemon linearis, Bursaria spinosa, Baeckea omissa, Leptospermum gregarium, Hakea microcarpa, Acacia binervia, Pultenaea foliolosa, Epacris breviflora*.

Climbers & trailers: none apparent.

Ground cover: *Schoenus apogon, Gahnia sieberiana, Juncus alexandri, Baloskion stenocoleum, Hydrocotyle laxiflora, Hydrocotyle geraniifolia, Gratiola peruviana, Lomandra longifolia, Viola hederacea, Viola caleyana, Pratia purpurascens, Microlaena stipoides, Hypericum japonicum, Gonocarpus micranthus, Geranium solanderi* var. *grande, Carex lobolepis, Utricularia dichotoma, Schoenus melanostachys, Pteridium esculentum, Galium propinquum, Entolasia stricta, Echinopogon caespitosus, Viola betonicifolia, Veronica calycina, Spiranthes sinensis, Panicum queenslandicum, Hypoxis hygrometrica, Hypolepis glandulifera, Hydrocotyle peduncularis, Goodenia rotundifolia, Gonocarpus teucrioides, Geranium solanderi* var. *solanderi, Galium migrans, Euchiton involucratus, Coronidium scorpioides, Carex gaudichaudiana, Calochlaena dubia, Poa sieberiana, Poa queenslandica, Patersonia fagilis, Mentha satureioides, Euchiton gymnocephalus, Epilobium billardierianum, Dichondra repens, Arthropodium milleflorum, Acaena novae-zelandiae.*

Introduced taxa: *Axonopus affinis, Vulpia muralis, Prunella vulgaris, Medicago polymorpha, Hypochaeris radicata.*

Percent of species introduced: 6%

Taxa of conservation importance: none apparent.

Notes & conservation status: this is a highly restricted community that only occurs on areas of impeded drainage within basalt or rhyolitic areas. Within granite areas these systems appear to become upland bogs. *Eucalyptus acaciiformis* often occurs on waterlogged soils and is replaced further upslope by *Eucalyptus radiata* subsp. *sejuncta.* Many elements within the understorey and mid storey of this community are similar to community 8: Wet Heath & Peatland (Montane Peatlands and Swamps) and sphagnum does occur indicating the presence or ability to lay peat. However there is some floristic affinities to fen communities with the more prominent herbaceous components. However overall this community should also fall within the determination of Montane Peatlands of the New England and therefore should be considered a highly disjunct, limited and interesting variant of this endangered community. These peatlands should be protected from high frequency fire.

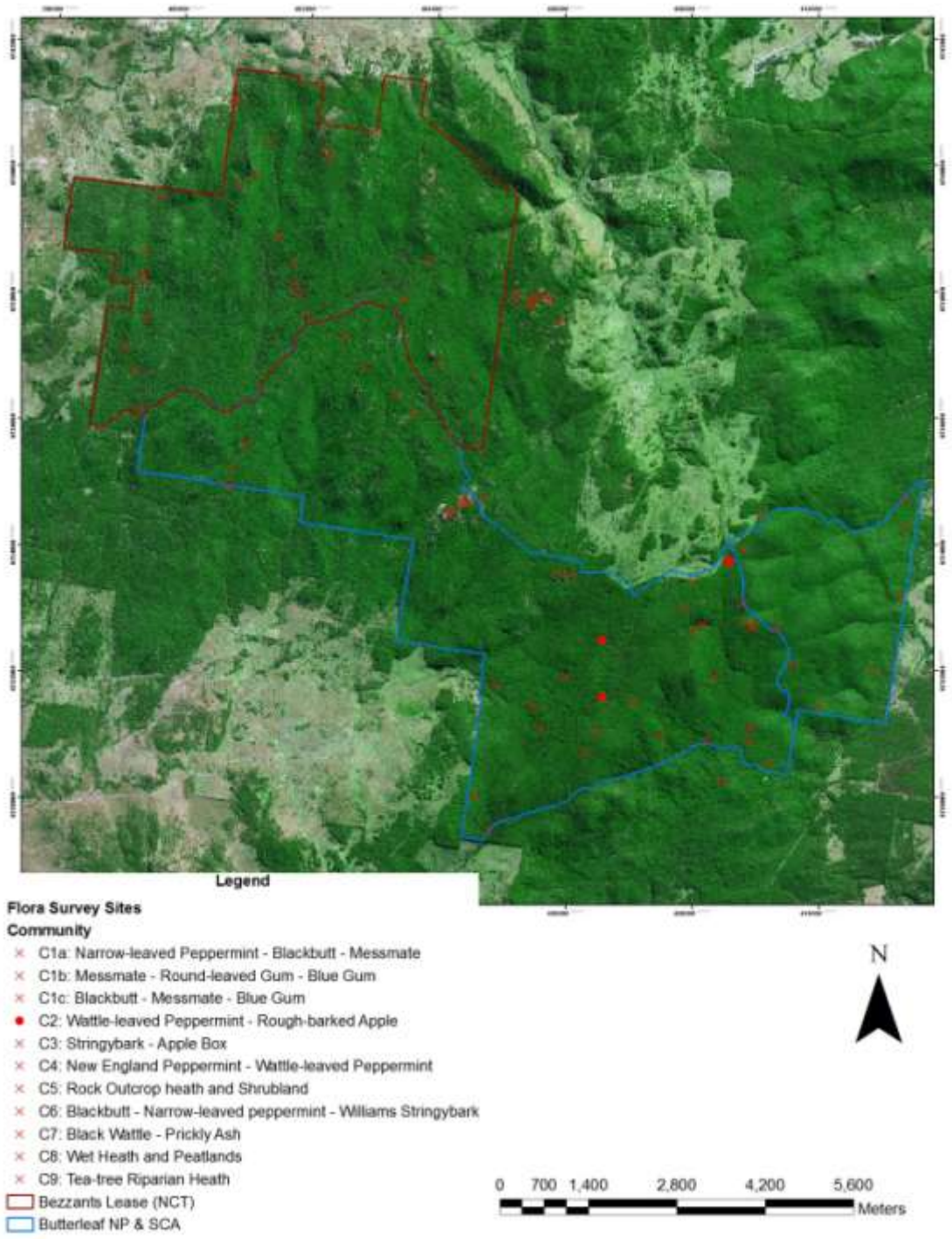

Figure 10: Placement of sites within Community 2 at Butterleaf and Bezzants Lease.

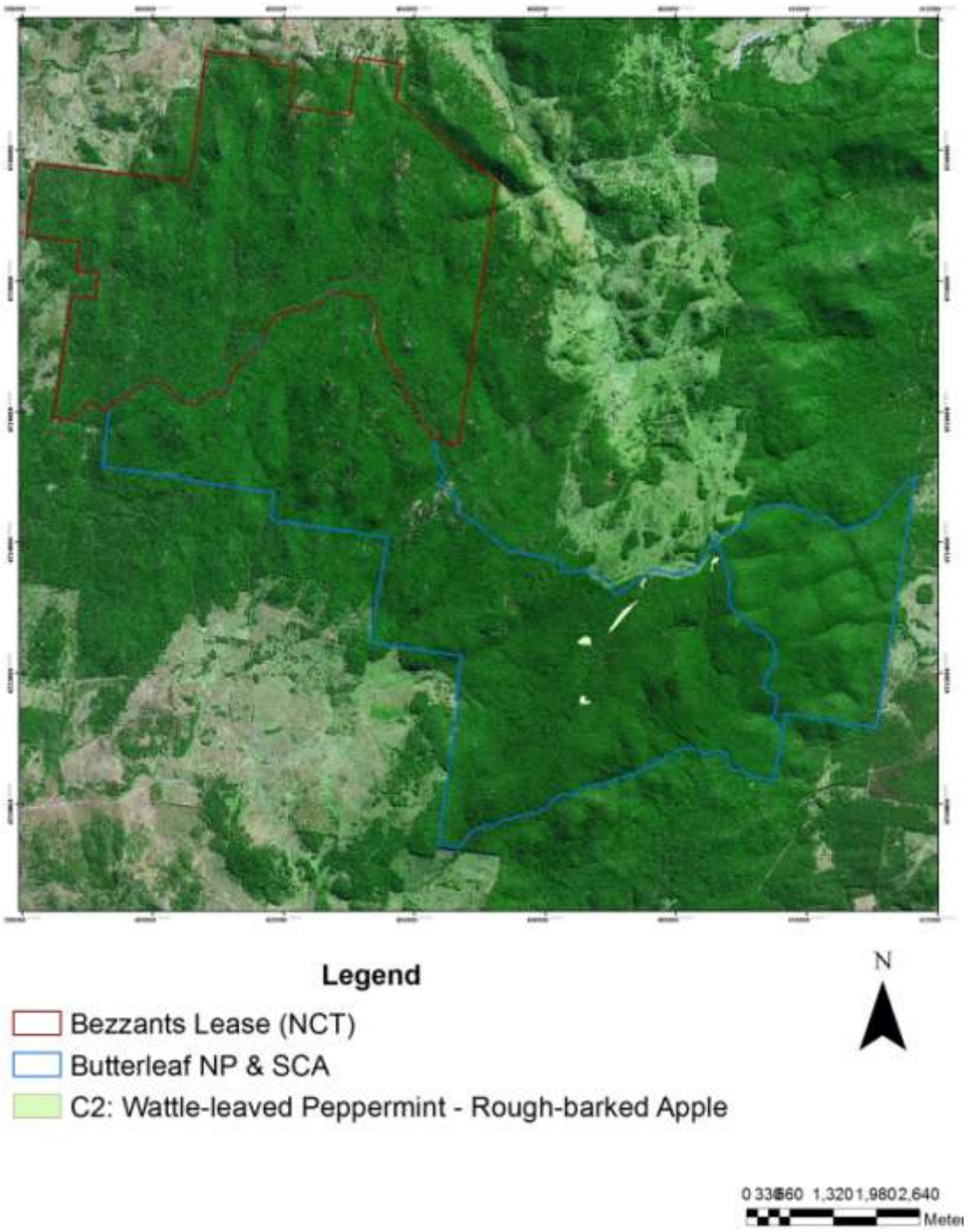

Figure 11: Mapped distribution of Community 2.

Plate 7: Photograph of Community 2; above Site 25, below Site 51.

3.4.3 Community 3: Stringybark – Apple Box – Peppermint Woodland & Forest

Eucalyptus caliginosa (New England Stringybark) – *Eucalyptus bridgesiana* (Apple Box) – *Eucalyptus laevopinea* (Silvertop Stringybark) Woodland and Forest

Sample sites (6): 32, 36, 37, 44, 59, 69.

Number of hectares: 433 **Proportion of reserve:** 7%

Environmental relationships: found on open depressions to upper slopes on well drained to moist and usually deep though sometimes shallow sandy loam loamy sand or sandy clay loam soils. Soil colour is variable from red chocolate brown, dark brown to black or grey.

Distribution within reserve: restricted to Bezzants Lease and associated with major valley lines particularly in the north west of the property.

Structure: a grassy to shrubby woodland or forest.

- Tree-layer: (10-) 20-30 m tall. 30-40 (-60)% cover.
- Tall shrub layer: 3-15 m tall. 20-40% cover. Usually absent.
- Low shrub layer: 1-5 m tall. 20-50% cover. Sometimes absent.
- Understorey layer: < 1 m tall. 30-90% cover.

No. of taxa: 109 **No. of taxa per plot:** 25-**35**-40-.

Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).

Trees: *Eucalyptus caliginosa, Banksia integrifolia, Eucalyptus bridgesiana, Eucalyptus laevopinea, Eucalyptus nova-anglica, Callitris rhomboidea, Eucalyptus nobilis, Eucalyptus dalrympleana*.

Shrubs: *Leptospermum polygalifolium* subsp. *montanum, Acacia fimbriata, Leucopogon lanceolatus, Cassinia leptocephala, Bursaria spinosa, Acacia filicifolia, Melichrus urceolatus, Cassinia laevis, Allocasuarina littoralis, Acacia irrorata, Leucopogon fraseri*.

Climbers & trailers: *Desmodium varians, Smilax australis, Clematis glycinoides, Hardenbergia violacea.*

Ground cover: *Microlaena stipoides, Echinopogon caespitosus, Lomandra longifolia, Pteridium esculentum, Pomax umbellata, Poa sieberiana, Lepidosperma laterale, Dichondra repens, Austrostipa rudis, Solanum campanulatum, Pratia*

purpurascens, Oxalis perennans, Lomandra multiflora, Imperata cylindrica, Viola betonicifolia, Goodenia bellidifolia, Euchiton sphaericus, Digitaria breviglumis, Solenogyne bellioides, Opercularia aspera, Mentha diemenica, Gahnia sieberiana, Eragrostis leptostachya, Dichondra sp. A, *Cymbopogon refractus, Brachyscome nova-anglica, Austrodanthonia racemosa.*

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

Percent of species introduced: 4%

Taxa of conservation importance: *Callitris rhomboidea*.

Notes & conservation status: this is an unusual community with the combination of overstorey taxa. It provides a floristic link between Community 2 and 4 but it also is intermediate between assemblages on the drier central parts of the tablelands and the more moist eastern parts of the tablelands. This is likely to be the case as these north and western valleys of Bezzants lease open up to the central parts of the tablelands and the upper parts of the valleys are high altitude moist assemblages that are likely outliers from Capoompeta, Western Washpool and Gibraltar Range areas. As such similar communities are not described in the literature despite the dominants being common and widely distributed species. This community should be considered to be of limited extent across the tablelands and likely to have been much reduced within the local valleys by clearing.

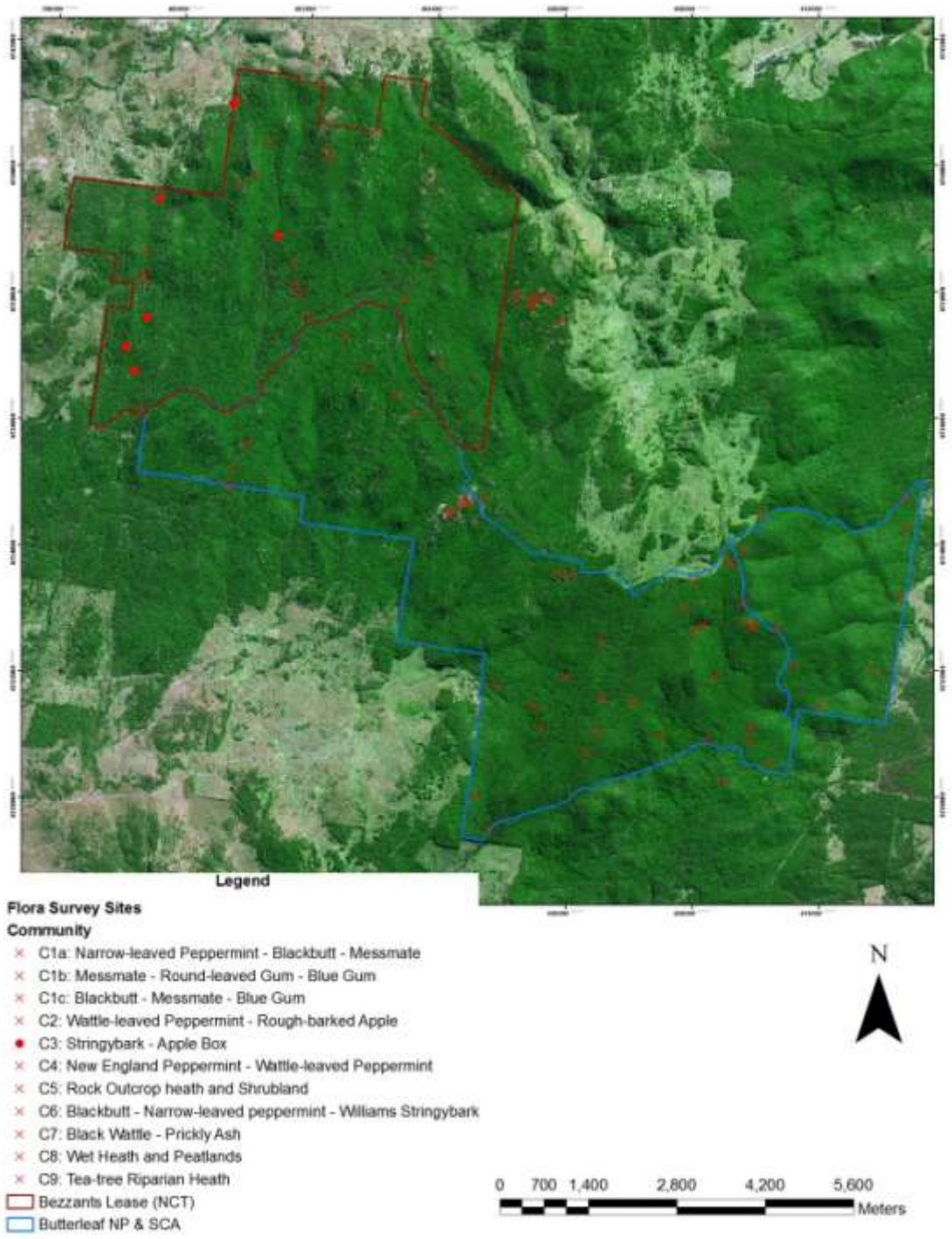

Figure 12: Placement of sites within Community 3 at Butterleaf and Bezzants Lease.

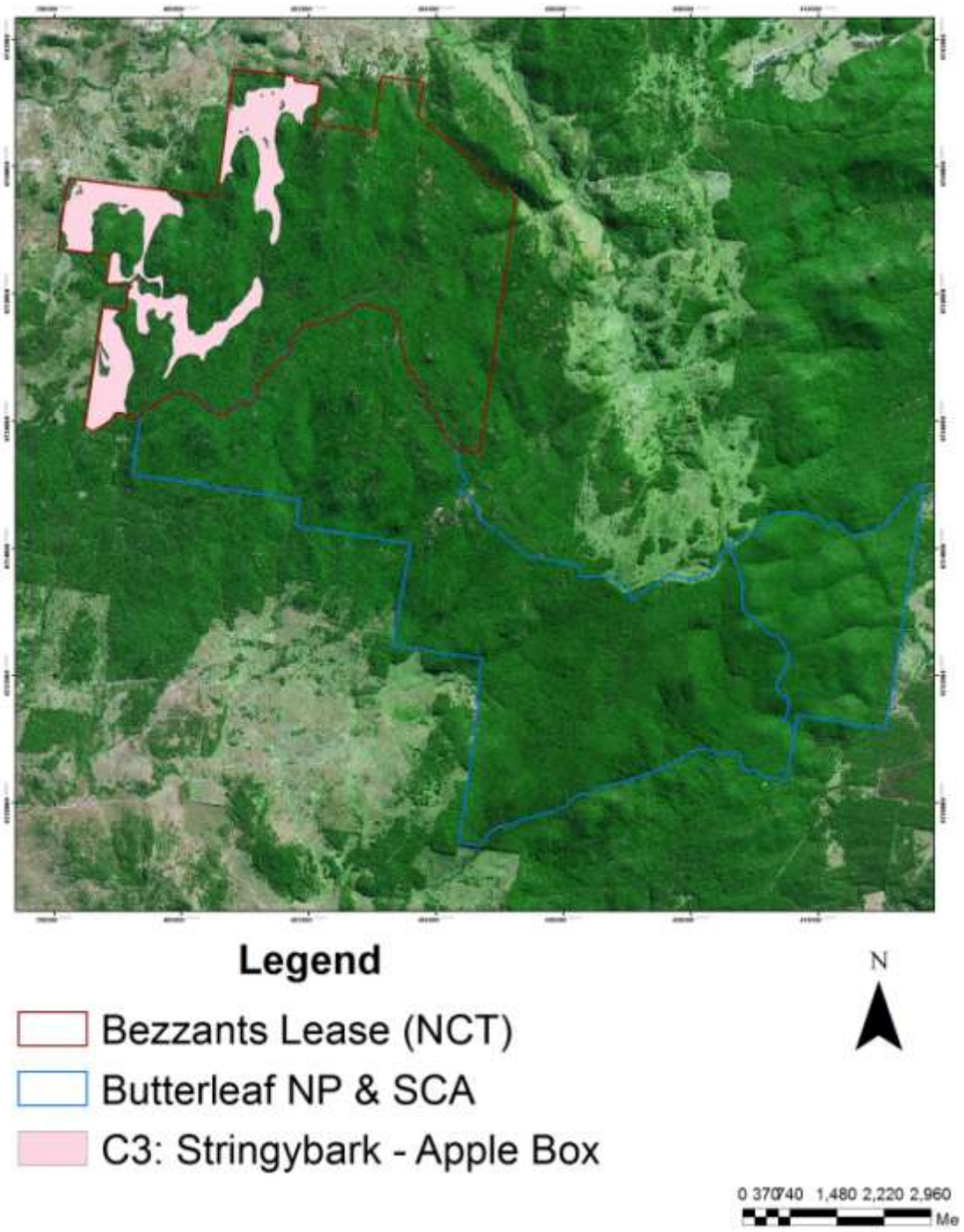

Figure 13: Mapped distribution of Community 3.

Plate 8: Photographs of Community 3; above Site 36, below Site 37.

Plate 9: Photographs of Community 3; above Site 44, below Site 69.

3.4.4 Community 4: New England Peppermint – Wattle Leaved Peppermint Woodland & Forest

Eucalyptus nova-anglica (New England Peppermint) – *Eucalyptus acaciiformis* (Wattle-leaved Peppermint) – *Eucalyptus subtilior* (Stringybark) Woodland and Forest

New England Peppermint Woodland on Basalts and Sediments in the New England Tableland Bioregion – Endangered Ecological Community Listing. *NSW Threatened Species Conservation Act.*

New England Peppermint (*Eucalyptus nova-anglica*) Grassy Woodlands – Listed as Critically Endangered. *Environmental Protection and Biodiversity Act*.

Sample sites (2): 35, 70.

Number of hectares: 39.8 **Proportion of reserve:** 0.6%

Environmental relationships: restricted to lower slopes on moist to deep sandy loam or loam soils that are usually grey in colour.

Distribution within reserve: found only on lower slopes on sedimentary soils within Bezzants Lease to the north and north east of the property.

Structure: a low woodland.

- Tree-layer: 8-16 m tall. 25-30% cover.
- Shrub layer: 0.5-2.5 m tall. 20-50% cover.
- Understorey layer: < 1 m tall. 70-80% cover.

No. of taxa: 57 **No. of taxa per plot:** 28-**36**-43.

Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).

Trees: *Eucalyptus nova-anglica, Eucalyptus acaciiformis, Eucalyptus subtilior, Eucalyptus caliginosa, Eucalyptus bridgesiana, Banksia integrifolia*.

Shrubs: *Leptospermum arachnoides, Mirbelia rubiifolia, Aotus subglauca, Notelaea longifolia, Melichrus procumbens, Leptospermum minutifolium, Kunzea parviflora, Hakea microcarpa, Epacris microphylla, Bursaria spinosa, Baeckea omissa, Acacia irrorata*.

Climbers & trailers: none apparent.

Ground cover: *Themeda triandra, Eragrostis leptostachya, Schoenus apogon, Microlaena stipoides, Goodenia bellidifolia, Gonocarpus micranthus, Digitaria breviglumis, Austrostipa rudis, Rhynchospora brownii, Hypoxis hygrometrica, Haloragis heterophylla, Entolasia stricta, Trachymene incisa, Poa queenslandica, Lomandra multiflora, Gahnia sieberiana, Fimbristylis dichotoma, Echinopogon caespitosus, Cyperus difformis, Calotis lappulacea, Austrodanthonia monticola, Aristida personata, Wahlenbergia communis, Oxalis perennans, Murdannia graminea, Juncus alexandri, Hypericum gramineum, Haemodorum planifolium, Gonocarpus tetragynus, Euchiton sphaericus, Echinopogon mckiei, Cymbopogon refractus, Cheilanthes sieberi, Bulbostylis densa, Bulbostylis barbata, Brachyscome nova-anglica.*

Introduced taxa: *Hypochaeris radicata, Setaria pumila, Rubus discolor*.

Percent of species introduced: 3%

Taxa of conservation importance: .

Notes & conservation status: would fall within the New England Peppermint Woodland on Basalts and Sediments in the New England Tableland Bioregion – Endangered Ecological Community Listing. *NSW Threatened Species Conservation Act* and New England Peppermint (*Eucalyptus nova-anglica*) Grassy Woodlands – Listed as Critically Endangered. *Environmental Protection and Biodiversity Act*. This endangered community is known to occur within the New England Tablelands from primarily valley flats. Benson and Ashby (2001) considered similar assemblages to be endangered, with more than 85% of their occurrences cleared and much of the remaining highly modified. Very few stands occur within the reserve system and much of this has been highly modified in the past. This community type is rarely found within the reserve network. The occurrence of this endangered community within Bezzants Lease is a highly significant addition to the reserve network.

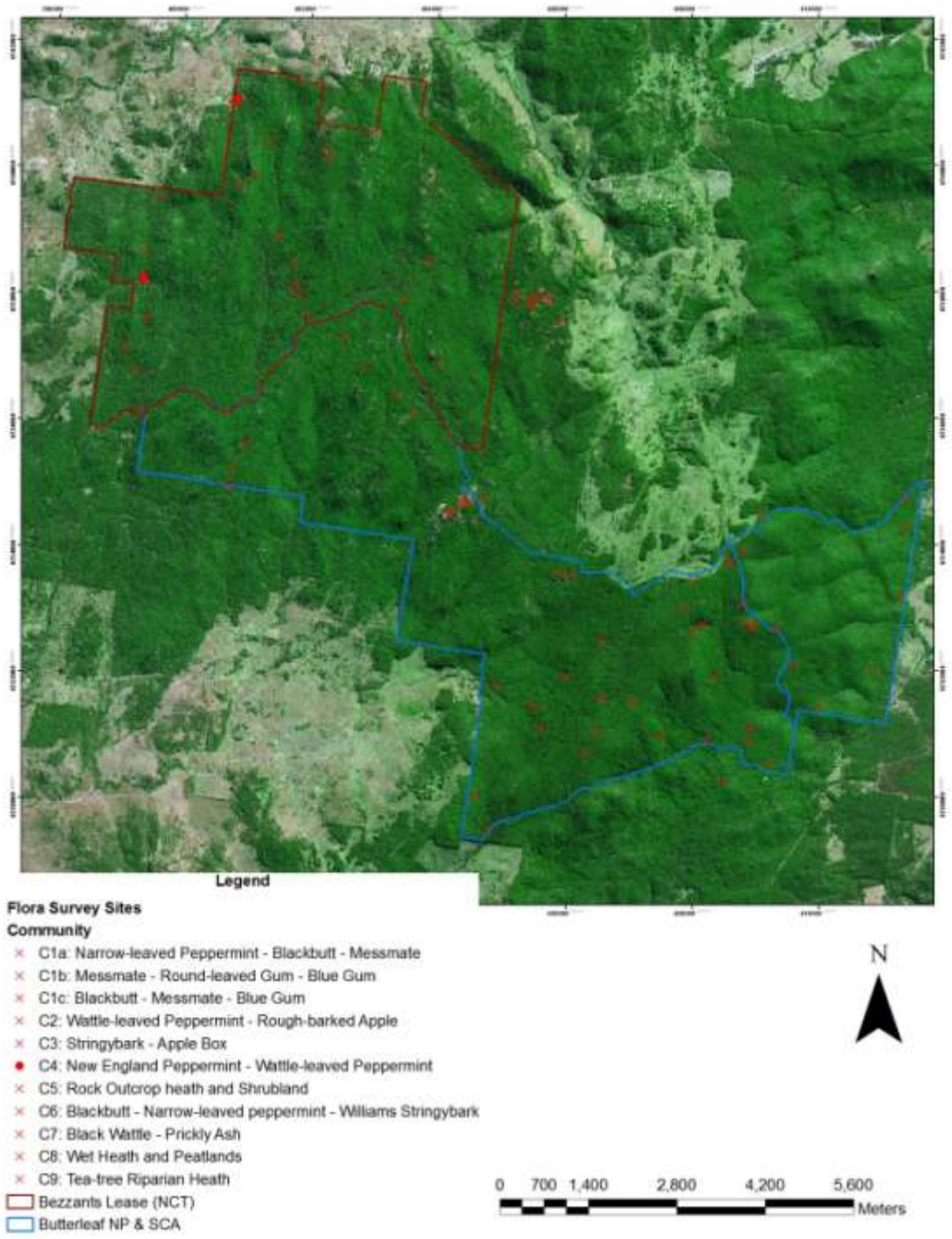

Figure 14: Placement of sites within Community 4 at Butterleaf and Bezzants Lease.

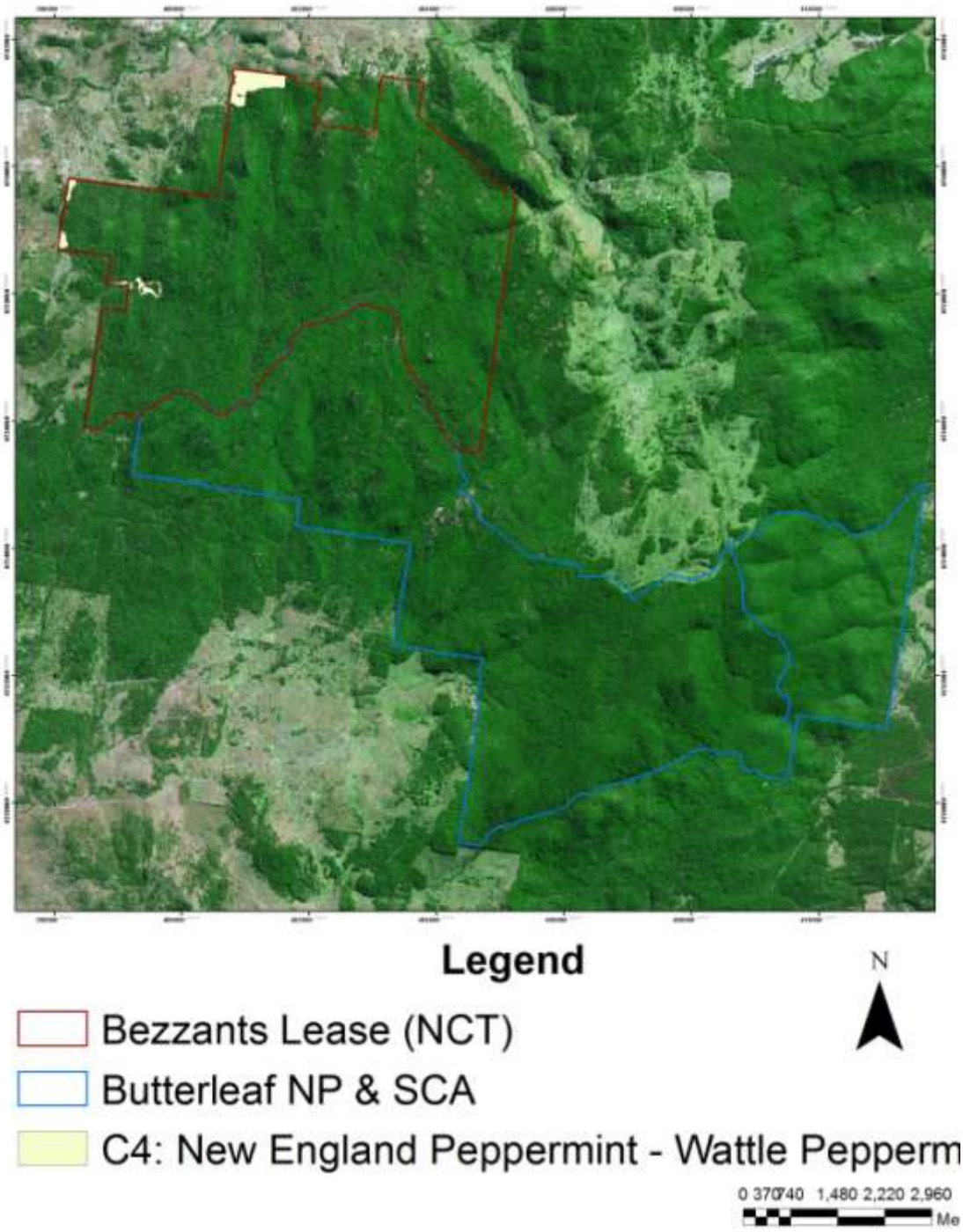

Figure 15: Mapped distribution of Community 4.

Plate 10: Photographs of Community 4; above Site 35, below Site 70.

3.4.5 Community 5: Rock Outcrop Heath & Shrubland

Leucopogon neo-anglicus (New England Beard Heath) – *Kunzea obovata* (Kunzea) – *Leptospermum novae-angliae* (New England Tea-tree) Heath and Shrubland

Sample sites (17): 28, 48 + 1OA, 2OA, 3OA, 3OB, 4OA, 4OB, 4OC, 4OD, 5OA, 6OA, 7OA, 7OB, 7OC, 7OD, 7OE.

Number of hectares: 138 **Proportion of reserve:** 2.2%

Environmental relationships: restricted to rock outcrops, primarily granite but also rhyolitic ones. Soils are well drained to moist and skeletal and usually of a peaty loam texture.

Distribution within reserve: found primarily within the central to northern parts of the study area but scattered locations throughout all parts of the study area.

Structure: .

- Tall shrub layer: 1-6 m tall. 20-30% cover.
- Ground layer: <1 m tall. 20-30% cover.

No. of taxa: 117 **No. of taxa per plot:** 12-**34**-61.

Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).

Trees: *Allocasuarina littoralis, Eucalyptus codonocarpa, Eucalyptus campanulata, Eucalyptus williamsiana*.

Shrubs: *Leucopogon neo-anglicus, Kunzea obovata, Leptospermum novae-angliae, Philotheca eplilosa, Brachyloma saxicola, Hibbertia riparia, Calytrix tetragona, Acacia viscidula, Leptospermum polygalifolium* var. *transmontanum, Leucopogon lanceolatus, Cryptandra amara, Acacia venulosa, Epacris microphylla, Allocasuarina rigida, Astrotricha longifolia, Persoonia cornifolia, Hovea pedunculata, Hibbertia serpyllifolia, Pimelea linifolia, Monotoca scoparia, Lomatia silaifolia, Boronia anethifolia, Agiortia cicatricata, Mirbelia speciosa, Lasiopetalum ferrugineum, Dillwynia sieberi*.

Climbers & trailers: *Smilax australis.*

Ground cover: *Entolasia stricta, Brachyscome stuartii, Schoenus apogon, Lepidosperma gunnii, Gonocarpus oreophilus, Cheilanthes sieberi, Trachymene* sp. aff. *pilosa, Gonocarpus micranthus, Austrodanthonia monticola, Lomandra*

longifolia, Echinopogon caespitosus, Empodisma minus, Laxmannia compacta, Gahnia sieberiana, Dianella tasmanica, Gonocarpus teucrioides, Actinotus gibbonsii, Goodenia bellidifolia, Digitaria breviglumis, Microlaena stipoides, Drosera peltata, Poa sieberiana, Lepidosperma laterale, Trachymene incisa, Patersonia sericea, Schoenus melanostachys, Pteridium esculentum, Platysace ericoides, Muehlenbeckia costata, Isotoma anethifolia, Chloanthes parviflora, Asplenium flavellifolium.

Introduced taxa: *Hypochaeris radicata, Acetosella vulgaris, Phytolacca octandra, Cynodon dactylon, Cirsium vulgare.*

Percent of species introduced: 4%

Taxa of conservation importance: *Actinotus gibbonsii, Agiortia cicatricata, Brachyloma saxicola, Eucalyptus codonocarpa, Muehlenbeckia costata, Philotheca epilosa, Trachymene* sp. aff. *pilosa*.

Notes & conservation status: . Hunter & Clarke (1998) in a region wide analysis of outcrop communities would place this community within a broader Element named Glen Innes Shrubby Open Scrubs and Closed Heaths. This element is found at high altitudes north and south-east of Glen Innes. This community is described as 1a: *Kunzea obovata* Heath (Butterleaf Heaths) by Hunter & Clarke (1998). This type of assemblage is only known from the Butterleaf area and also some occurrences within the Warra NP area a little further to the south. The additions inclusion of Butterleaf within the Reserve system and Bezzants Lease in private reservation changes the reservation status of this community type significantly. This community could now be considered to be well reserved across its range. This community is unrelated to the Acid Volcanic heaths found in other areas of the Washpool Western Additions NP. Threats are largely due to direct damage caused by pigs, rabbits, goats and humans. This includes rutting of soil and rocks by pigs, browsing of shrubs and herbs by goats and rabbits. Trampling by pigs, stray cattle and humans are also threats. Inappropriate fire regimes also threaten this assemblage. In addition this community is likely to be severely affected by climate change, in particular prolonged dry periods. Communities on outcrops are fragile and may be severely impacted upon by walking traffic or nutrient addition. Plants are known to die due to soil compaction and an increase in nutrients due to organic rubbish. Trails should not be constructed or maintained in this community. Appropriate fire regimes for this community are likely to be of great importance as most of the species primarily restricted to outcrops are obligate seeders that are potentially frequent fire avoiders (Hunter 2003). Research

into the dynamics of this community in terms of fire and general recruitment is necessary. Some ‘fire ephemeral’ species are known to occur after major fires or lightning strikes. These communities may have long-term climate driven processes that aid in the reshuffling of dominant species. Casual monitoring of such changes and a written record may give insight in years to come of such processes and their implications.

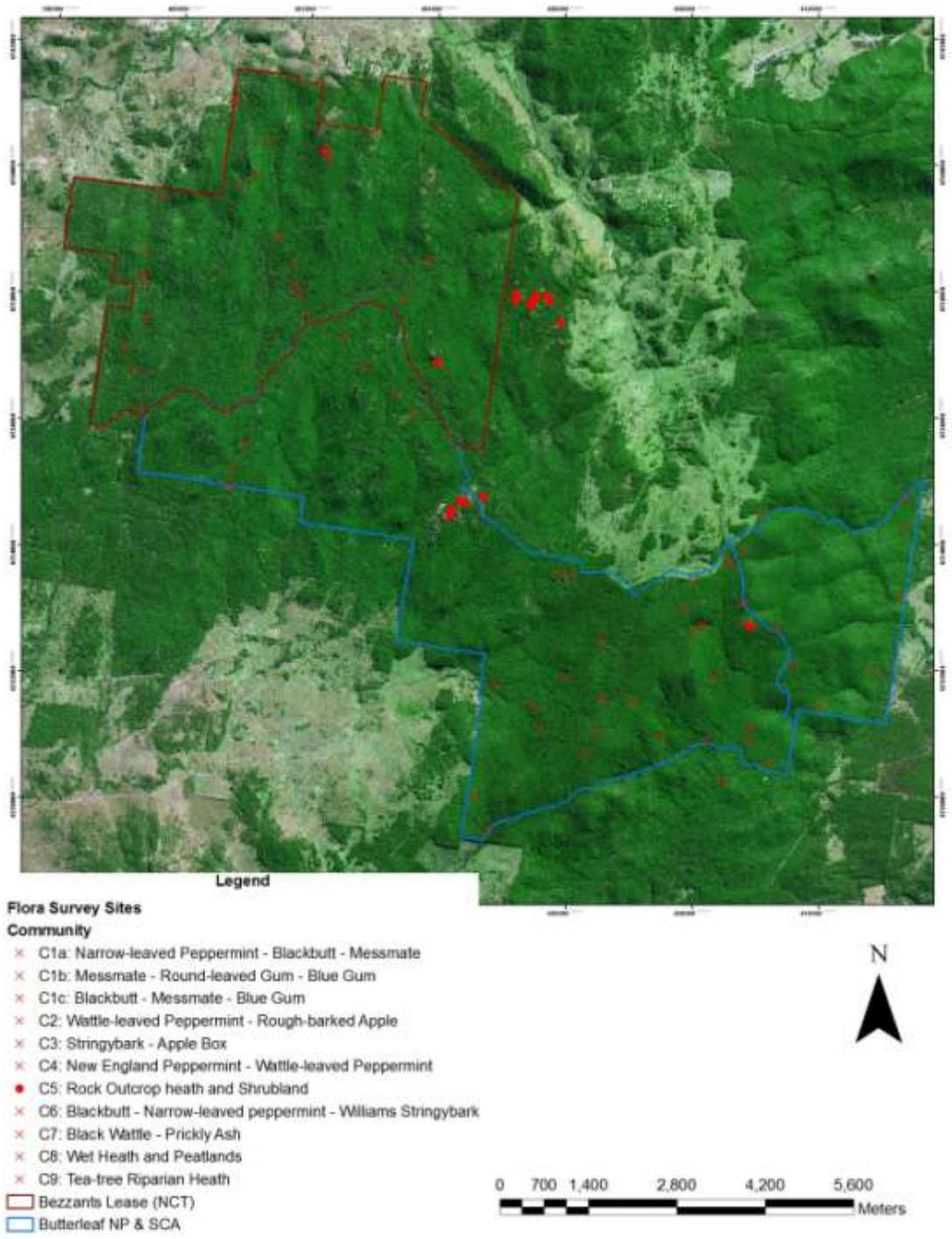

Figure 16: Placement of sites within Community 5 at Butterleaf and Bezzants Lease.

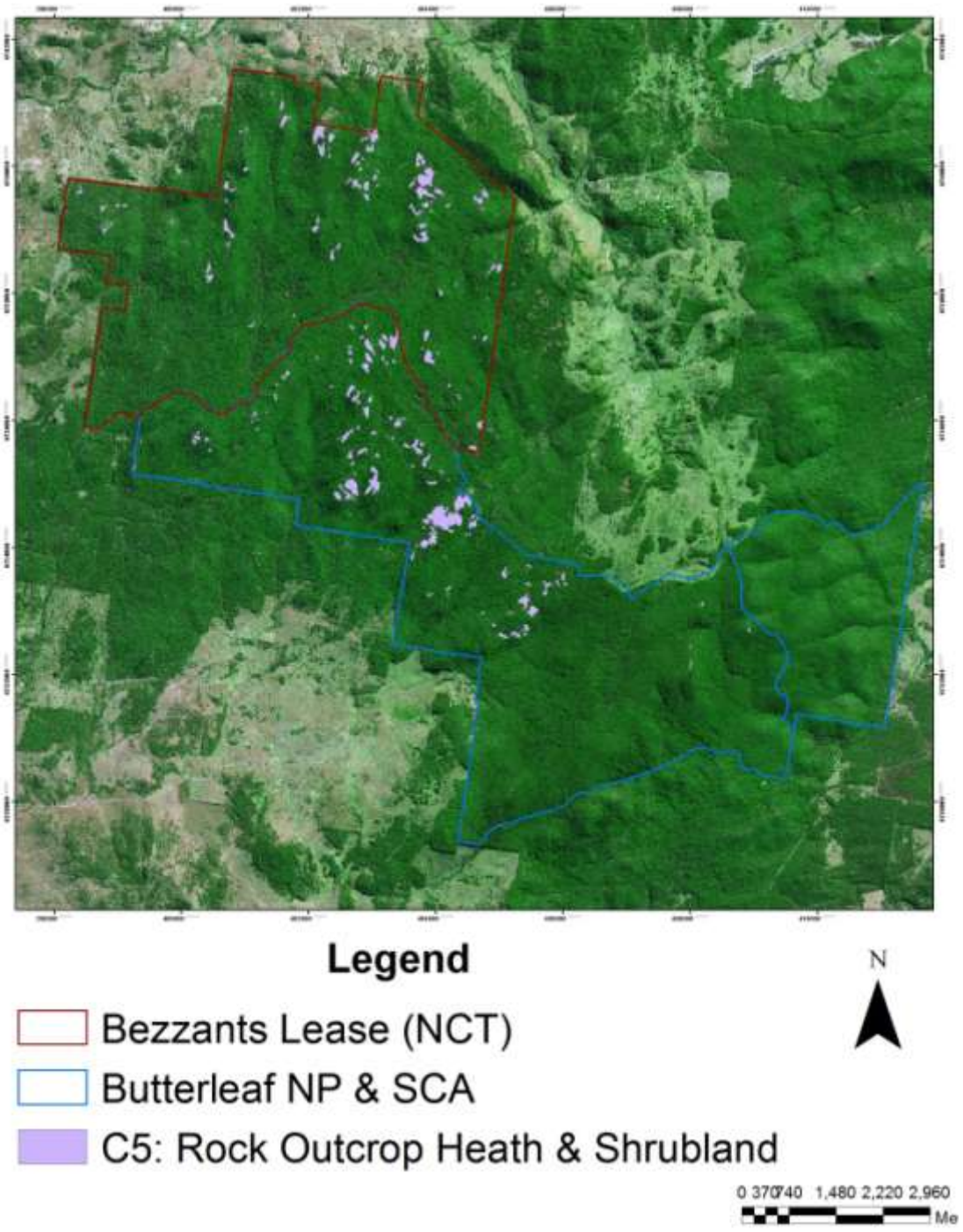

Figure 17: Mapped distribution of Community 5.

Plate 11: Photographs of Community 5; above Site 28, below Site 48.

3.4.6 Community 6: Blackbutt – Peppermint – Williams Stringybark Shrubby Forest

Eucalyptus campanulata (New England Blackbutt) – *Eucalyptus radiata* subsp. *sejuncta* (Narrow-leaved Peppermint) – *Eucalyptus williamsiana* (Williams Stringybark) Shrubby Forest

Sample sites (13): 1, 16, 30, 39. 43, 45, 52, 53, 61, 63, 64, 66, 67.

Number of hectares: 3,071 **Proportion of reserve:** 49.4%

Environmental relationships: found on upper slopes to lower slopes on moist to well drained shallow to deep soils. Soil is highly variable from dark red brown, light brown, chocolate brown to grey white in colour and from loam, sandy clay loam, clay loam sandy loam, coarse sandy loam and loamy sand in texture.

Distribution within reserve: almost entirely restricted to granite and the most common assemblage within both Bezzants Lease and Butterleaf NP though some occurrences on rhyolite on exposed hill tops within Butterleaf NP and SCA.

Structure: variable but often a low shrubby woodland to tall shrubby forest.

- Tree-layer: (6-) 10-30 (-35) m tall. 35-50 (-60)% cover.
- Tall Shrub layer: 3-8 m tall. 20% cover. Almost never present.
- Lower Shrub layer: 0.5-4 (-6) m tall. 10-60 (-70)% cover. Rarely absent.
- Understorey layer: < 1 m tall. (15-) 20-80 (-90)% cover.

No. of taxa: 125 **No. of taxa per plot:** 13-**27**-44.

Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).

Trees: *Eucalyptus campanulata, Eucalyptus radiata* subsp. *sejuncta, Eucalyptus williamsiana, Eucalyptus obliqua, Eucalyptus caliginosa, Banksia integrifolia, Eucalyptus dalrympleana* subsp. *heptantha, Eucalyptus ligustrina, Eucalyptus laevopinea, Eucalyptus cameronii, Eucalyptus acaciiformis*.

Shrubs: *Petrophile canescens, Lomatia silaifolia, Banksia marginata, Hibbertia obtusifolia, Monotoca scoparia, Platysace ericoides, Boronia algida, Leucopogon lanceolatus, Allocasuarina littoralis, Bossiaea neo-anglica, Persoonia oleioides, Logania albiflora, Bossiaea scortechinii, Podolobium ilicifolium, Platysace lanceolata, Acacia mitchellii, Leptospermum novae-angliae, Pultenaea villosa,*

Melichrus procumbens, Leptospermum petersonii, Hibbertia acicularis, Banksia cunninghamii, Aotus subglauca, Amperea xiphoclada.

Climbers & trailers: *Smilax australis, Hardenbergia violacea.*

Ground cover: *Pteridium esculentum, Microlaena stipoides, Entolasia stricta, Patersonia sericea, Lepidosperma laterale, Gonocarpus tetragynus, Goodenia hederacea, Patersonia glabrata, Lomandra multiflora, Poa sieberiana, Lomandra filiformis, Goodenia bellidifolia, Dianella revoluta, Pomax umbellata, Lomandra longifolia, Austrostipa rudis, Imperata cylindrica, Gonocarpus teucrioides, Brachyscome nova-anglica, Austrostipa setacea, Themeda triandra, Poa queenslandica, Lagenifera stipitata.*

Introduced taxa: *Hypochaeris radicata.*

Percent of species introduced: 1%

Taxa of conservation importance: .

Notes & conservation status: this is a highly unusual assemblage that is only described within the literature from much further south. A similar assemblage with the same overstorey and understorey dominants is described for Aberbaldie Nature Reserve (Community 5; Hunter 2005) with a somewhat similar assemblage described from the Paradise VCA (Hunter 2002) in upland areas near Nundle. This assemblage is highly disjunct and unusual and rare. The inclusion of the community within Butterleaf and Bezzants Lease is of significance, particularly since it is the dominant vegetation type on granite. In the broadest sense *Eucalyptus campanulata* forests are probably the most extensive and best reserved systems in the escarpment areas of the New England. However, this sub-type dominated by *Eucalyptus williamsiana* and other rare sub-dominants is probably restricted to between the Nundle Region and Walcha and here around Butterleaf at high elevations is probably a naturally rare combination. Beadle (1981) states that *Eucalyptus radiata* is commonly associated with *E. acaciiformis* where rainfall is generally greater than 1000 mm annually and soils are of low fertility and especially where drainage is impeded. This community should be considered to be vulnerable due to its limited distribution.

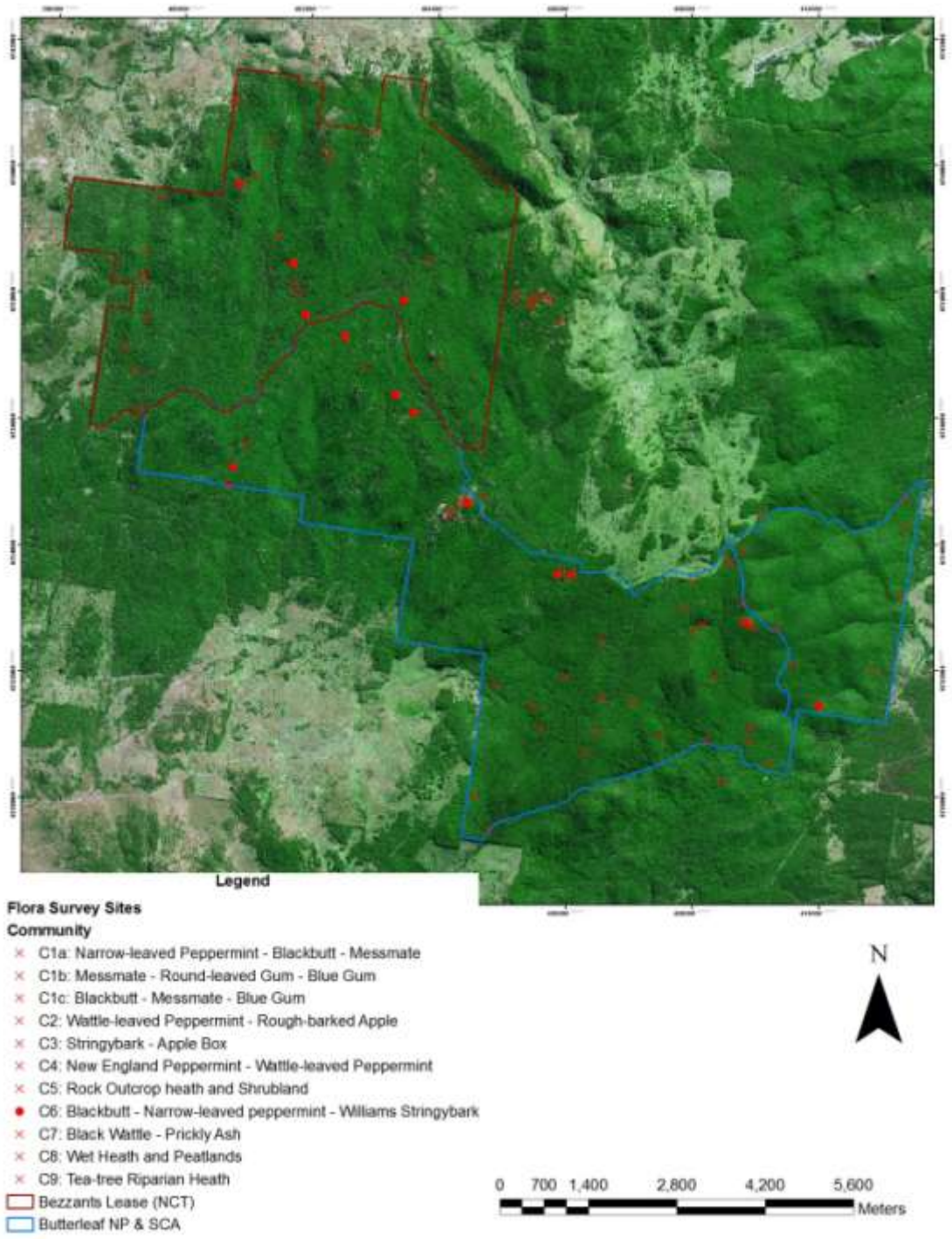

Figure 18: Placement of sites within Community 6 at Butterleaf and Bezzants Lease.

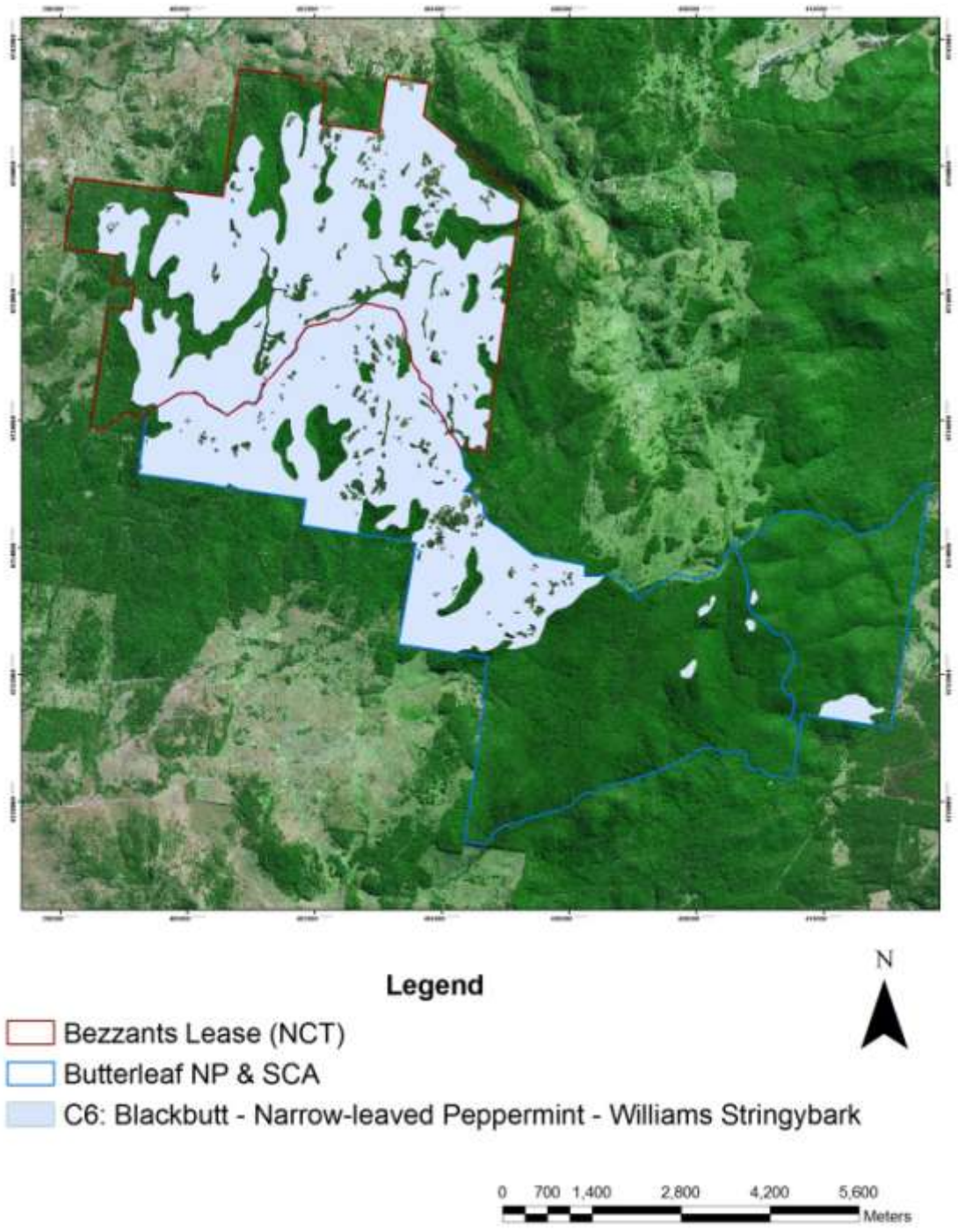

Figure 19: Mapped distribution of Community 6.

Plate 12: Photographs of Community 6; above Site 16, below Site 39.

Plate 13: Photographs of Community 6; above Site 43, below Site 53.

Plate 14: Photographs of Community 6; above Site 63, below Site 64.

Plate 15: Photograph of Community 6; above Site 66, below Site 67.

3.4.7 Community 7: Black Wattle – Prickly Ash Closed Forest

Callicoma serratifolia (Black Wattle) – *Orites excelsa* (Prickly Ash) Closed Forest

Sample sites (2): 21, 43.

Number of hectares: 34.7 **Proportion of reserve:** 0.6%

Environmental relationships: restricted to deeply incised and protected open depressions, soils are damp and deep to shallow clay loam.

Distribution within reserve: restricted to Butterleaf National Park within the deep gullies in the eastern section.

Structure: a closed forest.

- Tree-layer: 18-50 m tall. 80-90% cover.
- Tall shrub layer: 2-30 m tall. 40% cover.
- Understorey layer: < 1 m tall. 60-70% cover.

No. of taxa: 42 **No. of taxa per plot:** 26-**28**-29.

Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).

Trees: *Callicoma serratifolia, Orites excelsa, Doryphora sassafras, Acmena smithii, Banksia integrifolia*.

Shrubs: *Tasmannia insipida, Bursaria spinosa, Pittosporum multiflorum*.

Climbers & trailers: *Pandorea pandorana, Rumohra adiantiformis, Pyrrosia rupestris, Pyrrosia confluens, Parsonsia straminea, Parsonsia brownii, Microsorum scandens, Cayratia clematidea, Cissus hypoglauca, Eustrephus latifolius, Arthropteris tenella*.

Ground cover: *Lomandra longifolia, Hypolepis glandulifera, Hymenophyllum cupressiforme, Grammitis billardieri, Pteris umbrosa, Lomandra bracteata, Crepidomanes venosum, Viola hederacea, Pellaea nana, Microsorum scandens, Hymenophyllum bivalve, Dockrillia pugioniformis, Blechnum wattsii, Blechnum cartilagineum, Veronica plebeia, Solanum campanulatum, Pteridium esculentum, Hymenophyllum flabellatum, Hydrocotyle pedicellosa, Hydrocotyle laxiflora, Cyathea australis, Asplenium flaccidum.*

Introduced taxa: none apparent.

Percent of species introduced: 0%

Taxa of conservation importance: *Tmesipteris parva*.

Notes & conservation status: the understorey is a mosaic of closed forest mesophyllic understorey to dense stands of ferns and grasses along the margins. This community is highly stochastic in terms of composition as which species occur and in what numbers depends on time since fire, its intensity and frequency all of which are different at each locality. Placement of this assemblage is difficult as it appears to be a derived rather than natural assemblage. This is likely to be due to frequent fires and past disturbances within the region such as logging. As these stands mature they are likely to be similar to Floyds sub-alliance 35: *Ceratopetalum/Schizomeria-Caldcluvia* (Floyd 1990). This assemblage is considered to be common from south of Tenterfield along the escarpment at higher altitudes, particularly in the Washpool area where extensive stands are reserved in Washpool NP proper. It is likely that under lowered fire regimes expansion of this assemblage will occur and succession to Floyds sub-alliance 35 may be an outcome. similar assemblages are considered adequately reserved across their range at present. this assemblage is refugial and is found in small and isolated stands. These stands need to be protected from fires that are too frequent and from other disturbances and allowed to mature and expand in many situations. Any trails and works should avoid further damage to these stands.

Threats: frequent fire and weed invasion.

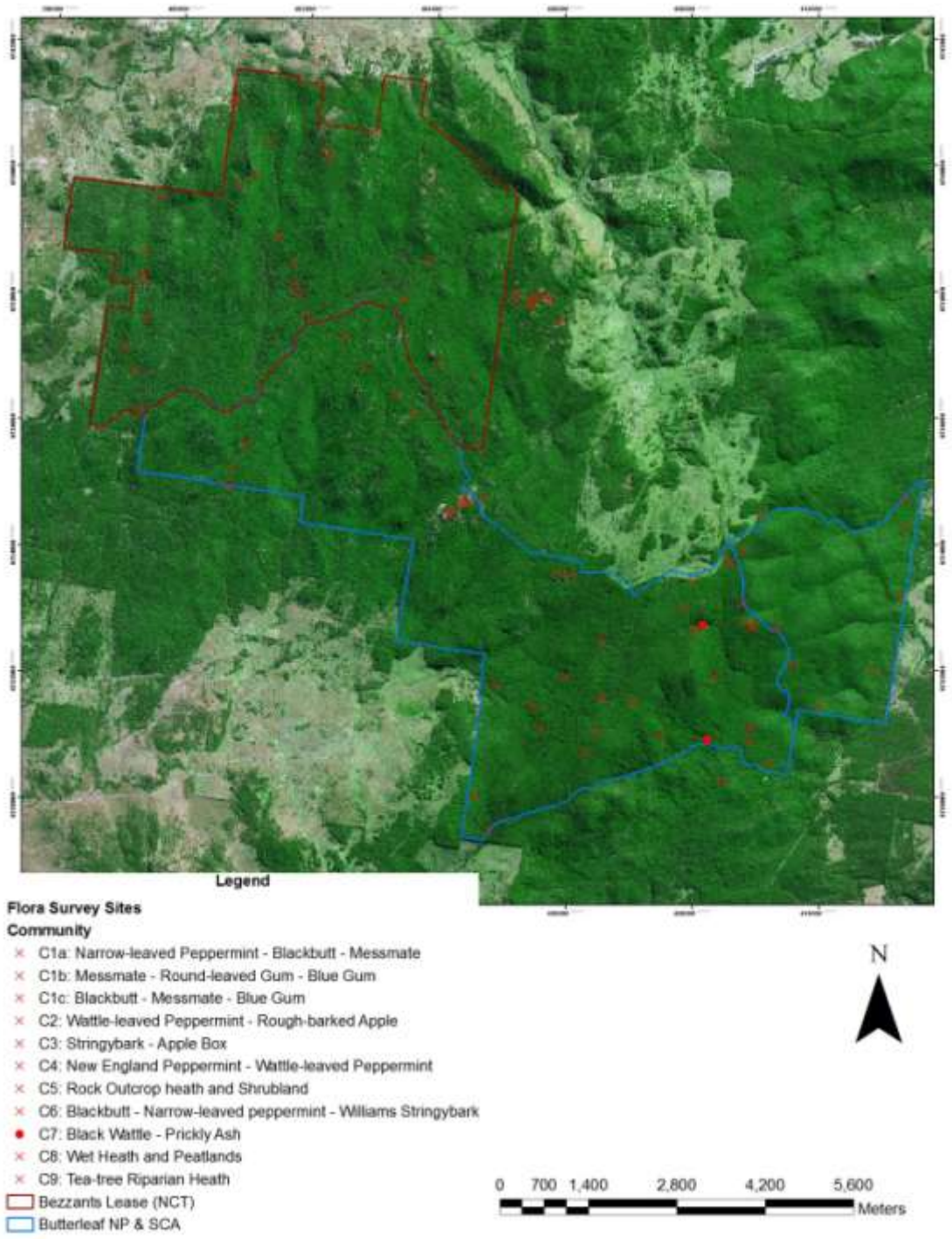

Figure 20: Placement of sites within Community 7 at Butterleaf and Bezzants Lease.

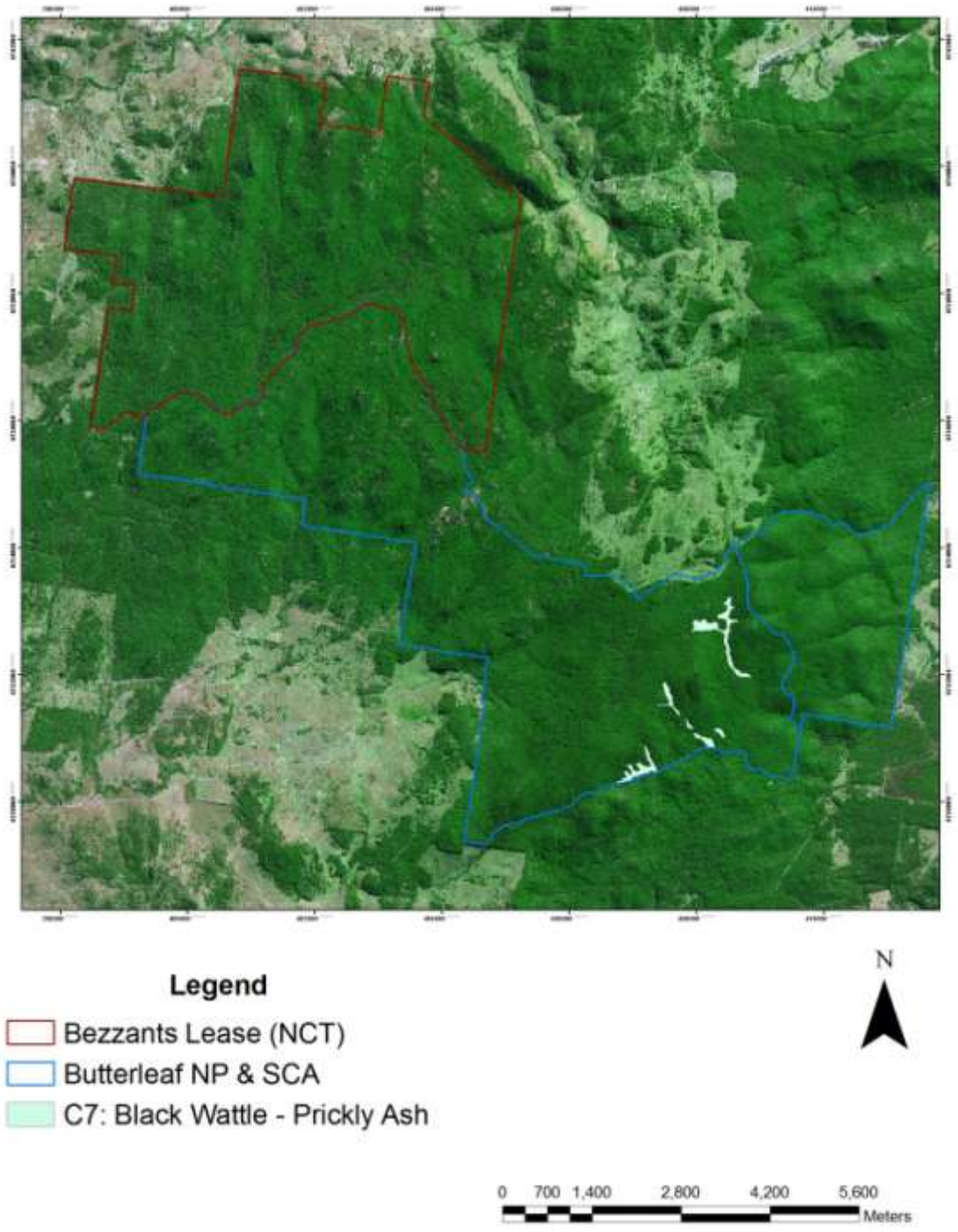

Figure 21: Mapped distribution of Community 7.

Plate 16: Photographs of Community 7; above Site 21, below Site 23.

3.4.7 Community 8: Wet Heath and Peatland

Baeckea omissa (Missed Baeckea) – *Epacris microphylla* (Heath) Wet Heaths and Peatlands

Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions Endangered Ecological Community.
http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10936

Sample sites (5): 34, 40, 58, 60, 62.

Number of hectares: 76.2 **Proportion of reserve:** 1.2%

Environmental relationships: open depressions and mid slopes. Soils are damp to waterlogged and deep with a peaty to clay loam texture and dark brown to black in colour. This community is restricted to areas of impeded drainage on granite.

Distribution within reserve: primarily occurring within the higher altitude areas of Bezzants Lease, though some smaller occurrences also found within Butterleaf NP.

Structure: a closed heathland.

- Tree-layer: 8-16 m tall. 10% cover. Rarely present.
- Tall shrub layer: 1-2 m tall. 15% cover. Rarely present.
- Understorey layer: < 1 m tall. 100% cover.

No. of taxa: 50 **No. of taxa per plot:** 12-**18**-25.

Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).

Trees: *Eucalyptus nobilis, Eucalyptus dalrympleana* subsp. *heptantha, Eucalyptus acaciiformis*.

Shrubs: *Baeckea omissa, Epacris microphylla, Callistemon pityoides, Leptospermum minutifolium, Banksia marginata, Leptospermum arachnoides, Epacris obtusifolia*.

Climbers & trailers: none apparent.

Ground cover: *Lepyrodia scariosa, Lepidosperma limicola, Gonocarpus micranthus, Entolasia stricta, Austrostipa rudis, Empodisma minus, Utricularia dichotoma, Lepyrodia anarthria, Lachnagrostis filiformis, Gymnoschoenus sphaerocephalus,*

Austrostipa setacea, Xyris bracteata, Viola hederacea, Schoenus apogon, Rhynchospora brownii, Patersonia fragilis, Murdannia graminea, Lycopodium deuterodensum, Lycopodiella lateralis, Goodenia bellidifolia, Empodisma minus, Drosera spatulata, Drosera peltata, Cyperus difformis, Burmannia disticha, Brachyscome angustifolia, Baloskion stenocoleum, Vallisneria gigantea, Spiranthes sinensis, Oxalis perennans, Orthroceras strictum, Mitrasacme paludosa, Lomandra longifolia, Juncus phaeanthus, Isopogon petiolaris, Hydrocotyle laxiflora, Haloragis heterophylla, geranium solanderi var. *grande, Fimbristylis dichotoma, Comesperma ericinum, Brachyscome radicans.*

Introduced taxa: *Axonopus affinis.*

Percent of species introduced: 2%

Taxa of conservation importance: none apparent.

Notes & conservation status: this community has a number of species with high constancy 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 separated into grass and cyperiod dominated areas along with situations with a strong shrub component. This internal variability within individual occurrences is primarily due to depth and duration of water logging. Zones can often be distinguished that are banded based on proximity to creek channels. In a few localities *Sphagnum* bogs have developed. In some small creek lines drainage can be impeded and this community may develop and be only a few meters wide, in such instances sedges appear to be more prominent. Similar associations are restricted to higher altitudes on the tablelands particularly along the eastern margin of the divide. *Sphagnum* bogs form a regeneration complex where hummocks of *Sphagnum* support shrubs while the hollows tend not to. The hollows are less acidic than the hummocks. The hummock and hollow system is not permanent with hummocks degenerating and becoming hollows and vice versa (Beadle 1981). Death of the hummock is thought to be due to lack of moisture at the surface. In a region wide analysis Hunter & Bell (2009) this assemblage within the study area would be placed within Community 1: *Epacris microphylla – Leptospermum arachnoides/Themeda triandra – Gonocarpus micranthus* which is found on granite and acid volcanic substrates generally north east of Tenterfield to Backwater. It is reserved within Bald Rock NP, Boonoo Boonoo NP, Western

Washpool NP, Mann River NR and here within Butterleaf and Bezzants Lease. This community falls within the *TSC* Act **endangered ecological community** of Upland Peatlands. Benson & Ashby (2000) found that for the Guyra 1: 100 000 Map Sheet area, 80% of the original extent of montane bogs were still extant and generally in good condition, though poorly-represented in conservation reserves. The Guyra map sheet area was thought to contain 370 ha of montane bogs of which 15 ha were in reserves. Based on current mapping technology which (using on ground surveying and verification) it is estimated that potentially 2700 ha of bog communities are incorporated in the reserve network (Hunter 1998; Hunter 1999; Hunter et al. 1999; Benson & Ashby 2000; Clarke et al. 2000; Hunter 2000; Sheringham & Hunter 2002; Hunter 2004ab; Hunter 2005b) and that at least 10 000 ha in total potentially exist in northern New England. Whinam and Chilcott (2002) found that *Sphagnum*-dominated bog communities, even within conservation reserves, were in poor condition due to past land use practices. They are vulnerable to both present landuse practices and future changes in climate, and are restricted in area, thus needing further conservation initiatives. Despite the apparent similarity in structure and composition of the overstorey shrubs these communities are best delineated by the composition of their herbaceous substratum.

Threats: high frequency fire, pigs and potentially fungus such as *Phytophthora*.

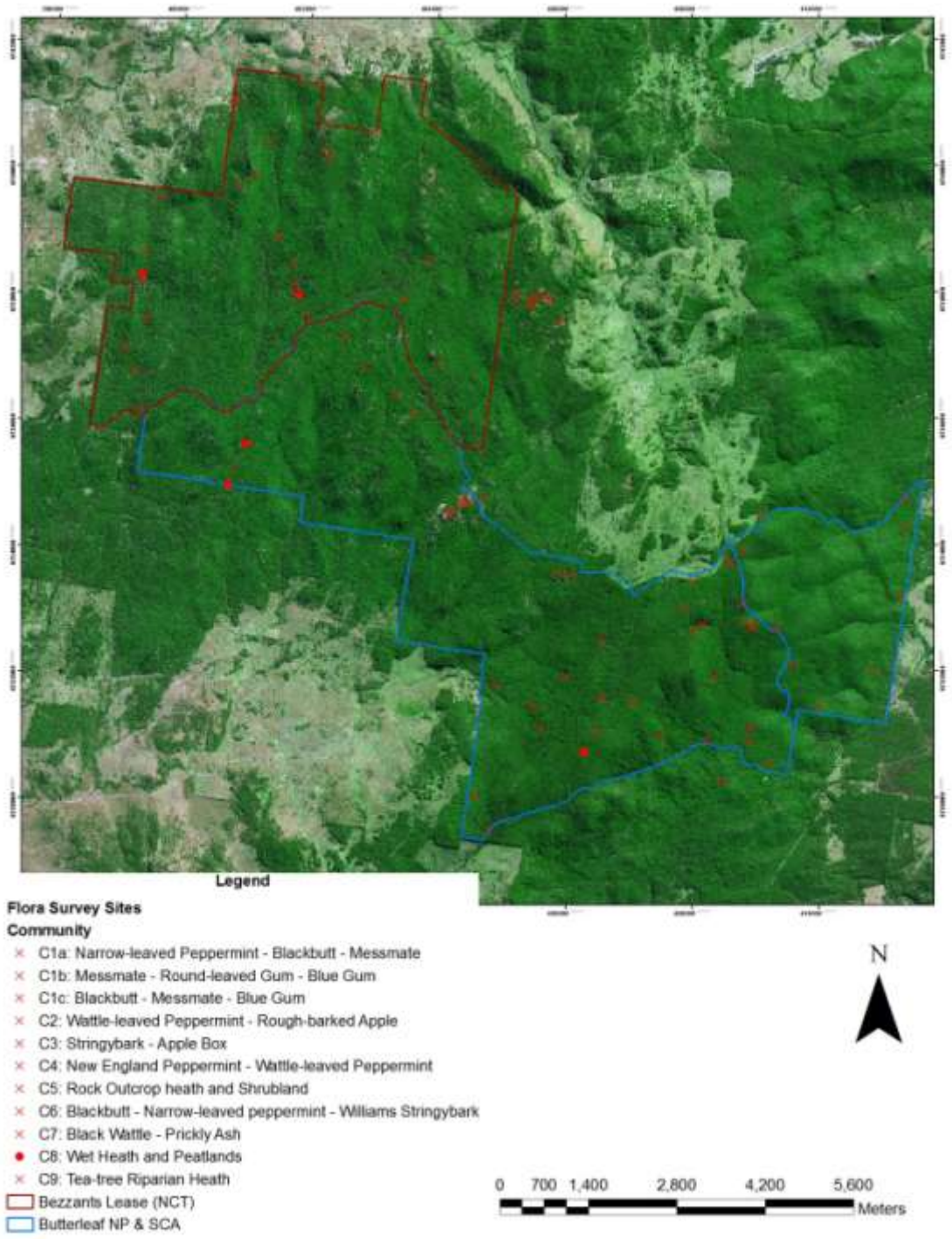

Figure 22: Placement of sites within Community 8 at Butterleaf and Bezzants Lease.

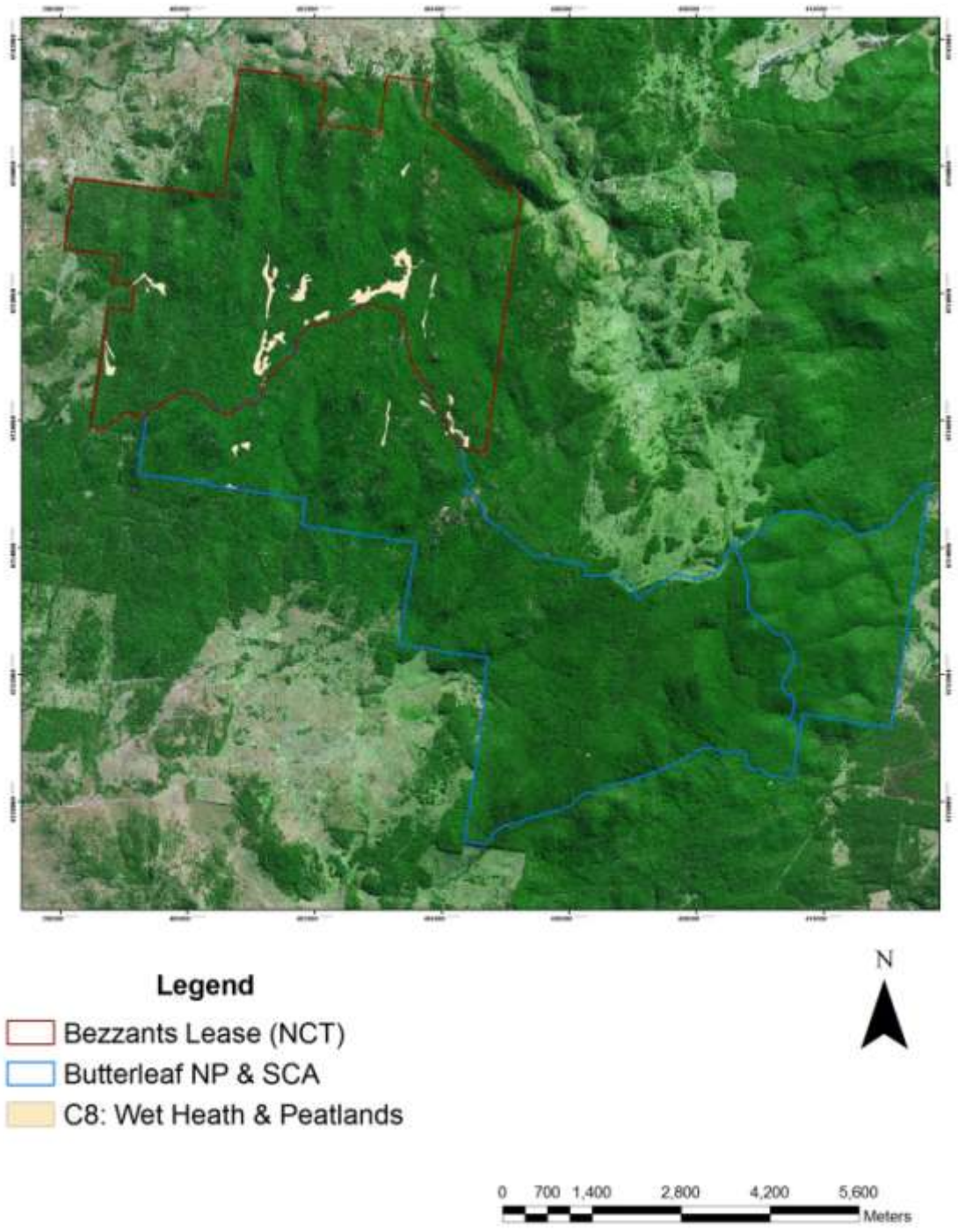

Figure 23: Mapped distribution of Community 8.

Plate 17: Photographs of Community 8; above Site 34, below Site 40

Plate 18: Photographs of Community 8; above Site 58, below Site 60.

3.4.9 Community 9: Tea-tree Riparian Heaths

Leptospermum novae-angliae (New England Tea-tree) – *Leptospermum polygalifolium* subsp. *montanum* (Mountain Tea-tree) Riparian Heaths

Sample sites (3): 41, 47, 68.

Number of hectares: 10.5 **Proportion of reserve:** 0.4%

Environmental relationships: restricted to lower slopes and open depressions. Soils are skeletal to deep and peaty loam or sandy clay loam and dark brown to black in colour.

Distribution within reserve: scattered throughout both Butterleaf NP and Bezzants Lease on granite in areas of impeded drainage usually with a prominent rocky substrate.

Structure: variable but primarily a low open shrubby woodland.

- Tree-layer: 6-10 (-25) m tall. 15% cover.
- Tall shrub layer: 1-3 (-4) m tall. 50-70% cover.
- Understorey layer: < 1 m tall. 20-30% cover.

No. of taxa: 48 **No. of taxa per plot:** 17-**23**-29.

Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).

Trees: *Eucalyptus williamsiana, Eucalyptus nobilis, Eucalyptus dalrympleana* subsp. *heptantha, Eucalyptus campanulata, Eucalyptus caliginosa, Eucalyptus acaciiformis*.

Shrubs: *Leptospermum novae-angliae, Leptospermum polygalifolium* subsp. *montanum, Baeckea omissa, Callistemon pungens, Leptospermum minutifolium, Kunzea parvifolia, Banksia marginata, Hakea laevipes, Callistemon pityoides, Epacris microphylla, Banksia spinulosa, Petrophile canescens, Melichrus urceolatus, Leptospermum gregarium, Platysace lanceolata, Platysace ericoides, Monotoca scoparia, Logania albiflora, Isopogon petiolaris, Hibbertia acicularis, Correa reflexa, Allocasuarina littoralis*.

Climbers & trailers: none apparent.

Ground cover: *Gleichenia dicarpa, Baloskion stenocoleum, Schoenus apogon, Gahnia sieberiana, Schoenus melanostachys, Empodisma minus, Lepidosperma laterale, Goodenia bellidifolia, Stylidium graminifolium, Pteridium esculentum,*

Lycopodium deuterodensum, Gonocarpus micranthus, Drosera burmannii, Cyperus gracilis, Velleia paradoxa, Lycopodiella lateralis, Gonocarpus teucrioides, Gonocarpus tetragynus, Dianella revoluta, Cheilanthes sieberi, Centella asiatica.

Introduced taxa: none apparent.

Percent of species introduced: 0%

Taxa of conservation importance: none apparent.

Notes & conservation status: the floristic dynamics of this assemblage are probably based on a constant cycle of disturbance by flooding and fire. The three sites where however, rather divergent on the dendrogram indicating a great diversity even within these three sites. This community is by nature linear with a great edge to area ratio and even common dominants may be absent often due to the great variability in substrate and depth of soil giving a rather variable structure. This community intergrades with the rock outcrop community (Community 5) where exposed granite platforms are larger and less exposed to riparian influences and also with Community 3 and 4. Benson and Ashby (2000) describe the condition of this community outside within the Guyra Map Sheet as highly variable with some areas in bad condition. Weeds are a prominent component outside of reserves of the assemblage and some of these are troublesome. Benson and Ashby (2000) consider this community type to be endangered locally and at least vulnerable within the state. They also consider the community to be poorly conserved locally. Based on published floristic analyses this community type does appears to be reserved within Warra NP and within Western Washpool NP. Hence, it is likely that this grouping of taxa is rather unique to the tablelands. Weed invasion, particularly from Blackberry, is the most immediate threat. Pollution and sedimentation of the watercourse may also be a threat if over clearing or mining occurs in the upper catchments (Benson & Ashby 2000). This community has a high edge to area ratio and as such will be prone to disturbances of all kinds. Further sampling along this assemblage would be an asset. This community probably occurs in more areas than mapped but delineating this assemblage proved difficult by SPOT imagery.

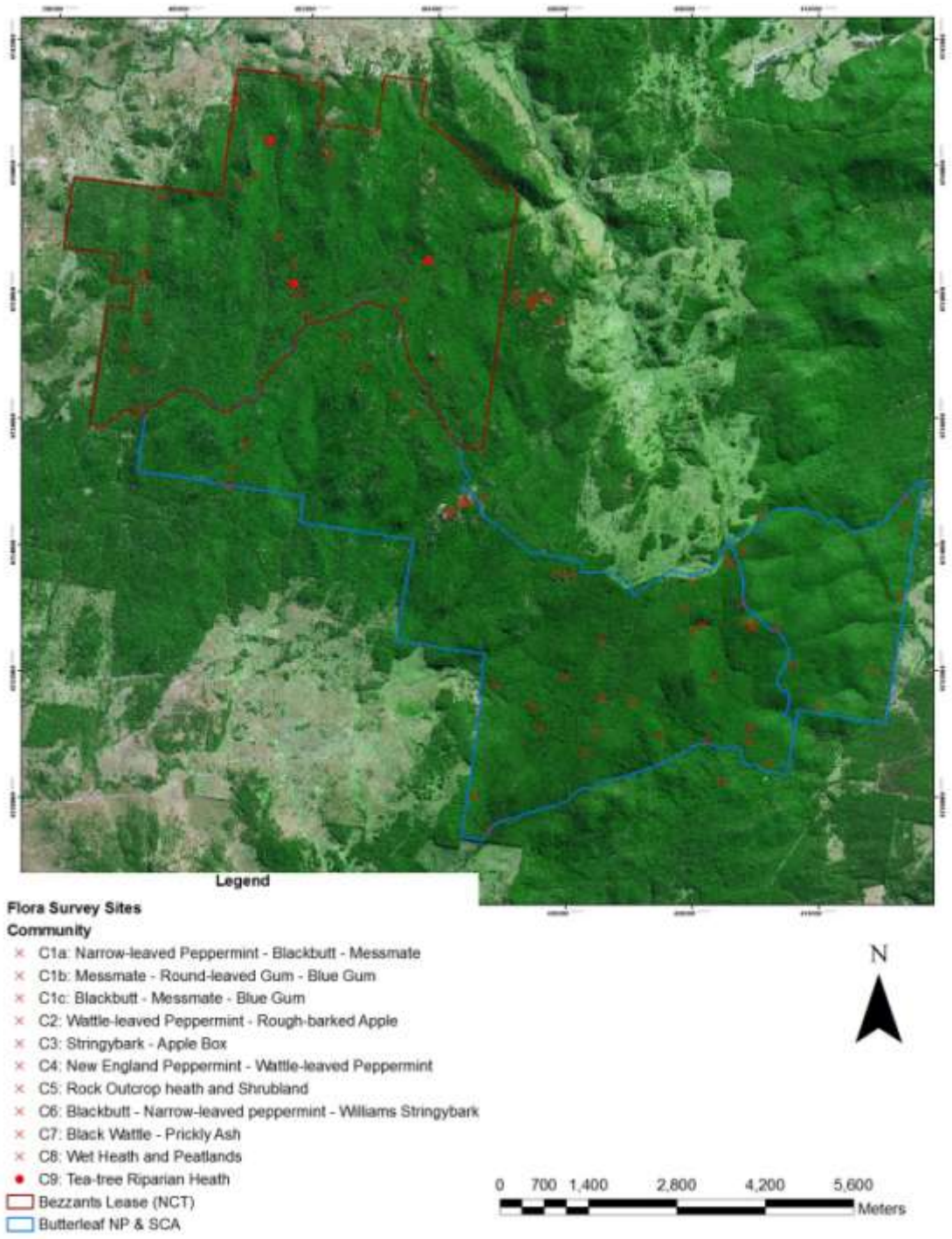

Figure 24: Placement of sites within Community 9 at Butterleaf & Bezzants Lease.

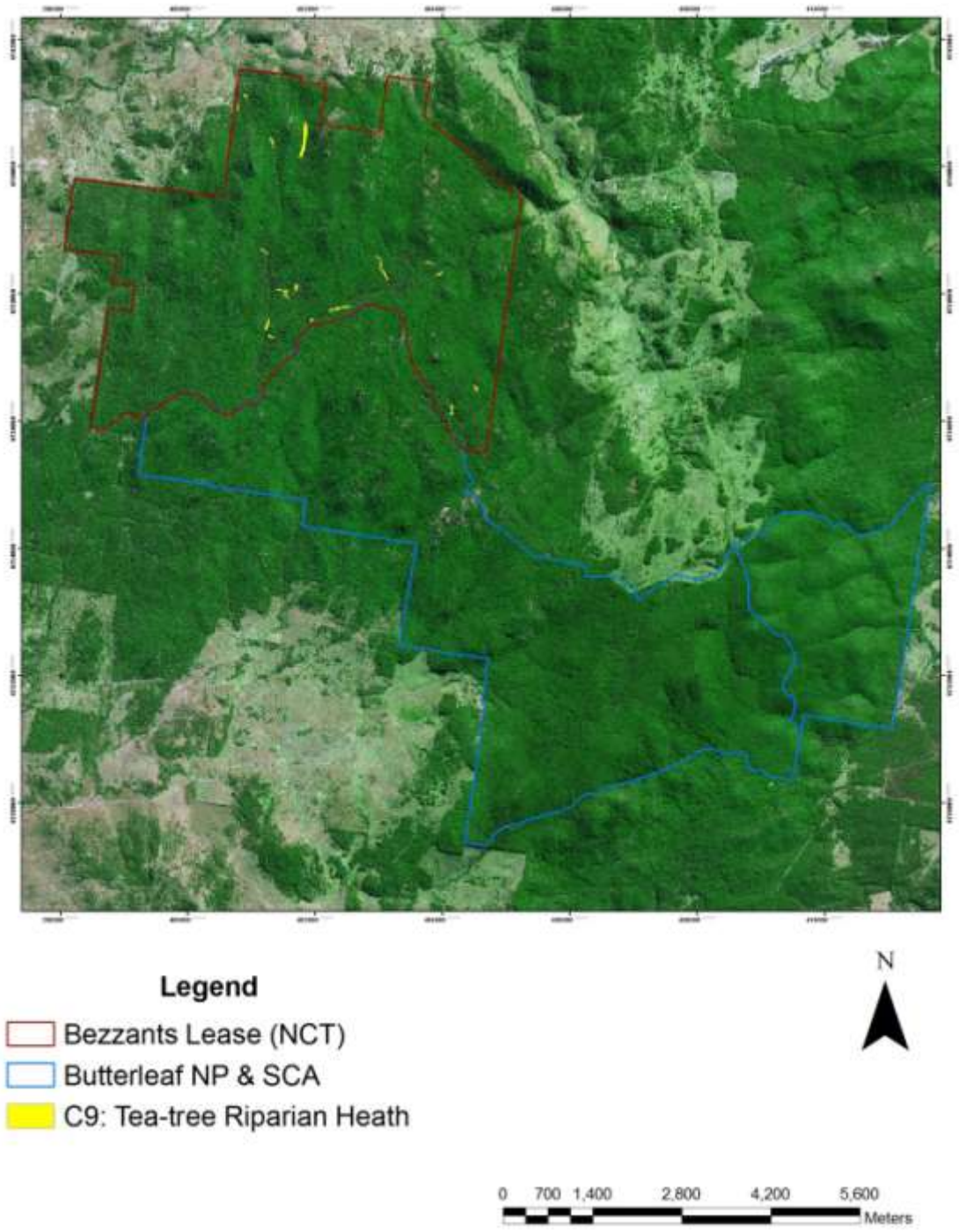

Figure 25: Mapped distribution of Community 9.

Plate 19: Photographs of Community 9; above Site 41, below Site 68.

3.5 Fire responses of individual taxa

The following represents a review of the current knowledge of the fire responses of selected taxa found within the conservation areas.

Table 2: Known fire responses and traits of taxa found in Butterleaf & Bezzants Lease. NPFR refers to National Fire Register. Fire responses are based on published information, some of which is contradictory. Possible reasons for these contradictions are in the discussion.

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Acacia binervia	Obligate Seeder	Soil stored seedbank	Seed	Immediately after fire	<2 yr			Killed. Size of stem may influence survival after low intensity fire. 20-60% stems killed low intensity fire, 100% if high. No protected buds no insulating bark.	Benson & McDougall (1996), Auld (1996), Morrison & Renwick (2000)
Acacia falciformis	Obligate Seeder	Soil stored seedbank, after medium intensity fire much germination	Seed		2-4			pers. obs. Perennial. Facultative resprouter.	NPFR, Williams (1998).
Acacia filicifolia	Resprouter	Soil stored seedbank	Seed	Will germinate after fires	2-4			Probably resprouts from root suckers	Benson & McDougall (1996).
Acacia fimbriata	Resprouter	Optimum: 70 degrees C., 10-200min - 80% germination.	Seed		2-4				Floyd (1976).
Acacia floribunda	Obligate seeder		Seed			<3 yr		Old plants killed young plants resprout from base after high intensity fire	Benson & McDougall (1996), Benson (1981).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
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	2-4		5-30	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	Obligate Seeder		Seed	Rapid growth rate. Ant adapted elaiosome.	3-6				Williams (1998).
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 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	5-9		<50	Facultative resprouter. Obligate 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 mitchellii	Obligate Seeder		Seed						
Acacia myrtifolia	Variable	Mainly after fire	Seed		<3 yr			Will germinate after high intensity fire. Obligate Seeder and facultative resprouter. Soil stored seed.	Benson & McDougall (1996), Auld & O'Connell (1991), Floyd (1976), Keith (1996),

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
								100% scorch killed. Min. temp to break seed dormancy 60-80 degrees C.	Siddiqi et al. (1976), Bradfield (1981), NPFR.
Acacia obtusifolia	Obligate Seeder	May germinate after fire	Seed		2-4			Resprouts from base and root suckers. Seedlings may establish on disturbed sites.	NPFR, 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 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 greater 16-24m than 0-16m after fire.	Dickinson & Kirkpatrick (1987), Benson & McDougall (2000).
Acetosella vulgaris	Resprouter								
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	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).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
				but possibly short-lived, no lignotuber on seedlings but produced later, quick growth rate, coloniser					
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).
Adiantum aethiopicum	Resprouter			Diaspore: spores dispersed by wind. Probably no dormancy mechanism.	1-2			Fire sensitive in open situations but tolerant if rhizomes amongst rocks. Resprouts at ground level.	NPFR, Benson & McDougall (1993).
Adiantum formosum	Resprouter				1-3			Facultative resprouter.	Benson & McDougall (1993), NPFR.
Adiantum hispidulum	Resprouter				1-2			Flush of growth from rhizome after fire	Benson & McDougall (1993), NPFR.
Agiortia cicatricata	Obligate Seeder		Fruit						
Ajuga australis	Resprouter		Fruit (indehiscent 1 seeded)	Erect flowering stems become horizontal at maturity, allowing short distance gravity				Grows rapidly after fire.	Benson & McDougall (1997), Lazarides & Hince (1993).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
				dispersal of se					
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.	3-5	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 torulosa	Resprouter, epicormic, basal			Survive 100% scorch - basal sprouts, seeds release after fire, will establish in absence of fire.	3-5			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).
Amperea xiphoclada	Resprouter					< 1yr		Stems killed, resprout from base. Flowering & fruiting within 1yr of high intensity fire.	Benson (1981), Benson & McDougall (1995).
Amyema pendulum	Obligate Seeder				4-8				Williams (1998).
Anagallis arvensis	Resprouter				1-2			Probably killed.	Benson & McDougall (1999).
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.	5-8		100+	Resprouts from epicormic shoots. Prolific stem suckering at Tinkrameanah.	Benson & McDougall (1998), Clarke (1989).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Aotus subglauca	Resprouter							pers. obs.	
Arenaria leptoclados	Obligate Seeder								
Aristida calycina	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive fruit, animal dispersed.		<1		Fruiting within 6 m of high intensity fire.	Benson & McDougall (2005).
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 personata	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive fruit, animal dispersed.	1-2				Williams (1998), Benson & McDougall (2005).
Arthropodium milleflorum	Resprouter							First recorded 1m after fire in grassy & wet forests. Cover value similar in areas burnt by high & low intensity fires.	Dickson & Kirkpatrick (1987).
Arthropteris tenella	Obligate Seeder				3-5			Probably killed.	NPFR, Benson & McDougall (1993).
Asperula conferta	Resprouter		Fruit	No particular mechanism for dispersal. Rhizomatous vegetative spread.	1-2				Lunt (1990), Benson & McDougall (2000).
Asplenium flavellifolium	Resprouter			Diaspore: spores, wind-dispersed. Probably no dormancy	1				Williams (1998).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
				mechanism.					
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 overcome dormancy.	Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.					Benson & McDougall (2005).
Austrodanthonia monticola	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.					Benson & McDougall (2005).
Austrodanthonia racemosa	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed & wind dispersed.					
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 rudis	Resprouter	Total germination 98 days.	Fruit (Dry indehiscent 1 seeded)	Adhesive, animal dispersed. Possible coloniser of bare					Lunt (1990), NPFR, Benson & McDougall (2005).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
				sites.					
Axonopus affinis	Resprouter		Fruit (Dry indehiscent 1 seeded)	Dispersed in mud on cars.	1		Indefinite		Williams (1998), Benson & McDougall (2005).
Baeckea omissa	Resprouter		Seed						
Baloskion fimbriatum	Resprouter		Fruit (capsule)	Wind			Indefinite	Seed maturation 6-8 months.	Benson & McDougall (2005).
Baloskion stenocoleum	Resprouter		Fruit (capsule)	Wind			Indefinite		
Banksia cunninghamii			Seed					Lignotuber.	Harden (1991).
Banksia integrifolia	Variable		Seed	Gravity. Seeds released on maturity.	4-9			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 recruitment, 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	Keith (1991), NPFR.

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
								after fire. Obligate Pyrogenic flowering.	
Bertya cunninghamii	Obligate Seeder								
Bidens pilosa	Resprouter			Diaspore: fruit, animal dispersed (eg. on human clothing).	18wks		1yr	Probably killed, vigorous recruitment from seed after high-intensity fire, most likely from soil-stored seed. Mature fruit within 18wks of high intensity fire.	Benson & McDougall (1994).
Bidens subalternans	Resprouter								
Billardiera scandens	Resprouter				3-4	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).
Boronia algida	Resprouter		Seed	Seed dispersed ballistically from dehiscent 4-lobed fruit.					Benson & McDougall (2001).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Boronia anethifolia	Obligate seeder?		Seed	Seed dispersed ballistically from dehiscent 4-lobed fruit.					Benson & McDougall (2001).
Bossiaea neo-anglica	Resprouter		Seed	Soil-stored seedbank.				pers. obs.	
Bossiaea scortechinii	Resprouter		Seed	Soil-stored seedbank.				pers. obs.	
Brachyloma saxicola	Obligate Seeder	Soil stored seed viable for many years							Hunter (1991).
Brachyscome angustifolia	Resprouter								
Brachyscome microcarpa	Resprouter								
Brachyscome nova-anglica	Resprouter								
Brachyscome radicans	Resprouter								
Brachyscome spathulata	Resprouter								
Brachyscome stuartii	Resprouter								
Bulbostylis barbata	Obligate Seeder							100% scorch kills - soil stored seed.	NPFR.
Bulbostylis densa	Obligate Seeder								
Bursaria longisepala	Resprouter				3-4				Williams (1998).
Bursaria spinosa	Resprouter				3-5				Williams (1998).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Caladenia carnea	Resprouter		Seeds, winged		2-4		Indefinite		Williams (1998).
Calandrinia eremaea	Obligate Seeder								
Callicoma serratifolia	Resprouter	Viable seed present at 9-12cm, most in top 6cm. low soil temp <75 deg C.			4-7			Resprout from base after high intensity fire, also germinates after fire from soil stored seed bank	Benson & McDougall (1995), Floyd (1976).
Callistemon linearis	Resprouter		Seed			2.75		Seed retain on bush for more than a year. Resprouts after high intensity fire.	Benson & McDougall (1998).
Callistemon pityoides	Resprouter	Germinates without treatment, viability 10%, may have some innate dormancy.	Seed	Dispersed locally, no dormancy.					Benson & McDougall (1998).
Callistemon pungens	Resprouter		Seed		3-5				Williams (1998).
Callistemon sieberi	Resprouter	Germinates without treatment. No soil-stored seedbank. Probably needs open conditions to germinate.	Seed.		3-5			Survives 100% scorch - basal sprouts.	NPFR. Benson & McDougall (1998).
Callitris rhomboidea	Obligate Seeder							Probably killed	Benson & McDougall (1993).
Calochilus robertsonii	Resprouter		Seed, winged			1	Indefinite	Self pollinating	Benson & McDougall (2005).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Calochlaena dubia	Resprouter		Seed, winged		3-6	< 1yr	Indefinite	Shoot within 1 month after fire, no spread after high intensity burn but may dominate after low intensity fire may indicate frequent low intensity fires	Benson & McDougall (1993), Benson (1985), NPFR.
Calotis cuneifolia	Obligate Seeder							Probably killed	Benson & McDougall (1994).
Calytrix tetragona	Variable	Soil-stored seedbank.	Fruit	Wind-dispersed locally, or gravity dispersed.	2-4	3.75		Resprouts. Killed after high intensity fire.	Benwell (1998), Myerscough et al (1995), Benson & McDougall (1998)
Cardamine paucijuga			Seed	Ejected mechanically.					
Carex gaudichaudiana	Resprouter								
Carex inversa	Resprouter								Lunt (1990).
Carex lobolepis	Resprouter								
Cassinia laevis	Obligate Seeder		Fruit (plumose)	Probably wind-dispersed.	2-3				Williams (1998)
Cassinia leptocephala	Obligate Seeder		Fruit (plumose)	Probably wind-dispersed.	2-4				Williams (1998).
Cassinia quinquefaria	Obligate Seeder		Fruit (plumose)	Probably wind-dispersed.					
Cayratia clematidea	Resprouter	Reproduction sexual, reproducing by seed propagation between 1-5yrs.		Seeds dispersed by animals.	2-4		5-30		Clarke (1989), Williams (1998).
Cheilanthes	Resprouter		Spores	Wind-dispersed.	1-2			Facultative resprouter.	NPFR, Benson &

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
sieberi				Probably no dormancy mechanism.					McDougall (1993).
Chenopodium pumilio	Obligate Seeder								
Chiloglottis platyptera	Resprouter		Seed, winged		1-3		Indefinite		Williams (1998).
Chiloglottis trilabra	Resprouter		Seed, winged				Indefinite		Benson & McDougall (2005).
Chloanthes parviflora	Obligate Seeder	In high numbers after fire even after long periods of absence	Seed		< 1yr			pers. obs.	
Chloris truncata	Resprouter	Viability decreases 12-30 m in storage. Total germination in 36 days. 30-40% germination of wild seed. Light assists germination.	Seed (dry indehiscent 1 seeded)	Wind, adhesion to animals & mud on cars.	1		2-3	Flowers opportunistically in response to rain.	Lunt (1990), Benson & McDougall (2005).
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

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
									(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 dispersal	Floyd (1966), Purdie & Slatyer (1976), Chesterfield et al. (1991), Dickinson & Kirkpatrick (1987), Bill (1981), NPFR, Purdie (1977).
Cissus hypoglauca	Resprouter	Reproduction sexual, reproduction by seed propagation between 1-5 yrs.		Seeds dispersed by animals.	3-6		5-30	Survives 100% scorch - basal sprouts.	NPFR, Clarke (1989), Williams (1998).
Clematis aristata	Variable		Fruit (achene)	Wind dispersed.		38w		Obligate seeder. Resprouted after high intensity fire. Survives 100% scorch - root suckers.	NPFR, Benson & McDougall (2000).
Clematis glycinoides	Obligate Seeder		Fruit (achene)	Wind dispersed. Coloniser, though growth rate appears slow.	3-7		?10-20y	Probably killed.	Benson & McDougall (2000).
Clerodendrum floribundum	Resprouter				2-4			Facultative resprouter.	NPFR, WIlliams (1998).
Clerodendrum tomentosum	Resprouter				2-4				Williams (1998).
Comesperma ericinum	Resprouter							Probably killed after high intensity fire.	Benson & McDougall (1999).
Conyza bonariensis	Obligate seeder	Coloniser of disturbed sites.		Diaspore: fruit, wind-dispersed locally and	<1		1	100% scorch kills - no seed stored in burnt area. Probably killed, fruit within	Benson & McDougall (1994).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
				probably long distance.				15wks of high intensity fire. Possibly resprouts after low intensity fire.	
Conyza sumatrensis	Obligate Seeder			Diaspore: fruit. Wind-dispersed locally & wide-spread, readily colonising disturbed sites.	<1		1-2	Killed. Seedlings recorded <1yr after fire, probably recruiting from wind-blown seed.	Purdie (1977), Benson & McDougall (1994).
Coprosma quadrifida	Resprouter			Fleshy fruit.	3-5				Barker (1990), Benson & McDougall (2000).
Coronidium elatum	Obligate Seeder	Germinates readily after fire	Fruit		1 yr			Will germinate readily after fire and seed within high intensity fire: pers obs	Benson & McDougall (1994).
Coronidium scorpioides	Resprouter		Fruit		<1 yr			Flower in 16 wks and fruit 23 wks after high intensity fire	Benson & McDougall (1994), Dickinson & Kirkpatrick (1987), Lunt (1994), NPFR.
Correa reflexa	Obligate seeder		Seed	Ballistically from dehiscent 1-4 lobed fruits. Also myrmecochorous. No vegetative spread. Soil stored seedbank.	2-4				Benson & McDougall (2001).
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		Diaspore: seed, mobile. Growing	< 1yr			Probably killed, seedlings recorded <1yr after fire,	Purdie (1977), NPFR, Purdie (1977), Benson &

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
		1yr after fire.		in winter.				flowering within 7m after high intensity fire.	McDougall (1995).
Crepidomanes venosum	Obligate Seeder							Spores.	Chesterfield et al. (1991), NPFR.
Cryptandra amara	Resprouter								
Cryptandra lanosiflora	Obligate Seeder								
Cryptostylis subulata	Resprouter		Seed, winged			2	Indefinite		Benson & McDougall (2005).
Cyathea australis	Resprouter	Soil stored spores.			5-10			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	Variable		Fruit (dry indehiscent 1 seeded)	Diaspore adhesive , animal dispersed & wind.	1	<1		Fruiting within 7 m of high intensity fire. Killed by high intensity crown fire and germination from seed at Tinkrameanah.	Williams (1998), Benson & McDougall (2005), Pers. Obs.
Cynodon dactylon	Resprouter	Reproduction sexual and vegetative. Reproducing by seed propagation between 1-5yrs.	Fruit (dry indehiscent 1 seeded)	Dispersed by wind & mud on cars, animal, water & vegetatively.	1		Indefinite		Clarke (1989), Williams (1998), Benson & McDougall (2005).
Cyperus fulvus	Resprouter							Survives 100% scorch - basal sprouts.	NPFR.
Cyperus gracilis	Obligate								

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
	Seeder								
Cyrtostylis reniformis	Resprouter		Seed, winged.		1-3		Indefinite		Williams (1998), Benson & McDougall (2005).
Daucus glochidiatus	Obligate Seeder				<1 yr			Seedlings recorded < 1yr after fire	Benson & McDougall (1993), Purdie & Slatyer (1976), Purdie (1977), NPFR.
Davallia solida	Obligate Seeder				4-8			Probably killed	Benson & McDougall (1993).
Desmodium gunnii	Resprouter				1-2				
Desmodium varians	Variable	Probably soil-stored seedbank.		Diaspore: 1-seeded segments, shed at maturity. Adhesive.	1-2	<1 yr		Flowering within 11 wks of high intensity fire. Resprouted. Killed by high intensity crown fire at Tinkrameanah.	Lunt (1990), NPFR, Benson & McDougall (1996).
Deyeuxia gunniana	Resprouter		Fruit (dry indehiscent 1 seeded)						Benson & McDougall (2005).
Deyeuxia parviseta	Resprouter		Fruit (dry indehiscent 1 seeded)	No particular mechanism for dispersal.					Benson & McDougall (2005).
Dianella caerulea	Resprouter		Fruit (Blue Berry)	Vertebrates. Only 20% of flowers produced fruit.	2-3				Roche et al. (1997), Benson & McDougall (2005).
Dianella caerulea	Resprouter		Fruit (White to Blue Berry)	Vertebrates.	2-3				Roche et al. (1997), Benson & McDougall (2005).
Dianella caerulea	Resprouter	Germination triggered by	Fruit (Blue Berry)	Birds for fruit & seeds for ants.	2-3	1		Flowers 10-12 m after high intensity fire.	Roche et al. (1997), Benson & McDougall

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
		seasonal temperature & humidity. Requires no pre-treatment but is slow to terminate.							(2005).
Dianella caerulea	Resprouter	Reproduction both sexual and vegetative, reproducing by seed propagation in the first year.	Fruit (Blue Berry)	Seeds dispersed by animals.	2-3		5-30	Regenerates after crown fire or partial burn by resprouting below ground.	Clarke (1989), Williams (1998).
Dianella revoluta	Resprouter	Germination takes approx. 2 yrs. Seeds should be smoked for 1 hr. Viability of fresh seed 80%.	Fruit (Blue Berry)	Vertebrates	2-3	2		Resprouter from rhizome after high intensity crown fire at Tinkrameanah.	Benson & McDougall (2005).
Dianella tasmanica	Resprouter	Germination takes approx. 83 days, germinates without fermentation.	Fruit (Blue Berry)	Vertebrates	2-3			Appeared 1st month after fire in wet forest. Initially good growth rate, then declines.	Dickinson & Kirkpatrick (1987), Roche et al. (1997), Benson & McDougall (2005).
Dichelachne micrantha	Resprouter		Fruit (dry indehiscent 1 seeded)		1				NPFR, Williams (1998), Benson & McDougall (2005).
Dichelachne parva	Resprouter		Fruit (dry indehiscent 1 seeded)						Benson & McDougall (2005).
Dichondra repens	Variable	Reproduction both sexual and		Stolons. Diaspore: seed,	1		<5	Resprouter (7091), Obligate Seeder (NPFR).	Lunt (1990), NPFR, Benson & McDougall

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
		vegetative means. Reproducing by seed propagation in the first year.		no special dispersal morphology. Dispersed in mud on cars.				Did not flower within 9m of intense autumn fire. Probably resprouts from stolons.	(1995), Clarke (1989).
Dichondra sp. A	Resprouter				1				
Digitaria breviglumis	Resprouter		Fruit (dry indehiscent 1 seeded)					Found resprouting at Tinkrameanah after crown fire.	Pers. Obs.
Digitaria ramularis	Resprouter		Fruit (dry indehiscent 1 seeded)						Benson & McDougall (2005).
Dillwynia phylicoides	Obligate Seeder							Killed	Fox (1988), Benson & McDougall (1996).
Dillwynia sieberi	Obligate Seeder	Soil stored seedbank			2-3			Killed	Benson & McDougall (1996).
Dipodium variegatum	Resprouter		Seed		2-4	1	Indefinite		Benson & McDougall (2005).
Dockrillia linguiformis	Obligate Seeder		Seed		2-4		Indefinite	May resprout if only lightly scorched.	Williams (1998), Benson & McDougall (2005).
Dockrillia pugioniformis	Obligate Seeder		Seed				Indefinite		Benson & McDougall (2005).
Dodonaea viscosa	Resprouter				3-5				Williams (1998).
Doodia aspera	Resprouter				1-2			24.6kg/ha dry wt. 1yr after slash burn - not recorded up to 1yr after tractor cleared.	Floyd (1966).
Doryphora sassafras				Wind dispersal plumed seeds.					
Drosera		Seedling		Diaspore: seed.			3-6m	Probably killed.	Benson & McDougall

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
burmannii		recruitment not fire related.							(1995).
Drosera peltata	Resprouter	Germinate in 14 days without special treatment. Coloniser.		Diaspore: seed. No special dispersal morphology.	1-3	1-2yr		Resprouts, secondary juvenile period 2 years. Flowered March-April after January fire.	Benson & McDougall (1995).
Drosera spatulata	Resprouter				1-2	1 yr		Facultative resprouter. 100% scorch kills. Soil stored seed.	Benson & McDougall (1995), NPFR.
Echinopogon caespitosus	Resprouter		Fruit (dry indehiscent 1 seeded)	Diaspore adhesive.	1	<1		Found after high intensity fire.	Williams (1998), Benson & McDougall (2005).
Echinopogon mckiei	Resprouter		Fruit (dry indehiscent 1 seeded)	Diaspore adhesive, animal dispersed.					
Echinopogon ovatus	Resprouter		Fruit (dry indehiscent 1 seeded)	Diaspore adhesive, animal dispersed.				Survive 100% scorch. Root suckers.	NPFR, Benson & McDougall (2005).
Elaeocarpus holopetalus	Obligate Seeder	May take years						Probably killed	Benson & McDougall (1995).
Elaeocarpus reticulatus	Resprouter				3-5			After high intensity fire but seedlings may be killed	Benson & McDougall (1995), Chesterfield et al. (1991), NPFR.
Empodisma minus	Resprouter			No special dispersal mechanism.		1	Indefinite	Recruitment mainly after fire.	Benson & McDougall (2005).
Entolasia marginata	Resprouter		Fruit (dry indehiscent 1 seeded)				Indefinite	Fruit produced within 7 m of high intensity fire.	Benson & McDougall (2005).
Entolasia stricta	Resprouter		Fruit (dry indehiscent 1	Vigorous growth after fire. No		< 1yr	Indefinite	Survives 100% scorch - root suckers & basal	Bradstock et al. (1997), Lumley & Spencer

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
			seeded)	special dispersal mechanism.				shoots. Soil stored seed and clonal increaser. Recruitment mainly after fire. Fruit within 5 m of high intensity fire.	(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).
Epilobium billardierianum	Variable					<3m		Obligate seeder (NPFR-P). Resprouted after high intensity fire (P.Kubiak pers. comm)	NPFR, Benson & McDougall (1999).
Eragrostis curvula	Resprouter		Fruit (dry indehiscent 1 seeded)	In mud on cars. No particular mechanism for dispersal.				Seedlings grow rapidly after summer rain. Spring burning promotes rapid growth to full maturity in early summer.	Benson & McDougall (2005).
Eragrostis leptostachya	Resprouter		Fruit (dry indehiscent 1 seeded)					Flowering within 2 m of high intensity fire.	Benson & McDougall (2005).
Eragrostis molybdea	Resprouter		Fruit (dry indehiscent 1 seeded)	No particular mechanism for dispersal. Possible coloniser of bare sites.				Reprouts from base.	Benson & McDougall (2005).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Eriochilus cucullatus	Resprouter		Seed, winged		1-2				Williams (1998), Benson & McDougall (2005).
Eucalyptus acaciiformis	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.	4-7				Williams (1998).
Eucalyptus andrewsii	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Eucalyptus bridgesiana	Resprouter	Seeds require light for germination, optimum temperature 25 degrees C.	Seed	Dispersed locally by wind and gravity. No dormancy mechanism.	5-9		<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.	5-9				Williams (1998).
Eucalyptus cameronii	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.	5-9				Williams (1998).
Eucalyptus campanulata	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.	5-10			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	5-9				Williams (1998).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
				gravity.					
Eucalyptus eugenioides	Resprouter	No soil stored seedbank.	Seed	Dispersed locally.			100+		Benson & McDougall (1998).
Eucalyptus laevopinea	Resprouter	No dormancy.	Seed	Dispersed locally.	5-9		100+	Resprouter - lignotuber and coppice.	Gill (1981), Benson & McDougall (1998).
Eucalyptus ligustrina	Resprouter	No dormancy.	Seed	Dispersed locally.			Indefinite		Benson & McDougall (1998).
Eucalyptus melliodora	Resprouter	No dormancy.	Seed	Dispersed locally.	5-9		100+	Seedlings remarkable tolerance for being burnt.	Gill (1997), Leigh & Holgate (1979).
Eucalyptus nobilis	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.	5-10				Williams (1998).
Eucalyptus nova-anglica	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.	5-9				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.	5-9		100+	Epicormic, lignotuber and coppice. 66% seeds in woody fruit killed by fire. Lignotubers developed in seedlings 9-12 weeks old. Tree falls release dormant lignotubers.	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).
Eucalyptus radiata	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity. No dormancy mechanism.	3-6			Resprouter - lignotuber and coppice. Epicormics to survive 100% scorch.	Gill (1997), Gill & Ashton (1968), Gill (1981), NPFR.

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Eucalyptus retinens	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity. No dormancy mechanism.	4-8				Williams (1998).
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.	6-10		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 subtilior	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Eucalyptus williamsiana	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.					
Euchiton gymnocephalus	Obligate Seeder		Fruit	Coloniser.					NPFR.
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 & Slatyer (1976), Purdie (1977), NPFR.
Euchiton sphaericus	Obligate Seeder		Fruit	Coloniser.	<1		1-2	Probably killed by fire	NPFR, Benson & McDougall (1994).
Eustrephus latifolius	Resprouter		Seed	Bird dispersed.	3-5	3 m		Facultative resprouter.	NPFR, Williams (1998), Benson & McDougall (2005).
Exocarpos cupressiformis	Resprouter	Hard seed is difficult to	Fruit.	Limited root suckering. Hemi-	5-9		Indefinite.	Facultative resprouter. Fire resistant increaser. Survives	NPFR; Benson & McDougall (2001).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
		germinate.		parasite on roots of other plants, commonly eucalypts but also other species.				100% scorch by root suckers and basal sprouts. Resprouts with numerous suckers from lateral roots and from rootstock. Seedlings recorded <1y after fire.	
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 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.	2-3	<1		Resprouts from base.	Williams (1998), Benson & McDougall (2005).
Geranium potentilloides	Obligate Seeder			Diaspore: probably seed, possibly animal					NPFR.

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
				dispersed.					
Geranium solanderi	Obligate Seeder				1-2				
Geranium solanderi	Obligate Seeder				1-2				Williams (1998).
Gleichenia dicarpa	Resprouter							At ground level or below. Facultative resprouter - basal sprouts. Survives 100% scorch.	Benson & McDougall (1993), NPFR.
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.	1-3		<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.	1-3			pers.obs. Resprouter from basal sprouts. Survives 100% scorch. Probably resprouts from above ground level (taxon B).	Stewart (1996), NPFR. Benson & McDougall (1996).
Gonocarpus humilis								Flowers Nov.-Feb.	Benson & McDougall (1997).
Gonocarpus oreophilus	Resprouter								
Gonocarpus tetragynus	Variable	Seedlings <1yr after fire (Purdie, 1977). May occur on disturbed sites.		Diaspore: fruit. No particular dispersal mechanism. Episodic		2		Obligate Seeder (NPFR-CH, W?.) Facultative resprouter - regrowth & suckers from root stocks and lateral roots. Soil	NPFR, Benson & McDougall (1997).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
				recruitment mainly after fire.				stored seed. Seedlings recorded <1yr after fire.	
Gonocarpus teucrioides	Variable	Reproduction by sexual means in the first year.		Episodic recruitment mainly after fire. Seeds dispersed by wind.	2-4		<5	Soil stored seed. Resprouts from base.	Benson (1985), Keith (1996), Benson & McDougall (1997), NPFR, Clarke (1989).
Goodenia bellidifolia	Resprouter								
Goodenia hederacea	Variable	Mucilaginous 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. Seedlings recorded <1yr after fire. Resprouting plants reached maturity in about 2 yrs. Killed by high intensity crown fire at Tinkrameanah.	Purdie (1977), Benson & McDougall (1997), Pers. Obs.
Goodia lotifolia	Obligate seeder				2-3			Soil stored seed. Mature plants died out after previous fire. Present after latest fire.	Chesterfield et al. (1991), NPFR.
Grammitis billardieri	Obligate Seeder							Probably killed	Benson & McDougall (1993).
Gratiola peruviana	Resprouter				1-2				NPFR, Williams (1998).
Gymnoschoenus sphaerocephalus	Resprouter								
Haemodorum planifolium	Resprouter							Survives 100% scorch - basal sprouts.	Clemens & Franklin (1980), NPFR.

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Hakea eriantha	Obligate Seeder		Seed (winged)		4-8				NPFR, Williams (1998).
Hakea florulenta			Seed (winged)						
Hakea laevipes	Obligate Seeder		Seed (winged)						
Hakea microcarpa	Resprouter	Seed viability 81.2%. Water logging inhibits germination.	Seed (winged)	Gravity or short distance wind-dispersed.				Resprouts from lignotuber.	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 fraction 5%. Coloniser of disturbed sites.		Seedlings recorded 1 yr after fire and will establish in charcoal beds. Diaspore: seeds, ant-adapted.	1	>1 yr	5-30	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). Killed by crown fire at Tinkrameanah.	Fox (1988), Floyd (1966), Auld & O'Connell (1991), Purdie (1977), NPFR, Benson & McDougall (1996), Clarke (1989).
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	Obligate Seeder		Seed						NPFR.
Hibbertia dentata	Resprouter		Seed			1 yr		Resprout from base and flowering within 10 m after fire, some seedlings 10 m	Benson & McDougall (1995), NPFR.

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
								after fire	
Hibbertia obtusifolia	Variable	Within 1yr after fire (7020).	Seed	Seedlings within 1 yr	1-2			Resprout from suckers of roots and lateral root stock. Soil seedbank. Fire resistant increaser. Resprout from high intensity fire at Tinkrameanah.	Benson & McDougall (1995), Fox & Fox (1986), Purdie & Slatyer (1976), Siddiqi et al. (1976), Purdie (1977), Benwell (1998), NPFR.
Hibbertia riparia	Resprouter		Seed	Ant-adapted food body. No particular dispersal mechanism.	1-2		60+	From base	Benson & McDougall (1995), Benson & McDougall (1995).
Hibbertia scandens	Resprouter	Also soil stored seed germination. Reproduction by sexual means, by seed propagation between 1-5 yrs	Seed	Seeds dispersed by expulsion.			5-30	From base after high intensity fire	Benson & McDougall (1995), Fox & Fox (1986), NPFR, Clarke (1989).
Hibbertia serpyllifolia	Resprouter	Also soil stored seed germination	Seed			2 yr		Facultative resprouter - basal sprouts.	Benson & McDougall (1995), Bradstock et al. (1997), NPFR.
Hibbertia vestita	Resprouter		Seed					Facultative resprouter. Non-clonal decreaser. Soil seedbank.	Benwell (1998), NPFR.
Hibbertia villosa	Resprouter		Seed						
Hovea heterophylla	Resprouter								
Hovea lanceolata	Obligate Seeder				2-3				

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Hovea linearis	Resprouter			Diaspore: seed, hard-coated, adapted for ant dispersal.		<3 yr		Facultative resprouter - basal sprouts, survives 100% scorch. 100% scorch kills - soil stored seed. Decreaser. Resprouts from base, flowers within 3 years of fire.	Fox (1988), Benson & McDougall (1996), Clark (1988), NPFR, Benson & McDougall (1996).
Hovea pedunculata	Resprouter								
Hybanthus monopetalus	Obligate Seeder							100% scorch kills - soil stored seed.	NPFR.
Hydrocotyle geraniifolia	Obligate Seeder								
Hydrocotyle laxiflora	Obligate Seeder				1				NPFR, Williams (1998).
Hydrocotyle peduncularis	Obligate Seeder				1				Williams (1998).
Hydrocotyle tripartita	Obligate Seeder				1				Williams (1998).
Hymenophyllum bivalve			Spores	Dispersed by wind. Probably no dormancy mechanism.					
Hymenophyllum cupressiforme	Obligate Seeder		Spores					Spores. Epiphytic fern. widley distributed pre fire, not recorded after wildfire.	Chesterfield et al. (1991), NPFR.
Hymenophyllum flabellatum			Spores	Dispersed by wind. Probably no dormancy mechanism.					

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Hyparrhenia hirta	Resprouter		Fruit (dry indehiscent 1 seeded)	Wind & vehicles.				Encouraged by regular burning.	Benson & McDougall (2005).
Hypericum gramineum	Resprouter	Will recruit heavily after fire	Seed	Probably wind-dispersed.	1-2	1 yr	5-20	Will fruit within 3m after high intensity fire. Facultative root resprouter. Fire resistant decreaser. Also obligate seeder.	Benson & McDougall (1995), Lunt (1990), Purdie & Slatyer (1976), Dickinson & Kirkpatrick (1987), NPFR, Benson & McDougall (1995).
Hypericum japonicum	Resprouter								
Hypochaeris microcephala	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. Killed by high intensity crown fire and recovery by seed germination at Tinkrameanah.	Lunt (1990), Hamilton et al. (1991), Purdie & Slatyer (1976), Dickinson & Kirkpatrick (1987), Purdie (1977), NPFR, Clarke (1989), Pers. Obs.
Hypolepis glandulifera	Obligate Seeder		Spores					Probably killed	Benson & McDougall (1993), NPFR.
Hypoxis hygrometrica	Resprouter				1-2			Facultative resprouter	NPFR, Williams (1998).
Imperata cylindrica	Resprouter	No germination after application of smoke for 1 hr. May become dormant after low	Fruit (dry indehiscent 1 seeded)	Wind.	1	<1	Indefinite	Survives 100% scorch - root suckers. Absent from infrequently burnt sites. Stimulated by fire. Flowers prolifically within weeks of	Benson & McDougall (1993), Nieuwenhuis (1987), Gill (1981), NPFR, Benson & McDougall (2005).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
		intensity fire.						burning. Can be eliminated by regular mowing.	
Indigofera australis	Resprouter	Soil-stored seedbank.		Seedlings <1 yr after fire. Diaspore: hard-coated seed. No particular mechanism for dispersal.	2-3			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 indehiscent 1 seeded)		1				Williams (1998), Benson & McDougall (2005).
Isopogon petiolaris	Resprouter		Fruit (nut)						
Isotoma anethifolia	Resprouter		Seed						
Isotoma axillaris	Resprouter		Seed		1			Probably from base after fire.	Benson & McDougall (1997).
Jacksonia scoparia	Resprouter	Soil stored seedbank			3-4			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).
Juncus firmus	Resprouter								
Juncus remotiflorus	Resprouter								

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Kennedia rubicunda	Obligate Seeder	Soil stored seedbank. Reproduction sexual, by seed propagation between 1-5yrs.	Seed	vigorous recruitment after high intensity fire. Seeds dispersed by expulsion.	1-3		<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 obovata	Resprouter								
Kunzea opposita	Resprouter								
Kunzea parvifolia	Resprouter		Seed	Colonises open sites.					Benson & McDougall (1998).
Lachnagrostis filiformis	Obligate Seeder		Fruit (dry indehiscent 1 seeded)		<1		<1	Facultative resprouter. Not recorded in seedbank before fire. Regenerated from seed after intense autumn fire (flowered within 9m).	Williams (1998), Lunt (1990), NPFR.
Lagenifera gracilis	Resprouter							Probably resprouts at ground level or below	Benson & McDougall (1994).
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								
Laxmannia compacta	Resprouter								
Laxmannia gracilis	Obligate Seeder							Killed by fire after crown fire at Tinkrameanah.	Pers. Obs.

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
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 resprouter. First recorded 1m after fire.	Hamilton et al. (1991),Dickinson & Kirkpatrick (1987), Gill (1989, NPFR, Dickinson & Kirkpatrick (1987), Hamilton et al. (1991), Clarke (1989).
Lepidosperma limicola	Resprouter							Facultative resprouter - underground stocks. Relatively rare before hot spring fire, luxuriant growth after fire.	Siddiqi et al. (1976), NPFR.
Lepidosperma tortuosum	Resprouter								
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 gregarium	Resprouter	No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.					
Leptospermum minutifolium	Resprouter	No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.	3-4				Williams (1998).
Leptospermum novae-angliae	Variable	No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.	4-8				Williams (1998).
Leptospermum petersonii		No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.					Benson & McDougall (1989).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Leptospermum polygalifolium	Resprouter	No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.					
Leptospermum polygalifolium	Resprouter	No soil stored seedbank.	Seed	Dispersed locally by gravity and wind.				Resprouting after crown fire at Tinkrameanah.	Pers. Obs.
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 large reserves or starch. Flowering more abundant after fire.	Bradstock et al. (1997), Siddiqi et al. (1976), NPFR, Benson & McDougall (2005).
Leucopogon fraseri			Fruit	Adapted for dispersal by ingestion.					
Leucopogon lanceolatus	Resprouter		Fruit		2-3	< 2yr		From ground level after fire, flowering within 20 m of fire	Benson & McDougall (1995).
Leucopogon microphyllus			Fruit	Dispersal: ant-adapted food body.	4-5		5-20	Killed by high intensity fire, regenerates from soil-stored seed 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	Benson & McDougall (1995).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
								fire and flower following winter	
Leucopogon neoanglicus	Obligate Seeder	Soil stored seedbank which lasts for many years	Fruit	Will recruit in the absence of fire				pers. obs.	
Lindsaea linearis	Resprouter							At ground level or below	Benson & McDougall (1993).
Lissanthe strigosa	Resprouter		Fruit	Adapted for dispersal by ingestion.	2-3			Resprouts from base after high intensity fire, one plant flowering within 9 months.	Benson & McDougall (1995).
Logania albiflora	Resprouter				2-4			Resprouts from base after high intensity fire.	Benson & McDougall (1997).
Lomandra bracteata			Seed						
Lomandra confertifolia	Resprouter		Seed						
Lomandra confertifolia	Resprouter		Seed					Facultative and obligate resprouter.	NPFR.
Lomandra filiformis	Resprouter		Seed		2-3			Obligate Seeder (NPFR-E). Facultative and obligate resprouter. Rhizome. Soil seedbank. Fire resistant increaser.	Fox & Fox (1986), Purdie & Slatyer (1976), Purdie (1977), Bradstock et al. (1997), NPFR.
Lomandra filiformis	Resprouter	Recruitment mainly after fire.	Seed	No special dispersal morphology.	2-3			Rhizomes.	Benson & McDougall (2005).
Lomandra longifolia	Resprouter	Reproduction sexual, reproducing by	Seed	Ant adapted elaiosome.	2-3	1	5-30	Obligate Seeder (E). Facultative and obligate resprouter. Clonal	Hamilton et al. (1991), Fox et al. (1979), Leigh & Holgate (1979),

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
		seed propagation beween 1-5 yrs.						decreaser. Survives 100% scorch - root suckers. Fire resistant increaser. Clonal decreaser.	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				3-6				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 abundantly only in first year after fire has destroyed previous shoot system, predominantly in second summer after flowering.	Bradstock (1990), Beadle (1940), Keith (1996), Gill (1997), NPFR, Benson & McDougall (2000), Benson & McDougall (2000).
Luzula flaccida	Obligate Seeder								
Lycopodiella lateralis	Resprouter		Spores						
Lycopodium deuterodensum	Resprouter		Spores						
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).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Medicago polymorpha	Obligate Seeder								
Melichrus procumbens	Resprouter							From ground level or below. Survives 100% scorch - basal sprouts.	Benson & McDougall (1995), NPFR.
Melichrus urceolatus	Resprouter			No seedlings within 1 yr of fire. Diaspore: fruit, adaptation for dispersal by ingestion.	2-3			From rootstock. Facultative root resprouter. Fire resistant decreaser. Resprouting after high intensity crown fire at Tinkrameanah.	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).
Microlaena stipoides	Resprouter	Total germination 25 days. Little dormancy. Germination slow if under 10C and develop slowly.	Fruit (dry indehiscent 1 seeded).	No particular mechanism for dispersal.	1	<1		Flowers at anytime of the year.	Williams (1998), Benson & McDougall (2005).
Microsorum scandens	Obligate Seeder							Spores.	NPFR.
Microtis parviflora	Resprouter	Readily germinates & colonises new sites especially after disturbance.	Seed, winged		1-2		Indefinite		Benson & McDougall (2005).
Mirbelia	Resprouter		Seed					Stems killed resprouts from	Benson & McDougall

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
rubiifolia								root suckers	(1996).
Mirbelia speciosa	Obligate Seeder	Soil stored seedbank	Seed					Killed	Benson & McDougall (1996).
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 & Holgate (1979), Purdie & Slatyer (1976), Purdie (1977), Benwell (1998), NPFR.
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).
Muellerina eucalyptoides	Resprouter			Bird and bat dispersal.	4-7			Resprouter after low - medium intensity fire, with host canopy <100% scorched.	Benson & McDougall (1997), Williams (1998).
Murdannia graminea	Resprouter								
Notelaea linearis	Resprouter								
Notelaea longifolia	Resprouter	Reproduction sexual, reproducing by seed propagation between 1-5 yrs.	Seed	Dispersed by animals.	3-6	<2	30+	Survives fire by suckering. Resprouted after high intensity fire.	Benson & Howell (1994), Benson & McDougall (1999), Clarke (1989).
Notelaea sp. A.	Resprouter								

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Notodanthonia longifolia	Resprouter		Fruit (dry indehiscent 1 seeded)						Benson & McDougall (2005).
Olearia alpicola			Fruit						
Olearia chrysophylla			Fruit						
Olearia oppositifolia	Obligate Seeder		Fruit						
Olearia ramosissima	Obligate Seeder		Fruit						
Olearia ramulosa	Obligate Seeder		Fruit						
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 hispida	Resprouter		Seed	No particular morphology for dispersal.	2-3			Survives 100% scorch - basal sprouts.	NPFR, Benson & McDougall (2000).
Oplismenus aemulus	Obligate Seeder		Fruit (dry indehiscent 1 seeded).	No special dispersal morphology. Coloniser of bare shady sites.	1	<1	Indefinite	Flowering 5 m after high intensity fire.	Williams (1998), Benson & McDougall (2005).
Oplismenus imbecillis	Obligate Seeder		Fruit (dry indehiscent 1 seeded).	Bird dispersed. Coloniser of bare sites.	1		Indefinite	Flowers at anytime of the year.	Williams (1998), Benson & McDougall (2005).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Orthoceras strictum	Resprouter		Seed		1-3	2	Indefinite	Obligate self pollinating.	Williams (1998), Benson & McDougall (2005).
Oxalis chnoodes	Resprouter								
Oxalis perennans	Variable.							Resprouter. Minor Obligate seeder. Seedlings not flowered within 9m of autumn fire.	Lunt (1990).
Ozothamnus diosmifolius	Resprouter		Fruit		2-4			Killed by high intensity fire, few resprout from base, stem resprouter under lower fire intensity, scattered germinations	Benson & McDougall (1994), Williams (1998).
Pandorea pandorana	Variable	Reproducing by seed propagation between 1-5 years of age.		Seeds dispersed by wind.	2-4	< 1yr	5-30	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 queenslandicum	Resprouter		Inflorescence						
Parsonsia straminea	Obligate Seeder				2-4			Probably killed	Benson & McDougall (1993), NPFR, Williams (1998).
Paspalidium constrictum	Resprouter		Inflorescence						
Paspalidium distans	Resprouter		Inflorescence	Colonises disturbed sites. Resilient and persists despite mowing.	1				Williams (1998), Benson & McDougall (2005).
Patersonia glabrata	Resprouter							Non-clonal decreaser. Soil seed bank.	Benwell (1998), Roche et al. (1997).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Patersonia sericea	Resprouter							Transient seedbank. Non-clonal decreaser. No veg. spread.	Clark (1988), Bradstock et al. (1997), Lumley & Spencer (1990).
Pelargonium australe	Resprouter	Reproduction sexual, by seed propagation in first year.	Fruit	Seeds dispersed by wind.			<5		NPFR, Clarke (1989).
Pellaea nana	Resprouter		Spores	Wind-dispersed. Probably no dormancy mechanism.	2-3				Williams (1998).
Pennisetum alopecuroides	Resprouter		Fruit (dry indehiscent 1 seeded)	Wind dispersal & adhesion.	1				Williams (1998), Benson & McDougall (2005).
Persicaria decipiens								Probably resprouts. Flowering within 5m after high intensity fire.	Benson & McDougall (1999).
Persoonia cornifolia	Resprouter		Fruit						
Persoonia oleoides	Resprouter		Fruit						
Petrophile canescens	Resprouter		Fruit (nut)	Gravity dispersed locally				Stems killed, resprouts from base. Canopy seedbank. Non-clonal decreaser.	Benwell (1998), Benson & McDougall (2000).
Philotheca epilosa	Obligate Seeder								
Phragmites australis	Resprouter	Germination in NSW low but consistent. Germination only	Fruit (dry indehiscent 1 seeded)	Spreads extensively by horizontal rhizomes. Dies	1-2	<2	Indefinite		Williams (1998), Benson & McDougall (2005).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
		occurs in a narrow range of habitats.		back after frosts.					
Phyllanthus gunnii	Variable		Seed	Explosive	1-3			Resprouter from base (3453, 4264). Obligate Seeder (NPFR-W).	Benson & Howell (1994), Benson & McDougall (1995), NPFR.
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).
Pimelea linifolia	Resprouter				2-3				Williams (1998).
Pittosporum multiflorum	Resprouter				2-5				Williams (1998).
Plantago debilis	Resprouter				1-2				Williams (1998).
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).
Platysace lanceolata	Variable			Seeds dispersed by wind.	2-4	2-4	<5	Resprouts + numerous seedlings and can be killed, juvenile period 2 yrs after high intensity fire or 4 years after low	Benson & McDougall (1993), Fox (1988), Clarke (1989).
Plectranthus graveolens	Resprouter								

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Poa labillardieri	Resprouter	Total germination approx. 39 days.	Fruit (dry indehiscent 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).
Poa queenslandica	Resprouter		Fruit (dry indehiscent 1 seeded)			<1		Flowers anytime in response to seasonal conditions.	Benson & McDougall (2005).
Poa sieberiana	Resprouter		Fruit (dry indehiscent 1 seeded)		1-2			Facultative resprouter. No mortality when grazed and burnt.	Lunt (1990), Leigh & Holgate (1979), Keith (1996), NPFR.
Podolepis jaceioides	Resprouter		Fruit					Perennial.	Lunt (1990).
Podolepis neglecta	Resprouter		Fruit						
Podolobium ilicifolium	Resprouter		Seed		2-3			Stems killed, from base. 100% scorch kills, soil stored seed.	Fox (1988), Benson & McDougall (1996), NPFR.
Polycarpon tetraphyllum	Obligate Seeder	Reproduced by sexual means.		Seeds dispersed by wind.	1		1		Clarke (1989), Williams (1998).
Polygala japonica								Possibly resprouts.	Benson & McDougall (1999).
Pomaderris nitidula	Resprouter		Seed		3-6				Williams (1998).
Pomax umbellata	Obligate Seeder	Reproduction by sexual means, reproducing by seed propagation in the first year.	Seed	Ejected ballistically when ripe capsules touched (?and by wind). Coloniser. Soil stored seedbank.	<1y		<5	Soil stored seed - no veg. regeneration in dry heath. 100% scorch kills.	Benson & McDougall (2000), Benwell (1998), NPFR, Clarke (1989).
Poranthera ericifolia					1		1-5	Fire sensitive. Individuals all disappear within 5yrs.	Benson (1985).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
								died out before fire, re-appeared after low intensity fire.	
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).
Portulaca oleracea	Obligate Seeder								
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 nivea	Obligate Seeder		Seed						
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).
Pteridium esculentum	Resprouter	Dormant rhizome buds may remain dormant for at least 10 years.	Spores	Wind-dispersed. Probably no dormancy mechanism.	3-6	< 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	Fox (1988), Benson (1985), Barker (1990), Hamilton et al. (1991), Fox et al. (1979), Keith (1996), Dickinson & Kirkpatrick (1987), Cremer & Mount (1965),

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
								fire, autumn fire not	NPFR, Benson & McDougall (1993).
Pteris umbrosa	Resprouter		Spores		2-4				Williams (1998).
Pterostylis daintreana	Resprouter		Seed			<1	Indefinite	Fruiting within 31 weeks of high intensity fire.	Benson & McDougall (2005).
Pterostylis decurva	Resprouter		Seed		1-3		Indefinite		NPFR, Williams (1998), Benson & McDougall (2005).
Pterostylis longifolia	Resprouter		Seed		1-3	<1	Indefinite	Flowering 24-33 weeks after high intensity fire.	Williams (1998), Benson & McDougall (2005).
Pterostylis pedunculata	Resprouter		Seed				Indefinite		Benson & McDougall (2005).
Pultenaea foliolosa	Obligate Seeder		Seed						
Pultenaea villosa			Seed						
Pyrrosia rupestris	Obligate Seeder		Spores					Probably killed. Spores.	Benson & McDougall (1993), Chesterfield et al. (1991), NPFR.
Ranunculus lappaceus	Resprouter		Fruit (achene)	Morphology for dispersal by adhesion.	1-2				Benson & McDougall (2000).
Ranunculus sessiliflorus	Resprouter		Fruit (achene)	No particular morphology for dispersal.	<1y		<1y		Benson & McDougall (2000).
Rhytidosporum procumbens	Resprouter							One plant resprouted and flowered <10m after high intensity fire, but most plants were seedlings.	Benson & McDougall (1999).
Rostellularia adscendens	Obligate Seeder				1				Williams (1998).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
Rubus discolor	Resprouter		Infructescence	Fleshy edible fruits or seeds animal-dispersed e.g. foxes, birds. Roots suckering, stems layering with arching canes.	3-6		Indef.	Probably resprouts from base and root suckers.	Benson & McDougall (2000).
Rubus moluccanus			Infructescence	Fleshy edible fruits, vertebrate adapted dispersal.					Benson & McDougall (2000).
Rubus nebulosus			Infructescence	Fleshy fruit.					Benson & McDougall (2000).
Rubus parvifolius	Resprouter		Infructescence	Attractive fleshy edible fruits, vertebrate adapted dispersal. Vegetative spread.	2-3		Indef.	Probably resprouts.	Benson & McDougall (2000).
Rumex brownii	Resprouter					<5m		Resprouted after high intensity fire.	Benson & McDougall (1999).
Rumohra adiantiformis			Spores	Wind-dispersed. Probably no dormancy mechanism.					
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,	NPFR, Dickinson & Kirkpatrick (1987), Lunt (1990).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
								1m after fire in grassy forest.	
Schoenus melanostachys	Resprouter							Obligate resprouter.	NPFR.
Scleria mackaviensis	Obligate Seeder								
Scutellaria humilis	Obligate Seeder								
Senecio amygdalifolius	Obligate Seeder		Fruit (achene)						
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 madagascariensis	Obligate Seeder		Fruit (achene)						
Senecio prenanthoides	Obligate Seeder		Fruit (achene)	Probably wind-dispersed.					
Setaria pumila	Obligate Seeder		Fruit (dry indehiscent 1 seeded)	No particular morphology for dispersal.	1		<1		Williams (1998), Benson & McDougall (2005).
Sigesbeckia orientalis	Obligate Seeder	Vigorous immediately after fire			< 1yr			Killed, germinates vigorously from soil stored seed immediately after fire, will flower within 11 wks to 4 m and may fruit within 16 wks	Benson & McDougall (1994), NPFR.
Smilax australis	Resprouter	Reproduction sexual, reproducing by seed propagation between 1-5yrs.	Fruit (black berry)	Seeds dispersed by animals, vertebrates & ants.			5-30	Survives 100% scorch - basal sprouts. Prolific flowering after fire. Flowers all year round. Vigorous growth after high	Melick & Ashton (1991), NPFR, Jones (1983), Clarke (1989), Benson & McDougall (2005).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
								intensity fire.	
Solanum aviculare	Obligate Seeder				2-3			Seedling regeneration. Present 7m after hot fire.	Chesterfield et al. (1991), Gill (1981), NPFR.
Solanum brownii	Resprouter				2-3				Williams (1998).
Solanum campanulatum	Obligate Seeder								
Solanum cleistogamum	Obligate Seeder								
Solanum prinophyllum	Obligate Seeder				2-4				Williams (1998).
Solenogyne bellioides	Resprouter							Probably resprouts from ground level or below	Benson & McDougall (1994).
Sorghum leiocladum	Resprouter		Fruit (dry indehiscent 1 seeded)		1				Williams (1998), Benson & McDougall (2005).
Spiranthes sinensis	Resprouter		Seed		1-3		<5	Self pollinating.	Williams (1998), Benson & McDougall (2005).
Stackhousia monogyna	Variable				1-2			Obligate Seeder (CH, BU). Facultative resprouter (W, WO, E?). 100% scorch kills - soil seed storage.	Lunt (1990), NPFR, Williams (1998).
Stackhousia muricata	Resprouter								
Stackhousia viminea	Obligate Seeder				1-2				Keith (1996), NPFR.
Stellaria angustifolia	Obligate Seeder		Seed	No particular dispersal morphology.	1				Williams (1998).
Stephania japonica	Resprouter	Reproduction both sexual and		Seeds dispersed by animals.	2-3		<5	Facultative resprouter - from base after high	Benson & McDougall (1997), NPFR, Clarke

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
		vegetative, by seed propagation in first year.						intensity fire.	(1989).
Sticherus lobatus	Resprouter							At ground level. Spores. Survives 100% scorch by basal sprouts.	Benson & McDougall (1993), NPFR.
Stylidium graminifolium	Variable				2-3			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.
Swainsona reticulata	Obligate Seeder								
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								
Tetrastigma nitens	Resprouter				3-5				Williams (1998).
Thelymitra pauciflora	Resprouter		Seed			1	Indefinite	Flowers open on hot, sunny, humid days. Self compatible.	Benson & McDougall (2005).
Themeda triandra	Resprouter	Primary dormancy usually breaks slowly with storage up to 12 m or more. To break dormancy,	Fruit (dry indehiscent 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).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
		seeds need cold 4C for at least 1 month. Total germination 100 days.							
Thysanotus tuberosus	Variable							Obligate seeder (E?). Facultative resprouter (I, WO). Obligate resprouter (W, P). Common in areas burnt severely 2 years ago.	Bradfield (1981), Fox (1974), Benwell (1998), NPFR.
Trachymene incisa	Resprouter				1				Williams (1998).
Trachymene sp. nov.	Resprouter							Swollen stems usually protected between rocks: pers obs	
Trema aspera	Obligate Seeder				2-4				Gill (1981), Williams (1998).
Tricoryne elatior	Resprouter	fresh seed : 0% germination. 76% initial viability.			1-2			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).
Utricularia dichotoma	Resprouter	Recruitment mainly after fire.						Facultative resprouter. 100% scorch kills (BW) - soil stored seed. Carnivorous herb.	Benson & McDougall (1997), NPFR.
Vallisneria gigantea	Resprouter				1-2				Williams (1998).
Velleia paradoxa	Resprouter							Veg. regeneration.	Lunt (1990).
Veronica calycina	Resprouter				1-2				Williams (1998).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev.	Notes	References
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 muralis	Obligate Seeder		Fruit (dry indehiscent 1 seeded)	Adhesive for dispersal.	<1		<1		Benson & McDougall (2005).
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).
Xanthorrhoea malacophylla	Resprouter								Benson & McDougall (2005).
Xerochrysum bracteatum	Obligate Seeder	Disturbance related, fire or other	Fruit	Wind-dispersed.	1			Probably killed.	Benson & McDougall (1994), Williams (1998).
Xyris bracteata	Resprouter		Seed			1	Indefinite		Benson & McDougall (2005).
Zieria fraseri	Obligate Seeder								
Zieria smithii	Obligate Seeder								

3.6 Taxa of conservation significance

Only one taxon was found to be of federal significance *Eucalyptus scias* subsp. *apoda* no other species were found to be of state or federal significance, however of general significance was the occurrence of six RoTAP species. RoTAP as a guide of rarity is currently obsolete but still can be used for general purposes.

3.6.1 *Muehlenbeckia costata* K.L.Wilson & Mackinson 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: disturbance ephemeral with explosive population growth after fires and rapid declines. Though fires in quick succussion will not germinate seed, requires long interfire period.

Interactions with other organisms: all populations appear to become infested by a rust fungus at around 1 yr of age in both the field and in glasshouse seedlings. 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: generally in areas above 1100 m from Mount Kaputar to Bald Rock, Glen Innes, Backwater and a disjunct distribution in the Blue Mountains.

Distribution within the Mt Kaputar NP: Restricted to the summit of Mt Kaputar.

Habitat

Habitat: wholly restricted to the post disturbance environment on exposed granite, acid volcanic or sandstone surfaces.

Altitude: 500-1500 m.

Annual Rainfall: 600-1400 mm.

Abundance: boom and bust population strategy.

Substrate: Sheet granite and exposed rhyolitic outcrops and sandstone.

Exposure: fully exposed sites.

Management

Population size: many hundreds of individuals seen also growing on rock outcrops after high intensity fire. None found during current survey.

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

Threats: inappropriate fire regimes.

Management considerations: appropriate fire regimes is the only management criteria at this stage. Fires may need to have long intervals and be of high temperatures when they do occur.

Plate 20: Photograph of *Muehlenbeckia costata*.

3.6.2 Chiloglottis platyptera D.L.Jones (2KC-; Vulnerable on the TSC Act)

Taxonomy

Type: New South Wales; north of Dingo Gate, Barrington Topes, (*D.L.Jones 5093*) holo: CBG; iso CBG, NSW.

Reference: *The Orchadian*15: 37 (2005).

Family: Orchidaceae.

Synonymy: *Myrmechila platyptera* (D.L.Jones) D.L.Jones & M.A.Clem.

Common name: Barrington Tops Ant Orchid.

Published conservation status: 2KC- (Briggs & Leigh 1996).

Life history

Growth form: terrestrial herb .

Vegetative spread: none.

Longevity: unknown.

Primary juvenile period: unknown but likely to be within 1 yr.

Flowers: spring to summer.

Fruit/seed: summer.

Dispersal, establishment & growth: via seed.

Fire response: possibly resprouter under low intensity fire otherwise seeder.

Interactions with other organisms: none apparent.

Distribution

Botanical sub-regions: North Coast, Northern Tablelands, a Northern Tablelands Endemic.

General distribution: north from Barrington Tops.

Habitat

Habitat: found during a previous survey in wetter forests.

Altitude: 1000-1500 m.

Annual Rainfall: 800-1200 mm.

Abundance: scattered and in low numbers.

Substrate: granite only.

Exposure: fully exposed sites.

Management

Population size: unknown, found during previous surveys but in general are only known from a less than 100 individuals at any location.

Reserved: only currently known from 10 locations across 300 km. Barrington Tops NP, Oxley Wild Rivers NP, Ben Halls Gap NP, Tomalla Nature Reserve, Butterleaf National Park and State Conservation Area.

Threats: unknown but probably grazing and clearing.

Management considerations: a targeted survey for this species is warranted.

Plate 21: Image of *Chiloglottis platyptera* taken from http://www.orchidsonline.com.au/node/9430.

3.6.3 Agiortia cicatricata (J.M.Powell) Quinn (3RCa)

Taxonomy

Reference: *Australian Systematic Botany* 18: 451 (2005).

Family: Epacridaceae.

Affinities: non apparent.

Synonymy: *Leucopogon cicatricatus, Leucopogon* sp. B.

Derivation of name: in reference to the leaf.

Common name: none apparent.

Published conservation status: 3RCa (Hunter & Richards 1995).

Life history

Growth form: shrub to 1.5 m tall.

Vegetative spread: none.

Longevity: unknown but probably long lived (> 50 yrs).

Primary juvenile period: unknown but likely to be within 5 yrs.

Flowers: spring to summer.

Fruit/seed: summer.

Dispersal, establishment & growth: via fruit.

Fire response: obligate seeder with soil stored seed viable for many years.

Interactions with other organisms: none apparent.

Distribution

Botanical sub-regions: North Coast, Northern Tablelands.

General distribution: highly disjunct from Girraween National Park to Werrikimbe.

Habitat

Habitat: found restricted to rock outcrops or their margins on shallow and skeletal soils.

Altitude: 1000-1500 m.

Annual Rainfall: 800-1200 mm.

Abundance: scattered and in low numbers.

Substrate: granite only.

Exposure: fully exposed sites.

Management

Population size: potentially restricted to Mt Scott but not in high numbers.

Reserved: Girraween National Park, Butterleaf National Park, Cathedra Rock National Park and Werrikimbe National Park.

Threats: inappropriate fire regimes, particularly those of high frequency.

Plate 22: Photograph of *Agiortia cicatricata*.

3.6.4 Brachyloma saxicola J.T.Hunter (3RCa)

Taxonomy

Type: Wattleridge, Backwater, *J.T.Hunter s.n.*, 2 Nov. 1991 (*holo*: NSW; *iso*: NE).

Reference: *Telopea* 6: 5 (1994).

Family: Epacridaceae.

Affinities: *Brachyloma daphnoides*.

Synonymy: *Brachyloma daphnoides* in *pro. parte*.

Derivation of name: *saxi* meaning rock and *cola* meaning loving.

Common name: none apparent.

Published conservation status: 2VC (Hunter & Williams 1994); 3RCa (Richards & Hunter 1997); 3RCa (Benson & Ashby 2000).

Life history

Growth form: shrub to 4 m tall.

Vegetative spread: none.

Longevity: unknown but probably long lived (> 50 yrs).

Primary juvenile period: unknown but likely to be within 5 yrs.

Flowers: spring to summer.

Fruit/seed: summer.

Dispersal, establishment & growth: via fruit.

Fire response: obligate seeder with soil stored seed viable for many years.

Interactions with other organisms: none apparent.

Distribution

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

General distribution: found from Torrington in the north to Chaelundi in the south at higher altitudes.

Habitat

Habitat: found restricted to rock outcrops or their margins on shallow and skeletal soils.

Altitude: 1000-1500 m.

Annual Rainfall: 800-1200 mm.

Abundance: scattered and in low numbers.

Substrate: granite only.

Exposure: fully exposed sites.

Management

Population size: many populations throughout the rock outcrop areas of the reserve though none in very high numbers.

Reserved: Guy Fawkes River NP (Devils Forehead), Warra NP, Bolivia Hill NR, Torrington SRA, Butterleaf NP, Bezzants Lease, Gibraltar Range NP, Nymboida NP, Basket Swamp NP, Washpool NP (Western), Timbarra NP and Cathedral Rocks NP.

Threats: inappropriate fire regimes, particularly those of high frequency.

Plate 23: Photograph of *Brachyloma saxicola*.

3.6.5 *Callistemon pungens* Lumley & Spencer (3RCa)

Taxonomy

Type: New South Wales, Northern Tablelands, *c.* 3 km along road to Armidale from junction with road from Armidale/Dorrigo Road to Hillgrove, (*c.* 4 km from Highway), 30°33'S, 151°54'E, 21.xi.1983, *P.F.Lumley 1150* (*holo*: MEL; *iso*: NSW).

Reference: *Muelleria* 7: 253 (1991).

Family: Myrtaceae.

Affinities: close to *Callistemon citrinus* but characterized by purple stamens and pungent leaf tips.

Synonymy: known in cultivation for a number of years as *C. 'Lana'* and *C. 'gilesii'*.

Derivation of name: in reference to the pungent leaves.

Common name: none.

Published conservation status: Lumley and Spencer (1991) considered the species was vulnerable. Given a 3R by Briggs & Leigh (1996). Copeland and Hunter (2000) have given this species a 3RCa coding.

Life history

Growth form: shrub or small tree to 5 m tall with rigid branches.

Vegetative spread: none.

Longevity: unknown but apparently long lived.

Primary juvenile period: unknown.

Flowers: spring to Summer.

Fruit/seed: Autumn.

Dispersal, establishment & growth: seed.

Fire response: potentially a resprouter (Clarke & Fulloon 1999).

Interactions with other organisms: none apparent.

Distribution

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

General distribution: from Armidale to Stanthorpe.

Habitat

Habitat: restricted to shallow soils associated with creeks and rivers on granite or rhyolitic soils.

Altitude: 500-11000 m.

Annual Rainfall: 600-1000 mm.

Abundance: common and abundant along creek lines throughout the western margin of the tablelands.

Substrate: found on granite or rhyolite.

Exposure: fully exposed to partially protected.

Management

Population size: uncommon along major creek lines within the reserve and likely only in the hundreds at this stage.

Reserved: Ironbark NR, Kings Plains NP, Severn River NR, Mann River NR, Butterleaf NP, Bezzants Lease, Oxley Wild Rivers NP, Torrington SRA, Bolivia Hill NR, Arakoola NP, Warrabah NP and Sundown NP and at Goonoowiggal SCA.

Threats: none readily apparent apart form possible inappropriate fire regimes.

Management: will require further sampling to assess population size.

Plate 24: Photograph of *Callistemon pungens.*

3.6.6 *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 (1862).

Family: Rhamnaceae.

Affinities: Uncertain.

Synonymy: None.

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

Common name: Woolly Cryptandra.

Life history

Growth form: Branched shrub to 30cm tall.

Vegetative Spread: Not known

Longevity: Not known.

Primary Juvenile Period: Not Known

Flowers: Spring to Summer. Flowering observed in May and July.

Fruit/seed: Late summer to autumn.

Dispersal, establishment & growth: Via seed.

Fire response: Not known but may be an obligate seeder.

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

Habitat

Habitat: Growing in high altitude shrublands and mallee woodlands on granite geology. Usually in heath and heathy forests in exposed sites with shallow sandy or rocky soils.

Altitude: 700-1225 m.

Distribution

Botanical subdivisions: Northern Tablelands.

General Distribution: From the Liverpool Range, Central Tablelands with scattered localities on the Northern Tablelands north to Girraween National Park in Queensland.

Distribution within Study Area: Restricted to rock outcrops at high altitude.

Conservation

Conservation Status: 3RCa.

Reservation status: Boonoo Boonoo National Park, Bolivia Hill Nature Reserve, Butterleaf National Park, Gibraltar Range National Park, New England National Park and Werrikimbe National Park. Also Girraween National Park in Queensland.

Abundance: Apparently rare in New South Wales and not common in the study area. Found usually as small clumped populations, scattered throughout the region.

Threats: Not known.

Management

Management considerations: Not known.

Plate 25: Photograph of *Cryptandra lanosiflora*.

3.6.7 *Eucalyptus codonocarpa* Blakely & McKie [3RC-]

Taxonomy

Type: Pheasant Mountain, 3.2 km NE of Backwater, N.S.W. 30th October 1929, *E.N. McKie, T. Youman & W.F. Blakely. sn:* (Holo:NSW iso: Bri, K, L, Mel).

Reference: *Proceedings of the Linnean Society of New South Wales* 55: 589 (1930)

Family: Myrtaceae

Affinities: *Eucalyptus approximans*.

Synonymy: *Eucalyptus approximans* subsp *codonocarpa.*

Derivation of name: Refers to the bell shaped fruits

Common name: Bell fruited Mallee.

Life history

Growth form: A mallee to about six metres in height.

Vegetative Spread: None.

Longevity: Probably long-lived.

Primary Juvenile Period: Unknown

Flowers: Unknown.

Fruit/seed: Seed gradually released all year round.

Dispersal, establishment & growth:

Fire response: Resprouter.

Interactions with other organisms: Not known.

Habitat

Habitat: Rock outcrops at high altitude.

Altitude: 1050-1372 m.

Distribution

Botanical subdivisions: Northern Tablelands.

General Distribution: From the Cathedral Rock NP in scattered localities north to Girraween National NP in Queensland.

Distribution within Study Area: Restricted to the highest altitudes on rock outcrops predominantly north of the highway such as Waratah Trig and along the Cangai Spur.

Conservation

Conservation Status: 3RC- ; Large populations in several National Parks and Nature Reserve, a species coding of 3RCa is probably appropriate for this species.

Occurrence in Reserves: Butterleaf National Park, Cathedral Rock National Park, Gibraltar Range National Park, Warra National Park, Also in Queensland in Girraween National Park.

Abundance: Locally common on high altitude rock outcrops in several scattered localities on the Northern Tablelands of New South Wales. Within the study area the largest stands occur on top of Mt Scott.

Threats: Not considered threatened.

Management

Management considerations: No actions necessary.

Plate 26: Stand of *Eucalyptus codonocarpa*.

3.6.8 *Eucalyptus retinens* L.A.S.Johnson & K.D.Hill (2RC-)

Taxonomy

Type: New South Wales: Northern Tablelands: Dyamberin Station, Connaughtmans Creek area, *c.* 15 miles [24 km] NW of Ebor, *R.J.Turner 11*, 2.8.1954 (*holo*: NSW).

Reference: *Telopea* 4: 56 (1990).

Family: Myrtaceae.

Affinities: within the broader *E. cypellocarpa* complex but most closely related to *E. banksii* and *E. volcanica*.

Synonymy: *E.* sp. aff. *cypellocarpa* in many collections. *E. elaeophora* F.Muell. *pro. parte*. The taxonomy of this species has been a matter of debate. Recently Brooker & Kleinig (1998) have included *E. volcanica* within the circumscription of *E. retinens*. However, most would consider this an inadequate combination and the two taxa can be readily separated by their juvenile leaves being round and glaucous in the former and elongated and green in the latter. Recent studies within the *E. retinens* group (Hunter, *unpublished data*) indicate that there are at least two other taxa often included within *E. retinens*. These have added to the confused circumscription of this species and probably led Brooker & Kleinig (1998) to lump *E. volcanica* within *E. retinens*. A number of specimens identified as *E. retinens* in herbaria and in the field are likely to have been miss-identified. Due to this *E. retinens* is most likely rarer and more specialised than current records indicate.

Derivation of name: meaning retaining and in reference to the 'box' bark which is retained in this taxon.

Common name: Hillgrove Box.

Changes in conservation status: not considered to be at risk (Johnson & Hill 1990). 3RC- (Richards & Hunter 1997).

Life history

Growth form: Box barked tree usually 15 m tall but also to 20 m.

Vegetative spread: none.

Longevity: unknown

Primary juvenile period: unknown.

Flowers: unknown.

Fruit/seed: many seasons held on individuals and seeds released continuously.

Dispersal, establishment & growth: via seed.

Fire response: unknown.

Interactions with other organisms: none apparent.

Distribution

Botanical sub-regions: Northern Tablelands.

General distribution: mostly restricted to the Oxley Wild Rivers escarpment but also in forests further north around Butterleaf National Park and Capoompeta National Park.

Habitat

Habitat: usually steep gorge and escarpment country however isolated patches are also known in undulating forest country.

Altitude: 800-1200 m.

Abundance: scattered but often common when it is found. Extensive stands occur along the escarpment south-east of Armidale.

Substrate: on Metasediments and Granite.

Exposure: often fully exposed sites but also sheltered localities.

Management

Population size: only a small number of plants were seen within Bezzants Lease the likely population size would not exceed a hundred plants at this stage.

Reserved: Oxley Wild Rivers National Park, Guy Fawkes River National Park, Capoompeta National Park, Bezzants Lease.

Threats: none apparent but a high frequency of fire is likely to deplete populations.

Management considerations: research into the circumscription of this taxon and its relatives is warranted to enable proper definition of its conservation status. This species is generally restricted and sporadic in its distribution and no direct management is warranted.

Plate 27: Scan of *Eucalyptus retinens* buds and fruit (Taken from Hunter (2011).

3.6.9 *Hibbertia villosa* Conn [3KC-]

Taxonomy

Type: *Lander 526,* 3.x.1974, c. 1.5km S of 'The Haystack' on Wade's Road, Gibraltar Range National Park, Northern Tablelands, New South Wales (holo: NSW; iso: MEL).

Reference: *Muelleria* 7: 289 (1990).

Family: Dilleniaceae.

Affinities: none.

Synonymy: none.

Derivation of name: in reference to hairs i.e. villous all over.

Common name: none.

Life history

Growth form: shrub to fifty centimetres.

Vegetative Spread: none apparent.

Longevity: not known

Primary Juvenile Period: not known.

Flowers: Spring.

Fruit/seed: follicle.

Dispersal, establishment & growth: via seed.

Fire response: not known.

Interactions with other organisms: none apparent.

Habitat

Habitat: dry open forests and woodlands on granite.

Altitude: 900-1400 m

Distribution

Botanical subdivisions: Northern Tablelands.

General Distribution: endemic to the Northern Tablelands, only know from Guy Fawkes River National Park, Timbarra National Park, Butterleaf National Park, Gibraltar Range and Werrikimbe National Park.

Distribution within Study Area: widespread in granite areas.

Conservation

Conservation Status: 3KC-

Occurrence in reserves: Gibraltar Range National Park, Guy Fawkes River National Park, Nymboida National Park, Butterleaf NP, Butterleaf SCA, Bezzants Lease, Basket Swamp NP, Timbarra NP, Werrikimbe and Willi Willi National Park. Also recorded in western half of Mount Boss State Forest that was recently added to Werrikimbe National Park.

Abundance: locally common in dry open forests on granite.

Threats: not considered threatened.

Management

Management considerations: determine fire regeneration response.

Plate 28: Photograph of *Hibbertia villosa*. [P.Sheringham].

3.6.10 *Philotheca epilosa* (Paul G. Wilson) P.I.Forst. (3RCa)

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*, *Philotheca 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.

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.

Substrate: sheet granite.

Exposure: fully exposed.

Management

Population size: probably under 500 individuals within the area.

Reserved: found in Girraween NP, Bald Rock NP, Boonoo Boonoo NP, Butterleaf NP, Bezzants Lease, Demon NR, Bolivia Hill NR and the Torrington SRA.

Threats: inappropriate fire regimes and trampling.

3.6.11 *Other taxa of conservation significance*

Acacia mitchellii is a pinnate-leaved shrub which has a disjunct distribution from Victoria and South Australia through to the Northern Tablelands of New South Wales. *A. mitchellii* is locally common in the Gibraltar Range National Park growing in dry open forests and woodlands on granite. The disjunct occurrence of the population of *Acacia mitchelii* in Warra NP is considered of regional conservation significance. The species is also known from Cathedral Rock NP, Guy Fawkes River, Butterleaf NP and Single NP (Clarke *et al.* 2000).

Plate 29: Photograph of *Acacia mitchellii*.

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.

Callitris rhomboidea this species is primarily found along the coast and ranges but has some scattered populations within the Northern Tablelands of NSW in particular within the Chaelundi and Guy Fawkes areas and further north to Bald Rock, this is yet another new disjunct distribution for this species and is significance. A large population was found growing on a single hillside within Bezzants Lease. This taxon should be protected from fire.

Plate X: Photograph of *Callitris rhomboidea* from Bezzants Lease.

Isotoma axillaris is a disjunct regionally rare herb. It is found often on rock outcrops on the NT and NWS of NSW. The species has previously been found within the New England Tablelands management area within Arakoola NP, Bald Rock & Boonoo

Boonoo NPs, Bluff River NR, Bolivia Hill NR, Kings Plains NP, Kwiambal NP, Severn River NR, Torrington SRA, Warrabah NP, Ironbark NR and Mt Yarrowyck NR. The occurrence within Warra is possibly of regional significance.

Tmesipteris parva is a species of coastal areas within rainforest but has not previously been found within the Northern Tablelands of NSW. The occurrence of this species within the very small rainforest patches within Butterleaf NP is of significance.

Plate 31: Photograph of *Tmesipteris parva* taken within Butterleaf NP.

***Trachymene* sp. nov** is a herb that has often been lumped within *Trachymene incisa*. The taxon has a disjunct occurrence across the Northern Tablelands and is uncommon in the region. It has previously been recorded within the reserves Butterleaf NP, Bald Rock NP, Boonoo Boonoo NP, Chaelundi NP, Guy Fawkes River NP, Cathedral Rock NP, Oxley Wild Rivers NP, Single NP and the Washpool Western Additions NP. This taxon has been known for some time but is yet to be formally described.

Discussion

4.1 General comments

Butterleaf National Park and State Conservation and Bezzants Lease complement each other greatly in terms of the communities found and reserved. This study area contains a number of listed threatened communities but also a number of communities that are highly disjunct or atypical and unusual in terms of their composition and likely to be quite unique. While Butterleaf NP and SCA contain important closed forest remnants and communities such as Community 4 & 6 which are highly unusual, Bezzants Lease contains by far the larger sample of Community 8 a listed endangered community and all of mapped endangered New England Peppermint for the study area. But more important, particularly in Bezzants Lease which has the majority, though some examples exist in the adjacent Butterleaf NP, is the old growth forests which have been largely undisturbed or have only had minor incursions for selective removal of timber. There is not a lot of this old growth even in Bezzants lease, but to have it at all, along with long periods of no grazing is incredibly important. This is a feature that should be held in high regard along with the listed endangered communities. This survey was conducted over only six days and many areas remain to be surveyed in order to complete a comprehensive understanding of the flora that occurs.

4.2 Fire

Fire is an infrequent yet pivotal event in the arid and semi-arid landscape (Porteners *et al.* 1997). Fire is a natural component of many communities within Australia, particularly within the southeast. 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. Much of this research has centred on temperate communities such as coastal forests and heaths. This research is also habitat and site specific and the usefulness of findings to other areas, even somewhat synonymous ones, is debatable. Table 12 shows the responses of some of the study area species to the effects of fire. Several of these observations may be based on mis-

classification of functional type or the taxa in question being a complex of yet undefined entities. Recent research suggests that other factors may also be involved; plant age (Hansen *et al.* 1991), seed age and dormancy requirements (Roche *et al*. 1997; Hunter *et al.* 1998), local population differences (Benwell 1998; Hunter 1999a), the cumulative effects of fires, stem size (Morrison & Renwick 2000), post fire climate (Cohn & Bradstock 2000), or presence of predators (Clarke *et al.* 1996; Cohn & Bradstock 2000). The application of fire response data at the community level based on the culmination of the responses of individual taxa is of debatable use. Morrison and Renwick (2000) warn that land managers should be aware that predictions on community dynamics based on placing species into categories according to perceived generalised response to fires are highly suspicious as no simple category can cover the potential range of post fire behaviours. Differences in fire responses within individual species and/or populations may exist nearby or within the same sites. 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 are more specific become available. Only research and constant monitoring can achieve this.

Other facets of fire management include the post-fire environment. Studies in temperate Australia have shown that grazing after fires can affect species composition significantly and this can be greater in smaller and/or patchy burns (Leigh & Holgate 1979). Grazing pressure from introduced rabbits, but also from native fauna such as Kangaroos, is accentuated in small burns if dry conditions follow in the post fire environment (Cohn & Bradstock 2000). There is a need to regulate feral animals such as rabbits if good seedling recruitment is to occur in the post fire environment (Cohn & Bradstock 2000).

Morrison and Renwick (2000) have highlighted a number of issues that may need to be considered when applying management burning regimes and these include:

- Population dynamics of different species will diverge after a prescribed fire in comparison to a wildfire.

- Any particular fire intensity affects some species more than others and any regime will favour a particular subset of species within a community
- No simple classification scheme of plant responses to fires can cover the potential range of post-fire behaviour
- To predict the fate of a population in response to a fire it is necessary to know whether the individuals have been subjected to 100% leaf scorch rather than whether it is fire-tolerant or fire-sensitive
- Species subject to previous fires will be more susceptible to further fires.
- It is clearly inappropriate to predict community responses from a limited study of one or a few species, because species will vary considerably even within a single category.

Prescribed fires probably will have little effect on the occurrence or intensity of the subsequent wildfire, low intensity fires have little effect on fuel loads, as such they will be inadequate as a fire-control measure.

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). Rigorously imposed fire regimes based on blocks in the landscape are 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 regime that creates a variability in chronosequences (Bradstock *et al.* 1995) and that some mature systems be maintained even though richness will decline. Some species even within a single assemblage are associated with more regular fires and others will only occur in longer unburned stands. Maintenance of chronosequences will require that the extent and effects 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).

Due to the very large gap in knowledge of responses of some communities, both in terms of frequency and intensity of fire, only a few broad management guidelines can be recommended.

- Collation of fire records, verbal reports and evidence from aerial photographs.
- When fires occur, accurate boundary maps of the extent of fires should be made. This needs to include accurate ground truthing.
- Map opportunistic evidence of lightning strikes.
- Site specific research needs to be conducted in each of the communities within the reserve.
- Old age stands (absence of fire) of all community types should be maintained if possible.
- Feral animal control will need to precede and follow or accompany any management burns particularly if weather conditions are dry post fire.

Most fires in western New South Wales (88%) are caused by lightning strikes (Day 1981). Much work has currently been carried out in semi-arid and arid regions of Australia in regards to fire. However, a great proportion of this effort has been disproportionately placed in the mallee lands of Mediterranean regions of Australia. The climatic conditions and vegetation in the study area, being primarily of summer or non-seasonal rainfall as opposed to winter rainfall, preclude effective cross comparisons. Even where similarly structured and climatically placed communities exist, the transfer and implementation of fire management practices from other areas can be a dangerous practice (Hunter 1998; Hunter 1999, Hunter 2003c). Ecotypic species responses are prevalent, a single taxon may posses the ability to resprout, or not, due to age or placement in a different community (Hansen *et al.* 1991; Roche *et al.* 1997; Benwell 1998; Lawler *et al.* 1998)

Changes are known to occur in the composition of algal and bryophyte crusts on soils after fire. These crusts help stabilise the soil surface against water erosion (Eldridge &

Bradstock 1994). The condition of these crusts can be crucial to soil surface regenerates and nutrient cycling (Cheal 1981; Eldridge & Bradstock 1994; Eldridge & Tozer 1997). Continued frequent burning has been shown to completely destroy cryptogamic crusts (Greene *et al.* 1990). Eldridge and Bradstock (1994) showed that cryptogamic crusts were best developed about 16 years after fire and that they begin to decrease after this time. The increase in litter from the overstorey species causes this reduction. Within the reserve very little development of cryptogamic crusts were noticed. This may largely be due to the long-term absence of fire across the reserve.

Although biodiversity is shown to increase after fire one should not be misled by a too great an emphasis on diversity at the cost of considering which species are contributing to the diversity and to richness at the landscape scale (Gill 1977; Noble 1981). Rigid prescriptions for fires will inevitably lead to the development of vegetation communities adapted to an inflexible fire regime with the consequent loss of many plant species (Heislers *et al.* 1981). For example, while fires were shown to increase local richness at Yathong it decreased the richness between sites and while richness declined with greater inter-fire periods differences between sites (beta diversity) increased (Cohn *et al.* 2002). A variety and range of age classes of each vegetation type is the most desirable outcome, with most vegetation being in the older age classes (Heislers *et al.* 1981). Variability and adaptability in fire regimes is the goal suggested by recent research (Bradstock *et al.* 1995; Conroy 1996).

4.2.1 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 are 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. These comments are corroborated by Binns (1991; 1995b) who observed the replaced of mesomorphic closed forest taxa with an understorey of grasses. Moore & 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 most of the areas within the current reserve 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.

4.2.2 Fire and areas of impeded drainage

Only a small number of areas exist with impeded drainage and these have wet heath and sedgeland communities. Research in sedgelands conducted within the nearby 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. The composition of wet heath sites is reported to be different due to time since fire. Williams (1995) suggested that wet heaths within the nearby Gibraltar Range National Park require a fire frequency of between 10-15 yrs and that although higher frequencies can be tolerated they are likely to be destructive.

4.2.3 Fire and granite outcrops

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 NR.

Hunter (1999) has shown that 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). 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.

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 in this region, a number of vegetation outcrops

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 many granitic outcrops. 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).

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; Grger & 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., and *Trochocarpa laurina*. 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; Grger & 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.

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.

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 by Hunter (1999) have shown that despite high viability, only a few germinations occurred in germination trials of outcrop taxa, 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.

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 (Hunter 1999), 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. 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.
importance rather than richness and density (i.e. diversity) (Bradstock *et al.* 1995).

Table 3: Suggested fire regimes for each of the five defined communities by the author. The suggestions made here are only broadly applicable.

Community	Suggested Fire Regimes
C1a: Eucalyptus radiata – E. campanulata – E. obliqua	Fire regime should be highly variable. Usually within a 100-300 yr cycle but with some areas burning more frequently i.e. 50-100 yrs.
C1b: Eucalyptus obliqua – E. brunnea – E. saligna	Fire regime should be highly variable. Usually within a 100-300 yr cycle but with some areas burning more frequently i.e. 50-100 yrs.
C1c: Eucalyptus campanulata – E. obliqua – E. saligna	Fire regime should be highly variable. Usually within a 100-300 yr cycle but with some areas burning more frequently i.e. 50-100 yrs.
C2: Eucalyptus acaciiformis – Angophora floribunda	10-50 yr cycles in general but maintain areas as long unburnt as well.
C3: Eucalyptus caliginosa – E. bridgesiana – E. laevopinea	10-50 yr cycles in general but maintain areas as long unburnt as well.
C4: Eucalyptus nova-anglica – E. acaciiformis – E. subtilior	10-30 yr cycles in general but maintain areas as long unburnt as well.
C5: Leucopogon neo-anglicus – Kunzea obovata – Leptospermum novae-angliae	Exclude fires from most areas, allow for irregular hot fires to occur but cycles of 100-300 yrs are likely natural regimes with only small areas being burnt with greater regularity or being perpetually excluded.
C6: Eucalyptus campanulata – E. radiata – E. williamsiana	No requirement for management burns. No two fires within a 20 yr period. Fires between 20 yrs to indefinite. Some areas maintained with high fire intervals
C7: Callicoma serratifolia – Orites excelsa	No requirement for fire. Exclude fire.
C8: Baeckea omissa – Epacris microphylla	Minimum 8-15 yr cycles but up to 30 yrs or longer fire free period.
C9: Leptospermum	8-15 yr cycles but up to 30 yrs or more fire free period.

Community	Suggested Fire Regimes
novae-angliae – Leptospermum polygalifolium	

4.3 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 *c*. 4% of species were introduced in origin, most of which were found associated with areas of high previous disturbance or around the margins of the reserves or where roads dissected. Exotic species more commonly occur along boundaries and tracks, but they usually are restricted to a short distance from the disturbance 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. Measures to reduce the incidence of introduced species may include:

- Keep any clearing activities to a minimum, this includes those associated with fence line maintenance and fire breaks if needed.
- The tracks should not be used in unfavourable weather unless necessary. Weeds are more likely to be spread more widely in muddy conditions.
- Stray livestock should be removed when found.
- Maintain weed eradication within the access road to Bezzants Lease, this access contains *Eragrostis curvula* and *Hyparrhenia hirta* and vehicles moving along it can bring seed of these species through the whole property

It is highly likely that the number and abundance of introduced species will increase dramatically under more favourable climatic conditions, particularly after winter rainfall events.

4.4 Management considerations

Literature review combined with the survey results indicate that the following management options should be considered:

- Co-ordination of weed programs with local authorities and neighbours to ensure infestations do not build up around boundaries.
- Monitoring of the permanently marked sites over different seasons to assess changes in the understorey will be of importance, especially since grazing leases have only recently been removed.
- Additional opportunistic floristic survey during a period of good rainfall or under different climatic conditions.
- Pursue Voluntary Conservation Agreements or other conservation initiatives in neighbouring lands that contain good quality remnants to maintain or improve links.
- Control of feral animals.
- Collation of fire records, verbal reports and evidence from aerial photographs.
- When fires occur, accurate boundary maps of the extent of fires should be made. This needs to include accurate ground truthing.
- Map opportunistic evidence of lightning strikes.
- Site specific research needs to be conducted in each of the communities within the reserves.
- Recording the fire response of individual species is needed to guide appropriate fire frequencies (in collaboration with DECC Bushfire Ecology Unit (Scientific Services Division). Specialist task that doesn't require specialist skills.
- Old age stands (absence of fire) of all community types should be maintained if possible.
- Feral animal control will need to precede or accompany any management burns particularly if weather conditions are dry post fire.
- Site specific research needs to be conducted in each of the communities within the reserves.

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Appendix A: Site Record Forms.

Narrabri Region: 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. Includes taxa found from previous survey sites sampled by other botanists.

Flora
of
Butterleaf National Park and State Conservation Area and Bezzant's Lease
(compiled by Dr John T. Hunter)

Fern & Fern Allies

Adiantaceae
Adiantum atroviride Bostock.....Maidenhair Fern
Adiantum aethiopicum L. .....Common Maidenhair
Adiantum formosum R.Br. .....Giant Maidenhair
Adiantum hispidulum Sw.....Rough Maidenhair
Cheilanthes sieberi Kunze
subsp. *sieberi*.....Narrow Rock Fern
Pellaea nana (Hook.) Bostock .....Sickle Fern

Aspleniaceae
Asplenium flaccidum G.Forst.
subsp. *flaccidum*.....Weeping Spleenwort
Asplenium flavellifolium Cav.....Necklace Fern

Blechnaceae
Blechnum cartilagineum Sweet.....Gristle Fern
Blechnum nudum (Labill.) Mett. ex Luerss. .....Fishbone Water Fern
Blechnum wattsii Tindale .....Hard Water Fern
Doodia aspera R.Br.....Prickly Rasp Fern
Doodia caudata (Cav.) R.Br.....Small Rasp Fern

Cyatheaceae
Cyathea australis (R.Br.) Domin .....Rough Treefern

Davalliaceae
Arthropteris tenella (G.Forst.) J.Sm. ex Hook.f. .....Fishbone Fern
Davallia solida
var. *pyxidata* (Cav.) Noot.....Hare's Foot Fern
Rumohra adiantiformis (Forst.f.) Ching.....Rumohra

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

Gleicheniaceae
Gleichenia dicarpa R.Br. .....Coral Fern
Sticherus lobatus N.A.Wakef. .....Spreading Shield Fern

Hymenophyllaceae
Crepidomanes venosum (R.Br.) Bostock.....Filmy Fern
Crepidomanes walleri (Watts) Tindale .....Filmy Fern
Hymenophyllum bivalve (G.Forster) Sw.....Filmy Fern
Hymenophyllum cupressiforme Labill. .....Common Filmy Fern

Hymenophyllum flabellatum Labill. .....Shiny Filmy Fern

Lindsaeaceae
Lindsaea linearis Sweet .....Screw Fern

Lycopodiaceae
Lycopodiella lateralis (R.Br.) B.Ollg. .....Slender Clubmoss
Lycopodium deuterodensum Herter .....Bushy Clubmoss

Polypodiaceae
Grammitis billardieri Willd. .....Finger Fern
Microsorum scandens (G.Forst.) Tindale .....Fragrant Fern
Platycerium bifurcatum (Cav.) C.Chr.
subsp. *bifurcatum* Elkhorn .....Elkhorn Fern
Pyrrosia confluens
var. *dielsii* (C.Chr.) Hovenkamp .....Horsehoe Felt Fern
Pyrrosia rupestris (R.Br.) Ching .....Rock Felt Fern

Psilotaceae
Tmesipteris parva Wakef. .....Fork Fern

Pteridaceae
Pteris umbrosa R.Br. .....Jungle Brake

Gymnosperm

Cupressaceae
Callitris rhomboidea R.Br. ex Rich. .....Port Jackson Pine

Monocotyledon

Anthericaceae
Arthropodium milleflorum (DC.) J.F.Macbr. .....Vanilla 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

Burmanniaceae
Burmannia disticha L. .....Burmannia

Commelinaceae
Murdannia graminea (R.Br.) G.Bruckn. .....Chocolate Lily

Cyperaceae
Baumea articulata (R.Br.) S.T.Blake .....Jointed Twig-rush
Baumea nuda (Steud.) S.T.Blake .....Twig-rush
Baumea rubiginosa (Forst.) Boeck. .....Twig-rush
Bulbostylis barbata (Rottb.) C.B.Clarke .....Club-rush
Bulbostylis densa (Wall.) Hand.-Mazz. .....Club-rush
Carex gaudichaudiana Kunth .....Sedge
Carex inversa R.Br. .....Knob Sedge
Carex lobolepis F.Muell. .....Sedge
Cyperus difformis L. .....Dirty Dora
Cyperus fulvus R.Br. .....Sticky Sedge
Cyperus gracilis R.Br. .....Sedge
Cyperus sphaeroideus L.A.S.Johnson & O.D.Evans .....Globe Kyllinga
Fimbristylis dichotoma (L.) Vahl .....Common Fringe Rush
Gahnia aspera (R.Br.) Spreng. .....Rough Saw Sedge

Gahnia sieberiana Kunth .....Red-fruit Saw Sedge
Gymnoschoenus sphaerocephalus (R.Br.) Hook.f.....Button Grass
Lepidosperma gunnii Boeck.....Little Sword Sedge
Lepidosperma laterale R.Br. .....Variable Saw Sedge
Lepidosperma limicola N.A.Wakef.....Razor Sword Sedge
Lepidosperma tortuosum F.Muell. .....Tortuous Rapier Sedge
Rhynchospora brownii Roem. & Schult.....Grassy Beak Rush
Schoenus apogon Roem. & Schult. .....Common Bog Rush
Schoenus melanostachys R.Br.....Club Rush
Scleria mackaviensis Boeck. .....White Head Sedge

Haemodoraceae
Haemodorum planifolium R.Br. .....Bloodroot

Hydrocharitaceae
Vallisneria gigantea Graeb.....Ribbonweed

Hypoxidaceae
Hypoxis hygrometrica Labill.....Golden Weather-grass

Iridaceae
Patersonia fragilis (Labill.) Asch. & Greaebn. .....Swamp Iris
Patersonia glabrata R.Br. .....Native Iris
Patersonia sericea R.Br. .....Silky Purple Flag

Juncaceae
Juncus alexandri L.A.S.Johnson
subsp. *alexandri* .....Rush
Juncus firmus L.A.S.Johnson .....Rush
Juncus fockei Buchenau .....Rush
Juncus phaeanthus L.A.S.Johnson .....Rush
Juncus remotiflorus L.A.S.Johnson.....Rush
Luzula flaccida (Buchenau) Edgar .....Grass Rush

Lomandraceae
Lomandra bracteata A.T.Lee.....Mat-rush
Lomandra confertifolia
subsp. *pallida* A.T.Lee.....Mat-rush
Lomandra filiformis
subsp. *coriacea* A.T.Lee .....Wattle Mat-rush
Lomandra longifolia Labill. .....Spiny-headed Mat-rush
Lomandra multiflora (R.Br.) Britten
subsp. *multiflora*.....Many-flowered Mat-rush

Luzuriagaceae
Eustrephus latifolius R.Br. ex Ker Gawl. .....Wombat Berry
Geitonoplesium cymosum (R.Br.) A.Cunn. ex Hook.....Scrambling Lily

Orchidaceae
Caladenia carnea R.Br.....Pink Fairy
Calochilus robertsonii Benth.....Purplish Beard Orchid
Chiloglottis platyptera D.L.Jones.....Bird Orchid
Chiloglottis trilabra Fitzg.....Bird Orchid
Cryptostylis subulata (Labill.) Rchb.f. .....Large Tongue-orchid
Cyrtostylis reniformis R.Br. .....Gnat Orchid
Dipodium variegatum D.L.Jones & M.A.Clem.....Hyacinth Orchid
Dockrillia linguiformis (Sw.) Brieger.....Tongue Orchid
Dockrillia pugioniformis (A.Cunn.) Rauschert .....Dagger Orchid
Eriochilus cucullatus (Labill.) Rchb.f. .....Parson's Band
Microtis parviflora R.Br.....Slender Onion Orchid

Orthoceras strictum R.Br. ..... Horned Orchid
Pterostylis daintreana Benth. ..... Greenhood
Pterostylis decurva R.S.Rogers ..... Summer Greenhood
Pterostylis longifolia R.Br. ..... Tall Greenhood
Pterostylis pedunculata R.Br. ..... Maroonhood
Spiranthes sinensis
subsp. *australis* (R.Br.) Kitam. ..... Ladies' Tresses
Thelymitra pauciflora R.Br. ..... Slender Sun Orchid

Phormiaceae
Dianella caerulea
var. *assera* R.J.F.Hend. ..... Blue Flax Lily
Dianella caerulea
var. *producta* R.J.F.Hend. ..... Rough Flax Lily
Dianella caerulea Sims
var. *caerulea* ..... Rough Flax Lily
Dianella revoluta R.Br.
var. *revoluta* ..... Spreading Flax Lily
Dianella tasmanica Hook.f. ..... Tasman Flax Lily

Poaceae
Aristida calycina R.Br.
var. *calycina* ..... Kerosene Grass
Aristida jerichoensis
subsp. *subspinulifera* Henrard ..... Jericho Wiregrass
Aristida personata Henrard ..... Purple Wiregrass
Austrodanthonia bipartita (Link) H.P.Linder ..... Wallaby Grass
Austrodanthonia monticola (Vickery) H.P.Linder ..... Wallaby Grass
Austrodanthonia racemosa (R.Br.) H.P.Linder
var. *racemosa* ..... Wallaby Grass
Austrodanthonia tenuior (Steud.) H.P.Linder ..... Wallaby Grass
Austrostipa aristiglumis (F.Muell.) S.W.L.Jacobs & J.Everett ..... Plains Grass
Austrostipa rudis
subsp .*nervosa* (Vickery) S.W.L.Jacobs & J.Everett ..... Speargrass
**Axonopus affinis* Chase ..... Narrow-leaved Carpet Grass
Chloris truncata R.Br. ..... Windmill Grass
Cymbopogon refractus (R.Br.) A.Camus ..... Barbed Wire Grass
**Cynodon dactylon* (L.) Pers. ..... Couch
Deyeuxia gunniana (Nees) Benth. ..... Bent
Deyeuxia parviseta Vickery
var. *parviseta* ..... Bent
Dichelachne micrantha (Cav.) Domin ..... Short-haired Plumegrass
Dichelachne parva B.K.Simon ..... Plumegrass
Digitaria breviglumis (Domin) Henrard ..... Finger Panic Grass
Digitaria ramularis (Trin.) Henrard ..... Finger Panic Grass
Echinopogon caespitosus C.E.Hubb.
var. *caespitosus* ..... Tufted Hedgehog Grass
Echinopogon mckiei C.E.Hubb. ..... Hedgehog Grass
Echinopogon ovatus (G.Forst.) P.Beauv. ..... Forest Hedgehog Grass
Entolasia marginata (R.Br.) Hughes ..... Bordered Panic
Entolasia stricta (R.Br.) Hughes ..... Wiry Panic
**Eragrostis curvula* (Schrad.) Nees ..... African Lovegrass
Eragrostis leptostachya Steud. ..... Paddock Lovegrass
Eragrostis molybdea Vickery ..... Granite Lovegrass
**Hyparrhenia hirta* (L.) Stapf ..... Coolatai Grass
Imperata cylindrica
var. *major* (Nees) C.E.Hubb ..... Blady Grass
Isachne globosa (Thunb.) Kuntze ..... Swamp Millet
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 queenslandicum Domin
var. *queenslandicum*.....Yadbila Grass
Paspalidium constrictum (Domin) C.E.Hubb.....Knottybutt Grass
Paspalidium distans (Trin.) Hughes .....Panic
Pennisetum alopecuroides (L.) Spreng.....Swamp Foxtail
Phragmites australis (Cav.) Trin ex Steud. .....Common Reed
Poa labillardieri Steud. .....Tussock
Poa queenslandica C.E.Hubb.....Poa
Poa sieberiana Spreng. .....Snow Grass
**Setaria pumila* (Poir.) Roem. & Schult. .....Pale Pigeon Grass
Sorghum leiocladum (Hack.) C.E.Hubb. .....Wild Sorghum
Themeda triandra Forssk. .....Kangaroo Grass
**Vulpia muralis* (Kunth) Nees .....Fescue

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. ex Benth. .....Scale Rush
Lepyrodia scariosa R.Br. .....Scale Rush

Smilaceae
Smilax australis R.Br.....Sarsaparilla

Xanthorrhoeaceae
Xanthorrhoea malacophylla D.J.Bedford.....Grasstree

Xyridaceae
Xyris bracteata R.Br.....Xyris

<u>Dicotyledon</u>

Acanthaceae
Rostellularia adscendens (R.Br.) R.M.Barker
subsp. *adscendens* .....Pink Justicia

Apiaceae
Actinotus gibbonsii F.Muell. .....Gibbons Flannel Flower
Centella asiatica (L.) Urb.....Pennywort
Daucus glochidiatus (Labill.) Fisch., C.A.Mey. & Ave-Lall. .....Native Carrot
Hydrocotyle geraniifolia F.Muell. .....Forest Pennywort
Hydrocotyle laxiflora DC. .....Stinking Pennywort
Hydrocotyle pedicellosa F.Muell. .....Pennywort
Hydrocotyle peduncularis R.Br. ex A.Rich. .....Small-leaved Pennywort
Hydrocotyle tripartita R.Br. ex A.Rich. .....Pennywort
Platysace ericoides (Sieber ex Spreng.) C.Norman .....Platysace
Platysace lanceolata (Labill.) Druce.....Shrubby Platysace
Trachymene incisa Rudge
subsp. *incisa* .....Native Carrot
Trachymene sp. nov. .....Granite Carrot

Apocynaceae
Parsonsia brownii (Britten) Pichon.....Mountain Silkpod

Parsonsia straminea (R.Br.) F.Muell. ..... Common Silkpod

Araliaceae
Astrotricha longifolia Benth. ..... Star-hair
Polyscias sambucifolia (Sieber ex DC.) Harms ..... Elderberry Panax

Asclepiadaceae
Tylophora paniculata R.Br. ..... Thin-leaved Tylophora

Asteraceae
Arrhenechthites mixta (A.Rich.) Belcher ..... Purple Fireweed
**Bidens pilosa* L. ..... Cobbler's Pegs
**Bidens subalternans* DC. ..... Greater Beggar's Ticks
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 radicans Steetz ex Lehm. ..... Daisy
Brachyscome spathulata Gaudich. ..... Daisy
Brachyscome stuartii Benth. ..... Granite Daisy
Calotis cuneifolia R.Br. ..... Purple Burr-daisy
Calotis lappulacea Benth. ..... Yellow Burr-daisy
Cassinia laevis R.Br. ..... Cough Bush
Cassinia leptocephala F.Muell. ..... Cassinia
Cassinia quinquefaria R.Br. ..... Rosemary Cassinia
Chrysocephalum apiculatum (Labill.) Steetz ..... Common Everlasting
Chrysocephalum semipapposum (Labill.) Steetz ..... Yellow Buttons
**Cirsium vulgare* (Savi) Ten. ..... Spear Thistle
**Conyza bonariensis* (L.) Cronq. ..... Flaxleaf Fleabane
**Conyza sumatrensis* (Retz.) E.Walker ..... Tall Fleabane
Coronidium elatum (A.Cunn. ex DC.) Paul G.Wilson ..... White Everlasting
Coronidium scorpioides (Labill.) Paul G.Wilson ..... Button Everlasting
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 spicata* (Lam.) Cabrera ..... Spiked Cudweed
**Hypochaeris microcephala*
var. *albiflora* (Kuntze) Cabrera ..... White Flatweed
**Hypochaeris radicata* L. ..... Catsear
Lagenifera gracilis Steetz ..... Slender Lagenophora
Lagenifera stipitata (Labill.) Druce ..... Blue Bottle-daisy
Olearia alpicola (F.Muell.) F.Muell. ex Benth. ..... Alpine Daisy Bush
Olearia chrysophylla (DC.) Benth. ..... Daisy Bush
Olearia oppositifolia (F.Muell.) Lander ..... Daisy Bush
Olearia ramosissima (DC.) Benth. ..... Daisy Bush
Olearia ramulosa (Labill.) Benth. ..... Daisy Bush
Ozothamnus diosmifolius (Vent.) DC. ..... White Dogwood
Podolepis jaceioides (Sims) Voss ..... Showy Copper-wire Daisy
Podolepis neglecta G.L.R.Davis ..... Copper-wire Daisy
Senecio amygdalifolius F.Muell. ..... Forest Fireweed
Senecio bipinnatisectus Belcher ..... Fireweed
Senecio biserratus Belcher ..... Fireweed
Senecio diaschides Drury ..... Fireweed
**Senecio madagascariensis* Poir. ..... Fireweed
Senecio minimus Poiret ..... Groundsel
Senecio prenanthoides A.Rich. ..... Fireweed
Senecio vagus
subsp. *eglandulosus* Ali ..... Gully Fireweed
Sigesbeckia australiensis D.L.Schulz ..... Sigesbeckia

Sigesbeckia orientalis L.
subsp. *orientalis* ..... Indian Weed
Solenogyne bellioides Cass. ..... Solenogyne
**Taraxacum officinale* Weber ..... Dandelion
Vernonia cinerea (L.) Less.
var. *cinerea* ..... Vernonia
Vittadinia cervicularis
var. *subcervicularis* N.T.Burb.. ..... Fuzzweed
Vittadinia hispidula
var. *setosa* N.T.Burb. ..... Fuzzweed
Xerochrysum bracteatum (Vent.) Tzvelev ..... Golden Everlasting
Xerochrysum viscosum (DC.) Tzvelev ..... Sticky Everlasting

Bignoniaceae
Pandorea pandorana (Andrews) Steenis ..... Wonga Wonga Vine

Brassicaceae
Cardamine paucijuga Turcz. ..... Bittercress
**Rapistrum rugosum* (L.) All. ..... Turnip Weed

Campanulaceae
Wahlenbergia ceracea Loth. ..... Bluebell
Wahlenbergia communis Carolin ..... Tufted Bluebell
Wahlenbergia gracilis (G.Forst.) A.DC. ..... Sprawling Bluebell
Wahlenbergia littoricola P.J.SM. ..... Bluebell
Wahlenbergia luteola P.J.Sm. ..... Bluebell
Wahlenbergia planifolia
subsp. *longipila* Carolin ex P.J.Sm. ..... Bluebell
Wahlenbergia stricta (R.Br.) Sweet ..... Bluebell

Caryophyllaceae
**Arenaria leptoclados* (Rchb.) Guss. ..... Arenaria
**Cerastium balearicum* Herm. ..... Lesser Mouse-ear Chickweed
* *Scleranthus biflorus* (J.R.Forst. & G.Forst.) Hook.f. ..... Scleranthus
Polycarpon tetraphyllum (L.) L. ..... Four-leaved Allseed
Stellaria angustifolia Hook. ..... Swamp Starwort

Casuarinaceae
Allocasuarina littoralis (Salisb.) L.A.S.Johnson ..... Black She-oak
Allocasuarina rigida (Miq.) L.A.S.Johnson
subsp. *rigida* ..... Rock She-oak
Allocasuarina torulosa (Aiton) L.A.S.Johnson ..... Forest She-oak

Celastraceae
Maytenus bilocularis (F.Muell.) Loes. ..... Orangebark
Maytenus silvestris Lander & L.A.S.Johnson ..... Narrow-leaved Orangebark

Chenopodiaceae
Chenopodium pumilio R.Br. ..... Goosefoot

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

Crassulaceae
Crassula sieberiana (Schult. & Schult.f.) Druce.....Australian Stonecrop

Cunoniaceae
Caldcluvia paniculosa (F.Muell.) Hoogland..... Soft Corkwood
Callicoma serratifolia Andrews..... Callicoma
Ceratopetalum apetalum D.Don..... Coachwood
Schizomeria ovata D.Don..... Crabapple

Dilleniaceae
Hibbertia acicularis (Labill.) F.Muell.....Sharp Guinea Flower
Hibbertia aspera DC.....Guinea Flower
Hibbertia dentata R.Br. ex DC.....Twining Guinea Flower
Hibbertia obtusifolia DC.....Grey Guinea Flower
Hibbertia riparia (R.Br. ex. DC.) Hoogl.....Common Guinea Flower
Hibbertia scandens (Willd.) K.D.Konig & J.Sims.....Climbing Guinea Flower
Hibbertia serpyllifolia R.Br. ex DC. .....Guinea Flower
Hibbertia vestita A.Cunn. ex Benth. .....Guinea Flower
Hibbertia villosa B.J.Conn.....Hairy Guinea Flower

Droseraceae
Drosera burmannii Vahl .....Burman's Sundew
Drosera peltata Thunb. .....Sundew
Drosera spatulata Labill. .....Sundew

Elaeocarpaceae
Elaeocarpus holopetalus F.Muell.....Black Olive Berry
Elaeocarpus reticulatus Sm.....Blueberry Ash

Epacridaceae
Agiortia cicatricata (J.Powell) C.J.Quinn .....Rock Beard Heath
Brachyloma saxicola J.T.Hunter .....Granite Daphne Heath
Epacris breviflora Stapf. .....Drumstick Heath
Epacris microphylla R.Br.
var. *microphylla* .....Coral Heath
Epacris obtusifolia Sm. .....Blunt-leaved Heath
Leucopogon fraseri A.Cunn. .....Fraser's Beard Heath
Leucopogon lanceolatus (Sm.) R.Br.
var. *lanceolatus*.....Lance-leaf 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
Lissanthe strigosa (Sm.) R.Br.
subsp. *strigosa*.....Peach Heath
Melichrus procumbens (Cav.) Druce.....Jam Tarts
Melichrus urceolatus R.Br. .....Urn Heath
Monotoca scoparia (Sm.) R.Br. .....Heath

Eriocaulaceae
Eriocaulon scariosum Sm. .....Eriocaulon

Euphorbiaceae
Amperea xiphoclada (Sieber ex Spreng.) Druce
var. *xiphoclada*.....Broom Spurge
Bertya cunninghamii Planch.....Spurge
Phyllanthus gunnii Hook.f.....Shrubby Spurge
Poranthera ericifolia Rudge.....Poranthera
Poranthera microphylla Brongn. .....Small Poranthera

Fabaceae

Acacia binervia (J.C.Wendl.) J.F.Macbr. ..... Coast Myall
Acacia falciformis DC. ..... Broad-leaved Hickory
Acacia filicifolia Cheel & M.B.Welch ..... Fern-leaved Wattle
Acacia fimbriata A.Cunn. ex G.Don. ..... Fringed Wattle
Acacia floribunda (Vent.) Willd. ..... White Sally
Acacia gunnii Benth. ..... Ploughshare Wattle
Acacia implexa Benth. ..... Hickory Wattle
Acacia irrorata Sieber ex Spreng.
subsp. *irrorata* ..... Blueskin
Acacia longifolia (Andrews) Willd.
subsp. *longifolia* ..... Sydney Golden Wattle
Acacia melanoxylon R.Br. ..... Blackwood
Acacia mitchellii Benth. ..... Mitchell's Wattle
Acacia myrtifolia (Sm.) Willd. ..... Red-stemmed Wattle
Acacia obtusifolia A.Cunn. ..... Thick-leaved Wattle
Acacia ulicifolia (Salisb.) Court ..... Prickly Moses
Acacia venulosa Benth. ..... Veiny Wattle
Acacia viscidula Benth. ..... Sticky Wattle
Aotus subglauca Blakely & McKie
var. *subglauca* ..... Aotus
Bossiaea neo-anglica F.Muell. ..... New England Bossiaea
Bossiaea scortechinii F.Muell. ..... Scortechini's Bossiaea
Desmodium gunnii Benth. ex J.D.Hook. ..... Slender Tick Trefoil
Desmodium varians (Labill.) Endl. ..... Slender Tick Trefoil
Dillwynia phylicoides A.Cunn. ..... Parrot Pea
Dillwynia sieberi Steud. ..... Parrot Pea
Glycine clandestina Wendl. ..... Twining Glycine
Glycine microphylla (Benth.) Tindale ..... Small-leaved Glycine
Glycine tabacina (Labill.) Benth. ..... Variable Glycine
Goodia lotifolia Salisb.
var. *lotifolia* Salisb. ..... Golden Tip
Hardenbergia violacea (Schneev.) Stearn ..... False Sarsaparilla
Hovea graniticola I.Thomps. ..... Granite Hovea
Hovea heterophylla A.Cunn. ex Hook.f. ..... Hovea
Hovea lanceolata Sims ..... Grey Hovea
Hovea linearis (Sm.) R.Br. ..... Hovea
Hovea pedunculata I.Thomps. ..... Hovea
Indigofera australis Willd. ..... Australian Indigo
Jacksonia scoparia R.Br. ..... Dogwood
Kennedia rubicunda (Schneev.) Vent. ..... Red Kennedy Pea
**Medicago polymorpha* L. ..... Burr Medic
Mirbelia rubiifolia (Andrews) G.Don. ..... Mirbelia
Mirbelia speciosa Sieber ex DC.
subsp. *speciosa* ..... Mirbelia
Podolobium ilicifolium (Andrews) Crisp & P.H.Weston ..... Prickly Shaggy Pea
Pultenaea foliolosa A.Cunn. ex Benth. ..... Bush Pea
Pultenaea villosa Willd. ..... Hairy Bush Pea
Swainsona reticulata J.M.Black ..... Kneed Swainson Pea

Geraniaceae

Geranium potentilloides L.'Her. ex DC.
var. *potentilloides* ..... Geranium
Geranium retrorsum L.'Her. ex DC. ..... Geranium
Geranium solanderi
var. *grande* Carolin ..... Native Geranium
Geranium solanderi Carolin
var. *solanderi* ..... Native Geranium
Pelargonium australe Willd. ..... Native Storksbill

Goodeniaceae
Goodenia bellidifolia Sm.
subsp. *bellidifolia* ..... Goodenia
Goodenia hederacea Sm.
subsp. *hederacea* ..... Ivy Goodenia
Goodenia rotundifolia R.Br. ..... Round-leaf Goodenia
Velleia paradoxa R.Br. ..... Velleia

Haloragaceae
Gonocarpus humilis Orchard ..... Raspwort
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

Lamiaceae
Ajuga australis R.Br. ..... Australian Bugal
Mentha diemenica Spreng. ..... Pennyroyal Mint
Mentha satureioides R.Br. ..... Mintbush
Plectranthus graveolens R.Br. ..... Cockspur Flower
Prostanthera nivea A.Cunn. ex Benth.
var. *nivea* ..... Showy Mint-bush
**Prunella vulgaris* L. ..... Self-heal
Scutellaria humilis R.Br. ..... Dwarf Skullcap

Lentibulariaceae
Utricularia dichotoma Labill. ..... Fairy Aprons

Lobeliaceae
Isotoma anethifolia Summerh. ..... Isotome
Isotoma axillaris Lindl. ..... Showy Isotome
Pratia purpurascens (R.Br.) F.Wimmer ..... Whiteroot

Loganiaceae
Logania albiflora (Andrews) Druce ..... Narrow-leaved Logania
Mitrasacme paludosa R.Br. ..... Mitrasacme

Loranthaceae
Amyema pendulum (Sieber ex Spreng.) Tiegh.
subsp. *pendulum* ..... Drooping Mistletoe
Muellerina eucalyptoides (DC.) Barlow ..... Mistletoe

Menispermaceae
Stephania japonica
var. *discolor* (Blume) Forman ..... Snake Vine

Monimiaceae
Doryphora sassafras Endl. ..... Sassafras

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
Baeckea omissa A.R.Bean ..... Fogotten Beackea

Callistemon linearis (Schrad. & Wendl.) Sweet.....Narrow-leaved Bottlebrush
Callistemon pityoides F.Muell.....Alpine Bottlebrush
Callistemon pungens Lumley & R.D.Spencer.....Pungent Bottlebrush
Callistemon sieberi DC. .....River Bottlebrush
Calytrix tetragona Labill. .....Fringe Myrtle
Eucalyptus acaciiformis H.Deane & Maiden .....Wattle-leaved Peppermint
Eucalyptus andrewsii Maiden .....New England Blackbutt
Eucalyptus bridgesiana R.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.....Mallee
Eucalyptus dalrympleana
subsp. *heptantha* L.A.S.Johnson .....Mountain Gum
Eucalyptus eugenioides Sieber ex Spreng. .....Thin-leaved Stringybark
Eucalyptus laevopinea R.Baker.....Silver-top Stringybark
Eucalyptus ligustrina DC. .....Privet-leaved Stringybark
Eucalyptus melliodora A.Cunn. ex Schauer.....Yellow Box
Eucalyptus nobilis L.A.S.Johnson & K.D.Hill .....Forest Ribbon Gum
Eucalyptus nova-anglica H.Deane & Maiden .....New England Peppermint
Eucalyptus obliqua L'Her. .....Messmate
Eucalyptus radiata
subsp. *sejuncta* L.A.S.Johnson & K.D.Hill .....Narrow-leaved Peppermint
Eucalyptus retinens L.A.S.Johnson & K.D.Hill .....Hillgrove Box
Eucalyptus saligna Sm. .....Sydney Blue Gum
Eucalyptus subtilior L.A.S.Johnson & K.D.Hill .....Stringybark
Eucalyptus williamsiana L.A.S.Johnson & K.D.Hill .....Williams Stringybark
Kunzea obovata Byrnes.....Kunzea
Kunzea opposite F.Muell. .....Opposite-leaved Kunzea
Kunzea parvifolia Schauer .....Violet Kunzea
Leptospermum arachnoides Gaertn. .....Spider 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 petersonii F.M.Bailey
subsp. *petersonii*.....Lemon-scented Teatree
Leptospermum polygalifolium
subsp. *montanum* Joy Thomps. .....Creek Tea-tree
Leptospermum polygalifolium
subsp. *transmontanum* Joy Thomps. .....Creek Tea-tree

Oleaceae
Notelaea linearis Benth. ..... Narrow-leaved Mock Olive
Notelaea longifolia Vent. .....Large Mock-Olive
Notelaea sp. A. .....Apple Mock Olive

Onagraceae
Epilobium billardierianum
subsp. *cinereum* (Rich) Raven & Engelhorn .....Hairy Willow Herb
Epilobium gunnianum Hausskn. .....Willow Herb
Epilobium hirtigerum A.Cunn. .....Willow Herb

Oxalidaceae
Oxalis chnoodes Lourteig.....Wood Sorrel
Oxalis perennans Haw. .....Wood Sorrel

Phytolaccaceae
**Phytolacca americana* L. .....Pokeweed
**Phytolacca octandra* L. .....Inkweed

Pittosporaceae
Billardiera scandens Sm.
var. *scandens* ..... Apple Dumplings
Bursaria longisepala Domin ..... Native Blackthorn
Bursaria spinosa Cav. ..... Native Blackthorn
Pittosporum multiflorum
(A.Cunn. ex Loudon) L.Cayzer, Crisp & I.Telford ..... Forest Thorn
Rhytidosporum procumbens (Hook.) F.Muell. ..... Rhytidosporum

Plantaginaceae
Plantago debilis R.Br. ..... Small Plantain
Plantago varia R.Br. ..... Variable Plantain

Polygalaceae
Comesperma ericinum DC. ..... Heath Milkwort
Polygala japonica Houtt. ..... Polygala

Polygonaceae
**Acetosella vulgaris* Fourr. ..... Sheep Sorrel
Muehlenbeckia costata m.s. ..... Muehlenbeckia
Persicaria decipiens (R.Br.) K.L.Wilson ..... Dock
Rumex brownii Campd. ..... Swamp Dock

Portulacaceae
Calandrinia eremaea Ewart ..... Small Purslane
Portulaca oleracea L. ..... Pigweed, Purslane

Primulaceae
**Anagallis arvensis* L. ..... Scarlet Pimpernel

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
Hakea eriantha R.Br. ..... Tall Hakea
Hakea florulenta Meisn. ..... Hakea
Hakea laevipes
subsp. *graniticola* Haegi ..... Granite Hakea
Hakea microcarpa R.Br. ..... Small-fruited Hakea
Isopogon petiolaris R.Br. ..... Drumsticks
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 oleoides L.A.S.Johnson & P.H.Weston ..... Geebung
Petrophile canescens A.Cunn. ex R.Br. ..... Prickly Conesticks

Ranunculaceae
Clematis aristata R.Br. ex Ker Gawl. ..... Traveller's Joy
Clematis glycinoides DC.
var. *glycinoides* ..... Forest Clematis
Ranunculus lappaceus Sm. ..... Common Buttercup
Ranunculus sessiliflorus R.Br. ex DC.
var. *sessiliflorus* ..... Small-flowered Buttercup

Rhamnaceae
Cryptandra amara
var. *floribunda* Maiden & Betche ..... Showy Cryptandra
Cryptandra lanosiflora F.Muell. ..... Woolly Cryptandra
Pomaderris nitidula (Benth.) N.A.Wakef. ..... Shining Pomaderris

Rosaceae
Acaena novae-zelandiae Kirk ..... Bidgee Widgee
**Rubus discolor* Weihe & Nees ..... Blackberry
Rubus moluccanus
var. *trilobus* A.R.Bean ..... Molucca Bramble
Rubus nebulosus A.R.Bean ..... Green-leaved Bramble
Rubus parvifolius L. ..... Small-leaved Bramble

Rubiaceae
Asperula conferta Hook.f. ..... Common Woodruff
Coprosma quadrifida (Labill.) Robinson ..... Prickly Currant Bush
Galium binifolium Wakef. ..... Bedstraw
Galium migrans Ehrend. & McGillivray ..... Bedstraw
Galium propinquum A.Cunn. ..... Bedstraw
Opercularia aspera Gaertn. ..... Coarse Stinkweed
Opercularia hispida Spreng. ..... Hairy Stinkweed
Pomax umbellata (Gaertn.) Sol. ex A.Rich. ..... Pomax

Rutaceae
Boronia algida F.Muell. ..... Boronia
Boronia anethifolia A.Cunn. ex Endl. ..... Boronia
Boronia bipinnata Lindl. ..... Boronia
Correa reflexa (Labill.) Vent.
var. *reflexa* ..... Native Fuchsia
Philotheca epilosa (Paul G.Wilson) P.I.Forst. ..... Granite Philotheca
Zieria fraseri Hook.
subsp. *fraseri* ..... Smooth Zieria
Zieria smithii J.A.Armstr.
subsp. *smithii* ..... Sandfly Zieria

Santalaceae
Exocarpos cupressiformis Labill. ..... Cherry Ballart

Sapindaceae
Dodonaea viscosa Jacq.
subsp. *viscosa* ..... Hop Bush

Scrophulariaceae
Gratiola peruviana L. ..... Brooklime
Veronica calycina R.Br. ..... Hairy Speedwell
Veronica notabilis F.Muell. ex Benth. ..... Speedwell
Veronica plebeia R.Br. ..... Trailing Speedwell

Solanaceae
Solanum aviculare G.Forst. ..... Kangaroo Apple
Solanum brownii Dunal ..... Violet Nightshade
Solanum campanulatum R.Br. ..... Nightshide
Solanum cleistogamum Symon ..... Shy Nightshade
Solanum prinophyllum Dunal ..... Forest Nightshade

Stackhousiaceae
Stackhousia monogyna Labill. ..... Creamy Candles
Stackhousia muricata Lindl. ..... Stackhousia
Stackhousia viminea Sm. ..... Yellow Stackhousia

Sterculiaceae
Lasiopetalum ferrugineum
var. *cordatum* Benth. .....

Stylidiaceae
Stylidium graminifolium Sm. ex Willd. .....Grass Triggerplant

Thymelaeaceae
Pimelea linifolia Sm.
subsp. *linifolia* .....Rice Flower

Trimeniaceae
Trimenia moorei (Oliv. ex Benth.) Philipson .....Bitter Vine

Ulmaceae
Trema aspera (Brongn.) Blume..... Native Peach, Poison Peach

Verbenaceae
Clerodendrum floribundum R.Br. .....Smooth Clerodendrum
Clerodendrum tomentosum R.Br. .....Hairy Clerodendrum

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

Vitaceae
Cayratia clematidea (F.Muell.) Domin .....Slender Grape
Cissus hypoglauca A.Gray .....Giant Water Vine
Tetrastigma nitens (F.Muell.) Planch. .....Shiny-leaved Grape

Winteraceae
Tasmannia insipida R.Br. ex DC.....Brush Pepperbush
Tasmannia stipitata (Vickery) A.C.Sm. .....Northern Pepperbush

Appendix C: Locality and site information.

Site	Date	Aspect	AMG Zone	AMG Coordinates	Easting	Northing	Notes	Altitude
1	?		56.00	66.00	405880	6733530	SSFDATA. GGBUT01.	
2	?		56.00	66.00	408030	6732630	SSFDATA. GGBUT02.	
3	?		56.00	66.00	408930	6731100	SSFDATA. GGBUT03.	
4	?		56.00	66.00	408800	6733900	CRA. une06027.	
5	?		56.00	66.00	409600	6732100	CRA. une06028.	
6	?		56.00	66.00	408900	6730900	CRA. une06029.	
7	?		56.00	66.00	408450	6730250	CRA. une06030.	
8	?		56.00	66.00	408000	6733400	CRA. une06044.	
9	?		56.00	66.00	405600	6731100	CRA. une06045.	
10	?		56.00	66.00	406000	6731900	CRA. une06046.	
11	9/03/2011	22	56.00	94.00	409218	6734641	Soil chocolate brown clay loam.	1,329.00
12	9/03/2011	335	56.00	94.00	411479	6734895	Soil chocolate brown sandy loam.	990
13	9/03/2011	80	56.00	94.00	411483	6734441	Soil red chocolate brown clay loam.	998
14	9/03/2011	353	56.00	94.00	411406	6733339	Soil dark brown black clay loam.	961
15	9/03/2011	75	56.00	94.00	410976	6732183	Soil dark chocolate brown sandy loam.	988
16	9/03/2011	344	56.00	94.00	410125	6731627	Soil light brown sandy clay loam.	1,043.00
17	9/03/2011	228	56.00	94.00	409308	6730705	Soil dark brown black clay loam.	1,039.00
18	9/03/2011	110	56.00	94.00	407602	6731144	Soil dark brown black clay loam.	1,170.00
19	9/03/2011	339	56.00	94.00	407178	6731684	Soil dark red brown clay loam.	1,244.00
20	9/03/2011	317	56.00	94.00	406607	6731195	Soil red brown clay loam.	1,276.00
21	10/03/2011	207	56.00	94.00	408348	6731089	Soil dark brown black clay loam.	991
22	10/03/2011	93	56.00	94.00	408473	6732068	Soil dark brown clay loam.	956
23	10/03/2011	55	56.00	94.00	408272	6732901	Soil dark brown clay loam.	1,064.00
24	10/03/2011	310	56.00	94.00	407963	6733182	Soil chocolate brown clay loam.	159

Site	Date	Aspect	AMG Zone	AMG Coordinates	Easting	Northing	Notes	Altitude
25	10/03/2011	210	56.00	94.00	408705	6733919	Soil dark brown clay loam.	1,174.00
26	10/03/2011	207	56.00	94.00	408689	6733900	Soil peaty clay.	1,179.00
27	10/03/2011	216	56.00	94.00	408897	6733246	Soil dark brown sandy loam.	1,227.00
28	10/03/2011	124	56.00	94.00	409021	6732882	Soil peaty loam.	1,272.00
29	10/03/2011	220	56.00	94.00	409077	6732876	Soil dark brown clay loam.	2,345.00
30	10/03/2011	271	56.00	94.00	408957	6732944	Soil dark brown clay loam.	1,268.00
31	10/03/2011	230	56.00	94.00	409432	6732857	Soil dark brown clay loam.	1,163.00
32	14/03/2011	8	56.00	94.00	399683	6739672	Soil sandy loam.	1,049.00
33	14/03/2011	69	56.00	94.00	399456	6738831	Soil loamy coarse granitic sand.	1,085.00
34	14/03/2011	357	56.00	94.00	399407	6738468	Soil peaty clay loam.	1,090.00
35	14/03/2011	346	56.00	94.00	399446	6738390	Soil sandy loam.	1,085.00
36	14/03/2011	393	56.00	94.00	399155	6737313	Soil light chocolate brown sandy loam.	1,139.00
37	14/03/2011		56.00	94.00	399276	6736931	Soil grey brown loamy sand.	1,134.00
38	14/03/2011	147	56.00	94.00	399362	6736354	Soil dark brown sandy loam.	1,139.00
39	15/03/2011	242	56.00	94.00	402006	6737819	Soil dark chocolate brown coarse sandy loam.	1,203.00
40	15/03/2011	241	56.00	94.00	401882	6738131	Soil peaty.	1,193.00
41	15/03/2011	206	56.00	94.00	401808	6738310	Soil peaty loam. Rock outcrop.	1,193.00
42	15/03/2011	244	56.00	94.00	401804	6738626	Soil coarse sandy loam.	1,207.00
43	15/03/2011	244	56.00	94.00	401804	6738626	Soil coarse sandy loam.	1,207.00
44	15/03/2011	339	56.00	94.00	401560	6739063	Soil grey white coarse sandy loam.	1,176.00
45	15/03/2011	51	56.00	94.00	400969	6739883	Soil dark red brown loam.	1,212.00
46	15/03/2011	86	56.00	94.00	401189	6740015	Soil sandy loam.	1,191.00
47	15/03/2011	1	56.00	94.00	401433	6740573	Soil sandy clay loam.	1,113.00
48	15/03/2011	279	56.00	94.00	402310	6740409	Soil peaty.	1,293.00
49	15/03/2011	410	56.00	94.00	402370	6740298	Soil sandy loam.	1,274.00

Site	Date	Aspect	AMG Zone	AMG Coordinates	Easting	Northing	Notes	Altitude
50	21/03/2011	185	56.00	94.00	406685	6731769	Soil peaty dark brown black.	1,245.00
51	21/03/2011	73	56.00	94.00	406684	6732669	Sandy dark brown clay loam.	1,219.00
52	21/03/2011	101	56.00	94.00	404561	6734838	Soil sandy loam chocolate brown.	1,337.00
53	21/03/2011	172	56.00	94.00	406196	6733696	Soil chocolate brown sandy loam.	1,261.00
54	21/03/2011	211	56.00	94.00	404979	6731966	Chocolate brown sandy loam.	1,172.00
55	21/03/2011	118	56.00	94.00	404867	6729661	Soil chocolate brown sandy loam.	1,178.00
56	21/03/2011	72	56.00	94.00	404646	6730203	Soil chocolate brown sandy loam.	1,269.00
57	21/03/2011	228	56.00	94.00	405574	6731625	Soil chocolate brown sandy loam.	1,243.00
58	21/03/2011	266	56.00	94.00	406398	6730899	Soil chocolate brown sandy loam.	1,281.00
59	21/03/2011	358	56.00	94.00	399475	6737774	Soil dark brown black sandy loam. Old selective logging.	1,147.00
60	21/03/2011	213	56.00	94.00	400767	6735138	Soil black clay loam.	1,223.00
61	25/03/2011	268	56.00	94.00	400849	6735410	Soil coarse sandy loam.	1,216.00
62	25/03/2011	197	56.00	94.00	401059	6735780	Soil black clay loam.	1,220.00
63	25/03/2011	86	56.00	94.00	403709	6736268	Soil light brown loamy sand.	1,301.00
64	25/03/2011	239	56.00	94.00	403416	6736554	Soil light brown sandy loam.	1,307.00
65	25/03/2011	251	56.00	94.00	402926	6736967	Soil dark chocolate brown sandy loam.	1,297.00
66	25/03/2011	286	56.00	94.00	402618	6737470	Soil dark brown black sandy loam.	1,259.00
67	25/03/2011	12	56.00	94.00	403555	6738047	Soil dark chocolate brown sandy loam.	1,211.00
68	25/03/2011	113	56.00	94.00	403939	6738673	Soil dark brown black sandy loam.	1,177.00
69	25/03/2011	342	56.00	94.00	400856	6741153	Soil red chocolate brown sandy loam.	1,044.00
70	25/03/2011	287	56.00	94.00	400940	6741225	Soil grey brown loam.	1,041.00
1O	30/11/1995	220	56.00	66.00	403990	6736890		1,330.00
2O	30/11/1995	5	56.00	66.00	406230	6737050	Rabbit and cattle grazing	1,210.00
3O	30/11/1995	44	56.00	66.00	405210	6737860	Rabbit and cattle grazing	1,225.00
3O	30/11/1995	60	56.00	66.00	405210	6737970	Rabbit and cattle grazing	1,220.00

Site	Date	Aspect	AMG Zone	AMG Coordinates	Easting	Northing	Notes	Altitude
4O	1/12/1995	70	56.00	66.00	405450	6737820		1,215.00
4O	1/12/1995	84	56.00	66.00	405520	6737890		1,205.00
4O	1/12/1995	90	56.00	66.00	405470	6737780		1,225.00
4O	1/12/1995	90	56.00	66.00	405520	6737940	Rabbit and cattle grazing	1,195.00
5O	1/12/1995	110	56.00	66.00	405750	6737860		1,220.00
6O	1/12/1995	10	56.00	66.00	405700	6737930		1,230.00
7O	18/06/1996	200	56.00	66.00	404700	6734750		1,335.00
7O	18/06/1996	230	56.00	66.00	404170	6734460		1,345.00
7O	18/06/1996	260	56.00	66.00	404330	6734700		1,335.00
7O	18/06/1996	286	56.00	66.00	404190	6734550		1,340.00
7O	18/06/1996	308	56.00	66.00	404390	6734660	Fire over most of the site	1,330.00

Appendix D: Traditional and other uses of plants found within the reserve.

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
Acacia binervia			Poison.	Honey.			Lazarides & Hince (1993).
Acacia fimbriata				Honey.		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 water logging, salinity and wind.		Clarke (1989), Lazarides & Hince (1993).
Acacia longifolia	Pods can be roasted & seeds eaten. Used as a fish poison.	Cribb & Cribb (1982), 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. Regarded as one of the best cabinet timbers. Used for beer barrels.	Cribb & Cribb (1982).		Lazarides & Hince (1993).
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).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use 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, water logging 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).
Actinotus gibbonsii				Fodder.			Lazarides & Hince (1993).
Ajuga australis				Fodder.		Ornamental.	Lazarides & Hince (1993).
Allocasuarina littoralis	Timber.	Lazarides & Hince (1993).			C3. Wind tolerant, drought tolerant, tolerant of salinity.	Tertiary sand coloniser, a wind barrier, propagation by seed. Used for firewood. Honey (pollen), ornamental.	Clarke (1989), Lazarides & Hince (1993).
Allocasuarina torulosa						Timber, fuel, honey (pollen), ornamental.	Lazarides & Hince (1993).
Amyema pendulum	Fruits eaten.						
Anagallis arvensis			Poison.	Fodder.		Weed, poisonous to horses, cattle, sheep, birds, dogs, rabbits and guinea pigs.	Lazarides & Hince (1993).
Angophora				Fodder. Important	C3. Drought	Tertiary sand coloniser,	Clarke (1989),

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
floribunda				pollen source.	tolerant. Intolerant of wind, water logging and salinity.	by seed propagation. Garden & shade plant. Bee attractant. Firewood, timber.	Lazarides & Hince (1993).
Arenaria leptoclados						Weed.	Lazarides & Hince (1993).
Aristida personata						Host plant of common army worm.	Benson & McDougall (2005).
Arthropodium milleflorum	Roots eaten raw or roasted.			Fodder, moderate 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).
Austrostipa aristiglumis				Palatable, provides good quality forage. Sharp seeds can injure stock.			Cunningham et al. (1981).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
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).
Bidens subalternans						Weed.	Lazarides & Hince (1993).
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).
Bulbostylis barbata	Food. The root is edible.			Fodder.			Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
Bursaria spinosa	Medicinal. Used for production of Aesculin (suntan lotions).	Lazarides & Hince (1993).		Fodder.		Useful honey plant.	Cunningham et al. (1981), Lazarides & Hince (1993).
Caladenia carnea	Tubers of some Caladenia species are edible.	Maiden (1889), Cribb & Cribb (1974), Cunningham et al. (1981).					
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).
Callicoma serratifolia	Originally used for wattle & daub huts in early Australia.	Cribb & Cribb (1982).				Wattle originally applied to this species in early Australia as it was first used for wattle & daub housing which was later transferred to Acacia.	Cribb & Cribb (1982).
Callistemon sieberi						Seed eaten by Crimson Rosella.	Benson & McDougall (1998).
Callitris rhomboidea						Gums, ornamental.	Lazarides & Hince (1993).
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).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
Calytrix tetragona	The fruit is edible.					Visited by honeybees, native bees, flies & beetles and small wasps.	Benson & McDougall (1998).
Carex inversa				Supplies limited amount of fair quality forage.		Weed.	Cunningham et al. (1981), Lazarides & Hince (1993).
Cassinia laevis			Poison?	Fodder.		Weed. Suspected cause of coughing and eye irritation of people in close proximity.	Lazarides & Hince (1993).
Cayratia clematidea	Food.	Lazarides & Hince (1993).			C3. Intolerant of wind, drought, water logging and salinity.	tertiary sand coloniser.	Clarke (1989).
Cheilanthes sieberi			Poison?				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 platyptera	Tuber edible.						
Chiloglottis trilabra	Tuber edible.					Pollination by sexual deception of Thynnine Wasps.	Benson & McDougall (2005).
Chloris truncata			Poison?	Widespread, valuable, warm-season grass.		Shelter. Useful for grassing waterways. Seed eaten by Stubble Quail. Resilient in mowed areas.	Cunningham et al. (1981), Lazarides & Hince (1993), Benson & McDougall (2005).
Cirsium vulgare						Honey, weed,	Lazarides & Hince

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
						miscellaneous. Fleshy roots laced with strychnine formerly sold as rabbit bait. Noxious in Vic, Tas, SA, part of NT.	(1993).
Cissus hypoglauca	Edible fruit.	Clarke (1989).			C3. Intolerant of wind, drought, water logging and salinity.	Tertiary sand coloniser. Bird attractant.	Clarke (1989).
Clematis aristata			Poison?			Tuberous roots to 30 cm deep branching underground may give rise to separate plants. Moth larvae Phrissogonus laticostata on flower	Lazarides & Hince (1993), Benson & McDougall (2000).
Clematis glycinoides						Flowers visited by honeybees for pollen.	Benson & McDougall (2000).
Clerodendrum floribundum	Food, timber, fuel, medicinal.	Lazarides & Hince (1993).					
Conyza bonariensis						Weed.	Lazarides & Hince (1993).
Conyza sumatrensis					C3. Wind tolerant, drought tolerant, intolerant of water logging.	Secondary sand coloniser, floral display. Cosmopolitan species, on the fore dune & back dune. Honey (pollen), weed.	Clarke (1989), Lazarides & Hince (1993).
Coprosma quadrifida	Fruit is edible, and can be made into					Berries eaten by Yellow-faced	Benson & McDougall (2000).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
	puddings.					Honeyeater Lichenostomus chrysops. Larval food plant of hawk moth Cizara ardenia.	
Correa reflexa						Leaves and roots eaten by wombat. Pollen eaten by Red Wattlebird, Crescent Honeyeater, New Holland Honeyeater, Tawny-crowned Honeyeater & Eastern Spinebill.	Benson & McDougall (2001).
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).
Cryptostylis subulata	Roots & tubers eaten raw or roasted.					Pollinated by psuedocopulation with Ichneumonid Wasps.	Benson & McDougall (2005).
Cyathea australis	Food. New shoots eaten if roasted.					Gums, ornamental.	Lazarides & Hince (1993).
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	C3. Wind tolerant.	Secondary sand coloniser. Tertairy sand	Clarke (1989), Cunningham et al.

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
				contain HCN.		coloniser, by transplants. Pollen known to cause asthma in humans. Food plant of Australian Shelduck, Plumed Whistling Duck, Freckled Duck & butterfly larvae.	(1981), Lazarides & Hince (1993), Benson & McDougall (2005).
Cyperus difformis			Poison?	Has been suspected of causing the deaths of sheep.	C3	Weed.	Cunningham et al. (1981), Lazarides & Hince (1993).
Cyperus fulvus					C4	Ornamental.	Lazarides & Hince (1993).
Cyperus gracilis					C3	Weed.	Lazarides & Hince (1993).
Cyperus sphaeroideus					C4		Lazarides & Hince (1993).
Cyrtostylis reniformis						Pollinated by small flies.	Benson & McDougall (2005).
Daucus glochidiatus	Tuber edible.			Fodder.		Weed.	Lazarides & Hince (1993).
Desmodium varians				Fodder.			Lazarides & Hince (1993).
Dianella caerulea	Fruits & roots edible. Stems can be pounded to make a fibre.					Buzz pollinated by bees.	Benson & McDougall (2005).
Dianella caerulea	Fruits & roots edible. Stems can be pounded to make a fibre.					Food plant of butterfly larvae.	Benson & McDougall (2005).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
Dianella caerulea	Fruits & roots edible. Stems can be pounded to make a fibre.					Probably pollinated by native bees.	Benson & McDougall (2005).
Dianella caerulea	Fruits & roots edible. Stems can be pounded to make a fibre.		Poison?		C3. Wind tolerant, drought tolerant, tolerant of salinity, intolerant of water logging.	Secondary sand coloniser. Tertiary sand coloniser by transplants, propagation by seed. Ornamental.	Clarke (1989), Lazarides & Hince (1993).
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 micrantha				Fodder.			Lazarides & Hince (1993).
Dichondra repens				Fodder.	C3. Wind intolerant, drought intolerant, tolerant of water logging, intolerant of salinity.	Tertiary sand coloniser. Gums, weed.	Clarke (1989), Lazarides & Hince (1993).
Dipodium variegatum	Roots eaten raw or roasted.						
Dockrillia linguiformis						Leaves eaten by Swamp Wallaby. Pollinated by insects.	Benson & McDougall (2005).
Dockrillia						Pollinated by bees.	Benson & McDougall

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
pugioniformis							(2005).
Doryphora sassafras			Poison.			Timber, medicinal.	Lazarides & Hince (1993).
Drosera peltata	The tuber is used to make a dye in India.	Cribb & Cribb (1982).	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).
Elaeocarpus reticulatus						Timber, ornamental.	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 leptostachya				Fodder.			Lazarides & Hince (1993).
Eragrostis molybdea				Useful forage alternative to Aristida			Cunningham et al. (1981).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
				jerichoensis.			
Eucalyptus andrewsii				Timber, Honey.			Lazarides & Hince (1993).
Eucalyptus bridgesiana				Gums, Honey.		Seed eaten by Gang Gangs. 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 eugenioides				Gum, Timber.			Lazarides & Hince (1993).
Eucalyptus laevopinea				Timber, Honey.			Lazarides & Hince (1993).
Eucalyptus melliodora				Gum, Fuel, Honey. Major source of honey, regarded as the best among eucalypts.		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.	Cribb & Cribb (1982), Lazarides & Hince (1993), Benson & McDougall (1998).
Eucalyptus nova-anglica				Gum, Timber.			Lazarides & Hince (1993).
Eucalyptus obliqua	One of the most important hardwoods in Australia, building	Cribb & Cribb (1982).		Gums, timber, pulp, honey. Timber marketed		Ants are predators to seed. Browsed by Koala. Provides hollows	Lazarides & Hince (1993), Benson & McDougall (1998).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
	construction indoor & outdoor, furniture, joinery, wine casks, case timber, wood wool, railway sleepers etc.			as 'Tasmanian oak'.		for arboreal mammals.	
Eucalyptus saligna	For general building purposes.	Cribb & Cribb (1982).		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).
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).
Fimbristylis dichotoma				Must be utilised while green for forage.			Cunningham et al. (1981), Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
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.						
Geranium potentilloides	Roots can be roasted & eaten.						
Geranium retrorsum	Turnip-like taproot was probably eaten by aborigines after roasting.	Lazarides & Hince (1993).					
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 back dune.	Clarke (1989), Lazarides & Hince (1993).
Glycine tabacina	Taproot has liquorice flavour and was chewed by Aborigines.	Lazarides & Hince (1993).	Poison?	Fodder.			Lazarides & Hince (1993).
Gonocarpus teucrioides						Grows on sandstone and sand, on back dune.	Clarke (1989).
Hardenbergia violacea	Food. Flowers used to create a grey blue dye for wool.	Cribb & Cribb (1982), Lazarides & Hince (1993).	Poison.	Fodder.	C3. Wind intolerant, drought tolerant, intolerant of	Tertiary sand coloniser, propagation by seed, garden plant, floral display. Cosmopolitan	Clarke (1989), Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
					water logging and salinity.	species, on back dune. Food, ornamental.	
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 water logging and salinity.	Secondary sand coloniser. Tertiary sand coloniser, propagation by cuttings and seed, garden plant, floral display.	Clarke (1989).
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 radicata				Fodder.	C3. Wind tolerant, drought tolerant, intolerant of water logging, intolerant of salinity.	Secondary & tertiary sand coloniser. Cosmopolitan species, on the back dune. Honey, weed.	Clarke (1989), Lazarides & Hince (1993).
Hypoxis hygrometrica	Food. Tubers eaten.	Lazarides & Hince (1993).					

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
Imperata cylindrica				Fodder, grazed when young.		Food plant for butterfly larvae.	Lazarides & Hince (1993).
Indigofera australis	Used for dyeing giving a blue colour. Used to stupify fish.	Cribb & Cribb (1982), 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).
Isotoma axillaris			Poison.			Ornamental.	Lazarides & Hince (1993).
Jacksonia scoparia				Honey. Valuable for pollen for honey.		Ornamental. Indicator of poor soils.	Cribb & Cribb (1982), Lazarides & Hince (1993).
Kennedia rubicunda				Fodder.	C3. Wind intolerant, drought tolerant, intolerant of water logging 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 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	Tertiary sand coloniser, propagation by transplants and seed.	Clarke (1989).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
					salinity and water logging.		
Leptospermum novae-angliae						Host specific gall.	Hunter (1997)
Leptospermum petersonii	Oil extracted and used.	Cribb & Cribb (1982).		Honey.		Ornamental.	Lazarides & Hince (1993).
Lepyrodia scariosa						Honeybees gather pollen.	Benson & McDougall (2005).
Leucopogon lanceolatus	Fruits are edible.						
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 water logging.	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).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
Medicago polymorpha			Poison?	Fodder, Honey.			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. Food plant for butterfly larvae. Finches eat seeds.	Benson & McDougall (2005).
Microtis parviflora						Pollinated by worker ants.	Benson & McDougall (2005).
Monotoca scoparia	Fruits are edible.						
Murdannia graminea	Roots baked then eaten.						
Notelaea longifolia					C3. Intolerant of wind, drought, water logging and salinity.	Tertiary sand coloniser, by seed propagation. Bird attractant. Cosmopolitan species, on the back dune.	Clarke (1989).
Olearia ramulosa				Low palatability fodder.			Lazarides & Hince (1993).
Opercularia aspera					C3. Intolerant of wind, drought, water logging and salinity.	Tertiary sand coloniser. Cosmopolitan species, on the back dune. Eaten by rabbits.	Clarke (1989), Benson & McDougall (2000).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
Oplismenus aemulus				Fodder.			Lazarides & Hince (1993).
Orthoceras strictum	Edible roots.						
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 water logging and salinity.	Tertiary sand coloniser, propagation by seed, garden plant, floral display. Cosmopolitan species, on the back dune.	Clarke (1989), Lazarides & Hince (1993).
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).
Patersonia glabrata	Rhizome edible.						
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),
Pennisetum alopecuroides							Lazarides & Hince (1993).
Persoonia cornifolia	Fruit is edible.						

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
Persoonia oleoides	Fruit is edible.						
Phragmites australis	Used by aborigines in Victoria for making bags or baskets.	Cunningham et al. (1981).		Young growth relatively palatable to stock. Useful forage plant. Fibre.	Susceptible to sea-strength salinity.		Cunningham et al. (1981), Lazarides & Hince (1993).
Phytolacca americana			Poison?			Roots and berries reported poisonous.	Lazarides & Hince (1993).
Phytolacca octandra			Poison?	Suspected of poisoning stock.			Cunningham et al. (1981), Lazarides & Hince (1993).
Plantago debilis	Leaves are edible.						
Plantago varia	Leaves are edible.						
Platysace lanceolata					C3. Wind intolerant, drought intolerant, water logging intolerant, intolerant of salinity.	Tertiary sand coloniser, floral display, cosmopolitan species, on the back dune.	Clarke (1989).
Poa labillardieri				New growth utilised by stock.			Cunningham et al. (1981), Lazarides & Hince (1993).
Poa sieberiana				Fodder.			Lazarides & Hince (1993).
Podolepis jaceoides	Roots roasted.			Fodder.			Lazarides & Hince (1993).
Polycarpon						Cosmopolitan. Weed.	Clarke (1989),

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
tetraphyllum							Lazarides & Hince (1993).
Pomax umbellata			Poison?	Fodder. Reputedly cyanogenetic, but rarely grazed. Considered to be a potential producer of hydrocyanic acid.	C3. Drought tolerant. Intolerant of wind, water logging and salinity.	Tertiary sand coloniser. Cosmopolitan species, on the back dune.	Clarke (1989), Lazarides & Hince (1993), Benson & McDougall (2000).
Poranthera microphylla			Poison?	HCN positive; suspected of deaths in sheep and cattle.			Lazarides & Hince (1993).
Portulaca oleracea	Eaten by aborigines and settlers as raw or cooked vegetable. Seeds ground to meal, made into cakes or bread.	Cribb & Cribb (1974), Cunningham et al. (1981) Lazarides & Hince (1993).	Poison.	Very palatable to stock, readily eaten. Nitrates and oxalates toxic. Poisonous to sheep and cattle.			Cunningham et al. (1981), Lazarides & Hince (1993).
Pratia purpurascens					C3. Intolerant of wind, drought and salinity. Tolerant of water logging.	Tertiary sand coloniser, propagation by transplants. Garden plant. Cosmopolitan species, on the back dune. Weed.	Clarke (1989), Lazarides & Hince (1993).
Pteridium esculentum	Food, medicinal. Rhizomes & young fronds contain starch which is chewed out and beaten to a paste. Rhizomes roasted.	Lazarides & Hince (1993).	Poison.	Causes poisoning of horses and cattle. Gums.			Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
	Carbohydrate content better than potatoes.						
Pterostylis daintreana	Tubers eaten.					Pollinated by pseudocopulation by fungus gnats & mosquitoes.	Benson & McDougall (2005).
Pterostylis decurva	Tubers eaten.					Pollinated by pseudocopulation by fungus gnats & mosquitoes.	Benson & McDougall (2005).
Pterostylis longifolia	Tubers eaten.					Pollinated by pseudocopulation by fungus gnats & mosquitoes.	Benson & McDougall (2005).
Pterostylis pedunculata	Tubers eaten.					Pollinated by pseudocopulation by fungus gnats & mosquitoes.	Benson & McDougall (2005).
Pultenaea villosa				Produces good quality honey.			Cribb & Cribb (1982), Lazarides & Hince (1993).
Ranunculus lappaceus				Not keenly sought after by stock. More suited to cattle than sheep.			Cunningham et al. (1981), Lazarides & Hince (1993).
Rapistrum rugosum			Poison.	Eaten by stock when young. May cause tainting in meat, milk and butter. Important source of pollen,			Cunningham et al. (1981), Cribb & Cribb (1982), Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
				produces strong honey.			
Rostellularia adscendens				Moderately palatable fodder.		Ornamental.	Lazarides & Hince (1993).
Rubus discolor						Weed.	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).
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).
Schoenus apogon				Fodder.			Lazarides & Hince (1993).
Senecio madagascariensis			Poison.	Alkaloid poisonous to livestock.		Weed.	Lazarides & Hince (1993).
Setaria pumila				Good herbage for stock.			Benson & McDougall (2005).
Sigesbeckia orientalis	Medicinal	Lazarides & Hince (1993).		Lightly grazed fodder.		Used for treatment of skin disorders.	Lazarides & Hince (1993).
Smilax australis	Leaf infusions used medicinally. Fruits	Lazarides & Hince (1993).			C3. Intolerant of wind, drought,	Tertiary sand coloniser. Medicinal, ornamental.	Clarke (1989), Lazarides & Hince

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
	edible & peppery. Woody stems used as fire sticks to ignite fire when rubbed together.				water logging and salinity.		(1993).
Solanum aviculare	Ripe berries edible.	Lazarides & Hince (1993).				Source of steroid drugs.	Lazarides & Hince (1993).
Sorghum leiocladum				Fodder.			Lazarides & Hince (1993).
Spiranthes sinensis	Tubers eaten.					Pollinated by small native bees.	Benson & McDougall (2005).
Stackhousia monogyna				Fodder.			Lazarides & Hince (1993).
Stellaria angustifolia				Possibly eaten by cattle.			Cunningham et al. (1981), Lazarides & Hince (1993).
Stephania japonica	Lengths of pounded stem thrown into water to stupify fish.	Cribb & Cribb (1982).	Poison?	Suspected stock poison.	C3. Wind tolerant. Intolerant of drought, water logging and salinity.	Tertiary sand coloniser. Grows on sand dunes, headlands and in swamps, on fore dune and back dune.	Clarke (1989), Lazarides & Hince (1993).
Taraxacum officinale				Honey.			Lazarides & Hince (1993)
Thelymitra pauciflora	Tubers eaten.						
Themeda triandra				Very palatable, heavily grazed in eastern NSW. Sparingly grazed in Western NSW.		Food plant of butterfly larvae. Will not tolerate continuous grazing. Very palatable when young but only	Cunningham et al. (1981), Lazarides & Hince (1993), Benson & McDougall (2005).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
				Young growth utilised		moderate nutritive value. Provides much roughage to offset effects of highly improved grasslands.	
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.						
Trema aspera	Wood-boring grub in shrub eaten. Medicinal, aboriginal timber.	Lazarides & Hince (1993).	Poison.				Lazarides & Hince (1993).
Tricoryne elatior				Eaten by stock but lacks bulk.			Cunningham et al. (1981), Lazarides & Hince (1993).
Vallisneria gigantea					Stoloniferous.	In stationary or flowing fresh water to 7 m deep on a variety of substrates.	Harden (1993).
Velleia paradoxa			Poisonous?	Honey.			Lazarides & Hince (1993).
Viola hederacea					C3. Tolerant of water logging. Intolerant of wind, drought	Tertiary sand coloniser. Propagation by cuttings, transplants and seed. Garden plant, floral	Clarke (1989).

Taxon	Use	Use Refs.	Toxicity	Agric. Use	Physiology	Notes	Use Refs.
					and salinity.	display.	
Wahlenbergia communis				Fodder, palatable to stock.			Lazarides & Hince (1993).
Xanthorrhoea malacophylla	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	Yellow inner bark used as a dye.	Cribb & Cribb (1982).					

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