Vegetation and Floristics of Little Llangothlin Nature Reserve

Dr John T. Hunter

April 2011

23 Kendall Rd, Invergowrie NSW, 2350
Ph. & Fax: (02) 6775 2452
Email: jhunter8@bigpond.com

A Report to the Parks and Wildlife

Contents

Tables

Plates

Figures

Introduction

1.1 Objectives

Dr John T. Hunter prepared this report of the vegetation of the Little Llangothlin Nature Reserve. Aims included the collation of existing information from previous floristic surveys and that the survey of ten, 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 Little Llangothlin. 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:

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 property 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. All sites were permanently marked in all four corners of the 20 x 20 m plot with LANDMARKER survey pegs.

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 AMG66.

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).

Results

3.1 Site stratification

A total of ten new sites were surveyed within the reserve over one day within April of 2011 and the collation of information for a further five sites were also included.

3.2 Floristics

A total of 218 vascular plant taxa were recorded during the collation of site data and opportunistic sampling (25% exotic). The 218 taxa occurred in 60 families and 149 genera. The families with the greatest number of taxa are: Poaceae (33), Asteraceae (31), Cyperaceae (15), Fabaceae (14), Juncaceae (12) and Myrtaceae (7). The richest genera are: *Juncus* (11), *Carex* (6) and *Eucalyptus* (6).

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.
342	4%	28	33/0.1 ha	3	135	Burnt Down Scrub Nature Reserve (Hunter 2000). 20 x 20 m sites.
502	17%	155	40/0.04 ha	5	132	Kwiambal National Park, 2008 update (2008). 20 x 20 m sites.

Number of Taxa	Introduced Species	Number of Sites	Mean Richness	*EPB&C – TSC* – RoTAP	Regional Diversity Index	Area Covered by Survey
460	9%	48	38/0.04 ha	17	130	Severn River 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.
331	15%	37	35/0.04 ha	2	93	Beresford Park/Carinya sections of Mt Kaputar NP (Hunter 2008). 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
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.
186	8%	19	28/0.04 ha	1	72	'Marrawah' (Hunter 2007) 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
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.
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).
Number of Taxa	**Introduced Species**	**Number of Sites**	**Mean Richness**	***EPB&C – TSC* – RoTAP**	**Regional Diversity Index**	**Area Covered by Survey**
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

Five communities are recognised as occurring within the Little Llangothlin (Figure 2).

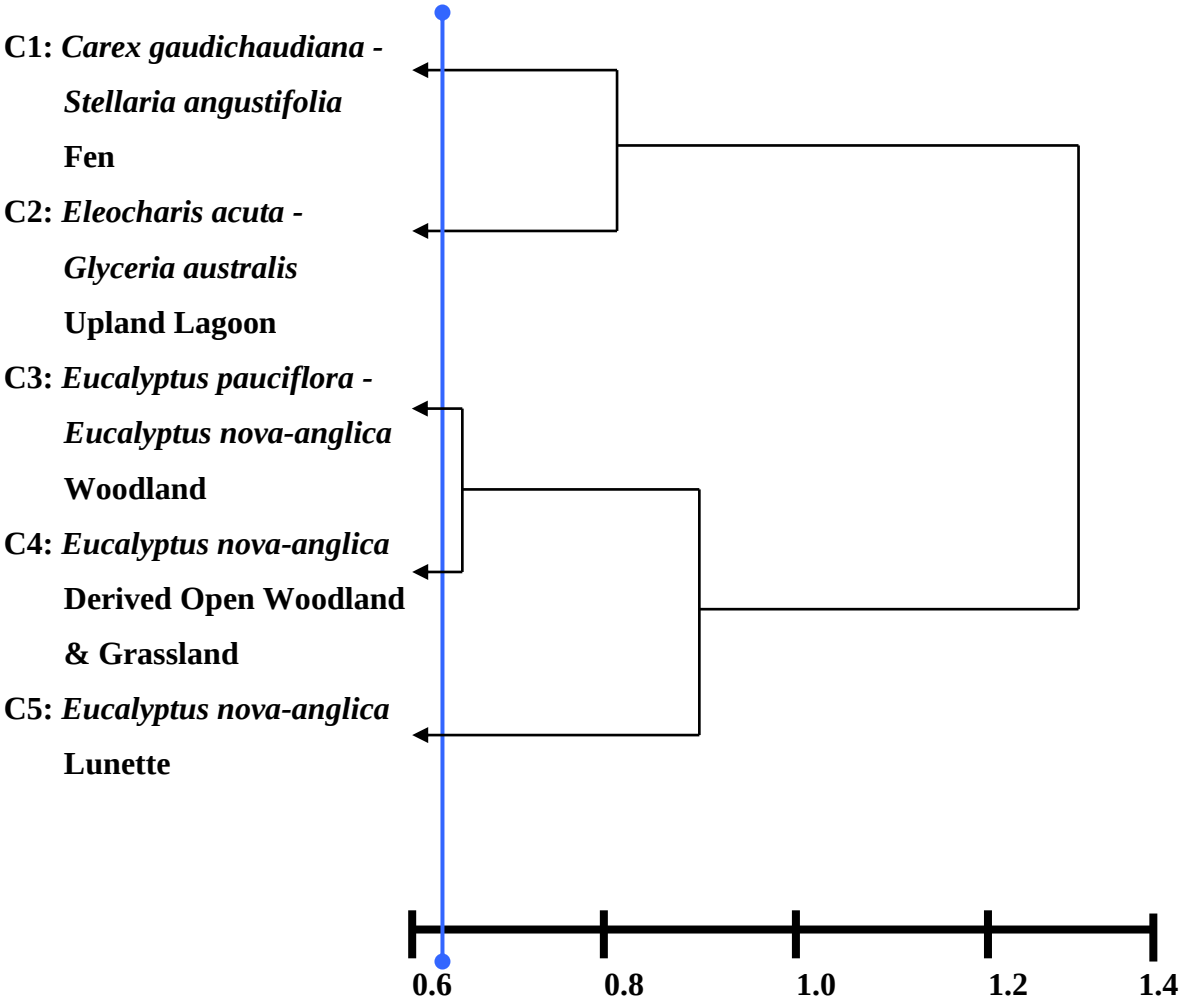

Figure 1: Summary dendrogram of dataset sites surveyed during this investigation using Kulczynski association and flexible UPGMA fusion strategy. Communities are defined at a dissociation of *c.* 0.6.

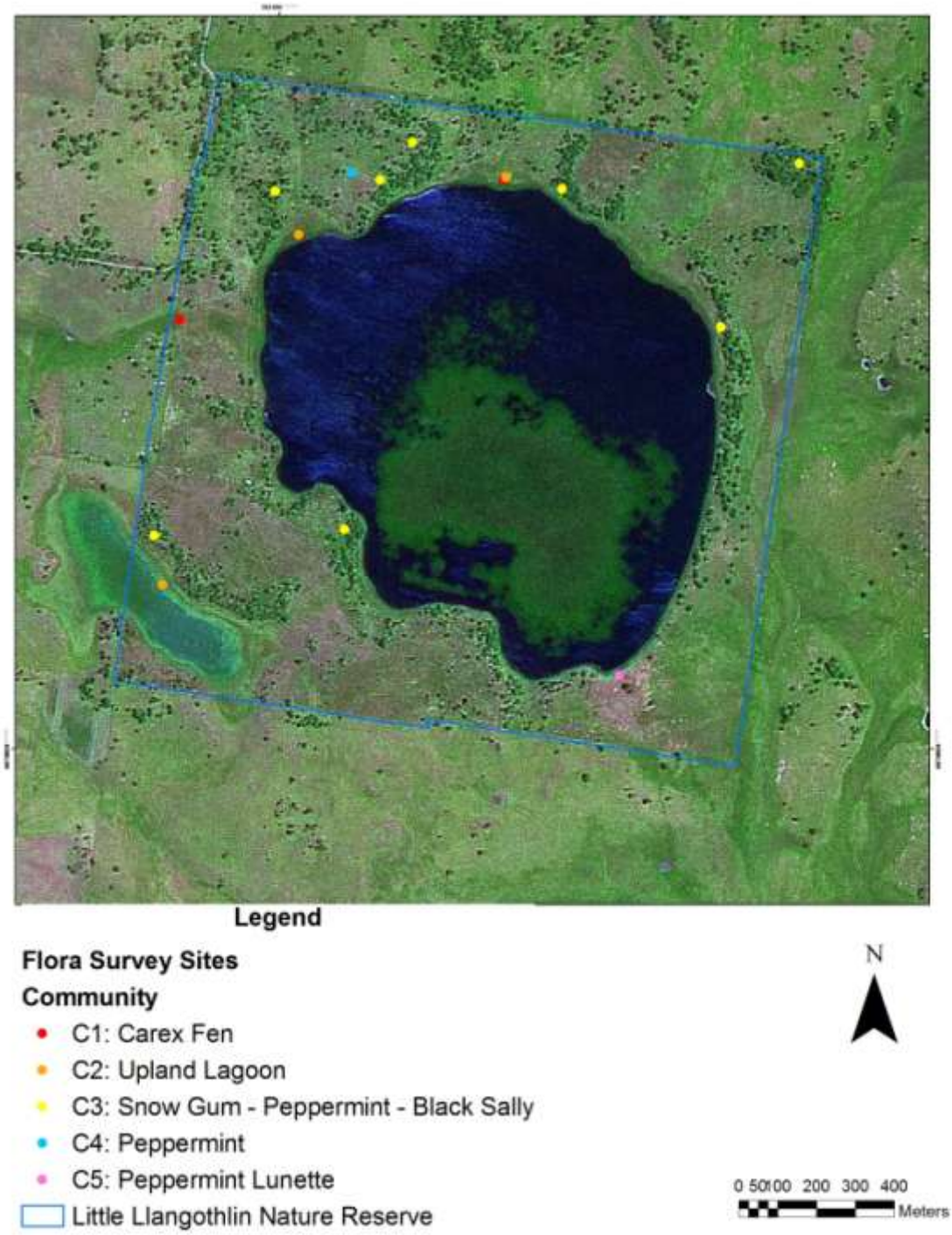

Figure 2: Location of sites within each community at Little Llangothlin.

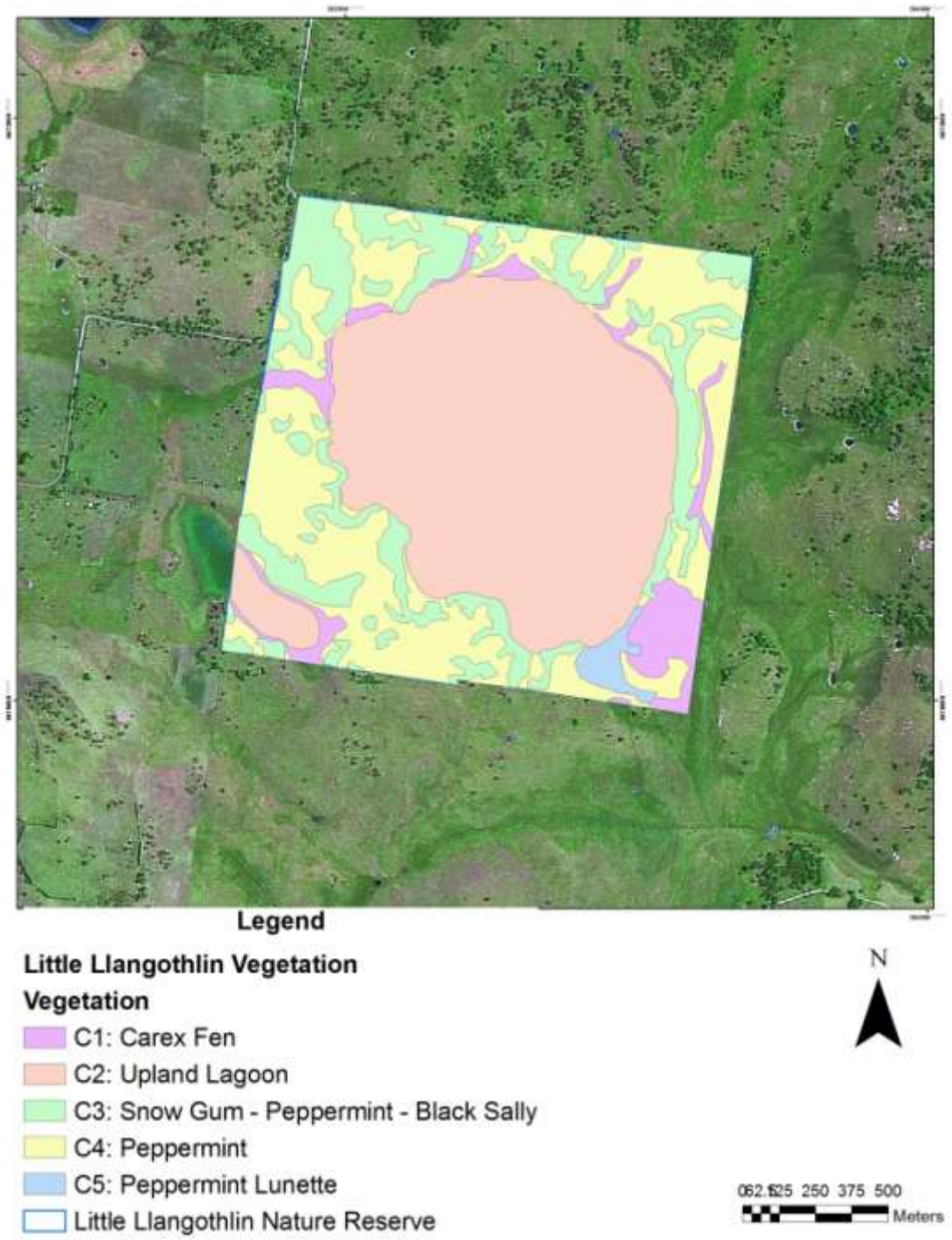

Figure 3: Mapped distribution of all communities within Little Llangothlin.

3.4 Description of plant communities

3.4.1 Community 1: Carex Fen (Endangered)

Carex gaudichaudiana (Sedge) – *Stellaria angustifolia* (Starwort) Fen

Falls within Carex Sedgelands of the New England Tableland, Nandewar, Brigalow Belt South and NSW North Coast Bioregions Endangered Ecological Community Listing. *NSW Threatened Species Conservation Act.*

Sample sites (1): FEN21, FEN22.
Environmental relationships: found restricted to areas of impeded drainage but not usually inundated permanently. Usually along drainage lines and generally forms a peaty soil layer.
Distribution within reserve: found throughout the reserve primarily around the margins of both lagoons and extending out beyond the outflow area..
Structure: a Sedgeland/fen.

- Understorey layer: < 1.5 m tall. 100% cover.

Number of hectares: 16.2 **Proportion of reserve:** 6.3%
No. of taxa: 27 **No. of taxa per plot:** 12-**17**-22.
Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).
Trees: none apparent.
Shrubs: none apparent.
Climbers & trailers: none apparent.
Ground cover: *Carex gaudichaudiana, Stellaria angustifolia, Neopaxia australasica, Glyceria australis, Carex* sp. Bendemeer, *Hydrocotyle tripartita, Asperula charophyton, Wahlenbergia ceracea, Lycopus australis, Epilobium billardierianum* subsp. *hydrophilum, Carex inversa, Leiocarpa* sp. A, *Lachnagrostis filiformis, Juncus falcatus, Geraniums solanderi* subsp. *solanderi, Epilobium billardierianum* subsp. *cinereum, Cyperus sphaeroideus, Brachyscome radicans*.
Taxa of conservation importance: *Asperula charophyton, Carex* sp. 'Bendemeer', *Leiocarpa* sp. A.

Introduced taxa: *Holcus lanatus, Rumex crispus, Lactuca serriola, Festuca elatior, Anthoxanthum odoratum, Trifolium pratense, Taraxacum officinale, Cirsium vulgare.*

Percent of species introduced: 30%

Notes & conservation status: Hunter & Bell (2009) described this assemblage within the Alliance: *Carex gaudichaudiana.* This alliance is occurs primarily east of the New England Highway south from Stanthorpe to Niangala with a south-western extension to the Watsons Creek area. This assemblage was also placed within Community 7: *Carex gaudichaudiana – Glyceria australis* which is found from south east of Walcha north to the Red Range east of Glen Innes and is only known to be reserved within Little Llangothlin Nature Reserve. Fens in Australia are described as occurring in catchments with mineral rich substrates (such as basalts and shales) that produce less acidic to alkaline soils higher in mineral nutrients often along watercourses on flat or concave valley floors (Costin 1959; Beadle 1981; Kirkpatrick 1983; Codd et al. 1998; Costin et al. 2000; Hope 2003; Keith 2004). These fens lack the prominent sclerophyllous shrub layer and are dominated by soft-leaved tussock sedges, grasses and semi-aquatic herbs (Beadle 1981; Kirkpatrick 1983; Keith 2004). Current literature describes fens in Australia as peatlands that occur along the eastern edge of the tablelands at altitudes of over 600 m from south of Stanthorpe in Queensland to Tasmania; *Carex gaudichaudiana* is considered to be the most common and dominant fen species (Beadle 1981; Costin 1959; Kirkpatrick 1983; Read 1994; Hope 2003; Keith 2004). Research into Australian fens has been restricted to southern alpine regions. The *Carex gaudichaudiana* alliance of Costin (1954) is included within the Endangered Ecological Community *Montane peatlands and swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and the Australian Alps bioregions* (17 December 2004) under the NSW *Threatened Species Conservation Act* (1995). Despite the fact that fens occur as far north as Stanthorpe (Keith 2004) and are at least in part included within a listed endangered ecological community. In a systematic survey of the Guyra 1:100 000 Map Sheet fens did not feature in the communities described (Benson & Ashby 2000). In common with communities further south, *Carex gaudichaudiana* was found to be a characteristic dominant of many fen communities. *Carex gaudichaudiana* is a widespread dominant of fens in New Guinea and New Zealand (Walker 1972; Wardle 1991; Mark et al. 1995). Within northern New South Wales the distribution of *Carex gaudichaudiana* fens generally follows that described by Keith (2004), occurring as

far north as Stanthorpe in Queensland and along the eastern parts of the escarpment. However, In contrast to communities previously described, *Carex gaudichaudiana* is not the sole dominant of fen communities in this more northerly region. Two other species of *Carex*, *C. appressa* and *C.* sp. 'Bendemeer' (a previously undescribed species for Australia), are community dominants and delineate alliances whose distributions exhibit a strong geographic bias. The *Carex gaudichaudiana* Alliance described here has the broadest environmental amplitude within the New England Tablelands Bioregion. This result confirms *Carex gaudichaudiana* as the dominant species in fens across Australia, New Zealand and New Guinea. Across the regional landscape fens were most commonly found on the lowest parts of broad drainage depressions or in more or less narrow bands along creeks and on extensive seepage areas associated with drainage lines on or close to the margins of other more northerly lagoons (Llangothlin, Little Llangothlin and Racecourse Lagoons). Keith (2004) infers that fens are more common on basalts and shales and bogs on acidic substrates such as leuco-monzogranites and sandstones. Our results for fens, as for bogs (Hunter and Bell 2007) indicate that substrate is less important as a driver of community patterns than variables such as rainfall, altitude and the origin of nutrients entering the system. These extensive and systematic surveys within the one region suggest that both systems may occur as readily on any type of substrate. We found fens were as likely to be found on acid-forming substrates as on more basic rock types (Table 1). The differentiation of bog and fen is predicted to be due to differences in acidity and nutrients but at a level removed from the substrate. Fen water is generally bordering on eutrophic (van Diggelen et al. 2006); fens represent landscape sinks where nutrients derived from catchments are concentrated in streams and where nutrient-rich ground water is close to the surface for much of the year (Weltzin et al. 2000; Hope 2003; van Diggelen et al. 2006). Bogs are oligo- or meso-trophic with nutrients derived from rain or nutrient-poor ground water (Hope 2003). The underlying differences between rock types can be blurred depending on the extent of contact occurring between the mire community and the subsurface mineral soils. In this study, where fens were found on granites some characteristic bog taxa such as *Baloskion stenocoleum* and *Gonocarpus micranthus* occurred, but only in that narrow band between the fen and surrounding grasslands or woodlands and not within the fen itself indicating a change in acidity and/or nutrients at fen boundaries. Where the level of nutrients and acidity do not appreciably change but where the soil water table is lower

or inundation less frequent *Carex* fens are described as grading into sod tussock grasslands, for example *Poa* grasslands (Costin 1959; Kirkpatrick 1983). In similar situations within the New England Tablelands Bioregion on a range of rock types fens grade into dense *Pennisetum alopecuroides* swards. This tussock grass community often surrounds *Carex* fens particularly where they occur in grazed treeless, gently sloping and shallow basin landscapes. Fens elsewhere are sensitive to small changes in groundwater flow (Van Diggelen 2006). Many of the largest *Carex* fens within the New England Tablelands Bioregion have been significant altered, reduced in size or completely eradicated by drains and dams and these activities still continue today. Areas that may have once contained *Carex* fens are now grasslands and on some soil types *Pennisetum* grassland rather than *Carex* fens are present in open depressions, suggesting that changes in moisture relationships could drive fen communities towards these and other grasslands. Recurrent fires may also cause degradation of the thin layers of peat or change its water holding capacity. Of the estimated 5000 ha of *Carex* Fens occurring in the New England Tablelands Bioregion less than 100 ha (0.2%) is within conservation reserves. Some of the best remaining examples of fens are, in fact, in conservation reserves but even these have large drains or dams Bishops Swamp, Racecourse Swamp and New Country Swamp. The majority of remaining fens (98.8%) occur on private freehold land or on travelling stock reserves where they are under pressure from grazing. Costin (1959) records that fens were selectively overgrazed within the Kosciuszko region due to the palatability of *Carex gaudichaudiana* and that trampling of cattle caused drying out of the soil through degradation of peat and erosion. On the New England Tablelands differential palatability of the *Carex* dominants may affect community composition and structure where more than one species co-dominate. Both *Carex gaudichaudiana* and *Carex* sp. 'Bendemeer' were readily eaten by grazing stock but, grazing of *Carex appressa* was never observed. The impact of grazing in fens thus requires further investigation.

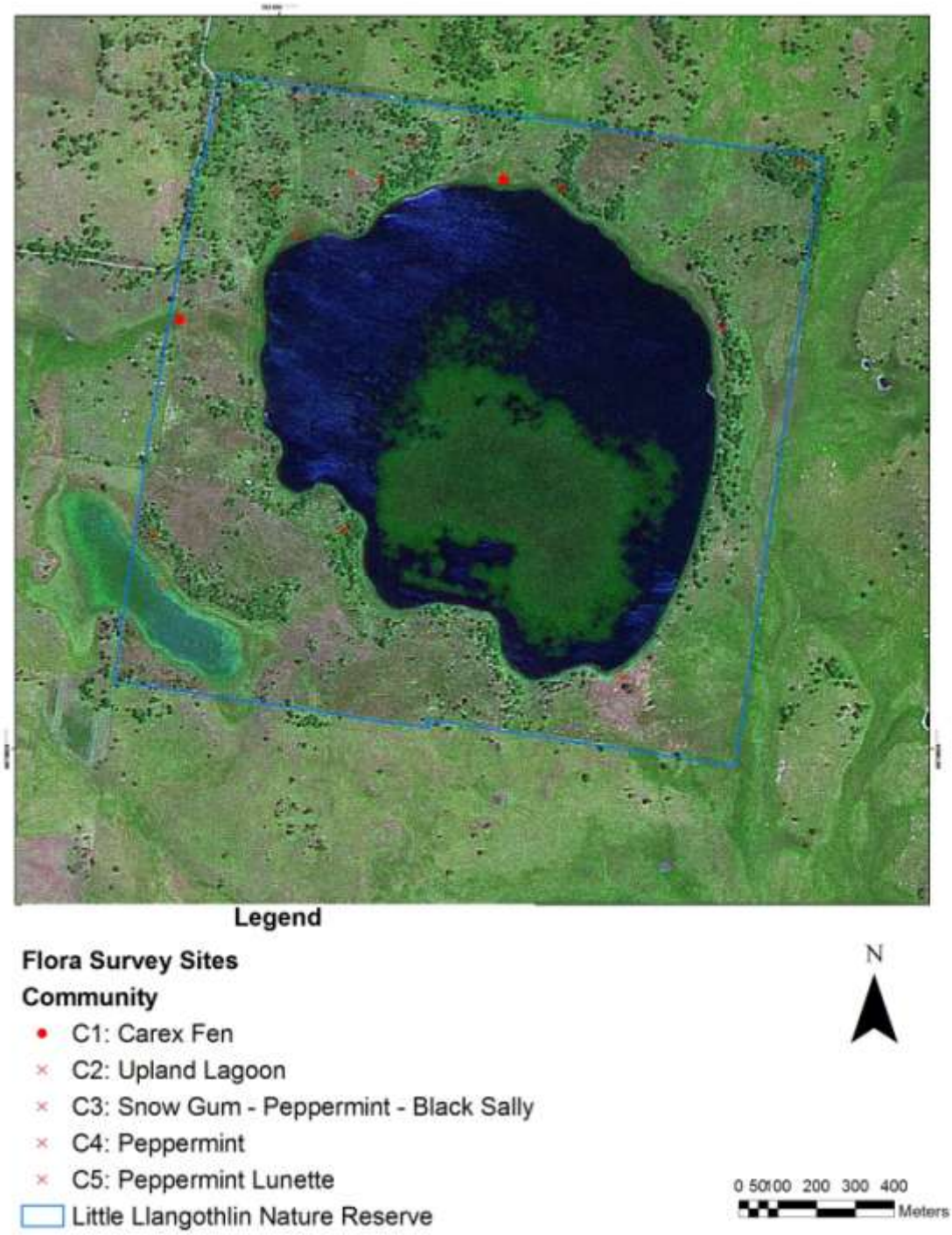

Figure 4: Placement of sites within Community 1 at Little Llangothlin.

Figure 5: Mapped distribution of Community 1.

Plate 1: Photographs of Community 1; above Site FEN21, below Site FEN22.

3.4.2 Community 2: Upland Lagoon (Endangered)

Eleocharis acuta (Rush) – *Glyceria australis* (Australian Wheatgrass) Grassy Woodland

Falls within Upland Wetlands of the Drainage Divide of the New England Tableland Bioregion – Endangered Community Listing. *NSW Threatened Species Conservation Act.*
Falls within Upland wetlands of the New England Tablelands and the Monaro Plateau – Endangered Community Listing. *Federal Environmental Protection and Biodiversity Act.*

Sample sites (3): LIT1, LIT2, LIT3.
Environmental relationships: found restricted to inundated areas around and within the Lagoon proper, also occurs on lagoon edge which may not always be inundated.
Distribution within reserve: restricted to within the lagoon zone proper.
Structure: a low grassy woodland or forest.

- Understorey layer: < 1 m tall. 20-100% cover.

Number of hectares: 118.5 **Proportion of reserve:** 46.5%
Though much of the area recorded for this community would be open water at any particular time
No. of taxa: 26 **No. of taxa per plot:** 16-**19**-23.
Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).
Trees: none apparent.
Shrubs: none apparent.
Climbers & trailers: none apparent.
Ground cover: *Eleocharis acuta, Glyceria australis, Stellaria angustifolia, Epilobium billardierianum* subsp. *hydrophilum, Eleocharis pusilla, Utricularia australis, Myriophyllum variifolium, Hydrocotyle tripartita, Eleocharis dietrichiana, Carex gaudichaudiana, Lachnagrostis filiformis, Crassula helmsii, Asperula charophyton, Ranunculus inundates, Isotoma fluviatilis, Eleocharis sphacelata, Elatine gratioloides, Limosella australis, Juncus bufonius, Isolepis fluitans, Carex inversa, Brachyscome radicans.*

Introduced taxa: *Holcus lanatus, Rorippa palustris, Gamochaeta americanum, Rumex crispus.*

Percent of species introduced: 15%

Notes & conservation status: Bell *et al.* (2009) have divided this community into four types depending on water depth that varies within this lagoon over time. These include:

Physiographic Position: Lagoon edges: restricted, in unmodified systems, to the lagoon edge towards the top of basin slopes at study sites but commonly occurs over the whole basin if very shallow (drained or in-filled).

Assemblage 1: *Hydrocotyle tripartita – Isotoma fluviatilis – Ranunculus inundatus – Lilaeopsis polyantha* herbfield.

Water level fluctuations are a feature of this habitat; many species here belong to the amphibious group described by Brock and Casanova (1997). In most drained lagoons and in shallow, presumably long in-filled lagoons, elements of this community occur across the whole basin. Often, where substantial hydrological disturbance has occurred, a few species of this community (e.g. *Hydrocotyle tripartita* and *Lachnagrostis filiformis*) are the only wetland species that remain, occurring alongside common terrestrial pasture species, both exotic and native.

Physiographic Position: Lagoon basins: Restricted to the lagoon basin in deeper water. Generally only occurs in intact lagoons with little or no hydrological disturbance. Elements of this community (*Eleocharis sphacelata* and *Myriophyllum variifolium*) may occur in some in-filled lagoons (Wyanbah, Barleyfields) and in some drained lagoons (Edenglen).

Assemblage 2: *Eleocharis sphacelata – Potamogeton tricarinatus* Sedgeland. Occurring in deepest parts of some lagoons. Characterised by high cover and abundance of both *Eleocharis sphacelata* and *Potamogeton tricarinatus* (where it occurs). In Little Llangothlin Lagoon often an *Eleocharis sphacelata* monoculture. This community is characterised by low species richness (4.4, range 1–8) and the floating submerged plant *Utricularia australis* is absent (compare to Communities 3, 4 and 5).

Assemblage 3: *Eleocharis sphacelata – Utricularia australis – Isolepis fluitans* herbfield. Occurring in deeper parts of smaller or shallower lagoons and at intermediate depths of large, deeper sites. Essentially represents communities at intermediate depths where relatively shallow water and vegetation cover prevent

disturbance by wind. Extensive in the deeper centre of Little Llangothlin Lagoon and covers almost the whole surface of Llangothlin Lagoon except for part of the southern end where open water and stands of *Myriophyllum variifolium* are common. Mean richness six (range 3–11).

Assemblage 4: *Utricularia australis – Nitella sonderi* herbfield. Occurring at sheltered intermediate depths of large lagoons where cover of emergents and floating-leaved plants is low and patchy. Characterised by submerged species, sparse cover of emergents and floating-leaved species and relatively high light penetration into the water column. Low richness (7.7, range 7–9) and extreme patchiness of all species is a feature of this community.

Keith (2004) refers to the intermittent and semi-permanent wetlands found on deflation hollows of the Northern Tablelands and the Monaro as montane lakes; Jacobs & Brock (1993) describe these wetlands as ephemeral lakes and swamps. However, Paijmans *et al*. (1985) restrict lakes to those water-bodies greater than 1 m deep when full, a definition that would exclude all but two of the wetlands in the New England Tablelands Bioregion. Timms (1992) discusses the pitfalls of attempting to define lakes in Australia where many lakes are ephemeral. In his study he excluded small water bodies (ponds; <1 ha) and those where vegetation dominates the water surface (swamps). We therefore have reservations about using the term lake for these New England Tablelands wetlands, since all are dominated by emergent macrophytes, most are shallow and a few are less than one hectare. It is symptomatic of this confusion over terminology that sees Benson & Jacobs (1994) describe these systems on the Monaro as lakes while describing vegetation communities in them as marshes. Globally these systems would probably best be described as semi-permanent or ephemeral marshes (Usback & James 1993). We, as does local custom and the geomorphological literature (Walker 1976; Haworth et al. 1999), will refer to these wetlands as lagoons (Usback & James 1993; Bell & Clarke 2004; Benson & Ashby 2000). Vegetation typical of these lagoons is incorporated within the community listed as an **endangered** ecological community both under the Threatened Species Conservation Act 1995 (Upland Wetlands of the Drainage Divide of the New England Tableland Bioregion) and the Environment Protection and Biodiversity Conservation Act 1999 (Upland wetlands of the New England Tablelands and the Monaro Plateau). Some species of these temporary wetlands display considerable morphological

plasticity with two architectural forms, one for growing in the water column and another for surviving on damp mud (Brock 1991). These species are termed amphibious responders by Brock & Casanova (1997), who allocated species of these and other Northern Tablelands wetlands into three broad functional groups based on their establishment characteristics. Lagoons in the Northern Tablelands Bioregion refer to a series of shallow upland wetlands and ponds, typically located in saucer-shaped areas of negative relief with closed or semi-closed drainage, on flat or gently undulating landscapes associated with Tertiary basalt flows (Walker 1977). Even when full, lagoons are rarely more than 1.5 m deep. However, a distinguishing feature is their well-defined and apparently wave-cut banks that contrast with sandy lunettes on their downwind shores, both features indicating that they formed under climatic conditions different from the present. Lagoons differ from other wetlands of the region in morphology and location. Most are oval-shaped often with distinct rocky margins, though with considerable recent siltation accumulated on lagoon edges. They all occur above 900 m close to the top of Great Divide or to adjacent leading ridges, and inland of the 1000 mm rainfall isohyet. They are therefore found not in the wettest areas of the eastern 'falls country' of the Tablelands, but in the more inland areas prone to cycles of wetting and drying where weathering by water table fluctuation is more intense. Retention of water in the closed basins has been facilitated by drainage impediment caused by the accumulation of the secondary products of weathering, such as stiff clays and the duricrusts ferricrete and silcrete. These secondary products are most commonly associated with basalt weathering but may occasionally form from different rock types under similar environmental conditions, probably that of marked seasonal variation in water tables and subsequent precipitation of duricrust minerals. Lagoons receive water from their relatively small catchments by various combinations of hydrological processes; some are mainly stream-fed, some spring-fed and some fed by overland flow. As most lagoons were probably initiated by return-flow sapping at the base of basalt rises, some have marginal peatlands that may retain moisture when the centre of the basin is dry. While largely closed systems, in extreme floods water may spill into the adjoining major river catchments, the Clarence, Macleay or Gwydir river systems. Lagoons of this type are found the length of the Great Divide in low relief tableland areas, such as in the Monaro district of southern New South Wales (Pillans 1987; Benson & Jacobs 1994). Although most often associated with basalt lithologies, they are not volcanic in

origin. Apart from obvious differences in morphology to volcanic maars, the superficial nature of the drainage divide lagoons was demonstrated by Coenraads (1989) when he drilled through the basement of four representative lagoons in the Glen Innes district to the underlying country rock. Some of the lagoons have either sand dunes or clay-rich mounds on their eastern (lee) side (called 'lunettes', because of their typical wind-formed crescent shape), probably products of deflation or wave action formed under different local climatic conditions during the glacial cycle of the last 2 million years (Pillans 1987). Thus, unlike most lakes, their basins tend to be renewed by deflation (wind erosion) over periods of tens of thousands of years and, as their catchments are small, they are rarely completely infilled. Lagoon sediments are rarely more than several metres deep, and radiocarbon dating of the peat fraction of these sediments indicates that the present cycle of sedimentation commenced ~ 15 000 years ago as climate became wetter and warmer after the last Glacial Maximum (Haworth 1994; Haworth et al. 1999). Species richness generally decreases with depth (Fig. 4) and communities at lagoon margins are consistently richer in species than those in deeper water. Margin communities typically occupy only a small part of the basin (Figs. 5 and 6) and edge and deeper communities (e. g. Communities 1, 4 and 5) are more extensive. All but a few lagoons have basaltic substrate and those that are on other bedrocks (e.g. Racecourse, Kyoma) are close to the edge of basaltic landscapes and are thought to have developed on them (Walker 1977; Haworth 1994). The influence of acid granite soils and sandy lunettes is seen particularly at the margins of Llangothlin and Little Llangothlin where soils have a high sand content (Bell 2000) and species such as *Baloskion stenocoleum* and *Eleocharis atricha*, that are more typical of acidic soils, occur. Lagoons are more numerous and extensive than previously described (Walker 1977; Keith 2004). Of the 58 lagoons identified all but New Country Swamp contain or potentially contain the listed Endangered Ecological Community. It is likely that many more existed in the Bioregion but have since been lost due to drainage or natural in-filling processes or to in-filling exacerbated by clearing and grazing (Haworth 1994; Haworth & Gale 1999). Some landholders refer to parts of their property that briefly hold water after rain – no doubt some of these areas were lagoons that have become silted up by natural processes and erosion. The majority (includes all drained and shallow lagoons) are temporary and only hold water for short periods each year or only in wet years. Only two the largest could be termed semi-permanent (Little Llangothlin, Llangothlin) and even these have been known to

dry completely in severe droughts. The transect survey thus represents the vegetation of these sites at one point in time. Lagoon vegetation is highly dynamic both within a growing season (Bell 1991) and over a number of years (Bell 2000) in response to changes in water depth and to water level history. A drought may see that part of Llangothlin Lagoon, which in 1998 supported the *Utricularia australis – Nitella sonderi* community, covered with terrestrial plants such as *Conyza bonariensis* and *Persicaria* sp. Even where the species mix is the same in, for example, the edge Community 1, under some conditions, different species such as *Myriophyllum variifolium* (wetter) or *Hydrocotyle tripartita* (drier) may dominate. Many of these species respond to deeper water by altering growth forms (Brock & Casanova 1997) but survive in dry sediments by means of seeds, tubers (*Potamogeton tricarinatus*) or dormant winter buds (*Utricularia australis*, *Aldrovanda vesiculosa*). Because of temporal and within wetland variation, vegetation description in these as in other dynamic systems is problematic (Bell 2000). Although vegetation at the regional or whole wetland scale is appropriate for large-scale mapping (Benson & Jacobs 1994; Benson & Ashby 2000), broad descriptions ignore, of necessity, a wealth of detail that occurs at finer grains. Species richness, for example, varies strongly with depth (Figs 4 and 5). Thus whole wetland presence/abundance lists imply that all species co-exist: our study suggests that this is not always the case. We suggest that, at finer grains, differences among within-lagoon communities emerge that may be more important to the functioning of these systems than differences among lagoons. These wetlands are, on geological time scales, temporary features of the landscape and have probably been slowly filling with sediment since the cessation of the active basin deflation period. Thus we need to be realistic about potential changes to these systems, particularly as we have no records of the sort of communities these basins supported before the influx of sheep to the Tablelands in the 1850s (Haworth 1994). At shorter time scales, what is certain is these systems depend for their diversity of habitat and species on their diversity of wetting and drying cycles (Brock et al. 1999). Restoring lagoon outlets to their original levels (Little Llangothlin Lagoon) is predicted, in time, to restore diversity of habitat. In 1998 a few plants of the weedy species *Ranunculus sceleratus* appeared at the edge of Dangars Lagoon. By 2006, the population at Dangars Lagoon was substantial and scattered plants have appeared at Racecourse and Little Llangothlin Lagoons. This species is dispersed by water birds (Green et al.

2008), is a coloniser of bare mud and is of particular concern to those wetlands where expanses of bar mud are common.

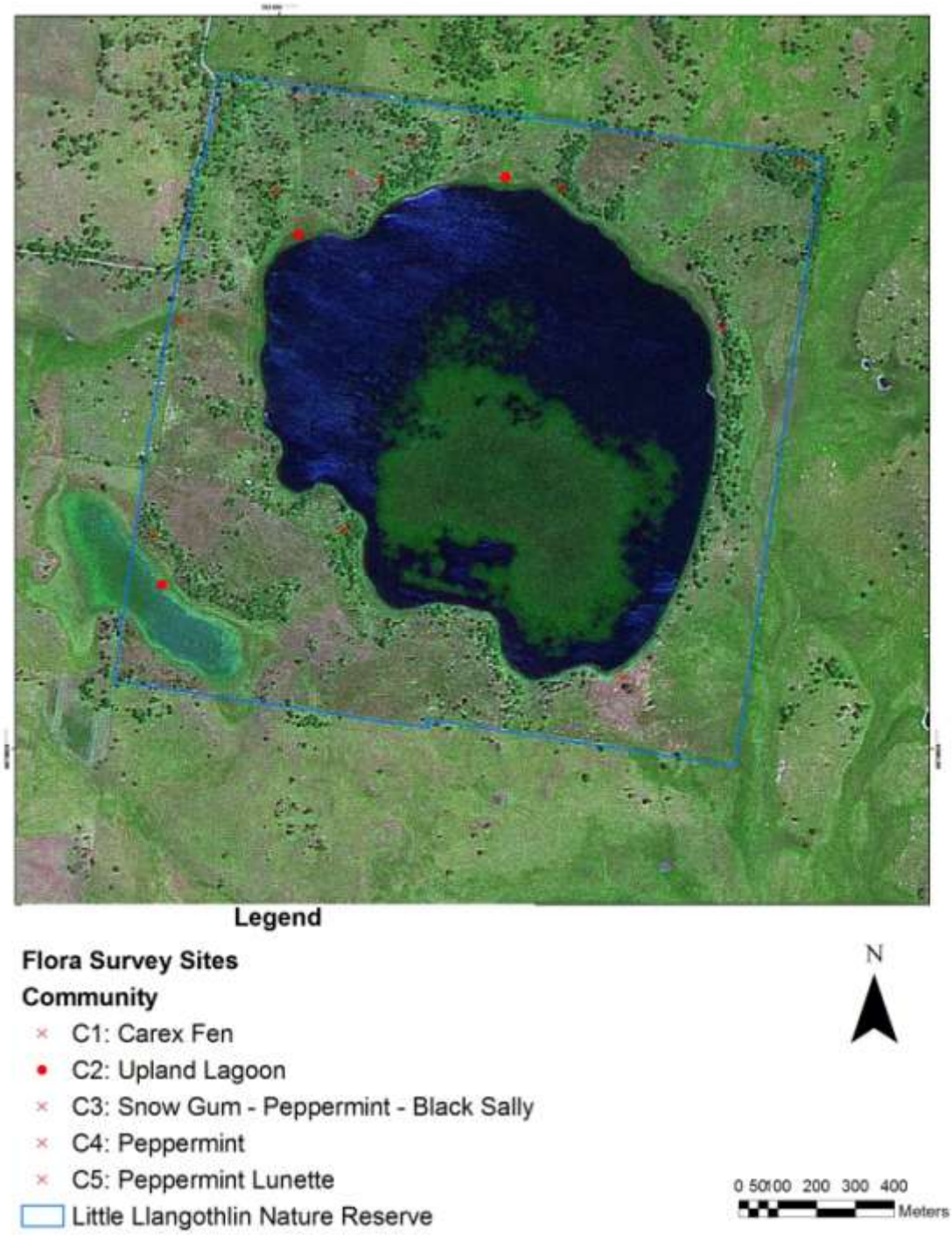

Figure 6: Placement of site within Community 2 at Little Llangothlin.

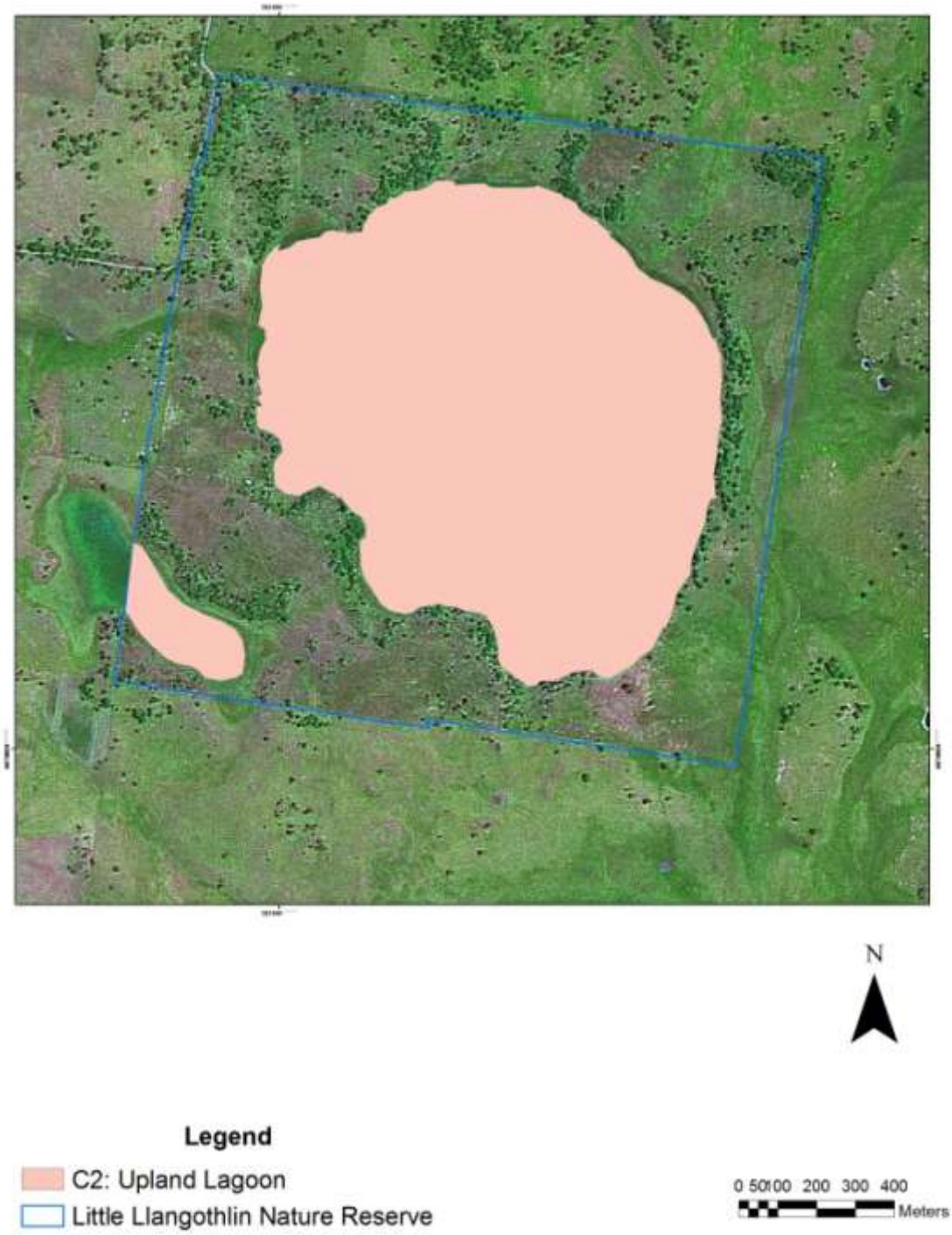

Figure 7: Mapped distribution of Community 2.

Plate 2: Photographs of Community 2, Lagoon edge.

3.4.3 Community 3: Snow Gum - Peppermint Woodland (Endangered)

Eucalyptus pauciflora (Snow Gum) – *Eucalyptus nova-anglica* (New England Peppermint) – *Eucalyptus stellulata* (Black Sally) Woodland

Will 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.*

Parts will also fall within the Ribbon Gum – Mountain Gum – Snow Gum grassy forest/woodland of the New England Tableland Bioregion – Endangered Ecological Community Listing. *NSW Threatened Species Conservation Act.*

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

Sample sites (8): 1, 2, 4, 5, 6, 7, 9, 10.
Environmental relationships: found through most of the reserve where clearing has not been overly conducted or where regeneration of cleared lands has occurred. Soils are black and basaltic.
Distribution within reserve: throughout all non-inundated areas.
Structure: a grassy woodland.

- Tree-layer: (4-) 6-15 m tall. 15-35% cover.
- Understorey layer: < 1 m tall. 100% cover.

Number of hectares: 46.3 **Proportion of reserve:** 18.1%
No. of taxa: 72 **No. of taxa per plot:** 18-**20**-30.
Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).
Trees: *Eucalyptus pauciflora, Eucalyptus nova-anglica, Eucalyptus stellulata, Eucalyptus acaciiformis¸ Eucalyptus dalrympleana* subsp. *heptantha, Eucalyptus viminalis*.
Shrubs: *Acacia dealbata, Acacia melanoxylon, Pimelea linifolia*.

Climbers & trailers: *Rubus parviflorus, Desmodium varians, Glycine clandestina, Cullen tenax.*

Ground cover: *Xerochrysum bracteatum, Pteridium esculentum, Poa sieberiana, Geraniums solanderi, Hydrocotyle laxiflora, Craspedia variabilis, Velleia paradoxa, Galium propinquum, Microlaena stipoides, Acaena novae-zelandiae, Acaena ovina, Carex inversa, Themeda triandra, Pennisetum alopecuroides, Gonocarpus tetragynus, Dianella revoluta, Asplenium flavellifolium, Asperula conferta, Wahlenbergia gracilis, Wahlenbergia ceracea, Thesium australe, Solanum opacum, Poa labillardieri, Lagenifera, stipitata, Hovea heterophylla, Euchiton sphaericus, Epilobium billardierianum* subsp. *cinereum, Dichondra repens, Coronidium scorpioides, Austrodanthonia monticola*.

Introduced taxa: *Festuca elatior, Leucanthemum vulgare, Hypochaeris radicata, Holcus lanatus, Lolium perenne, Centaurea solstitialis, Solanum nigrum, Acetosella vulgaris, Trifolium repens, Triolium dubium, Tragopogon dubius, Poa pratensis, Conyza bonariensis, Taraxacum officinale, Sonchus oleraceus, Conyza sumatrensis, Rubus discolor, Hypochaeris microcephala, Dianthus ameria, Cirsium vulgare, Chloris virgata, Sonchus asper, Plantago lanceolata, Paronychia brasiliana, Medicago polymorpha, Verbascum virgatum, Senecio madagascariensis, Petrorhagia nanteuilii, Lactuca serriola, Juncus articulatus.*

Percent of species introduced: 35%

Notes & conservation status: 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.

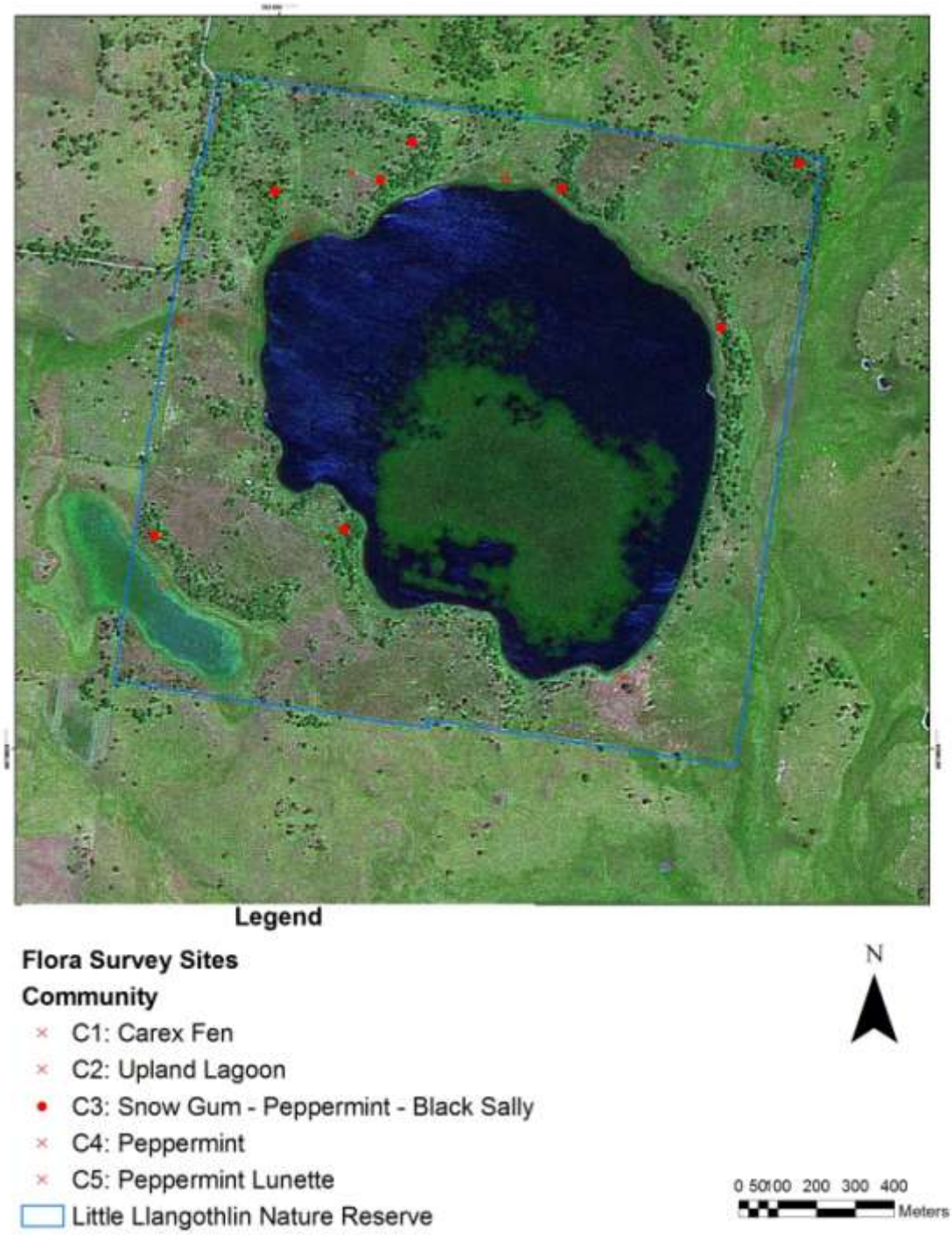

Figure 8: Placement of sites within Community 3 at Little Llangothlin.

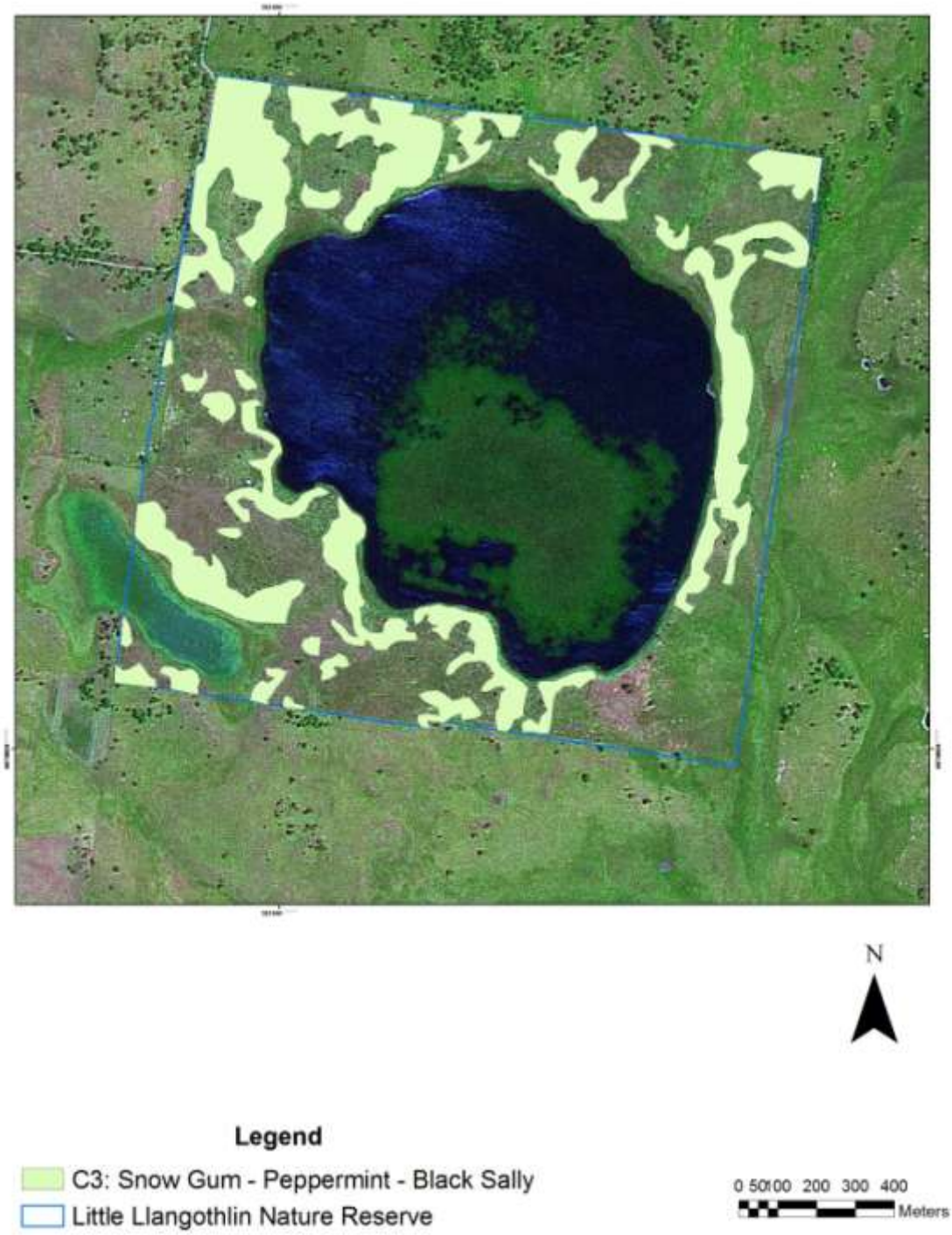

Figure 9: Mapped distribution of Community 3.

Plate 3: Photographs of Community 3; above Site 1, below Site 2.

Plate 4: Photographs of Community 3; above Site 4, below Site 7.

Plate 5: Photographs of Community 3; above Site 9, below Site 10.

3.4.4 Community 4: New England Peppermint Open Woodland (Endangered) & Derived Exotic Grassland

Eucalyptus nova-anglica (New England Peppermint) Open Woodland & Grassland

Falls 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.*

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

Sample sites (1): 3.

Environmental relationships: found throughout the reserve in areas that have been over-cleared and not yet regenerated. On black basaltic clays.

Distribution within reserve: throughout the reserve in non-inundated areas.

Structure: a grassland or open grassy woodland.

- Tree-layer: 3-10 m tall. 5-10% cover. Usually absent.
- Understorey layer: < 1 m tall. 90-100% cover.

Number of hectares: 70.3 **Proportion of reserve:** 27.6%

No. of taxa: 23 **No. of taxa per plot: 23**.

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

Trees: *Eucalyptus nova-anglica*.

Shrubs: none apparent.

Climbers & trailers: none apparent.

Ground cover: *Carex inversa, Velleia paradoxa, Poa sieberiana, Pennisetum alopecuroides, Hypoxis hygrometrica, Hydrocotyle laxiflora, Haloragis heterophylla, Geranium solanderi* subsp. *solanderi, Asperula conferta, Acaena ovina, Juncus usitatus, Juncus pauciflorus, Cyperus sphaeroideus, Craspedia variabilis*.

Introduced taxa: *Festuca elatior, Plantago lanceolata, Medicago polymorpha, Leucanthemum vulgare, Holcus lanatus, Onopordum acanthium, Hypochaeris microcephala, Cirsium vulgare.*

Percent of species introduced: 35%

Notes & conservation status: areas that are not overly dominated by weeds 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*. Many areas however are overly dominated by weedy taxa and would fall outside of these determinations due to their very poor state. However this poor state could be temporal and with natural or assisted regeneration areas that are poor may return to a reasonable state and again be included as a reasonable example of this endangered community. In particular Fescue is a major weed which prefers open well lit environments. Hence as cover increases this species is likely to become less dominant and then allow more native taxa to reinvade. Fire can be used as a management tool in many situations to control weedy taxa, unfortunately in this situation it is likely to assist or at least have little effect on Fescue. The increase of light to the soil and ash bed assists the recovery of this week. An increase in canopy cover is likely to be the best long term remedy for decreasing the cover of Fescue within these lands. As this community returns to a better condition it will fall within Community 3.

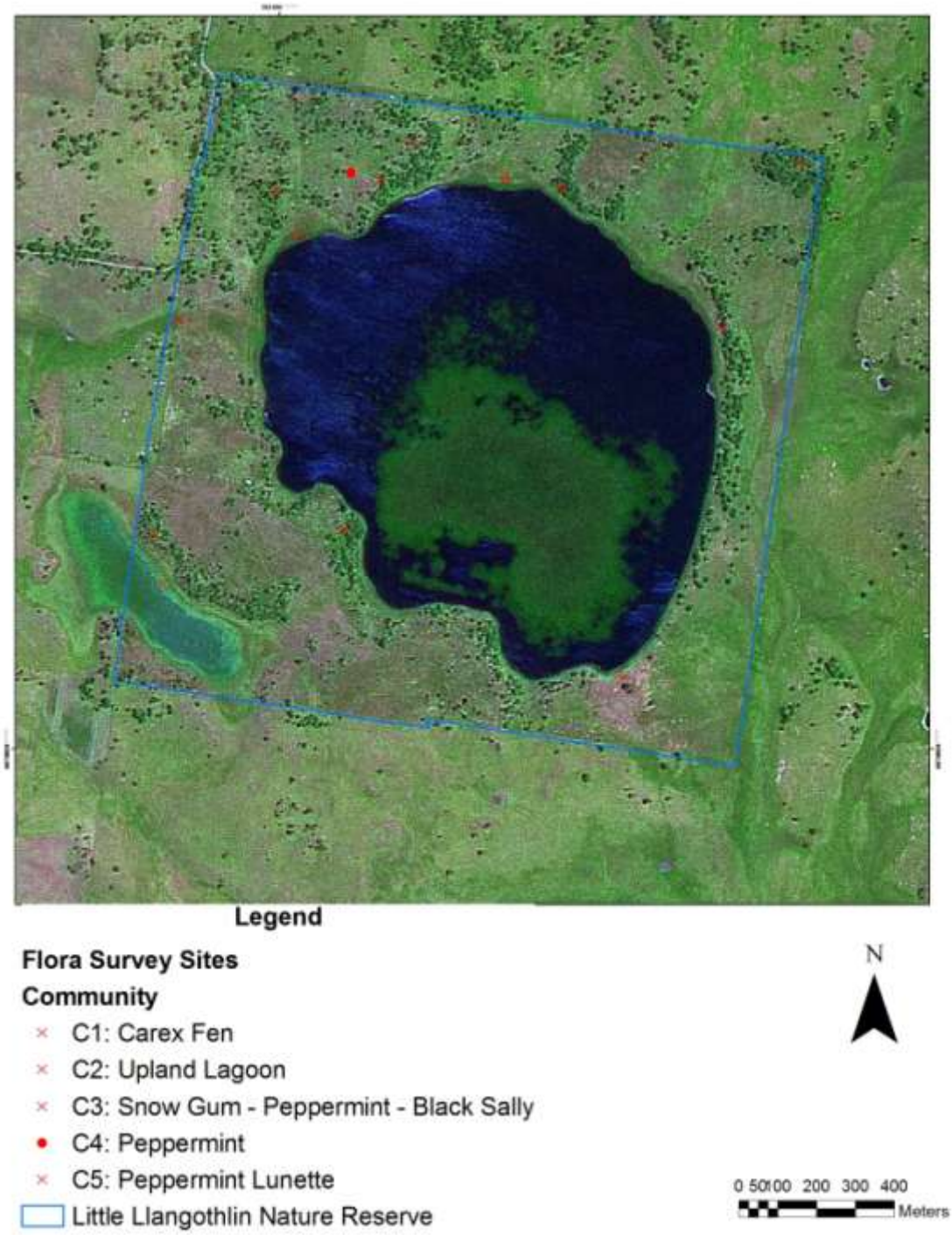

Figure 10: Placement of sites within Community 4 at Little Llangothlin.

Figure 11: Mapped distribution of Community 4.

Plate 6: Photograph of Community 4, above Site 3.

3.4.5 Community 5: New England Peppermint Lunette Woodland (Endangered)

Eucalyptus nova-anglica (New England Peppermint) Open Woodland on Alluvial Lunette

Will 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.*

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

Sample sites (1): 8.
Environmental relationships: found on sandy light coloured loamy sand associated within the depositional lunette.
Distribution within reserve: found restricted to the lunette area.
Structure: currently an open grassy woodland.

- Tree-layer: 12-15 m tall. 5-10% cover.
- Understorey layer: < 1 m tall. 60-100% cover.

Number of hectares: 3.2 **Proportion of reserve:** 1.3%
No. of taxa: 14 **No. of taxa per plot: 14**.
Most common natives: listed in order of decreasing summed cover scores (fidelity x cover).
Trees: *Eucalyptus nova-anglica*.
Shrubs: none apparent.
Climbers & trailers: none apparent.
Ground cover: *Ammobium alatum, Panicum effusum, Microlaena stipoides, Geraniums solanderi* subsp. *solanderi, Craspedia variabilis, Carex inversa*.
Introduced taxa: *Lolium perenne, Conyza bonariensis, Acetosella vulgaris, Paronychia brasiliana, Hypochaeris radicata, Solanum nigrum, Hypochaeris microcephala.*
Significant species: none apparent.

Percent of species introduced: 50%

Notes & conservation status: as with Community 4, this assemblage is in relatively poor condition due to clearing and weed invasion. Again an increase in cover is likely to help ameliorate some of these weed issues. Due to the soil texture and nutrient status this assemblage should always separate within analysis of this scale despite its condition. However in larger regional scale investigations it would be placed within the larger New England Peppermint group of communities and thus falls 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.*

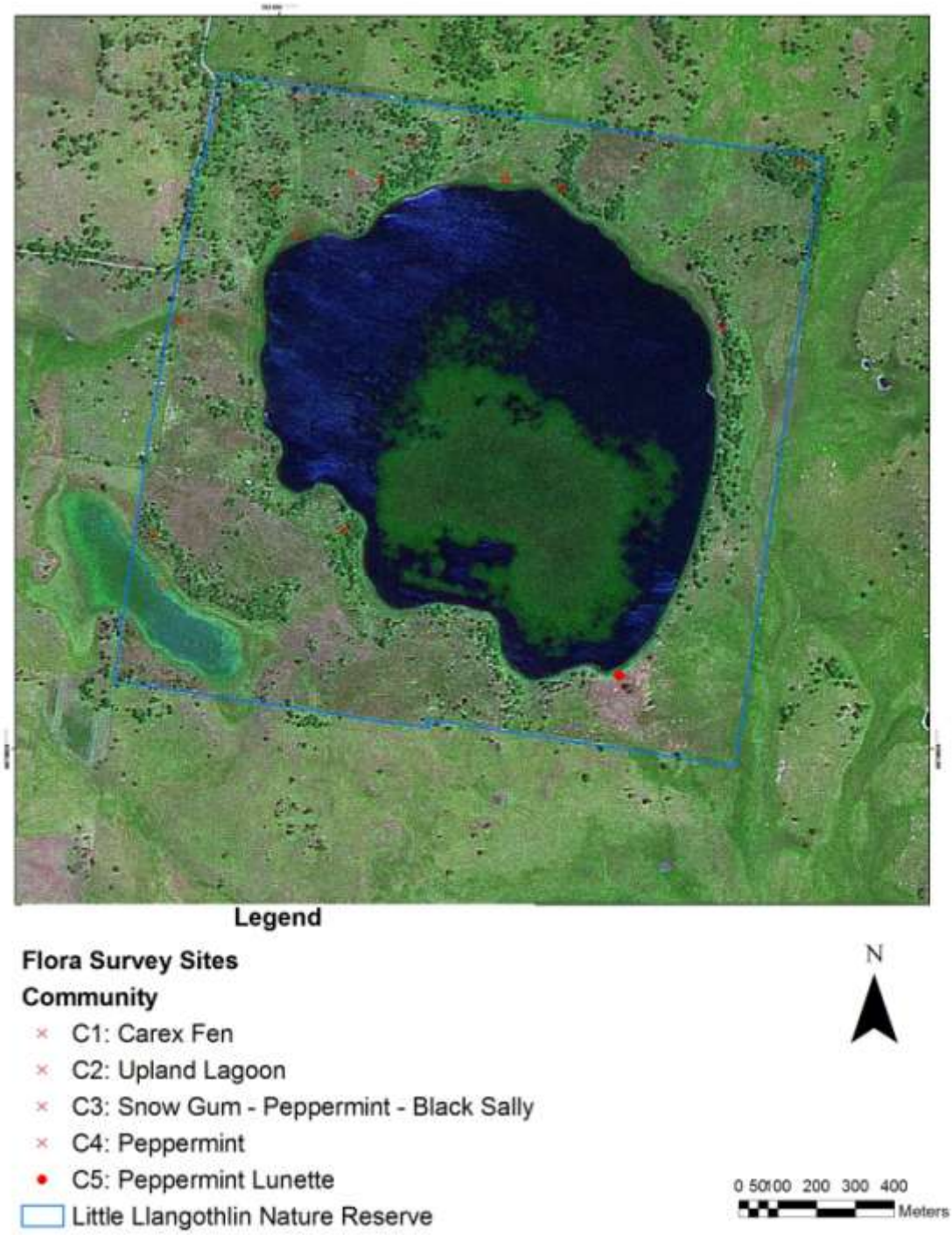

Figure 12: Placement of sites within Community 5 at Little Llangothlin.

Figure 13: Mapped distribution of Community 5.

Plate 6: Photograph of Community 5, above Site 8.

3.5 Taxa of conservation significance

3.5.1 *Thesium australe* R.Br. (3VCi; TSC Schedule 2)

Taxonomy

Type: New South Wales: Central Coast: Cow pasture plains (Camden), near Port Jackson, N.S.W., *R. Brown s.n.*, 19 October 1803 (ISO: MEL).

Family: Santalaceae.

Affinities: the genus has c. 245 species in Europe, Africa, Asia and South America however this is the only representative within Australia.

Synonymy: *Linosyris australe* (R.Br.) Kuntze.

Derivation of name:

Common name: Toadflax.

Published conservation status: 3ECi (Briggs & Leigh 1988); 3VCi (Briggs & Leigh 1996).

Life history

Growth form: perennial pale green or yellow green parasitic herb to 40 cm tall.

Vegetative spread: No.

Longevity: unknown.

Primary juvenile period: unknown.

Flowers: September to March.

Fruit/seed: September to March.

Dispersal, establishment & growth: dispersal by a dry nut like drupe.

Fire response: known to resprout after fire. Prolific germination associated with fire or other disturbances (Steve Griffith and Paul Sheringham, *pers. obs.*, *pers. comm.*).

Interactions with other organisms: parasitic on the roots of grasses. Despite records to the contrary since 1980 the species is still often recorded as being obligately parasitic on *Themeda triandra* (Cohn 1999), however a large number of records are from communities which do not contain *Themeda* but do include a number of other grass species including areas dominated solely by introduced grasses have been noted from as early as 1980. At localities within the reserve the species was not associated with *Themeda*.

Distribution

Botanical sub-regions: North Coast, Central Coast, Northern Tablelands, Southern Tablelands, North Western Slopes and Central Western Slopes in New South Wales. Known from Moreton, Darling Downs and Leichhardt in Queensland. In Victoria from D, N, R, S, V, V and from North-eastern in Tasmania.

General distribution: this species has a widespread distribution from south-east Queensland to Gippsland in Victoria and the Bass Strait Islands with a historical record from Tasmania.

Distribution within Barayamal NP: found primarily associated with the margins of creek banks on alluvial basaltic soils.

Habitat

Habitat: generally restricted to grasslands and woodlands usually on basalts although known from metamorphic sedimentary rocks associated with headlands on the coast and granitic and acid volcanic soils.

Altitude: 100-1800 m.

Annual Rainfall: 400-1200 mm.

Abundance: known from very sporadic and disjunct populations. Often many plants will occur in a single population.

Substrate: Basalt, Rhyolite, Granite and Metasediments.

Exposure: protected to exposed sites.

Management

Reserved: Known to be reserved in Bullen Range NR, Crowdy Bay NP, Hat Head NP, Kattang NR, Kwiambal NP, Bolivia Hill NR, Kings Plains NP, Arakoola NR, Severn River NR, Kosciusko NP, Little Llangotholin Lagoon NR, Moonee Beach NR, Mount Greville NP, Barayamal NP, and Namadgi NP.

Threats: domestic grazing is a threat to this species.

Plate 8: Photograph of *Thesium australe*.

3.5.2 *Aldrovandra vesiculosa* R.Br. (TSC Schedule 1 Endangered)

Taxonomy

Family: Droseraceae.

Affinities: sole member of its Genus.

Synonymy: none.

Common name: Waterwheel plant.

Published conservation status: *TSC* Act Endangered.

Life history

Growth form: a floating plant 5-20 cm long with whorls of reddish leaves.

Vegetative spread: No.

Longevity: unknown.

Dispersal, establishment & growth: dispersal by water or waterfowl.

Fire response: unknown but unlikely to burn.

Interactions with other organisms: parasitic ingesting insects.

Distribution

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

General distribution: known from mostly northern Australia and into Asia and Africa.

Distribution within Little Llangothlin: restricted to the lagoon area.

Habitat

Habitat: wetlands.

Altitude: coastal to 1500 m. Within Australia usually restricted to coastal districts.

Annual Rainfall: 1000-1400 mm.

Abundance: known from very sporadic and disjunct populations. Often many plants will occur in a single population.

Exposure: protected to exposed sites.

Management

Reserved: Known to be reserved in Little Llangothlin Nature Reserve.

Threats: domestic grazing is a threat to this species.

Plate 9: Image of *Aldovanda vesiculosa* by John Griggs from the DEC NSW Threatened Species Website.

3.9.3 *Asperula charophyton* Airy Shaw & Turrill (3RCa)

Taxonomy

Type: Mackenzie River and Suttor River, ND., F. Von Mueller.

Reference: *Bulletin of Miscellaneous Information*, Kew (18 April 1928) 101.

Family: Rubiaceae.

Affinities: *Asperula conferta*.

Synonymy: *Asperula conferta* var. *elongata*.

Derivation of name: similar to a charophyte.

Common name: Asperula.

Life History

Growth form: sub-erect to spreading perennial herb to 30 cm long with scabrous to glabrous stems with leaves and stipules in whorls of 6.

Vegetative Spread: none.

Longevity: unknown.

Primary Juvenile Period: unknown.

Flowers: Summer.

Fruit/seed: Sumer to Autumn.

Dispersal, establishment & growth: via seed, potentially fragments.

Fire response: unknown.

Interactions with other organisms: probably pollinated by insects.

Habitat

Habitat: Llangothlin Lagoon on the Northern Tablelands. Also found on scree and talus slopes at Warrumbungles NP however the form here is noticeably different (*pers. obs* & I.Telford *pers comm.*). It is highly likely that these two forms are distinct taxa and that the form at Little Llangothlin requires listed as threatened, probably Endangered on the *TSC* Act.

Distribution

Botanical subdivisions: Northern Tablelands, North Western Slopes and the Darling Downs and Moreton Districts of Queensland.

General Distribution: very disjunct distribution known from only a handful of collections in south east Queensland and Guyra, Walcha, Nundle and the Warrumbungle's. Infertile material from Victoria is also known but this may be *Asperula conferta.*

Distribution within Little Llangothlin: within Carex fens.

Conservation

Reservation status: Warrumbungle NP, Llangothlin NR, Mother of Ducks NR.

Abundance: common in fens.

Threats: grazing.

Management

Management considerations: this species may require further taxonomic investigation as the form found at the Warrumbungle's is markedly different from those found in fen swamps in the Guyra district.

Plate 10: Photograph of *Asperula charophyton* taken at Little Llangothlin Nature Reserve.

Five additional taxa are of significance: *Plantago* sp. nov., *Eryngium* sp. 'Little Llangothlin NR', *Helichrysum* sp. 'Glencoe' and *Leiocarpa* sp. 'Uralla'. The edge of Billybung Lagoon contains one of the two known populations of *Plantago* sp. nov. (*pers. com.* Lachlan Copeland). *Carex* sp. 'Bendemeer' is a yet un-named species found during surveys of Carex Fens (Hunter & Bell 2010), this species appears to be restricted to Carex Fens sporadically from Bendemeer to Tingha and across to Little Llangothlin. Also known also from the ACT, *Eryngium* sp. 'Little Llangothlin NR' occurs within the Bioregion almost exclusively as small scattered populations on the margins or edges of lagoons (Billybung, Llangothlin, Edenglen, Thomas and South Head) with the biggest population at Billybung Lagoon. Both *Plantago* sp. nov. and *Eryngium* sp. 'Little Llangothlin NR' display heterophylly; terrestrial forms have divided leaves, underwater forms undivided. *Leiocarpa* sp. 'Uralla', although fairly common and widespread, also occurs almost exclusively on the margins of lagoons.

Discussion

4.1 General comments

All the communities recognised in this report either entirely or contain listed endangered assemblages within then. In addition a *Thesium australe* and *Aldovandra vesiculosa* both threatened species occurs within the reserve along with a number of yet un-named taxa that may also be recognised as highly restricted and threatened species. Though many cleared areas are highly infested with exotic species it is likely that with time the recovery of the overstorey will assist in the regeneration of the understorey. These areas may always contain a high number and abundance of exotic species though the native taxa may became far more prominent with time.

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).

Table 5: 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
C1: Carex gaudichaudiana – Stellaria angustifolia	No requirement for fire.
C2: Eleocharis acuta – Glyceria australis	No requirement for fire.
C3: Eucalyptus pauciflora – Eucalyptus nova-anglica	No two fires within a 7 yr period, longer interfere period after a high intensity fire. Fires usually within a 30 yr period though longer unburnt examples could be of value.
C4: Eucalyptus nova-anglica	No two fires within a 7 yr period, longer interfere period after a high intensity fire. Fires usually within a 30 yr period though longer unburnt examples could be of value. Fires are unlikely to assist the recovery of areas dominated by Fescue.
C5: Eucalyptus nova-anglica Lunette	No two fires within a 7 yr period, longer interfere period after a high intensity fire. Fires usually within a 30 yr period though longer unburnt examples could be of value.

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.* 25% 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.
- Consider closing non-essential tracks, but upgrading those that are essential through the reserve.

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. Some areas may increase in cover and abundance of weeds with the release of grazing pressure.

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.
- Additional opportunistic floristic survey during a period of good rainfall or under different climatic conditions.
- High priority for a targeted search for threatened species previously noted but not found during this investigation.
- 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 property.

References & Bibliography

Ashley, P.M. & Flood, P. (Eds) (1997) *Tectonics and Metallogenesis of the New England Orogen.* Special Publication No. 19. (Geological Society of Australia Inc.: Sydney).

Ashton, D.H. (1986). Viability of seeds of *Eucalyptus obliqua* and *Leptospermum juniperinum* from capsules subjected to a crown fire. *Australian Forestry* 49: 28-35.

Ashton, D.H. and Webb, R.N. (1977) The ecology of granite outcrops at Wilson's Promontory, Victoria. *Australian Journal of Ecology*. 2: 269-296.

Auld, B.A. (1981) Aspects of the population ecology of Galvanised Burr (*Sclerolaena birchii*). *The Australian Rangeland Journal* 3: 142-148.

Auld, T.D. (1996). Ecology of the Fabaceae in the Sydney region: fire, ants and the soil seed bank. *Cunninghamia* 4: 531-552.

Auld, T.D. (1987). Population dynamics of the shrub *Acacia suaveolens* (Sm.) Willd.: Survivorship throughout the life cycle, a synthesis. *Australian Journal of Ecology* 12: 139-151.

Auld, T.D. & O'Connell, M.A. (1991). Predicting patterns of post-fire germination in 35 eastern Australian Fabaceae. *Australian Journal of Ecology* 16: 53-70.

Austin, M.P. (1991). Vegetation theory in relation to cost-efficient surveys. Pp. 17-22. In: C.R. Margules & M.P. Austin (eds). *Nature Conservation: Cost Effective Surveys and Data Analysis*. (CSIRO: Canberra).

Bakker, J. P. (1985) The impact of grazing on plant communities, plant populations and soil conditions on salt marshes. *Vegetatio* 62: 391–398.

Bale, C.L. (1995). 'Floristic Groups in North-Eastern New South Wales – The Eucalypt Woodlands and Forests Incorporating Associated Sclerophyll Taxa'. Unpublished Report to the New South Wales National Parks & Wildlife Service. (Armidale).

Barker, M. (1990). Effects of fire on the floristic composition, structure and flammability of rainforest vegetation. *TasForests* 2: 117-120.

Barnes, R.G., Henley, H.F. & Henley, J.E. (1995) Plan 1, Geology and Mineral Deposit Series Tenterfield 1:100 000 Sheet (9339) Edition 1. In: *Exploration Data Package for the Tenterfield and Coaldale 1:100 000 Sheet Areas.* Vol. 1

& 2. Geological Survey Report Number GS 1995-004 July 1995. (Geological Survey of New South Wales, Department of Minerals and Energy: Sydney).

Barnes, R.G., Brown, R.E., Brownlow, J.W. & Stroud, W.J. (1991) Late Permian volcanics in New England – the Wandsworth Volcanic Group. *Geological Survey of New South Wales Quarterly Notes* 84: 1-36.

Barnes, R.G. & Willis, I.L. (1989) *The Geology of Grafton and Maclean 1:25 000 Sheet Areas*. Geological Survey Report No. GS 1989-117. March 1989. (Geological Survey of New South Wales, Department of Minerals and Energy: Sydney).

Baskin, J.M. and Baskin, C.C. (1988) Endemism in rock outcrop plant communities of unglaciated eastern United States: an evaluation of the roles of edaphic, genetic and light factors. *Journal of Biogeography.* 15: 829-840.

Beadle, N.C.W. (1981) *The Vegetation of Australia*. (Cambridge University Press: Cambridge).

Beadle, N.C.W. (1940). Soil temperatures during forest fires and their effect on the survival of vegetation. *Journal of Ecology* 28: 180-192.

Bean, A.R. (1997a). A revision of *Baeckea* (Myrtaceae) in eastern Australia, Malesia and south-east Asia. *Telopea* 7: 245-268

Bean, A.R. (1997b). A revision of *Rubus* subg. *Malochoolus* (Focke) Focke and *Rubus* subg. *Diemenicus* A.R. Bean (Rosaceae) in Australia. *Austrobaileya* 5: 39-51.

Beard, J.S. (1997) Geography, environment and flora of Mt Mulanje, central Africa. *Journal of the Royal Society of Western Australia*. 80: 167-172.

Beckers, D. & Binns, D. (2000) Vegetation Survey and Mapping Stage 1: Report. *NSW Western Regional Assessments Brigalow Belt South*. (Resource and Conservation Assessment Council).

Belbin, L. (1995a). *Users Guide: PATN Pattern Analysis Package*. (Division of Wildlife & Ecology CSIRO: Canberra).

Belbin, L. (1995b). *Technical Reference: PATN Pattern Analysis Package.* (Division of Wildlife & Ecology CSIRO: Canberra).

Belbin, L. (1991). The analysis of pattern in bio-survey data. Pp. 176-190. In: C.R. Margules & M.P. Austin (eds). *Nature Conservation: Cost Effective Surveys and Data Analysis.* (CSIRO: Canberra).

Bell, D. M. (1991) *Plant phenology in temporary lagoons.* Grad. Dip. Sci. Thesis (University of New England: Armidale).

Bell, D. M. (2000) *The ecology of co-existing* Eleocharis *species.* PhD Thesis (University of New England: Armidale).

Bell, D. M. & Clarke, P.J. (2004) Seed-bank dynamics of *Eleocharis*: can spatial and temporal variability explain habitat segregation? *Australian Journal of Botany* 52: 119–131.

Benson, D.H. (1985). Maturation periods for fire sensitive shrub species in Hawkesbury sandstone vegetation. *Cunninghamia* 1: 339-350.

Benson, D.H. & Howell, J. (1994). The natural vegetation of the Sydney 1:100 000 Map Sheet. *Cunninghamia* 3: 679-788.

Benson, D.H. & Howell, J. (1993). *A strategy for the Rehabilitation of the Riparian Vegetation of the Hawkesbury-Nepean River*. (Royal Botanic Gardens: Sydney).

Benson, D.H. & McDougall, L. (2005) Ecology of Sydney plant species part 10. *Cunninghamia* 9: 16-215.

Benson, D.H. & McDougall, L. (2002) Ecology of Sydney plant species part 9. *Cunninghamia* 7: 695-930.

Benson, D.H. & McDougall, L. (2001) Ecology of Sydney plant species part 8. *Cunninghamia* 7: 241-462.

Benson, D.H. & McDougall, L. (2000) Ecology of Sydney plant species part 7b. *Cunninghamia* 6: 1016-1202.

Benson, D.H. & McDougall, L. (1999). Ecology of Sydney Plant species part 6. *Cunninghamia* 5: 809-987.

Benson, D.H. & McDougall, L. (1997). Ecology of Sydney plant species part 5. *Cunninghamia* 5: 330-544.

Benson, D.H. & McDougall, L. (1997) Ecology of Sydney plant species part 4. *Cunninghamia* 4: 553-752.

Benson, D.H. & McDougall, L. (1995) Ecology of Sydney plant species part 3. *Cunninghamia* 4: 217-431.

Benson, D.H. & McDougall, L. (1994) Ecology of Sydney plant species part 2. *Cunninghamia* 3: 789-1004.

Benson, D.H. & McDougall, L. (1993). Ecology of Sydney plant species part 1. *Cunninghamia* 3: 257-422.

Benson, J.S. (1993) *The biology and management of Ooline (Cadellia pentastylis) in New South Wales.* Species Management Report NO. 2 (NSW National Parks and Wildlife Service: Hurstville)

Benson, J.S. (1991). The effect of 200 years of European settlement on the vegetation and flora of New South Wales. *Cunninghamia* 2: 343-370.

Benson, J.S. (1981). Vegetation of Agnes Banks sand deposit Richmond, New South Wales. *Cunninghamia* 1: 35-58.

Benson, J.S. & Ashby, E. (2000). Vegetation of the Guyra 1:100 000 Map Sheet. *Cunninghamia* 6: 747-872.

Benson, J.S., Dick, R. & Zubovic, A. (1996) Semi-evergreen Vine Thicket vegetation at Derra Derra Ridge, Bingara, New South Wales. *Cunninghamia* 4: 497-510.

Benson, J. S. & Jacobs, S. W. L. (1994) Plant communities of the Monaro Lakes. *Cunninghamia* 3: 651–676.

Benwell, A. (2000). 'Nymboida National Park Vegetation Survey'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Benwell, A. (1998). Post-fire seedling recruitment in coastal heathland in relation to regeneration strategy and habitat. *Australian Journal of Botany* 46: 75-101.

Benwell, A. (1995). Sclerophyll Shrubland and Allied Vegetation of the Mt Warning Shield: Flora, Plant Communities and Island Biogeography. B.A. Hons. Thesis. (Department of Geography and Planning: University of New England, Armidale).

Binns, D.L. (1997). Floristics and vegetation patterns of Coolah Tops, New South Wales. *Cunninghamia* 5: 233-274.

Binns, D.L. (1995a). Flora Survey, Gloucester and Chichester Management Areas, Central Region, New South Wales. *Forest Resources Series No. 34.* (Research Division, State Forests of New South Wales: Sydney).

Binns, D.L. (1995b). Flora Survey, Tenterfield Management Area, Northern Region New South Wales. *Forest Resources Series No. 30.* (Research Division, State Forests of New South Wales: Sydney).

Binns, D.L. (1995c). Flora Survey, Casino Management Area, Northern Region, State Forests of New South Wales. *Casino Management Area Environmental*

Impact Statement Supporting Document No. 7. (Research Division, State Forests of New South Wales).

Binns, D.L. (1995d). Flora Survey, Dorrigo Three Year Environmental Impact Statement Area, Northern Region, New South Wales. *Forest Resources Series No. 25*. (Research Division, State Forests of New South Wales: Sydney).

Binns, D.L. (1992). Flora Survey, Glen Innes Management Area, Northern Region New South Wales. *Forest Resources Series No. 23*. (Forestry Commission of New South Wales: Sydney).

Binns, D.L. (1991). 'Vegetation Dynamics of *Eucalyptus microcorys – E. saligna* Wet Sclerophyll Forest in Response to Logging'. M.Res.Sc. Thesis. (Department of Geography and Planning, University of New England: Armidale).

Binns, D.L. & Chapman, W.S. (1993). Flora Survey, Kempsey and Wauchope Management Areas, Central Region, New South Wales. *Forest Resources Series no. 24.* (Research Division, State Forests of New South Wales: Sydney).

Bishop, T. (1996). *Field Guide to the Orchids of New South Wales and Victoria*. (University of New South Wales Press: Ltd. Sydney).

Bond, W.J. and van Wilgen, B.W. (1996) *Fire and Plants*. Chapman and Hall, London.

Boughton, V.H. (1970) *A Survey of the Literature Concerning the effects of Fire on the Forests of Australia*. The Council of the Municipality of Ku-ring-gai, Sydney.

Bradfield, G.E. (1981). Component analysis of fire patterns in open eucalypt forest. *Australian Journal of Ecology* 6: 99-109.

Bradstock, R.A. (1995).Demography of woody plants in relation to fire: *Telopea speciosissima*. *Proceedings of the Linnaean Society.* 115: 25-33.

Bradstock, R.A. (1990). Demography of woody plants in relation to fire: *Banksia serrata* L.f. and *Isopogon anemonifolius* (Salisb.) Knight. *Australian Journal of Ecology* 15: 117-132.

Bradstock, R.A. & Auld, T.D. (1995) Soil temperature during experimental bushfires in relation to fire intensity: consequences for legume germination and fire management in south eastern Australia. *Journal of Applied Ecology* 32: 76-84.

Bradstock, R.A., Keith, D.A. & Auld, T.D. (1995). Fire and conservation: imperatives and constraints on managing for diversity. Pp. 323-333. In: R.A. Bradstock,

T.D. Auld, D.A. Keith, R.T. Kingsford, D. Lunney & D.P. Sivertsen (Ed) *Conserving Biodiversity: Threats and Solutions* (Surrey Beatty & Sons: Sydney).

Bradstock, R.A., Tozer, M.G. & Keith, D.A. (1997). Effects of high frequency fire on floristic composition and abundance in fire-prone heathland near Sydney. *Australian Journal of Botany* 45: 641-655.

Braun-Blanquet, J. (1982). *Plant Sociology: the Study of Plant Communities*. (McGraw Hill: New York).

Briggs, J.D. & Leigh, J.H. (1996). *Rare or Threatened Australian Plants.* (CSIRO & the Australian Nature Conservation Agency: Canberra)

Briggs, J.D. & Leigh, J.H. (1988). *Rare or Threatened Australian Plants*. Australian National Parks & Wildlife Service Special Publication 14.

Brock, M. A. (1991) Mechanisms for maintaining persistent populations of *Myriophyllum variifolium* J. Hooker in a fluctuating shallow Australian wetland. *Aquatic Botany* 39: 211-219.

Brock, M. A. (1998) Are temporary wetlands resilient? Evidence from seed banks of Australian and South African wetlands. Pp. 193–206 in McComb, A. J. & Davis, J. A. (eds.) *Wetlands for the Future* (Gleneagles Publishing: Adelaide).

Brock, M. A., & Casanova, M. T. (1997) Plant life at the edge of wetlands: ecological responses to wetting and drying patterns. Pp. 181–192 in Klomp, N. & Lunt, I. (eds.) *Frontiers in ecology: building the links* (Elsevier Science: Oxford).

Brock, M.A., Smith, R.G.B, & Jarman, P.J. (1999) Drain it, dam it: Alteration of water regime in shallow wetlands on the New England Tableland of New South Wales. *Wetlands Ecology and Management* 3: 37-46.

Brock, M. A., Smith, R. G. B. & Jarman, P. J. (1997) Drain it, dam it: alteration of water regime in shallow wetlands on the New England Tableland of New South Wales, Australia. *Wetlands Ecology & Management* 7: 37-36.

Burbank, M.P. and Platt, R.B. (1964) Granite outcrop communities of the piedmont plateau in Georgia. *Ecology*. 45: 292-306.

Burke, A., Jurgens, N. and Seely, K. (1998) Floristic affinities of an inselberg archipelago in southern Namib desert – relic of the past, centre of endemism or nothing special? *Journal of Biogeography*. 25: 311-317.

Bush, G. (1996) Brigalow Park/Claremont Nature Reserves Biodiversity Survey Report April 1996. Unpublished report to the New South Wales National Parks and Wildlife Service.

Bussell, J.D. and James, S.H. (1997) Rocks as museums of evolutionary processes. *Journal of the Royal Society of Western Australia*. 80: 221-230.

Butler, S. (1996) Boomi and Boomi West Nature Reserves – Biodiversity Report. Unpublished report to the New South Wales National Parks and Wildlife Service.

Byrne, D. (1993). Aboriginal Archaeological Report Tenterfield Forest Management Area EIS Study. *Tenterfield Management Area Environmental Impact Statement Supporting Document No. 5*. (Research Division, State Forests of New South Wales: Sydney).

Campbell, P. (1984). Why the computer should precede the survey; computer assistance in data management. Pp. 1-11. In: K. Myers, C.R. Margules & I. Musto (eds). *Survey Methods for Nature Conservation*. Vol. 2. (CSIRO Division of Water & Land Resources: Canberra).

Cannon, G., Cannon, M., Harding, W, McCosker, R., Spunner, B, Steenbeeke, G and Watson, G. (2003) Vegetation of the Ballata, Gravesend, Horton and Boggabri 1:100 000 Map Sheets, New South Wales. Unpublished report to the NSW Department of Land and Water Conservation.

Carlquist, S. (1974) *Island Biology.* Columbia University Press, London.

Casanova, M. T. (1999) Life histories of charophytes from permanent and temporary wetlands in Eastern Australia. *Aust. J. Bot.* 47: 383-397.

Cayzer, L.W., Crisp, M.D. & Telford, I.R.H. (1999). Revision of *Rhytidosporum* (Pittosporaceae). *Australian Journal of Botany* 12: 689-708.

Chapman, W.S. & Binns, D.L. (1995). Flora Survey of the Walcha/Nundle and Styx River Management Areas Northern Region State Forests of New South Wales. *Walcha/Nundle and Styx River Management Areas EIS Supporting Document No. 2*. (Research Division, State Forests of New South Wales: Sydney).

Chesterfield, E.A., Taylor, S.J. & Molnar, C.D. (1991). Recovery after wildfire. Warm temperate rainforest at Jones Creek, East Gippsland, Victoria. *Australian Forestry* 54: 157-173.

Clancy, J.G. (1981). 'The Distribution and Floristics of Clay Heathlands in Northern New South Wales'. B.Sc. Hons. Thesis. (Department of Botany, University of New England: Armidale).

Clark, S.S. (1988). Effects of hazard-reduction burning on populations of understorey plant species on Hawkesbury sandstone. *Australian Journal of Ecology* 13: 473-484.

Clarke, P.J. (2002a) Habitat insularity and fire response traits: evidence from a sclerophyll archipelago. *Oecologia*. 132: 582-591.

Clarke, P.J. (2002b) Habitat islands in fire-prone vegetation: do landscape features influence community composition. *Journal of Biogeography*. 29: 677-684.

Clarke, P.J. (1994). 'Vegetation of Boonoo Boonoo National Park'. Unpublished compilation of student and staff surveys. University of New England, Armidale.

Clarke, P.J. (1989) *Coastal Dune Plants of New South Wales.* (Coastal Studies Unit, The University of Sydney: Sydney).

Clarke, P.J., Copeland, L.M. & Noble, N.E. (2000). *The Vegetation and Plants Species of Single National Park*. (University of New England: Armidale).

Clarke, P.J., Copeland, L.M., Hunter, J.T., Nano, C.E., Williams, J.B. and Wills, K. (1997) *The Vegetation and Plant Species of Torrington State Recreation Area*. University of New England, Armidale.

Clarke, P.J., Copeland, L.M., Noble, N.E., Bale, C.L. & Williams, J.B. (2000) *The Vegetation and Plant Species of New England National Park*. (University of New England & NSW NPWS: Armidale).

Clarke, P.J, & Fulloon, L. (1999). *Fire and Plants: Torrington State Recreation Area*. (Division of Botany, University of New England: Armidale).

Clarke, P.J., Gardner, M., Nano, C.E. & Whalley, R.D.B. (1999) The vegetation and plant species of Kirramingly. Unpublished report to the New South Wales National Parks and Wildlife Service.

Clarke, P.J., White, G.J., Beckers, D., Williams, J.B., Whalley, R.D.B., Bruhl, J.J. & Able, E. (1995) 'Survey and Assessment of Plant Species and Vegetation along the proposed EASTLINK Powerline Corridor between Armidale, New South Wales and Gatton, Queensland'. Unpublished Report to EASTLINK: TransGrid.

Clemens, J. & Franklin, M.H. (1980). A description of coastal heath at North Head, Sydney Harbour National Park: Impact of recreation and other disturbance since 1951. *Australian Journal of Botany* 28: 463-478.

Codd, P., Payne, B. Woolcock, C. (1998) *The Plant Life of Kosciuszko*. (Kangaroo Press: East Roseville).

Coenraads, R. R. (1989) Evaluation of the natural lagoons of the Central Province, N. S. W. – are they sapphire-producing maars? *Exploration Geophysics* 20: 347-363.

Cohn, J.S. & Bradstock, R.A. (2000) Combination of inter-fire factors affecting post-fire seedling establishment of selected mallee understorey species. *Australian Journal of Botany* 48: 59-70.

Conroy, R.J. (1996). To burn or not to burn? a description of the history, nature and management of bushfires within Ku-ring-gai Chase National Park. *Proceedings of the Linnean Society of New South Wales* 116: 79-95.

Copeland, L.C. & Hunter, J.T. (2005) Range extension, habitat and conservation status of three rare mallees, *Eucalyptus castrensis, Eucalyptus fracta* and *Eucalyptus pumila* from the Hunter Valley, NSW. *Cunninghamia* 9: (in press).

Copeland, L.C. & Hunter, J.T. (1999). Range extensions and conservation status of 18 restricted plant species in north-eastern New South Wales. *Cunninghamia* 6(2): 395-400

Cook, W.M., Lane, K.T., Foster, B.L. & Holt, D. (2002) Island theory, matrix effects and species richness patterns in habitat fragments. *Ecology Letters*. 5: 619-623.

Costin, A.B. (1954) A study of the ecosystems of the Monaro Region of New South Wales. (Government Printer: Sydney).

Costin, A.B. (1959) Vegetation of high mountains in Australian in relation to land use. In A. Keast, Crocker, R.L. & C.S. Christian (Eds) *Biogeography and Ecology in Australia*. Dr W. Junk: The Haag).

Costin, A.B., Gray, M., Totterdell, C. & Wimbush, D. (2000) *Kosciuszko Alpine Flora*. (CSIRO: Collingwood).

Cox, S.J., Sivertsen, D.P. & Bedward, M. (2001) Clearing of native woody vegetation in the New South Wales northern wheatbelt: extent, rate of loss and implications for biodiversity conservation. *Cunninghamia* 7: 101-155.

Cremer, K.W. & Mount, A.B. (1965). Early stages of plant succession following the complete felling and burning of *Eucalyptus regnans* forest in the Florentine Valley, Tasmania. *Australian Journal of Botany* 13: 303-322.

Cribb, A.B. & Cribb, J.W. (1989) *Useful Wild Plants in Australia*. (Collins: Sydney).

Cribb, A.B. & Cribb, J.W. (1986) *Wild Food in Australia*. (Fontana/Collins: Sydney).

Crisp, M.D. & Weston, P.H. (1995) Mirbelieae. *Advances in Legume Systematics* 7: 245-282.

Croft, P, Hoffmeyer, D. & Hunter, J.T. (2006) Fire responses in four rare plant species at Gibraltar Range National Park, Northern Tablelands, NSW. *Proceedings of the Linnean Society of New South Wales* 127: 1-6

Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (1981) *Plants of Western New South Wales*. (Soil Conservation Service of NSW: Sydney).

Curran, T.J. & Curran, S.R. (2005) Rediscovery of Ooline, *Cadellia pentastylis*, near Gunnedah: notes on the habitat and ecology of this dry rainforest tree. *Cunninghamia* 9: 311-316.

Day, R.W., Murray, C.G. & Whitaker, W.G. (1978) The eastern part of the Tasman Orogenic Zone. *Tectonophysics* 48: 327-364.

Department of Environment and Conservation (2005) *Midkin Nature Reserve Plan of Management*. (NSW National Parks and Wildlife Service: Sydney).

Department of Environment and Conservation (2004) Nandewar Western Regional Assessment. (NSW National Parks and Wildlife Service: Sydney).

Department of Environment and Conservation (2004) *Gamilaroi Nature Reserve Plant of Management*. (NSW National Parks and Wildlife Service: Sydney).

Department of Environment and Conservation (2004), Nandewar Biodiversity Surrogates: Vegetation. Report for the Resource and Conservation Assessment Council (RACAC), NSW Western Regional Assessments, coordinated by NSW Department of Infrastructure, Planning and Natural Resources, Project no. NAND06. Department of Environment and Conservation, Coffs Harbour.

DeVries, R. (ed) (2000) *Nandewar Bioregional Scoping Study*. Unpublished draft report prepared by the Conservation Assessment and Data Unit, Northern Directorate NSW National Parks and Wildlife Service.

Dickinson, K.J.M. & Kirkpatrick, J.B. (1987). The short-term effects of clear felling and slash-burning on the richness, diversity and relative abundance of higher

plant species in two types of eucalypt forest on dolerite in Tasmania. *Australian Journal of Botany* 35: 601-616.

Doing, H. (1981) Phytogeography of the Australia floristic kingdom. Pp. 1-25, In R.H. Groves (Ed) *Australian Vegetation.* (Cambridge University Press: Cambridge).

Earl, J. (2003) *The Distribution and Impacts of Lippia (Phyla canescens) in the Murray Darling System*. Final Report to the Lippia Working Group. (AIMS: Guyra).

Elsol, J.A. (1991). Vegetation Description and Map Ipswich South-Eastern Queensland. *Queensland Botany Bulletin No. 10*. (Queensland Department of Primary Industries: Brisbane).

Erickson, R., George, A.S., Marchant, N.G. and Morcombe, M.K. (1991) *Flowers and Plants of Western Australia*. (Reed: Balgowiah).

ERM Mitchell McCotter (1998). 'Demon Nature Reserve Vegetation Survey'. Unpublished Report for the Glen Innes District New South Wales National Parks and Wildlife Service. (ERM Mitchell McCotter: Taree).

Faith, D.P. (1991). Effective pattern analysis methods for nature conservation. Pp. 47-53. In: C.R. Margules & M.P. Austin (eds). *Nature Conservation: Cost Effective Surveys and Data Analysis*. (CSIRO Division of Wildlife and Ecology: Canberra).

Faith, D.P., Minchin, P.R. & Belbin, L. (1987). Compositional dissimilarity as a robust measure of ecological distance: A theoretical model and computer simulations. *Vegetatio* 69: 57-68.

Fleischmann, K., Porembski, S. Biedinger, N. and Barthlott, W. (1996) Inselbergs in the sea: vegetation of granite outcrops on the islands of Mahe, Praslin and Silhouette (Seychelles). *Bulletin of the Geobotanical Institute ETH*. 62: 61-74.

Flood, P.G. & Aitchison, J.C. (1993) Understanding the New England geology: the comparative approach. Pp. 1-10 In: P.G. Flood & J.C. Aitchison (eds) *New England Orogen Eastern Australia*. (Department of Geology and Geophysics, University of New England: Armidale).

Flood, P.G. & Fergusson, C.L. (1984) The geological development of the northern New England Province of the New England Fold Belt. Pp. 1-19 In: H.K. Herbert & J.M.W. Rynn (eds) *Volcanics, Granites and Mineralisation of the*

Stanthorpe-Emmaville-Drake Region. (Department of Geology and Geophysics, University of New England: Armidale).

Floyd, A.E. (1990). *Australian Rainforests in New South Wales*. Vol. 1 & 2. (Surrey Beatty & Sons Pty Ltd and the National Parks & Wildlife Service of New South Wales: Sydney).

Floyd, A.E. (1980). 'Rainforests of Gibraltar Range National Park and southern section of Washpool State Forest'. Unpublished Report for the New South Wales National Parks and Wildlife Service.

Floyd, A.E. (1978). 'Willowie Scrub Vegetation Survey'. Unpublished internal report to the Forestry Commission of New South Wales.

Floyd, A.E. (1976). Effect of burning on regeneration from seeds in wet sclerophyll forest. *Australian Forestry* 39: 210-220.

Floyd, A.E. (1966). Effect of fire upon weed seeds in the wet sclerophyll forests of northern New South Wales. *Australian Journal of Botany* 14: 243-256.

Forestry Commission of New South Wales (1989). Forest Types in New South Wales. *Forestry Commission of New South Wales Research Note No. 17*. (Forestry Commission of New South Wales: Sydney).

Fox, A.M (1974). The '72 Fire of Nadgee Nature Reserve. (New South Wales National Parks & Wildlife Service: Sydney).

Fox, M.D. (1988). Understorey changes following fire at Myall Lakes New South Wales. *Cunninghamia* 2: 85-96.

Fox, M. (1983). *A Vegetation Survey of the Washpool Area, Northern New South Wales*. A Report for the Department of Planning. (Department of Environment & Planning: Sydney).

Fox, M.D. & Fox, B.J. (1986). The effect of fire frequency on the structure and floristic composition of a woodland understorey. *Australian Journal of Ecology* 11: 77-85.

Fox, B.J., Fox, M.D. & McKay, G.M. (1979). Litter accumulation after fire in a eucalypt forest. *Australian Journal of Botany* 27: 157-165.

Fuls, E.R., Bredenkamp, G.J. and van Rooyen, N. (1992) Plant communities of the rocky outcrops of the northern Orange Free State, South Africa. *Vegetatio*. 103: 79-92.

Gauch, H.G. (1982). *Multivariate Analysis in Community Ecology*. (Cambridge University Press: Cambridge).

Gibbons, P., Ayres, D., Seddon, J. Doyle, S. & Briggs, S. (2005) 'Biometric Version 1.8 A terrestrial biodiversity assessment tool for the NSW property vegetation plan developer manual: Operational manual. NSW Department of Environment and Conservation.

Gill, A.M. (1997). Eucalypts and fires: interdependent or independent? Pp.151-167. In: J.E. Williams & J.C.Z. Woinarski. *Eucalypt Ecology: Individuals to Ecosystems*. (Cambridge University Press: Cambridge).

Gill, A.M. (1993) Interplay of Victoria's flora with fire. Pp. 212-226. In D.B. Foremen & N.G. Walsh (Eds) *Flora of Victoria Vol. 1*. (Inkata Press: Melbourne).

Gill, A.M. (1981). *Fire and the Australian Biota.* 1st Ed. (Australian Academy of Science: Canberra).

Gill, A.M. (1977). Management of fire-prone vegetation for plant species conservation in Australia. *Search* 8: 20-26.

Gill, A.M. (1975). Fire and the Australian flora: A review. *Australian Forestry* 38: 4-25.

Gill, A.M. & Ashton, D.H. (1968). The role of bark type in relative tolerance to fire of three central Victorian eucalypts. *Australian Journal of Botany* 16: 491-498.

Gill, A.M. and Bradstock, R.A. (1992) A national register of fire responses for plant species. *Cunninghamia*. 2: 653-660.

Gill, A.M. and Bradstock, R.A. (1981) *Fire and the Australian Biota*. (Australian Academy of Science: Canberra).

Gill, A.M. & Groves, R.H. (1981) Fire regimes in heathlands and their plant ecological effects. Pp. 61-84 In R.L. Specht (Ed.) *Ecosystems of the World 9B: Heathlands and Related Shrublands*. (Elsevier: Amsterdam).

Gill, A.M. & Ingwersen, F. (1975). Growth of *Xanthorrhoea australis* R.Br. in relation to fire. *Journal of Applied Ecology*. 195-203.

Gilligan, L.B., Brownlow, J.W., Cavenar, R.G. & Henly, H.F. (1992) *Dorrigo-Coffs Harbour Metallogenic Map Sheet 1:25 000.* (Department of Mineral Resources: Sydney).

Gilligan, L.B. & Brownlow, J.W. (1987) *Tamworth-Hastings 1:250 000 Metallogenic Map SH56-1 & SI56-2: Mineral Deposit Data Sheets and Metallogenic Map*. (NSW Geological Survey: Sydney).

Gilmour, P. & Helman, C. (1993). *Clarence Valley Rainforest Remnants Rescue: Stage 2 Inventory*. A Report to the Clarence Environment Group. (Clarence Environment Centre: Grafton).

Goodall, D.W. (1980). Numerical classification. Pp. 247-286. In: R.H. Whittaker (ed). *Classification of Plant Communities.* (Dr W. Junk: The Hague).

Gray, M. (1961). A list of vascular plants occurring in the New England Tablelands, New South Wales, with notes on distribution. *Contributions from the New South Wales National Herbarium* 3.

Green, A.J., Jenkins, K.M., Bell, D.M., Morris, P.J. & Kingsford, R.T (2008) The potential role of waterbirds in dispersing invertebrates and plants in arid Australia. *Freshwater Biology* 53: 380-392.

Groger, A. and Barthlott, W. (1996) Biogeography and diversity of the inselberg (Laja) vegetation of southern Venezuela. *Biodiversity Letters*. 3: 165-179.

Hager, T.C. & Benson, J.S. (1992). 'Review of the Conservation Status of Forest Plant Communities in North-Eastern N.S.W.'. Unpublished Report to the Australian Heritage Commission.

Hamilton, S.D., Lowrie, A.C., Hopmans, P. & Leonard, B.V. (1991). Effects of fuel-reduction burning on a *Eucalyptus obliqua* forest ecosystem in Victoria. *Australian Journal of Botany* 39: 203-217.

Hansen, A., Pate, J.S. & Hansen, A.P. (1991). Growth and reproduction performance of a seeder and a resprouter species of *Bossiaea* as a function of plant age after fire. *Annals of Botany* 67: 497-509.

Haworth R. J. (1994) *European impact on lake sedimentation in upland eastern Australia*. PhD Thesis (University of New England: Armidale).

Haworth, R.J. & Gale, S.J., Short, S.A. & Heijnis, H. (1999) Land use and lake sedimentation on the New England Tablelands of New South Wales, Australia. *Australian Geographer* 30: 51-73.

Heinze, D., O'Neill, G., Briggs, E. and Cardwell, T. (1998) Buffalo Sallow Wattle *Acacia phlebophylla* of Mount Buffalo. *Victorian Naturalist*. 115: 205-209.

Hennessy, K., Page, C., McInnes, K., Jones, R., Bathols, A. (2004) *Climate change in New South Wales. Part 1: Past climate variability and projected changes in average climate.* CSIRO, Australian Government Bureau of Meteorology, Canberra.

Hill, K.D. (1998) *Callitris*. *Flora of Australia* 48: 576-588

Hill, K.D. (1997). New species in *Angophora* and *Eucalyptus* (Myrtaceae) from New South Wales. *Telopea* 7(2): 104-186

Hill, K.D. (1997). New taxa in *Eucalyptus* (Myrtaceae) from New South Wales and Queensland. *Telopea* 7: 187-198.

Hill, R.S. (1982). Rainforest fire in western Tasmania. *Australian Journal of Botany* 30: 583-589.

Hill, R.S. & Read, J. (1984). Post-fire regeneration of rainforest and mixed forest in western Tasmania. *Australian Journal of Botany* 32: 481-493.

Hnatiuk, R.J. (1990) *Census of Australian Vascular Plants*. Australian Fauna & Series No. 11. (Bureau of Flora & Fauna: Canberra).

Hodgkinson, K.C. (1991). Shrub recruitment response to intensity and season of fire in a semi-arid woodland. *Journal of Applied Ecology* 28: 60-70.

Hodgkinson, K.C. & Oxley, R.E (1990). Influence of fire and edaphic factors on germination of the arid zone shrubs *Acacia aneura, Cassinia nemphila* and *Dodonaea viscosa*. *Australian Journal of Botany* 38: 269-279.

Hope, G., Whinam, J. & Good, R. (2005) Methods and preliminary results of post-fire experimental trials of restoration techniques in the peatlands of Namadgi (ACT) and Kosciuszko National Parks (NSW). *Ecological Management and Restoration* 6: 214-217.

Hopper, S.D. (2000) Floristics and Australian Granitoid Inselberg Vegetation. Pp. 391-408, In S. Porembski and W. Barthlott (Eds) *Inselbergs: Biotic Diversity of Isolated Rock Outcrops in Tropical and Temperate Regions.* (Springer: Berlin).

Hosking, J.R. & James, T.A. (1998) Native and exotic flora of the North Western Slopes upstream of the junction of the Peel and Namoi Rivers, New South Wales. *Cunninghamia* 5: 721-766.

Hosking, J.R., Sainty, G.R. & Jacobs, S.W.L. (1996). Certainty and uncertainty in plant identification. Pp. 464-467. In: R.C.H. Shepherd (ed). *Proceedings of the Eleventh Australian Weeds Conference.* (Weed Society of Victoria: Frankston).

Hopper, S.D., Brown, A.P. & Marchant, N.G. (1997) Plants of Western Australian granite outcrops. *Journal of the Royal Society of Western Australia*. 80: 141-158.

Houle, G. and Delwaide, A. (1991) Population structure and growth-stress relationship of *Pinus taeda* in rock outcrop habitats. *Journal of Vegetation Science*. 2: 47-58.

Hunt, R. (1993) Midkin Nature Reserve Flora and Fauna Survey, May 1993. Unpublished report to the New South Wales National Parks and Wildlife Service

Hunter, J.T. (2011a) Vegetation and floristics of Pilliga Nature Reserve, Pilliga East State Conservation Area, Willala Aboriginal Area and the Ukerbarley Addition. Unpublished report to the Department of Environment, Climate Change and Water.

Hunter, J.T. (2011b) Vegetation and floristics of Timbarra National Park. Unpublished report to the Department of Environment, Climate Change and Water.

Hunter, J.T. (2011c) Vegetation and floristics of Munro South section of the Gwydir River National Park. Unpublished report to the Department of Environment, Climate Change and Water.

Hunter, J.T. (2010a) Vegetation and floristics of Cubbo, Etoo & Dewson's Lease sections of the Pilliga SCA, Pilliga NP and Pilliga West SCA. Unpublished report to the Department of Environment, Climate Change and Water

Hunter, J.T. (2010b) Vegetation and floristics of Dowe National Park. Unpublished report to the Department of Environment, Climate Change and Water

Hunter, J.T. (2010c) Vegetation and floristics of *Euroka*. Unpublished report to the Nature Conservation Trust.

Hunter, J.T. (2010d) Vegetation and floristics of Mehi section of the Gwydir River National Park. Unpublished report to the Department of Environment, Climate Change and Water.

Hunter, J.T. (2009a) Vegetation and floristics of Berrygill Aboriginal Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2009b) Vegetation and floristics of Bullala National Park. Unpublished report to the Department and Environment and Climate Change.

Hunter, J.T. (2009c) Vegetation and floristics of Campbell and Montrose Aboriginal Areas. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2009d) Vegetation and floristics of Courallie Aboriginal Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2009e) Vegetation and floristics of Gunyerwarildi National Park. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2009f) Vegetation and floristics of Irrigappa Aboriginal Area. Unpublished report to the Department and Climate Change.

Hunter, J.T. (2009g) Vegetation and floristics of the Mission Aboriginal Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2009h) Vegetation and floristics of Terry Hie Hie Aboriginal Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2009i) Vegetation and floristics of Horton Falls National Park. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2009j) Vegetation and floristics of the Derra Derra section of the Bingara State Conservation Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008a) Vegetation and floristics of Bobbiwaa State Conservation Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008b) Vegetation and floristics of Bullawa Creek State Conservation Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008c) Vegetation and floristics of Couradda National Park. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008d) Vegetation and floristics of Killarney State Conservation Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008e) Vegetation and floristics of Moema National Park. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008f) Vegetation and floristics of Biddon State Conservation Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008g) Vegetation and floristics of Garrawilla National Park. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008h) Vegetation and floristics of Kelvin Aboriginal Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008i) Vegetation and floristics of Somerton National Park. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008j) Vegetation and floristics of Tinkrameanah National Park. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008k) Vegetation and floristics of Trinkey State Conservation Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008l) Vegetation and Floristics of Wondoba State Conservation Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008m) Vegetation and Floristics of Leard State Conservation Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008n) Vegetation and Floristics of Deriah Aboriginal Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008o) Vegetation and Floristics of Mt Kaputar National Park, Beresford Park additions. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008p) Vegetation and Floristics of Mt Kaputar, Rusden additions. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008q) Vegetation and Floristics of Mt Kaputar, Playgan additions. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008r) Vegetation and Floristics of Mt Kaputar, Formosa additions. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008s) Vegetation and Floristics of Mt Kaputar, Montawaa additions. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008u) Vegetation and Floristics of Goonoowiggal State Conservation Area. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008v) Vegetation and Floristics of Nullamanna National Park. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008w) Vegetation and Floristics of Barayamal National Park. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008x) Vegetation and Floristics of Dthiniia Dthinnawan Community Conservation Area, 2008 update. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2008y) Vegetation and Floristics of Gunyerwarildi National Park. Unpublished report to the Department of Environment and Climate Change.

Hunter, J.T. (2006t) Vegetation and floristics of Boomi, Boomi West and Boronga Nature Reserves. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2006b) Vegetation and floristics of Budelah Nature Reserve. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2006c) Vegetation and floristics of the Brigalow Park and Claremont Nature Reserves. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2006d) Vegetation and floristics of Careunga Nature Reserve. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2006e) Vegetation and floristics of Catarac National Park. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2006f) Vegetation and floristics of the Dthiniia-Dthinnawan Nature Reserve. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2006g) Vegetation and floristics of Gamilaroi Nature Reserve. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2006h) Vegetation and floristics of Maryland National Park. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2006i) Vegetation and floristics of the Midkin Nature Reserve. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2006j) Vegetation and floristics of the additions to Narran Lake Nature Reserve. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2006k) Vegetation and floristics of the Verdun Voluntary Conservation Area. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2005a) Phytogeography, range size and richness of Australian endemic *Sauropus* (Euphorbiaceae). *Journal of Biogeography* 32: 63-73.

Hunter, J.T. (2005b) Geographic variation in plant species richness patterns within temperate eucalypt woodlands of eastern Australia. *Ecography* 28: 505-514.

Hunter, J.T. (2005c) Vegetation and floristics of Warra National Park and *Wattleridge*, Northern Tablelands, New South Wales. *Cunninghamia* 9: (in press).

Hunter, J.T. (2005d) Vegetation of Culgoa National Park, central northern New South Wales. *Cunninghamia* 9: (in press).

Hunter, J.T. (2005e) 'The Werrikimbe Useful Book'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2005f) 'Vegetation and floristics of Aberbaldie Nature Reserve'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2005g) 'Vegetation survey and mapping of further additions to Severn River Nature Reserve'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2005h) 'Vegetation survey and mapping of further additions to Western Washpool and Capoompeta National Parks'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2005i) 'Vegetation and floristics of the Stannum Section of the Torrington State Park'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2005j) Floristics and distribution of Wattle Dry Sclerophyll Forests and Scrubs of north eastern New South Wales. *Cunninghamia* 9: 317-323.

Hunter, J.T. (2004a) Vegetation of Basket Swamp National Park, Northern Tablelands, New South Wales. *Cunninghamia* 8: 453-466.

Hunter, J.T. (2004b) Rare and threatened plants of the Singleton Training Area. Unpublished report to the SMA, Department of Defence.

Hunter, J.T. (2004c) 'Vegetation and floristics of the Mann River Nature Reserve'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2004) 'Vegetation of Mooraback'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2003a) Persistence on inselbergs: the role of obligate seeders and resprouters. *Journal of Biogeography* 30: 497-510.

Hunter, J.T. (2003b) Factors affecting the nestedness of rock outcrop floras of the New England Batholith of eastern Australia. *Proceedings of the Royal Society of Queensland* 111: 31-38.

Hunter, J.T. (2003c) Factors affecting range size differences for plant species on rock outcrops in eastern Australia. *Diversity and Distributions* 9: 211-220.

Hunter, J.T. (2003d) 'Vegetation and Floristics of Imbota Nature Reserve'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2003e) 'Vegetation and Floristics of Yina Nature Reserve'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2003f) Vegetation and flora of Arakoola Nature Reserve, North Western Slopes, New South Wales. *Cunninghamia* 8: 188-201.

Hunter, J.T. (2002a). 'Vegetation and Floristics of the Bald Rock and Boonoo Boonoo National Parks'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2002b) 'Vegetation and Floristics of Basket Swamp National Park'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2002c) 'Vegetation and Floristics of the *Paradise* Voluntary Conservation Area'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2002d) 'Vegetation and Floristics of the Tenterfield Nature Reserves'. Unpublished report to the New South Wales National Parks and Wildlife Service

Hunter, J.T. (2002e) How insular are ecological 'islands'? An example from the granitic outcrops of the New England Batholith of Australia. *Journal of the Royal Society of Queensland* 110: 1-13.

Hunter, J.T. (2002f) A preliminary overview of what is reserved in the Inverell and Yallaroi Shires, North Western Slopes, NSW. *Cunninghamia* 671-681.

Hunter, J.T. (2002g) Vegetation and floristics of Mount Canobolas State Recreation Area, Orange, New South Wales. *Cunninghamia* 7: 501-526.

Hunter, J.T. (2002h) 'Vegetation of Culgoa National Park'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2002i) *Grevillea kennedyana* F.Muell. an overview of distribution and demography. *Queensland Naturalist* 40: 63-68.

Hunter, J.T. (2001a). 'Vegetation and Floristics of the Capoompeta and Washpool Western Additions National Parks'. Unpublished report to the New South Wales National Parks & Wildlife Service.

Hunter, J.T. (2001b) 'Vegetation and Floristics of Warra National Park'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2001c) *Eucalyptus saxicola* (Myrtaceae), a new species from the Central Tablelands of New South Wales. (section Maidenaria series Bridgesiana). *Telopea* 9: 403-407.

Hunter, J.T. (2000a) 'Flora of the Bolivia Hill Rail Easement'. Unpublished report to Rail Services Australia.

Hunter, J.T. (2000b) 'Flora Survey of the Edinburgh Reserve, Orange'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2000c) Fragmentation and its implications for species richness and conservation of vascular plants on granitic outcrops of the New England Batholith. *Journal of the Royal Society of Queensland* 109: 75-82.

Hunter, J.T. (2000d). 'Vegetation and Floristics of Arakoola National Park'. Unpublished Report to the New South Wales National Parks & Wildlife Service.

Hunter, J.T. (2000e). 'Vegetation and Floristics of Burnt Down Scrub Nature Reserve'. Unpublished Report to the New South Wales National Parks & Wildlife Service.

Hunter, J.T. (2000f). 'Vegetation and Floristics of Kings Plains National Park'. Unpublished Report to the New South Wales National Parks & Wildlife Service.

Hunter, J.T. (2000g) 'Vegetation and Floristics of the Mt Canobolas State Recreation Area'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (2000h). 'Vegetation and Floristics of the Severn River Nature Reserve'. Unpublished Report to the New South Wales National Parks & Wildlife Service.

Hunter, J.T. (1999a) 'Floristics and Biogeography of the Granitic Outcrop Flora of the New England Batholith'. PhD. Thesis. (Division of Botany, University of New England: Armidale).

Hunter, J.T. (1999b) 'Vegetation and Floristics of the Narran Lake Nature Reserve'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (1998a) Granite Outcrop Vegetation of Wilson's Promontory. *Victorian Naturalist* 115: 322-325.

Hunter, J.T. (1998b) The botany of Howell a tin granite flora: revisited. *Victorian Naturalist* 115: 94-99.

Hunter, J.T. (1998c) Two new rare species of *Homoranthus* (Myrtaceae: Chamelaucieae) from the Northern Tablelands of New South Wales. *Telopea* 8: 35-40.

Hunter, J.T. (1998d) 'Vegetation Survey of the Proposed Kwiambal National Park'. Unpublished report for the New South Wales National Parks & Wildlife Service.

Hunter, J.T. (1998e) Notes on the occurrence of *Monotaxis microphylla* Benth. (Euphorbiaceae), with particular reference to New South Wales. *Queensland Naturalist* 36: 21-24.

Hunter, J.T. (1997a) A further record of *Homoranthus lunatus* Craven & S.R.Jones (Myrtaceae) for northern New South Wales. *Queensland Naturalist* 33: 24-25.

Hunter, J.T. (1997b) The use of host specific galls in the identification of vascular plant species. *Queensland Naturalist* 33: 26-27.

Hunter, J.T. (1997c) Severe blistering cased by *Parsonsia straminea* (R.Br.) F.Muell. (Apocynaceae) at Girraween National Park. *Queensland Naturalist* 35: 28-29.

Hunter, J.T. (1997d) *Acacia williamsiana* (Fabaceae: Juliflorae): a new granitic outcrop species from northern New South Wales. *Journal of the Royal Society of Western Australia* 80: 235-237.

Hunter, J.T. (1996a) 'Preliminary Checklist of plants found in two lands offered for purchase as additions to Ironbark Nature Reserve'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. (1996b) A further record of *Leucopogon cicatricatus* J.Powell (Epacridaceae) for Queensland. *Queensland Naturalist* 34: 20-21.

Hunter, J.T. (1995) Some observations on the fire responses of two rare species in the Girraween and Bald Rock National Parks. *Queensland Naturalist* 33: 146-147.

Hunter, J.T. (1992) 'Infraspecific variation of a widespread species: *Brachyloma daphnoides*'. Unpublished B.Sc. Hons. Thesis. Botany Dept. University of New England, Armidale.

Hunter, J.T. & Alexander, J. (2000a) 'Vegetation and Floristics of the Central and Northern sections of Mt Kaputar National Park'. Unpublished Report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. & Alexander, J. (2000b) 'Vegetation and Floristics of Myall Lakes National Park'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. & Alexander, J. (1999a) 'Vegetation and Floristics of Guy Fawkes River National Park'. Unpublished report to the New South Wales National Parks & Wildlife Service.

Hunter, J.T. & Bell, D.M. (2007) Vegetation of montane bogs in eastern flowing catchments of northern New England, New South Wales. *Cunninghamia* 10: 77-92.

Hunter, J.T. & Bruhl, J.J. (1999b) Two new species of *Eucalyptus* (Myrtaceae) from northern New South Wales (series *Viminales* section *Maidenaria*). *Telopea* 8: 257-263.

Hunter, J.T. & Bruhl, J.J. (1997a) Significant range extensions for 10 species of vascular plants in northern New South Wales. *Austrobaileya* 4: 691-694.

Hunter, J.T. & Bruhl, J.J. (1997b) Two new species of *Phyllanthus* and notes on *Phyllanthus* and *Sauropus* (Euphorbiaceae: Phyllantheae) in New South Wales. *Telopea* 7: 149-165.

Hunter, J.T. & Bruhl, J.J. (1997c) Four new rare species of *Sauropus* Blume (Euphorbiaceae: Phyllantheae) from north Queensland. *Austrobaileya* 4: 661-672.

Hunter, J.T. & Bruhl, J.J. (1997d) Three new species of *Phyllanthus* (Euphorbiaceae: Phyllantheae) for the Northern Territory, one new species for Western Australia, and notes on other *Phyllanthus* species occurring in these regions. *Nuytsia* 11: 147-163.

Hunter, J.T. & Bruhl, J.J. (1997e) New *Sauropus* (Euphorbiaceae: Phyllantheae) taxa for the Northern Territory and Western Australia and notes on other *Sauropus* occurring in these regions. *Nuytsia*11: 165-184.

Hunter, J.T. & Bruhl, J.J. (1996) Three new species of *Phyllanthus* (Euphorbiaceae: Phyllantheae) in South Australia. *Journal of the Adelaide Botanic Gardens* 17: 127-136.

Hunter, J.T. & Clarke, P.J. (1998). The vegetation of granitic outcrop communities of the New England Batholith of eastern Australia. *Cunninghamia* 5: 547-618.

Hunter, J.T. & Copeland, L.M. (2001) *Homoranthus binghiensis* (Myrtaceae: Chamaelaucieae), a new species from the North Western Slopes of New South Wales. *Telopea* 9: 431-433.

Hunter, J.T. & Curran, T. (2006) Vegetation and floristics of Planchonella Nature Reserve. Unpublished Report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. & Earl, J. (2002) 'Vegetation and Floristics of Culgoa National Park'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. & Earl, J. (2002) 'Floristic Descriptions of Grassland Areas on the Moree Plains'. Unpublished report for the Department of Land and Water Conservation and the New South Wales National Parks and Wildlife Service.

Hunter, J.T. & Harrison, K. (2002) Vegetation and floristics of Burnt Down Scrub Nature Reserve, North Coast, New South Wales. *Cunninghamia* 7: 539-562.

Hunter, J.T. & Hunter, V.H. (2003) Vegetation and floristics of Ironbark Nature Reserve and the Bornhardtia Voluntary Conservation Area. *Cunninghamia* 8: 93-110.

Hunter, J.T. & Hunter, V.H. (2002) 'Vegetation of Ironbark and Bornhardtia VCA'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. & Fallavollita (2003a) 'Vegetation of Thilta Karra section of the Paroo Darling National Park'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. & Fallavollita (2003b) 'Vegetation and floristics of Ledknapper Nature Reserve'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T., Fallavollita, E. & Hunter, V.H. (1998). Observations on the ecology of *Muehlenbeckia costata* m.s. (Polygonaceae), a rare fire ephemeral species occurring on the New England Batholith of northern New South Wales and southern Queensland. *Victorian Naturalist* 115: 9-17.

Hunter, J.T., Kingston, J. & Croft, P. (1999). Vegetation and floristics of Kwiambal National Park and surrounds, Ashford, New South Wales. *Cunninghamia* 6: 351-378.

Hunter, J.T., Kingswood, R. & Bell, D. (2001) Vegetation of Narran Lake Nature Reserve, North Western Plains, New South Wales. *Cunninghamia* 7: 43-63.

Hunter, J.T. & Sheringham, P. (2006) Vegetation and floristics of Melville Range Nature Reserve. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T. & Sheringham, P. (2005) 'Vegetation and floristics of Ngulin Nature Reserve'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Hunter, J.T., Quinn, F.C. & Bruhl, J.J. (1996) *Micromyrtus grandis* (Myrtaceae) a new species from New South Wales. *Telopea* 7: 77-81.

Hunter, J.T. & White, M. (1999) Notes on the distribution and conservation status of *Eucalyptus cannonii* R.T.Baker. *Cunninghamia* 6: 389-400.

Hunter, J.T. & Williams, J.B. (2005) Rediscovery of *Prostanthera staurophylla* F.Muell. and reinstatement of *P. teretifolia* Maiden & Betche (Lamiaceae). *Telopea* 11: 99-108.

Hunter, J.T. & Williams, J.B. (1994) A new species of *Brachyloma* and three new subspecies of *B. daphnoides* (Epacridaceae) from south-eastern Australia. *Telopea* 6: 1-7.

Hunter, J.T., Wyatt, A., Hofmeyer, D., Brown, L., Barkwell, N. & Beresford-Smith, N.J. (1999). Vegetation and floristics of the Demon Nature Reserve, Tenterfield, New South Wales. *Cunninghamia* 6: 331-350.

Hunter, V.H. & Hunter, J.T. (1999) Pollination biology of *Acacia pruinosa* A.Cunn. ex Benth. *Journal of the Royal Society of Queensland* 108: 49-55.

Huston, M.A. (1994) *Biological Diversity: the Coexistence of species on Changing Landscapes*. (Oxford University Press: Oxford).

Ibisch, P.L., Rauer, G., Rudolph, D. & Barthlott, W. (1995) Floristic, biogeographical, and vegetational aspects of Pre-Cambrian rock outcrops (inselbergs) in eastern Bolivia. *Flora*. 190: 299-314.

Ingram, M. (1995) Midkin Nature Reserve Biodiversity Study. Unpublished report to the New South Wales National Parks and Wildlife Service.

Jarrett, P.H. & Petrie, A.H.K. (1929). The vegetation of the Blacks' Spur region. A study in the ecology of some Australian mountain *Eucalyptus* forests. *Journal of Ecology* 17: 250-281.

Jacobs, S. W. L. & Brock, M. A. (1993) Southern (temperate) Australia Pp. 244-304 in Wetlands of the World I: inventory, ecology and management. Whigam D. F., Dykyjova, D. & Hejny, S. (Kluwer Academic Publishers, Dordrecht).

Jacobs, S.W.L. & Everett, J.C. (1996). *Austrostipa*, a new genus and new names for Australasian species formerly included in *Stipa* (Gramineae). *Telopea* 6: 579-596.

Jarman, S.J., Kantvilas, G. & Brown, M.J. (1988) *Buttongrass Moorland in Tasmania*. Research Report No. 2. (Tasmanian Forest Research Council Inc.: Hobart).

Johnson, L.A.S. & Hill, K.D. (1990). New taxa and combinations in *Eucalyptus* and *Angophora* (Myrtaceae). *Telopea* 4: 37-108.

Johnson, R.W. (1982) Flora and vegetation of the Brigalow Belt. Pp. 41-59, *The Brigalow Belt of Australia,* A. Bailey (Ed.). (Royal Society of Queensland: Brisbane).

Jones, D.L. (1993). *Native Orchids of Australia*. (Reed: Australia).

Jordon, G., Patmore, C., Duncan, F. & Luttrell, S. (1992). The effects of fire intensity on the regeneration of mixed forest tree species in the Clear Hill/Mount Wedge area. *TasForests* 4: 25-38.

Jutila, H.M. and Grace, J.B. (2002) Effects of disturbance on germination and seedling establishment in a coastal prairie grassland: a test of the competitive release hypothesis. *Journal of Ecology*. 90: 291-302.

Keith, D.A. (2004) *Ocean Shores to Desert Dunes: the Native Vegetation of New South Wales and the ACT*. (Department of Environment & Conservation: Hurstville).

Keith, D. (1996). Fire-driven extinction of plant populations: a synthesis of theory and review of evidence from Australian vegetation. *Proceedings of the Linnean Society of New South Wales* 116: 37-78.

Keith, D. (1992). Fire and the conservation of native bushland plants. *National Parks Journal* October 1992: 20-22.

Keith, H. (1997). Nutrient cycling in eucalypt ecosystems. Pp. 197-226. In: J.E. Williams & J.C.Z. Woinarski. *Eucalypt Ecology: Individuals to Ecosystems*. (Cambridge University Press: Cambridge).

Kellman, M. (1986). Fire sensitivity of *Casuarina torulosa* in north Queensland, Australia. *Biotropica* 18: 107-110.

King, G.C. (1985). Natural regeneration in wet sclerophyll forest with an overstorey of *Eucalyptus microcorys*, *E. saligna* and *Lophostemon confertus*. *Australian Forestry* 48: 54-62.

Kirkpatrick, J.B. (1984). Altitudinal and successional variation in the vegetation of the northern part of the West Coast Range, Tasmania. *Australian Journal of Ecology* 9: 81-91.

Kirkpatrick, J.B. (1983) Treeless plant communities of the Tasmanian High Country. *Proceedings of the Ecological Society of Australia* 12: 61-77.

Kirkpatrick, J.B. & Harwood, C.E. (1983) Plant communities of Tasmania Wetlands. *Australian Journal of Botany* 31: 437-451.

Lawler, S., Brown, S., Edney, G., Howelett, S. and Love, P. (1998) Buffalo Sallee at the Back Wall: an alpine species adapted to fire and drought. *Victorian Naturalist*. 115: 201-205.

Lazarides, M. & Hince, B. (1993) *CSIRO Handbook of Economic Plants of Australia.* (CSIRO: Canberra).

Le Brocque, A.F. & Benson, J.S. (1995) *Report of Stage 2 of Task 5 Pilot Survey for Basincare M305 Project*. (Royal Botanic Gardens: Sydney).

Lee, S.M. & Chao, A. (1994) Estimating population size via sample coverage for closed capture-recapture models. *Biometrics* 50: 88-97.

Leigh, C. (1968) The form and evolution of Bald Rock, New South Wales. *The Australian Geographer,* 10: 333–345.

Leigh, L., Boden, R., & Briggs, J. (1984). *Extinct and Endangered plants of Australia.* (World Wildlife Fund Australia: MacMillan).

Leigh, J.H. & Holgate, M.D. (1979). The response of the understorey of forests and woodlands of the Southern Tablelands to grazing and burning. *Australian Journal of Ecology* 4: 25-45.

Linder, H.P. (1997). Nomenclatural corrections in the *Rytidosperma* complex (Danthonieae, Poaceae). *Telopea* 7: 269-274.

Linder, H.P. & Verboom, G.A. (1996). Generic limits in the *Rytidosperma* (Danthonieae, Poaceae) complex. *Telopea* 6: 597-628.

Linhart, Y.B. (1980) Local biogeography of plants on a Caribbean atoll. *Journal of Biogeography*. 7: 159-171.

Lord, J. and Norton, D.A. (1990) Scale and the spatial concept of fragmentation. *Conservation Biology*. 4: 197-202.

Lumley, P.F. & Spencer, R.D. (1990) Two new species of *Callistemon* R.Br. (Myrtaceae). *Muelleria* 7: 253-257.

Lunt, I.D. (1994). Variation in flower production of nine grassland species with time since fire, and implications for grassland management and restoration. *Pacific Conservation Biology* 1: 359-366.

Lunt, I.D. (1990). Impact of an autumn fire on the long-grazed *Themeda triandra* (Kangaroo Grass) grassland: Implications for management of invaded, remnant vegetation. *Victorian Naturalist* 112: 45-51

Mallick, P. Haseler, M., Hocking, G.J., & Driessen, M.M. (1997) Past and present distribution of the Eastern Barred Bandicoot (*Peramales gunnii*) in the Midlands, Tasmania. *Pacific Conservation Biology* 3: 397-402.

Makinson, R.O. (2000) Proteaceae 2: *Grevillea*. *Flora of Australia* 17.

Maurer, B.A. (1994) *Geographic Population Analysis: Tools for the Analysis of Biodiversity*. Modern Methods in Ecology 8. (Blackwell Scientific Publishing: Melbourne).

McDonald, W.J.F. & Whiteman, W.G. (1979). *Moreton Region Vegetation Map Series: Murwillumbah Sheet*. (Botany Branch, Queensland Department of Primary Industries: Brisbane).

McDougall, K.L. & Walsh, N.G. (2007) Treeless vegetation of the Australian Alps. *Cunninghamia* 10: 1-57.

McMinn, W.G. (1970) *Allan Cunningham: Botanist and Explorer*. (Melbourne University Press: Melbourne).

McKenzie, N.L. (1991). An ecological survey of tropical rainforests in Western Australia: background and methods. Pp. 1-26. In: N.L. McKenzie, R.B. Johnston & P.G. Kendrick (eds). *Kimberley Rainforests of Australia*. (Surrey Beatty & Sons: Chipping Norton).

McKenzie, N.L., Robinson, A.C. & Belbin, L. (1991). Biogeographic survey of the Nullarbor district, Australia. Pp. 109-126. In: C.R. Margules & M.P. Austin (eds). *Nature Conservation: Cost Effective Biological Surveys and Data Analysis*. (CSIRO Division of Wildlife and Ecology: Canberra).

McVaugh, R. (1943) The vegetation of the granitic flat-rocks of the southeastern United States. *Ecological Monographs*. 12: 117-127.

Melick, D.R. & Ashton, D.H. (1991). The effects of natural disturbances on warm temperate rainforests in south-eastern Australia. *Australian Journal of Ecology* 39: 1-30.

Millington, R. J. (1949) *The ecology of Thomas' Lagoon – a mountain meadow pond*. Unpublished thesis (New England University College: Armidale).

Millington, R.J. (1954) *Sphagnum* bogs of the New England Plateau, New South Wales. *Journal of Ecology* 42: 328-344.

Minchin, P.R. (1987). An evaluation of the relative robustness of techniques of ordination. *Vegetatio* 69: 89-107.

Moore, D.M. & Floyd, A.G. (1994). A description of the flora and an assessment of impacts of the proposed forestry operations in the Grafton Forest Management Area. *Grafton Management Area Environmental Impact Statement Supporting Document No. 2*. (Austeco and State Forests of New South Wales: Grafton).

Moran, G.F. and Hopper, S.D. (1983) Genetic diversity and the insular population structure of the rare granite rock species *Eucalyptus caesia* Benth. *Australian Journal of Botany*. 31: 161-172.

Morrison, D.A. & Renwick, J.A. (2000) Effects of variation in fire intensity on regeneration of co-occurring species of small trees in the Sydney region. *Australian Journal of Botany* 48: 71-79.

Murdy, W.H. (1968) Plant speciation associated with granite outcrop communities of the southeastern Piedmont. *Rhodora*. 70: 394-407.

Morgan, G. & Terrey, J. (1999) *The New England Tableland: A Bioregional Strategy*. (Greening Australia: Armidale).

Morgan, G. & Terrey, J. (1992) *Nature Conservation in Western New South Wales*. (Landwater Management for the National Parks Association of NSW Inc.: Sydney).

Murray, C.G. (1988). Tectonic evolution and metallogenesis of the New England Orogen. In: J.D. Kleeman (Ed) *New England Orogen Tectonics and Metallogenesis*. (Department of Geology and Geophysics, University of New England: Armidale).

Myerscough, P.J., Clarke, P.J. & Skelton, N.J. (1995) Plant co-existence in coastal heaths: floristic patterns and species attributes. *Australian Journal of Ecology* 20: 482-493.

Nadolny, C. & Benson, J. (1993) *The Biology and Management of the Pigmy Cypress Pine (Callitris oblonga) in NSW*. Species Management Report No. 7. (National Parks & Wildlife Service of NSW; Hurstville).

Nadolny, C., Hunter, J.T. & Hawes, W. (2010) *Native grassy vegetation in the Border Rivers-Gwydir Catchment: diversity, distribution, use and management.* Border-Rivers Gwydir CMA.

National Parks and Wildlife Service Western Regional Assessment (2002) Targeted Flora Survey and Mapping. *New South Wales Western Regional Assessments Brigalow Belt South Stage 2.*

National Resources Audit Council (1995a). *Vegetation Survey and Mapping of Upper North East New south Wales*. A Report by the New South Wales National Parks and Wildlife Service for the Natural Resources Audit Council. (New South Wales National Parks & Wildlife Service: Coffs Harbour).

Nieuwenhuis, A. (1987). The effect of fire frequency on the sclerophyll vegetation of the West Head, New South Wales. *Australian Journal of Ecology* 12: 373-385.

New South Wales National Parks & Wildlife Service (2002) *Ironbark Nature Reserve and Bornhardtia Voluntary Conservation Area: Draft Plan of Management*. (NSW National Parks and Wildlife Service: Hurstville).

New South Wales National Parks & Wildlife Service (1996a). *Broad Old Growth Mapping Project*. Final Report Interim Forestry Assessment Process for RACAC. (New South Wales National Parks & Wildlife Service: Sydney).

New South Wales National Parks & Wildlife Service (1996b). *Interim Forest Assessment Process: Estimation of Pre 1750 Forest Type Distribution for*

RACAC Northern Study Area: *Supplementary Figures*. A Report to RACAC. (New South Wales National Parks & Wildlife Service: Sydney).

New South Wales National Parks & Wildlife Service (1995). *Flora of north-east National South Wales; North-East Forests Biodiversity Study Report No. 4* (New South Wales National Parks and Wildlife Service: Sydney).

Noble, I.R. (1984). Mortality of lignotuberous seedlings of *Eucalyptus* species after an intense fire in montane forest. *Australian Journal of Ecology* 9: 47-50.

Noble, I.R. & Slatyer, R.O. (1981) Concepts and models of succession in vascular plant communities subject to recurrent fire. Pp. 311-335 In A.M. Gill, R.H. Groves & I.R. Noble (Eds) *Fire and the Australian Biota*. (Australian Academy of Science: Canberra).

Noy-Meir, I. & Whittaker, R.H. (1978). Recent developments in continuous multivariate techniques. Pp. 337-378. In: R.H. Whittaker. *Ordination of Plant Communities*. (Dr W. Junk: The Hague).

Oakwood, M. Jurado, E., Leishman, M. & Westoby, M. (1993) Geographic ranges of plant species in relation to diaspore morphology, growth form and diaspore weight. *Journal of Biogeography* 20: 563-672.

Olde, P.M., & Marriot, N.R. (1994). A taxonomic revision of *Grevillea arenaria* and *Grevillea obtusiflora* (Proteaceae: Grevilleoideae). *Telopea* 5(4): 711-733

Orlohi, L. (1978). Ordination by resemblance matrices. Pp. 239-336. In: R.H. Whittaker (ed). *Ordination of Plant Communities*. (Dr W. Junk: The Hague).

Paijmans, K., Galloway, R.W., Faith, D.P., Fleming, P.M., Haantjens,H.A., Heyligers, P.C., Kalma, J.D. & Loffler, E. (1985) Aspects of Australian wetlands. CSIRO Division, Water & Land Resources *Technical Paper No. 44*.

Palmer, M.W. (1993). Putting things in even better order: The advantages of canonical correspondence analysis. *Ecology* 74: 2215-2230.

Parris, (1998). *Grammitidaceae*. *Flora of Australia* 48. Ferns, Gymnosperms and allied groups.

Pearson, S. (1992). Archaeological Survey of Historical Sites Report, Tenterfield Forest Management Area EIS Study. *Tenterfield Management Area EIS Supporting Document No. 6*. (State Forests of New South Wales: Sydney).

Pillans, B. J. (1987) Lake shadows – aeolian clay sheets associated with ephemeral lakes in basalt terrain, southern New South Wales. *Search* 18: 313–315,

Pickering, C.M. & Armstrong, T. (2003) The potential impact of climate change on plant communities in the Kosciuszko Alpine Zone. *Victorian Naturalist* 120: 15-24.

Porembski, S. (1995) Notes on the vegetation of inselbergs in Malawi. *Flora*. 191: 1-8.

Porembski, S. and Barthlott, W. (2000a) *Inselbergs: Biotic Diversity of Isolated Rock Outcrops in Tropical and Temperate Regions.* (Springer: Berlin).

Porembski, S. and Barthlott, W. (2000b) Granitic and gneissic outcrops (inselbergs) as centres of diversity for desiccation-tolerant vascular plants. *Plant Ecology*. 151: 193-199

Porembski, S., Becker, U. and Seine, R. (2000) Islands on Islands: Habitats on Inselbergs. Pp. 49-68, In S. Porembski and W. Barthlott (Eds) *Inselbergs: Biotic Diversity of Isolated Rock Outcrops in Tropical and Temperate Regions.* (Springer: Berlin).

Porembski, S., Barhtolott, W., Dorrstock, S. and Biedinger, N. (1994) Vegetation of rock outcrops in Guinea: granite inselbergs, sandstone table mountains and ferricretes – remarks on species numbers and endemism. *Flora*. 189: 315-238.

Porteners, M.F. (1998) 'Vegetation Survey of Mt Kaputar National Park (Southern Portion). Unpublished report to the New South Wales National Parks and Wildlife Service.

Porteners, M.F. (1997) 'Vegetation Survey of Sub-Alpine Communities in Mt Kaputar National Park'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Pulsford, I.F. (1984) Conservation status of Brigalow *Acacia harpophylla* (Mimosaceae) in New South Wales. In the *Brigalow Belt of Australia*, A. Bailey (Ed.). (Proceedings of the Royal Society of Queensland: Brisbane).

Purdie, R.W. (1977a). Early stages of regeneration after burning in dry sclerophyll vegetation. I Regeneration of the understorey by vegetative means. *Australian Journal of Botany* 25: 21-34.

Purdie, R.W. (1977b). Early stages of regeneration after burning in dry sclerophyll vegetation. II Regeneration by seed germination. *Australian Journal of Botany* 25: 35-46.

Purdie, R.W. & Slatyer, R.O. (1976). Vegetation succession after fire in sclerophyll woodland communities in south-eastern Australia. *Australian Journal of Ecology* 1: 223-236.

Quinn, F.C., Williams, J.B., Gross, C.L. & Bruhl, J.J. (1995). 'Report on rare and threatened plants of north-eastern New South Wales'. Unpublished report prepared for the New South Wales National Parks & Wildlife Service and the Australian Nature Conservation Agency.

Quinn, R.M., Gaston, K.J. & Arnold, H.R. (1996) Relative measures of geographic range size: empirical comparisons. *Oecologia* 107: 179-188.

Reed, R.A., Peet, R.K, Palmer, M.W. and White, P.S. (1993) Scale dependence of vegetation-environmental correlations: a case study of a North Carolina piedmont woodland. *Journal of Vegetation Science*. 4: 329-340.

Read, I.G. (1994) *The bush: a guide to the vegetated landscapes of Australia*. (University of New South Wales Press: Sydney).

Reid, J.B., Hill, R.S., Brown, M.J., Hovenden, M.J. (1999) *Vegetation of Tasmania*. Flora of Australia Supplimentary Series 8. (Australian Biological Resources Study: Canberra).

Reid, N. (1997). Control of mistletoes by possums and fire: A review of evidence. *Victorian Naturalist* 114: 149-158.

Resource and Conservation Assessment Council (1996a). *Regional Report of Upper North East New South Wales Vol. 2: Physical Attributes*. (Resource and Conservation Assessment Council: Sydney).

Resource and Conservation Assessment Council (1996b). *Regional Report of Upper North East New South Wales Vol. 4: Biodiversity Attributes*. (Resource and Conservation Assessment Council: Sydney).

Resource and Conservation Assessment Council (1996c). *Regional Report of Upper North East New South Wales Vol. 6: Heritage, Aboriginal and Social Values*. (Resource and Conservation Assessment Council: Sydney).

Richards, P.G. (1996). 'Significant Plants of the Glen Innes Forest Management Area'. Unpublished Report for the Northern Region, State Forests of New South Wales. (State Forests of New South Wales: Coffs Harbour).

Richards, P. G. & Hunter, J.T. (1997). Range extensions for several restricted plant species, Northern Tablelands, New South Wales. *Cunninghamia* 5: 275-280.

Roberts, G.W. (1983) 'A Vegetation Survey of the Granitic areas on part of the Northern Tablelands and Upper North Western Slopes, New South Wales. M.Sc. prelim. Thesis. University of New England.

Roche, S., Dixon, K.W. & Pate, J.S. (1997). Seed ageing and smoke: partner cues in the amelioration of seed dormancy in selected Australian native species. *Australian Journal of Botany* 45: 783-815.

Rowley, I & Brooker, M. (1987). The response of small insectivorous bird to fire in heathlands. Pp. 211-218. In: D.A. Saunders, G.W. Arnold, A.A. Burbidge & J.M. Hopkins: *Nature Conservation: The Role of Remnant Native Vegetation.* Vol. 1. (Surrey Beatty & Sons Pty Ltd: Chipping Norton).

Runnegar, B.N. (1974) The geological framework of New England. *Geological Society of Australia, Queensland Division, Field Conference, New England Area* 9-19.

Shaw, S.E. & Flood, R.H. (1992) Geology and Mineral Deposits Newton Boyd 1:100 000 sheet. In: *Exploration Data Package for the Newton-Boyd and Grafton 1:100 000 Sheet Areas*. Volumes 1 & 2. Geological Survey Report Number GS 1992-088 June 1992. (Geological Survey of New South Wales, Department of Mineral and Energy: Sydney).

Shaw, S.E. & Flood, R.H. (1981) The New England Batholith, eastern Australia: geochemical variations in time and space. *Journal of Geophysical Research* 86: 10530-10544

Sheringham, P. (1998). 'Draft species list – Gibraltar Range National Park'. Unpublished checklist. (Northern Zone, National Parks & Wildlife Service: Coffs Harbour).

Sheringham, P. & Hunter, J.T. (2002). 'Vegetation and Floristics of Gibraltar Range National Park'. Unpublished report to the New South Wales National Parks and Wildlife Service.

Sheringham, P. & Westaway, J. (1998). 'Significant Vascular Plants of Upper North East New South Wales. Unpublished update.

Sheringham, P. & Westaway, J. (1995). *Significant Vascular Plants of Upper North East New South Wales*. A Report by the New South Wales National Parks and Wildlife Service for the Natural Resources Audit Council. (New South Wales National Parks & Wildlife Service: Sydney).

Siddiqi, M.Y., Carolin, R.C. & Myerscough, P.J. (1976). Studies in the ecology of coastal heath in New South Wales. III. Regrowth of vegetation after fire. *Proceedings of the Linnean Society of New South Wales*. 101: 53-63.

Smith R. G. B. & Brock M. A. (1996) Coexistence of *Juncus articulatus* L. and *Glyceria australis* C. E. Hubb. in a temporary shallow wetland in Australia. *Hydrobiologia* 340: 147–151.

Soderstrom L. (1981). Distribution of bryophytes in spruce forests on hill slopes in central Sweden. *Wahlenbergia*. 7: 141-153.

Sparrow, A.D. (1990). Floristic patterns in South Australian mallee vegetation and some implications for conservation. Pp. 12-15. In: J.C. Noble, P.J. Joss & G.K. Jones (eds). *The Mallee Lands: A Conservation Perspective*. (CSIRO: Melbourne).

Specht, R.L., Specht, A., Whelan, M.B. & Hegarty, E.E. (1995) *Conservation Atlas of Plant Communities in Australia*. (Centre for Coastal Management and Southern Cross University Press: Lismore).

Specht, R.L. (1981) Responses to fires of Heathlands and Related Shrublands. Pp. 395-416 In A.M. Gill, R.H. Groves and I.R. Noble (Eds) *Fire and the Australian Biota*. (Australian Academy of Science: Lismore).

Specht, R.L. (1979a) The sclerophyllous (heath) vegetation of Australia: the eastern and central states. *Ecosystems of the World 9A: Heathlands and Related Shrublands.* (Elsevier Scientific Publishing Company: Amsterdam).

Specht, R. L. (1979a) *Ecosystems of the World 9A: Heathlands and Related Shrublands.* (Elsevier Scientific Publishing Company: Amsterdam).

Spence, D. H. N. (1964) Factors controlling the distribution of fresh-water macrophytes with particular reference to the lochs of Scotland. *Journal of Ecology* 55: 147-169.

State Forests of New South Wales (1995). *Tenterfield Management Area Proposed Forestry Operations Main Report*. Vol. A. (Research Division, State Forests of New South Wales: Sydney).

Stewart, J. (1996). Observations after a fire in a degraded grassland. *Victorian Naturalist* 113: 102-106.

Stone, G. & Martin, K. (2002) 'Ironbark Nature Reserve and *Bornhardtia* Voluntary Conservation Agreement Archaeological Survey Report'. Unpublished report

to J.T. & V.H. Hunter & the New South Wales National Parks and Wildlife Service.

Sun, D., Hnatiuk, R.J. & Neldner, V.J. (1997). Review of vegetation classification and mapping systems undertaken by major forested land management agencies in Australia. *Australian Journal of Botany* 45: 929-948.

Ter Braak, C.J.F. (1987-1992). 'CANOCO – a FORTRAN program for Canonical Community Ordination'. (Microcomputer Power: New York).

Ter Braak, C.J.F. (1986). Canonical correspondence analysis: A new eigenvector technique for multivariate direct gradient analysis. *Ecology* 67: 1167-1179.

Ter Braak, C.J.F. & Prentice, I.C. (1988). A theory of gradient analysis. *Advances in Ecological Research* 18: 271-317.

Ter Braak, C.J.F. & Verdonschot, P.F.M. (1995). Canonical correspondence analysis and related multivariate methods in aquatic ecology. *Aquatic Sciences* 57: 255—289.

Thanos, C.A. & Rundel, P.W. (1995) Fire-followers in chaparral: nitrogenous compounds trigger seed germination. *Journal of Ecology* 83: 207-216.

Timms, B. V. (1992) *Lake Geomorphology*. (Gleneagles Publishing: Adelaide).

Toelken, H.R. (1996). Dilleniaceae. Pp. 300—313 In: N.G. Walsh and T.J. Entwistle (Eds.) *Flora of Victoria* Vol. 3 (Inkata Press: Melbourne).

Turner, F. (1903). The vegetation of the New England, New South Wales. *Proceedings of the Linnean Society of New South Wales* 28: 406-442.

Turner, F. (1906). Botany of north-eastern New South Wales. *Proceedings of the Linnean Society of New South Wales*. 31: 365-392.

Turner, J. (1984). Radiocarbon dating of wood and charcoal in an Australian forest ecosystem. *Australian Forestry* 47: 79-83.

Tweedie, T.D., Bruskin, S, Chapman, W.S. & Heyward, R.W. (1995). Flora Survey, Urunga and Coffs Harbour Management Areas, Northern Region, New South Wales. *Forest Resources Series No. 33.* (Research Division, State Forests of New South Wales: Sydney).

Twidale, C.R. (1982) *Granite Landforms*. Elsevier, Amsterdam.

Usback, S. & James, R. (1993) *A Directory of Important Wetlands in Australia*. (Australian Nature Conservation Agency: Canberra).

Van Diggelen, R., Middleton, B., Bakker, J., Grootjans, A. & Wassen, M. (2006) Fens and floodplains of the temperate zone: Present status, threats, conservation and restoration. *Applied Vegetation Science* 9: 157-162.

Walker, D. (1972) Vegetation of the Lake Ipea Region, New Guinea Highlands: II. Kayamanda Swamp. *Journal of Ecology* 60: 479-504.

Walker, J. & Hopkins, M.S. (1990). Vegetation. Pp. 58-86. In: R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker, & M.S. Hopkins (eds). *Soil Field and Survey Handbook.* (Inkata Press: Melbourne).

Wall, J. (2000) 'Mapping Vegetation Types for Catchment Planning in Northern New South Wales'. *Technical Report*. (Unpublished Report to the Natural Heritage Trust).

Wardle, P. (1991) *Vegetation of New Zealand*. (Cambridge University Press: Cambridge).

Watson, G., Elks, G. & Smith, A. (2000). 'Guy Fawkes River National Park Vegetation Communities'. Unpublished report by AUSTECO for the New South Wales National Parks & Wildlife Service.

Walker, G. T. (1977) *Preliminary Report on the Geomorphology of Natural Lagoons in the New England District: Nature, Origin, Modification and Significance*. Unpublished ms (University of New England: Armidale).

Weltzin, J.F., Pastor, J. Harth, C, Bridgham, S.D., Updegraff, K. & Chapin, C.T. (2000) Response of bog and fen plant communities to farming and water-table manipulations. *Ecology* 81: 3454-3478.

Whelan, R.J. & Brown, C.L. (1988). The role of *Callistemon* fruits and infructescences in protecting seeds from heat in fires. *Australian Journal of Botany* 46: 235-239.

Whelan, R.J., De Jong, N.H. & Von der Burg, S. (1998). Variation in bradyspory and seedling recruitment without fire among populations of *Banksia serrata* (Proteaceae). *Australian Journal of Ecology* 23: 121-128.

Whinam, J. & Chilcott, N. (2002) Floristic description and environmental relationships of *Sphagnum* communities in NSW and the ACT and their conservation management. *Cunninghamia* 7: 463-500.

Whinam, J. & Hope, G. (2005) The peatlands of the Australasian region. *Stapfia* 85: 397-400.

Whinam, J. Barmuta, L.A. & Chilcott, N. (2001) Floristic description and environmental relationships of Tasmanian *Sphagnum* communities and their conservation management. *Australian Journal of Botany,* **49**, 673-685.

Whinam, J., Chilcott, N.M. & Morgan, J.W. (2002) Floristic composition and environmental relationships of *Sphagnum* dominated communities in Victoria. *Cunninghamia,* **8**, 162-174.

Wilkinson, G. & Jennings, S. (1993). Survival and recovery of *Eucalyptus obliqua* regeneration following wildfire. *TasForests* 5: 1-11.

Williams, J.B. (1997). *Parsonsia. Flora of Australia* 28: 154-196.

Williams, J.B. (1989). 'Eastwood State Forest List of Plants Species: 1986-1989'. Unpublished checklist. (Botany, University of New England: Armidale).

Williams, J.B. (1976). 'Flora of Gibraltar Range National Park'. Unpublished checklist. (Department of Botany, University of New England: Armidale).

Williams, J.B. (1970). 'A list of plants of Gibraltar Range National Park, N.S.W.: Plants of the Rainforest'. Unpublished checklist. (Department of Botany, University of New England: Armidale).

Williams, J.B. (1963). The vegetation of northern New South Wales from the eastern scarp to the western slopes – a general transect. Pp. 41-52. In: R.F. Warner (Ed) *New England Essays*. (University of New England: Armidale).

Williams, J.E. and Gill, A.M. (1995) The impact of fire regimes on native forests in eastern New South Wales. *Environmental Heritage Monograph Series No. 2*. (National Parks and Wildlife Service of New South Wales: Sydney).

Williams, P. (1995). 'Floristic Patterns within and between Sedge-Heath Swamps of Gibraltar Range National Park, New South Wales'. B.Sc. Hons. (Department of Botany, University of New England: Armidale).

Williams, P.R. & Clarke, P.J. (1997). Habitat segregations by serotinous shrubs in heaths: post-fire emergence and seedling survival. *Australian Journal of Botany* 45: 31-39.

Wiser, S.K., Peet, R.K. and White, P.S. (1996) High-elevation rock outcrop vegetation of the southern Appalachian Mountains. *Journal of Vegetation Science.* **7**: 703-722.

Wyatt, R. (1997) Reproductive ecology of granite outcrop plants from the south-eastern United States. *Journal of the Royal Society of Western Australia*. 80: 123-129.

Yates, C.J. & Hobbs, R.J. (1999) Temperate eucalypt woodlands in Australia – an overview. In R.J.Hobbs & C.J.Yates (ed) *Temperate Eucalypt Woodlands in Australia: Biology, Conservation, Management and Restoration*. (Surrey Beatty & Sons: Chipping Norton).

Young, P.A.R. & McDonald, T.J. (1989). Vegetation Map and Description of Warwick South-Eastern Queensland. *Queensland Botany Bulletin No. 8.* (Department of Primary Industries: Brisbane).

Zoete, T. (2000). Vegetation survey of the Barrington Tops and Mount Royal National Parks for use in Fire Management. *Cunninghamia* 6: 511-578.

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.

Flora
of
Little Llangothlin Nature Reserve
(compiled by Dr John T. Hunter incorporating the extensive list from Dr Dorothy M. Bell, Ian Telford & Dr Lachlan Copeland)

Fern & Fern Allies

Aspleniaceae
Asplenium flavellifolium Cav. ..... Necklace Fern

Azollaceae
Azolla filiculoides Lam. ..... Azolla

Dennstaedtiaceae
Pteridium esculentum (G.Forst.) Cockayne ..... Bracken Fern

Lemnaceae
Lemna trisulca L. ..... Duckweed

Monocotyledon

Anthericaceae
Arthropodium minus R.Br. ..... Small Vanilla Lily
Dichopogon fimbriatus (R.Br.) J.F.Macbr. ..... Nodding Chocolate Lily
Thysanotus tuberosus R.Br.
subsp. *tuberosus* ..... Common Fringe-lily

Asphodelaceae
Bulbine bulbosa (R.Br.) Haw. ..... Golden Lily
Bulbine sp. aff. bulbosa ..... Golden Lily

Cyperaceae
Carex chlorantha R.Br. ..... Sedge
Carex fascicularis Sol. ex Boott ..... Sedge
Carex gaudichaudiana Kunth ..... Sedge
Carex incomitata K.R.Thiele ..... Sedge
Carex inversa R.Br. ..... Knob Sedge
Carex sp. 'Bendemeer' ..... Sedge
Cyperus sanguinolentus Vahl ..... Flat Sedge
Cyperus sphaeroideus L.A.S.Johnson & O.D.Evans ..... Globe Kyllinga
Eleocharis acuta R.Br. ..... Common Spike Rush
Eleocharis dietrichiana Boeck. ..... Spike Rush
Eleocharis pusilla R.Br. ..... Small Spike Rush
Eleocharis sphacelata R.Br. ..... Tall Spike Rush
Isolepis fluitans (L.) R.Br. ..... Floating Club-rush
Isolepis gaudichaudiana Kunth ..... Club-rush
Schoenus apogon Roem. & Schult. ..... Common Bog Rush

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

Juncaceae

**Juncus articulatus* L. ..... Jointed Rush
**Juncus bufonius* L. ..... Toad Rush
Juncus falcatus E.Mey. ..... Rush
Juncus filicaulis Buchenau ..... Rush
Juncus fockei Buchenau ..... Rush
Juncus homalocaulis F.Muell. ex Benth. ..... Rush
Juncus pauciflorus R.Br. ..... Rush
Juncus prismatocarpus R.Br. ..... Branching Rush
Juncus subsecundus N.A.Wakef. ..... Finger Rush
Juncus usitatus L.A.S.Johnson ..... Common Rush
Juncus vaginatus R.Br. ..... Rush
Luzula flaccida (Buchenau) Edgar ..... Grass Rush

Lomandraceae
Lomandra longifolia Labill. ..... Spiny-headed Mat-rush

Orchidaceae
Microtis unifolia (G.Forst.) Rchb.f. ..... Common Onion Orchid
Prasophyllum dossenum R.J.Bates & D.L.Jones ..... Leek Orchid
Spiranthes sinensis
subsp. *australis* (R.Br.) Kitam. ..... Ladies' Tresses

Phormiaceae
Dianella revoluta R.Br.
var. *revoluta* ..... Spreading Flax Lily

Poaceae
Amphibromus sinuatus S.W.L.Jacobs & Lapinpuro ..... Amphibromus
**Anthoxanthum odoratum* L. ..... Sweet Vernal Grass
Austrodanthonia monticola (Vickery) H.P.Linder ..... Wallaby Grass
Austrodanthonia racemosa (R.Br.) H.P.Linder
var. *racemosa* ..... Wallaby Grass
Bothriochloa macra (Steud.) S.T.Blake ..... Red Grass
**Briza minor* L. ..... Shivery Grass
**Dactylis glomerata* L. ..... Cocksfoot
Dichelachne micrantha (Cav.) Domin ..... Short-haired Plumegrass
Echinopogon ovatus (G.Forst.) P.Beauv. ..... Forest Hedgehog Grass
**Eleusine tristachya* (Lam.) Lam. ..... Goose Grass
Elymus scaber (R.Br.) A.Love
var. *scaber* ..... Common Wheatgrass
**Festuca elatior* L. ..... Tall Fescue
Glyceria australis C.E.Hubb. ..... Australian Sweetgrass
Hemarthria uncinata R.Br.
var. *uncinata* ..... Matgrass
**Holcus lanatus* L. ..... Yorkshire Fog
Lachnagrostis filiformis (Forst.) Trinius ..... Blown Grass
**Lolium perenne* L. ..... Perennial Ryegrass
Microlaena stipoides (Labill.) Druce
var. *stipoides* ..... Weeping Meadow Grass
Panicum decompositum R.Br. ..... Native Millet
Panicum effusum R.Br. ..... Hairy Panic
**Panicum gilvum* Launert ..... Panic
**Paspalum dilatatum* Poir. ..... Paspalum
Pennisetum alopecuroides (L.) Spreng. ..... Swamp Foxtail
**Phalaris aquatica* L. ..... Phalaris
**Phleum pratense* L. ..... Timothy
Phragmites australis (Cav.) Trin ex Steud. ..... Common Reed
Poa labillardieri Steud. ..... Tussock
**Poa pratensis* L. ..... Kentucky Bluegrass

Poa sieberiana Spreng.
var. *sieberiana*.....Snowgrass
**Setaria pumila* (Poir.) Roem. & Schult. .....Pale Pigeon Grass
Sorghum leiocladum (Hack.) C.E.Hubb. .....Wild Sorghum
Themeda triandra Forssk. .....Kangaroo Grass
**Vulpia bromoides* (L.) Gray .....Squirrel Tail Fescue

Potamogetonaceae
Potamogeton crispus L. .....Curly Pondweed
Potamogeton tricarinatus F.Muell. & A.Benn. ex A.Benn. .....Floating Pondweed

Restionaceae
Baloskion stenocoleum
(L.A.S.Johnson & O.D.Evans) B.G.Briggs & L.A.S.Johnson .....Rush

Dicotyledon

Apiaceae
Eryngium sp. nov. .....New England Eryngium
Eryngium sp. 'Little Llangothlin NR (D.M.Be.. 56) .....Llangothlin Eryngium
Eryngium vesiculosum Labill. .....Prostrate Blue Devil
Hydrocotyle laxiflora DC. .....Stinking Pennywort
Hydrocotyle tripartita R.Br. ex A.Rich. .....Pennywort
Lilaeopsis polyantha (Gand.) H.Eichler .....Lilaeopsis
**Pastinaca sativa* L.
subsp. *sativa* .....Parsnip

Araliaceae
**Hedera helix* L. .....English Ivy

Asteraceae
Ammobium alatum R.Br. .....Winged Everlasting
**Anthemis arvensis* L. .....Corn Chamomile
Brachyscome radicans Steetz ex Lehm. .....Daisy
Calotis cuneifolia R.Br. .....Purple Burr-daisy
Chrysocephalum apiculatum (Labill.) Steetz .....Common Everlasting
**Cirsium vulgare* (Savi) Ten. .....Spear Thistle
**Conyza bonariensis* (L.) Cronq. .....Flaxleaf Fleabane
**Conyza sumatrensis* (Retz.) E.Walker .....Tall Fleabane
Coronidium scorpioides (Labill.) Paul G.Wilson .....Button Everlasting
Craspedia variabilis Everett & Doust .....Billy Buttons
**Crepis capillaris* (L.) Wallr. .....Smooth Hawksbeard
Euchiton involucratus (G.Forst.) Holub .....Star Cudweed
Euchiton sphaericus (Willd.) Holub .....Cudweed
**Hypochaeris microcephala*
var. *albiflora* (Kuntze) Cabrera .....White Flatweed
**Hypochaeris radicata* L. .....Catsear, Flatweed
**Lactuca serriola* forma
integrifolia .....Prickly Lettuce
Lagenifera stipitata (Labill.) Druce .....Blue Bottle-daisy
Leiocarpa sp. 'Uralla' (D.M.Be.. NE 54142) .....New England Leiocarpa
Leptorhynchos squamatus (Labill.) Less .....Scaly Buttons
**Leucanthemum vulgare* Lam. .....Oxeye Daisy
**Onopordum acanthium* L.
subsp. *acanthium* .....Scotch Thistle
Podolepis jaceioides (Sims) Voss .....Showy Copper-wire Daisy
Senecio interpositus I.Thomps. .....Fireweed
**Senecio madagascariensis* Poir. .....Fireweed
**Sonchus asper* (L.) Hill .....Prickly Sowthistle
**Sonchus oleraceus* L. .....Common Sowthistle

**Taraxacum officinale* Weber ..... Dandelion
**Tragopogon dubius* Scop. ..... Goatsbeard
Vittadinia cuneata DC. ..... Fuzzweed
Xerochrysum bracteatum (Vent.) Tzvelev ..... Golden Everlasting
Xerochrysum sp. 'Glencoe) ..... Golden Everlasting

Boraginaceae
Cynoglossum australe R.Br. ..... Austral Hounds Tongue
Myosotis australis R.Br. ..... Australian Forget-me-not

Brassicaceae
**Rorippa nasturtium-aquaticum* (L.) Hayek ..... Watercress
**Rorippa palustris* (L.) Besser ..... Yellow Cress

Campanulaceae
Wahlenbergia ceracea Loth. ..... Waxy Bluebell
Wahlenbergia communis Carolin ..... Tufted Bluebell
Wahlenbergia gracilis (Forster f.) A. DC. ..... Australian Bluebell

Caryophyllaceae
**Cerastium glomeratum* Thuill. ..... Mouse-ear Chickweed
**Dianthus armeria* L. ..... Deptford Pink
**Paronychia brasiliana* DC. ..... Brazilian Whitlow
Stellaria angustifolia Hook. ..... Swamp Starwort

Chenopodiaceae
**Chenopodium album* L. ..... Fat Hen

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

Crassulaceae
Crassula helmsii (Kirk) Cockayne ..... Swamp Stonecrop

Droseraceae
Aldrovandra vesiculosa L. ..... Waterwheel Plant

Elatinaceae
Elatine gratioloides A.Cunn. ..... Waterwort

Epacridaceae
Leucopogon fraseri A.Cunn. ..... Fraser's Beard Heath
Melichrus urceolatus R.Br. ..... Urn Heath

Euphorbiaceae
Poranthera microphylla Brongn. ..... Small Poranthera

Fabaceae
Acacia dealbata R.Br.
subsp. *dealbata* ..... Silver Wattle
Acacia melanoxylon R.Br. ..... Blackwood
Cullen tenax (Lindl.) J.W.Grimes ..... Emu-foot, Emu Grass
Desmodium varians (Labill.) Endl. ..... Slender Tick Trefoil
Glycine clandestina Wendl. ..... Twining Glycine
Hovea heterophylla A.Cunn. ex Hook.f. ..... Hovea
Lotus australis Andrews ..... Australian Trefoil

**Medicago polymorpha* L. ..... Burr Medic
Pultenaea microphylla Sieber ex DC. ..... Small-leaved Bush Pea
**Trifolium campestre* Schreb. ..... Hop Clover
**Trifolium dubium* Sibth ..... Yellow Suckling Clover
**Trifolium pratense* L. ..... Red Clover
**Trifolium repens* L. ..... White Clover
**Trifolium striatum* L. ..... Knotted Clover

Gentianaceae
**Centaurium erythraea* Rafn ..... Common Centaury

Geraniaceae
Geranium neglectum Carolin. ..... Geranium
Geranium potentilloides L.'Her. ex DC.
var. *potentilloides* ..... Geranium
Geranium solanderi
var.*grande* Carolin ..... Native Geranium
Geranium solanderi Carolin
var. *solanderi* ..... Native Geranium

Goodeniaceae
Scaevola hookeri (Vriese) F.Muell. ex Hook. f. ..... Scaevola
Velleia paradoxa R.Br. ..... Vellaia

Haloragaceae
Gonocarpus tetragynus Labill. ..... Poverty Raspwort
Haloragis heterophylla Brongn. ..... Variable Haloragis
Myriophyllum variifolium Hook.f. ..... Water Milfoil
Myriophyllum verrucosum Lindl. ..... Red Water-milfoil

Lamiaceae
Ajuga australis R.Br. ..... Australian Bugal
Lycopus australis R.Br. ..... Australian Gypsywort
Mentha satureioides R.Br. ..... Mintbush
**Prunella vulgaris* L. ..... Self-heal

Lentibulariaceae
Utricularia australis R.Br. ..... Yellow Bladderwort
Utricularia dichotoma Labill. ..... Fairy Aprons

Lobeliaceae
Isotoma fluviatilis
subsp. *borealis* McComb. ..... Swamp Isotome

Loranthaceae
Amyema pendulum (Sieber ex Spreng.) Tiegh.
subsp. *pendulum* ..... Drooping Mistletoe

Malaceae
Malus pumila Mill. ..... Apple

Menyanthaceae
Nymphoides montana Aston ..... Nymphoides

Myrtaceae
Angophora floribunda (Sm.) Sweet ..... Rough-barked Apple
Eucalyptus acaciiformis H.Deane & Maiden ..... Wattle-leaved Peppermint
Eucalyptus dalrympleana
subsp. *heptantha* L.A.S.Johnson ..... Mountain Gum
Eucalyptus nova-anglica H.Deane & Maiden ..... New England Peppermint

Eucalyptus pauciflora Sieber ex Spreng. ..... Snow Gum
Eucalyptus stellulata Sieber ex DC. ..... Black Sally
Eucalyptus viminalis Labill. ..... Ribbon Gum

Onagraceae
Epilobium billardierianum
subsp. *cinereum* (Rich) Raven & Engelhorn ..... Hairy Willow Herb
Epilobium billardierianum
subsp. *hydrophilum* Raven & Engelhorn ..... Variable Willow Herb
Epilobium gunnianum Hausskn. ..... Willow Herb

Oxalidaceae
Oxalis exilis A.Cunn. ..... Wood Sorrel

Pittosporaceae
Billardiera scandens Sm.
var. *scandens* ..... Apple Dumplings

Plantaginaceae
**Plantago lanceolata* L. ..... Lamb's Tongues
Plantago sp. 'Little Llangothlin NR (L.M.Copeland 342) ..... Plantain

Polygalaceae
Polygala japonica Houtt. ..... Polygala

Polygonaceae
**Acetosella vulgaris* Fourr. ..... Sheep Sorrel
Persicaria hydropiper (L.) Spach ..... Waterpepper
Persicaria lapathifolia (L.) S.F.Gray ..... Pale Knotweed
Persicaria orientalis (L.) Spach ..... Princes Feathers
Rumex brownii Campd. ..... Swamp Dock
**Rumex crispus* L. ..... Curled Dock

Portulacaceae
Neopaxia australasica (Hook.f.) O.Nilsson ..... Neopaxia

Ranunculaceae
Ranunculus inundates R.Br. ex DC. ..... River Buttercup
Ranunculus lappaceus Sm. ..... Common Buttercup
**Ranunculus scleratus* L. ..... Celery Buttercup

Rhamnaceae
Discaria pubescens (Brongn.) Druce ..... Australian Anchor Plant

Rosaceae
Acaena novae-zelandiae Kirk. ..... Bidgee Widgee
Acaena ovina A.Cunn. ..... Bidgee Widgee
**Rubus discolor* Weihe & Nees ..... Blackberry
Rubus parvifolius L. ..... Small-leaved Bramble

Rubiaceae
Asperula charophyton Airy Shaw & Turrill ..... Woodruff
Asperula conferta Hook.f. ..... Common Woodruff
Galium binifolium Wakef. ..... Bedstraw
Galium propinquum A.Cunn. ..... Bedstraw

Santalaceae
Thesium australe R.Br. ..... Austral Toadflax

Scrophulariaceae

**Verbascum virgatum* Stokes.....Twiggy Mullein
**Veronica anagallis-aquatica* L.....Blue Water-Speedwell
Veronica calycina R.Br. .....Hairy Speedwell

Solanaceae
**Solanum nigrum* L.....Black-berry Nightshade
Solanum opacum A.Braun & Bouche.....Green-berry Nightshade

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

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

Verbenaceae
**Verbena bonariensis* L. .....Purpletop

Violaceae
Hybanthus monopetalus (Schult.) Domin.....Slender Violet-bush
Viola betonicifolia Sm.....Long-leaf Violet

Appendix C: Uses of plants

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
Acacia implexa	Poison.	Lazarides & Hince (1993).	Poison?	Fodder, Gum, Timber, Fuel, Honey.	C3. Drought tolerant. Intolerant of waterlogging, salinity and wind.		Clarke (1989), Lazarides & Hince (1993).
Acacia neriifolia				Fodder.			Lazarides & Hince (1993).
Aira cupaniana				Fodder.			Lazarides & Hince (1993).
Ajuga australis				Fodder.		Ornamental.	Lazarides & Hince (1993).
Alphitonia excelsa	Timber, poison, medicinal, honey, miscellaneous. Leaves used to wrap meat. May be used to create red-brown or yellow-orange dyes.	Cribb & Cribb (1982), Lazarides & Hince (1993).		Fodder. Used for cabinet work, fencing & house stumps. When exposed the wood turns a orange to red colour.		Food plant for several butterfly larvae, fruit eaten by various birds and fruit bat. Pollination by honeybee and native bees.	Cribb & Cribb (1982), Benson & McDougall (2000).
Alternanthera denticulata				Fodder.		Weed.	Lazarides & Hince (1993), Cunningham et al. (1981).
Amyema pendulum	Fruits eaten.						
Anagallis arvensis			Poison.	Fodder.		Weed, poisonous to horses, cattle, sheep, birds, dogs, rabbits and guinea pigs.	Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
Angophora floribunda				Fodder. Important pollen source.	C3. Drought tolerant. Intolerant of wind, water logging and salinity.	Tertiary sand coloniser, by seed propagation. Garden & shade plant. Bee attractant. Firewood, timber.	Clarke (1989), Lazarides & Hince (1993).
Arenaria serpyllifolia						Weed.	Lazarides & Hince (1993).
Aristida personata						Host plant of common army worm.	Benson & McDougall (2005).
Aristida vagans				Useful drought fodder.		Seed eaten by finches.	Lazarides & Hince (1993), Benson & McDougall (2005).
Arthropodium milleflorum	Roots eaten raw or roasted.			Fodder, moderate forage.			Lazarides & Hince (1993).
Arthropodium minus				Fodder. Moderate winter-spring forage.			Lazarides & Hince (1993).
Arundinella nepalensis				Fodder.			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).
Austrostipa verticillata				Rarely observed to be grazed.			Cunningham et al. (1981).
Bidens pilosa						Honey, weed, medicinal. Seed burrs	Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
						troublesome to clothing and wool. Medicinal uses in South Africa.	
Bidens subalternans						Weed.	Lazarides & Hince (1993).
Boerhavia dominii	Outer flesh of the roots edible.	Lazarides & Hince (1993).				Weed.	Lazarides & Hince (1993).
Bothriochloa decipiens				Not readily eaten by stock.		Shelter. Drought resistant, colonises scalded soils.	Cunningham et al. (1981), Lazarides & Hince (1993).
Bothriochloa macra				Fodder.		Valuable coloniser of disturbed and degenerated areas. Seeding stems avoided by stock, widespread in overgrazed paddocks.	Lazarides & Hince (1993), Benson & McDougall (2005).
Brachychiton populneus	Young roots can be boiled & taste like turnips. Seeds are edible & can make a beverage. Leaves also edible. Inner bark pulled off in strips used for dilly bags, nets etc.	Cribb & Cribb (1982).					

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
Breynia cernua					C3. Wind tolerant, drought intolerant, intolerant of water logging and salinity.	Tertiary sand coloniser. Cosmopolitan species, on the back dune. Shelter.	Clarke (1989), Lazarides & Hince (1993).
Bromus catharticus				Fodder.		Pollen known to cause allergy in humans.	Lazarides & Hince (1993).
Brunoniella australis				Fodder.		Reported good sheep herbage.	Lazarides & Hince (1993).
Bulbine bulbosa	Roots eaten raw or roasted, leaves also eaten.		Poison?	Acceptable to stock and may be heavily utilised. No positive evidence of toxicity.		Ornamental.	Cunningham et al. (1981), Lazarides & Hince (1993).
Bursaria spinosa	Medicinal. Used for production of Aesculin (suntan lotions).	Lazarides & Hince (1993).		Fodder.		Useful honey plant.	Cunningham et al. (1981), Lazarides & Hince (1993).
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).
Callitris endlicheri				Antihelminthic for horses.		Gums, timber, fuel, medicinal, shelter. Used in the tannin industry produces	Lazarides & Hince (1993). Cribb & Cribb (1982).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
						strongly coloured red leather.	
Callitris glaucophylla	Used as splints, molded when wet and then dries in place holding limb in place. Because so flammable was used by Aboriginals for torches by which to spear fish at night.	Cribb & Cribb (1992), Harris et al. (2000).		Used for building construction, fencing posts & telegraph poles.		Resistant to termite attack.	Cribb & Cribb (1982).
Calotis cuneifolia				Useful forage. Barbed seeds prolific and troublesome to sheep and fleece.		Honey, weed.	Lazarides & Hince (1993).
Carduus pycnocephalus			Poison?			Weed.	Lazarides & Hince (1993).
Carex appressa	The leaves were used by aborigines for weaving baskets and other such articles.	Cunningham et al. (1981), Lazarides & Hince (1993).		Fodder.		Shelter. Controls creek bank erosion, harbours rabbits.	Lazarides & Hince (1993).
Carex inversa				Supplies limited amount of fair		Weed.	Cunningham et al. (1981), Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
				quality forage.			
Carthamus lanatus				Fodder. Inedible to stock after flowering. Flowers yield an oil similar to safflower oil.		Honey, weed. Declared noxious in Qld.	Lazarides & Hince (1993). Cribb & Cribb (1982).
Cassinia laevis			Poison?	Fodder.		Weed. Suspected cause of coughing and eye irritation of people in close proximity.	Lazarides & Hince (1993).
Centaurea melitensis			Poison?	Fodder.		Weed.	Lazarides & Hince (1993).
Centaurium erythraea						Weed.	Lazarides & Hince (1993).
Centaurium spicatum				Fodder.		Weed.	Lazarides & Hince (1993).
Cheilanthes distans			Poison?				Cunningham et al. (1981), Lazarides & Hince (1993).
Cheilanthes sieberi			Poison?				Lazarides & Hince (1993).
Chenopodium album			Poison?	Readily acceptable to stock, but likely to taint milk if eaten in quantity by dairy cattle. Potentially toxic		Weed.	Cunningham et al. (1981), Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
				to livestock.			
Chenopodium carinatum			Poison?			Weed of agricultural and disturbed land.	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).
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).
Chloris ventricosa			Poison?	Grazed readily by stock in early stages.			Cunningham et al. (1981), Lazarides & Hince (1993).
Ciclospermum leptophyllum				Fodder.		Weed. Reported to taint milk.	Lazarides & Hince (1993).
Cirsium arvense						Weed. Declared noxious in Vic, Tas, SA, WA part of NT.	Lazarides & Hince (1993).
Cirsium vulgare						Honey, weed, miscellaneous. Fleshy roots laced with strychnine formerly sold as rabbit bait. Noxious in Vic, Tas, SA, part of NT.	Lazarides & Hince (1993).
Clematis glycinoides						Flowers visited by honeybees for pollen.	Benson & McDougall (2000).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
Commelina cyanea					C3.	Used as a cooked green vegetable by early settlers to combat scurvy.	Clarke (1989), Cunningham et al. (1981), Lazarides & Hince (1993).
Conyza bonariensis						Weed.	Lazarides & Hince (1993).
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).
Cymbidium canaliculatum	Stems eaten cooked or raw, grated, powdered, starch washed out & allowed to settle. Sap from	Cribb & Cribb (1974), Cunningham et al. (1981), Lazarides & Hince (1993).				Ornamental.	Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
	stems fixes ochre to bark in paint. Starch fed to 'delicate children. Fibre.						
Cymbonotus lawsonianus						Weed, medicinal.	Lazarides & Hince (1993).
Cymbopogon obtectus				Drought resistant, lemon-scented fodder.			Lazarides & Hince (1993).
Cymbopogon refractus	Medicinal.	Lazarides & Hince (1993).		Heavily grazed when young, unpalatable when mature.		Shelter.	Cunningham et al. (1981), Lazarides & Hince (1993).
Cynoglossum australe				Fodder.		Grows on sand dunes, headlands, on the back dune.	Clarke (1989), Lazarides & Hince (1993).
Cyperus fulvus					C4	Ornamental.	Lazarides & Hince (1993).
Cyperus gracilis					C3	Weed.	Lazarides & Hince (1993).
Daucus glochidiatus	Tuber edible.			Fodder.		Weed.	Lazarides & Hince (1993).
Dendrophthoe glabrescens	Fruits were probably utlilised by aborigines.	Cunningham et al. (1981).		Readily grazed if lopped.		Weed, food.	Cunningham et al. (1981), Lazarides & Hince (1993).
Desmodium brachypodum			Poison?				Lazarides & Hince (1993).
Desmodium varians				Fodder.			Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
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 longifolia	Fruits & roots edible. Stems can be pounded to make a fibre.	Lazarides & Hince (1993).	Poison?			Ornamental.	Lazarides & Hince (1993).
Dianella revoluta	Fruits & roots edible. Stems can be pounded to make a fibre.					Pollinated by native bees.	Benson & McDougall (2005).
Dichanthium sericeum				Highly palatable and productive fodder.		Sheep sometimes reported to rarely graze this species. Tolerates moderate grazing.	Lazarides & Hince (1993), Benson & McDougall (2005).
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).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
Dichopogon fimbriatus	Tubers eaten raw.			Readily grazed in the early stages of growth.			Cunningham et al. (1981).
Digitaria brownii				Readily eaten by stock, valuable fodder.			Cunningham et al. (1981), Lazarides & Hince (1993).
Echinopogon caespitosus				Grazed by stock.		Food plant for butterfly larvae.	Benson & McDougall (2005).
Echinopogon ovatus			Poison	Fodder, low forage value.		Young plants poisonous to stock.	Lazarides & Hince (1993), Benson & McDougall (2005).
Einadia hastata	Edible fruit.						
Einadia nutans	Edible fruit.						
Einadia polygonoides			Poison?	Palatable fodder, taints milk. Cattle poison and suspected cause of jaundice.			Lazarides & Hince (1993).
Elymus scaber				Fodder.		Valuable for stock, high protein content 10-36%.	Benson & McDougall (2005).
Enchylaena tomentosa			Poison?	Fodder. Contains toxic levels of soluble oxalate. Sheep have been observed to eat large quantities of the shrub without ill effect		Succulent berries are quite edible.	Cunningham et al. (1981), Lazarides & Hince (1993).
Enneapogon				Has some forage			Cunningham et al. (1981),

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
gracilis				value.			Lazarides & Hince (1993).
Enneapogon nigricans				Fodder. Susceptible to overgrazing.			Cunningham et al. (1981), Lazarides & Hince (1993).
Entolasia stricta				Fodder, low palatability.			Lazarides & Hince (1993).
Eragrostis brownii				Fodder.		Seed eaten by Finches.	Lazarides & Hince (1993), Benson & McDougall (2005).
Eragrostis lacunaria				Reasonable feed for sheep.			Cunningham et al. (1981), Lazarides & Hince (1993).
Eragrostis leptostachya				Fodder.			Lazarides & Hince (1993).
Eragrostis molybdea				Useful forage alternative to Aristida jerichoensis.			Cunningham et al. (1981).
Erodium crinitum	Fleshy taproot can be cooked & eaten.	Lazarides & Hince (1993).		Palatable green or dry. Seeds injurious to stock.			Lazarides & Hince (1993).
Eucalyptus blakelyi				Gums, Timber, Fuel, Honey.		Browsed by Koala. Blossoms Grey-headed Flying Fox. Seed by Crimson Rosella. Flowers by Fuscous Honeyeater & Leaves visited by White-plumed Honeyeater.	Lazarides & Hince (1993), Benson & McDougall (1998).
Eucalyptus bridgesiana				Gums, Honey.		Seed eaten by Gang Gangs. Crimson	Lazarides & Hince (1993), Benson & McDougall (1998).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
						Rosella eats seed. Little Lorikeet eats Nectar.	
Eucalyptus dealbata				Valued for Honey and Pollen.		Blossoms eaten by Grey-headed Flying Fox.	Benson & McDougall (1998).
Eucalyptus macrorhyncha	Foliage used in commercial production of Rutin. Bark used for dying, producing a khaki colour.	Cribb & Cribb (1982).		Gums, timber, honey, medicinal, fibre.		Blossoms eaten by Grey Headed Flying Fox.	Lazarides & Hince (1993), Benson & McDougall (1998).
Eucalyptus melanophloia				Gum, Timber, Honey.			Lazarides & Hince (1993).
Eucalyptus melliodora				Gum, Fuel, Honey. Major soruce 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 moluccana	Durable, hard, strong & non-splitting, piles &	Cribb & Cribb (1982).		Gum, Timber, Fuel, Honey.		Blossoms eaten by Grey Headed & Little Red Flying Fox.	Lazarides & Hince (1993), Benson & McDougall (1998).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
	decking. Excellent fuel.						
Eucalyptus sideroxylon	Oil valued for medicinal use.	Benson & McDougall (1998).		Gum, Timber, Oil, Honey.		Nectar eaten by Little Lorikeet, Swift Parrot & Regent Honeyeater. Blossoms eaten by Grey Headed Flying Fox. Browsed by Koala.	Lazarides & Hince (1993), Benson & McDougall (1998).
Eulalia aurea				Fodder, palatable when young.			Lazarides & Hince (1993).
Ficus rubiginosa	Fruit can be eaten raw or made into a jelly.						
Fimbristylis dichotoma				Must be utilised while green for forage.			Cunningham et al. (1981), Lazarides & Hince (1993).
Gahnia aspera	Red-brown seeds were pounded by the aborigines to produce a flour. The roots are also edible.	Cribb & Cribb (1974), Cunningham et al. (1981), Lazarides & Hince (1993).		Fodder, of little forage value.			Lazarides & Hince (1993).
Galium divaricatum							Lazarides & Hince (1993).
Galium gaudichaudii							Benson & McDougall (2000).
Galium propinquum							

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
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).
Gomphocarpus fruticosus			Poison.			Ornamental.	Lazarides & Hince (1993).
Gypsophyla tubulosa						Weed of disturbed often sandy soils.	Lazarides & Hince (1993).
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 water logging and salinity.	Tertiary sand coloniser, propagation by seed, garden plant, floral display. Cosmopolitan species, on back dune. Food, ornamental.	Clarke (1989), Lazarides & Hince (1993).
Hibbertia acicularis						Ornamental.	Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
Hibbertia obtusifolia			Poison?	Fodder.			Lazarides & Hince (1993).
Hyparrhenia hirta				Fodder.		Can be used for fodder if constantly managed by generally unpalatable with age reducing productivity of pastures. Aggressive coloniser.	Lazarides & Hince (1993).
Hypericum gramineum			Poison.	Fodder. Causes enteritis in sheep.			Lazarides & Hince (1993).
Hypericum perforatum			Poison.	Poisonous to sheep, cattle, horses and goats, and causes PS.		Weed. Noxious in all states.	Lazarides & Hince (1993).
Hypochaeris glabra				Fodder.			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).
Imperata cylindrica				Fodder, grazed when young.		Food plant for butterfly larvae.	Lazarides & Hince (1993).
Lachnagrostis filiformis				Fodder.		Detached seed heads cause acute fire hazard.	Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
Lactuca saligna			Poison?				Lazarides & Hince (1993).
Lactuca serriola			Poison?	Fodder.			Lazarides & Hince (1993).
Lepidium bonariense				Taints butter of dairy cows, and pig meat.			Cunningham et al. (1981), Lazarides & Hince (1993).
Lepidosperma laterale					C3. Wind intolerant, drought intolerant, intolerant of salinity and water logging.	Tertiary sand coloniser, propagation by transplants and seed.	Clarke (1989).
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).
Macrozamia stenomera	Nut kernels eaten after pounding, maceration & leaching.						
Marrubium			Poison?	Fodder.		Honey, weed.	Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
vulgare						Declared noxious in Vic, SA, WA and parts of NT.	
Medicago minima			Poison?	Fodder.			Lazarides & Hince (1993).
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 unifolia	Tubers of some species of Microtis were eaten by aborigines.	Cribb & Cribb (1974), Cunningham et al. (1981).				Pollinated by worker ants.	Benson & McDougall (2005).
Mirbelia pungens						Ornamental.	Lazarides & Hince (1993).
Murdannia graminea	Roots baked then eaten.						
Oncinocalyx						Weed. Burr-like fruit	Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
betchei						troublesome in wool.	
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).
Oplismenus aemulus				Fodder.			Lazarides & Hince (1993).
Oxalis perennans						Ornamental.	Lazarides & Hince (1993).
Pandorea pandorana	Long wiry branches used as spear shafts by Aborigines.	Lazarides & Hince (1993).		Moderately palatable fodder.	C3. Wind intolerant, drought intolerant, intolerant of 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).
Panicum effusum	Seeds utilised to make bread.		Poison?	Palatable when young. Overconsumption can cause photo-sensitisation and 'yellow bighead' in sheep. Susceptible to close grazing.		Seed eaten by Stubble Quail.	Cunningham et al. (1981), Lazarides & Hince (1993).
Panicum simile				Fodder.			Lazarides & Hince (1993).
Paronychia brasiliana							Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
Parsonsia eucalyptophylla			Poison?	Often eaten by sheep and cattle as drought fodder. Suspected sheep poison at certain times.			Lazarides & Hince (1993).
Paspalidium constrictum				Very palatable to stock. Susceptible to preferential grazing.	Drought resistant.		Cunningham et al. (1981), Lazarides & Hince (1993).
Paspalidium gracile	Seeds are edible.			Hardy and readily grazed.			Cunningham et al. (1981), Lazarides & Hince (1993).
Pennisetum alopecuroides							Lazarides & Hince (1993).
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).
Pimelea neo-anglica			Poison.				Lazarides & Hince (1993).
Pittosporum undulatum					C3. Intolerant of wind, drought, water logging and salinity.	Tertiary sand coloniser, propagation by seed, garden & shade plant. Gums, weed.	Clarke (1989), Lazarides & Hince (1993).
Plantago				Fodder.			Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
cunninghamii							
Plantago debilis	Leaves are edible.						
Plantago lanceolata				Fodder, Honey.			Lazarides & Hince (1993).
Plantago varia	Leaves are edible.						
Polycarpon tetraphyllum						Cosmopolitan. Weed.	Clarke (1989), 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).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
Prasophyllum campestre	Edible root.						
Pterostylis bicolor	Tubers eaten.					Pollinated by pseudocopulation by fungus gnats & mosquitoes.	Benson & McDougall (2005).
Pterostylis curta	Tubers eaten.					Pollinated by pseudocopulation by fungus gnats & mosquitoes.	Benson & McDougall (2005).
Ranunculus lappaceus				Not keenly sought after by stock. More suited to cattle than sheep.			Cunningham et al. (1981), Lazarides & Hince (1993).
Rosa rubiginosa	Rose hips can be eaten, may be made into ajam. Petals can be used in jams & salads.	Cunningham et al. (1981), Lazarides & Hince (1993).		Foliage grazed by stock.		Weed. Declared noxious in ACT, Vic, Tas, part NT.	Cunningham et al. (1981), Lazarides & Hince (1993).
Rostellularia adscendens				Moderately palatable fodder.		Ornamental.	Lazarides & Hince (1993).
Rubus 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	Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
						out chamber.	
Rumex brownii	Leaves and midrib can be steamed or boiled & used as a substitute for silverbeet. Thick yellow taproot can be ground, roasted & used as a coffee substitute.		Poison.			Weed.	Lazarides & Hince (1993).
Salix babylonica	Honey, shelter, ornamental.	Lazarides & Hince (1993).		Fodder.		Exotic but not truly naturalised. Only female plants in Australia. Some are fertile hybrids with S. fragilis or S. alba and do produce viable seed.	Benson & McDougall (2001).
Scandix pecten-veneris						Weed.	Lazarides & Hince (1993).
Senecio hispidulus						Weed.	Lazarides & Hince (1993).
Senecio quadridentatus			Poison.	Fodder.	Drought resistant.	Weed.	Lazarides & Hince (1993).
Sida corrugata			Poison?	Valuable forage plant. Suspected cause of paralysis			Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
				in sheep.			
Sida cunninghamii				Fodder, readily grazed.			Lazarides & Hince (1993).
Sigesbeckia orientalis	Medicinal	Lazarides & Hince (1993).		Lightly grazed fodder.		Used for treatment of skin disorders.	Lazarides & Hince (1993).
Solanum ellipticum	Berries eaten by Aborigines.	Lazarides & Hince (1993).	Poison?				Lazarides & Hince (1993).
Solanum nigrum	Edible but vary in flavour from aniseed to tomato or tamarillo flavour.		Poison?				
Sonchus asper	Eaten as a green.			Fodder.			Lazarides & Hince (1993).
Sonchus oleraceus	Food. Eaten as a vegetable.	Lazarides & Hince (1993).	Poison?	Fodder. Suspected cause of photo-sensitisation in cattle. Readily grazed by stock.	C3. Wind intolerant , drought intolerant, intolerant of water logging and salinity.	Cosmopolitan species, on the back dune. Juice used medicinally. Weed.	Clarke (1989), Lazarides & Hince (1993).
Stackhousia monogyna				Fodder.			Lazarides & Hince (1993).
Stellaria angustifolia				Possibly eaten by cattle.			Cunningham et al. (1981), Lazarides & Hince (1993).
Stellaria media				Food.		Edible as a vegetable, either cooked or raw.	Cunningham et al. (1981), Lazarides & Hince (1993).
Swainsona galegifolia	Seeds are edible.		Poison.	Fodder, Honey.		Ornamental.	Lazarides & Hince (1993).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
Themeda triandra				Very palatable, heavily grazed in eastern NSW. Sparingly grazed in Western NSW. Young growth utilised		Food plant of butterfly larvae. Will not tolerate continuous grazing. Very palatable when young but only moderate nutritive value. Provides much roughage to offset effects of highly improved grasslands.	Cunningham et al. (1981), Lazarides & Hince (1993), Benson & McDougall (2005).
Trachymene incisa	Edible tap root eaten raw or roasted.						
Tricoryne elatior				Eaten by stock but lacks bulk.			Cunningham et al. (1981), Lazarides & Hince (1993).
Trifolium arvense				Fodder.			Lazarides & Hince (1993).
Trifolium campestre				Fodder.			Lazarides & Hince (1993).
Trifolium glomeratum				Fodder.			Lazarides & Hince (1993).
Trifolium repens				Fodder, honey.			Lazarides & Hince (1993).
Tripogon loliiformis				Should be utilised quickly. Quite palatable.			Cunningham et al. (1981), Lazarides & Hince (1993).
Triptilodiscus pygmaeus				Fodder.			Lazarides & Hince (1993).
Urtica incisa	Young shoots	Lazarides &	Painfall				Cunningham et al. (1981),

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
	edible when boiled.	Hince (1993).	when contacted.				Lazarides & Hince (1993).
Verbena bonariensis			Poisonous?	Fodder.			Lazarides & Hince (1993).
Viola hederacea					C3. Tolerant of water logging. Intolerant of wind, drought and salinity.	Tertiary sand coloniser. Propagation by cuttings, transplants and seed. Garden plant, floral display.	Clarke (1989).
Vittadinia cuneata				Fodder.			Lazarides & Hince (1993).
Vittadinia pterochaeta				Fodder.			Lazarides & Hince (1993).
Vulpia myuros				Fodder.			Lazarides & Hince (1993).
Wahlenbergia communis				Fodder, palatable to stock.			Lazarides & Hince (1993).
Wahlenbergia stricta				Readily grazed, cool season plant.			Lazarides & Hince (1993).
Xanthium spinosum			Poisonous?				Lazarides & Hince (1993).
Xanthorrhoea johnsonii	Aboriginal people collected nectar for food, dryied flower stalks for fishing spears and fire making, trunk a			Honey.		Blossoms eaten by Grey Headed Flying Fox.	Benson & McDougall (2005).

Taxon	Use	Use Refs.	Toxicity	Ag. Use	Physiology	Notes	Gen. Refs.
	source of resin.						

Appendix D: The following represents a review of the current knowledge of the fire responses of selected taxa found within the conservation areas. Known fire responses and traits of taxa found in Little Llangothlin. 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	Refs.
Acacia dealbata		Requires fire. Seed dormant in ground >100yrs. After burn 1000's of seedlings/acre.	Hard-coated seed					Formed dense scrubs after fires (intense) - 4yr frequency.	Wakefield (1970), Floyd (1966).
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).
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).
Acaena ovina			Fruit	Dispersed by attachment to animal fur, clothing etc					Benson & McDougall (2000).
Acetosella vulgaris	Resprouter								

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
Ajuga australis	Resprouter		Fruit (indehiscent 1 seeded)	Erect flowering stems become horizontal at maturity, allowing short distance gravity dispersal of se				Grows rapidly after fire.	Benson & McDougall (1997), Lazarides & Hince (1993).
Ammobium alatum					<1				
Amphibromus sinuatus			Fruit (Dry indehiscent 1 seeded)						
Amyema pendulum	Obligate Seeder				4-8				Williams (1998).
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).
Anthemis arvensis		Spring and autumn.		Dispersed by wind, ater, animals and humans.			1-2	Probably killed.	Benson & McDougall (1994).
Anthoxanthum odoratum	Resprouter		Fruit (Dry indehiscent 1 seeded)						Benson & McDougall (2005).
Arthropodium minus	Resprouter								

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
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 mechanism.	1				Williams (1998).
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.					
Baloskion stenocoleum	Resprouter		Fruit (capsule)	Wind			Indefinite		
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).
Bothriochloa macra	Resprouter		Fruit (Dry indehiscent 1 seeded)	Adhesive, by animals. Wind & mud on cars.				Flowers when competition from other vegetation is removed by burning , grazing or mowing.	Lunt (1990), Benson & McDougall (2005).
Brachyscome	Resprouter								

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
radicans									
Briza minor	Obligate Seeder		Fruit (Dry indehiscent 1 seeded)	Diaspore adhesive, animal, wind & water dispersed.				Significantly more abundant in burnt areas.	Lunt (1990).
Bulbine bulbosa	Obligate Seeder				1-2				Williams (1998).
Calotis cuneifolia	Obligate Seeder							Probably killed	Benson & McDougall (1994).
Carex chlorantha	Resprouter								
Carex fascicularis	Resprouter								
Carex gaudichaudiana	Resprouter								
Carex incomitata	Resprouter								
Carex inversa	Resprouter								Lunt (1990).
Centaurium erythraea	Obligate Seeder			Diaspore: mobile seed, possibly animal and water dispersed.	1				Williams (1998).
Cerastium glomeratum				Diaspore: seed, mobile. Possibly animal, water and wind dispersed.	<1		1	Probably killed. Seedlings observed. Fruited and seeds shed (with some still flowering) within 6m of high intensity fire.	Benson & McDougall (1995).
Chenopodium album	Obligate Seeder		Fruit.	Dispersed in mud on cars.	<1		1	Probably killed by high intensity fire. A few flowers within 4m high intensity fire and one	Benson & McDougall (1995).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
								plant fruiting within 5m.	
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.
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), Purdier & Slatyer (1976), Chesterfield et al. (1991), Dickinson & Kirkpatrick (1987), Bill (1981), NPFR, Purdie (1977).
Conyza bonariensis	Obligate seeder	Coloniser of disturbed sites.		Diaspore: fruit, wind-dispersed locally and probably long distance.	<1		1	100% scorch kills - no seed stored in burnt area. Probably killed, fruit within 15wks of high intensity fire. Possibly resprouts after low intensity fire.	Benson & McDougall (1994).
Conyza sumatrensis	Obligate Seeder			Diaspore: fruit. Wind-dispersed locally & wide-spread, readily colonising	<1		1-2	Killed. Seedlings recorded <1yr after fire, probably recruiting from wind-blown seed.	Purdie (1977), Benson & McDougall (1994).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
				disturbed sites.					
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.
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 helmsii	Obligate Seeder			Diaspore: seed / possibly stem fragments.	<1		1		Williams (1998).
Cullen tenax	Obligate Seeder								
Cynoglossum australe	Resprouter		Fruit (mericarp)	Seedling recruitment possibly related to soil disturbance. Seeds dispersed by animals.	1		<5		Clarke (1989), Williams (1998).
Cyperus sanguinolentus	Obligate Seeder				1			Therophyte.	Purdie & Slatyer (1976), NPFR.
Dactylis glomerata	Resprouter		Fruit (dry indehiscent 1 seeded)	On mud on cars.					Benson & McDougall (2005).
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	Lunt (1990), NPFR, Benson & McDougall (1996).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
								high intensity crown fire at Tinkrameanah.	
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).
Dianthus armeria			Seed	Not adapted for dispersal.	<1		1		
Dichelachne micrantha	Resprouter		Fruit (dry indehiscent 1 seeded)		1				NPFR, Williams (1998), Benson & McDougall (2005).
Dichondra repens	Variable	Reproduction both sexual and vegetative means. Reproducing by seed propagation in the first year.		Stolons. Diaspore: seed, no special dispersal morphology. Dispersed in mud on cars.	1		<5	Resprouter (7091), Obligate Seeder (NPFR). Did not flower within 9m of intense autumn fire. Probably resprouts from stolons.	Lunt (1990), NPFR, Benson & McDougall (1995), Clarke (1989).
Dichopogon fimbriatus	Resprouter								
Discaria pubescens	Resprouter				3-5				Williams (1998).
Echinopogon ovatus	Resprouter		Fruit (dry indehiscent 1 seeded)	Diaspore adhesive, animal dispersed.				Survive 100% scorch. Root suckers.	NPFR, Benson & McDougall (2005).
Eleocharis sphacelata	Resprouter								
Eleusine	Resprouter		Fruit (dry	No particular	1				Williams (1998),

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
tristachya			indehiscent 1 seeded)	mechanism for dispersal. In mud on cars.					Benson & McDougall (2005).
Elymus scaber	Obligate Seeder	Total germination approx. 35 days. Some ecotypes have dormancy of several months. 80% germination recorded after 8 yrs.	Fruit (dry indehiscent 1 seeded)	Diaspore adhesive.				Cold temperatures often required to stimulate flowering.	Benson & McDougall (2005).
Epilobium billardierianum	Variable					<3m		Obligate seeder (NPFR-P). Resprouted after high intensity fire (P.Kubiak pers.comm)	NPFR, Benson & McDougall (1999).
Eryngium vesiculosum	Resprouter								Lunt (1990).
Eucalyptus acaciiformis	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.	4-7				Williams (1998).
Eucalyptus dalrympleana	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.	5-9				Williams (1998).
Eucalyptus nova-anglica	Resprouter	No dormancy.	Seed	Dispersed locally by wind or gravity.	5-9				Williams (1998).
Eucalyptus pauciflora	Resprouter	Seeds require cool moist conditions for germination.	Seed	Lignotuberous seedlings. Diaspore: seed. Dispersed locally by wind or gravity. No dormancy.	5-8		<400	Resprouter - coppice from lignotuber, epicormic to survive 100% scorch. Burning/grazing combination can	Gill (1997), Keith (1997), Noble (1984), Leigh & Holgate (1979), Keith (1996), Gill (1981), NPFR, Benson & McDougall

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
								substantially increase mortality of this plant.	(1998).
Eucalyptus stellulata	Resprouter	Germination rates increase with stratification.	Seed	Dispersed locally by wind or gravity. No dormancy mechanism.	3-6		100+		Benson & McDougall (1998), Williams (1998).
Eucalyptus viminalis	Resprouter	No soil-stored seedbank.	Seed	Wind-dispersed locally. No dormancy.	4-8		100+	Resprouts from lignotuber and weakly from epicormic buds, mortality following high intensity fire 12.1%. Seed retained on tree for 1 yr.	Gill (1981), Strasser et al. (1996), Benson & McDougall (1998).
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).
Festuca elatior			Fruit (dry indehiscent 1 seeded)	No particular mechanism for dispersal.					Benson & McDougall (2005).
Galium binifolium	Obligate Seeder		Seed	With no special morphology for dispersal.					NPFR, Benson & McDougall (2000).
Galium propinquum	Resprouter		Seed	Seed with tiny hooks presumably for dispersal by attachment to				Facultative resprouter.	NPFR, Benson & McDougall (2000).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
				animals. Vegetative spread.					
Geranium potentilloides	Obligate Seeder			Diaspore: probably seed, possibly animal dispersed.					NPFR.
Geranium solanderi	Obligate Seeder				1-2				
Geranium solanderi	Obligate Seeder				1-2				Williams (1998).
Glyceria australis	Resprouter	Germination in all seasons.	Fruit (dry indehiscent, 1 seeded).						Benson & McDougall (2005).
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).
Gonocarpus tetragynus	Variable	Seedlings <1yr after fire (Purdie, 1977). May occur on disturbed sites.		Diaspore: fruit. No particular dispersal mechanism. Episodic recruitment mainly after fire.		2		Obligate Seeder (NPFR-CH, W?.) Facultative resprouter - regrowth & suckers from root stocks and lateral roots. Soil stored seed. Seedlings recorded <1yr after fire.	NPFR, Benson & McDougall (1997).
Haloragis heterophylla	Resprouter			No particular mechanism for dispersal.	1			Multiplied vegetatively after autumn fire. Probably killed (7114).	Lunt (1990), Benson & McDougall (1997), Benson & McDougall

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
									(1997).
Hemarthria uncinata			Fruit (dry indehiscent 1 seeded)			<1	Indefinite	Recruitment mainly after fire. Flower 3-5 m after high intensity fire.	Benson & McDougall (2005).
Holcus lanatus		Seed germinates quickly after maturity but may be delayed by freezing.	Fruit (dry indehiscent 1 seeded)	No particular mechanism for dispersal.				Regenerative strategy uncertain. Flowered within 9 months of intense autumn fire. Prolific seeder (240 000 per annum).	Lunt (1990), Benson & McDougall (2005).
Hovea heterophylla	Resprouter								
Hybanthus monopetalus	Obligate Seeder							100% scorch kills - soil stored seed.	NPFR.
Hydrocotyle laxiflora	Obligate Seeder				1				NPFR, Williams (1998).
Hydrocotyle tripartita	Obligate Seeder				1				Williams (1998).
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	Obligate								

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
microcephala	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.
Hypoxis hygrometrica	Resprouter				1-2			Facultative resprouter	NPFR, Williams (1998).
Isotoma fluviatilis			Seed						
Juncus bufonius	Obligate Seeder							Significantly more abundant in burnt areas.	Lunt (1990), NPFR.
Juncus pauciflorus	Resprouter							Obligate resprouter.	NPFR.
Juncus subsecundus	Resprouter.							Obligate resprouter. Veg. regrowth. Root resprouter. Fire resistant increaser. Secondary juvenile period <9m after intense autumn fire.	Lunt (1990), Purdie & Slatyer (1976), Purdie & Slatyer (1976), Lunt (1990).
Juncus usitatus	Resprouter				1-2			Obligate resprouter.	NPFR, Williams (1998).
Lachnagrostis filiformis	Obligate Seeder		Fruit (dry indehiscent 1 seeded)		<1		<1	Facultative resprouter. Not recorded in seedbank before fire.	Williams (1998), Lunt (1990), NPFR.

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
								Regenerated from seed after intense autumn fire (flowered within 9m).	
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).
Leucanthemum vulgare		Germination in autumn, develops slowly during winter and spring. Some seeds dormant for >20yrs.	Fruit	No special dispersal morphology.	>1				
Leucopogon fraseri			Fruit	Adapted for dispersal by ingestion.					
Lolium perenne	Resprouter		Fruit (dry indehiscent 1 seeded)	No particular morphology for dispersal. In muck on cars.		<1	<3	Flowering 44 weeks after high intensity fire.	Benson & McDougall (2005).
Lomandra longifolia	Resprouter	Reproduction sexual, reproducing by seed propagation between 1-5 yrs.	Seed	Ant adapted elaiosome.	2-3	1	5-30	Obligate Seeder (E). Facultative and obligate resprouter. Clonal decreaser. Survives 100% scorch - root suckers. Fire	Hamilton et al. (1991), Fox et al. (1979), Leigh & Holgate (1979), Dickinson & Kirkpatrick (1987),

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
								resistant increaser. Clonal decreaser.	Purdie (1977), Benwell (1998), NPFR, Clarke (1989), Benson & McDougall (2005).
Luzula flaccida	Obligate Seeder								
Medicago polymorpha	Obligate Seeder								
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 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 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).
Microtis unifolia	Resprouter	Readily germinates & can colonise new sites especially after disturbance.	Seed, winged		1-3	1	Indefinite	Flowering diminishes the longer since fire.	Williams (1998), Benson & McDougall (2005).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
Myriophyllum verrucosum	Resprouter				1				
Onopordum acanthium		Pioneer species, establishing on bare soil.	Fruit	Wind-dispersed.			2		
Oxalis exilis	Resprouter								
Panicum decompositum	Resprouter		Inflorescence						Benson & McDougall (2005).
Panicum effusum	Resprouter		Inflorescence	Wind dispersed. In mud on cars. Coloniser of disturbed sites.	1				Williams (1998), Benson & McDougall (2005).
Panicum gilvum	Resprouter	Germination in all seasons.	Inflorescence	Wind dispersal.					Benson & McDougall (2005).
Paronychia brasiliana	Obligate Seeder				1				Williams (1998).
Paspalum dilatatum	Resprouter		Inflorescence	Adhesive for dispersal. In mud on cars.		<1	Indefinite	Fruit within 4 m of high intensity fire.	Benson & McDougall (2005).
Pastinaca sativa			Fruit (mericarp)	Possibly wind-dispersed.			2		
Pennisetum alopecuroides	Resprouter		Fruit (dry indehiscent 1 seeded)	Wind dispersal & adhesion.	1				Williams (1998), Benson & McDougall (2005).
Persicaria lapathifolia								Probably resprouts. Fruiting in 5m after high intensity fire.	Benson & McDougall (1999).
Phalaris aquatica	Resprouter		Fruit (dry	No particular					Benson & McDougall

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
			indehiscent 1 seeded)	morphology for dispersal. In mud on cars.					(2005).
Phleum pratense	Resprouter		Fruit (dry indehiscent 1 seeded)	No particular morphology for dispersal.					Benson & McDougall (2005).
Phragmites australis	Resprouter	Germination in NSW low but consistent. Germination only occurs in a narrow range of habitats.	Fruit (dry indehiscent 1 seeded)	Spreads extensively by horizontal rhizomes. Dies back after frosts.	1-2	<2	Indefinite		Williams (1998), Benson & McDougall (2005).
Pimelea linifolia	Resprouter				2-3				Williams (1998).
Plantago lanceolata	Resprouter							Obligate resprouter (CH). Seeder? Regenerative strategy uncertain (7091).	Lunt (1990), NPFR.
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 pratensis	Resprouter		Fruit (dry indehiscent 1 seeded)	No particular morphology for dispersal. In mud in cars.			Indefinite		Benson & McDougall (2005).
Poa sieberiana	Resprouter	Typical germination rate approx. 570 per gram of seed.	Fruit (dry indehiscent 1 seeded)	No particular morphology for dispersal.			Indefinite	Flowers anytime in response to seasonal conditions.	Benson & McDougall (2005).
Podolepis jaceoides	Resprouter		Fruit					Perennial.	Lunt (1990).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
Polygala japonica								Possibly resprouts.	Benson & McDougall (1999).
Poranthera microphylla	Obligate Seeder	Readily after fire from soil stored seedbank		Within 5 m of fire. Diaspore: seed. Both ballistic & ant-adapted dispersal mech. Coloniser.	< 1yr		1	(Will have an initial flush after fire which is reduced soon after: pers. obs.) Flowers profusely after high intensity fire. Killed. Seedlings recorded <1yr after fire.	Benson & McDougall (1995), Purdie & Slatyer (1976), Bradfield (1981), NPFR, Fox (1988), Purdie (1977).
Potamogeton crispus			Fruit (nut)						Benson & McDougall (2005).
Potamogeton tricarinatus		Germination in autumn-winter in the Northern Tablelands.	Fruit (nutlets)						Benson & McDougall (2005).
Prasophyllum dossenum	Resprouter		Seed, winged	Wind			Indefinite		
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 fire, autumn	Fox (1988), Benson (1985), Barker (1990), Hamilton et al. (1991), Fox et al. (1979), Keith (1996), Dickinson & Kirkpatrick (1987), Cremer & Mount (1965), NPFR, Benson

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
								fire not	& McDougall (1993).
Pultenaea microphylla			Seed						
Ranunculus inundatus			Fruit (achene)						Benson & McDougall (2000).
Ranunculus lappaceus	Resprouter		Fruit (achene)	Morphology for dispersal by adhesion.	1-2				Benson & McDougall (2000).
Ranunculus scleratus			Fruit (achene)		<1y		<1y		Benson & McDougall (2000).
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 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).
Rumex crispus	Resprouter							Resprouted after high intensity fire.	Benson & McDougall (1999).
Schoenus apogon	Variable							Variable, obligate seeder and facultative and	NPFR, Dickinson & Kirkpatrick (1987),

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
								obligate seeder. Secondary juv. period <9m after intense autumn fire. 1st recorded 3m after fire in wet forest, 1m after fire in grassy forest.	Lunt (1990).
Senecio madagascariensis	Obligate Seeder		Fruit (achene)						
Setaria pumila	Obligate Seeder		Fruit (dry indehiscent 1 seeded)	No particular morphology for dispersal.	1		<1		Williams (1998), Benson & McDougall (2005).
Solanum nigrum	Obligate Seeder				1-2				Williams (1998).
Solanum opacum	Obligate Seeder								
Sonchus asper	Obligate Seeder	Within first year after fire.						Therophyte. Successful post-burn seed coloniser.	Purdie & Slatyer (1976), Dickinson & Kirkpatrick (1987), Purdie (1977), NPFR.
Sonchus oleraceus	Obligate Seeder.			Seeds dispersed by wind.	1		1-2		Lunt (1990), Clarke (1989).
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).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
Stellaria angustifolia	Obligate Seeder		Seed	No particular dispersal morphology.	1				Williams (1998).
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.
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).
Themeda triandra	Resprouter	Primary dormancy usually breaks slowly with storage up to 12 m or more. To break dormancy, seeds need cold 4C for at least 1 month. Total germination 100 days.	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).
Thesium australe	Obligate Seeder	Very erratic in wild. Facilitated by: 24 hour immersion in 1 M HCl; 2-3 months cold treatment at 5	Fruit.	Hemi-parasitic on roots of other plants. Seed can remain dormant > 12 months. Fire or	1-3		2-3 or < 2y.	Probably killed by fire. Germination stimulated by fire but may germinate in absence of fire. Favoured by	Benson & McDougall (2001).

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
		degrees C then 20-25 degrees C; planting with Themeda australis hosts in 1:1 potting mix and natural soil; not stimulated by sub-zero temp.		hot summers may stimulate mass germination; land use and weather conditions in following summer critical to survival. Variable growth rate due to host health/vigour?				medium-term absence of fire, depleted by late-season burning.	
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.
Trifolium campestre	Obligate Seeder				1		<1		Lunt (1990).
Trifolium dubium	Obligate seeder			No particular dispersal morphology, dispersed in mud on cars.	<1		<1		Lunt (1990).
Trifolium repens	Obligate Seeder	Usually germinates in autumn.		No particular morphology for dispersal. Dispersed in mud on cars, & by wind, animals &					

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
				humans.					
Trifolium striatum	Obligate Seeder								Lunt (1990).
Utricularia dichotoma	Resprouter	Recruitment mainly after fire.						Facultative resprouter. 100% scorch kills (BW) - soil stored seed. Carnivorous herb.	Benson & McDougall (1997), NPFR.
Velleia paradoxa	Resprouter							Veg. regeneration.	Lunt (1990).
Verbena bonariensis	Obligate Seeder				1				Williams (1998).
Veronica calycina	Resprouter				1-2				Williams (1998).
Viola betonicifolia	Resprouter				1				Williams (1998).
Vittadinia cuneata	Resprouter							Perennial.	Lunt (1990).
Vulpia bromoides	Obligate Seeder		Fruit (dry indehiscent 1 seeded)	Adhesive for dispersal. In mud on cars.	1	<1	<1	Increased 100-fold after an autumn fire. Significantly different mean number of plants between burnt & unburnt areas. Flowering within 10 m after high intensity fire.	Lunt (1990), Benson & McDougall (2005).
Wahlenbergia ceracea				Diaspore: seed.					
Wahlenbergia communis	Obligate Seeder	Soil-stored seedbank. Coloniser.		Diaspore: seed. Wind-dispersed. No particular dispersal	3-6m			Killed, flowers within 15 wks, flower and fruit 10 months high intensity fire	Benson & McDougall (1995), NPFR, Fox (1988), Benson &

Taxon	Response	Germination	Diaspore	Dispersal	1 Juv	2 Juv	Longev	Notes	Refs.
				morphology.					McDougall (1995).
Wahlenbergia gracilis	Variable			Seeds dispersed by expulsion.	< 1yr		1-2	Probably killed by high intensity fire, flowering within 4 m and fruiting within 6 m of fire. Regenerates after crown fire & partial burn by resprouting above ground.	Benson & McDougall (1995), NPFR, Clarke (1989).
Xerochrysum bracteatum	Obligate Seeder	Disturbance related, fire or other	Fruit	Wind-dispersed.	1			Probably killed.	Benson & McDougall (1994), Williams (1998).

Appendix E: Locality and site information.

Site	Date	Aspect	Easting	Northing	Notes	Altitude
1	25/04/2010	320	292,896.00	6,674,452.00	Soil chocolate brown loam.	519
2	25/04/2010	335	292,969.00	6,673,617.00	Soil red chocolate brown loam.	458
3	25/04/2010	2	292,681.00	6,673,542.00	Soil light brown loam.	469
4	25/04/2010	4	292,394.00	6,674,025.00	Soil chocolate brown loam.	451
5	25/04/2010	291	295,090.00	6,676,412.00	Soil dark chocolate brown peaty loam.	668
6	25/04/2010	220	295,040.00	6,676,530.00	Soil grey sandy loam.	670
7	25/04/2010	149	293,077.00	6,675,099.00	Soil light chocolate brown loam.	616
8	26/04/2010	36	293,945.00	6,676,815.00	Soil grey brown sandy loam.	639
9	26/04/2010	181	294,711.00	6,676,806.00	Soil dark brown black, peaty sandy loam.	666
10	26/04/2010	13	294,456.00	6,677,172.00	Soil dark chocolate brown sandy loam.	634
11	26/04/2010	46	294,284.00	6,677,395.00	Soil chocolate brown sandy loam.	618
12	26/04/2010	261	294,142.00	6,676,140.00	Soil dark brown peaty loam.	651
13	26/04/2010	238	294,114.00	6,676,168.00	Soil dark brown sandy clay loam.	642
14	26/04/2010	318	294,278.00	6,675,974.00	Soil dark brown sandy loam.	652
15	26/04/2010	163	294,641.00	6,676,276.00	Soil cream sandy loam.	672
16	15/10/2003	215	293,476.00	6,673,490.00	MCT232.	500
17	15/10/2003	60	294,677.00	6,673,358.00	MCT233.	712
18	15/10/2003	45	293,818.00	6,675,265.00	MCT234.	687
19	15/10/2003	60	294,949.00	6,674,917.00	MCT235.	755
20	16/10/2003	235	292,935.00	6,677,140.00	MCT236.	727
21	16/10/2003	245	295,063.00	6,677,554.00	MCT237.	560

Site	Date	Aspect	Easting	Northing	Notes	Altitude
22	16/10/2003	140	292,413.00	6,676,165.00	MCT238.	492
23	16/10/2003	0	291,213.00	6,677,533.00	MCT239.	415
24	22/10/2003	40	294,403.00	6,677,478.00	MCT242.	600

Acknowledgements

Thanks to Jason for overall management of the projects and assistance in the field.