Biomass and floristic patterns in the ground layer vegetation of box-gum grassy eucalypt woodland in Goorooyarroo and Mulligans Flat Nature Reserves, Australian Capital Territory

S. McIntyre, J. Stol, J. Harvey, A. O. Nicholls, M. Campbell, A. Reid, A. D. Manning and D. Lindenmayer

Corresponding author: Sue McIntyre, CSIRO Sustainable Ecosystems, PO Box 284, Canberra ACT 2601 AUSTRALIA
Email: Sue.Mcintyre@csiro.au.

Abstract: We establish a methodology and present baseline data for a long-term grassy woodland restoration study that commenced in 2007 in two nature reserves (Mulligans Flat, Goorooyarroo (35° 9–13' S; 149° 9–12' E)) totalling 1386 ha on the northern boundary of Canberra, in the Australian Capital Territory in south eastern Australia. The experimental infrastructure comprises 96 × 1 ha sites established in *Eucalyptus blakelyi* / *Eucalyptus melliodora* dominated woodland. These are being subjected to varying kangaroo grazing pressure and augmentation with logs, while burning treatments are planned. One reserve (Mulligans Flat) has been fenced for feral predator control and contains half the sites, forming a companion experiment to Goorooyarroo. Our baseline floristic study comprised estimates, at the site level, of ground layer biomass, species biomass, ground cover types and soil (0–10 cm) properties. From these data we conclude that the groundlayer vegetation is dominated by *Joycea pallida*, *Austrodanthonia* spp., *Themeda australis* and *Aristida ramosa*. These grasses varied in abundance according to differences in soil pH, phosphorus and to a lesser extent nitrates. Forb frequencies were highly sensitive to nitrate levels with annual exotic forbs dominating at high nitrate sites. More generally, soil nutrient levels and exotic species in some sites indicated areas of previous pasture improvement activities. Biomass estimates indicated extremely high grazing pressure, sufficient to negatively affect the habitat quality for ground-dependent fauna and some soil processes. These data will provide an important basis for examining rates of ecosystem recovery under different restoration strategies.

Key words: macropod grazing, woodland restoration, grassland, BOTANAL, grassy woodland, ecosystem restoration, phosphorus tolerance

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Introduction

Temperate grassy woodlands are an ecological community of major concern in conservation management owing to the pervasive and often severe effects of pastoralism on their floristic composition and ecological functioning. Extensive areas in good condition do not exist, and so the establishment of significant conservation reserves invariably involves the need for restoration and active management. Such a task is currently being undertaken in the Australian Capital Territory (ACT) in south eastern Australia in two adjacent reserves: Mulligans Flat Nature Reserve: 683 ha established in 1994 and Goorooyarroo Nature Reserve: 702 ha established in 2006 (Lyn Jones, ACT Planning and Land Authority pers. comm.).

The management changes since the establishment of these reserves have been the removal of livestock, cessation of pasture improvement and protection from tree clearing and firewood removal. Other active management includes the control of exotic weeds (primarily serrated tussock *[1]*Nasella tricotoma* and sweet briar **Rosa rubiginosa*). However, the effects of previous pastoralism on the ecosystems are significant, and it cannot be assumed that protection status alone will allow the ecosystems to spontaneously recover their complete diversity and function. Some elements may recover over time (e.g. mature tree densities, fallen timber, soil condition) and others may need more active management to either address inappropriate processes operating, or to reverse transformative actions that have led to alternative stable states. An example of an inappropriate process is the

*[1]. Exotic species are denoted with an asterisk throughout the text and tables.

high grazing pressure resulting from large populations of macropods that have developed in the absence of predators, and in response to changes in pasture and the provision of dams (Caughley et al. 1980; Viggers & Hearn 2005). An example of a transformative action is conversion to exotic plant dominance due to grazing, the use of fertilizers and the introduction of exotic species (Prober et al. 2002b; McIntyre & Lavorel 2007).

In 2004, in recognition of the importance of the need to improve management of grassy woodlands, a partnership was formed between the Australian Capital Territory Government and The Australian National University to experimentally impose active management to improve the woodlands for biodiversity, with an emphasis on the fauna and woody vegetation (Manning et al. in prep.). CSIRO Sustainable Ecosystems has joined the partnership to provide data on understory vegetation condition. The first stage of these research partnerships has been to collect baseline data on biodiversity and resource condition and to establish experimental treatments. It is envisaged that while some changes will be readily observable, it will take decades to detect some treatment effects, and that the project will necessarily be medium- to long-term. It is therefore important to establish an accessible, well-documented baseline data set at the beginning of the project.

The objectives of this paper are twofold. First, we provide a description of the groundlayer vegetation and its floristic patterns. There is little published information on the vegetation in this area beyond a general description of Mulligans Flat and a species list (Lepschi 1993). In our analysis, we provide an overview of the composition and condition of woody and herbaceous vegetation less than 0.5 m in height in both Mulligans Flat and Goorooyarroo reserves. Through multivariate analysis, we have also sought to identify major variation in the vegetation and identify soil and other site factors that might be associated with this variation. Our second objective is to provide a permanent record of the baseline data to underpin long-term studies of floristic change and ecological condition. An additional use of these data will be to inform the interpretation of the faunal data sets being collected, and this has influenced the vegetation survey protocol.

Fig. 1a. General view of Goorooyarroo Nature Reserve showing grassy woodland on rolling hills (Photo S. McIntyre).

Fig. 1b. Clumped and scattered timber addition (40 tonne.ha^{-1}) on *Themeda* lawn in Mulligans Flat (Photo S. McIntyre).

Table 1. Rainfall at the Canberra airport prior to and during the survey in 2007, and long-term averages for the same months. Note district rainfall varies greatly and estimated annual rainfall for the reserves is 650 mm (Jenkins 2000)

Month	Total rainfall 2007 (mm)	Long-term average for month (mm)
January	10	59
February	95	55
March	37	50
April	28	46
May	42	44
June	93	41
July	19	41
August	12	47
September	15	52
October	23	63
November	95	64
December	101	54
Annual	**568**	**615**

Reserve features and overall experimental design

The two reserves total 1,386 ha and are joined along a boundary of 300–400 m and located within 35° 9–13' S; 149° 9–12' E. Elevation ranges from 650 – 700 m and mean annual rainfall is about 650 mm (Table 1; Jenkins 2000). The soils in the reserves are derived from Silurian volcanics that form the ridges and Silurian sedimentary rocks. Four intergrading soil landscapes have been identified in the area:

Fig. 1c. *Joycea pallida* dominates on acid soils of low fertility and forms large tussocks that are largely avoided by grazers (Photo J. Stol).

Fig. 1d. Group 1 site with history of previous pasture development - elevated phosphorus and nitrates supporting **Phalaris* , **Trifolium* and *Austrodanthonia* as dominants (Photo J. Stol).

Fig. 1e. Heavy macropod grazing was pervasive. This grazing lawn is dominated by *Austrodanthonia* and had a biomass of 280 kg.ha^{-1} (Photo S. McIntyre).

Fig. 1f. *Themeda* dominance was associated with high grazing pressure on the less acid soils with low nitrates and moderate phosphorus levels. This quadrat was 828 kg.ha^{-1}, well above the average of 570 kg.ha^{-1} (Photo S. McIntyre).

Campbell, Burra, Williamsdale and Franklin (Jenkins 2000). These vary mainly in their topography, ranging from rolling hills (Campbell)(Fig. 1a), low hills (Burra), to undulating plains and flats (Franklin, Williamsdale). Yellow Podzolic soils are associated with all these landscapes, with various occurrences of Red Podzolics, Red and Yellow Earths, Solodic, Solonized Solonetz and Alluvial soils (Sleeman & Walker 1979; Jenkins 2000).

Three broad vegetation types were recognized by Lepschi (1993) in his description of Mulligans Flat: 1) open forest on the shallower soils of the ridges and slopes dominated by *Eucalyptus macrorhyncha*, *Eucalyptus rossii* and *Eucalyptus mannifera*; 2) woodlands on the deeper soils of the lower slopes and flats (*Eucalyptus blakelyi* and *Eucalyptus melliodora*) and 3) patches of grassland dominated by *Panicum effusum*, *Themeda australis* and *Austrodanthonia* spp. The woodlands are a critically endangered ecological community under the *Environment Protection and Biodiversity Conservation Act 1999* (Box-Gum Grassy Woodlands and Derived Grasslands) and are the focus of the experiment. The primary criteria for location of the experimental sites was that the dominant tree species be *Eucalyptus blakelyi* and *Eucalyptus melliodora*. However, there are gradients between vegetation types (Lepschi 1993), particularly with *Eucalyptus macrorhyncha* and this species was well represented in sites in Mulligans Flat. In addition, the 'woodland' species (*Eucalyptus blakelyi* and *Eucalyptus melliodora*) are densely regenerating in places and are developing a forest structure. Given a history of clearing and subsequent regeneration, and in the absence of an endogenous disturbance regime, identifying and creating appropriate tree densities across the reserves will pose a challenge for managers.

The experimental infrastructure comprises 96 × 1 ha permanently marked sites, 48 sites in each reserve, across which a number of treatments are being imposed (or are planned):

- Kangaroo control though fencing and partial exclosure (two levels of grazing, uncontrolled or reduced).
- Fallen timber augmentation (none, 20 tonnes.ha^{-1} dispersed, 20 tonnes.ha^{-1} clumped, 40 tonnes.ha^{-1} both clumped and dispersed, Fig.1b).
- Fire (burned, not burned, regime yet to be determined).

These treatments are being imposed on four tree and shrub density classes that represent a range of existing densities in the reserves: 1) high tree – low shrub; 2) high tree – high shrub; 3) low tree – low shrub; 4) low tree – high shrub. The 48 sites in each reserve are being treated as two companion experiments. This is primarily due to the management of Mulligans Flat sites as a feral predator free site, with the establishment of a predator-proof fence around all the sites in this reserve. None of the sites in Goorooyarroo are fenced in this way.

Further details of the experiment and its implementation are being reported elsewhere (Manning *et al.* in prep) and are not germane to this paper as the treatments had either not yet been implemented (kangaroo control, fire, feral pest exclusion) or had only been implemented within weeks of vegetation sampling (fallen timber augmentation). Augmented fallen timber was in the form of eucalypt main stems (smaller branches and bark removed) salvaged from Canberra suburbs and placed across the sites with a logging forwarder (Fig.1b).

Methods for sampling ground layer vegetation

In this survey, ground layer vegetation comprised herbaceous species as well as individuals of woody plants that were less than 0.5 m high (regardless of potential height). Vegetation was sampled between 12th October and 27th November 2007. A field team of four people completed the floristic survey which took 25 days. All 96 sites were sampled. Thirty quadrats (0.5 × 0.5 m) were located systematically across each site (see Fig. 2). Measuring tapes were run out from the permanent posts to mark the spine of the site and the 20 m intervals, while the 15m intervals were paced out at right angles from the central tape (Fig. 2). There was some variation in the distance between the two permanent posts, so we used post B as the absolute reference point for the location of the quadrats. Quadrats falling on logs (whether pre-existing or part of the treatment addition) or live tree stems were not displaced around these features.

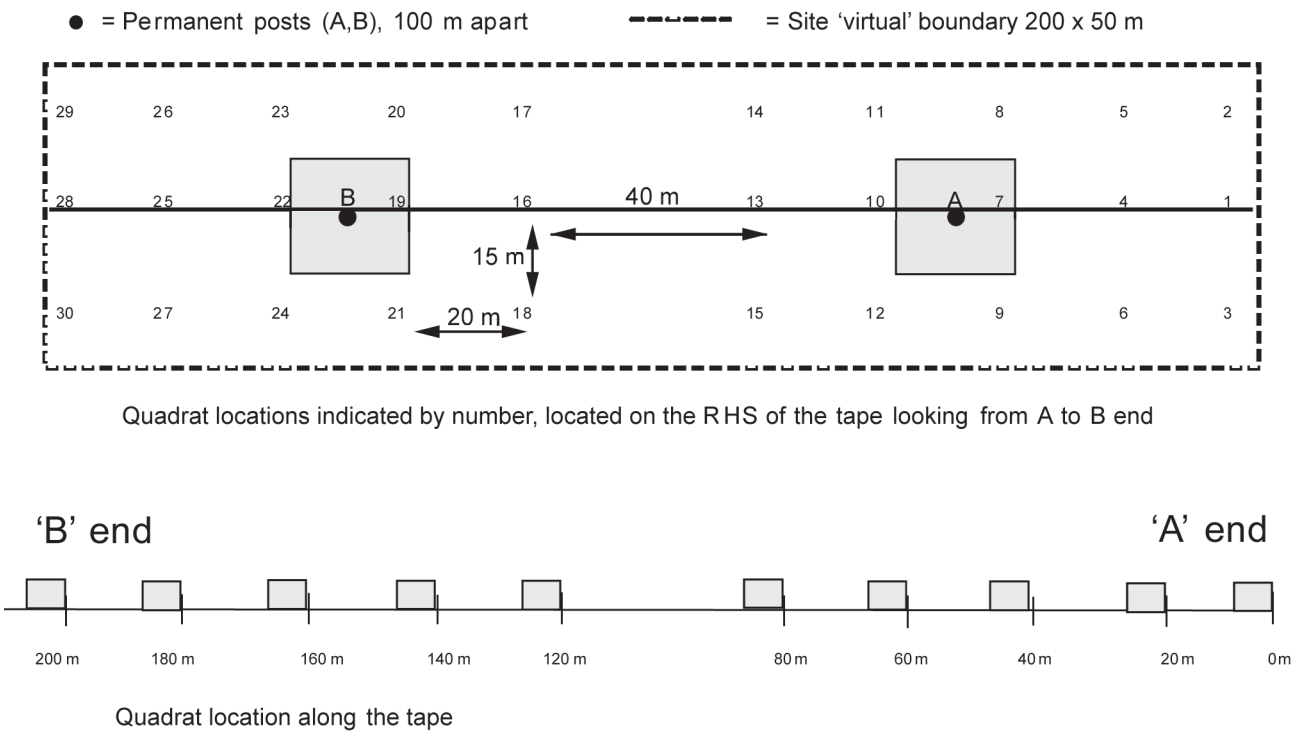


Fig 2. Plant sampling layout within the 96 x1 ha permanent sites showing location of permanent posts (A, B), boundary of site (referenced from posts), numbered location of the 30 quadrats sampled (non-permanent) and relative position of the quadrats along the three transect lines (non-permanent).

Ground cover characterization

We used point–based estimates of ground cover, one point in each of the four corners of the quadrats, giving a total of 120 points per site. At each point, we recorded the type of ground cover defined as follows:

Litter – included organic material that was unattached to a plant or the ground and included stems, leaves, bark, animal dung, sticks diameter <10 cm and shorter than 0.5m. If litter was present, we measured its depth to the nearest mm.

Cryptogams – included moss, lichen, liverwort, thick algal crusts.

Bare – included loose rock with longest side ≤20 cm, bare earth, earth with thin layer of algae.

Rock – any size, attached to the ground or loose rock, with longest side >20 cm.

Fallen logs – minimum diameter of 10 cm, minimum length of 0.5 m, smaller sizes are included in litter. A section of the log having a 10 cm diameter needed to be in the quadrat for it to qualify as a log.

Live plant basal area – the attachment area of the ground occupied by the stem or tiller bases of non-cryptogam plants, including the basal area of live tree stems.

Ground cover was thus characterized as % cover of litter, cryptogams, bare ground, rock, fallen logs and basal area. Average litter depth (where litter present) was also calculated.

Tree and shrub count

We recorded number and identification of eucalypts with a height of <0.5 m. Shrubs with a height of <0.5 m in the quadrats were recorded as part of the ground layer biomass data (see methods below). We also recorded identity and numbers of all non-eucalypt shrubs ≥0.5 m high and a DBH of ≤2cm, even if the same species was recorded in the ground layer data. Trees and shrubs were counted only if they were rooted in the quadrat.

Methods for ground layer biomass and composition

We used the BOTANAL method for estimating species abundance (t' Mannetje & Haydock 1963, Tothill et al. 1992) which requires species to be ranked in terms of biomass and the total biomass to be estimated.

Species rankings

Dominant species were ranked according to their contribution to dry weight of biomass (green and dead attached tissues) and the top six species recorded to enable assessment of contribution of abundant forbs to the sward. Winter growing annuals were included in the ranking even if dried off, as long as they were identifiable. Species were ranked according to the amount of foliage projected over the quadrat, regardless of where it was rooted.

Total biomass estimates

Total biomass (both green and dead attached tissues) was estimated for each quadrat. Estimates did not include any eucalypt, or shrub >0.5 m high of any species in the total biomass estimates. If there were any herbaceous plants that were higher than 0.5 m, they were included in the total biomass estimates. We included only higher plants and true ferns but not cryptogams (ie no lichen, moss, liverworts, pre-ferns).

Sixteen standards were established to train two members of the field team in biomass estimation, representing the range of structures and biomass available. Two adjacent closely matched 0.5 × 0.5 m quadrats were selected, one was photographed and cut, the other left and marked out as the visual standard. Live plants and dead attached litter were cut at ground level. Material was oven dried at 80^0C to constant weight to provide correct dry weights. The team used these standards to establish their estimation skills, and used the photos for later reference.

Consistent bias by individual observers was addressed by using individual calibration regressions of estimates following the approach of Tothill et al. (1992). Halfway though the sampling, 20 quadrats were located across a range of biomass levels and the total biomass estimated by each operator. These were then cut, dried and weighed. This process was repeated on the completion of sampling. The 40 calibrated estimates were used in regressions to adjust the total biomass data. Straight line regressions were obtained with R^2 values of 0.93 and 0.97.

Species composition data

To calculate species composition from the estimate of total biomass and species rankings, the proportional contribution (PR) was calculated using the following geometric series:

$$PR = (1–k)*k^{R-1}$$

where R is the Rank order, and k is a parameter. We used a k = 0.3 (best match for empirical results, Scott 1986), which give % contributions of: Rank 1 = 70%, Rank 2 = 21%, Rank 3 = 6.3%, Rank 4 = 1.9%, Rank 5 = 0.6%, Rank 6 = 0.2%.

If a maximum of 3, 4, or 5 species were recorded in a quadrat, the above weightings were not changed, as the non-existent ranks (4, 5 and 6) totalled a maximum of 2.7%, and we regarded this amount of unaccounted-for biomass as acceptable. If there were two species only in a quadrat, the weighting used was 70%, 30%. Ties were used if two species had similar biomass, in which case, the next rank was not filled. For ties, the two or three relevant tied ranks were added together and divided evenly e.g. 2–3 tied was weighted 70, 13.65, 13.65, 1.9, 0.6, 0.2; 1–3 tied was 32.4, 32.4, 32.4, 1.9, 0.6, 0.2%.

For highly dominant species we used a modification proposed by Jones & Hargreaves (1979). If the dominant species in a quadrat represented >85% of the biomass, we allocated it to both 1st & 2nd ranks. The 2nd ranked species then dropped to 3rd , and so on, while the 6th species was not ranked. This allowed for the variation normally found in grasslands, the arbitrary limit of 85% suggested by Jones and Hargreaves to apply the correction results in proportions close to those achieved by harvesting and sorting. Calculations to determine the average biomass per site ($kg.ha^{-1}$) of each ranked species were performed following the methodology in t' Mannetje & Haydock (1963).

Soil sampling

Soil sampling was conducted between 28th February and 14th March 2008. Soils were sampled at the site level by taking a single soil core at each of the 30 plant quadrat sites (Fig. 2) and bulking the 30 soil samples together. Samples were taken using a soil corer to a depth of 10 cm. The internal diameter of the soil corer was 20mm with total volume of $32cm^3$. Before taking individual cores, the obvious undecomposed leaf, grass or other plant material on the soil was scraped away using the end of the soil corer (ie. not using any other broader implements or by hand) so that the soil surface was visible. If plant material present was decomposed and integrated into the A horizon this was included in the sample. Animal dung ie. kangaroo pellets, was specifically excluded, however soils below kangaroo dung were still collected. On the centre transect line the soil sampling point was directly below the tape measure at the appropriate distance. A toe-point method was used to locate samples away from the tape e.g. when pacing 15m from the centre transect, the point of the boot at 15m indicated exactly where to sample, with no displacement. Exceptions were when the point was directly on a live grass tussock, log, tree or rock, in which case the soil sample was taken at the closest possible area available not having these impediments.

Soil samples were dried at 38º C for 24 hrs on the day of collection to reduce microbial activity of samples, some of which were damp on sampling. They were then stored in paper bags in a dark, cool area of a laboratory until all sampling was complete and the samples sent for analysis on May 30 th 2008.

Soil analysis

Analyses were performed by the Victorian Department of Primary Industries Laboratory, Werribee, Victoria, applying the following methods to sieved (2mm) and ground samples:

Soil Colour – described on dried and ground soil in the laboratory, using Munsell Colour Charts.

Soil Texture – described on dried and ground samples (after McDonald et al. 1990).

pH – measured by two methods, in water and in $CaCl_2$ after Rayment & Higginson (1992). Only data for the $CaCl_2$ method were analysed but the results of both methods are reported in Appendix 2.

Electrical conductivity – after Rayment & Higginson (1992). Samples of $<0.05\ dSm^{-1}$ were not discriminated by the analysis.

Available phosphorus – using the Colwell method (Code no. 9B2 pg 68, Rayment and Higginson 1992). Samples of $<4\ mg.kg^{-1}$ were not discriminated by the analysis, and were given a nominal value of $2\ mg.kg^{-1}$ where averages were required for the analyses.

Nitrate nitrogen – using method Code no. 7C2 pg 53 in Rayment and Higginson (1992). Samples of $<0.25\ mg.kg^{-1}$ were not discriminated in the analysis and were given a nominal value of $0.2\ mg.kg^{-1}$ where averages were required for the analyses.

Total nitrogen (%) – after Rayment & Higginson (1992) The Werribee DPI lab use the FP–2000 instrument and their method was drawn from the following sources:

a) 6B3 as per Rayment & Higginson (1992). b) LECO manufacturer application note #165 at the following web address http://www.leco.com/resources/application_note_subs/pdf/organic/-165.pdf c) LECO application note # 005 http://www.leco.com/resources/application_note_subs/pdf/organic/-005.pdf

Total Carbon (%) – as for total nitrogen. Organic matter was calculated by multiplying total carbon by 1.9.

Carbon: nitrogen ratio – Total carbon divided by total nitrogen.

Data analysis

To explore the structure of the vegetation data and examine variation in relation to environmental factors, we conducted classification and ordination of the floristic data summarized at the site level. The classification of the sites was based on a matrix calculated from a Bray and Curtis dissimilarity measure (Faith et al. 1987) using the raw biomass data. We chose not to standardise the biomass data as the large range was believed to reflect strong environmental effects in the study area. Approximately one in five entries in the site by species matrix contained positive biomass estimates. A hierarchical clustering strategy was used to generate groups using the complete linkage method (equivalent to furthest neighbour method; McCune & Grace 2002). The number of groups selected was determined by inspection of the dendrogram, evaluating the height of the splits and the number and size of the groups at different levels. Groups were characterized by dominant species, soil attributes [Nitrate-N, total Carbon, total Nitrogen, organic matter, pH ($CaCl_2$), Phosphorus, Texture, Colour], landscape position of sites and ground cover variables.

Table 2. Multi-species taxa used in the survey in cases where there was ambiguity in their identification. The species that were positively identified in the survey are denoted with #. Other species are those not found or confirmed in the field, but which could possibly occur based on Lepschi (1993) and Eddy *et al.* (1998). Exotic species denoted by *.

Aira spp.
**A. cupaniana*
**A. elegantissima*

Austrodanthonia spp.
#A. auriculata
#A. caespitosa
#A. carphoides
#A. eriantha
#A. laevis
#A. monticola
#A. penicillata
#A. pilosa
#A. racemosa
#A. setacea

Cheilanthes spp.
#C. austrotenuifolia
C. sieberi

Cymbonotus spp.
#C. lawsonianus
C. preissianus

Dichelachne spp.
D. micrantha
#D. rara

Glycine spp.
#G. clandestina
#G. tabacina

Hordeum sp.
**H. leporinum*

Juncus subgen. *Genuini*
J. australis
J. capitatus
J. sarophorus
J. subsecundus
J. vaginatus

Lolium spp.
**L. rigidum*
*#*L. perenne*

Luzula spp.
L. flaccida
L. densiflora

Thelymitra sp.
T. pauciflora

Vulpia spp.
**V. bromoides*
**V. myuros*

Wahlenbergia spp.
#W. communis
#W. graniticola
#W. luteola
#W. multicaulis
#W. stricta

Non-metric multidimensional scaling ordination also was performed on vegetation data using the same dissimilarity matrix as that for the classification. The ordination was evaluated by fitting a generalized additive model (GAM) surface for the continuous soil and ground cover variables and superimposing the contours over the ordination.

Two data sets were analysed. The first was biomass data for all taxa that were recorded in the survey. A second analysis was performed on the frequency data for the non-grass species only. This was to determine whether the high biomass of the grasses in the all species data set were concealing possible patterns of occurrence in the forbs that might otherwise be detected.

To explore the relationship between phosphorus and plant response, we performed regression analyses of species biomass and soil P for a selection of dominant grasses: *Aristida ramosa, Bothriochloa macra, Austrodanthonia* spp.*, Elymus scaber, Joycea pallida, Microlaena stipoides, *Phalaris aquatica, Austrostipa scabra* and *Themeda australis*. We explored both linear relationships and generalized additive functions for each taxon. The package R was used to conduct the classification, ordinations and regressions (R Development Core Team 2007).

Results

Growth conditions during survey and delineation of taxa

The timing of our sampling (mid-spring to the end of spring) is generally considered an optimal time to detect the maximum number of species in grassy woodlands (Burrows 2004). However, conditions leading up to the survey were dry, with below average rainfall for most months of 2007 (Table 1). Conditions were dry at the commencement of sampling in October with annuals rapidly desiccating and for the first 2–3 weeks, plants were increasingly difficult to identify. Rain started on 26th October and good rain in November 2007 allowed plant growth to be re-initiated and permitted the data collecting to be completed (Table 1).

The dry conditions and heavily grazed state of the vegetation severely limited our ability to identify species and limited our collection of voucher specimens. Nonetheless, team members were experienced, so that even poor quality material could be identified to species, species groups or generic level. These taxonomic categories are robust and will stand up in the future even under adverse growing conditions. Regardless of conditions, treatment of groups such as *Austrodanthonia* are difficult in survey work, delineation in the field is not possible even under ideal growing conditions, and the current keys do not work well with collected material. Our final categories are listed in Appendix 1, together with average biomass, cover and environmental variables at the site scale. Multiple species categories are defined in Table 2.

Table 3. Litter depth and ground cover characteristics of 961 ha sites at Mulligans Flat (n = 48) and Goorooyarroo (n = 48) Reserves. Biomass estimates are of 30 x 0.25m^2 quadrats per ha, and ground cover estimates are from four points in each of the quadrats. Bare patches are quadrats in which ≥¾ points had a litter depth of zero. SE = standard error of mean.

	Mulligans Flat		**Goorooyarroo**	
	Mean ± SE	**Range**	**Mean ± SE**	**Range**
Live plant basal area (%)	13 ± 0.9	1.7–27	12 ± 0.8	3.3–34
Litter depth where present (mm)	14 ± 0.6	6–24	11 ± 0.6	4.0–20
Bare ground (%)	16 ± 1.2	2.5–39	10 ± 0.9	1.7–27
Cryptogam (%)	7.8 ± 1.1	0–33	4.1 ± 0.5	0–17
Fallen log (%)	1.2 ± 0.3	0–7.5	1.7 ± 0.3	0–8.3
Rock (%)	0.3 ± 0.1	0–3.3	1.4 ± 0.3	0–6.7
Litter (%)	62 ± 2.5	23–87	70 ± 1.5	42–88
Bare patches (% quadrats classed as bare)	0.3 ± 0.03	0–0.7	0.15 ± 0.01	0–0.47

Ground cover and biomass attributes

The ground cover variables for each site are given in Appendix 2 and summarized in Table 3 for each reserve. Bare ground, litter and plant basal area were the dominant types of ground cover, together totalling 92% of the surveyed ground area. Fallen logs represented 1.4% of the ground cover and this represented the total of the naturally occurring timber and added timber. Mulligans Flat had more bare ground, more cryptogam cover and more bare patches, but less litter cover than Goorooyarroo. Live basal areas were similar in both reserves. Biomass data are detailed at site level in Appendix 2 and summarized in Table 4. Average total biomass for all sites was 569 kg.ha^{-1} with the highest estimates around 2,000 kg.ha^{1}. The average sward structure represents that of a grazing lawn (Fig. 1f) and in some parts of the reserve, biomass levels were exceptionally low (Fig. 1e) with the average slightly lower in Goorooyarroo.

Soil characteristics

Quantitative data characterizing each site are given in Appendix 2 and median values in Table 5. Note the following descriptions relate only to the 0–10 cm profile depth averaged over each of the 96 × 1 ha sites.

Soil colour was relatively uniform, falling into two broad groups "greyish brown / brownish grey" and "yellowish greyish brown". Their texture was predominantly sandy clay loams (81 sites) with four light-clay sites (indicating possible removal of upper horizons), and 11 sites that were silty clay or silty clay loams indicating possible deposition from higher parts of the landscape. In terms of acidity, their pH ($CaCl_2$ values) ranged from 4 to 5.2, with a median of 4.5, reflecting the natural acidity of the soil and its general limitations for intensive agriculture (Jenkins 2000). Nearly half of the sites had a pH of <4.5, a level which can be associated with aluminium toxicity (Jenkins 2000). These low values are possibly linked with prior pasture improvement in some parts of the reserves, but a clear relationship is not evident, as many sites low in P also had acid soils. Low pH also may be linked to poor litter cycling. However, the below-median pH sites were not associated with lower total carbon or high C:N ratios. This points to the occurrence of naturally extremely acid soils.

The median value of electrical conductivity was 0.05 dS.m^{-1}, with a maximum value of 0.1 indicating that soluble salts occurred at low levels at all sites. Available phosphorus values ranged from <4 to 23 mg.kg^{-1} with a median of 7 mg.kg^{-1}. Only three sites had P values over 15. Median total nitrogen was 0.14% and median nitrate was 1.0 mg.kg^{-1}. Nitrate values tended to be higher when P values were high. Total carbon median value was 2.6% and the range was 1.5–4.7%. The median carbon: nitrogen ratio was 19, with only 18 sites having values of 15–16.

Summary of ground layer vegetation

The most abundant species in terms of biomass was *Joycea pallida* followed by *Austrodanthonia* spp., *Themeda australis, Aristida ramosa, *Phalaris aquatica* and *Lomandra filiformis* (Table 6, Appendix 1). The reserves were similar in that these six were highly ranked in each, though in different order. There was considerably more *Joycea* and *Themeda* in Mulligans Flat than Goorooyarroo and the latter reserve was notable for its higher levels of **Phalaris* within the sites. There was more evenness among the dominants in Goorooyarroo, with nine species averaging over 20 kg.ha^{-1} compared with four in Mulligans Flat. There was also a greater abundance of shrubs (<0.5 m) in Mulligans Flat (*Melichrus, Lissanthe* and *Daviesia*).

Table 4. Mean, median and range of total biomass estimates (kg.ha^{-1}) for 961 ha sites and in the two reserves. Estimates were made in Spring 2007.

	Mean (±SE)	Median	Range	No. sites >1,000 kg.ha^{-1}	No. sites >2,000 kg.ha^{-1}
Mulligans Flat (n = 48)	**592±76**	**381**	**204 – 2,352**	**7**	**3**
Goorooyarroo (n = 48)	**546±45**	**430**	**289 – 1,833**	**3**	**0**
All sites (n = 96)	**569±44**	**421**	**204 – 2,352**	**10**	**3**

Table 5. Median and range of soil properties for the 96 sites. Soil samples were from 30 cores (0–10 cm) combined to characterize each 1 ha site.

	Nitrate-N (mg.kg^{-1})	Total carbon (%)	Total nitrogen (%)	C:N ratio	Electrical conductivity (dS.m^{-1})	pH ($CaCl_2$)	Available phosphorus (mg.kg^{-1})
Median	1.0	2.6	0.14	19.0	0.05	4.5	7
Max.	11	4.7	0.3	31.5	0.11	5.2	23
Min.	<0.25	1.5	0.07	14.8	<0.05	4	<4

Trees and shrubs

While the scale of sampling was not designed for trees and shrubs, we did count eucalypt suckers and seedlings less than 0.5 m high in the quadrats, recording an average density of 875 per ha of which 94% were *Eucalyptus blakelyi*, 3% were *Eucalyptus macrorhyncha*, 1.6% *Eucalyptus mannifera* and 1.6% *Eucalyptus melliodora*. Given that *Eucalyptus melliodora* was the co-dominant adult tree alongside *Eucalyptus blakelyi* (data not presented), these results indicate the prolific regeneration of *Eucalyptus blakelyi*.

Shrubs >0.5 m high were also counted but only three species were recorded: *Acacia dealbata* (222 ha^{-1}), *Acacia parramattensis* (97 ha^{-1}), and *Daviesia mimosoides* (28 ha^{-1}). The two *Acacia* species were also recorded as plants <0.5 m high among the dominants in the biomass assessments, but at extremely low frequencies occurring in only three quadrats (of a total of 2,880 quadrats), suggesting a very low density of recruitment.

Additional species of shrub were recorded in the quadrats as less than 0.5m high, and these were sub-shrubs that are generally of low stature, most commonly *Melichrus urceolatus, Daviesia genistifolia* and *Lissanthe strigosa*. Other shrubs recorded in Mulligans Flat but which did not fall into the quadrat samples included: *Acacia implexa*, *Acacia mearnsii*, *Acacia decurrens*, *Cassinia* spp, *Daviesia leptophylla*, *Exocarpos cupressiformis* and *Indigofera australis* and are locally uncommon to rare in the reserves (Lepschi 1993).

Patterns in the ground layer vegetation

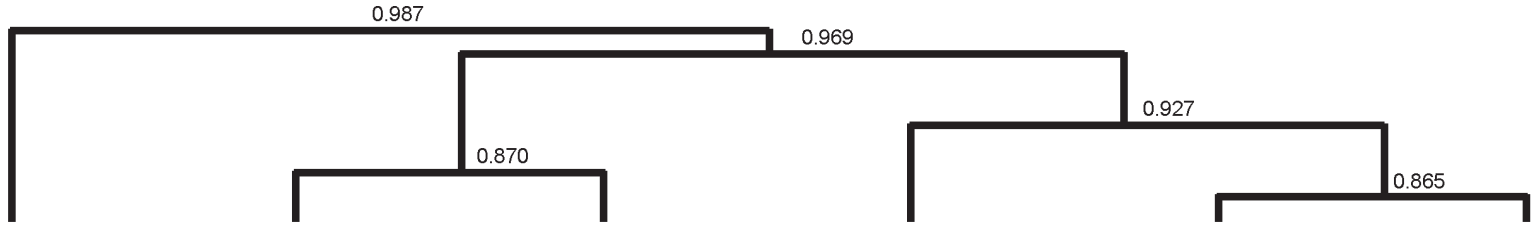
The classification of the 96 sites, based on the biomass of all plant taxa recorded, produced six groups that met our subjective criteria and which were ecologically interpretable. These are described floristically in Table 7 and summarized in terms of physical characteristics in Fig. 3. Group 2 (named *Austrodanthonia* – lawn) comprised nearly half the sites, and appears to represent the typical ground layer vegetation in not being distinctively different from the 'average' floristic composition (Table 6) apart from a paucity of *Joycea*. This group was found in all landscape positions, and had soil attributes that were generally intermediate in value, but tending towards low biomass and available phosphorus.

The next largest group was typified as *Themeda* lawn (Group 4), low biomass areas dominated by *Themeda* with moderate phosphorus levels, relatively elevated pH, low nitrates and a low carbon nitrogen ratio. Two other *Austrodanthonia*-dominated groups appeared to have had a history of pasture development, occurring on lower and mid-slopes, with elevated phosphorus and nitrate levels: Group 1 (**Phalaris* co-dominance, Fig. 1d) was associated with the highest P

Table 6. Average biomass ($kg.ha^{-1}$) for 20 most abundant taxa recorded in all 1 ha sites and in the two reserves.

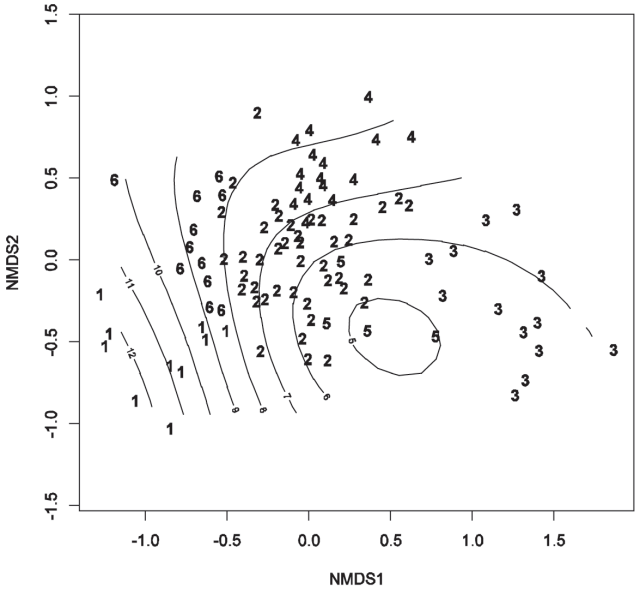
All sites		**Goorooyarroo**		**Mulligan's Flat**	
Joycea pallida	**143**	*Austrodanthonia* spp.	**125**	*Joycea pallida*	**240**
Austrodanthonia spp.	**111**	*Joycea pallida*	**45**	*Austrodanthonia* spp.	**97**
Themeda australis	**50.6**	*Aristida ramosa*	**41.7**	*Themeda australis*	**62.6**
Aristida ramosa	**35.1**	*Themeda australis*	**38.5**	*Aristida ramosa*	**28.5**
**Phalaris aquatica*	**23.8**	**Phalaris aquatica*	**36.5**	*Lomandra filiformis*	**18.1**
Lomandra filiformis	**19.9**	*Austrostipa densiflora*	**34.1**	*Melichrus urceolatus*	**13.7**
Bothriochloa macra	**17.4**	*Bothriochloa macra*	**27.7**	**Phalaris aquatica*	**11.2**
Austrostipa densiflora	**17.2**	*Austrostipa scabra*	**23.8**	*Lissanthe strigosa*	**10.1**
Austrostipa scabra	**14.4**	*Lomandra filiformis*	**21.7**	*Bothriochloa macra*	**7.1**
**Trifolium subterraneum*	**10.5**	**Lolium* spp.	**18.2**	*Microlaena stipoides*	**6.5**
Elymus scaber	**10.3**	**Trifolium subterraneum*	**16.6**	*Daviesia genistifolia*	**6.3**
**Lolium* spp.	**10.2**	*Elymus scaber*	**15.7**	*Austrostipa scabra*	**5.1**
Melichrus urceolatus	**9.2**	*Austrostipa bigeniculata*	**13.4**	*Elymus scaber*	**4.9**
Microlaena stipoides	**7.0**	*Microlaena stipoides*	**7.5**	*Poa sieberiana*	**4.7**
Lissanthe strigosa	**6.9**	**Arctotheca calendula*	**6.3**	**Trifolium subterraneum*	**4.3**
Austrostipa bigeniculata	**6.7**	*Melichrus urceolatus*	**4.7**	*Juncus* subgen. *Genuini*	**4.0**
Poa sieberiana	**4.4**	*Poa sieberiana*	**4.2**	*Gonocarpus tetragynus*	**3.6**
**Arctotheca calendula*	**3.5**	*Lissanthe strigosa*	**3.7**	*Vittadinia muelleri*	**3.3**
Daviesia genistifolia	**3.1**	**Bromus hordeaceus*	**3.4**	*Hydrocotyle laxiflora*	**2.9**
Juncus subgen. *Genuini*	**2.9**	**Poa bulbosa*	**2.8**	*Solenogyne dominii*	**2.6**

Fig 3. Dendrogram showing the relationship between the six floristic groups which are characterized by landscape position, average total biomass (with standard error), ground cover, soil properties (medians in brackets) and proportional representation of sites in Mulligans Flat (MF) and Goorooyarroo (Gooroo) Reserves. Floristic features of the groups are described in Table 7. Dissimilarity values for the top five fusions in the dendrogram are given at the points of fusion.

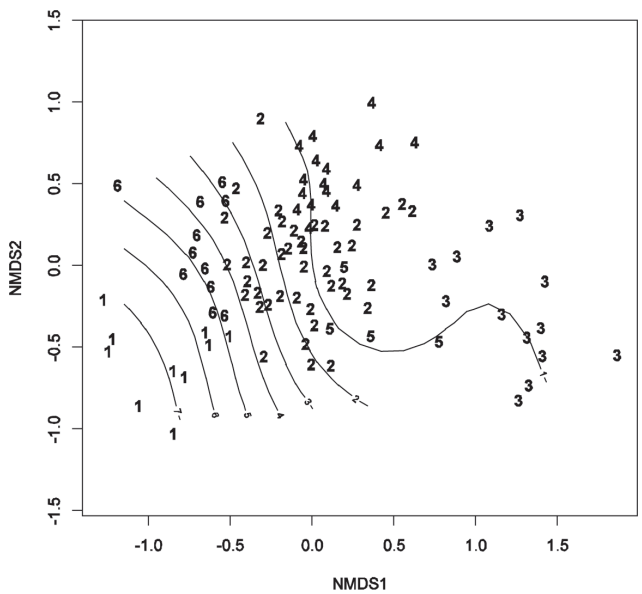


***Joycea* – large tussocks**	***Austrodanthonia* - fertilized**	****Phalaris* - fertilized**	***Themeda* - lawn**	***Joycea* - shrubby**	***Austrodanthonia* - lawn**
Group 3 (13 sites)	Group 6 (11 sites)	Group 1 (10 sites)	Group 4 (16 sites)	Group 5 (4 sites)	Group 2 (42 sites)
All on slopes (no flats)	Lower- to mid-slopes	Lower-slopes	All on slopes (no flats)	Lower-slopes	All landscape positions
V. high biomass (1346 ± 176 kg.ha^{-1})	Low biomass (351 ± 16)	High biomass (817 ± 144)	Low biomass (352 ± 33)	Average biomass (521 ± 52)	Low biomass (413 ± 23)
High basal areas, thick litter	High basal areas, thin litter, low bare ground	High basal areas, thick litter, low bare ground	Low basal areas	High cryptogam cover, thick litter	Average values
Phosphorus low (6 mg.kg^{-1})	P moderate (7)	P high (12)	P moderate (8)	P moderate (7)	P low (5)
Nitrate low (0.5 mg.kg^{-1})	Nitrate high (5.2)	Nitrate highest (7.9)	Nitrate low (0.55)	Nitrate low (0.58)	Nitrate mod. low (0.8)
pH very low (4.1)	pH moderate (4.5)	pH mod. low (4.35)	pH high (4.6)	pH moderate (4.45)	pH moderate (4.5)
C:N ratio high (23)	C:N ratio low (17)	C:N ratio low (17)	C:N ratio low (17)	C:N ratio high (23)	C:N ratio moderate (19)
77% in MF; 23% in Gooroo	100% in Gooroo	10% MF; 90% Gooroo	75% MF; 25% Gooroo	100% MF	50% MF; 50% Gooroo

a) Soil available phosphorus



b) Soil nitrate



c) pH

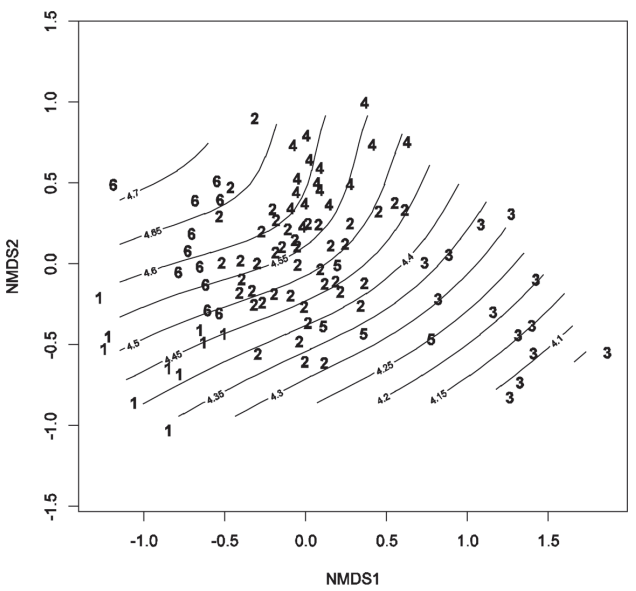


Fig. 4. Non-metric multidimensional scaling ordination of the 96 sites based on biomass estimates for all species with contour lines showing the GAM fitted surface for a) soil available phosphorus (mg.kg^{-1}) b) nitrate (mg.kg^{-1}) and c) soil pH. The large bold numbers indicated the position of sites in the ordination space and the group affinity of the sites at the six group level (see Figure 3).

levels and more acidic soil, while Group 6 had lower levels of P and higher pH and was co-dominated by **Trifolium subterraneum*. The most distinctive group was *Joycea*-dominated slopes (Group 3, Fig. 1c), characterized by the most acidic soils, the highest biomass, the highest carbon nitrogen ratio and low phosphorus and nitrate levels. One small group (Group 5, comprising 4 sites) was also dominated by *Joycea* and had a high shrub component (*Daviesia* most abundant), but only average total biomass and more moderate soil properties. The significance of this group is unknown.

The generalized surfaces fitted to the NMDS axes 1 and 2 scores are shown in Fig. 4 for soil available phosphorus, soil nitrate and pH. The surfaces for soil phosphorus and soil nitrate were complex with strong gradients in both nutrients along the first axis but with interactions with the second axis. The relationship between pH and the first two axes scores is less complex, broadly showing the majority of the sites in Groups 3 have the lowest pH values and groups 1, 6 and 4 tending to occur in areas with intermediate to high pH values.

The classification of the sites based on the frequency data of non-grass (forb) taxa did not produce groups that were an improvement on the 'all-species' biomass data. However, the ordination with a generalized additive model surface fitted for nitrates revealed a strong relationship between the ordination of the forb frequency data and soil nitrates. We have represented this relationship in terms of proportion of exotic species represented in the forb biomass (Figure 5), as there is a strong positive relationship between nitrates and exotics, most of which are annual species.

Soil phosphorus and abundance of dominant grasses

Based on linear regression analysis four of the nine grasses showed a significant relationship to available soil phosphorus (P) levels (Table 8). *Elymus scaber*, **Phalaris aquatica* and *Austrostipa scabra* show a positive relationship; as phosphorus levels increased so did the biomass. *Aristida ramosa* showed a negative relationship to phosphorus.

Table 7. The identity and mean biomass (kg.ha^{-1}) of the fifteen most abundant species per site for the six groups identified from a classification of 96 x 1 ha sites in Mulligans Flat and Goorooyarroo nature Reserves. Classification was based on the average biomass per site of all plant taxon groups that were ranked 1–6 in 30 quadrats. Note Group 3 is the most distinct group in the dendrogram (Fig. 3), groups 1 and 6 are closely-related, groups 2 and 5 are closely-related. Group 4 is more closely-related to the combined groups 2 and 5 than to the other groups.

***Phalaris* – fertilized**		***Austrodanthonia* – lawn**		***Joycea* – large tussocks**		***Themeda* – lawn**		***Joycea* – shrubby**		***Austrodanthonia* – fertilized**	
Group 1 (10 sites)		**Group 2 (42 sites)**		**Group 3 (13 sites)**		**Group 4 (16 sites)**		**Group 5 (4 sites)**		**Group 6 (11 sites)**	
Austrodanthonia spp.	**259**	*Austrodanthonia* spp.	**122**	*Joycea pallida*	**986**	*Themeda australis*	**142**	*Joycea pallida*	**145**	*Austrodanthonia* spp.	**79**
**Phalaris aquatica*	**195**	*Aristida ramosa*	**53**	*Aristida ramosa*	**72**	*Austrodanthonia* spp.	**62**	*Austrodanthonia* spp.	**119**	**Trifolium subterraneum*	**52**
Austrostipa scabra	**75**	*Themeda australis*	**36**	*Themeda australis*	**64**	*Lomandra filiformis*	**19**	*Daviesia genistifolia*	**62**	*Bothriochloa macra*	**29**
**Lolium* spp.	**60**	*Austrostipa densiflora*	**30**	*Austrodanthonia* spp.	**48**	*Bothriochloa macra*	**12**	*Melichrus urceolatus*	**35**	**Phalaris aquatica*	**22**
Elymus scaber	**49**	*Bothriochloa macra*	**25**	*Melichrus urceolatus*	**45**	*Austrostipa scabra*	**9.5**	*Themeda australis*	**31**	*Lolium* spp.	**20**
Austrostipa bigeniculata	**46**	*Lomandra filiformis*	**21**	*Lomandra filiformis*	**37**	*Poa sieberiana*	**7.4**	*Lomandra filiformis*	**18**	*Elymus scaber*	**17**
Microlaena stipoides	**20**	*Lissanthe strigosa*	**13**	*Austrostipa densiflora*	**8**	*Aristida ramosa*	**6.9**	*Aristida ramosa*	**14**	*Austrostipa densiflora*	**13**
**Arctotheca calendula*	**14**	*Austrostipa scabra*	**8.7**	*Brachyloma daphnoides*	**6.5**	*Lissanthe strigosa*	**5.8**	*Bothriochloa macra*	**12**	*Lomandra filiformis*	**11**
**Trifolium subterraneum*	**14**	*Joycea pallida*	**6.0**	*Poa sieberiana*	**6.2**	*Microlaena stipoides*	**5.6**	*Vittadinia muelleri*	**7.8**	**Arctotheca calendula*	**10**
Austrostipa densiflora	**12**	*Microlaena stipoides*	**5.7**	*Gonocarpus tetragynus*	**5.5**	*Leptorhynchos squamatus*	**5.5**	**Trifolium subterraneum*	**5.7**	*Themeda australis*	**9.3**
**Bromus diandrus*	**8.6**	**Trifolium subterraneum*	**5.2**	*Goodenia hederacea*	**3.6**	*Enneapogon nigricans*	**5.4**	**Trifolium dubium*	**4.8**	*Panicum effusum*	**8.8**
Einadia nutans	**7.8**	*Poa sieberiana*	**5.0**	*Dillwynia sericea*	**3.5**	*Juncus* subgen. *Genuini*	**5.4**	*Panicum effusum*	**4.7**	*Austrostipa scabra*	**8.6**
**Hordeum* ∞_	**5.6**	*Elymus scaber*	**4.8**	**Hypochaeris radicata*	**3.1**	*Elymus scaber*	**5.2**	*Gonocarpus tetragynus*	**4.6**	*Microlaena stipoides*	**8.6**
Bothriochloa macra	**5.4**	*Melichrus urceolatus*	**3.3**	**Trifolium striatum*	**2.8**	*Joycea pallida*	**4.4**	*Lissanthe strigosa*	**3.8**	**Bromus hordeaceus*	**8.3**
**Bromus hordeaceus*	**4.8**	*Tricoryne elatior*	**3.1**	*Microlaena stipoides*	**2.5**	*Vittadinia muelleri*	**4.2**	*Poa sieberiana*	**3.5**	*Austrostipa bigeniculata*	**7.6**

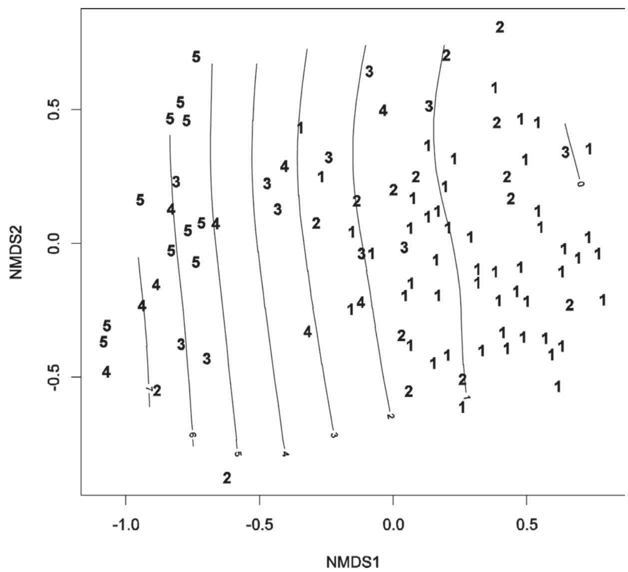


Fig. 5. Non-metric multidimensional scaling ordination of the frequency of non-grass species with contour lines showing the GAM fitted surface for soil nitrates (mg.kg^{-1}). Sites are coded by the proportion of biomass that is exotic. 1 = 0 – 20%; 2 = 20 – 40%; 3 = 40 – 60%; 4 = 60 – 80%; 5 = 80 – 100%.

Microlaena stipoides showed a weaker but positive relationship between phosphorus and biomass.

From diagnostic plots of the linear regressions it was clear that the relationships between species biomass and soil phosphorus levels were more complex than simple straight line relationships. These were explored using generalized additive models. GAMs were fitted using penalized regression splines with smoothing parameters selected by generalized cross validation (Cook 2006). Using this approach the same four species as noted in Table 8 showed significant relationships. An additional species, *Microlaena stipoides*, now exhibited a complex relationship between soil phosphorus and biomass. The generalized additive model for *Microlaena stipoides* was complex with local maxima and minima along the phosphorus gradient suggesting that there was a range of other factors influencing this species.

Aristida ramosa had a significant negative relationship with P, with an average biomass of 65 kg.ha^{-1} at low P (0–6 mg.kg^{-1}) compared with 12 kg.ha^{-1} at higher P (7–23 mg.kg^{-1}). While *Joycea pallida* had a non-significant relationship, it too is generally considered to be a P sensitive species (McIntyre 2008; Fig. 4a), and had biomass values of 230 (0–6 mg.kg^{-1}) and 76 (7–23 mg.kg^{-1}). *Bothriochloa macra* occurs over the range of P levels, but had a slight (non-significant) decline as P increased. *Elymus scaber* had a significant but weak increase with increasing P, but was most abundant between 8–13 mg.kg^{-1}. In a similar way, *Themeda australis* whilst having a non-significant linear relationship with P, was most abundant in the 5–10 mg.kg^{-1} range. *Microlaena stipoides*

Table 8. Linear regression coefficients, standard error and F ratio statistics for regressions relating species biomass (kg. ha^{-1}) and available soil phosphorus (mg.kg^{-1}) with significant relationships highlighted in bold.

Species	Intercept	Slope	s.e.	F ratio	P
Aristida ramosa	88	-7.3	1.4	25	<0.001
Bothriochloa macra	21	-0.5	0.82	0.38	0.54
Austrodanthonia spp.	97	2.0	3.3	0.36	0.55
Elymus scaber	-3.1	1.8	0.68	7.2	0.009
Joycea pallida	269	-17	12	2.0	0.16
Microlaena stipoides	2.6	0.59	0.35	2.9	0.092
**Phalaris aquatica*	-60	11	2.4	23	<0.001
Austrostipa scabra	-14	3.9	0.74	28	<0.001
Themeda australis	46	0.65	2.17	0.089	0.77

had some positive relationship with P, but occurred across the range of values. **Phalaris* had a strong and significant positive relationship, as would be expected of an introduced pasture grass, but it was too infrequent to enable its response to be characterized. The group of pooled *Austrodanthonia* species did not exhibit significant or interpretable response to P, but this is unsurprising considering the group is comprised of at least ten species (Table 2).

Discussion

Patterns in groundlayer vegetation

The site locations for the experiment aimed to capture box-gum woodland on the better soils, so that our description cannot claim to be characteristic of the entire landscape, as the stony ridge tops dominated by *Eucalyptus mannifera* and *Eucalyptus rossii* were excluded, although these two eucalypts were recorded in low numbers in the sites. Nonetheless, a range of slope positions was still represented in the sites, but there was only weak evidence of changes in the ground layer vegetation linked to this (*Themeda* and *Joycea* were less dominant on the flats). Phosphorus, nitrates and pH appeared to more strongly characterize the differences between floristic groups, both delineating the weed dominated vegetation (see below) and the native dominated groups. *Joycea* dominance was associated with the most acidic soil, *Themeda* dominated where phosphorus and pH was slightly higher and *Austrodanthonia* was dominant at sites intermediate in pH, low in P and slightly higher in nitrates. We found forb composition to be particularly sensitive to nitrates.

Sub-shrubs (<0.5 m) had a significant presence in few sites and even in these, their biomass was not particularly high (Group 5, Table 7). The three most abundant taller shrubs (*Acacia dealbata*, *Acacia parramattensis*, and *Daviesia mimosoides*) do not have strong presence in the study area overall, and collectively, their regeneration was sparse (300–400 plants per ha , <0.5 m tall). Based on observations on other parts of the district, we would predict that with reduced grazing pressure, an increase in all shrubs would be expected.

Evidence of past disturbances

The soil attributes of the reserves are consistent with native soils that are naturally acid, and low in phosphorus and nitrogen (Prober et al. 2002a) although there is some evidence of past disturbances in the form of pasture development. There are areas with elevated phosphorus and nitrates, and the floristics of these was consistent with a history of past fertilization and sowing of exotic species. **Phalaris* was associated with the highest levels of available phosphorus (Group 1, Fig. 3, Table 6) and as this species does not generally establish or persist on highly acid, infertile soils (Keys 1996) its dominance is taken as an indication of locations of previous pasture development rather than being viewed as an active invader. Another set of sites dominated by *Austrodanthonia* and **Trifolium subterraneum* (Group 6, Fig. 3, Table 6) is also likely to have had a history of fertilization, with elevated levels of P and high levels of nitrate. The presence of annuals such as **Trifolium subterraneum* is considered to be a barrier to native perennial restoration as annual patterns of release and recapture of nitrates creates a positive feedback loop that encourages continuing dominance of annual plants (Prober et al. 2002b). There were 19 sites (20% of the total) with available P levels of 10 mg.kg^{-1} or more and which are likely to have been fertilized in the past. A more extensive area may have been fertilized but has now recovered levels close to those of native soils. Available phosphorus tends to become unavailable over time due to immobilization in the soil. Given the linear positive relationship between **Phalaris* and P, we predict that over time, this grass will decline in the reserves. Other exotics such as **Trifolium* spp. and the annual grasses are predicted to persist as annual nitrate release is more likely to be ongoing.

The effects of past livestock grazing are confounded with the current impacts of macropod grazing, but the current levels of ground cover are moderately high (at least compared to commercial pasture management standards) with about 13% bare ground, and cover consisting primarily of litter, plant basal area and cryptogams. Over 30% bare ground is considered to leave grassland vulnerable to soil erosion (McIvor 2002), so in terms of cover, we consider the soil to be generally stable. We did not measure sorbtivity or infiltration, and visual observation would suggest there are significant areas of low infiltration in parts of the landscape, with the possible suggestion that this has been the result of livestock trampling and grazing, and subsequent erosion in

the past. The difficulty with such measures, is that we do not have reference conditions for whole landscapes of this type, and that the inherently poor soils may have originally had areas of low infiltration in the past, with a mosaic of run-off and run-on areas. A possible scenario is that past livestock grazing has coarsened the spatial scale of any natural patchiness in the landscape and it could be hypothesized that these will become more fine-scale with ongoing relief from heavy grazing pressure.

Total carbon values were comparable to those of reference woodland in sites under trees (Prober et al. 2002a). These values tend to be slightly lower in open areas (Prober et al. 2002a), although this patterning is not evident in our study as open and canopy areas were not differentiated at the quadrat level. The carbon: nitrogen ratios for Goorooyarroo and Mulligans Flat were high (median 19) even compared to below canopy values in reference woodlands (16 under trees, 15 in the open). Certainly the accumulation of woody debris and leaf litter is very evident under the larger trees in the reserves, and the accumulation of carbon and litter would be expected over the life of a eucalypt. The question is whether these higher ratios are an indication of abnormally low rates of litter recycling due to past erosion events removing topsoil. If this were the case, we would predict slight reductions in the C:N ratio in coming years, assuming the potential impacts of heavy grazing are controlled.

Sward structure and current grazing pressure

An intended outcome for these reserves is to restore ecosystem structure and function sufficiently to enable a range of fauna to re-colonize, either naturally or with assistance. Two methods planned to achieve this is active addition (and natural accumulation) of fallen timber (coarse woody debris) and the control of total grazing pressure. Managed fire is also being considered both as a fuel reduction tool and potential conservation tool, although its role in this ecosystem is not well understood.

Kangaroo densities in the ACT generally are extremely high and have been recorded at 233 km^{-2} in ACT reserves, the highest densities in south-eastern Australia (Kangaroo Advisory Committee 1996). Kangaroo density in Goorooyarroo was estimated at approximately 195 km^{-2} (summer 2007, Howland 2009) and 142 km^{-2} in Mulligans Flat (winter 2008, B. Howland *unpublished data*). Our biomass estimates, which are an indicator of grazing pressure, are consistent with these high kangaroo densities. The overall average biomass that we measured (570 $kg.ha^{-1}$) would represent a short lawn if dominated by *Themeda* (Fig. 1f) and can be much shorter over large areas (Fig. 1e). There were high biomass sites in the reserves, but these were associated with the dominance of *Joycea*, an extremely coarse, unpalatable large tussock grass (Fig. 1c), and its presence does not necessarily indicate areas of lower grazing pressure.

McIntyre & Tongway (2005) determined that grazing lawns are well below optimal condition from the point of view of soil health (nutrient cycling, infiltration). In sub-tropical grassy woodlands, 750 $kg.ha^{-1}$ would be needed to protect pastures from spring storms (Partridge 1993), and this is higher than the average biomass in our study. The presence of cryptogams and litter plays a significant role in stabilizing the soil surface (Tongway & Hindley 1995). While the presence of kangaroos instead of livestock would have encouraged the development of these protective cryptogam and litter layers, extremely high numbers of kangaroos can still damage them, and this can be observed elsewhere in the ACT.

A lawn sward structure is also sub-optimal from the perspective of fauna habitat (McIntyre 2005) and a variety of structures and ground cover types is considered to be better for faunal persistence. Fortunately, the *Joycea* tussocks avoided by grazers can provide some protection for fauna in the reserves in the face of high grazing. We do not know whether this can substitute entirely for the loss of tussock structure cause by the grazing of other large tussock species (e.g. *Aristida*, *Themeda*, *Poa*). Clearly reduction of kangaroo densities will be an important treatment for the experiment, and an ongoing issue for the reserves overall.

Limitations and strengths of the survey

Our floristic description of the vegetation was necessarily restricted, owing to the seasonal conditions which were initially dry, and to the short duration of our observations (six weeks). The latter feature was necessary to provide a comparable snapshot of biomass across the treatments. The result has been that we have not adequately detected early season geophytes such as orchids and lilies which are sensitive to seasonal conditions and become difficult to detect by late spring. Similarly, we have probably underestimated the biomass of some late season, C_4 grasses such as *Bothriochloa*, *Chloris, Panicum* and *Eragrostis*. We sampled few species that had not been recorded by Lepschi (1993) who searched monthly throughout the year. Our sampling protocol also has restricted our ability to compare species richness with other studies, owing to the use of only the top six ranked species per quadrat. However, site-scale comparisons of richness will be possible with subsequent surveys using the same methods.

While previous surveys of grassland conducted by the first author elsewhere have been more taxonomically explicit, and covered larger areas, they have also spanned more than one season and up to five months in a season, and have not estimated biomass (McIntyre et al. 1993; 2002). In all three surveys, there has been a need to use multiple species groups, as so many taxa require good flowering and/or seeding material for identification and this needs to be available in, or very near, a quadrat. Even with adequate material, identification of some groups requires collection, microscopic examination and consultation with specialists (e.g. *Austrodanthonia*, *Wahlenbergia*, **Hordeum*, *Eragrostis*, *Aristida*). Beyond this,

it may still not be possible to identify all material owing to difficulties with regional variation within and intergrading of characters. Particularly problematic is *Austrodanthonia*, as they are so abundant and vary greatly in their ecological responses (Scott & Whalley 1982). There appears no easy solution to these problems which can only be addressed with rigorous collecting and a long-developed familiarity with field characters of local plant assemblages.

Conclusions

Although there have been limitations imposed on this study, we have established a relatively robust and repeatable methodology, that has struck a reasonable balance of floristic and physical attributes. The resulting baseline data set provides a strong foundation for monitoring of ecological and broad floristic changes in the reserves over the medium to long-term. Floristic patterns and soil properties indicate areas of previous pasture improvement and some patterns of native grass dominance that are linked primarily to variation in pH and phosphorus. Our results are consistent with a conclusion that the reserves are being subjected to extremely high grazing pressures throughout, sufficient to affect soil processes and the value of the grassy sward structure as habitat. Continued high levels of grazing may inhibit soil, water and nutrient processes essential for restoration of well-functioning grassy woodlands. In the absence of reference conditions, it is not possible to understand, in detail, the soil and vegetation properties that management should be aiming to restore, and a search for reference sites on comparable soils is needed. Other important information that has not been provided in this study, and which could be considered for subsequent studies include: i) direct assessments of soil function such as stability, infiltration and nutrient cycling (Tongway & Hindley 1995); ii) detailed studies of *Austrodanthonia* occurrence and ecology and; iii) surveys and grazing response studies of winter-growing and early spring-flowering species such as geophytes and orchids.

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Appendix 1.

Summary of plant data in 96 × 1 ha sites, giving frequency (n = 96) and average biomass (n = 96) of all plant taxa recorded in the survey a) native species; b) exotic species ranked alphabetically.

a) Native plant species	Family	Frequency (% of plots)	Average biomass (kg ha^{-1})
Acacia dealbata	**FAB**	**2**	**0.14**
Acacia gunnii	**FAB**	**2**	**0.02**
Acacia parramattensis	**FAB**	**1**	**0.06**
Acaena ovina	**ROS**	**51**	**2.1**
Alternanthera sp. A	**POLYGON**	**13**	**0.02**
Aristida ramosa	**PO**	**70**	**35.1**
Arthropodium minus	**ANTHERIC**	**21**	**0.12**
Asperula conferta	**RUBI**	**23**	**0.42**
Astroloma humifusum	**EPACRID**	**2**	**0.17**
Austrodanthonia spp.	**PO**	**100**	**111**
Austrostipa bigeniculata	**PO**	**14**	**6.7**
Austrostipa densiflora	**PO**	**27**	**17.2**
Austrostipa scabra	**PO**	**69**	**14.4**
Bossiaea buxifolia	**FAB**	**7**	**0.23**
Bossiaea prostrata	**FAB**	**13**	**0.17**
Bothriochloa macra	**PO**	**68**	**17.4**
Brachyloma daphnoides	**FAB**	**1**	**0.89**
Bulbine bulbosa	**ASPHODEL**	**9**	**0.18**
Carex inversa	**CYPER**	**37**	**0.54**
Chamaesyce drummondii	**EUPHORBI**	**17**	**0.14**
Cheilanthes spp.	**SINOPTERID**	**35**	**0.38**
Chloris truncata	**PO**	**30**	**1.2**
Chrysocephalum apiculatum	**ASTER**	**6**	**0.59**
Chrysocephalum semipapposum	**ASTER**	**2**	**0.02**
Convolvulus angustissimus	**CONVOLUL**	**18**	**0.28**
Cotula australis	**ASTER**	**7**	**0.01**
Craspedia variabilis	**ASTER**	**13**	**0.25**
Crassula sieberiana	**CRASSUL**	**38**	**0.22**
Cymbonotus spp.	**ASTER**	**11**	**0.11**
Cynodon dactylon	**PO**	**2**	**0.002**
Cynoglossum suaveolens	**BORAGIN**	**4**	**0.03**
Daucus glochidiatus	**API**	**44**	**0.20**
Daviesia genistifolia	**FAB**	**10**	**3.1**
Desmodium varians	**FAB**	**43**	**0.50**
Dianella revoluta	**PHORMI**	**1**	**0.09**
Dichelachne spp.	**PO**	**3**	**0.03**
Dichopogon fimbriatus	**ANTHERIC**	**9**	**0.15**
Dillwynia sericea	**FAB**	**10**	**1.0**
Diuris sulphurea	**ORCHID**	**2**	**0.12**
Drosera peltata	**DROSER**	**2**	**0.01**
Einadia nutans	**CHENOPODI**	**13**	**1.5**
Eleocharis acuta	**CYPER**	**2**	**0.05**
Elymus scaber	**PO**	**95**	**10.3**
Enneapogon nigricans	**PO**	**16**	**1.1**
Eragrostis brownii	**PO**	**11**	**0.07**
Erodium crinitum	**GERANI**	**2**	**0.01**
Eryngium rostratum	**API**	**1**	**0.02**

Euchiton gymnocephalus	**ASTER**	**5**	**0.01**
Euchiton sphaericus	**ASTER**	**6**	**0.01**
Galium gaudichaudii	**RUBI**	**1**	**0.01**
Geranium solanderi	**GERANI**	**34**	**0.30**
Glycine spp.	**FAB**	**19**	**0.22**
Gonocarpus tetragynus	**HALORAG**	**73**	**2.4**
Goodenia hederacea	**GOODENI**	**45**	**0.88**
Goodenia pinnatifida	**GOODENI**	**7**	**0.11**
Haloragis heterophylla	**RUBI**	**45**	**0.72**
Hibbertia obtusifolia	**DILLENI**	**8**	**0.45**
Hovea heterophylla	**FAB**	**3**	**0.07**
Hydrocotyle laxiflora	**API**	**65**	**1.9**
Hypericum gramineum	**CLUSI**	**48**	**0.55**
Isoetopsis graminifolia	**ASTER**	**1**	**0.0004**
Joycea pallida	**PO**	**34**	**143**
Juncus subgen. *Genuini*	**JUNC**	**67**	**2.9**
Leptorhynchos squamatus	**ASTER**	**45**	**2.1**
Lissanthe strigosa	**EPACRID**	**11**	**6.9**
Lomandra filiformis	**LOMANDR**	**85**	**19.9**
Lomandra multiflora	**LOMANDR**	**13**	**0.63**
Luzula spp.	**JUNC**	**19**	**0.06**
Lythrum hyssopifolia	**LYTHR**	**4**	**0.02**
Melichrus urceolatus	**EPACRID**	**22**	**9.2**
Mentha diemenica	**LAMI**	**5**	**0.03**
Microlaena stipoides	**PO**	**65**	**7.0**
Microseris lanceolata	**ASTER**	**3**	**0.004**
Opercularia hispida	**RUBI**	**1**	**0.01**
Oxalis perennans	**OXALID**	**69**	**0.42**
Panicum effusum	**PO**	**52**	**2.5**
Pimelea curviflora	**THYMELAE**	**5**	**0.11**
Pimelea linifolia	**THYMELAE**	**1**	**0.01**
Plantago gaudichaudii	**PLANTAGIN**	**2**	**0.01**
Plantago varia	**PLANTAGIN**	**9**	**0.59**
Poa sieberiana	**PO**	**45**	**4.4**
Pultenaea procumbens	**FAB**	**1**	**0.07**
Ranunculus sessiliflorus	**RANUNCUL**	**5**	**0.14**
Rumex brownii	**POLYGON**	**26**	**0.31**
Schoenus apogon	**CYPER**	**8**	**0.13**
Scleranthus biflorus	**CAROPHYLL**	**3**	**0.01**
Senecio hispidulus	**ASTER**	**2**	**0.08**
Senecio quadridentatus	**ASTER**	**1**	**0.09**
Solenogyne dominii	**ASTER**	**75**	**1.8**
Stackhousia monogyna	**STACKHOUSI**	**4**	**0.11**
Stuartina muelleri	**ASTER**	**8**	**0.01**
Stylidium graminifolium	**STYLID**	**1**	**0.01**
Thelymitra sp.	**ORCHID**	**1**	**0.0005**
Themeda australis	**PO**	**79**	**50.6**
Thysanotus patersonii	**ANTHERIC**	**4**	**0.01**
Tricoryne elatior	**ANTHERIC**	**64**	**2.4**
Triptilodiscus pygmaeus	**ASTER**	**68**	**0.98**
Viola betonicifolia	**VIOL**	**4**	**0.05**
Vittadinia cuneata	**ASTER**	**4**	**0.03**
Vittadinia muelleri	**ASTER**	**32**	**2.1**
Wahlenbergia spp.	**CAMPANUL**	**55**	**0.50**
Wurmbea dioica	**COLCHIC**	**39**	**0.16**

b) Exotic plant species

Acetosella vulgaris	**POLYGON**	**26**	**0.85**
Aira spp.	**PO**	**92**	**0.79**
Anagallis arvensis	**PRIMUL**	**11**	**0.10**
Aphanes arvensis	**ROS**	**4**	**0.002**
Arctotheca calendula	**ASTER**	**45**	**3.5**
Briza maxima	**PO**	**17**	**0.21**
Briza minor	**PO**	**50**	**0.19**
Bromus diandrus	**PO**	**27**	**1.2**
Bromus hordeaceus	**PO**	**59**	**1.9**
Bromus rubens	**PO**	**6**	**0.19**
Carduus pycnocephalus	**ASTER**	**3**	**0.43**
Carthamus lanatus	**ASTER**	**3**	**0.26**
Centaurium erythraea	**GENTIAN**	**1**	**0.002**
Chondrilla juncea	**ASTER**	**9**	**0.39**
Cicendia quadrangularis	**GENTIAN**	**3**	**0.04**
Echium plantagineum	**BORAGIN**	**3**	**0.22**
Erodium botrys	**GERANI**	**5**	**0.03**
Erodium cicutarium	**GERANI**	**21**	**0.22**
Galium divaricatum	**RUBI**	**32**	**0.19**
Galium murale	**RUBI**	**1**	**0.001**
Gamochaeta americana	**ASTER**	**2**	**0.01**
Gypsophila tubulosa	**CAROPHYLL**	**3**	**0.02**
Hordeum sp.	**PO**	**5**	**0.60**
Hypericum perforatum	**CLUSI**	**1**	**0.04**
Hypochaeris glabra	**ASTER**	**72**	**2.1**
Hypochaeris radicata	**ASTER**	**58**	**2.4**
Lactuca serriola	**ASTER**	**2**	**0.09**
Linaria arvensis	**SCROPHULARI**	**2**	**0.01**
Linaria pelisseriana	**SCROPHULARI**	**7**	**0.03**
Linum trigynum	**LIN**	**2**	**0.001**
Logfia gallica	**ASTER**	**22**	**0.12**
Lolium spp.	**PO**	**53**	**10.2**
Modiola caroliniana	**MALV**	**1**	**0.04**
Moenchia erecta	**CAROPHYLL**	**15**	**0.02**
Myosotis discolor	**BORAGIN**	**6**	**0.05**
Nassella trichotoma	**PO**	**9**	**0.17**
Paronychia brasiliana	**CAROPHYLL**	**7**	**0.09**
Paspalum dilatatum	**PO**	**1**	**0.02**
Petrorhagia nanteuilii	**CAROPHYLL**	**31**	**0.14**
Phalaris aquatica	**PO**	**21**	**23.8**
Plantago coronopus	**PLANTAGIN**	**2**	**0.01**
Plantago lanceolata	**PLANTAGIN**	**2**	**0.003**
Poa bulbosa	**PO**	**39**	**1.8**
Romulea rosea	**IRID**	**1**	**0.005**
Rosa rubiginosa	**ROS**	**3**	**0.15**
Salvia verbenaca	**LAMI**	**3**	**0.22**
Sherardia arvensis	**RUBI**	**4**	**0.07**
Silene gallica	**CAROPHYLL**	**2**	**0.01**
Sisymbrium officinale	**BRASSIC**	**2**	**0.01**
Soliva sessilis	**ASTER**	**1**	**0.002**
Tolpis barbata	**ASTER**	**35**	**0.39**
Trifolium angustifolium	**FAB**	**5**	**0.33**
Trifolium arvense	**FAB**	**51**	**0.55**
Trifolium campestre	**FAB**	**8**	**0.02**
Trifolium dubium	**FAB**	**40**	**0.40**
Trifolium glomeratum	**FAB**	**40**	**1.3**
Trifolium striatum	**FAB**	**27**	**1.5**
Trifolium subterraneum	**FAB**	**80**	**10.5**
Vulpia spp.	**PO**	**88**	**1.1**

Appendix 2. Floristic data and soil properties for 96 1 ha sites in Mulligans Flat (indicated by MF site codes) and Goorooyarroo Nature Reserves (indicated by WG and GO site codes). Floristic groups numbers are those described in Figure 3.

Site code	WG108-1	WG108-2	WG108-3	WG108-4	GO72A-1	GO72A-2	GO72A-3	GO72A-4	WG78-1	WG78-2	WG78-3	WG78-4	MF27A-1
Floristic group	1	1	1	1	2	2	3	3	2	2	4	2	2
a) Ground cover attributes													
Total biomass kgha^{-1}	1413	1452	779	509	418	688	877	1833	383	421	409	289	278
Live plant basal area %	3.3	10.0	8.3	10.0	8.3	4.2	12.5	13.3	9.2	5.8	9.2	12.5	12.5
Litter %	87.5	83.3	84.2	78.3	70.8	88.3	72.5	62.5	65.0	84.2	69.2	64.2	65.0
Litter depth where present (mm)	17.0	14.4	15.3	12.7	12.9	15.7	13.7	20.2	7.3	7.9	6.8	10.8	8.6
Bare ground %	5.0	5.0	5.0	5.0	15.0	3.3	9.2	9.2	15.8	3.3	12.5	12.5	7.5
Fallen log %	3.3	-	0.8	-	-	-	2.5	7.5	0.8	-	-	-	0.8
Cryptogam %	0.8	1.7	1.7	6.7	5.0	2.5	3.3	2.5	7.5	3.3	6.7	5.8	14.2
Rock %	-	-	-	-	0.8	1.7	-	5.0	1.7	3.3	2.5	5.0	-
b) Soil attributes (0 - 10 cm)													
Nitrate-N (mgkg^{-1})	9.8	5.8	9.3	6.1	0.4	0.6	0.5	0.5	0.7	0.9	0.3	1.5	1.7
Carbon (%)	2.8	2.3	3.4	3.0	1.9	2.1	2.5	3.4	2.2	2.8	2.3	2.4	2.0
Nitrogen (%)	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1
Electrical conductivity (dSm^{-1})	0.1	0.1	0.1	0.1	<0.05	0.1	0.1	<0.05	<0.05	<0.05	<0.05	0.1	<0.05
pH(CaCl2)	4.6	4.3	4.4	4.3	4.5	4.7	4.5	4.3	5.0	5.0	4.9	4.8	4.4
pH(water)	5.3	5.0	5.1	5.0	5.3	5.4	5.3	5.2	5.8	5.8	5.7	5.5	5.2
Available phosphorous (mgkg^{-1})	11.0	9.0	11.0	13.0	4.0	5.0	6.0	8.0	5.0	7.0	7.0	7.0	<4
c) Native plant species (kg ha^{-1})													
Acacia dealbata	-	-	-	-	-	-	-	-	-	-	-	-	-
Acacia gunnii	-	-	-	-	-	-	-	-	-	-	-	-	-
Acacia parramattensis	-	-	-	-	-	6.07	-	-	-	-	-	-	-
Acaena ovina	-	-	-	-	0.88	5.06	-	-	1.53	0.06	1.94	2.82	-
Alternanthera sp. *A*	-	-	-	-	-	-	-	-	-	0.02	-	-	-
Aristida ramosa	-	-	-	-	198	95.54	151	58.05	-	-	-	22.53	4.85
Arthropodium minus	2.82	-	-	-	-	-	-	-	0.11	0.34	-	0.02	-
Asperula conferta	-	-	-	-	-	-	-	-	-	1.06	0.02	-	-
Astroloma humifusum	-	-	-	-	-	-	-	-	-	-	-	-	-
Austrodanthonia spp.	574	827	201	199	45.77	203	55.29	52.52	122	143	56.59	99.57	139
Austrostipa bigeniculata	77.61	71.35	174	0.07	-	72.78	-	-	-	-	-	29.98	-
Austrostipa densiflora	-	-	-	-	-	17.50	61.70	40.36	-	-	-	-	-
Austrostipa scabra	80.83	138	126	66.81	-	22.16	13.81	-	5.48	47.38	10.37	4.27	0.49
Bossiaea buxifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Bossiaea prostrata	-	-	-	-	-	-	-	-	-	-	-	-	-
Bothriochloa macra	-	-	18.20	27.72	-	2.03	9.71	1.71	110	85.41	87.93	38.48	6.14
Brachyloma daphnoides	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulbine bulbosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex inversa	-	1.93	0.54	-	-	0.55	-	-	-	-	-	0.05	-
Chamaesyce drummondii	-	-	-	-	-	-	-	-	-	-	0.17	-	-
Cheilanthes spp.	-	-	-	-	0.05	0.17	1.32	0.67	0.05	-	0.02	0.06	5.69
Chloris truncata	-	-	-	-	-	0.05	-	-	-	-	-	-	1.32
Chrysocephalum apiculatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysocephalum semipapposum	-	-	-	-	-	-	-	0.58	-	-	-	-	-
Convolvulus angustissimus	-	-	0.06	-	-	0.06	0.78	-	2.19	1.31	0.83	-	0.09
Cotula australis	-	-	-	-	-	-	-	-	-	-	-	0.13	-
Craspedia variabilis	-	-	-	-	-	-	-	-	-	-	-	-	-
Crassula sieberiana	2.61	8.97	1.27	0.33	-	0.08	-	0.06	-	0.22	0.06	0.18	0.06
Cymbonotus spp.	-	-	-	-	-	-	-	-	-	-	0.26	-	-
Cynodon dactylon	-	-	-	-	-	-	-	-	-	-	-	-	-
Cynoglossum suaveolens	-	0.79	-	-	-	-	-	-	0.18	0.92	0.70	-	-
Daucus glochidiatus	-	-	-	-	0.08	0.21	0.20	1.75	-	0.02	4.39	0.02	-
Daviesia genistifolia	-	-	-	-	-	0.03	-	-	-	-	-	-	-
Desmodium varians	4.37	1.25	0.09	0.42	-	1.53	1.05	0.78	3.74	1.42	1.28	0.51	-
Dianella revoluta	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichelachne spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichopogon fimbriatus	-	-	-	-	-	-	-	-	-	-	-	-	-
Dillwynia sericea	-	-	-	-	-	-	-	-	-	-	-	-	-
Diuris sulphurea	-	-	-	-	-	-	-	-	-	-	-	-	-
Drosera peltata	-	-	-	-	-	-	-	-	-	-	-	-	-
Einadia nutans	7.60	-	33.24	10.04	-	-	-	-	-	-	-	4.95	-
Eleocharis acuta	-	-	-	-	-	-	-	-	-	-	-	-	-
Elymus scaber	92.65	158	115	27.49	0.56	2.24	1.61	0.57	1.20	4.59	0.78	6.46	12.79
Enneapogon nigricans	-	-	-	-	-	-	0.96	-	-	-	-	-	-

Site code	WG108-1	WG108-2	WG108-3	WG108-4	GO72A-1	GO72A-2	GO72A-3	GO72A-4	WG78-1	WG78-2	WG78-3	WG78-4	MF27A-1
Eragrostis brownii	-	-	-	-	-	-	-	-	-	-	-	-	-
Erodium crinitum	-	-	-	-	-	-	-	-	-	-	-	-	-
Eryngium rostratum	-	-	-	-	-	-	-	-	-	-	-	-	-
Euchiton gymnocephalus	-	-	-	-	-	-	-	-	-	-	-	-	-
Euchiton sphaericus	-	-	-	-	-	-	-	-	-	-	-	-	-
Galium gaudichaudii	-	-	-	-	-	-	-	-	-	-	-	-	-
Geranium solanderi	-	-	-	-	0.06	-	0.35	0.08	0.01	-	-	0.47	-
Glycine spp.	-	-	-	-	0.02	2.65	-	-	0.69	2.82	0.19	0.17	-
Gonocarpus tetragynus	-	-	-	-	1.54	1.34	2.21	0.26	1.93	-	0.47	0.69	0.56
Goodenia hederacea	-	-	-	-	0.04	0.05	0.03	-	-	-	-	-	-
Goodenia pinnatifida	-	-	-	-	-	-	-	-	0.26	0.26	-	-	0.22
Haloragis heterophylla	-	-	-	-	-	-	-	-	-	-	0.05	-	-
Hibbertia obtusifolia	-	-	-	-	-	0.55	-	-	-	-	-	-	-
Hovea heterophylla	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrocotyle laxiflora	-	-	0.46	-	0.71	2.30	4.17	0.78	6.85	2.25	0.14	1.73	3.58
Hypericum gramineum	-	-	-	-	-	0.18	0.02	0.09	0.06	1.22	0.66	-	-
Isoetopsis graminifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Joycea pallida	-	-	-	-	-	-	379	1454	-	-	-	-	-
Juncus subgen. *Genuini*	14.90	-	-	0.58	1.85	-	-	-	-	0.43	-	-	-
Leptorhynchos squamatus	-	-	-	-	15.05	5.88	1.43	0.77	6.58	0.67	9.36	4.60	-
Lissanthe strigosa	-	-	-	-	25.55	5.69	-	-	-	-	-	-	-
Lomandra filiformis	-	10.14	1.60	3.19	58.61	172.09	151.38	26.88	-	2.37	-	9.63	36.12
Lomandra multiflora	-	-	-	-	-	-	-	-	-	-	-	-	-
Luzula spp.	-	-	-	-	0.34	-	0.02	-	-	-	0.04	-	-
Lythrum hyssopifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Melichrus urceolatus	-	-	-	-	0.40	41.81	-	134.33	10.37	-	-	-	-
Mentha diemenica	-	-	-	-	-	-	-	-	-	-	0.06	-	-
Microlaena stipoides	2.93	22.04	-	62.23	-	2.09	0.66	-	-	0.21	1.73	-	0.06
Microseris lanceolata	-	-	-	-	0.04	-	-	-	-	-	0.30	-	-
Opercularia hispida	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxalis perennans	7.59	0.63	1.21	1.34	0.04	-	-	2.59	0.03	0.15	0.26	0.16	0.33
Panicum effusum	-	-	-	-	-	-	-	-	-	-	-	-	2.16
Pimelea curviflora	-	-	-	-	-	-	-	-	-	-	-	-	-
Pimelea linifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago gaudichaudii	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago varia	-	-	-	-	-	-	0.60	-	4.44	2.22	-	-	-
Poa sieberiana	-	-	-	-	-	-	-	-	-	-	5.59	-	-
Pultenaea procumbens	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus sessiliflorus	-	-	-	-	-	-	-	-	-	-	-	-	-
Rumex brownii	0.36	0.82	-	-	-	-	-	-	-	4.07	0.68	-	-
Schoenus apogon	-	-	-	-	2.25	2.94	3.10	-	-	-	-	-	-
Scleranthus biflorus	-	-	-	-	-	-	-	-	-	-	-	-	-
Senecio hispidulus	-	-	-	-	-	-	-	-	-	-	-	-	-
Senecio quadridentatus	-	-	-	-	-	-	-	-	-	-	-	-	-
Solenogyne dominii	0.06	-	-	0.02	1.06	0.21	-	0.07	3.42	0.15	0.80	0.84	2.02
Stackhousia monogyna	-	-	-	-	-	-	-	0.17	-	-	-	-	-
Stuartina muelleri	-	0.06	-	0.24	-	-	-	-	-	-	-	-	-
Stylidium graminifolium	-	-	-	-	-	-	-	-	-	-	-	-	-
Thelymitra sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Themeda australis	-	-	-	-	58.31	2.08	27.29	15.81	82.38	22.73	198	32.05	-
Thysanotus patersonii	-	-	-	-	0.04	0.19	-	0.23	-	-	-	-	-
Tricoryne elatior	-	0.53	0.11	0.62	4.70	2.94	0.05	0.62	-	-	-	-	0.05
Triptilodiscus pygmaeus	-	0.17	-	-	0.11	0.06	0.31	1.04	1.30	0.25	0.63	1.38	0.63
Viola betonicifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Vittadinia cuneata	-	-	-	-	-	-	-	-	-	-	-	-	-
Vittadinia muelleri	-	-	-	-	-	0.20	-	-	9.63	-	10.93	-	1.93
Wahlenbergia spp.	-	-	-	-	-	4.62	0.60	2.54	3.39	0.17	0.81	0.31	1.31
Wurmbea dioica	-	-	-	-	1.23	0.05	1.77	0.02	0.07	0.02	1.11	0.72	-
d) Exotic plant species (kg ha^{-1})													
Acetosella vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	0.21
Aira spp.	-	0.40	-	0.50	0.22	0.40	0.14	0.37	1.19	0.03	0.15	0.91	4.50
Anagallis arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Aphanes arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Arctotheca calendula	24.58	8.58	10.84	4.31	-	-	-	-	0.28	38.27	0.07	1.32	8.57
Briza maxima	-	-	-	-	-	-	-	-	-	-	-	-	-
Briza minor	-	-	-	-	-	-	-	-	-	-	0.13	-	-
Bromus diandrus	3.07	-	0.43	1.69	-	-	-	-	-	-	-	-	0.38
Bromus hordeaceus	-	33.06	-	0.11	-	-	0.09	-	0.12	1.32	0.42	-	-
Bromus rubens	-	-	-	-	-	-	-	-	-	-	-	-	-
Carduus pycnocephalus	-	-	-	-	-	-	-	-	-	-	-	-	-
Carthamus lanatus	-	5.59	-	-	-	-	-	-	-	-	-	-	-

Site code	WG108-1	WG108-2	WG108-3	WG108-4	GO72A-1	GO72A-2	GO72A-3	GO72A-4	WG78-1	WG78-2	WG78-3	WG78-4	MF27A-1
Centaurium erythraea	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondrilla juncea	-	-	-	-	-	-	-	-	-	-	-	-	-
Cicendia quadrangularis	-	-	-	-	-	-	-	-	-	-	0.08	-	-
Echium plantagineum	-	-	-	-	-	-	-	-	-	-	-	-	-
Erodium botrys	-	-	-	-	-	-	-	-	-	-	-	-	-
Erodium cicutarium	0.92	-	-	-	-	4.63	-	-	-	0.06	-	0.17	-
Galium divaricatum	-	-	-	-	0.03	-	-	-	-	-	-	-	-
Galium murale	-	-	-	-	-	-	-	-	-	-	-	-	-
Gamochaeta americana	-	-	-	-	-	-	-	-	-	-	-	-	-
Gypsophila tubulosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum sp.	-	-	4.82	5.69	-	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Hypochaeris glabra	-	0.53	-	-	-	-	0.14	0.51	0.45	1.09	-	0.20	-
Hypochaeris radicata	11.04	13.54	2.18	-	-	-	-	-	-	3.66	0.07	0.17	4.42
Lactuca serriola	-	-	-	-	-	-	-	-	-	-	-	-	-
Linaria arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Linaria pelisseriana	-	-	-	-	-	-	-	-	-	-	-	-	-
Linum trigynum	-	-	-	-	-	-	-	-	-	-	-	-	-
Logfia gallica	-	-	-	-	-	-	-	-	-	-	-	-	-
Lolium spp.	196	69.38	50.93	80.10	-	-	-	-	-	0.04	0.17	1.48	1.26
Modiola caroliniana	-	-	-	-	-	-	-	-	-	-	-	-	-
Moenchia erecta	0.16	-	-	-	-	-	-	-	-	-	-	-	-
Myosotis discolor	-	-	-	-	-	-	-	-	-	-	-	-	-
Nassella trichotoma	-	-	-	-	-	0.56	-	3.30	-	-	-	-	-
Paronychia brasiliana	0.08	-	4.45	-	-	-	-	-	-	1.26	-	-	-
Paspalum dilatatum	-	-	2.25	-	-	-	-	-	-	-	-	-	-
Petrorhagia nanteuilii	-	-	-	-	-	-	-	-	-	0.07	-	0.02	-
Phalaris aquatica	234	27.53	-	7.91	-	-	-	-	-	-	-	-	-
Plantago coronopus	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago lanceolata	-	-	-	-	-	-	-	-	-	-	-	-	-
Poa bulbosa	-	3.35	1.75	3.48	-	-	-	-	2.51	30.62	-	20.29	5.12
Romulea rosea	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosa rubiginosa	-	-	-	-	-	-	-	3.00	-	-	-	-	-
Salvia verbenaca	-	-	-	-	-	-	-	-	-	-	-	-	-
Sherardia arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Silene gallica	-	-	-	-	-	-	-	-	-	-	-	-	-
Sisymbrium officinale	-	-	-	-	-	-	-	-	-	-	-	-	-
Soliva sessilis	-	-	-	-	-	-	-	-	-	-	-	-	-
Tolpis barbata	-	-	-	-	-	-	-	-	-	-	-	-	0.29
Trifolium angustifolium	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium arvense	-	-	-	-	-	-	-	-	0.43	3.95	7.72	0.51	0.75
Trifolium campestre	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium dubium	-	-	-	0.06	-	-	-	-	0.07	-	2.15	-	0.04
Trifolium glomeratum	-	-	-	-	-	-	-	-	-	-	0.08	0.47	0.24
Trifolium striatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium subterraneum	57.48	14.80	19.42	0.26	-	0.17	2.00	-	-	14.83	0.05	0.02	29.69
Vulpia spp.	4.98	3.43	3.26	0.71	0.12	0.51	0.03	0.22	-	0.19	0.80	0.03	0.06

Site code	MF27A-2	MF27A-3	MF27A-4	MF34-1	MF34-2	MF34-3	MF34-4	MF16A-1	MF16A-2	MF16A-3	MF16A-4	WG92-1	WG92-2
Floristic group	5	2	2	4	4	2	1	2	4	2	2	6	6
a) Ground cover attributes													
Total biomass kgha^{-1}	378	277	266	211	213	219	674	314	356	315	276	421	472
Live plant basal area %	13.3	13.3	11.7	2.5	5.8	6.7	15.8	21.7	25.8	8.3	19.2	24.2	20.8
Litter %	45.0	51.7	52.5	82.5	74.2	73.3	74.2	70.0	55.8	66.7	54.2	56.7	69.2
Litter depth where present (mm)	7.9	12.6	6.3	16.9	15.7	20.4	22.5	7.7	9.6	20.9	14.3	11.5	12.0
Bare ground %	25.0	27.5	23.3	12.5	17.5	12.5	2.5	5.0	15.0	16.7	15.0	7.5	2.5
Fallen log %	0.8	-	0.8	1.7	-	6.7	7.5	-	-	4.2	-	-	-
Cryptogam %	15.0	7.5	10.8	0.8	2.5	0.8	-	3.3	3.3	4.2	11.7	11.7	7.5
Rock %	0.8	-	0.8	-	-	-	-	-	-	-	-	-	-
b) Soil attributes (0 - 10 cm)													
Nitrate-N (mgkg^{-1})	0.8	2.4	1.4	0.5	0.5	1.5	3.2	0.7	1.0	1.1	1.3	4.8	5.9
Carbon (%)	1.5	1.8	1.8	3.8	2.7	3.4	3.3	3.1	3.4	3.4	3.0	2.5	2.5
Nitrogen (%)	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Site code	MF27A-2	MF27A-3	MF27A-4	MF34-1	MF34-2	MF34-3	MF34-4	MF16A-1	MF16A-2	MF16A-3	MF16A-4	WG92-1	WG92-2
Electrical conductivity (dSm^{-1})	<0.05	0.1	<0.05	0.1	0.1	0.1	0.1	<0.05	<0.05	0.1	<0.05	0.1	<0.05
pH(CaCl2)	4.4	4.4	4.4	4.5	4.6	4.4	4.7	4.5	4.5	4.3	4.5	4.7	4.5
pH(water)	5.4	5.1	5.3	5.3	5.4	5.1	5.5	5.3	5.4	5.0	5.3	5.5	5.3
Available phosphorous ($mgkg^{-1}$)	<4	4.0	<4	7.0	7.0	10.0	13.0	10.0	9.0	9.0	8.0	9.0	8.0
c) Native plant species (kg ha^{-1})													
Acacia dealbata	-	-	-	-	-	-	-	-	-	-	-	-	-
Acacia gunnii	-	-	-	-	-	-	-	-	-	-	-	-	-
Acacia parramattensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Acaena ovina	0.02	14.88	5.19	-	-	0.43	-	8.97	1.17	6.72	18.95	0.48	0.13
Alternanthera sp. *A*	-	-	-	-	-	-	-	-	-	-	-	-	-
Aristida ramosa	29.19	6.48	14.03	-	-	-	-	11.70	0.35	8.36	25.90	-	-
Arthropodium minus	-	0.05	0.31	0.41	0.84	-	2.24	-	-	-	3.01	-	-
Asperula conferta	-	0.22	-	-	-	-	0.06	0.16	2.03	1.98	8.11	0.13	0.23
Astroloma humifusum	-	-	-	-	-	-	-	-	-	-	-	-	-
Austrodanthonia spp.	146	119	156	67.89	58.48	94.37	80.67	89.30	65.96	105	92.63	49.73	62.18
Austrostipa bigeniculata	-	-	-	-	-	-	-	-	-	-	-	50.96	27.05
Austrostipa densiflora	-	-	-	-	-	-	-	-	-	-	-	-	-
Austrostipa scabra	2.10	8.92	4.99	-	4.70	-	-	0.02	-	1.26	-	14.08	-
Bossiaea buxifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Bossiaea prostrata	-	-	-	0.53	-	-	-	-	-	-	-	-	-
Bothriochloa macra	-	8.42	10.91	-	-	-	-	47.26	22.48	0.02	11.00	21.73	57.49
Brachyloma daphnoides	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulbine bulbosa	-	-	-	10.63	3.05	-	-	-	-	-	-	-	-
Carex inversa	-	-	-	-	-	-	0.11	-	-	0.56	-	-	-
Chamaesyce drummondii	-	-	-	-	-	-	-	-	-	-	-	-	-
Cheilanthes spp.	0.05	-	0.02	-	-	-	-	-	-	-	-	-	-
Chloris truncata	2.97	0.60	-	-	-	-	-	-	-	-	-	-	1.93
Chrysocephalum apiculatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysocephalum semipapposum	-	-	-	-	-	-	-	-	-	-	-	-	-
Convolvulus angustissimus	-	-	-	-	-	-	-	-	-	-	-	-	-
Cotula australis	-	-	-	-	-	-	-	-	-	-	-	-	-
Craspedia variabilis	-	-	-	0.86	2.59	3.15	0.04	1.41	-	-	0.62	-	-
Crassula sieberiana	0.06	0.02	0.08	-	0.01	-	0.01	-	-	0.22	0.90	-	0.11
Cymbonotus spp.	0.16	-	-	-	-	-	-	0.06	-	-	0.21	-	-
Cynodon dactylon	-	-	-	-	-	-	-	-	-	-	-	-	-
Cynoglossum suaveolens	-	-	-	-	-	-	-	-	-	-	-	-	-
Daucus glochidiatus	-	0.06	-	0.07	0.36	-	-	-	-	1.65	0.16	-	-
Daviesia genistifolia	-	12.36	-	-	-	-	-	-	-	-	-	-	-
Desmodium varians	-	0.18	-	-	-	-	-	-	-	-	-	-	-
Dianella revoluta	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichelachne spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichopogon fimbriatus	-	-	-	-	-	-	-	-	-	-	-	-	-
Dillwynia sericea	-	-	-	-	-	-	-	-	-	-	-	-	-
Diuris sulphurea	-	-	-	-	-	-	-	-	-	-	-	-	-
Drosera peltata	-	-	-	-	-	-	-	-	-	-	-	-	-
Einadia nutans	-	-	-	-	-	-	-	-	-	-	-	-	-
Eleocharis acuta	-	-	-	-	-	-	-	-	-	-	-	-	-
Elymus scaber	0.93	13.61	13.33	0.43	-	2.75	6.78	5.41	8.69	7.80	4.73	11.17	52.23
Enneapogon nigricans	-	-	0.05	-	-	-	-	-	-	-	-	-	-
Eragrostis brownii	-	-	-	-	-	-	-	-	-	-	-	-	-
Erodium crinitum	-	-	-	-	-	-	-	-	-	-	-	-	-
Eryngium rostratum	1.78	-	-	-	-	-	-	-	-	-	-	-	-
Euchiton gymnocephalus	-	-	-	-	-	-	-	-	-	-	-	-	-
Euchiton sphaericus	-	-	-	-	-	-	-	-	-	-	-	-	-
Galium gaudichaudii	-	-	-	-	-	-	-	-	-	-	-	-	-
Geranium solanderi	-	0.07	-	0.37	-	4.48	0.54	-	-	0.53	0.04	-	0.05
Glycine spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Gonocarpus tetragynus	3.16	0.53	1.61	2.78	1.19	2.95	-	1.85	-	9.75	3.31	-	-
Goodenia hederacea	0.75	-	-	-	0.01	0.37	-	-	-	0.98	-	-	-
Goodenia pinnatifida	-	-	-	-	-	-	-	-	-	-	-	-	8.65
Haloragis heterophylla	0.53	0.21	0.05	0.07	0.02	-	-	0.04	0.08	0.02	0.23	-	-
Hibbertia obtusifolia	-	-	-	-	-	-	-	-	-	0.33	-	-	-
Hovea heterophylla	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrocotyle laxiflora	-	-	-	8.34	2.71	7.04	0.07	-	0.51	4.35	5.79	-	-
Hypericum gramineum	-	0.67	-	0.13	0.38	0.21	0.03	-	-	-	-	-	0.10
Isoetopsis graminifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Joycea pallida	110	-	-	-	-	-	-	-	-	61.34	-	-	-
Juncus subgen. *Genuini*	-	-	0.67	12.09	11.38	0.09	1.52	12.42	19.52	3.26	1.11	-	4.59
Leptorhynchos squamatus	10.67	0.49	3.41	15.67	4.01	1.08	-	-	-	-	-	-	-

Site code	MF27A-2	MF27A-3	MF27A-4	MF34-1	MF34-2	MF34-3	MF34-4	MF16A-1	MF16A-2	MF16A-3	MF16A-4	WG92-1	WG92-2
Lissanthe strigosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Lomandra filiformis	9.76	0.60	7.93	10.78	8.52	20.61	-	-	9.64	27.02	0.42	12.84	40.26
Lomandra multiflora	-	-	-	-	2.17	-	-	-	-	-	-	-	-
Luzula spp.	-	-	0.02	-	-	-	-	0.02	0.25	0.77	-	-	-
Lythrum hyssopifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Melichrus urceolatus	0.05	8.65	-	-	-	-	-	-	-	-	-	-	-
Mentha diemenica	-	-	-	-	-	-	-	-	-	-	-	-	-
Microlaena stipoides	-	0.05	-	-	-	17.65	34.23	30.84	32.76	4.65	21.39	-	-
Microseris lanceolata	-	-	-	-	-	-	-	-	-	-	-	-	-
Opercularia hispida	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxalis perennans	0.02	0.19	-	1.28	0.07	1.11	-	0.26	0.44	0.82	1.39	0.80	0.02
Panicum effusum	9.75	2.40	1.92	-	-	-	0.09	0.71	-	-	-	-	0.02
Pimelea curviflora	-	-	-	-	-	-	-	-	-	-	-	-	-
Pimelea linifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago gaudichaudii	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago varia	-	-	-	-	-	0.05	0.47	-	-	-	-	-	-
Poa sieberiana	-	-	-	-	7.24	1.20	-	-	-	-	-	-	-
Pultenaea procumbens	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus sessiliflorus	-	-	-	0.04	0.03	2.37	7.83	-	-	-	3.00	-	-
Rumex brownii	-	-	-	-	0.19	0.30	0.02	-	0.25	-	-	0.16	0.87
Schoenus apogon	-	-	-	1.93	-	-	-	-	-	-	-	-	-
Scleranthus biflorus	-	-	-	-	-	-	-	-	-	0.02	-	-	-
Senecio hispidulus	-	-	-	-	-	-	-	-	-	-	-	-	-
Senecio quadridentatus	-	-	-	-	-	-	-	-	-	-	-	-	-
Solenogyne dominii	0.45	-	0.15	1.92	0.24	0.59	-	5.46	2.69	6.62	3.53	-	-
Stackhousia monogyna	-	-	-	-	-	-	-	-	-	-	-	-	-
Stuartina muelleri	0.03	-	-	-	-	-	-	0.10	-	-	0.01	-	-
Stylidium graminifolium	-	-	-	-	-	-	-	-	-	-	-	-	-
Thelymitra sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Themeda australis	0.75	10.28	-	61.57	82.73	10.10	-	60.99	173.97	25.70	49.29	38.03	36.56
Thysanotus patersonii	-	-	-	-	-	-	-	-	-	-	-	-	-
Tricoryne elatior	11.13	0.78	0.31	2.12	-	1.46	-	0.17	1.24	-	0.21	-	2.57
Triptilodiscus pygmaeus	3.45	1.20	8.58	0.47	0.08	-	-	2.35	0.54	3.69	3.21	-	-
Viola betonicifolia	-	-	-	-	-	-	0.58	-	-	-	-	-	-
Vittadinia cuneata	-	-	-	-	-	-	-	0.62	-	-	-	-	-
Vittadinia muelleri	10.60	6.67	1.31	-	-	-	-	27.57	6.75	5.34	8.76	-	-
Wahlenbergia spp.	0.59	-	-	-	0.90	0.21	-	-	-	-	0.02	0.19	-
Wurmbea dioica	0.05	0.05	0.85	-	0.16	-	-	1.48	0.75	0.17	2.71	-	-
d) Exotic plant species (kg ha^{-1})													
Acetosella vulgaris	-	8.91	-	-	-	-	3.05	0.21	0.71	-	-	-	-
Aira spp.	1.26	1.78	0.97	4.70	0.14	0.85	0.05	0.17	0.76	1.29	1.67	0.76	0.41
Anagallis arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Aphanes arvensis	-	-	-	-	-	-	0.06	0.09	-	-	-	-	0.06
Arctotheca calendula	-	6.73	-	-	-	-	-	-	-	0.08	-	5.69	33.26
Briza maxima	-	-	-	-	-	0.09	-	-	-	-	-	-	-
Briza minor	0.02	-	-	0.06	0.03	0.02	-	0.18	0.05	0.18	1.13	-	-
Bromus diandrus	-	1.89	-	-	-	-	0.74	-	-	-	-	0.02	-
Bromus hordeaceus	-	0.45	-	0.26	1.63	4.64	3.06	-	-	0.48	0.10	8.39	32.91
Bromus rubens	-	-	-	-	-	-	-	-	-	-	-	-	-
Carduus pycnocephalus	-	-	-	2.45	-	-	-	-	-	-	-	-	-
Carthamus lanatus	-	-	-	-	-	-	-	-	-	-	-	-	-
Centaurium erythraea	-	-	-	-	-	-	-	-	-	-	0.20	-	-
Chondrilla juncea	-	-	-	-	-	-	-	-	-	-	-	-	-
Cicendia quadrangularis	-	-	-	-	-	-	-	-	-	-	-	-	-
Echium plantagineum	-	8.16	-	-	-	-	-	-	-	-	-	-	12.22
Erodium botrys	-	-	-	-	-	-	-	-	-	-	-	-	-
Erodium cicutarium	-	-	-	-	-	-	-	-	-	-	-	7.73	1.29
Galium divaricatum	-	-	-	0.01	-	0.15	0.11	-	-	-	-	-	-
Galium murale	-	-	-	-	-	-	-	-	-	-	-	-	-
Gamochaeta americana	-	-	-	-	-	-	-	0.24	-	-	0.67	-	-
Gypsophila tubulosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Hypochaeris glabra	0.36	-	-	0.04	-	-	-	-	-	0.12	0.06	-	0.11
Hypochaeris radicata	6.00	2.29	21.59	0.02	-	2.54	2.49	0.81	0.31	0.37	0.14	0.62	4.35
Lactuca serriola	-	-	-	-	-	-	-	-	-	-	-	-	-
Linaria arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Linaria pelisseriana	-	-	-	-	-	-	-	-	-	-	-	-	-
Linum trigynum	-	-	-	-	-	-	-	-	-	-	-	-	-

Site code	MF27A-2	MF27A-3	MF27A-4	MF34-1	MF34-2	MF34-3	MF34-4	MF16A-1	MF16A-2	MF16A-3	MF16A-4	WG92-1	WG92-2
Logfia gallica	-	0.17	-	-	-	-	-	-	-	-	-	-	-
Lolium spp.	-	1.09	-	0.18	9.29	13.47	50.28	-	-	0.71	0.37	65.60	13.89
Modiola caroliniana	-	-	-	-	-	-	-	-	-	-	-	3.70	-
Moenchia erecta	0.49	0.06	0.05	-	-	-	-	-	-	-	-	0.14	0.07
Myosotis discolor	-	-	-	-	-	3.50	0.25	-	-	0.17	-	-	-
Nassella trichotoma	-	-	-	-	-	-	-	0.06	-	-	-	-	-
Paronychia brasiliana	-	-	-	-	-	-	-	-	-	-	-	-	-
Paspalum dilatatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Petrorhagia nanteuilii	-	-	-	0.26	-	-	-	-	-	-	-	-	-
Phalaris aquatica	-	-	-	-	-	6.59	473	-	-	-	-	-	-
Plantago coronopus	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago lanceolata	-	-	-	-	-	-	-	-	-	-	-	-	0.20
Poa bulbosa	-	2.40	0.56	-	0.17	6.64	0.46	-	-	-	-	42.06	1.76
Romulea rosea	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosa rubiginosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Salvia verbenaca	-	-	-	-	-	-	-	-	-	-	-	-	-
Sherardia arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Silene gallica	-	-	-	-	-	-	-	-	-	-	-	-	-
Sisymbrium officinale	-	-	-	-	-	-	-	-	-	-	-	1.11	-
Soliva sessilis	-	-	-	-	-	0.21	-	-	-	-	-	-	-
Tolpis barbata	0.05	0.22	0.24	-	-	-	-	-	-	-	-	-	-
Trifolium angustifolium	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium arvense	0.17	0.17	0.12	-	-	-	-	0.02	-	-	0.03	0.05	-
Trifolium campestre	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium dubium	-	0.02	0.06	0.13	0.04	0.27	0.27	0.48	0.15	0.07	0.11	-	0.17
Trifolium glomeratum	-	1.56	0.66	-	-	-	-	-	-	0.03	0.06	15.22	2.76
Trifolium striatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium subterraneum	14.70	22.54	9.26	1.41	0.26	4.09	0.67	3.05	3.38	6.79	0.82	67.92	72.60
Vulpia spp.	0.05	0.17	0.17	0.14	0.46	-	-	-	0.04	10.40	-	0.05	0.50
Vulpia spp.	0.05	0.17	0.17	0.14	0.46	-	-	-	0.04	10.40	-	0.05	0.50

Site code	WG92-3	WG92-4	MF22A-1	MF22A-2	MF22A-3	MF22A-4	MF19A-1	MF19A-2	MF19A-3	MF19A-4	WG81-1	WG81-2	WG81-3
Floristic group	6	6	3	3	3	3	4	4	4	2	2	2	2
a) Ground cover attributes													
Total biomass kgha^{-1}	334	306	2352	1241	1722	890	229	232	304	288	355	398	363
Live plant basal area %	34.2	15.8	14.2	10.0	18.3	12.5	7.5	6.7	7.5	1.7	10.8	13.3	11.7
Litter %	55.8	66.7	60.8	69.2	54.2	68.3	85.8	87.5	79.2	85.0	74.2	74.2	63.3
Litter depth where present (mm)	6.6	14.5	16.5	11.6	12.4	13.1	15.7	24.1	20.5	20.2	13.1	11.9	11.6
Bare ground %	5.8	3.3	17.5	10.8	21.7	14.2	5.8	2.5	9.2	9.2	13.3	6.7	15.0
Fallen log %	-	5.0	-	-	-	0.8	-	3.3	2.5	0.8	-	1.7	-
Cryptogam %	4.2	2.5	7.5	9.2	5.8	4.2	0.8	-	1.7	3.3	1.7	4.2	8.3
Rock %	-	6.7	-	0.8	-	-	-	-	-	-	-	-	1.7
b) Soil attributes (0 - 10 cm)													
Nitrate-N (mgkg^{-1})	3.3	8.0	1.6	<0.25	2.8	<0.25	0.4	1.2	0.4	1.2	1.0	0.5	0.3
Carbon (%)	2.7	3.3	2.2	2.8	2.3	2.2	3.6	3.5	3.3	2.9	2.7	2.6	2.4
Nitrogen (%)	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Electrical conductivity (dSm^{-1})	0.1	0.1	<0.05	<0.05	<0.05	<0.05	0.1	0.1	0.1	<0.05	<0.05	<0.05	<0.05
pH(CaCl2)	4.7	5.2	4.1	4.0	4.1	4.1	4.4	4.4	4.3	4.4	4.4	4.5	4.2
pH(water)	5.5	5.8	4.9	4.8	4.9	4.9	5.1	5.2	5.0	5.2	5.2	5.4	5.1
Available phosphorous (mgkg^{-1})	7.0	9.0	7.0	6.0	6.0	6.0	10.0	12.0	11.0	5.0	8.0	<4	<4
c) Native plant species (kg ha^{-1})													
Acacia dealbata	-	-	-	-	-	-	-	-	-	-	-	-	-
Acacia gunnii	-	-	-	-	-	-	-	-	-	-	-	-	-
Acacia parramattensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Acaena ovina	24.03	0.77	-	-	0.05	-	-	-	-	-	-	-	-
Alternanthera sp. *A*	-	-	-	-	-	-	-	-	-	-	-	-	-
Aristida ramosa	-	8.65	72.96	46.25	112.23	123.26	-	-	14.12	0.77	115	113	104
Arthropodium minus	-	-	-	-	-	-	-	0.04	-	0.53	-	-	-
Asperula conferta	-	-	-	-	0.22	-	-	-	0.05	-	-	-	-
Astroloma humifusum	-	-	-	-	-	-	-	-	-	-	-	-	-
Austrodanthonia spp.	56.15	54.10	18.94	25.18	50.98	35.92	26.29	7.72	11.80	74.57	61.32	35.11	71.23

Site code	WG92-3	WG92-4	MF22A-1	MF22A-2	MF22A-3	MF22A-4	MF19A-1	MF19A-2	MF19A-3	MF19A-4	WG81-1	WG81-2	WG81-3
Austrostipa bigeniculata	-	6.18	-	-	-	-	-	-	-	-	-	-	-
Austrostipa densiflora	-	-	-	-	-	-	-	-	-	-	22.82	48.39	79.46
Austrostipa scabra	0.17	2.59	-	-	-	-	-	-	-	-	5.14	-	2.23
Bossiaea buxifolia	-	-	-	-	-	-	-	2.22	-	-	-	-	-
Bossiaea prostrata	-	-	-	-	-	-	-	0.02	-	0.45	-	-	-
Bothriochloa macra	42.58	49.28	-	-	0.62	-	-	-	0.51	-	7.47	4.90	0.48
Brachyloma daphnoides	-	-	85.14	-	-	-	-	-	-	-	-	-	-
Bulbine bulbosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex inversa	-	0.06	-	-	-	-	-	-	-	-	1.03	-	-
Chamaesyce drummondii	0.25	-	-	-	-	-	-	-	-	-	-	-	-
Cheilanthes spp.	-	-	1.59	0.03	1.29	-	-	-	-	-	0.02	1.23	0.67
Chloris truncata	-	-	-	-	3.19	5.17	-	-	-	-	-	-	-
Chrysocephalum apiculatum	-	-	-	-	-	0.19	-	-	-	-	-	10.13	-
Chrysocephalum semipapposum	-	-	-	-	-	-	-	-	-	-	-	-	-
Convolvulus angustissimus	-	-	-	-	-	-	-	-	-	-	-	-	-
Cotula australis	-	-	-	-	-	-	-	-	-	-	-	-	-
Craspedia variabilis	-	-	-	-	-	-	-	-	-	-	-	3.37	-
Crassula sieberiana	-	0.05	-	0.05	-	-	-	-	-	-	0.28	0.03	-
Cymbonotus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Cynodon dactylon	-	-	-	-	-	-	-	-	-	-	0.02	-	-
Cynoglossum suaveolens	-	-	-	-	-	-	-	-	-	-	-	-	-
Daucus glochidiatus	-	-	-	-	-	-	0.12	0.45	0.27	0.65	-	0.02	0.53
Daviesia genistifolia	-	-	-	-	-	-	-	-	-	4.59	-	-	-
Desmodium varians	-	0.35	-	-	-	-	-	-	-	-	0.47	0.23	1.35
Dianella revoluta	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichelachne spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichopogon fimbriatus	-	-	-	-	-	-	-	-	-	-	-	-	-
Dillwynia sericea	-	-	1.17	-	-	-	-	-	-	-	-	-	-
Diuris sulphurea	-	-	11.77	-	0.03	-	-	-	-	-	-	-	-
Drosera peltata	-	-	-	0.14	0.36	-	-	-	-	-	-	-	-
Einadia nutans	-	-	-	-	-	-	-	-	-	-	-	-	-
Eleocharis acuta	-	-	-	-	-	-	-	0.71	-	-	-	-	-
Elymus scaber	6.74	42.46	-	-	-	-	1.82	16.62	0.12	0.13	6.12	0.63	2.56
Enneapogon nigricans	-	-	-	-	-	-	-	-	-	-	-	-	-
Eragrostis brownii	-	-	0.63	-	-	-	-	2.37	-	-	-	0.03	-
Erodium crinitum	-	-	-	-	-	-	-	-	-	-	-	-	-
Eryngium rostratum	-	-	-	-	-	-	-	-	-	-	-	-	-
Euchiton gymnocephalus	-	-	-	-	-	-	-	-	-	-	-	-	-
Euchiton sphaericus	-	-	-	-	-	-	-	-	-	-	-	-	-
Galium gaudichaudii	-	-	-	-	-	-	-	-	-	-	-	-	-
Geranium solanderi	-	0.07	-	-	-	-	-	1.63	-	-	-	-	-
Glycine spp.	-	0.66	-	-	-	0.06	-	-	-	0.57	-	-	-
Gonocarpus tetragynus	-	-	4.23	3.76	15.13	2.12	3.48	1.32	0.24	0.80	0.44	2.83	10.58
Goodenia hederacea	-	-	0.28	-	8.78	4.28	-	-	0.14	4.94	1.56	0.07	0.34
Goodenia pinnatifida	0.09	-	-	-	-	-	-	-	-	-	-	-	-
Haloragis heterophylla	-	-	1.56	-	0.14	0.38	-	-	0.25	3.04	-	0.09	-
Hibbertia obtusifolia	-	-	-	-	0.53	-	-	-	-	-	-	-	-
Hovea heterophylla	-	-	0.71	-	-	-	-	-	-	3.00	-	-	-
Hydrocotyle laxiflora	-	-	-	5.35	-	0.96	1.60	8.41	0.63	4.84	0.27	0.10	0.77
Hypericum gramineum	-	-	2.23	-	-	0.11	-	0.06	0.01	2.90	-	-	0.02
Isoetopsis graminifolia	-	-	-	-	0.03	-	-	-	-	-	-	-	-
Joycea pallida	-	-	1870	1028	1231	627	26.56	-	41.39	40.74	3.70	-	40.20
Juncus subgen. *Genuini*	0.15	-	7.63	3.96	0.78	-	5.06	5.02	24.50	11.31	6.90	13.06	-
Leptorhynchos squamatus	-	-	-	-	-	-	5.18	-	-	1.65	6.98	12.24	-
Lissanthe strigosa	-	-	-	-	-	-	-	-	-	0.90	-	-	0.20
Lomandra filiformis	18.55	12.15	4.61	7.29	43.03	34.38	18.48	42.48	38.79	24.46	30.77	37.03	11.90
Lomandra multiflora	-	-	-	-	-	5.75	-	-	-	4.08	-	-	-
Luzula spp.	-	-	-	-	-	-	-	-	-	0.02	0.04	1.43	0.93
Lythrum hyssopifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Melichrus urceolatus	-	-	193.63	13.14	181.15	0.06	-	-	-	26.31	-	-	-
Mentha diemenica	-	-	-	-	-	-	-	-	1.48	-	-	-	-
Microlaena stipoides	0.07	11.75	0.98	5.40	7.15	4.13	0.06	2.19	2.04	2.42	27.08	5.64	0.20
Microseris lanceolata	-	-	-	-	-	-	-	-	-	-	-	-	-
Opercularia hispida	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxalis perennans	0.35	0.02	-	0.11	0.71	0.27	-	-	-	0.04	0.05	0.13	-
Panicum effusum	-	-	1.04	0.36	-	-	-	-	-	-	-	1.82	-
Pimelea curviflora	-	-	-	-	-	0.26	-	-	-	4.45	-	-	-
Pimelea linifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago gaudichaudii	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago varia	-	-	-	-	-	-	-	-	-	-	-	-	-

Site code	WG92-3	WG92-4	MF22A-1	MF22A-2	MF22A-3	MF22A-4	MF19A-1	MF19A-2	MF19A-3	MF19A-4	WG81-1	WG81-2	WG81-3
Poa sieberiana	-	-	-	-	-	-	5.25	2.30	7.37	3.70	25.43	3.50	9.67
Pultenaea procumbens	-	-	6.78	-	-	-	-	-	-	-	-	-	-
Ranunculus sessiliflorus	-	-	-	-	-	-	-	-	-	-	-	-	-
Rumex brownii	12.86	0.05	-	-	-	-	-	-	-	-	0.02	0.13	-
Schoenus apogon	-	-	-	-	-	-	-	-	-	-	-	-	1.71
Scleranthus biflorus	-	-	-	-	-	-	-	-	-	-	-	-	-
Senecio hispidulus	-	-	-	-	-	2.37	-	5.42	-	-	-	-	-
Senecio quadridentatus	-	-	-	-	-	-	-	-	-	-	-	-	-
Solenogyne dominii	-	-	0.66	4.16	3.60	1.61	0.80	0.70	1.65	0.10	10.39	10.24	0.29
Stackhousia monogyna	-	-	8.70	-	-	-	-	-	-	-	-	-	-
Stuartina muelleri	-	-	-	0.04	-	-	-	-	-	-	-	-	-
Stylidium graminifolium	-	-	-	-	-	-	-	-	-	-	-	-	-
Thelymitra sp.	-	-	-	-	0.04	-	-	-	-	-	-	-	-
Themeda australis	15.96	1.93	28.24	69.56	26.95	13.40	119	110	90.41	57.48	10.06	69.41	8.11
Thysanotus patersonii	-	-	-	-	-	-	-	-	-	-	-	-	-
Tricoryne elatior	25.12	-	-	0.15	0.28	2.65	0.24	5.15	0.20	5.54	2.00	8.58	-
Triptilodiscus pygmaeus	-	-	9.10	4.10	7.45	0.63	0.02	-	-	0.05	0.02	0.75	0.02
Viola betonicifolia	-	-	-	-	-	-	-	0.02	-	-	-	-	-
Vittadinia cuneata	-	-	-	-	-	-	-	-	-	-	-	-	-
Vittadinia muelleri	-	-	-	-	-	-	-	-	-	-	-	-	0.06
Wahlenbergia spp.	0.06	-	-	-	-	-	-	0.06	-	-	0.19	0.02	4.13
Wurmbea dioica	-	-	-	0.21	-	-	0.06	-	-	0.01	-	-	0.27
d) Exotic plant species (kg ha^{-1})													
Acetosella vulgaris	-	-	-	-	-	-	-	-	-	-	0.06	-	-
Aira spp.	1.28	0.08	5.51	1.08	4.39	1.05	0.07	-	0.42	0.15	0.20	4.33	0.13
Anagallis arvensis	-	-	-	-	-	0.06	-	-	-	-	-	-	-
Aphanes arvensis	0.02	-	-	-	-	-	-	-	-	-	-	-	-
Arctotheca calendula	0.97	21.60	-	-	-	-	-	-	-	-	1.15	0.09	0.34
Briza maxima	-	-	-	-	0.02	-	-	-	-	-	-	-	-
Briza minor	0.02	-	0.67	2.78	3.13	1.88	-	-	-	-	0.02	-	0.06
Bromus diandrus	-	0.90	-	-	-	-	-	-	2.71	-	3.27	-	-
Bromus hordeaceus	24.90	1.69	-	-	-	-	-	-	1.35	0.02	0.59	1.12	-
Bromus rubens	-	1.23	-	-	-	-	-	-	-	-	-	-	-
Carduus pycnocephalus	-	-	-	-	-	-	-	-	39.13	-	-	-	-
Carthamus lanatus	-	-	-	-	-	-	-	-	-	-	-	-	-
Centaurium erythraea	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondrilla juncea	-	6.22	-	-	-	-	-	-	-	-	-	-	-
Cicendia quadrangularis	-	-	-	-	-	-	-	-	-	-	-	-	-
Echium plantagineum	-	0.71	-	-	-	-	-	-	-	-	-	-	-
Erodium botrys	-	-	-	-	-	-	-	-	-	-	-	-	-
Erodium cicutarium	0.60	0.07	-	-	-	-	-	-	-	-	-	-	-
Galium divaricatum	-	-	0.04	0.11	0.19	-	-	-	-	-	0.02	-	0.07
Galium murale	-	-	-	-	-	-	-	-	-	-	-	-	-
Gamochaeta americana	-	-	-	-	-	-	-	-	-	-	-	-	-
Gypsophila tubulosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum sp.	-	1.48	-	-	-	-	-	-	-	-	-	-	-
Hypericum perforatum	-	4.30	-	-	-	-	-	-	-	-	-	-	-
Hypochaeris glabra	-	-	-	-	0.97	-	7.42	0.19	0.06	0.55	-	0.93	-
Hypochaeris radicata	10.91	10.36	0.69	8.24	11.65	17.85	-	-	5.69	0.15	0.05	-	-
Lactuca serriola	-	-	-	-	-	-	-	-	-	-	-	-	-
Linaria arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Linaria pelisseriana	-	-	-	0.05	-	-	-	-	-	-	-	-	-
Linum trigynum	-	-	-	-	-	-	-	-	-	-	-	-	-
Logfia gallica	-	-	0.01	-	0.25	0.04	-	-	-	-	-	-	-
Lolium spp.	0.11	31.03	-	-	-	-	0.26	-	-	-	3.28	1.76	-
Modiola caroliniana	-	-	-	-	-	-	-	-	-	-	-	-	-
Moenchia erecta	0.02	-	-	-	0.10	-	-	-	0.09	-	-	-	-
Myosotis discolor	-	-	-	-	-	-	-	-	0.26	-	-	-	-
Nassella trichotoma	-	-	-	-	-	-	-	-	-	-	-	-	-
Paronychia brasiliana	0.15	-	-	-	-	-	-	-	-	0.45	-	-	-
Paspalum dilatatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Petrorhagia nanteuilii	-	-	-	-	-	-	0.08	0.17	-	0.08	-	0.11	-
Phalaris aquatica	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago coronopus	-	-	-	-	0.47	-	-	-	-	-	-	-	-
Plantago lanceolata	-	-	-	-	-	-	-	-	-	-	-	-	-
Poa bulbosa	5.82	1.25	-	-	-	-	-	-	0.05	-	-	-	4.22
Romulea rosea	-	-	-	-	-	0.47	-	-	-	-	-	-	-

Site code	WG92-3	WG92-4	MF22A-1	MF22A-2	MF22A-3	MF22A-4	MF19A-1	MF19A-2	MF19A-3	MF19A-4	WG81-1	WG81-2	WG81-3
Rosa rubiginosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Salvia verbenaca	-	3.67	-	-	-	-	-	-	-	-	-	-	-
Sherardia arvensis	-	-	-	-	0.06	-	-	-	-	-	-	-	-
Silene gallica	-	-	-	-	-	-	-	-	-	-	-	-	-
Sisymbrium officinale	-	-	-	-	-	-	-	-	-	-	-	-	-
Soliva sessilis	-	-	-	-	-	-	-	-	-	-	-	-	-
Tolpis barbata	-	-	0.02	-	0.02	0.13	-	-	-	-	-	-	-
Trifolium angustifolium	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium arvense	0.03	0.09	-	-	0.18	-	-	-	-	-	0.35	0.75	0.04
Trifolium campestre	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium dubium	0.09	-	-	-	-	0.04	-	-	-	0.02	-	-	-
Trifolium glomeratum	35.31	2.61	-	-	0.60	-	-	-	-	-	-	-	-
Trifolium striatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium subterraneum	46.13	26.90	0.40	0.13	3.07	1.78	0.05	-	-	0.03	0.02	0.20	-
Vulpia spp.	0.02	0.06	0.59	0.47	0.03	-	1.67	3.96	0.15	0.40	0.14	-	0.63

Site code	WG81-4	WG150A-1	WG150A-2	WG150A-3	WG150A-4	MF32-1	MF32-2	MF32-3	MF32-4	WG63-1	WG63-2	WG63-3	WG63-4
Floristic group	2	6	6	6	6	5	2	2	3	2	2	4	2
a) Ground cover attributes													
Total biomass kgha^{-1}	612	320	349	369	329	512	264	267	578	501	462	531	390
Live plant basal area %	16.7	9.2	14.2	13.3	11.7	16.7	19.2	23.3	15.8	10.8	7.5	10.8	4.2
Litter %	62.5	79.2	72.5	75.0	84.2	69.2	40.8	46.7	32.5	78.3	70.8	73.3	70.8
Litter depth where present (mm)	12.8	8.1	10.2	10.1	13.8	14.3	14.4	16.1	17.4	8.0	12.1	10.0	16.9
Bare ground %	10.8	6.7	3.3	6.7	1.7	9.2	28.3	30.0	39.2	5.8	19.2	8.3	18.3
Fallen log %	2.5	2.5	1.7	0.8	-	1.7	4.2	-	-	0.8	1.7	4.2	-
Cryptogam %	7.5	1.7	8.3	4.2	1.7	3.3	7.5	-	12.5	4.2	0.8	3.3	4.2
Rock %	-	0.8	-	-	0.8	-	-	-	-	-	-	-	2.5
b) Soil attributes (0 - 10 cm)													
Nitrate-N (mgkg^{-1})	<0.25	1.6	11.0	4.1	3.9	8.9	1.4	1.3	1.9	0.4	1.0	1.0	<0.25
Carbon (%)	2.0	2.3	2.6	2.5	2.6	3.8	2.8	2.7	2.4	1.6	2.2	2.1	2.6
Nitrogen (%)	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Electrical conductivity (dSm^{-1})	<0.05	<0.05	0.1	<0.05	0.1	0.1	<0.05	<0.05	<0.05	<0.05	0.1	0.1	0.1
pH(CaCl2)	4.2	4.4	4.8	4.5	4.6	4.5	4.4	4.4	4.2	4.5	4.8	4.9	4.9
pH(water)	5.1	5.2	5.6	5.3	5.4	5.2	5.1	5.3	5.1	5.4	5.5	5.6	5.6
Available phosphorous (mgkg^{-1})	<4	5.0	7.0	6.0	12.0	10.0	8.0	6.0	7.0	<4	6.0	6.0	7.0
c) Native plant species (kg ha^{-1})													
Acacia dealbata	-	-	-	-	-	-	-	-	-	-	-	-	-
Acacia gunnii	-	-	-	-	-	-	-	-	-	-	-	-	-
Acacia parramattensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Acaena ovina	-	0.08	-	0.06	0.62	-	2.68	3.22	-	15.12	-	1.20	2.38
Alternanthera sp. *A*	-	0.01	-	-	0.05	-	0.20	-	-	-	-	-	-
Aristida ramosa	288	-	14.93	18.05	-	2.22	6.09	1.19	45.60	103	36.22	32.64	45.05
Arthropodium minus	0.01	-	-	-	-	-	-	-	-	-	-	-	0.07
Asperula conferta	-	-	-	-	-	-	-	9.39	-	-	0.83	-	0.08
Astroloma humifusum	-	-	-	-	-	-	-	-	-	-	-	-	-
Austrodanthonia spp.	52.66	10.06	73.87	73.27	86.24	100	108	102	43.64	178	108	92.08	124
Austrostipa bigeniculata	-	-	-	-	-	-	-	-	-	-	-	-	-
Austrostipa densiflora	5.88	-	109	18.13	-	-	-	-	-	88.15	-	22.24	42.25
Austrostipa scabra	-	0.03	-	10.41	1.56	0.33	0.51	-	-	0.87	18.09	2.96	-
Bossiaea buxifolia	-	-	-	-	-	-	-	-	-	-	8.20	-	-
Bossiaea prostrata	-	-	-	-	-	-	-	-	-	-	-	-	-
Bothriochloa macra	-	64.95	0.22	45.69	27.48	17.58	12.02	1.91	-	5.79	21.87	0.16	4.74
Brachyloma daphnoides	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulbine bulbosa	-	-	-	-	-	-	-	0.25	-	-	0.87	0.20	-
Carex inversa	-	0.20	-	0.27	6.29	-	-	-	-	1.10	6.69	0.04	-
Chamaesyce drummondii	-	-	-	-	-	-	-	-	-	0.36	-	-	-
Cheilanthes spp.	-	-	0.20	1.66	-	-	3.58	-	0.10	2.42	-	-	-
Chloris truncata	-	-	-	-	-	0.86	0.56	-	-	2.79	-	-	0.07
Chrysocephalum apiculatum	-	-	-	-	-	-	-	-	-	-	-	3.06	15.49
Chrysocephalum semipapposum	-	-	-	-	-	-	-	-	-	-	-	-	-
Convolvulus angustissimus	-	-	-	-	-	-	-	-	-	-	14.48	0.25	0.90
Cotula australis	-	-	-	-	-	0.07	-	-	-	-	0.65	-	-

Site code	WG81-4	WG150A-1	WG150A-2	WG150A-3	WG150A-4	MF32-1	MF32-2	MF32-3	MF32-4	WG63-1	WG63-2	WG63-3	WG63-4
Craspedia variabilis	-	-	-	-	-	-	-	-	-	-	-	-	-
Crassula sieberiana	0.02	0.15	-	0.05	0.16	-	-	-	-	-	-	-	-
Cymbonotus spp.	-	-	-	-	-	0.02	-	-	-	-	-	-	7.19
Cynodon dactylon	-	-	-	-	-	0.13	-	-	-	-	-	-	-
Cynoglossum suaveolens	-	-	-	-	-	-	-	-	-	-	-	-	-
Daucus glochidiatus	-	-	-	-	-	0.14	0.02	0.26	-	-	-	-	0.03
Daviesia genistifolia	-	-	-	-	-	9.15	-	-	-	-	-	-	-
Desmodium varians	3.15	-	-	-	-	-	-	-	-	-	0.24	1.21	5.45
Dianella revoluta	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichelachne spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichopogon fimbriatus	-	-	-	-	-	-	-	-	-	7.31	0.08	1.24	0.10
Dillwynia sericea	39.49	-	-	-	-	-	-	-	3.71	-	-	-	-
Diuris sulphurea	-	-	-	-	-	-	-	-	-	-	-	-	-
Drosera peltata	-	-	-	-	-	-	-	-	-	-	-	-	-
Einadia nutans	-	-	-	-	-	0.06	-	-	-	4.49	-	7.27	-
Eleocharis acuta	-	-	-	-	-	-	-	-	-	-	-	-	-
Elymus scaber	1.19	4.26	8.53	21.80	18.01	3.65	0.23	0.62	0.03	4.30	2.25	14.36	6.24
Enneapogon nigricans	-	-	-	-	-	-	-	-	-	-	-	-	-
Eragrostis brownii	-	-	-	-	-	-	-	0.18	-	-	-	-	-
Erodium crinitum	-	-	-	-	-	-	-	-	-	-	-	-	-
Eryngium rostratum	-	-	-	-	-	-	-	-	-	-	-	-	-
Euchiton gymnocephalus	-	-	-	-	-	-	-	-	-	-	-	-	-
Euchiton sphaericus	-	-	-	0.02	-	-	-	-	-	-	-	-	-
Galium gaudichaudii	-	-	-	-	-	-	-	-	-	-	-	-	-
Geranium solanderi	0.04	0.80	-	-	0.43	0.20	0.04	0.04	-	1.59	0.53	-	-
Glycine spp.	-	-	-	-	-	-	-	-	-	-	1.12	-	2.84
Gonocarpus tetragynus	14.94	-	-	0.02	-	-	6.69	6.39	1.68	0.91	0.80	0.81	2.02
Goodenia hederacea	4.01	-	-	-	-	-	0.01	0.01	0.14	0.38	0.02	0.62	-
Goodenia pinnatifida	-	-	-	-	-	-	-	-	-	-	-	-	-
Haloragis heterophylla	-	-	-	-	-	0.06	0.23	0.22	0.76	-	-	-	-
Hibbertia obtusifolia	34.32	-	-	-	-	-	-	-	-	-	-	-	2.23
Hovea heterophylla	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrocotyle laxiflora	1.01	0.08	-	-	-	1.68	0.95	1.24	0.06	2.56	2.56	0.99	6.46
Hypericum gramineum	-	-	0.06	-	-	-	0.04	1.79	0.43	0.44	0.20	-	0.24
Isoetopsis graminifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Joycea pallida	-	-	0.15	-	-	133	2.03	6.92	357	-	-	-	-
Juncus subgen. *Genuini*	0.78	0.98	4.52	7.49	2.38	0.12	-	1.47	-	0.12	1.65	-	10.03
Leptorhynchos squamatus	3.93	-	-	-	-	0.45	-	-	2.22	0.05	0.19	2.76	14.93
Lissanthe strigosa	53.81	-	-	-	-	-	-	-	-	-	-	92.66	-
Lomandra filiformis	20.11	20.27	9.65	-	-	13.48	11.59	10.55	11.60	7.45	10.49	21.29	3.00
Lomandra multiflora	-	-	-	-	-	6.18	0.53	-	5.93	-	-	-	-
Luzula spp.	0.24	-	-	-	-	0.29	-	-	-	-	-	-	0.58
Lythrum hyssopifolia	-	-	0.17	-	-	-	-	-	-	-	-	-	-
Melichrus urceolatus	-	-	-	-	-	141.26	-	-	4.02	-	-	-	-
Mentha diemenica	-	-	-	-	-	-	-	-	-	-	0.92	-	-
Microlaena stipoides	1.04	38.52	18.75	17.53	2.37	-	-	4.25	-	-	2.66	-	-
Microseris lanceolata	-	-	-	-	-	-	-	-	-	-	-	-	-
Opercularia hispida	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxalis perennans	0.42	-	0.06	1.13	0.29	1.75	1.54	-	-	0.36	0.85	0.06	0.38
Panicum effusum	-	-	13.82	11.25	-	5.01	6.68	1.77	-	3.06	-	-	1.48
Pimelea curviflora	-	-	-	-	-	-	-	-	-	-	-	-	-
Pimelea linifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago gaudichaudii	-	-	-	-	-	-	-	-	-	-	-	-	0.03
Plantago varia	-	-	-	-	-	-	-	-	-	-	1.27	26.26	20.78
Poa sieberiana	6.30	-	-	-	-	7.07	-	-	2.14	-	-	-	0.03
Pultenaea procumbens	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus sessiliflorus	-	-	-	-	-	-	-	-	-	-	-	-	-
Rumex brownii	-	2.82	-	-	0.42	-	-	-	-	-	-	-	-
Schoenus apogon	-	-	-	-	-	-	-	-	-	-	-	-	-
Scleranthus biflorus	-	-	0.10	-	-	-	-	-	-	-	-	-	-
Senecio hispidulus	-	-	-	-	-	-	-	-	-	-	-	-	-
Senecio quadridentatus	-	-	-	-	-	-	-	-	-	-	-	-	-
Solenogyne dominii	0.92	1.04	-	1.13	0.13	3.25	1.18	1.30	1.17	-	0.24	0.26	0.09
Stackhousia monogyna	-	-	-	-	-	-	-	-	-	-	-	0.92	-
Stuartina muelleri	-	-	-	-	-	-	-	-	-	-	-	-	-
Stylidium graminifolium	-	-	-	-	-	-	-	-	-	-	-	-	-
Thelymitra sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Themeda australis	58.65	-	-	-	-	10.63	60.26	91.72	65.81	37.89	84.48	166	22.75
Thysanotus patersonii	0.07	-	-	-	-	-	-	-	-	-	-	-	-
Tricoryne elatior	-	-	-	-	0.10	0.01	0.23	4.75	8.59	18.55	10.52	3.20	2.01

Site code	WG81-4	WG150A-1	WG150A-2	WG150A-3	WG150A-4	MF32-1	MF32-2	MF32-3	MF32-4	WG63-1	WG63-2	WG63-3	WG63-4
Triptilodiscus pygmaeus	-	-	-	-	-	2.62	5.52	4.73	4.84	1.42	-	0.05	-
Viola betonicifolia	-	-	-	-	-	-	-	-	-	-	-	3.21	-
Vittadinia cuneata	-	-	-	-	-	-	-	-	-	-	-	-	-
Vittadinia muelleri	-	-	-	-	-	-	6.18	-	-	-	-	-	-
Wahlenbergia spp.	2.14	-	-	-	0.01	0.14	0.41	0.96	-	1.07	1.41	0.85	1.53
Wurmbea dioica	-	-	-	-	-	-	-	0.36	0.71	0.24	-	0.11	-
d) Exotic plant species (kg ha^{-1})													
Acetosella vulgaris	-	-	1.03	1.94	12.62	-	-	0.06	-	-	3.47	6.31	-
Aira spp.	1.89	0.04	3.05	0.21	0.12	0.55	0.15	0.34	1.22	2.40	0.19	1.09	0.04
Anagallis arvensis	-	0.07	-	-	-	-	-	-	-	-	-	-	-
Aphanes arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Arctotheca calendula	-	35.61	4.45	5.59	4.48	9.93	0.02	-	0.12	-	0.11	-	0.81
Briza maxima	-	-	-	-	-	-	-	-	1.26	-	-	-	-
Briza minor	-	0.28	0.31	0.02	0.90	-	0.04	0.02	0.29	0.30	0.54	0.16	-
Bromus diandrus	-	-	0.06	0.05	0.91	0.05	4.82	-	-	-	0.18	6.99	0.85
Bromus hordeaceus	0.27	1.38	8.59	2.73	8.99	0.18	0.23	0.73	-	-	0.11	0.84	0.27
Bromus rubens	-	-	-	-	-	-	-	-	-	-	-	-	0.26
Carduus pycnocephalus	-	-	-	-	-	-	-	-	-	-	-	-	-
Carthamus lanatus	-	-	-	-	-	-	-	-	-	-	-	-	-
Centaurium erythraea	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondrilla juncea	-	-	-	-	-	-	-	-	-	0.92	15.18	0.27	10.00
Cicendia quadrangularis	-	-	-	-	-	-	0.07	-	3.22	-	-	-	-
Echium plantagineum	-	-	-	-	-	-	-	-	-	-	-	-	-
Erodium botrys	-	-	0.06	-	-	-	-	-	-	-	-	-	-
Erodium cicutarium	-	0.06	-	-	-	2.18	-	-	-	-	-	-	-
Galium divaricatum	2.60	0.01	-	-	-	0.15	8.01	0.57	0.20	-	-	-	-
Galium murale	-	-	-	-	-	-	-	-	-	-	-	-	-
Gamochaeta americana	-	-	-	-	-	-	-	-	-	-	-	-	-
Gypsophila tubulosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Hypochaeris glabra	0.06	0.88	0.36	0.67	-	0.56	4.03	1.74	4.05	0.91	0.32	0.22	0.22
Hypochaeris radicata	0.40	12.76	0.62	0.23	0.06	-	1.45	-	0.04	2.84	0.08	0.25	-
Lactuca serriola	-	-	-	-	-	-	-	-	-	-	-	-	-
Linaria arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Linaria pelisseriana	-	-	-	-	-	-	-	-	-	-	-	-	-
Linum trigynum	-	-	-	-	-	-	-	-	-	-	-	-	-
Logfia gallica	-	-	-	0.07	-	-	0.01	-	1.71	-	-	0.81	0.22
Lolium spp.	11.33	4.36	29.05	17.38	38.22	-	-	-	-	0.02	36.59	3.98	18.58
Modiola caroliniana	-	-	-	-	-	-	-	-	-	-	-	-	-
Moenchia erecta	-	0.06	0.04	0.02	0.27	-	-	-	-	-	-	-	-
Myosotis discolor	-	0.03	-	-	-	-	-	-	-	-	-	-	-
Nassella trichotoma	-	-	-	-	-	-	-	-	-	-	-	1.93	-
Paronychia brasiliana	-	-	-	-	-	-	-	-	-	-	-	-	-
Paspalum dilatatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Petrorhagia nanteuilii	0.78	0.03	-	-	-	0.03	-	-	-	-	0.17	0.03	1.85
Phalaris aquatica	-	47.43	25.80	59.16	55.58	-	-	-	-	-	33.58	-	-
Plantago coronopus	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago lanceolata	-	-	-	-	-	-	-	-	-	-	-	-	-
Poa bulbosa	-	-	-	-	1.45	-	-	-	-	-	2.80	-	1.04
Romulea rosea	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosa rubiginosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Salvia verbenaca	-	-	-	-	-	-	-	-	-	-	-	-	-
Sherardia arvensis	-	0.02	-	-	-	-	-	-	-	-	-	-	-
Silene gallica	-	-	-	-	-	-	-	-	-	-	-	-	-
Sisymbrium officinale	-	-	-	-	-	-	-	-	-	-	-	-	-
Soliva sessilis	-	-	-	-	-	-	-	-	-	-	-	-	-
Tolpis barbata	-	-	-	-	-	-	1.87	0.22	-	0.06	-	-	-
Trifolium angustifolium	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium arvense	0.92	-	-	-	-	0.13	0.20	0.05	-	1.91	12.14	1.80	0.11
Trifolium campestre	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium dubium	-	0.66	0.06	0.84	-	19.29	-	0.25	2.38	-	-	-	0.21
Trifolium glomeratum	-	1.11	-	0.67	-	2.37	0.11	0.89	-	-	0.03	-	0.21
Trifolium striatum	-	-	-	-	-	0.56	-	-	-	-	-	-	-
Trifolium subterraneum	0.31	68.97	19.13	50.61	45.83	7.89	3.02	3.16	0.08	0.21	0.21	0.26	0.34
Vulpia spp.	0.08	1.60	0.55	0.47	7.83	1.19	0.04	-	0.15	0.61	6.54	0.11	0.34

Site code	WG76-1	WG76-2	WG76-3	WG76-4	WG109-1	WG109-2	WG109-3	WG109-4	MF37-1	MF37-2	MF37-3	MF37-4	MF25A-1
Floristic group	3	4	2	2	1	1	1	1	2	3	2	5	2
a) Ground cover attributes													
Total biomass kgha^{-1}	602	359	415	308	457	458	947	834	834	849	495	599	436
Live plant basal area %	7.5	7.5	5.8	5.0	10.0	8.3	14.2	8.3	15.8	15.0	8.3	10.0	10.8
Litter %	75.0	67.5	77.5	75.8	78.3	77.5	77.5	60.8	62.5	65.0	62.5	73.3	75.0
Litter depth where present (mm)	11.4	10.3	13.5	14.3	17.3	14.5	12.8	13.4	6.6	16.1	13.6	13.8	10.5
Bare ground %	10.8	19.2	10.8	12.5	3.3	6.7	8.3	19.2	20.0	15.0	19.2	8.3	4.2
Fallen log %	-	5.0	1.7	1.7	3.3	5.0	-	8.3	-	-	3.3	-	0.8
Cryptogam %	0.8	0.8	3.3	1.7	5.0	2.5	-	0.8	1.7	5.0	6.7	8.3	9.2
Rock %	5.8	-	0.8	3.3	-	-	-	2.5	-	-	-	-	-
b) Soil attributes (0 - 10 cm)													
Nitrate-N (mgkg^{-1})	0.4	0.5	0.6	2.4	9.9	9.0	2.9	11.0	1.3	0.7	1.5	0.4	<0.25
Carbon (%)	2.8	2.3	2.6	2.8	4.2	3.6	3.0	4.7	3.0	2.6	2.9	2.7	2.5
Nitrogen (%)	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.2	0.1	0.2	0.1	0.1
Electrical conductivity (dSm^{-1})	0.1	<0.05	0.1	0.1	0.1	0.1	<0.05	0.1	<0.05	<0.05	0.1	<0.05	0.1
pH(CaCl2)	4.6	4.8	4.9	4.9	4.3	4.4	4.3	4.3	4.6	4.5	4.7	4.5	4.2
pH(water)	5.3	5.6	5.7	5.7	5.0	5.0	5.1	5.0	5.4	5.3	5.4	5.3	5.0
Available phosphorous (mgkg^{-1})	6.0	5.0	5.0	6.0	18.0	13.0	10.0	23.0	9.0	6.0	10.0	8.0	<4
c) Native plant species (kg ha^{-1})													
Acacia dealbata	-	-	-	-	-	-	-	-	-	0.03	-	-	-
Acacia gunnii	-	-	-	-	-	-	-	-	-	-	-	-	-
Acacia parramattensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Acaena ovina	5.93	1.19	0.21	0.02	-	-	-	-	5.48	3.26	-	2.84	-
Alternanthera sp. *A*	-	0.62	-	0.15	-	-	0.31	-	-	-	-	-	-
Aristida ramosa	27.29	27.39	141.42	108.29	-	0.80	-	-	8.20	2.68	-	19.47	12.65
Arthropodium minus	-	-	0.04	-	-	-	-	-	-	-	-	-	-
Asperula conferta	-	-	-	1.28	-	-	-	-	-	-	-	-	11.97
Astroloma humifusum	13.48	-	-	-	-	-	-	-	-	-	-	-	-
Austrodanthonia spp.	14.51	42.30	62.85	67.05	193	168	215	74.68	179	80.40	168	167	192
Austrostipa bigeniculata	-	1.25	-	-	-	-	127	4.94	-	-	-	-	-
Austrostipa densiflora	2.07	-	10.19	4.95	55.45	16.55	32.29	11.67	-	-	-	-	-
Austrostipa scabra	0.89	2.08	2.59	10.31	37.45	89.10	97.89	87.72	9.71	2.80	18.93	-	-
Bossiaea buxifolia	0.38	-	-	-	-	-	-	-	-	1.51	-	-	-
Bossiaea prostrata	0.32	-	0.25	-	-	-	-	-	-	6.44	-	-	-
Bothriochloa macra	0.22	4.74	36.50	20.51	0.27	-	0.99	6.30	48.47	19.10	59.11	30.60	9.20
Brachyloma daphnoides	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulbine bulbosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex inversa	0.72	0.59	-	5.82	-	7.47	0.75	0.14	0.24	-	-	0.23	2.76
Chamaesyce drummondii	-	-	-	-	-	-	-	-	-	0.10	-	-	0.93
Cheilanthes spp.	0.08	-	0.73	1.63	-	-	-	-	0.25	-	-	-	-
Chloris truncata	-	-	-	-	-	-	0.11	-	-	0.26	0.26	3.91	3.57
Chrysocephalum apiculatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysocephalum semipapposum	-	-	-	-	-	-	-	-	-	-	-	-	-
Convolvulus angustissimus	0.05	-	-	-	-	-	-	-	-	-	-	-	-
Cotula australis	-	-	-	-	-	-	-	0.33	-	-	-	-	-
Craspedia variabilis	-	4.42	-	-	-	-	-	-	-	-	7.19	0.04	-
Crassula sieberiana	-	-	-	-	1.50	1.45	1.04	0.78	-	-	-	-	-
Cymbonotus spp.	-	0.88	-	-	-	0.82	-	-	-	-	-	-	-
Cynodon dactylon	-	-	-	-	-	-	-	-	-	-	-	-	-
Cynoglossum suaveolens	-	-	-	-	-	-	-	-	-	-	-	-	-
Daucus glochidiatus	0.16	0.52	0.18	0.04	-	-	-	-	3.29	0.30	0.03	0.38	0.09
Daviesia genistifolia	0.82	-	-	-	-	-	-	-	-	-	-	-	-
Desmodium varians	1.32	0.59	0.89	0.71	1.04	0.14	0.65	-	-	-	-	-	-
Dianella revoluta	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichelachne spp.	-	-	-	-	0.36	-	-	-	-	-	-	-	-
Dichopogon fimbriatus	-	-	-	-	-	-	-	-	-	-	0.43	-	0.99
Dillwynia sericea	9.39	-	-	-	-	-	-	-	-	3.37	-	-	-
Diuris sulphurea	-	-	-	-	-	-	-	-	-	-	-	-	-
Drosera peltata	-	-	-	-	-	-	-	-	-	-	-	-	-
Einadia nutans	-	-	-	-	4.23	2.74	-	20.12	-	-	38.47	-	-
Eleocharis acuta	-	-	-	-	-	-	-	-	-	-	-	-	-
Elymus scaber	0.19	4.97	1.13	0.86	49.98	26.60	3.99	9.20	0.85	1.84	8.70	1.75	35.73
Enneapogon nigricans	0.02	-	-	5.19	-	-	-	-	-	0.29	-	-	-
Eragrostis brownii	-	-	-	-	-	-	-	-	-	-	-	-	0.28
Erodium crinitum	-	-	-	-	-	0.52	-	0.89	-	-	-	-	-
Eryngium rostratum	-	-	-	-	-	-	-	-	-	-	-	-	-
Euchiton gymnocephalus	-	-	-	-	-	-	-	-	-	-	-	-	-

Site code	WG76-1	WG76-2	WG76-3	WG76-4	WG109-1	WG109-2	WG109-3	WG109-4	MF37-1	MF37-2	MF37-3	MF37-4	MF25A-1
Euchiton sphaericus	-	-	-	-	-	0.41	-	-	0.03	-	-	0.04	0.28
Galium gaudichaudii	1.26	-	-	-	-	-	-	-	-	-	-	-	-
Geranium solanderi	-	-	-	-	-	-	-	-	1.85	0.03	-	-	-
Glycine spp.	0.12	0.29	1.88	0.98	-	-	-	-	-	-	-	-	-
Gonocarpus tetragynus	7.33	0.16	0.13	-	0.36	-	-	-	1.64	2.00	-	0.94	0.03
Goodenia hederacea	0.98	-	-	-	-	-	-	-	0.08	4.69	-	0.60	-
Goodenia pinnatifida	-	-	-	0.29	-	-	-	-	-	-	-	-	-
Haloragis heterophylla	-	0.16	0.18	5.83	-	-	-	-	-	-	0.13	-	0.93
Hibbertia obtusifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Hovea heterophylla	-	-	-	-	-	-	-	-	-	2.69	-	-	-
Hydrocotyle laxiflora	3.41	3.02	3.02	0.58	-	-	-	-	1.43	2.16	5.20	5.72	10.67
Hypericum gramineum	0.11	-	-	0.25	-	-	-	-	-	0.62	4.57	4.49	0.62
Isoetopsis graminifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Joycea pallida	296	-	-	0.80	-	-	-	-	-	483	-	144	-
Juncus subgen. *Genuini*	0.34	6.48	4.27	6.39	-	0.24	-	-	0.92	5.23	0.19	8.71	22.72
Leptorhynchos squamatus	5.12	6.97	0.18	0.02	-	-	-	-	0.03	-	0.22	-	-
Lissanthe strigosa	-	-	-	-	-	-	-	-	375	1.55	86.12	-	-
Lomandra filiformis	75.52	31.65	78.39	10.73	-	20.55	-	-	8.60	19.94	14.65	28.02	28.86
Lomandra multiflora	-	-	-	-	-	-	-	-	-	-	-	-	-
Luzula spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Lythrum hyssopifolia	-	-	-	0.42	-	-	-	-	-	-	-	-	-
Melichrus urceolatus	36.50	3.85	-	-	-	-	-	-	-	-	-	-	-
Mentha diemenica	-	-	-	0.17	-	-	-	-	-	-	-	-	-
Microlaena stipoides	-	29.15	1.41	23.19	-	9.64	38.08	0.09	-	-	15.23	10.21	12.11
Microseris lanceolata	0.09	-	-	-	-	-	-	-	-	-	-	-	-
Opercularia hispida	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxalis perennans	0.02	0.05	0.02	-	0.27	2.02	-	0.14	1.55	0.11	0.26	1.21	1.28
Panicum effusum	-	0.24	0.16	0.64	-	-	1.23	0.32	3.67	3.21	10.59	4.08	9.95
Pimelea curviflora	-	-	-	-	-	-	-	-	-	1.66	-	2.53	-
Pimelea linifolia	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago gaudichaudii	-	-	-	-	-	-	-	-	-	-	-	-	0.83
Plantago varia	0.51	-	-	-	-	-	-	-	-	-	-	-	-
Poa sieberiana	14.68	66.37	48.05	10.05	-	-	-	-	3.89	7.63	7.70	-	13.27
Pultenaea procumbens	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus sessiliflorus	-	-	-	-	-	-	-	-	-	-	-	-	-
Rumex brownii	-	-	-	-	1.16	-	0.28	0.58	-	-	-	-	-
Schoenus apogon	-	-	-	-	-	-	-	-	-	-	-	-	-
Scleranthus biflorus	-	-	-	-	-	-	-	-	-	-	-	1.03	-
Senecio hispidulus	-	-	-	-	-	-	-	-	-	-	-	-	-
Senecio quadridentatus	-	-	-	-	-	-	-	-	-	-	-	-	-
Solenogyne dominii	-	7.64	0.81	1.55	-	-	-	-	2.99	1.29	1.54	2.71	7.56
Stackhousia monogyna	1.04	-	-	-	-	-	-	-	-	-	-	-	-
Stuartina muelleri	-	-	-	-	-	-	-	-	-	-	-	-	-
Stylidium graminifolium	-	-	-	-	-	-	-	-	-	-	-	-	-
Thelymitra sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Themeda australis	76.69	106	9.33	16.89	-	-	12.70	-	67.76	113	11.40	106	27.27
Thysanotus patersonii	-	-	-	-	-	-	-	-	-	-	-	-	-
Tricoryne elatior	-	-	-	0.69	-	-	-	-	0.11	0.32	0.11	1.42	1.78
Triptilodiscus pygmaeus	0.21	0.10	0.05	-	-	-	-	-	0.72	0.03	0.03	1.51	0.13
Viola betonicifolia	-	0.98	-	-	-	-	-	-	-	-	-	-	-
Vittadinia cuneata	-	-	-	-	-	-	-	-	-	-	1.05	-	-
Vittadinia muelleri	-	-	-	0.05	-	-	-	-	0.94	10.71	14.07	20.45	-
Wahlenbergia spp.	0.69	0.45	0.22	0.20	-	-	-	-	0.04	0.03	0.99	0.56	0.30
Wurmbea dioica	0.07	-	0.39	-	-	-	-	-	-	-	-	-	-
d) Exotic plant species (kg ha^{-1})													
Acetosella vulgaris	-	-	-	-	0.48	0.03	-	2.41	12.22	4.34	-	-	-
Aira spp.	-	0.18	-	-	-	0.08	0.78	-	0.14	0.12	0.10	0.43	0.48
Anagallis arvensis	-	-	-	0.05	-	-	-	-	2.06	-	-	0.13	1.15
Aphanes arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Arctotheca calendula	-	-	0.07	0.04	28.15	20.59	10.93	32.82	3.31	-	0.33	-	-
Briza maxima	-	-	-	-	-	-	-	-	0.09	-	-	0.28	-
Briza minor	-	0.20	0.06	0.02	-	-	-	-	0.09	-	0.03	0.40	-
Bromus diandrus	-	-	-	-	7.29	28.13	0.24	40.45	-	-	-	0.09	-
Bromus hordeaceus	-	0.30	0.04	-	0.39	0.62	7.52	0.61	-	0.10	-	0.04	-
Bromus rubens	-	-	-	-	-	-	-	-	-	-	-	-	-
Carduus pycnocephalus	-	-	-	-	-	-	-	-	-	-	-	0.03	-
Carthamus lanatus	-	-	-	-	-	-	-	1.16	-	-	-	-	-
Centaurium erythraea	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondrilla juncea	-	-	-	-	-	-	-	-	-	-	-	-	-

Site code	WG76-1	WG76-2	WG76-3	WG76-4	WG109-1	WG109-2	WG109-3	WG109-4	MF37-1	MF37-2	MF37-3	MF37-4	MF25A-1
Cicendia quadrangularis	-	-	-	-	-	-	-	-	-	-	-	-	-
Echium plantagineum	-	-	-	-	-	-	-	-	-	-	-	-	-
Erodium botrys	-	-	-	-	-	-	-	-	0.37	-	-	-	-
Erodium cicutarium	-	-	-	-	0.02	-	-	0.02	-	-	-	-	-
Galium divaricatum	-	-	0.02	-	-	-	-	-	-	0.56	0.09	2.63	0.08
Galium murale	-	-	-	-	-	-	-	-	-	-	-	-	-
Gamochaeta americana	-	-	-	-	-	-	-	-	-	-	-	-	-
Gypsophila tubulosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum sp.	-	-	-	-	14.11	-	-	31.80	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Hypochaeris glabra	-	0.40	0.04	0.23	0.06	2.10	0.49	0.35	1.15	-	0.28	4.61	0.81
Hypochaeris radicata	-	-	-	-	0.29	-	-	0.96	12.57	1.54	0.82	0.56	0.42
Lactuca serriola	-	-	-	-	-	8.29	-	0.29	-	-	-	-	-
Linaria arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Linaria pelisseriana	-	0.53	-	-	-	-	-	-	0.09	-	-	1.19	-
Linum trigynum	-	-	-	-	-	-	-	-	-	-	-	-	0.03
Logfia gallica	-	-	-	-	-	-	-	-	-	-	-	-	0.34
Lolium spp.	-	0.90	-	-	49.94	44.66	32.31	19.30	1.44	-	1.80	9.45	-
Modiola caroliniana	-	-	-	-	-	-	-	-	-	-	-	-	-
Moenchia erecta	-	-	-	-	-	-	-	-	-	-	-	-	-
Myosotis discolor	-	-	-	-	-	-	-	-	-	-	-	-	-
Nassella trichotoma	-	-	2.60	-	-	-	-	-	-	-	-	-	0.92
Paronychia brasiliana	-	-	-	-	-	-	-	1.71	-	-	-	-	-
Paspalum dilatatum	-	-	-	-	-	-	-	-	-	-	-	-	-
Petrorhagia nanteuilii	0.05	0.06	0.02	0.01	-	-	-	-	0.03	-	-	1.16	-
Phalaris aquatica	-	-	-	-	-	-	345	466	-	-	-	-	12.79
Plantago coronopus	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago lanceolata	-	-	-	-	-	-	-	-	-	-	-	-	-
Poa bulbosa	-	-	-	-	0.15	-	1.02	1.07	3.00	-	2.84	-	0.28
Romulea rosea	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosa rubiginosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Salvia verbenaca	-	-	-	-	-	-	-	-	-	-	-	-	-
Sherardia arvensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Silene gallica	-	-	-	-	-	-	-	-	-	-	-	-	-
Sisymbrium officinale	-	-	-	-	-	-	-	-	-	-	-	0.13	-
Soliva sessilis	-	-	-	-	-	-	-	-	-	-	-	-	-
Tolpis barbata	-	-	-	-	-	-	-	-	1.43	0.04	0.13	0.81	0.96
Trifolium angustifolium	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium arvense	0.04	0.29	0.02	-	-	-	-	-	0.32	0.12	1.18	-	-
Trifolium campestre	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium dubium	-	0.08	5.93	-	-	-	0.25	-	-	1.72	-	0.03	-
Trifolium glomeratum	-	0.03	-	0.02	-	-	0.25	-	18.09	11.66	0.28	1.42	-
Trifolium striatum	-	-	-	-	-	-	-	-	18.56	30.43	-	-	-
Trifolium subterraneum	-	0.19	-	-	7.09	1.03	3.65	0.14	31.78	12.47	9.04	0.14	8.15
Vulpia spp.	-	0.30	0.21	0.78	2.51	2.25	1.50	0.05	0.24	0.36	0.02	3.32	-

Site code	MF25A-2	MF25A-3	MF25A-4	MF11A-1	MF11A-2	MF11A-3	MF11A-4	WG148-1	WG148-2	WG148-3	WG148-4
Floristic group	2	2	2	4	4	4	3	2	2	2	2
a) Ground cover attributes											
Total biomass kgha^{-1}	450	377	404	514	514	598	1049	661	690	586	608
Live plant basal area %	10.0	5.0	7.5	7.5	10.0	12.5	10.0	15.0	14.2	10.0	17.5
Litter %	70.0	70.0	66.7	70.0	77.5	68.3	79.2	63.3	74.2	65.8	70.0
Litter depth where present (mm)	13.3	14.9	11.0	9.5	7.2	10.0	8.7	9.3	11.3	7.5	8.4
Bare ground %	15.8	19.2	22.5	11.7	10.0	5.0	10.8	8.3	7.5	15.8	6.7
Fallen log %	0.8	-	-	-	-	5.0	-	1.7	1.7	2.5	1.7
Cryptogam %	3.3	5.8	3.3	8.3	2.5	8.3	-	7.5	1.7	3.3	3.3
Rock %	-	-	-	2.5	-	0.8	-	4.2	0.8	2.5	0.8
b) Soil attributes (0 - 10 cm)											
Nitrate-N (mgkg^{-1})	<0.25	<0.25	<0.25	1.6	0.6	1.1	0.5	1.4	1.1	3.3	2.4
Carbon (%)	3.2	2.2	2.0	3.1	3.1	3.8	3.3	2.9	2.7	2.3	2.9
Nitrogen (%)	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2

Site code	MF25A-2	MF25A-3	MF25A-4	MF11A-1	MF11A-2	MF11A-3	MF11A-4	WG148-1	WG148-2	WG148-3	WG148-4
Electrical conductivity (dSm^{-1})	0.1	0.1	0.1	<0.05	<0.05	0.1	0.1	<0.05	<0.05	0.1	<0.05
pH(CaCl2)	4.1	4.2	4.2	4.6	4.6	4.6	4.4	4.6	4.4	4.5	4.7
pH(water)	4.9	5.0	5.1	5.4	5.4	5.3	5.2	5.4	5.2	5.3	5.5
Available phosphorous ($mgkg^{-1}$)	<4	<4	5.0	16.0	10.0	9.0	6.0	9.0	7.0	8.0	7.0
c) Native plant species (kg ha^{-1})											
Acacia dealbata	13.10	-	-	-	-	-	-	-	-	-	-
Acacia gunnii	-	-	-	-	-	-	-	-	-	-	-
Acacia parramattensis	-	-	-	-	-	-	-	-	-	-	-
Acaena ovina	-	-	0.08	0.41	0.04	19.70	3.74	-	0.43	-	17.04
Alternanthera sp. *A*	-	-	-	-	0.11	-	0.14	-	-	-	-
Aristida ramosa	102.14	29.27	98.07	0.96	-	-	1.33	45.10	48.13	1.76	12.97
Arthropodium minus	-	0.16	0.67	0.03	-	-	-	-	-	-	-
Asperula conferta	-	-	-	-	-	-	0.40	-	-	-	-
Astroloma humifusum	-	-	-	-	-	-	-	-	-	-	-
Austrodanthonia spp.	82.55	262	194	126	82.89	87.37	27.30	115	50.13	87.34	110
Austrostipa bigeniculata	-	-	-	-	-	-	-	-	-	-	-
Austrostipa densiflora	-	-	-	-	-	-	-	282	363	231	54.76
Austrostipa scabra	-	-	0.85	21.31	21.05	13.92	-	11.77	2.61	46.47	70.16
Bossiaea buxifolia	-	-	-	-	8.70	-	0.24	-	-	-	-
Bossiaea prostrata	-	-	-	0.09	-	6.48	-	-	-	-	-
Bothriochloa macra	8.95	0.08	-	10.21	-	-	0.44	27.99	114.62	53.46	66.09
Brachyloma daphnoides	-	-	-	-	-	-	-	-	-	-	-
Bulbine bulbosa	-	-	-	0.29	-	0.28	1.37	-	-	-	-
Carex inversa	2.38	0.58	-	0.16	-	-	-	0.31	0.18	0.33	0.54
Chamaesyce drummondii	-	0.08	-	0.86	-	0.09	-	-	-	-	-
Cheilanthes spp.	-	0.87	0.32	-	-	-	-	0.12	4.87	1.88	0.40
Chloris truncata	0.29	9.52	0.26	-	-	-	-	-	0.37	-	-
Chrysocephalum apiculatum	-	-	-	-	-	-	-	-	-	-	-
Chrysocephalum semipapposum	-	-	-	-	-	-	-	-	-	-	-
Convolvulus angustissimus	-	-	-	-	-	-	-	-	-	-	0.23
Cotula australis	-	-	-	-	-	-	-	-	-	-	0.04
Craspedia variabilis	-	-	-	-	-	-	0.42	-	-	-	-
Crassula sieberiana	-	-	-	-	-	-	-	0.14	-	-	-
Cymbonotus spp.	-	-	-	0.46	0.31	-	-	-	-	-	-
Cynodon dactylon	-	-	-	-	-	-	-	-	-	-	-
Cynoglossum suaveolens	-	-	-	-	-	-	-	-	-	-	-
Daucus glochidiatus	0.03	-	0.03	0.12	0.40	0.31	0.49	-	-	-	-
Daviesia genistifolia	-	-	19.80	-	-	-	-	-	-	-	-
Desmodium varians	-	-	-	-	-	0.12	-	1.32	0.10	0.23	0.28
Dianella revoluta	-	-	-	-	-	-	-	-	-	-	-
Dichelachne spp.	-	-	-	0.43	-	-	-	-	-	-	-
Dichopogon fimbriatus	-	-	-	-	-	3.66	0.13	-	-	-	-
Dillwynia sericea	11.97	-	-	-	-	-	-	-	-	-	-
Diuris sulphurea	-	-	-	-	-	-	-	-	-	-	-
Drosera peltata	-	-	-	-	-	-	-	-	-	-	-
Einadia nutans	-	-	-	-	-	-	-	-	-	11.96	-
Eleocharis acuta	-	-	-	-	-	-	-	-	-	-	-
Elymus scaber	3.19	12.38	7.16	4.51	6.78	4.08	3.35	3.62	3.30	4.16	1.51
Enneapogon nigricans	-	-	-	36.87	0.92	16.99	-	-	-	-	0.11
Eragrostis brownii	-	1.38	0.85	-	-	-	-	-	-	-	-
Erodium crinitum	-	-	-	-	-	-	-	-	-	-	-
Eryngium rostratum	-	-	-	-	-	-	-	-	-	-	-
Euchiton gymnocephalus	-	-	-	-	-	-	-	-	-	0.55	-
Euchiton sphaericus	-	-	-	-	-	-	-	-	-	0.04	-
Galium gaudichaudii	-	-	-	-	-	-	-	-	-	-	-
Geranium solanderi	-	-	-	0.04	0.09	6.04	1.60	0.06	-	-	-
Glycine spp.	-	-	-	-	-	-	-	-	-	-	-
Gonocarpus tetragynus	5.35	-	7.05	0.12	1.01	-	0.52	-	1.18	0.12	-
Goodenia hederacea	2.40	0.30	0.08	-	1.77	-	3.15	-	-	-	-
Goodenia pinnatifida	-	-	-	-	-	-	-	-	-	-	-
Haloragis heterophylla	0.81	0.99	1.09	-	0.04	-	0.49	-	-	-	0.03
Hibbertia obtusifolia	-	-	-	-	-	-	-	-	-	-	-
Hovea heterophylla	-	-	-	-	-	-	-	-	-	-	-
Hydrocotyle laxiflora	6.91	0.07	0.27	8.07	3.76	9.60	4.91	-	-	-	-
Hypericum gramineum	0.09	-	1.23	0.41	1.32	11.14	0.04	-	-	-	-
Isoetopsis graminifolia	-	-	-	-	-	-	-	-	-	-	-
Joycea pallida	-	-	15.23	2.46	-	-	518	-	-	-	-
Juncus subgen. *Genuini*	15.00	0.62	2.87	1.14	0.43	-	0.59	0.18	0.59	-	-
Leptorhynchos squamatus	-	-	-	4.49	30.10	-	0.09	0.39	-	-	1.17

Site code	MF25A-2	MF25A-3	MF25A-4	MF11A-1	MF11A-2	MF11A-3	MF11A-4	WG148-1	WG148-2	WG148-3	WG148-4
Lissanthe strigosa	-	-	-	-	-	-	-	-	-	-	-
Lomandra filiformis	43.66	-	10.52	22.52	27.17	20.86	48.61	26.95	43.11	1.89	39.28
Lomandra multiflora	-	-	-	4.72	4.87	0.36	13.98	-	-	-	-
Luzula spp.	-	-	-	-	-	-	-	-	-	-	-
Lythrum hyssopifolia	-	-	-	-	-	-	-	-	-	-	-
Melichrus urceolatus	-	-	-	-	-	-	-	-	-	-	-
Mentha diemenica	-	-	-	-	-	-	0.11	-	-	-	-
Microlaena stipoides	10.08	3.44	-	-	-	15.08	-	0.27	-	-	3.14
Microseris lanceolata	-	-	-	-	-	-	-	-	-	-	-
Opercularia hispida	-	-	-	-	-	-	-	-	-	-	-
Oxalis perennans	1.14	0.28	0.10	-	0.28	-	0.38	0.04	-	-	-
Panicum effusum	3.30	13.58	1.04	4.82	0.06	-	-	0.42	4.40	-	1.33
Pimelea curviflora	-	-	-	-	-	-	-	-	-	-	-
Pimelea linifolia	-	-	-	-	-	-	-	-	-	-	-
Plantago gaudichaudii	-	-	-	-	-	-	-	-	-	-	-
Plantago varia	-	-	-	-	-	-	-	-	-	-	-
Poa sieberiana	11.74	-	3.14	5.99	3.21	5.46	-	1.30	-	-	1.98
Pultenaea procumbens	-	-	-	-	-	-	-	-	-	-	-
Ranunculus sessiliflorus	-	-	-	-	-	-	-	-	-	-	-
Rumex brownii	-	-	-	1.03	-	0.19	0.28	-	-	-	-
Schoenus apogon	-	-	-	-	-	0.05	-	-	-	-	-
Scleranthus biflorus	-	-	-	-	-	-	-	-	-	-	-
Senecio hispidulus	-	-	-	-	-	-	-	-	-	-	-
Senecio quadridentatus	-	-	-	-	-	-	-	-	-	-	-
Solenogyne dominii	22.85	7.79	0.31	-	-	-	0.81	0.28	0.49	2.14	0.94
Stackhousia monogyna	-	-	-	-	-	-	-	-	-	-	-
Stuartina muelleri	-	-	-	0.03	-	-	-	-	-	0.06	-
Stylidium graminifolium	-	-	-	-	-	-	-	-	-	-	-
Thelymitra sp.	-	-	-	-	-	-	-	-	-	-	-
Themeda australis	24.36	-	10.21	185	284	338	387	89.27	12.42	48.56	72.82
Thysanotus patersonii	-	-	-	-	-	-	-	-	-	-	-
Tricoryne elatior	8.20	0.85	6.09	5.32	4.34	7.39	16.40	7.97	6.42	5.14	16.42
Triptilodiscus pygmaeus	5.72	0.43	0.03	1.18	0.96	0.24	0.37	0.44	0.67	0.12	-
Viola betonicifolia	-	-	-	-	-	-	-	-	-	-	-
Vittadinia cuneata	-	-	-	-	-	-	-	-	-	-	-
Vittadinia muelleri	-	1.01	-	1.21	-	11.18	-	-	-	-	-
Wahlenbergia spp.	0.07	0.37	1.23	-	0.28	-	-	-	-	0.27	-
Wurmbea dioica	-	-	-	0.36	-	-	-	-	-	0.05	0.60
d) Exotic plant species (kg ha^{-1})											
Acetosella vulgaris	-	-	-	11.53	-	-	-	-	-	-	-
Aira spp.	0.19	0.15	0.21	0.31	0.65	0.36	0.84	1.00	0.63	0.41	0.30
Anagallis arvensis	5.26	-	-	-	-	0.06	-	0.65	-	-	-
Aphanes arvensis	-	-	-	-	-	-	-	-	-	-	-
Arctotheca calendula	-	0.27	-	-	-	-	-	-	0.05	-	-
Briza maxima	0.03	-	-	-	-	0.42	-	3.64	-	-	1.73
Briza minor	0.03	-	-	-	0.56	0.34	0.13	-	0.18	-	0.40
Bromus diandrus	1.86	-	-	-	-	-	-	-	-	-	-
Bromus hordeaceus	0.12	-	-	1.09	0.12	1.20	-	1.20	17.55	1.73	1.71
Bromus rubens	-	-	-	12.91	-	-	-	0.10	-	0.04	3.74
Carduus pycnocephalus	-	-	-	-	-	-	-	-	-	-	-
Carthamus lanatus	-	-	-	-	-	-	-	-	-	-	18.64
Centaurium erythraea	-	-	-	-	-	-	-	-	-	-	-
Chondrilla juncea	-	-	-	-	-	0.09	-	-	-	4.34	0.11
Cicendia quadrangularis	-	-	-	-	-	-	-	-	-	-	-
Echium plantagineum	-	-	-	-	-	-	-	-	-	-	-
Erodium botrys	-	-	-	-	-	-	-	-	-	-	-
Erodium cicutarium	-	-	-	1.56	-	0.09	0.32	-	-	0.08	0.66
Galium divaricatum	-	-	-	0.42	0.06	0.17	0.24	-	-	-	-
Galium murale	-	-	-	-	-	0.05	-	-	-	-	-
Gamochaeta americana	-	-	-	-	-	-	-	-	-	-	-
Gypsophila tubulosa	-	-	-	0.03	-	-	-	-	-	-	-
Hordeum sp.	-	-	-	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-	-	-	-
Hypochaeris glabra	0.09	-	-	0.23	0.24	0.13	0.21	2.03	5.12	39.40	7.09
Hypochaeris radicata	0.08	6.44	-	0.38	-	1.05	-	0.41	2.15	-	31.64
Lactuca serriola	-	-	-	-	-	-	-	-	-	-	-
Linaria arvensis	-	-	-	-	-	-	-	-	-	-	-
Linaria pelisseriana	-	-	-	-	-	-	-	-	-	-	-
Linum trigynum	0.03	-	-	-	-	-	-	-	-	-	-

Site code	MF25A-2	MF25A-3	MF25A-4	MF11A-1	MF11A-2	MF11A-3	MF11A-4	WG148-1	WG148-2	WG148-3	WG148-4
Logfia gallica	-	0.08	0.09	-	-	-	-	-	-	-	-
Lolium spp.	0.08	0.31	-	-	-	0.15	-	17.80	-	0.25	8.72
Modiola caroliniana	-	-	-	-	-	-	-	-	-	-	-
Moenchia erecta	-	-	-	-	-	-	-	-	-	-	-
Myosotis discolor	-	-	-	0.38	-	-	-	-	-	-	-
Nassella trichotoma	-	-	-	-	-	-	-	-	-	-	-
Paronychia brasiliana	-	-	-	-	-	-	-	-	-	-	-
Paspalum dilatatum	-	-	-	-	-	-	-	-	-	-	-
Petrorhagia nanteuilii	-	-	-	1.25	0.11	2.91	-	-	0.07	0.03	-
Phalaris aquatica	33.53	-	-	-	-	-	-	-	-	-	-
Plantago coronopus	-	-	-	-	-	-	-	-	-	-	-
Plantago lanceolata	-	-	-	0.04	-	-	-	-	-	-	-
Poa bulbosa	-	3.66	-	-	-	-	-	3.14	1.35	5.30	0.12
Romulea rosea	-	-	-	-	-	-	-	-	-	-	-
Rosa rubiginosa	-	-	-	8.20	-	-	-	-	-	-	-
Salvia verbenaca	-	-	-	-	-	-	-	0.69	-	-	16.86
Sherardia arvensis	-	-	-	6.48	-	0.60	-	-	-	-	-
Silene gallica	-	-	-	-	-	-	-	-	-	-	-
Sisymbrium officinale	-	-	-	-	-	-	-	-	-	-	-
Soliva sessilis	-	-	-	-	-	-	-	-	-	-	-
Tolpis barbata	0.62	0.22	-	0.92	-	-	0.11	-	0.04	2.10	0.13
Trifolium angustifolium	-	-	-	-	-	-	-	-	-	-	-
Trifolium arvense	-	-	-	1.61	2.08	4.04	0.23	0.12	0.04	0.29	0.04
Trifolium campestre	-	-	-	-	-	-	-	0.12	-	-	-
Trifolium dubium	-	-	-	-	-	1.69	-	-	-	0.09	0.25
Trifolium glomeratum	-	-	-	-	4.25	0.06	-	1.75	1.43	-	9.54
Trifolium striatum	-	-	-	0.38	8.43	0.19	6.33	0.29	0.04	10.73	0.37
Trifolium subterraneum	-	-	0.02	12.28	2.41	5.07	0.04	9.42	0.57	19.96	32.29
Vulpia spp.	-	0.03	8.40	1.96	9.04	0.90	1.64	0.46	0.04	0.98	0.40

Site code	MF38-1	MF38-2	MF38-3	MF38-4	WG152-1	WG152-2	WG152-3	WG152-4	MF9A-1	MF9A-2
Floristic group	5	2	3	2	6	6	6	1	4	4
a) Ground cover attributes										
Total biomass kgha^{-1}	597	267	1101	204	314	346	304	650	243	258
Live plant basal area %	7.5	12.5	5.8	3.3	6.7	10.0	15.8	19.2	19.2	15.0
Litter %	66.7	66.7	77.5	79.2	75.0	74.2	62.5	71.7	23.3	26.7
Litter depth where present (mm)	12.9	12.6	18.0	18.4	6.0	5.7	4.2	7.3	13.5	22.2
Bare ground %	18.3	18.3	15.0	14.2	17.5	12.5	10.8	7.5	27.5	20.8
Fallen log %	2.5	2.5	0.8	-	-	-	2.5	1.7	1.7	1.7
Cryptogam %	5.0	-	0.8	3.3	0.8	2.5	6.7	-	26.7	32.5
Rock %	-	-	-	-	-	0.8	1.7	-	1.7	3.3
b) Soil attributes (0 - 10 cm)										
Nitrate-N (mgkg^{-1})	0.3	0.5	0.3	0.4	8.6	8.3	5.2	6.8	0.5	0.7
Carbon (%)	2.8	3.4	3.9	3.0	2.0	2.0	1.9	2.6	2.5	2.5
Nitrogen (%)	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Electrical conductivity (dSm^{-1})	0.1	0.1	<0.05	0.1	0.1	0.1	<0.05	0.1	<0.05	<0.05
pH(CaCl2)	4.2	4.5	4.1	4.3	4.4	4.4	4.4	4.8	4.5	4.5
pH(water)	5.0	5.3	4.9	5.0	5.2	5.2	5.3	5.6	5.3	5.3
Available phosphorous (mgkg^{-1})	6.0	5.0	5.0	8.0	7.0	7.0	7.0	9.0	8.0	7.0
c) Native plant species (kg ha^{-1})										
Acacia dealbata	-	-	-	-	-	-	-	-	-	-
Acacia gunnii	-	-	2.08	-	-	-	-	-	0.28	-
Acacia parramattensis	-	-	-	-	-	-	-	-	-	-
Acaena ovina	1.48	-	-	5.44	-	-	-	-	9.88	-
Alternanthera sp. *A*	-	-	-	-	-	-	0.02	-	-	-
Aristida ramosa	6.81	16.34	11.47	7.56	6.92	-	-	-	7.63	19.04
Arthropodium minus	-	-	-	-	-	0.05	-	-	-	-
Asperula conferta	-	-	-	-	-	-	-	-	-	-
Astroloma humifusum	-	-	-	-	-	-	-	-	-	-
Austrodanthonia spp.	64.34	73.90	40.09	63.89	146	174	80.00	60.03	34.17	61.88
Austrostipa bigeniculata	-	-	-	-	-	-	-	-	-	-
Austrostipa densiflora	-	-	-	-	11.38	6.98	-	-	-	11.43

Site code	MF38-1	MF38-2	MF38-3	MF38-4	WG152-1	WG152-2	WG152-3	WG152-4	MF9A-1	MF9A-2
Austrostipa scabra	1.56	7.39	4.19	0.56	24.64	28.87	12.53	22.55	40.11	17.77
Bossiaea buxifolia	-	-	-	-	-	-	-	-	1.04	-
Bossiaea prostrata	-	-	0.82	-	-	-	-	-	-	-
Bothriochloa macra	-	-	-	7.41	-	-	6.86	0.08	-	8.90
Brachyloma daphnoides	-	-	-	-	-	-	-	-	-	-
Bulbine bulbosa	-	0.07	-	-	-	-	-	-	-	-
Carex inversa	0.60	0.14	-	5.93	-	-	-	0.34	-	-
Chamaesyce drummondii	-	-	-	-	0.18	1.48	0.05	-	0.14	0.13
Cheilanthes spp.	-	-	-	-	-	-	0.53	-	-	0.14
Chloris truncata	-	-	-	-	21.10	4.06	9.78	-	-	-
Chrysocephalum apiculatum	-	-	-	-	-	-	-	-	-	-
Chrysocephalum semipapposum	-	-	-	-	-	-	-	-	-	-
Convolvulus angustissimus	-	-	-	-	-	-	5.24	-	0.06	-
Cotula australis	-	-	-	-	0.02	-	-	-	-	-
Craspedia variabilis	-	-	-	-	-	-	-	-	-	-
Crassula sieberiana	-	-	-	-	0.13	0.04	-	0.03	0.03	-
Cymbonotus spp.	-	-	-	0.49	-	-	-	-	-	-
Cynodon dactylon	-	-	-	-	-	-	-	-	-	-
Cynoglossum suaveolens	-	-	-	-	-	-	-	-	-	-
Daucus glochidiatus	-	0.34	-	0.05	-	-	-	-	0.04	0.17
Daviesia genistifolia	237	-	-	-	-	-	-	-	-	-
Desmodium varians	-	1.13	-	-	-	-	0.16	-	-	3.52
Dianella revoluta	-	8.67	-	-	-	-	-	-	-	-
Dichelachne spp.	-	-	-	-	-	-	-	-	-	-
Dichopogon fimbriatus	-	-	-	-	-	-	-	-	-	-
Dillwynia sericea	2.25	-	4.55	-	-	-	-	-	-	-
Diuris sulphurea	-	-	-	-	-	-	-	-	-	-
Drosera peltata	-	-	-	-	-	-	-	-	-	-
Einadia nutans	-	-	-	-	-	-	-	-	-	-
Eleocharis acuta	-	-	-	-	-	-	-	3.82	-	-
Elymus scaber	1.45	0.60	0.53	2.25	3.99	5.13	13.56	1.82	0.98	7.68
Enneapogon nigricans	-	-	-	-	-	-	-	-	20.75	8.65
Eragrostis brownii	-	-	-	-	0.45	-	0.03	-	-	-
Erodium crinitum	-	-	-	-	-	-	-	-	-	-
Eryngium rostratum	-	-	-	-	-	-	-	-	-	-
Euchiton gymnocephalus	-	-	0.17	0.05	-	-	-	-	-	-
Euchiton sphaericus	-	-	-	-	-	-	-	-	-	-
Galium gaudichaudii	-	-	-	-	-	-	-	-	-	-
Geranium solanderi	-	0.05	-	-	-	-	-	0.12	-	-
Glycine spp.	-	-	-	-	-	-	0.75	-	-	-
Gonocarpus tetragynus	14.34	7.04	5.45	18.41	0.06	-	-	0.11	1.50	3.47
Goodenia hederacea	0.59	-	9.47	1.98	-	-	-	-	0.25	6.92
Goodenia pinnatifida	-	-	-	-	-	-	0.67	-	-	-
Haloragis heterophylla	0.20	0.02	0.16	0.09	-	-	-	-	-	-
Hibbertia obtusifolia	0.31	-	-	-	-	-	-	-	-	-
Hovea heterophylla	-	-	-	-	-	-	-	-	-	-
Hydrocotyle laxiflora	2.03	9.62	0.89	2.48	-	-	-	-	0.01	4.30
Hypericum gramineum	1.42	3.89	-	2.68	-	-	-	-	-	-
Isoetopsis graminifolia	-	-	-	-	-	-	-	-	-	-
Joycea pallida	193	3.71	930	16.13	-	-	-	-	-	-
Juncus subgen. *Genuini*	1.51	-	7.41	-	0.02	-	-	-	-	-
Leptorhynchos squamatus	-	0.67	-	0.11	-	-	-	-	-	-
Lissanthe strigosa	15.14	-	6.79	-	-	-	-	-	-	-
Lomandra filiformis	21.37	17.25	17.98	38.62	-	2.08	0.60	-	6.16	8.74
Lomandra multiflora	-	6.18	6.18	-	-	-	-	-	-	-
Luzula spp.	0.11	-	0.03	-	-	-	-	-	0.03	-
Lythrum hyssopifolia	-	-	-	-	-	-	-	-	-	-
Melichrus urceolatus	-	51.38	-	-	-	-	-	-	13.17	5.44
Mentha diemenica	-	-	-	-	-	-	-	-	-	-
Microlaena stipoides	1.27	7.41	1.84	-	3.19	2.67	-	29.93	-	6.92
Microseris lanceolata	-	-	-	-	-	-	-	-	-	-
Opercularia hispida	-	-	0.62	-	-	-	-	-	-	-
Oxalis perennans	-	-	0.19	0.13	-	0.58	0.06	0.04	-	-
Panicum effusum	-	0.51	-	-	24.47	3.47	43.52	7.16	2.00	0.23
Pimelea curviflora	-	-	-	-	-	-	-	-	-	-
Pimelea linifolia	-	-	-	-	-	-	-	-	-	-
Plantago gaudichaudii	-	-	-	-	-	-	-	-	-	-
Plantago varia	-	-	-	-	-	-	-	-	-	-
Poa sieberiana	7.03	11.03	11.50	8.74	-	-	2.67	-	-	0.01
Pultenaea procumbens	-	-	-	-	-	-	-	-	-	-

Site code	MF38-1	MF38-2	MF38-3	MF38-4	WG152-1	WG152-2	WG152-3	WG152-4	MF9A-1	MF9A-2
Ranunculus sessiliflorus	-	-	-	-	-	-	-	-	-	-
Rumex brownii	-	-	-	-	-	-	-	1.15	-	-
Schoenus apogon	0.29	-	-	-	-	-	-	-	-	-
Scleranthus biflorus	-	-	-	-	-	-	-	-	-	-
Senecio hispidulus	-	-	-	-	-	-	-	-	-	-
Senecio quadridentatus	8.29	-	-	-	-	-	-	-	-	-
Solenogyne dominii	0.04	1.94	0.34	5.62	-	0.17	-	-	-	3.52
Stackhousia monogyna	-	-	-	-	-	-	-	-	-	-
Stuartina muelleri	-	-	-	-	-	-	-	-	-	-
Stylidium graminifolium	-	-	-	-	-	-	-	-	-	-
Thelymitra sp.	-	-	-	-	-	-	-	-	-	-
Themeda australis	6.92	30.26	7.82	8.23	0.06	0.56	8.89	-	48.16	50.42
Thysanotus patersonii	-	-	-	-	-	-	-	-	-	-
Tricoryne elatior	-	-	-	-	-	-	-	-	-	-
Triptilodiscus pygmaeus	0.70	0.15	-	-	-	-	-	-	0.04	0.90
Viola betonicifolia	-	-	-	-	-	-	-	-	-	-
Vittadinia cuneata	0.47	-	-	0.67	-	-	-	-	-	-
Vittadinia muelleri	-	-	-	1.92	-	-	0.20	-	6.45	13.54
Wahlenbergia spp.	-	0.13	2.68	0.95	-	-	-	-	3.47	-
Wurmbea dioica	0.04	0.02	-	0.15	-	-	-	-	0.20	-
d) Exotic plant species (kg ha^{-1})										
Acetosella vulgaris	-	-	-	-	0.19	0.02	0.20	0.87	0.08	-
Aira spp.	0.07	0.24	0.02	0.39	1.37	0.67	2.21	1.18	1.35	1.02
Anagallis arvensis	-	-	-	-	-	-	-	-	-	-
Aphanes arvensis	-	-	-	-	-	-	-	-	-	-
Arctotheca calendula	-	-	-	-	0.29	0.66	-	0.03	-	-
Briza maxima	0.20	0.48	-	-	-	0.10	-	-	4.24	0.82
Briza minor	0.02	0.83	0.05	-	-	-	-	-	0.97	-
Bromus diandrus	-	-	-	-	0.05	-	-	4.01	-	-
Bromus hordeaceus	-	0.05	-	-	1.21	0.63	0.08	2.98	0.29	-
Bromus rubens	-	-	-	-	-	-	-	-	-	-
Carduus pycnocephalus	-	-	-	-	-	-	-	-	-	-
Carthamus lanatus	-	-	-	-	-	-	-	-	-	-
Centaurium erythraea	-	-	-	-	-	-	-	-	-	-
Chondrilla juncea	-	-	-	-	-	-	-	0.33	-	-
Cicendia quadrangularis	-	-	-	-	-	-	-	-	-	-
Echium plantagineum	-	-	-	-	-	-	-	-	-	-
Erodium botrys	-	-	-	-	-	1.39	-	0.90	-	-
Erodium cicutarium	-	-	-	-	0.02	-	-	-	-	0.38
Galium divaricatum	-	0.02	-	-	-	-	-	-	0.15	0.08
Galium murale	-	-	-	-	-	-	-	-	-	-
Gamochaeta americana	-	-	-	-	-	-	-	-	-	-
Gypsophila tubulosa	-	-	-	-	-	-	-	-	1.51	0.15
Hordeum sp.	-	-	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-	-	-
Hypochaeris glabra	0.19	2.47	0.02	0.60	2.15	9.28	4.44	3.21	20.05	3.63
Hypochaeris radicata	-	-	-	-	-	0.02	-	9.14	-	-
Lactuca serriola	-	-	-	-	-	-	-	-	-	-
Linaria arvensis	-	-	-	-	-	-	-	-	-	-
Linaria pelisseriana	-	-	-	-	-	-	-	-	-	-
Linum trigynum	-	-	-	-	-	-	-	-	-	-
Logfia gallica	-	-	-	-	0.31	-	6.97	-	-	-
Lolium spp.	-	-	-	-	10.51	12.41	0.02	5.73	-	4.47
Modiola caroliniana	-	-	-	-	-	-	-	-	-	-
Moenchia erecta	-	-	-	-	-	-	-	0.07	-	-
Myosotis discolor	-	-	-	-	-	-	-	-	-	-
Nassella trichotoma	-	-	-	-	-	-	-	0.26	-	-
Paronychia brasiliana	-	-	-	-	-	-	-	0.20	-	-
Paspalum dilatatum	-	-	-	-	-	-	-	-	-	-
Petrorhagia nanteuilii	-	0.16	-	-	-	-	-	-	2.23	0.85
Phalaris aquatica	-	-	-	-	18.16	23.48	13.64	394	-	-
Plantago coronopus	-	-	-	-	-	-	-	-	-	-
Plantago lanceolata	-	-	-	-	-	-	-	-	-	-
Poa bulbosa	-	-	-	0.45	-	-	-	0.11	-	-
Romulea rosea	-	-	-	-	-	-	-	-	-	-
Rosa rubiginosa	-	-	-	-	-	-	-	-	-	-
Salvia verbenaca	-	-	-	-	-	-	-	-	-	-
Sherardia arvensis	-	-	-	-	-	-	-	-	-	-
Silene gallica	-	-	-	-	-	-	0.02	-	-	-

Site code	MF38-1	MF38-2	MF38-3	MF38-4	WG152-1	WG152-2	WG152-3	WG152-4	MF9A-1	MF9A-2
Sisymbrium officinale	-	-	-	-	-	-	-	-	-	-
Soliva sessilis	-	-	-	-	-	-	-	-	-	-
Tolpis barbata	-	-	-	-	-	-	-	-	0.04	0.44
Trifolium angustifolium	-	-	-	-	-	-	-	-	0.04	-
Trifolium arvense	-	0.94	-	-	0.62	0.34	0.19	1.06	3.46	1.50
Trifolium campestre	-	-	-	-	0.14	0.03	0.26	0.52	-	-
Trifolium dubium	-	-	-	-	0.02	-	0.12	0.49	-	-
Trifolium glomeratum	-	-	-	-	0.05	0.27	0.62	5.92	2.39	-
Trifolium striatum	-	-	-	0.02	0.93	3.70	5.03	47.66	0.22	0.05
Trifolium subterraneum	-	0.47	-	0.02	33.99	60.38	83.97	34.11	2.09	-
Vulpia spp.	0.42	0.73	0.09	0.45	1.17	1.24	0.31	3.85	2.26	0.75

Site code	MF9A-3	MF9A-4	MF22AZ-1	MF 22AZ-2	MF22AZ-3	MF22AZ-4	WG63A-1	WG63A-2	WG63A-3	WG63A-4
Floristic group	4	2	2	3	3	2	2	2	2	4
a) Ground cover attributes										
Total biomass kgha^{-1}	236	262	704	2276	2123	384	355	452	429	432
Live plant basal area %	15.8	16.7	14.2	22.5	26.7	19.2	19.2	21.7	13.3	19.2
Litter %	57.5	58.3	30.8	28.3	24.2	35.0	42.5	53.3	45.8	49.2
Litter depth where present (mm)	15.3	15.2	12.7	11.4	16.9	10.3	4.0	4.1	4.3	5.0
Bare ground %	10.8	11.7	25.8	27.5	20.8	32.5	19.2	20.8	27.5	16.7
Fallen log %	-	1.7	1.7	-	-	-	1.7	-	-	5.0
Cryptogam %	13.3	11.7	27.5	21.7	28.3	13.3	17.5	2.5	7.5	6.7
Rock %	2.5	-	-	-	-	-	-	1.7	5.8	3.3
b) Soil attributes (0 - 10 cm)										
Nitrate-N (mgkg^{-1})	2.2	4.5	<0.25	<0.25	<0.25	<0.25	0.4	<0.25	<0.25	0.4
Carbon (%)	3.6	4.4	2.6	2.1	2.6	2.4	1.7	1.8	1.8	2.3
Nitrogen (%)	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Electrical conductivity (dSm^{-1})	0.1	0.1	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
pH(CaCl2)	4.7	4.5	4.0	4.0	4.0	4.1	4.6	4.7	4.7	4.9
pH(water)	5.5	5.2	4.8	4.8	4.7	4.9	5.4	5.6	5.5	5.8
Available phosphorous (mgkg^{-1})	8.0	11.0	<4	6.0	<4	5.0	5.0	5.0	<4	5.0
c) Native plant species (kg ha^{-1})										
Acacia dealbata	-	-	-	-	-	-	-	-	-	-
Acacia gunnii	-	-	-	-	-	-	-	-	-	-
Acacia parramattensis	-	-	-	-	-	-	-	-	-	-
Acaena ovina	0.30	0.16	-	-	-	-	7.66	-	1.20	0.33
Alternanthera sp. *A*	-	-	-	-	-	-	0.48	0.23	-	-
Aristida ramosa	-	-	108	116	165	111	22.48	76.00	72.53	8.22
Arthropodium minus	-	-	-	-	-	-	-	-	-	-
Asperula conferta	-	0.04	-	-	-	-	-	1.19	0.27	0.33
Astroloma humifusum	-	-	-	-	3.15	-	-	-	-	-
Austrodanthonia spp.	67.77	89.08	354	83.21	97.67	174	201	163	106	95.41
Austrostipa bigeniculata	3.59	-	-	-	-	-	-	-	-	-
Austrostipa densiflora	-	-	-	-	-	-	-	-	-	-
Austrostipa scabra	15.49	45.92	-	0.67	-	-	3.83	12.49	0.53	2.83
Bossiaea buxifolia	-	-	-	-	-	-	-	-	-	-
Bossiaea prostrata	0.47	0.03	-	-	-	-	-	-	0.34	-
Bothriochloa macra	0.76	-	-	-	-	-	39.68	67.67	96.08	53.45
Brachyloma daphnoides	-	-	-	-	-	-	-	-	-	-
Bulbine bulbosa	-	-	-	-	-	-	-	-	-	-
Carex inversa	-	0.63	-	-	-	-	-	1.67	-	-
Chamaesyce drummondii	-	-	-	-	-	0.82	7.41	-	0.16	-
Cheilanthes spp.	-	-	-	-	-	-	-	3.57	0.40	0.09
Chloris truncata	-	-	12.93	5.42	6.38	-	11.78	4.20	0.53	-
Chrysocephalum apiculatum	-	-	-	15.61	11.80	-	-	-	-	-
Chrysocephalum semipapposum	1.04	-	-	-	-	-	-	-	-	-
Convolvulus angustissimus	-	0.03	-	-	-	-	0.06	-	-	0.16
Cotula australis	-	0.06	-	-	-	-	-	-	-	-
Craspedia variabilis	-	0.23	-	-	-	-	-	-	-	-
Crassula sieberiana	-	0.02	-	-	-	-	-	-	-	-

Site code	MF9A-3	MF9A-4	MF22AZ-1	MF 22AZ-2	MF22AZ-3	MF22AZ-4	WG63A-1	WG63A-2	WG63A-3	WG63A-4
Cymbonotus spp.	-	-	-	-	-	-	-	-	-	-
Cynodon dactylon	-	-	-	-	-	-	-	-	-	-
Cynoglossum suaveolens	-	-	-	-	-	-	-	-	-	-
Daucus glochidiatus	0.94	-	-	-	-	-	-	-	-	-
Daviesia genistifolia	-	-	5.19	10.37	-	2.52	-	-	-	-
Desmodium varians	2.24	0.47	-	-	-	-	0.34	0.03	0.73	2.52
Dianella revoluta	-	-	-	-	-	-	-	-	-	-
Dichelachne spp.	-	-	-	-	-	2.10	-	-	-	-
Dichopogon fimbriatus	-	-	-	-	-	-	-	0.04	-	-
Dillwynia sericea	-	-	-	3.72	19.06	-	-	-	-	-
Diuris sulphurea	-	-	-	-	-	-	-	-	-	-
Drosera peltata	-	-	-	-	-	-	-	-	-	-
Einadia nutans	-	-	-	-	-	-	-	-	-	-
Eleocharis acuta	-	-	-	-	-	-	-	-	-	-
Elymus scaber	11.53	8.10	2.62	2.72	3.93	0.73	4.03	1.13	0.51	0.35
Enneapogon nigricans	1.48	-	-	-	-	-	5.07	-	6.21	0.90
Eragrostis brownii	-	-	-	0.29	-	-	0.23	-	-	-
Erodium crinitum	-	-	-	-	-	-	-	-	-	-
Eryngium rostratum	-	-	-	-	-	-	-	-	-	-
Euchiton gymnocephalus	-	-	-	-	-	-	0.02	-	-	0.29
Euchiton sphaericus	-	-	-	-	-	-	-	-	-	-
Galium gaudichaudii	-	-	-	-	-	-	-	-	-	-
Geranium solanderi	0.02	6.76	-	-	-	-	-	-	-	-
Glycine spp.	5.44	-	-	-	-	-	-	-	-	0.23
Gonocarpus tetragynus	0.97	0.15	1.76	19.72	6.67	0.88	0.81	0.84	1.21	0.56
Goodenia hederacea	0.40	2.59	1.02	3.30	11.00	2.22	-	3.05	-	-
Goodenia pinnatifida	-	-	-	-	-	-	-	-	-	-
Haloragis heterophylla	-	0.13	27.71	0.21	0.30	17.89	0.21	2.31	1.38	-
Hibbertia obtusifolia	4.45	-	-	-	-	-	-	-	0.09	-
Hovea heterophylla	-	-	-	-	-	-	-	-	-	-
Hydrocotyle laxiflora	1.14	2.78	-	0.21	-	-	-	-	-	1.34
Hypericum gramineum	0.06	0.10	-	3.22	-	3.82	-	0.82	0.06	-
Isoetopsis graminifolia	-	-	-	-	-	-	-	-	-	-
Joycea pallida	-	-	63.30	1894	1746	0.08	-	-	-	-
Juncus subgen. *Genuini*	0.31	0.45	0.76	0.62	0.47	0.20	0.71	0.40	-	0.29
Leptorhynchos squamatus	-	0.23	-	-	-	-	0.03	6.11	7.48	8.69
Lissanthe strigosa	-	-	-	-	-	-	-	-	-	-
Lomandra filiformis	23.92	4.80	22.94	34.91	1.52	7.13	-	1.27	0.98	16.01
Lomandra multiflora	-	-	-	-	-	-	-	-	-	-
Luzula spp.	-	-	-	-	-	-	-	0.20	-	-
Lythrum hyssopifolia	-	-	0.28	-	-	1.08	-	-	-	-
Melichrus urceolatus	3.47	-	-	12.35	4.22	-	-	-	-	-
Mentha diemenica	-	-	-	-	-	-	-	-	-	-
Microlaena stipoides	0.34	17.78	23.39	3.68	8.36	2.52	-	-	-	-
Microseris lanceolata	-	-	-	-	-	-	-	-	-	-
Opercularia hispida	-	-	-	-	-	-	-	-	-	-
Oxalis perennans	0.30	0.02	-	-	-	-	0.89	-	-	0.19
Panicum effusum	0.02	-	10.99	1.52	3.51	9.04	3.90	7.72	-	0.26
Pimelea curviflora	-	-	-	-	-	-	-	-	2.01	-
Pimelea linifolia	-	-	-	-	0.95	-	-	-	-	-
Plantago gaudichaudii	-	-	-	-	-	-	-	-	-	-
Plantago varia	-	-	-	-	-	-	-	-	-	-
Poa sieberiana	4.28	17.40	6.50	40.64	3.77	16.37	-	-	0.48	4.68
Pultenaea procumbens	-	-	-	-	-	-	-	-	-	-
Ranunculus sessiliflorus	-	-	-	-	-	-	-	-	-	-
Rumex brownii	-	0.02	-	-	-	-	-	-	-	0.98
Schoenus apogon	-	-	-	-	0.17	-	-	-	-	-
Scleranthus biflorus	-	-	-	-	-	-	-	-	-	-
Senecio hispidulus	-	-	-	-	-	-	-	-	-	-
Senecio quadridentatus	-	-	-	-	-	-	-	-	-	-
Solenogyne dominii	0.53	-	2.19	12.16	3.70	4.89	0.29	0.71	0.03	0.02
Stackhousia monogyna	-	-	-	-	-	-	-	-	-	-
Stuartina muelleri	-	-	-	-	-	-	-	-	-	-
Stylidium graminifolium	-	-	-	1.02	-	-	-	-	-	-
Thelymitra sp.	-	-	-	-	-	-	-	-	-	-
Themeda australis	62.99	16.83	-	-	-	-	20.23	83.31	107	195
Thysanotus patersonii	-	-	-	-	-	-	-	-	-	-
Tricoryne elatior	0.58	0.02	10.04	-	0.55	-	0.91	1.30	0.41	0.05

Site code	MF9A-3	MF9A-4	MF22AZ-1	MF 22AZ-2	MF22AZ-3	MF22AZ-4	WG63A-1	WG63A-2	WG63A-3	WG63A-4
Triptilodiscus pygmaeus	0.18	-	6.19	0.20	0.20	0.38	0.07	0.62	0.27	0.26
Viola betonicifolia	-	-	-	-	-	-	-	-	-	-
Vittadinia cuneata	-	-	-	-	-	-	-	-	-	-
Vittadinia muelleri	0.69	-	-	2.22	-	-	2.54	5.78	0.62	16.35
Wahlenbergia spp.	1.38	0.13	2.91	-	0.02	-	1.61	0.25	0.03	0.06
Wurmbea dioica	0.09	0.07	-	-	-	-	-	0.03	-	0.10
d) Exotic plant species (kg ha^{-1})										
Acetosella vulgaris	-	9.89	0.27	-	-	-	-	-	-	-
Aira spp.	0.54	0.04	0.45	0.44	0.17	3.27	0.63	0.29	0.29	0.19
Anagallis arvensis	0.31	-	0.05	-	-	-	-	-	-	-
Aphanes arvensis	-	-	-	-	-	-	-	-	-	-
Arctotheca calendula	-	-	-	-	-	-	5.70	0.23	0.82	-
Briza maxima	-	0.31	6.36	-	-	-	-	-	-	-
Briza minor	-	-	0.05	-	0.02	0.06	-	0.43	0.04	0.02
Bromus diandrus	-	-	-	-	-	-	-	-	-	-
Bromus hordeaceus	0.12	0.26	-	-	-	-	-	-	0.13	-
Bromus rubens	-	-	-	-	-	-	-	-	-	-
Carduus pycnocephalus	-	-	-	-	-	-	-	-	-	-
Carthamus lanatus	-	-	-	-	-	-	-	-	-	-
Centaurium erythraea	-	-	-	-	-	-	-	-	-	-
Chondrilla juncea	-	-	-	-	-	-	-	-	-	-
Cicendia quadrangularis	-	-	-	-	-	-	-	-	-	-
Echium plantagineum	-	-	-	-	-	-	-	-	-	-
Erodium botrys	-	0.10	-	-	-	-	-	-	-	-
Erodium cicutarium	-	0.02	-	-	-	-	-	-	-	-
Galium divaricatum	0.28	-	-	-	-	0.73	-	0.04	-	0.03
Galium murale	-	-	-	-	-	-	-	-	-	-
Gamochaeta americana	-	-	-	-	-	-	-	-	-	-
Gypsophila tubulosa	-	-	-	-	-	-	-	-	-	-
Hordeum sp.	-	-	-	-	-	-	-	-	-	-
Hypericum perforatum	-	-	-	-	-	-	-	-	-	-
Hypochaeris glabra	1.07	15.41	9.07	3.89	12.58	7.06	8.66	0.22	1.45	0.38
Hypochaeris radicata	-	-	0.58	-	-	-	-	-	-	3.26
Lactuca serriola	-	-	-	-	-	-	-	-	-	-
Linaria arvensis	1.08	-	-	-	-	-	-	-	0.03	-
Linaria pelisseriana	-	-	0.05	-	0.82	-	-	0.10	-	-
Linum trigynum	-	-	-	-	-	-	-	-	-	-
Logfia gallica	-	-	0.12	-	0.10	0.03	0.08	0.03	0.08	0.02
Lolium spp.	-	4.04	-	-	-	-	-	-	-	-
Modiola caroliniana	-	-	-	-	-	-	-	-	-	-
Moenchia erecta	-	-	-	-	-	-	-	-	-	-
Myosotis discolor	-	-	-	-	-	-	-	-	-	-
Nassella trichotoma	6.92	0.04	-	-	-	-	-	-	-	-
Paronychia brasiliana	-	-	-	-	-	-	-	-	-	-
Paspalum dilatatum	-	-	-	-	-	-	-	-	-	-
Petrorhagia nanteuilii	0.07	0.84	-	-	-	-	-	-	0.24	-
Phalaris aquatica	-	2.28	8.02	-	-	-	-	-	-	-
Plantago coronopus	-	-	0.02	-	-	-	-	-	-	-
Plantago lanceolata	-	-	-	-	-	-	-	-	-	-
Poa bulbosa	-	9.40	-	-	-	-	0.50	0.03	-	-
Romulea rosea	-	-	-	-	-	-	-	-	-	-
Rosa rubiginosa	3.18	-	-	-	-	-	-	-	-	-
Salvia verbenaca	-	-	-	-	-	-	-	-	-	-
Sherardia arvensis	-	-	-	-	-	-	-	-	-	-
Silene gallica	-	-	0.71	-	-	-	-	-	-	-
Sisymbrium officinale	-	-	-	-	-	-	-	-	-	-
Soliva sessilis	-	-	-	-	-	-	-	-	-	-
Tolpis barbata	0.25	0.04	13.07	0.87	1.54	10.07	0.06	0.12	0.50	0.17
Trifolium angustifolium	-	-	-	-	-	-	1.79	2.50	17.49	10.03
Trifolium arvense	0.10	1.12	-	-	-	-	0.23	-	-	-
Trifolium campestre	-	-	-	-	-	0.24	-	-	0.44	0.19
Trifolium dubium	0.05	0.02	-	-	-	-	-	-	-	-
Trifolium glomeratum	0.10	1.02	-	-	-	-	-	-	-	-
Trifolium striatum	0.22	0.15	0.07	-	0.02	0.43	0.46	1.94	-	7.11
Trifolium subterraneum	-	1.60	1.97	-	0.07	4.34	-	-	0.09	-
Vulpia spp.	0.16	0.06	0.08	-	0.02	0.03	0.13	0.03	0.10	0.03