# THE COMPOSITION AND SEASONAL CHANGES IN THE BEETLE (COLEOPTERA) FAUNA OF THE WESTERN VICTORIAN BASALT PLAINS NATIVE GRASSLANDS

ALAN L. YEN[1,2] & AMANDA J. KOBELT[1,2]

[1]Museum Victoria, GPO Box 666E, Melbourne, VIC 3001, Australia.
[2]Current address: Biosciences Research Division, Department of Primary Industries, 621 Burwood Highway, Knoxfield, VIC 3156, Australia.
Email: alan.yen@dpi.vic.gov.au

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The western Victorian basalt plains native grasslands are recognised as one of the most endangered plant communities in Australia. Since European settlement, they have been cleared, grazed, and fragmented and are now found as small scattered remnants. No general invertebrate surveys were undertaken in these grasslands until the 1990s, and this paper reports on the beetles associated with 12 native grassland sites that were sampled seasonally between 1992 and 1993. A total of 114 beetle morphospecies from 26 families were collected, dominated by members of four families (Carabidae, Staphylinidae, Scarabaeidae and Tenebrionidae). The beetle fauna comprised a small number of widespread species and over 63% of species were found at only one or two sites. In terms of relative abundances, a small number of beetle species dominated the fauna; the 10 most common species comprised nearly 64% of the total number of individuals collected.

*Key words:* Victorian basalt plains native grasslands, beetles, Coleoptera.

THE NATIVE GRASSLANDS of western Victoria's basalt plains are the most threatened vegetation type in Victoria as a result of clearing and stock grazing after European settlement (Barlow & Ross 2001); it is estimated that there was over one million hectares of native grasslands prior to European settlement, and this has been reduced to less than 0.5% of the original grasslands through sowing of introduced pastures and application of fertilizers. The result is that the extant patches are isolated small remnant patches or strips (Stuwe 1986). As a consequence, these grasslands have been given the highest conservation significance levels both at the state and national levels (Craigie & Moorrees 2003; DEWHA 2008).

These basalt plains grasslands were heavily compromised before any invertebrate inventories were even considered. While the conservation plight of plant and vertebrate species is well known (Stuwe 1986; Coulson 1990), the best known invertebrate studies associated with native grasslands involve the golden sun moth, *Synemon plana* (Gibson & New 1997a), and the invertebrate diet of the striped legless lizard, *Delma impar* (Kutt et al. 1998). The lack of information about the invertebrates of these native grasslands has been partly addressed by a survey of 46 known remnant grassland sites from 1992-1994 (Yen et al. 1994, 1995). These sites were those identified by Keith McDougall (pers. comm. 1992). Thirty-four of these sites were sampled only once (1992-1994), while 12 were sampled seasonally (autumn, winter, spring and summer 1992-1993).

It could be argued that invertebrate inventories in heavily fragmented and disturbed remnant habitats could be classed as 'salvage' and of questionable scientific merit because it is assumed that the fauna has been severely depleted and that there is also a high proportion of invasive exotic species. However, any information obtained is important for the future conservation management of these extant remnant grasslands, and for future native grassland restoration (Gibson Roy et al. 2007a,b). The basic questions are (1) what species are found; (2) are they native species; (3) are they grassland dependent; and (4) do they occur in adjacent habitats? This paper provides answers to the first question for beetles by presenting information on their composition and seasonal occurrences at 12 of the remnant grassland sites.

## SITES AND METHODS

The 12 grassland sites sampled seasonally were (in 1992) five roadside reserves (sites 10, 13, 23, 24 and 28), three railway reserves (sites 44, 45 and 86), one

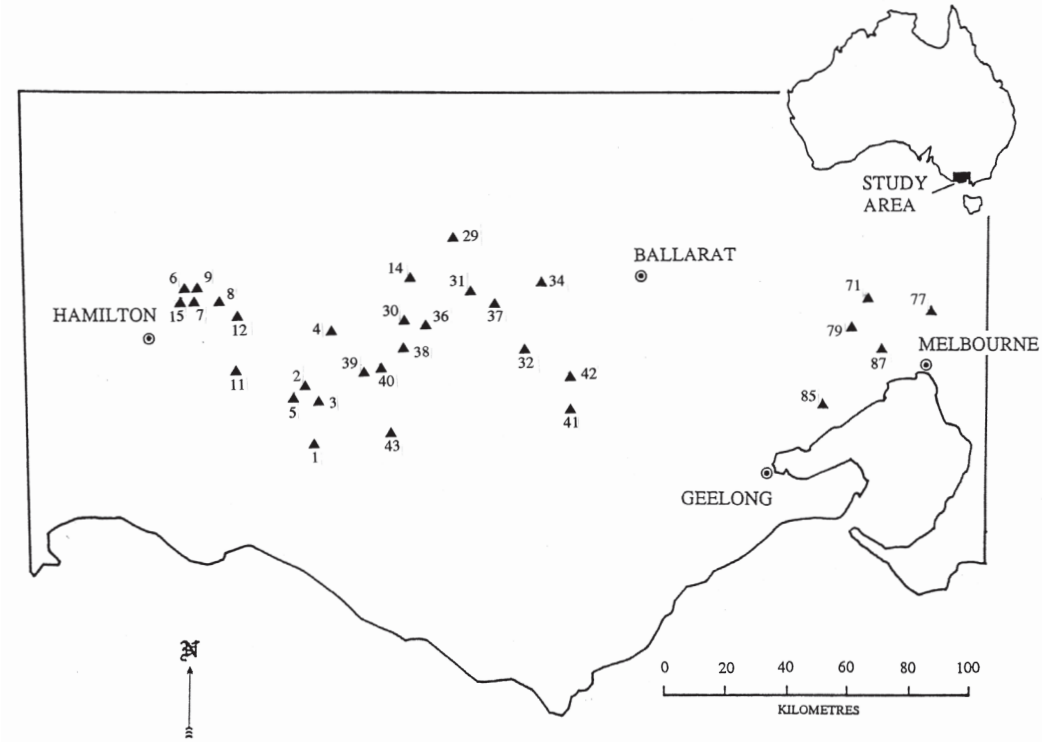


*Fig. 1.* Locations of sites given as site number, road, AMG reference, size (ha), and land tenure. Site 10 (Hamilton-Chatsworth Road, XD121172, 15 ha, road reserve), 13 (South Gums Road, XD166085, 2 ha, road reserve), 23 (Shelford-Mt. Mercer Road, YC565986, 31.5 ha, road reserve), 24 (Dundonnell-Woorndoo Road, XD715024, 25 ha, road reserve), 28 (Woorndoo roadsides, XD602042, 15 ha, road reserve), 35 (Chepstowe, YD212358, 20 ha, private property), 44 (Elaine Rail Reserve, BU379169, 6 ha, railway reserve), 45 (Bannockburn Rail Reserve, BT514857, 1.5 ha, railway reserve), 73 (Truganina, BU992109, 1 ha, cemetery), 74 (Derrimut Grassland Reserve, CU061134, 153 ha, conservation reserve), 76 (Craigieburn, CU201340, 400 ha, private property) and 86 (Manor Rail Reserve, BT880994, 1 ha, railway reserve).

cemetery (site 73), one conservation reserve (site 74), and two sites on private property (sites 35 and 76) (Fig. 1). Site numbers are based on information supplied by McDougall (pers. comm. 1992). At the time of the survey, seven of the sites were burnt annually (sites 10, 13, 23, 24, 28, 44 and 45), one was burnt irregularly (site 86), two were grazed (sites 35 and 76), and two were not burnt (sites 73 and 74).

Each of the sites was sampled in May (autumn), August (winter) and November 1992 (spring) and February 1993 (summer). Four sampling techniques were used: pitfall trapping, sweeping, suction sampling and direct searching. Pitfall trapping involved 10 plastic drink cups (7 cm diameter x 8 cm deep) placed one metre apart in a T formation with ethylene glycol preservative and run for 5 days. Sweeping involved 50 sweeps through the grass along a 50 m transect using a standard entomological net (38 cm diameter). Suction sampling involved collecting 50 x 10 cm diameter samples along a 25 m transect using a petrol driven suction sampler. Direct searching consisted of collecting visible invertebrates for one person-hour. The sweeping, suction sampling and direct searching were undertaken within 100 m of the pitfall trap transect.

In terms of the efficiency of the different collecting techniques, direct searching collected 40% of the beetle species and 12% of individuals, pitfall trapping collected 49% of species and 23% of individuals, vacuum sampling collected 38% of species and 35% of individuals, while sweep netting yielded 20% of species and 30% of individuals (the totals exceed 100% because some beetle species were collected in more than one technique) (Yen et al. 1994). Results are presented combining the beetles from the four different collecting techniques because no one

technique within any particular season gives a good assessment of the beetle fauna, and combined results from all four techniques gives a better indication of the fauna (Kobelt, Yen & Hamilton, in prep.).

Samples were sorted to the lowest taxonomic level possible (morphospecies) and the collection is stored at the Museum of Victoria. Beetle species were also allotted to one of four trophic groups based on their ecological functions at the family level from Lawrence and Britton (1994) and Moore (1980-1996): predators, herbivores, detritivores and fungivores. Although some species could be assigned to more than one trophic level, they were placed into the trophic level that best represented their function at the family level.

Multivariate analysis of beetle species, using presence/absence data, was performed using Primer (Clarke & Warwick 1994); differences in the composition of beetles at each of the 12 sites were examined using the Bray-Curtis similarity coefficients after transforming abundances to log (x+1). The similarity coefficients were subjected to multi-dimensional scaling (MDS) to prepare a two-dimensional ordination of the sites.

## RESULTS

### *Number of species and abundance*

The beetles collected at the 12 seasonally sampled sites are presented on the basis of combined collecting techniques for the sites and based on season (Appendix 1). A total of 1873 adult beetle individuals were collected. This comprised 114 morphospecies from 26 families. The dominant families, in terms of number of species, were: Carabidae (24 species), Staphylinidae (18), Scarabaeidae (10), Tenebrionidae (9), Curculionidae (7), Elateridae and Pselaphidae (each 5), Chrysomelidae (4), then four families each with three species, five families each with two species, and nine families represented by only one species (Table 1).

Beetle families with larger number of species did not necessarily dominate in terms of abundance. While the most speciose family (the Carabidae) did have most individual beetles (292), some of the families with largest numbers of individuals had only a small number of species (Anthicidae, Lathridiidae, Phalacridae) (Table 1).

In terms of numbers of individuals/species, the 10 most common species comprised nearly 64% of the beetles (1198/1873 individuals). The dominant species were *Phalacrus* sp. 1 (Phalacaridae), *Tomoderus* sp. 1 (Anthicidae), *Corticaria* sp. 1 (Lanthridiidae), Curculionidae sp. 1, *Agrypnus* sp. 1 (Elateridae), *Notonomus gravis* (Carabidae), *Aphodius* sp. 1 (Scarabaeidae), *Scirtes* sp. 1 (Scirtidae), *Hispellinus multispinosus* (Chrysomelidae), and *Notonomus* sp. 2 (Carabidae) (Appendix 1).

Different beetle species were dominant during each season (Appendix 1). In autumn, the dominant

*Table 1.* Number of beetle species and individuals in each beetle family. Families grouped into presumed trophic levels.

| Trophic level | Family | No. of species | No. of individuals |
|---|---|---|---|
| **Predators** | Carabidae | 24 | 292 |
| | Staphylinidae | 18 | 103 |
| | Pselaphidae | 5 | 29 |
| | Melyridae | 3 | 15 |
| | Cleridae | 2 | 55 |
| | Coccinellidae | 2 | 3 |
| | Scydmaenidae | 2 | 5 |
| | Dytiscidae | 1 | 3 |
| | Trogossitidae | 1 | 2 |
| | Total | 58 | 507 |
| **Herbivores** | Curculionidae | 8 | 165 |
| | Elateridae | 5 | 97 |
| | Chrysomelidae | 4 | 98 |
| | Buprestidae | 1 | 1 |
| | Cerambycidae | 1 | 8 |
| | Total | 24 | 433 |
| **Detritivores** | Tenebrionidae | 9 | 44 |
| | Scarabaeidae | 10 | 128 |
| | Anthicidae | 3 | 260 |
| | Leiodidae | 3 | 7 |
| | Scirtidae | 3 | 72 |
| | Corylophidae | 2 | 17 |
| | Nitidulidae | 1 | 2 |
| | Total | 31 | 530 |
| **Fungivores** | Lathrididae | 2 | 181 |
| | Discolomidae | 1 | 4 |
| | Eucnemidae | 1 | 2 |
| | Languriidae | 1 | 14 |
| | Phalacridae | 1 | 266 |
| | Total | 6 | 467 |

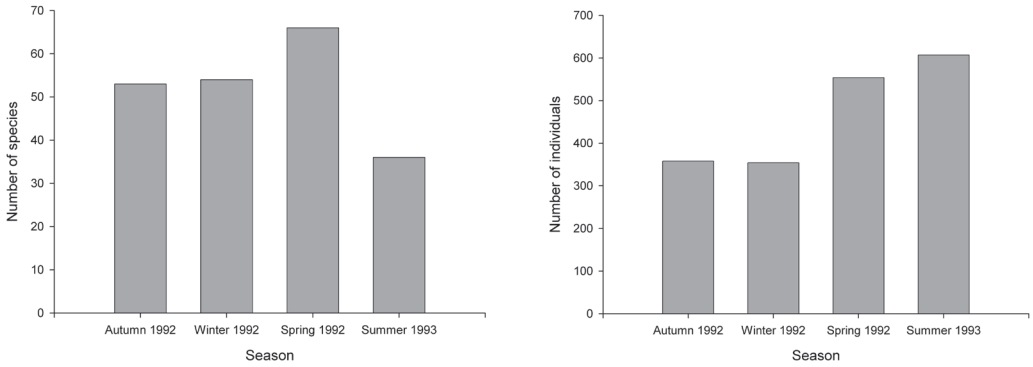


*Fig. 2.* Number of species and individuals of beetles for each season. (a) Number of species. (b) Number of individuals.

species were *Tomoderus* sp. 1 (101 individuals), *Phalacrus* sp. 1 (34), Curculionidae sp. 1 (27), and *Scirtes* sp. 1 (27); winter were *Agrypnus* sp. 1 (48), *Tomoderus* sp. 1 (39), Curculionidae sp. 1 (30), *Notonomus gravis* (28), *Notonomus* sp. 2 (21), and *Scirtes* sp. 1 (21); spring dominants were Curculionidae sp. 1 (67), *Tomoderus* sp. 1 (62), *Corticaria* sp. 1 (46), Cleridae sp. 2 (39), *Geoscaptus* sp. 1 (23), *Cryptocephalus sp*. 1 (23), and *Formicomus* sp. 1 (21); and summer dominants were *Phalacrus* sp. 1 (218), *Corticaria* sp. 1 (132), *Aphodius* sp. 1 (57), *Hispellinus multispinosus* (49), and *Notonomus gravis* (31). *Tomoderus* sp. 1 and Curculionidae sp. 1 were among the dominant species in autumn, winter and spring, *Phalacris* sp. 1 occurred in large numbers in summer and autumn, *Corticaria* sp. 1 was common in spring and summer, and *Aphodius* sp. 1 and *Hispellinus multispinosus* occurred in large numbers only in summer.

*Seasonality*

The largest number of beetle species was found in spring (66 species) with similar numbers of species in autumn and winter (53 and 54 species respectively), and the lowest number in summer (36 species) (Fig. 2). A different pattern occurred when total numbers of individuals were examined: largest numbers in summer, followed by spring, with much lower numbers in autumn and winter. The larger number of individuals in summer was mainly due to large numbers of two species: *Phalacrus* sp. 1 (218) and *Corticaria* sp. 1 (132).

*Distribution across sites*

When the number of sites in which each was found is considered, only one species occurred at all sites (*Agrypnus* sp. 1), Curculionidae sp. 1 and *Formicomus* sp. 1 were found at 11 sites, *Tomoderus* sp. 1 at 10, *Phalacrus* sp. 1 at 9, and *Aphodius* sp. 1 at 8. Over 42% of the beetle species were found at only one site and a further 21% only found at two sites. The beetle fauna was represented by a small number of widespread species and over 63% of species were only found at one or two sites (Fig. 3).

The multivariate analysis indicates that the 12 sites can be divided into two main groups. Sites 10, 13, 24, 28 and 76 form one group and sites 23, 35, 44, 45, 73, 74 and 86 comprise the second group. Except for site 76 in the first group, the remaining sites separate geographically into western and eastern blocks. Differences in composition may be geographical (and may be related to rainfall) (Fig. 4).

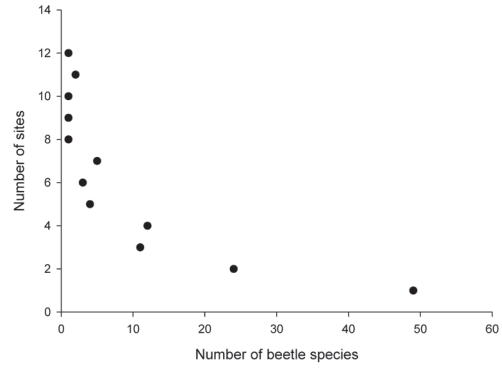


*Fig. 3.* Distribution of beetle species across sites.

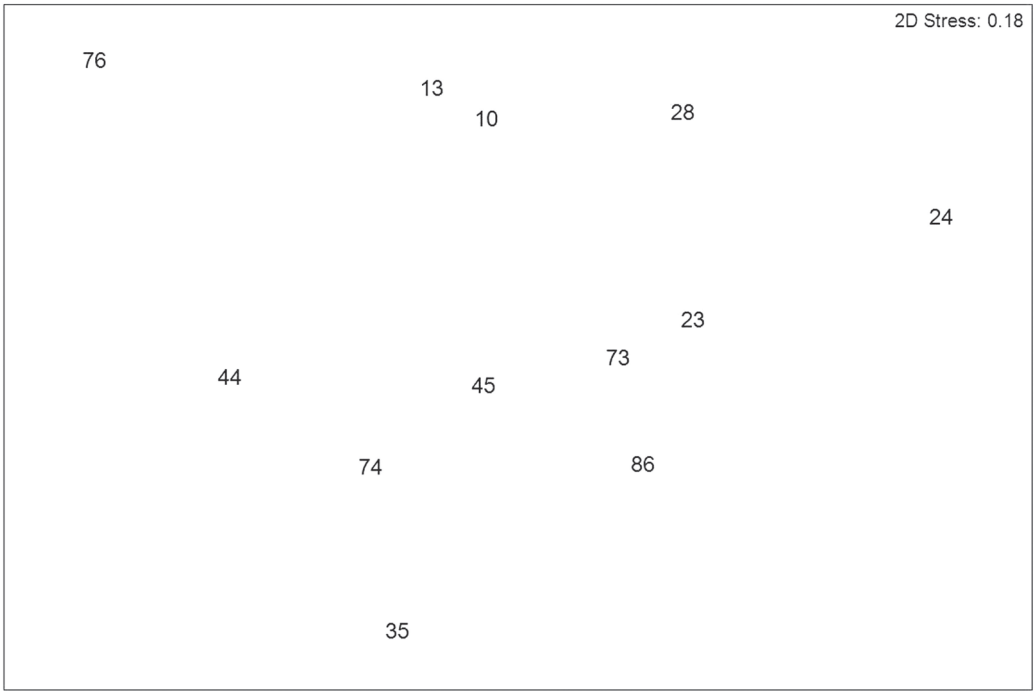


*Fig. 4.* Ordination of species composition of the 12 sites using multi-dimensional scaling.

*Trophic structure*

The number of individuals in each of the main trophic groups is similar, however the number of species differed; the majority of species were predators (58 species), followed by detritivores (26 species), phytophagous (24 species) and fungivores (6 species) (Table 1). Seasonal trends in abundances varied according to the trophic group and beetle family. Most species occurred in small numbers so that seasonal trends were not apparent (Appendix 1). However, the more abundant families of detritivores (Anthicidae, Scarabaeidae and Tenebrionidae) were found in larger numbers in autumn, winter and spring, and except for one species, were low in summer. The exception was *Aphodius* sp. 1, which may be more appropriately classified as a root-feeding phytophagous species rather than a detritivore. The fungivores were dominated by large numbers of Lathridiidae and Phalacridae in summer. Predators occurred throughout the year, although Carabidae were in lower numbers during autumn while Staphylinidae were in low numbers in summer. Phytophagous species were found all year round.

## DISCUSSION

This paper presents descriptive information on beetles collected seasonally in 12 remnant grasslands over 12 months. A total of 114 beetle morphospecies were found. Over 50% of the beetle species were from four families of beetles (Carabidae, Staphylinidae, Scarabaeidae and Tenebrionidae), while at the species level, the 10 most common species comprised nearly 64% of the total number of individuals collected. Seasonal trends in number of species and abundances differed: the highest number of beetle species was found in spring (66 species) with similar numbers of species in autumn and winter (53 and 54 species respectively), and the lowest number in summer (36 species), while with abundances, highest numbers in summer, followed by spring, with much lower numbers in autumn and winter. The higher number of individuals in summer was mainly due to large numbers of two species: *Phalacrus* sp. 1 and *Corticaria* sp. 1 (both fungivores).

Gibson and New (2007b) presented results of a pitfall trapping study at Craigieburn (site 76 of this study). They collected 27 beetle species (371 indi-

viduals) (compared to 27 species, 111 individuals this study). Their results also found that the beetles were dominated by a few species (although the species in their survey and this one are different). These differences may be attributed to differences in trapping methodologies. They ran 60 pitfall traps of 25 mm diameter over early and late summer, set up their traps over many more locations within the site, and did not sweep, vacuum or direct search. The pitfall traps in this survey were tightly grouped and may not have reflected the likely spatial heterogeneity of beetles found by Gibson and New (2007b).

Information on the biology and distribution of most of the beetle species found is lacking. The exception for beetles is phenological information about some predatory carabids (Horne 1992). Further research is required to determine the origin of the beetles collected in these remnant grassland sites: whether any of the beetles are exotic, and how many of the native species are grassland dependent. The native grasslands have been colonised by exotic species in other invertebrate groups. For example, among the molluscs, all species (3 snails and 5 slug species) were exotic (Holland et al. 2007).

Reid and Hochuli (2007) showed that host plants and microhabitat structure are important factors in determining the composition of invertebrates in grasslands. With regard to this study, detailed information on the structure of the 12 grassland sites was collected by McDougall (pers. comm.) but this information, at the scale required for invertebrates, has been lost. Management of the grasslands is an important determinant of grassland composition and structure (Tscharntke & Greiler 1995), and most of the grassland sites were subjected to unplanned influences such as fire, grazing and mowing, and information on past management regimes are not known.

The multivariate analysis of the beetles at the 12 sites suggests that they can be divided into two groups: four sites at the western end of the grassland range plus the one site at the eastern end, and seven sites primarily at the eastern side of the grasslands. Leaving the most easterly site aside (site 76, Craigieburn), it is possible that the division into the two groups may be related to the division of the Victorian native grasslands into different rainfalls: higher rainfall in the west and lower to the east (McDougall et al. 1994). However, further research is required to determine why the beetle composition at site 76 is more similar to the sites further to the west rather than the closer sites.

The information presented from this 1992-1993 survey provides background information for more detailed work on the beetles in the future. This work will need to relate the composition and abundance of the fauna to host plants and microhabitat structure, management of the sites, and the nature of adjacent sites. However, the grassland sites are still subject to enormous pressures, and some of the sites used in the 1992-1993 survey have been alienated since. Williams (2007) compared the native grasslands in western Victoria from the 1980s to the 1990s with those in 2004. Approximately 880 ha of grasslands were recorded in the earlier surveys, and by 2004, approximately 225 ha had been destroyed. Most was lost on roadside reserves (169 ha) and private property (67 ha). However, due to incomplete surveys earlier, the area of private grasslands destroyed may be severely underestimated.

Regular burning of road side reserves, aimed at reducing fuel loads to provide fire breaks, benefited native grasslands by controlling introduced grasses with high biomass production (e.g. *Phalaris aquatica*) and favours lower, more open native grasses that remain greener later in the fire season (Williams 2007). However, much of this burning has been replaced by herbicide application (Williams 2007). This is another example of management decisions being made for these small remnant grassland patches when there is scant, if any, data on the effects of fire or herbicide application on grassland invertebrates in the western Victorian grasslands.

The survey results presented in this paper indicate a fairly rich fauna. The fauna differs across the sites, but is generally dominated by a smaller number of more common species. The species composition and abundance changes seasonally. However, more information is required on these beetles before we can prepare conservation management plans to protect an important component of the invertebrate faunas of the remaining small patches of western basalt plains grasslands.

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## REFERENCES

Barlow, T.J. & Ross, J.R., 2001. Vegetation of the Victorian volcanic plain. *Transactions of the Royal Society of Victoria* 113:xxv-xxviii.

Clarke, K.R. & Warwick, R.M., 1994. *Change in marine communities: An approach to statistical analysis and interpretation.* Plymouth Marine Laboratory, Natural Environment Research Council, UK: Plymouth.

Coulson, G., 1990. Conservation biology of the Striped Legless Lizard (*Delma impar*). An initial investigation. *Arthur Rylah Institute for Environmental Research Technical Report Series* No. 106:1-40.

Craigie, V. & Moorrees, A., 2003. Central Gippsland Plains Grassland, Forest Red Gum Grassy Woodland, Northern Plains Grassland, South Gippsland Plains Grassland, Western (Basalt) Plains Grassland. *Flora and Fauna Guarantee Act 1988 Action Statement* No. 182. Department of Sustainability and Environment: East Melbourne. 35 pp.

Department of the Environment, Water, Heritage and the Arts, 2008. Natural Temperate Grassland of the Victorian Volcanic Plain: A nationally threatened ecological community. *Environment Protection Biodiversity Conservation Act 1999 Policy Statement* 3.8. 16 pp.

Gibson, L. & New, T.R., 2007a. Problems in studying populations of the golden sun-moth, *Synemon plana* (Lepidoptera: Castniidae), in south eastern Australia. *Journal Insect Conservation* 11:309-313.

Gibson, L. & New, T.R., 2007b. Characterising insect diversity on Australia's remnant native grasslands: ants (Hymenoptera: Formicidae) and beetles (Coleoptera) at Craigieburn Grasslands Reserve, Victoria. *Journal Insect Conservation* 11:409-413.

Gibson-Roy, P., Delpratt, J. & Moore, G., 2007a. Restoring the Victorian Western (Basalt) Plains grassland. 1. Laboratory trials of viability and germination, and the implications for direct seeding. *Ecological Management & Restoration* 8:114-122.

Gibson-Roy, P., Delpratt, J. & Moore, G., 2007b. Restoring Western (Basalt) Plains grassland. 2. Field emergence, establishment and recruitment following direct seeding. *Ecological Management & Restoration* 8:123-132.

Holland, K.D., McDonnell, M.J. & Williams, N.S.G., 2007. Abundance, species richness and feeding preferences of introduced molluscs in native grasslands of Victoria, Australia. *Austral Ecology* 32:626-634.

Horne, P.A., 1992. Comparative life histories of two species of *Notonomus* (Coleoptera: Carabidae) in Victoria. *Australian Journal of Zoology* 40:163-171.

Kutt, A.S., Coulson, G. & Wainer, J., 1998. Diet of the Striped Legless Lizard *Delma impar* (Squamata: Pygopodidae) in a western (Basalt) plains grassland, Victoria. *Australian Zoologist* 30(4):412-418.

Lawrence, J.F. & Britton, E.B., 1994. *Australian Beetles*. Melbourne University Press, Carlton.

McDougall, K.L., Barlow, T.J. & Appleby, M.L., 1994. Western basalt plains, Lake Omeo, Murray Valley Riverine Plains, & the Wimmera. In: Conservation of lowland native grasslands in south-eastern Australia. K. McDougall, K. & J.B. Kirkpatrick (eds). World Wide Fund for Nature, Sydney, pp. 44-115.

Moore, B.P., 1980-1996. *A Guide to the Beetles of South-Eastern Australia.* Australian Entomological Press: Greenwich, NSW. Fascicles 1-12. 226 pp.

Reid, A.M. & Hochuli, D.F., 2007. Grassland invertebrate assemblages in managed landscapes: Effect of host plant and microhabitat architecture. *Austral Ecology* 32:708-718.

STUWE, J., 1986. An assessment of the conservation status of native grasslands on the Western Plains, Victoria and sites of botanical significance. *Arthur Rylah Institute for Environmental Research Technical Report Series* No. 48.

TSCHARNTKE, T. & GREILER, H-J., 1995. Insect communities, grasses, and grasslands. *Annual Review of Entomology* 40:535-558.

WILLIAMS, N.S.G., 2007. Environmental, landscape and social predictors of native grassland loss in western Victoria, Australia. *Biological Conservation* 137:308-318.

YEN, A.L., HORNE, P.A., KAY, R. & KOBELT, A.J., 1994. The Use of Terrestrial Invertebrates to Rank Sites of the Remnant Western Victorian Basalt Plains Grasslands. Unpublished report to the Endangered Species Unit, Australian Nature Conservation Agency. 155 pp.

YEN, A.L., HORNE, P.A., & KOBELT, A.J., 1995. Invertebrates of the Victorian Basalt Plains Grasslands. Unpublished report to the Australian Heritage Commission. 87 pp.

*Appendix 1.* Species and total number of beetles collected at each site and in each season 1992–1993

| Family | Species | Site | | | | | | | | | | | | Season | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 | 13 | 24 | 28 | 23 | 35 | 44 | 45 | 73 | 74 | 76 | 86 | Autumn | Winter | Spring | Summer | |
| Anthicidae | *Formicomus* sp. 1 | 3 | 13 | 5 | 2 | 6 | | 1 | 7 | 1 | 1 | 1 | 5 | 4 | 19 | 21 | 1 | 45 |
| Anthicidae | *Formicomus* sp. 2 | | | 1 | | 8 | | | | 2 | | | 2 | 13 | | | | 13 |
| Anthicidae | *Tomoderus* sp. 1 | 3 | 1 | 4 | 3 | 51 | | 13 | 6 | 55 | 6 | | 60 | 101 | 39 | 62 | | 202 |
| Buprestidae | *Cisseis* sp. 1 | | | | | | | | | 1 | | | | | | | 1 | 1 |
| Carabidae | *Homothes* sp. 1 | | | | | | | | | | | | 1 | | | 1 | | 1 |
| Carabidae | *Notogonum* sp. 1 | | | 1 | | | 1 | | | | | | | 2 | | | | 2 |
| Carabidae | *Notogonum* sp. 3 | | | | | | | | | | | 2 | | | 2 | | | 2 |
| Carabidae | *Notogonum* sp. 4 | 1 | | | | | | | | | | | | | 1 | | | 1 |
| Carabidae | *Promecoderus* sp. 1 | 3 | 1 | 4 | 4 | 1 | | | | 1 | | | 2 | 9 | 6 | | 1 | 16 |
| Carabidae | *Amblystomus* sp. 1 | 3 | 3 | | | 1 | 8 | | | | | | | | 5 | 9 | 1 | 15 |
| Carabidae | *Diaphoromerus* sp. 1 | | | | 1 | | | | | | 9 | 4 | | | 1 | | 13 | 14 |
| Carabidae | *Egadroma* sp. 1 | | | | 1 | | | | | | | | | | | 1 | | 1 |
| Carabidae | *Euthenaris* sp. 1 | | | | | | | | | | | 1 | | | | 1 | | 1 |
| Carabidae | *Hypharpax* sp. 1 | 1 | | 2 | 1 | | 1 | | | | | | | 3 | | 2 | | 5 |
| Carabidae | *Lecanomerus* sp. 1 | 1 | | | | | | | | | | | | | 1 | | | 1 |
| Carabidae | *Microlestes* sp. 1 | | | | | | | | 1 | | | | | | | 1 | | 1 |
| Carabidae | *Oodes* sp. 1 | 1 | 1 | | 1 | | | | | | | | | | 2 | 1 | | 3 |
| Carabidae | *Scopodes* sp. 1 | 1 | 1 | | 5 | | | | | | | | | 2 | 4 | 1 | | 7 |
| Carabidae | *Sphallomorpha nitiduloides* Guerin-Meneville | | | | | | | | | 2 | | | | | | | 2 | 2 |
| Carabidae | *Catadromus lacordairei* Boisduval | 1 | 1 | | 2 | 4 | | | 3 | | | | | 1 | | 1 | 9 | 11 |
| Carabidae | *Notonomus* sp. 2 | | | 41 | 12 | | | | | | | | | 3 | 21 | 14 | 15 | 53 |
| Carabidae | *Notonomus* sp. 3 | | 2 | | | | | | | | | | | | 2 | | | 2 |
| Carabidae | *Notonomus gravis* Chaudoir | 7 | 7 | 2 | 8 | | 13 | 12 | | | | 32 | | 11 | 28 | 11 | 31 | 81 |
| Carabidae | *Platycoelus* sp. 1 | | | 1 | | | | | | | | | | | 1 | | | 1 |
| Carabidae | *Rhytisternus* sp. 1 | | | | 1 | 8 | | | | 1 | | | | 1 | 5 | 3 | 1 | 10 |
| Carabidae | *Clivina* sp. 1 | | | 3 | 8 | | 1 | | | 1 | 13 | 3 | | | 10 | 16 | 3 | 29 |

| Family | Species | Site | | | | | | | | | | | | Season | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carabidae | *Geoscaptus* sp. 1 | | | 7 | 8 | 7 | | | 6 | 1 | 2 | | 1 | | 2 | 23 | 7 | 32 |
| Carabidae | *Trechobembix* sp. 1 | | | | | 1 | | | | | | | | | | | 1 | 1 |
| Cerambycidae | Cerambycidae sp. 1 | | | | | | 1 | 1 | 2 | | 4 | | | | | 7 | 1 | 8 |
| Chrysomelidae | Chrysomelidae sp. 1 | 2 | | | | | | | | 2 | | | | 2 | | 1 | 1 | 4 |
| Chrysomelidae | *Cryptocephalus* | 3 | 30 | 1 | 2 | 1 | | | 1 | 1 | | | | 1 | 15 | 23 | | 39 |
| Chrysomelidae | Galerucinae sp. 1 | | | | | | | | | 1 | | | | 1 | | | | 1 |
| Chrysomelidae | *Hispellinus multispinosus* (Germar) | | | | | 2 | 6 | 4 | 15 | 8 | 18 | 1 | | | 2 | 3 | 49 | 54 |
| Cleridae | Cleridae sp. 1 | | | | | 4 | | | 10 | 2 | | | | | | | 16 | 16 |
| Cleridae | Cleridae sp. 2 | 18 | | | 6 | 15 | | | | | | | | | | 39 | | 39 |
| Coccinellidae | *Diomus* sp. 1 | | | | | | | | | 1 | | | | | | | 1 | 1 |
| Coccinellidae | *Coccinella repanda* (Thunberg) | | 1 | | | | | 1 | | | | | | s | | 1 | 1 | 2 |
| Corylophidae | Corylophidae sp. 1 | | | | | | 1 | 14 | | | | | | | | 15 | | 15 |
| Corylophidae | *Corylophodes* sp. 1 | | | | | | 1 | 1 | | | | | | | 2 | | | 2 |
| Curculionidae | Curculionidae sp. 1 | 2 | 11 | | 6 | 33 | 25 | 24 | 8 | 3 | 1 | 15 | 12 | 27 | 30 | 67 | 15 | 139 |
| Curculionidae | *Cubicorrhynchus* sp. 1 | | | | | | 1 | | | | | | | 1 | | | | 1 |
| Curculionidae | *Prophalidura* sp. 1 | | | | | | | | | | 1 | 1 | | 2 | | | | 2 |
| Curculionidae | *Rhinaria* sp. 1 | | | | 1 | | | | | | | | | 1 | | | | 1 |
| Curculionidae | *Naupactus leucoloma* Boheman | | | | | | | | | | | 4 | 2 | 3 | 1 | | 2 | 6 |
| Curculionidae | *Lietroderes costirostris* Schonherr | | | | | | | | | 1 | | 1 | | 2 | | | | 2 |
| Curculionidae | *Desiantha* sp. 1 | 1 | | 4 | 7 | | | | | | | | | 8 | 4 | | | 12 |
| Curculionidae | *Misophrice alternata* Lea | | | | 1 | | | | | | | | | 1 | | | | 1 |
| Discolomidae | *Aphanocephalus* sp. 1 | | | | | 4 | | | | | | | | | 4 | | | 4 |
| Dytiscidae | *Eretes* sp. 1 | | | 3 | | | | | | | | | | | | 3 | | 3 |
| Elateridae | Elateridae sp. 1 | 1 | | | | | | | | | | | | | | 1 | | 1 |
| Elateridae | Elaterinae genus B sp. 1 | | 1 | | | | | | | | | | | | | 1 | | 1 |
| Elateridae | *Agrypnus* sp. 1 | 7 | 2 | 12 | 5 | 14 | 3 | 2 | 5 | 16 | 1 | 9 | 6 | 19 | 48 | 12 | 3 | 82 |
| Elateridae | *Agrypnus* sp. 2 | | | | | | | | | | | 2 | | | | 2 | | 2 |

| Family | Species | Site | | | | | | | | | | | | Season | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elateridae | *Conoderus* sp. 1 | | 10 | | | | 1 | | | | | | | | 1 | 10 | | 11 |
| Eucnemidae | *Euryptichus* sp. 1 | | | | | | | | | 2 | | | | | | 2 | | 2 |
| Languriidae | *Leucohimatium* sp. 1 | | | | | | | | | 3 | | | 11 | 2 | | 5 | 6 | 13 |
| Lathrididae | *Corticaria* sp. 1 | 3 | | | | | 5 | 39 | 1 | 130 | | | 2 | 2 | | 46 | 132 | 180 |
| Lathrididae | *Corticaria* sp. 2 | | | | | | | 1 | | | | | | | | 1 | | 1 |
| Leiodidae | *Colon* sp. 1 | | | | | 1 | 2 | | | | 1 | | 1 | 4 | 1 | | | 5 |
| Leiodidae | *Dietta* sp. 1 | | 1 | | | | | | | | | | | | | 1 | | 1 |
| Leiodidae | *Zeadolopus* sp. 1 | | | | | | 1 | | | | | | | 1 | | | | 1 |
| Melyridae | *Carphurus* sp. 1 | | | | | | | | | | 1 | | | | | 1 | | 1 |
| Melyridae | *Dicranolaius* sp. 1 | | | 1 | 4 | 4 | | | | | | | | 1 | 6 | 2 | | 9 |
| Melyridae | *Helcogaster* sp. 1 | 3 | | | | | | | 1 | | | 1 | | | | 5 | | 5 |
| Nitidulidae | *Epuraea* sp. 1 | | | | | | | | | | | | 2 | 1 | 1 | | | 2 |
| Phalacridae | *Phalacrus* sp. 1 | 5 | 43 | | 3 | 20 | 22 | | 23 | 125 | 5 | | 20 | 34 | 8 | 12 | 218 | 272 |
| Pselaphidae | *Eupines* sp. 1 | | | | | | 1 | 1 | | | | | | | | 2 | | 2 |
| Pselaphidae | *Narcodes* sp. 1 | 1 | | | | | 1 | | 1 | | 1 | | | | | 4 | | 4 |
| Pselaphidae | *Pselaphaulax* sp. 1 | | 1 | | | | | | | | | | | | 1 | | | 1 |
| Pselaphidae | *Rybaxis* sp. 1 | | | 1 | | 3 | 7 | | | 5 | | | 5 | 12 | 3 | 6 | | 21 |
| Pselaphidae | *Schaufussia* sp. 1 | | | | | | | | | | 1 | | | | 1 | | | 1 |
| Scarabaeidae | Scarabaeidae sp. 1 | | | | | | | | 1 | | | | | | | | 1 | 1 |
| Scarabaeidae | *Aphodius* sp. 1 | 4 | 2 | | | | 4 | 2 | | 49 | 2 | 2 | 5 | 2 | 4 | 7 | 57 | 70 |
| Scarabaeidae | *Adoryphorus* sp. 1 | 4 | 6 | | | | | | | | | 4 | | | | 14 | | 14 |
| Scarabaeidae | *Aneucomides* sp. 1 | | | 3 | | | | | | | | | | | | | 3 | 3 |
| Scarabaeidae | *Antitrogus* sp. 1 | 4 | | | 3 | | | | | 2 | | 6 | | 3 | | 11 | 1 | 15 |
| Scarabaeidae | *Automolius* sp. 1 | | 1 | | | | | | | | | 2 | | | 1 | 1 | 1 | 3 |
| Scarabaeidae | *Haplopsis* sp. 1 | | | | | | | | | | | 2 | | | | 2 | | 2 |
| Scarabaeidae | *Sciton* sp. 1 | | | | | | | | | | | 3 | | | | 3 | | 3 |
| Scarabaeidae | *Onthophagus* sp. 1 | 2 | 5 | | | | | | | | | 8 | | | 1 | 14 | | 15 |
| Scarabaeidae | *Onthophagus* sp. 2 | | 2 | | | | | | | | | | | | | 2 | | 2 |
| Scirtidae | *Scirtes* sp. 1 | | 1 | | | 60 | 1 | | 1 | | | | 2 | 27 | 21 | 17 | | 65 |
| Scirtidae | *Scirtes* sp. 2 | | | 2 | | | | | | | | 2 | | | | 2 | 2 | 4 |

| Family | Species | Site | | | | | | | | | | | | Season | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scirtidae | *Scirtes* sp. 3 | | | | | | 3 | | | | | | | | 2 | 1 | | 3 |
| Scydmaenidae | *Neuraphoconnus* sp. 1 | | | | | | 4 | | | | | | | | | 4 | | 4 |
| Scydmaenidae | *Stechinus* sp. 1 | | | | | | 1 | | | | | | | | | 1 | | 1 |
| Staphylinidae | *Atheta* sp. 1 | | | | | | | | | | | | 2 | 2 | | | | 2 |
| Staphylinidae | *Calodera/Polylobus* sp. 1 | 5 | 2 | | | | | 1 | | 3 | | | 10 | 11 | 1 | 9 | | 21 |
| Staphylinidae | *Leucocraspedum* sp. 1 | | | | | | | | | 2 | | | | 2 | | | | 2 |
| Staphylinidae | *Carpelimus* sp. 1 | | | | 1 | | 1 | | 1 | | 1 | | | 4 | | | | 4 |
| Staphylinidae | *Ochthephilum* sp. 1 | | | | 1 | 2 | | | | | | | | 1 | 2 | | | 3 |
| Staphylinidae | *Ochthephilum* sp. 2 | | | | | | | | | | | 1 | | | 1 | | | 1 |
| Staphylinidae | *Paederus* sp. 1 | | | 1 | | | | 3 | 1 | 1 | | | | 1 | 1 | 3 | 1 | 6 |
| Staphylinidae | *Suniopsis* sp. 1 | | 1 | | | 1 | 2 | 10 | 2 | 11 | | | | 10 | 12 | 5 | | 27 |
| Staphylinidae | *Pinophilus* sp. 1 | | | | | | | | | | | 1 | 1 | | 2 | | | 2 |
| Staphylinidae | *Pinophilus rufitarsis* Fauvel | | | 1 | | | | | | | | | | 1 | | | | 1 |
| Staphylinidae | *Heterothops* sp. 1 | | | | | | 1 | | | | | | 1 | | | 2 | | 2 |
| Staphylinidae | *Heterothops luctuosus* Fauvel | | | | | | 2 | | | | | | | 2 | | | | 2 |
| Staphylinidae | *Staphylinus ater* (Gravenstein) | | | | | | | | | | | 1 | | 1 | | | | 1 |
| Staphylinidae | *Tachinus* sp. 1 | | | | | 6 | | 4 | | | | | | 1 | 4 | 1 | 3 | 9 |
| Staphylinidae | *Tachinus* sp. 2 | | | | | | | | 2 | | | | | | 1 | | | 1 |
| Staphylinidae | *Thyreocephalus* sp. 1 | | 1 | | | 2 | 1 | | | | | | 1 | 1 | 1 | | 3 | 5 |
| Staphylinidae | *Thyreocephalus* sp. 2 | | 3 | | | 1 | | 2 | | | | 1 | | | 4 | 3 | | 7 |
| Staphylinidae | *Thyreocephalus lorquini* (Fauvel) | | | | 2 | 3 | | | | | | | | 1 | 4 | | | 5 |
| Tenebrionidae | *Adelium* sp. 1 | | | | | | 18 | 1 | | | | | | 4 | 10 | 5 | | 19 |
| Tenebrionidae | *Adelium* sp. 2 | | | 2 | | | 3 | | | | | | | 3 | | 2 | | 5 |
| Tenebrionidae | *Adelium* sp. 3 | | | | 1 | | | | | | | | | | 1 | | | 1 |
| Tenebrionidae | *Isopteron* sp. 1 | 1 | | | 1 | | 1 | | | | | 1 | 1 | 3 | 1 | 1 | | 5 |
| Tenebrionidae | *Lagria* sp. 1 | | 1 | | | | | | | | | | | | | | 1 | 1 |
| Tenebrionidae | *Celibe* sp. 1 | | | | | | | | | | 1 | | | 1 | | | | 1 |
| Tenebrionidae | *Celibe* sp. 2 | | | 3 | | | | | | | 1 | | | 1 | | 1 | | 2 |
| Tenebrionidae | *Celibe catenulatus* Boisduval | | | 2 | | | | | | | | | | | 2 | | | 2 |

| Family | Species | Site | | | | | | | | | | | | Season | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tenebrionidae | *Pterohelaeus* sp. 1 | | | 4 | | | | | | 2 | | | | | | 3 | 3 | 6 |
| Trogossitidae | *Ancyrona* sp. 1 | | | | | 1 | | | | | | | 1 | 1 | 1 | | | 2 |
| | | 91 | 155 | 111 | 101 | 264 | 144 | 137 | 98 | 435 | 70 | 111 | 156 | 358 | 354 | 554 | 607 | 1873 |