



Review of the Experimental Design of the Alpine Cattle Grazing Project

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Summary

The Victorian Government and the Department of Sustainability and Environment recently announced the re-introduction of cattle grazing into the Alpine National Park as part of a research trial investigating the efficacy of using cattle grazing to reduce the risk of bushfire. Ecology Australia has undertaken a review of the site selection, research design and potential information gaps relating to this project.

The selection of study sites appears to have been undertaken based on an incomplete and highly variable desktop dataset, with no field validation. Ecology Australia has substantial reservations about the environmental assumptions and the interpretation of data used as the basis for site selection, and for this project we believe that a desktop analysis is not sufficient for the purpose of selection of sites '*to avoid or minimise significant environmental impacts*'.

The research design summary for this research trial provides very little detail or emphasis on assessing the potential impact of cattle grazing on ecological values. In particular, no provision has been made for the collection of baseline data at sites prior to cattle grazing occurring. No detail on the monitoring of key biodiversity values is provided, and it appears that the only assessment of ecological values will not occur until following the first season of grazing. The scientific viability of this research trial is significantly compromised by the commencement of grazing prior to the experimental design being finalised, as well as the lack of a peer-review process for the research proposal.

Ecology Australia considers that there is a very high likelihood that threatened flora and fauna species and/or ecological communities occur within the study sites. Database searches revealed records of 33 faunal and 29 plant species listed under the EPBC Act, the FFG Act, or DSE advisory lists within ten kilometres of the sites. Of these, at least four animals are considered vulnerable to cattle impacts, and 21 plants are expected to occur in environments subject to impacts. Based on the known potential of cattle to impact upon these matters, a referral is required under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. In addition, this project may also breach State legislation, including the *Flora and Fauna Guarantee Act 1988* and the *National Parks Act 1975*.

Overall, Ecology Australia considers the experimental design and site selection of this project to be fundamentally flawed, and that the project represents a poorly-made decision which appears to ignore over 30 years of peer-reviewed alpine research and science.

Introduction

In January 2010, the Victorian Government and the Department of Sustainability and Environment (DSE) announced the re-introduction of cattle grazing into the Alpine National Park. The press release and DSE website describe this project as a research trial, to investigate ‘the use of strategic cattle grazing as a tool to reduce bushfire risk in Victoria’s high country, including the Alpine National Park’ (www.dpi.vic.gov.au/DSE/; accessed 04 February, 2010).

Ecology Australia has undertaken a review of the available information on this project, focusing on the site selection, research design and potential information gaps relating to threatened species or ecological communities. The findings of this review are provided below under those categories.

The re-introduction of cattle grazing into the Alpine National Park may constitute a breach of relevant State and/or Commonwealth legislation. In particular, this action may breach or be contrary to the following Acts:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – potential impacts to matters of national significance, requiring a referral;
- Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) – potential impacts to listed matters, introduction of threatening processes, permit requirements; and
- Victorian *National Parks Act 1975*.

While policy considerations and potential breaches of relevant legislation by the alpine grazing research trial require further consideration, this review focuses on the scientific merits of the research design of the alpine grazing project, and does not address relevant policy and legislation issues in detail.

Selection of Sites

The DSE website states that ‘*Research sites have been carefully selected to avoid or minimise significant environmental impacts*’. The map provided on this website shows the study sites and threatened flora and fauna records (listed under the EPBC Act and FFG Act), as well as protected area boundaries, high-altitude wetlands and other data. Based on a review of the available spatial data for this area (including DSE’s Flora Information System and the Atlas of Victorian Wildlife), Ecology Australia has found the following errors associated with database interpretation, inconsistencies and/or misleading information in the assumption of avoiding or minimising significant environmental impacts in the site selection process.

- While the sites are located in areas which appear to have few records of threatened flora and fauna species, this does not necessarily mean that threatened species are unlikely to occur there. The threatened flora and fauna databases are compiled from survey data collected and compiled by researchers and observers, and are highly variable in their coverage across the state, particularly in more remote locations, such as the Alpine National Park. This clustering of data based on survey effort can be seen on the DSE supplied map, which shows numerous threatened species records around Falls Creek and Mt Hotham, where many targeted surveys have previously been undertaken. If few or no

surveys have been undertaken in an area, which is common in areas with limited access or development, there will necessarily be a lack of records for that area. Ecology Australia considers that if targeted surveys were undertaken within the selected sites, at least some of these sites would be likely to support State or Commonwealth listed threatened species and/or ecological communities. For example, a recent survey at one of the sites where cattle have been re-introduced (Wahren 2011) has recorded an extant population of the EPBC Act-listed Alpine Tree Frog (see Fauna section below).

- The records of threatened species shown on the DSE supplied map are limited to those records which occur within the Alpine National Park, with records outside the park not shown. As many of the grazing sites occur on the periphery of the park, it is likely that additional threatened species records occur near to the sites. Indeed, examination of the full threatened species datasets shows a substantial number of records within close proximity to the sites, including numerous records of threatened fauna within four kilometres of the Treasure and McCormack sites.
- The high-altitude wetlands mapping shown in the DSE supplied map suggests that few wetlands occur within the sites. However, like the threatened species data, the wetland mapping information is variable and clustered in particular areas. Further, the mapping was largely based on interpretation of aerial photographs, which is not as reliable as ground-based survey. Previous surveys by Ecology Australia have in fact recorded a number of high-altitude wetlands within and surrounding the sites. Furthermore, recent surveys by Dr Henrik Wahren (2011) at the Treasure and Higgins sites have recorded not only the presence of high-altitude wetlands, but substantial impacts to these wetlands following approximately two weeks of cattle grazing.
- The records displayed upon the DSE supplied map have similar symbology for FFG Act-listed species and EPBC Act-listed species. As the FFG Act-listed species are shown 'above' the EPBC Act-listed species in the map and legend, the symbols for EPBC Act-listed species are obscured wherever that species is listed under both Acts (as occurs for many species). This map is therefore misleading in giving the impression of far fewer records of EPBC Act-listed species occurring in or near the sites than actually do occur.

The limited effectiveness and potential errors in using flora and fauna databases for assessment purposes are acknowledged in the draft Victoria's Biodiversity Strategy (2010 – 2015), which states: *'biodiversity datasets have been limited in terms of their consistency, coverage, scale and currency across Victoria...data layers required to adequately support policy objectives are not yet available'* (DSE 2010 p 74). This demonstrates the inadequacy of using existing databases as the means for determining presence or absence of taxa or communities when deciding on where to locate potentially damaging activities.

Ecology Australia has substantial reservations about the environmental assumptions and the interpretation of data (namely a lack thereof) used as the basis for the selection of sites in this project. Given the findings above, we conclude that a desktop analysis does not provide a sufficient basis for the selection of sites for the purpose of avoiding or minimising significant environmental impacts.

Research Design

This section is based on the research design summary released by DSE to the Victorian National Parks Association in January 2011. The summary document consists of three pages briefly outlining the background and approach of the project, and the plans for 2011 (year 1) as well as a brief overview of plans for 2012-2016 (years 2-6). It is difficult to determine the authorship and development of this document, as the document does not have any letterhead, proprietary information or names of authors.

The approach and plan for the first year largely consist of determining the following: the efficacy of tracking cattle; developing techniques for measuring cattle effects on fuel loads; scientific literature analysis of various factors associated with the study; feasibility of expanding the number of sites; and planning a grazing and fire interaction study. The ecological component of the scientific literature analysis appears to focus on plant diversity and abiotic processes, and does not mention fauna or threatened species and communities. No mention is made of field surveys to investigate ecological values prior to, or until the end of the first year. The research summary states that *'At the end of the first season of grazing (Autumn 2011), techniques for fuel load and ecological condition in areas that have been grazed and representative ungrazed areas will be trialled'*. This statement does not provide any detail on what ecological parameters will be measured, and as discussed further below, the selection of spatially separate 'representative' ungrazed areas is a poor substitute for baseline data at a site pre-treatment.

Ecology Australia understands that the experimental design for the project, to be led by Professor Mark Adams of the University of Sydney, has not yet been developed, and that the actual collection of data may not begin until October 2011 ('Grazing study can't start for months' The Age, January 29, 2011). The re-introduction of cattle into the Alpine National Park long prior to data collection occurring, and without a detailed experimental design having been developed, is not consistent with established scientific research methods, and also precludes the collection of baseline data (*i.e.* pre-experimental treatment). Therefore, biodiversity values which may occur at the sites (see below) cannot be investigated prior to the experimental treatment (cattle grazing) occurring, and hence, accurate interpretation of the impacts of cattle to these values cannot be confidently made.

Ecology Australia is concerned that the research design appears to be largely focused upon the singular question of cattle grazing effects on fuel loads, with insufficient regard given to the potential impact of cattle grazing upon ecological values present within the Alpine National Park. Of particular concern is that no specific monitoring of key biodiversity values at the sites has been incorporated into the research design, including monitoring of threatened flora and fauna, ecological communities and wetlands.

Threatened Species and Communities

Flora

The existing DSE Flora Information System (FIS) database cannot be used as a means of establishing the absence or distribution of flora within a given geographical area, as has been done in the location of the grazing trial areas – as the absence of a record does not necessarily indicate that the species is not present. This is because, as mentioned above, the vast majority of flora records are opportunistic and piecemeal, reflecting the fact that in Victoria generally there has been little dedicated, systematic flora survey effort. Further, the quality of the data indicating presence may be in some cases questionable given its age, time of collection and other factors. For example, ongoing taxonomic research (mostly within Australia) with increasingly greater taxonomic resolution means that the taxonomic understanding of some groups (e.g. orchids), as well as their current conservation status, has become rapidly dated.

An examination of the FIS data relating to the areas subject to the grazing shows that the number of species of plants recorded for the areas (Table 1) is in many cases miniscule. In the case of Lovick for example, with 35 species recorded, this is likely to be less than 10% of the flora species present, or in the case of Rogers (70 species) less than 25% of species present.

Table 1. Proposed Grazing Research Sites: DSE Flora Information System records

Name	Area Ha	Number Plant Spp. Recorded
Higgins	7920	220
McCormack	6226	66
Heywood	3308	?
Treasure	6938	180
Lovick	861	35
Rogers	975	70

Significant plant species

The conservation significance of flora (and fauna) is typically driven by its formal listing under the FFG Act and the EPBC Act. While this is sound in principle, only a fraction of plant (and animal) species that would qualify for listing are actually listed. There is no systematic process for nomination and listing under these acts, and listing is ad hoc and opportunistic: thus a focus on listed taxa and communities in the consideration of conservation significance of an area is highly inadequate. This is reflected in the DSE Advisory Lists of Victorian Rare and Threatened Species (VROTS), of which only a small proportion are FFG Act and EPBC Act-listed species (e.g. see VAGO 2009 p2).

The rare and threatened species (VROTS) tend to occur in habitats that are rare in the landscape and particularly vulnerable to cattle-grazing impacts; these habitats include wetlands and drainage lines of all types, as well as grasslands and grassy woodlands. Cattle concentrate activities in these highly vulnerable environments because they are well-watered, often a source of drinking water for cattle, and have the most fertile alluvial, colluvial and volcanic soils. Of the

29 VROT plant species listed in Table 3 as recorded within 10 km of the six grazing areas (captured from the FIS database), no fewer than 21 (74%) occur in such environments in montane, sub-alpine and alpine locations. This list of VROT plant species is only a fraction of those that are expected to occur in the sites selected for grazing.

Impacts of cattle grazing on the environment and biota

The negative impacts of cattle grazing on the environment, biota and ecosystems have been well documented but are reiterated below. Cattle are known to:

- eat plants, reducing reproductive ability, curtailing longevity and often resulting in death of the plants;
- trample and mechanically damage vegetation, fauna habitats and soils, resulting in soil compaction, reduced moisture infiltration, soil erosion and altered hydrology;
- damage vegetation and fauna habitats by smothering effects of faeces and the scalding impacts of urine (localised plant death); death of vegetation under faeces results in the creation of sites for weed recruitment;
- increase and concentration of nutrients in faeces and urine, often in the most vulnerable location (wetlands and drainage lines);
- promote weed invasion by differential grazing impacts i.e. the promotion of unpalatable or toxic weeds (e.g. Soft Rush and St John's Wort) at the expense of palatable indigenous flora;
- spread weed seeds in faeces and externally on their bodies; and
- disturb soils, creating mineral-earth sites for weed recruitment.

From the list of impacts listed above, reinstating cattle grazing in the Alpine National Park is also clearly contrary to a number of *Threatening Processes* listed under the Victorian *Flora and Fauna Guarantee Act 1988*:

- *Soil erosion and vegetation damage and disturbance in the alpine regions of Victoria caused by cattle grazing;*
- *Wetland loss and degradation as a result of change in water regime, dredging, draining, filling and grazing;*
- *Invasion of native vegetation by 'environmental weeds'; and potentially*
- *Infection of amphibians with Chytrid Fungus, resulting in chytridiomycosis.*

Vulnerability of biota in relation to climate change

Projected and documented climate-change scenarios include:

- contraction and changes in alpine and montane habitats and vegetation communities;
- extinction of flora and fauna species;
- decreased rainfall and increased temperatures and evaporation;

- increasing frequency and intensity of severe weather events; and
- increased frequency and intensity of wildfire.

Reinstating cattle grazing in the Alpine National Park is contrary to DSE’s statutory obligations as the primary agency managing biodiversity in Victoria. This is doubly the case in view of climate-change threats that are already manifesting in alpine areas.

Fauna

The lack of fauna records, as discussed above, reflect a lack of survey effort in remote areas, and this is reflected in Table 2 which list only a fraction of the species that would be expected to occur in the area, especially for the Heywood, Rogers and Lovick sites.

Table 2. Proposed Grazing Research Sites: DSE Fauna 25 and Fauna 100 database records

Name	Area ha	Number fauna species recorded – Fauna 25	Number fauna species recorded – Fauna 100
Higgins	7920	48	58
McCormack	6226	20	58
Heywood	3308	11	1
Treasure	6938	21	59
Lovick	861	20	2
Rogers	975	36	2

DSE’s Fauna 25 and Fauna 100 databases listed 33 threatened fauna species as occurring within a 10 km radius of the grazing lease sites (Table 4). The list includes some of Australia’s rarest, most threatened and iconic vertebrate species: Mountain Pygmy-possum; Spot-tailed Quoll; Long-footed Potoroo; Brush-tailed Rock-wallaby; Smoky Mouse; Powerful Owl; Alpine She-oak Skink; Alpine Bog Skink; Alpine Water Skink; Spotted Tree Frog; and Alpine Tree Frog.

Some of these species have been recorded previously within the grazing lease areas. For example, under the Fauna 100 database (DSE): there are 20 records of the EPBC Act and FFG Act-listed Alpine Tree Frog from the Treasure grazing area; FFG Act-listed Caddisfly has been recorded in the McCormack lease area; and Latham’s Snipe has been recorded at the Treasure grazing area. Under the Fauna 25 database (DSE): EPBC Act and FFG Act-listed Spotted Tree Frog has been recorded in the McCormack grazing area; FFG Act-listed Alpine Bog Skink has been recorded at Lovick; and FFG Act-listed White-footed Dunnart has been recorded at Rogers.

Some of these threatened species would almost certainly occur in habitats preferentially grazed by cattle at these lease areas. Fauna habitats that are rare in the landscape and especially vulnerable to cattle-grazing impacts include wetlands, drainage lines, grasslands and grassy woodlands (Wahren 2011; see ‘Impacts’ above). Threatened fauna species that occur in these habitats and are therefore potentially impacted by cattle grazing include:

- EPBC Act and FFG Act-listed Alpine She-oak Skink (*Cyclodomorphus praealtus*) – Alpine Tussock Grasslands, Tall Alpine Herbfields and grassy heaths;

- FFG Act-listed Alpine Bog Skink (*Pseudomoia cryodroma*) – Alpine Bogs and streams and some grasslands;
- FFG Act-listed Alpine Water Skink (*Eulamprus kosciuskoi*) – Alpine Bogs and streams; and
- EPBC Act and FFG Act-listed Alpine Tree Frog (*Litoria verreauxii alpina*) – a wide variety of waterbodies, especially permanent pools amongst Alpine Bogs, and stock dams in grasslands and grassy woodlands.

The above species represent key fauna species for consideration in the grazing trial project because they occupy habitats preferentially grazed by cattle on gentler sloping land (<10°) at higher altitudes (> 1000 m). For example, during a visit to two of the grazing lease areas in January 2011, Wahren (2011) recorded the Alpine Tree Frog in the Treasure site, and also recorded significant disturbance to the habitat of this species from cattle grazing and trampling after just two weeks following the re-introduction of cattle. Other rare or threatened species (VROTS), not currently listed under the EPBC Act or FFG Act, are likely to have bog or drainage line habitat within the grazed areas which may be preferentially impacted by cattle, such as the Broad-toothed Rat and Latham's Snipe.

In addition to those listed above, there are further threatened species which have been recorded in or near to grazing lease areas which may also be impacted in some manner by cattle grazing. These species include the EPBC Act and FFG Act-listed Spot-tailed Quoll, Long-footed Potoroo, Smoky Mouse and Spotted Tree Frog. The impacts of cattle on these species or their habitats are less clear, however, the potential exists for cattle grazing to adversely affect them. For example, cattle grazing can potentially impact on Spotted Tree Frog populations downstream through increased sedimentation and nutrient run-off, as well as increased weed invasion and the deterioration of riparian habitat (Robertson and Gillespie 1998; G. Gillespie pers. comm. 2011).

Ecological Communities

Ecology Australia is not aware whether data on modelled Ecological Vegetation Class (EVC) distribution was used in the selection of sites or the development of the research design summary. While often useful as an indication of EVC presence in an area, the modelled EVC distribution occurs on a coarse scale (up to 1:100,000) with frequent errors, which makes it unsuitable to represent actual on-ground vegetation at small scales (e.g. <1 ha, or narrow bands of vegetation). These smaller scales frequently apply to wetland and bog vegetation communities.

Interrogation of the modelled EVC distribution indicates that at least two EVC's which are likely to represent the EPBC Act-listed Alpine *Sphagnum* Bogs and Associated Fens ecological community are modelled as present within the study area. Specifically, EVC 210 Sub-alpine Wet Heathland has been modelled to occur at the Treasure, Higgins and Lovick sites, while EVC 211 Sub-alpine Wet Heathland/Alpine Valley Peatland Mosaic has been modelled as occurring at the Treasure site. As discussed above, the EVC modelling occurs at a coarse scale which is unlikely to accurately reflect the distribution of EVC's occurring at finer scales, and Ecology Australia considers it likely that further areas which would qualify as the EPBC Act-listed ecological community occur within the study sites.

A total of approximately 125 ha of EVC 44 Sub-alpine Treeless Vegetation has been modelled to occur at the sites. This undifferentiated EVC can comprise various EVC's including several bog and fen communities. Ecology Australia considers it likely that areas of this EVC within the sites would include some areas of bog vegetation potentially qualifying as the EPBC Act-listed ecological community.

Despite its name, the Alpine *Sphagnum* Bogs and Associated Fens ecological community occurs at alpine, sub-alpine and montane elevations, and is known to occur as low as 1200 m above sea level in Victoria (Threatened Species Scientific Committee 2008). Two components of the EPBC Act-listed ecological community are also listed under the Victorian FFG Act: Alpine Bog Community and the Fen (Bog Pool) Community. Ecology Australia considers that these communities may also occur within some or all of the study sites.

The Conservation Listing Advice for the Alpine *Sphagnum* Bogs and Associated Fens ecological community lists grazing and trampling by non-native animals as a significant threat to this community (Threatened Species Scientific Committee 2008). Given the likely presence of this community in several or all of the study sites, and the known potential for cattle grazing and trampling to significantly impact upon this community, referral of this project under the EPBC Act is required.

Conclusion

Based on the information reviewed in this report, there are fundamental flaws in the site selection, research design and assessment of potential impacts to ecological values for the alpine cattle grazing project. Site selection appears to have been made based largely on the presence of threatened flora and fauna records, despite these databases being highly variable in their coverage across the state. In remote locations, such as the study sites in this project, a lack of records of threatened species does not equate to their absence, but rather is far more likely to reflect a lack of survey effort in the area. Without field surveys to validate the limited desktop analysis, the purported selection of research sites '*to avoid or minimise significant environmental impacts*' can not be supported.

The research design summary for this project provides little detail on the experimental design of the project, and even less on assessing the potential impacts on ecological values. The re-introduction of cattle grazing without gathering baseline data is not consistent with established scientific research methods, and subsequently an accurate interpretation of the impacts of cattle to ecological values cannot be confidently made. The design of this project does not appear to have been subject to a peer-review process, and as cattle grazing has commenced prior to a final experimental design having been developed, there are serious reservations about the viability of this project as a scientifically-robust research trial.

Based on examination of the full threatened flora and fauna datasets for the region, modelled EVC distribution, and survey work conducted throughout the region, Ecology Australia believes it is highly likely that threatened species and/or ecological communities occur within the research sites. A substantial body of scientific literature also outlines the potential for cattle to significantly impact upon many of these threatened species or communities. It is therefore

considered that a referral under the EPBC Act is required for this action, and that the potential implications of this action under other relevant legislation are investigated.

Overall, Ecology Australia considers the site selection and experimental design of this project to be fundamentally flawed, and to represent a poorly-made decision which appears to ignore over 30 years of peer-reviewed alpine research and science.

References

- DSE (2005) Advisory List of Rare and Threatened Plants in Victoria – 2005. Department of Sustainability and Environment, East Melbourne.
- DSE (2007) Advisory List of Threatened Vertebrate Fauna in Victoria – 2007. Department of Sustainability and Environment, East Melbourne.
- DSE (2009) Advisory List of Threatened Invertebrate Fauna in Victoria – 2009. Department of Sustainability and Environment, East Melbourne
- DSE (2010) *Victorian Biodiversity Strategy 2010 – 2015: Biodiversity is Everyone's Business*. Consultation Draft, Department of Sustainability and Environment, Melbourne
- Robertson, P. and Gillespie, G. (1998) Recovery Plan for the Spotted Tree Frog (*Litoria spenceri*). Report to Environment Australia, Canberra.
- Threatened Species Scientific Committee (2008) *Commonwealth Listing Advice on Alpine Sphagnum Bogs and Associated Fens*.
- VAGO (2009) *Administration of the Flora and Fauna Guarantee Act 1988* Victorian Auditor-General's Office, Melbourne
- Wahren, H. (2011) Cattle Grazing Trials in the Victorian Alpine National Park. Notes from visits to two Department of Sustainability and Environment grazed areas (unpublished report). La Trobe University, Bundoora

Table 3. Victorian rare or threatened flora species recorded within 10 km of cattle grazing sites

Codes: EPBC Act = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*; FFG Act = Victorian *Flora and Fauna Guarantee Act 1988*; DSE (2005) = classified under Department of Sustainability and Environment Threatened Plant Advisory Lists for Victoria 2005.

Scientific Name	Common Name	Number of Records	FFG Act	DSE (2005)	EPBC Act
<i>Almaleea capitata</i>	Slender Parrot-pea	9	Listed	Vulnerable	
<i>Boronia citrata</i>	Lemon Boronia	1	Rejected	Vulnerable	
<i>Botrychium australe</i>	Austral Moonwort	2	Listed	Vulnerable	
<i>Brachyscome sp. 3</i>	Mountain Daisy	6	Listed	Vulnerable	
<i>Carex capillacea</i>	Hair Sedge	11	Rejected	Rare	
<i>Carex paupera</i>	Dwarf Sedge	3	Listed	Vulnerable	Vulnerable
<i>Carex raleighii</i>	Raleigh Sedge	5	Rejected	Rare	
<i>Celmisia sericophylla</i>	Silky Snow-daisy	1	Listed	Vulnerable	
<i>Cyperus gracilis</i>	Slender Flat-sedge	1	Listed	Endangered	
<i>Deyeuxia pungens</i>	Narrow-leaf Bent-grass	2	Listed	Vulnerable	Vulnerable
<i>Discaria nitida</i>	Shining Anchor Plant	1	Listed	Endangered	
<i>Discaria pubescens</i>	Australian Anchor Plant	13	Listed	Rare	
<i>Diuris ochroma</i>	Pale Golden Moths	1	Listed	Endangered	Vulnerable
<i>Drabastrum alpestre</i>	Mountain Cress	1	Listed	Vulnerable	
<i>Epilobium willisii</i>	Carpet Willow-herb	4	Listed	Presumed extinct	
<i>Euphrasia scabra</i>	Rough Eyebright	1	Listed	Endangered	
<i>Glycine latrobeana</i>	Clover Glycine	3	Listed	Vulnerable	Vulnerable
<i>Lobelia gelida</i>	Snow Pratia	1	Listed	Vulnerable	Vulnerable
<i>Myoporum floribundum</i>	Slender Myoporum	6	Listed	Endangered	
<i>Oreomyrrhis argentea</i>	Silver Caraway	2	Rejected	Rare	
<i>Poa saxicola</i>	Rock Poa	4	Listed	Vulnerable	
<i>Prasophyllum lindleyanum</i>	Green Leek-orchid	1	Rejected	Vulnerable	
<i>Prasophyllum niphopedium</i>	Marsh Leek-orchid	1	Listed	Endangered	
<i>Psilotum nudum</i>	Skeleton Fork-fern	1	Rejected	Vulnerable	
<i>Pterostylis cucullata</i>	Leafy Greenhood	12	Listed	Vulnerable	Vulnerable
<i>Ranunculus eichlerianus</i>	Eichler's Buttercup	35	Rejected	Rare	
<i>Taraxacum aristum</i>	Mountain Dandelion	2	Rejected	Rare	
<i>Thesium australe</i>	Austral Toad-flax	12	Listed	Vulnerable	Vulnerable
<i>Wahlenbergia densifolia</i>	Fairy Bluebell	5	Listed	Vulnerable	

Table 4. Victorian rare or threatened fauna species recorded within 10 km of cattle grazing sites

Codes: EPBC Act = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*; FFG Act = Listed under the Victorian *Flora and Fauna Guarantee Act 1988*; DSE (2007) or (2009) = classified under Department of Sustainability and Environment Threatened Vertebrate or Invertebrate Advisory Lists for Victoria, 2007 and 2009, respectively; Mi and MA-O = listed under the Migratory and Marine-overfly Schedules of the EPBC Act.

Common Name	Scientific Name	Number of records Fauna 25 Database	Number of records Fauna 100 Database	FFG Act	DSE (2007 or 2009)	EPBC Act
Birds						
Grey Goshawk	<i>Accipiter novaehollandiae novaehollandiae</i>	-	2	Listed	Vulnerable	Ma-O
Eastern Great Egret	<i>Ardea modesta</i>	-	4	Listed	Vulnerable	Mi; Ma-O
Bush Stone-curlew	<i>Burhinus grallarius</i>	-	2	Listed	Endangered	
Chestnut-rumped Heathwren	<i>Calamanthus pyrrhopygius</i>	-	2	Listed	Vulnerable	
Speckled Warbler	<i>Chthonicola sagittata</i>	-	6	Listed	Vulnerable	
Latham's Snipe	<i>Gallinago hardwickii</i>	-	1		Near Threatened	Mi; Ma-O
Painted Honeyeater	<i>Grantiella picta</i>	-	2	Listed	Vulnerable	
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	-	2	Listed	Vulnerable	Mi; Ma-O
Turquoise Parrot	<i>Neophema pulchella</i>	1	2	Listed	Near Threatened	
Barking Owl	<i>Ninox connivens connivens</i>	-	1	Listed	Endangered	
Powerful Owl	<i>Ninox strenua</i>	11		Listed	Vulnerable	
Lewin's Rail	<i>Lewinia pectoralis pectoralis</i>	1	-	Listed	Vulnerable	
Diamond Firetail	<i>Stagonopleura guttata</i>	6	14	Listed	Vulnerable	
Sooty Owl	<i>Tyto tenebricosa tenebricosa</i>	15	-	Listed	Vulnerable	
Hooded Robin	<i>Melanodryas cucullata cucullata</i>	5	9	Listed	Near Threatened	
Mammals						
Mountain Pygmy-possum	<i>Burramys parvus</i>	3	2	Listed	Critically Endangered	Endangered
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	7	5	Invalid/Ineligible/Rejected	Near Threatened	
Spot-tailed Quoll	<i>Dasyurus maculatus maculatus</i>	16	8	Listed	Endangered	Endangered
Eastern Wallaroo	<i>Macropus robustus robustus</i>	5	2	Listed	Endangered	

Common Name	Scientific Name	Number of records Fauna 25 Database	Number of records Fauna 100 Database	FFG Act	DSE (2007 or 2009)	EPBC Act
Common Bent-wing Bat	<i>Miniopterus schreibersii</i> GROUP	2	-	Listed		
Brush-tailed Rock-wallaby	<i>Petrogale penicillata</i>	2	14	Listed	Critically Endangered	Vulnerable
Long-footed Potoroo	<i>Potorous longipes</i>	82	2	Listed	Endangered	Endangered
Smoky Mouse	<i>Pseudomys fumeus</i>	3	14	Listed	Critically Endangered	Endangered
White-footed Dunnart	<i>Sminthopsis leucopus</i>	2	-	Listed	Near Threatened	
Reptiles						
Alpine She-oak Skink	<i>Cyclodomorphus praealtus</i>	22	10	Listed	Endangered	Endangered
Alpine Water Skink	<i>Eulamprus kosciuskoi</i>	13	-	Listed	Critically Endangered	
Alpine Bog Skink	<i>Pseudemoia cryodroma</i>	14	12	Listed	Endangered	
Frogs						
Spotted Tree Frog	<i>Litoria spenceri</i>	31	1	Listed	Critically Endangered	Endangered
Alpine Tree Frog	<i>Litoria verreauxii alpina</i>	237	114	Listed	Critically Endangered	Vulnerable
Fish						
Barred Galaxias	<i>Galaxias fuscus</i>	42	-	Listed	Critically Endangered	Endangered
Australian Grayling	<i>Prototroctes maraena</i>	6		Listed	Vulnerable	Vulnerable
Invertebrates						
Caddisfly	<i>Archaeophylax canarus</i>	-	1	Listed	Data Deficient	
Murray Spiny Crayfish	<i>Euastacus armatus</i>	4	3	Listed	Near Threatened	