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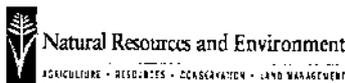


# Australian Alps National Parks Feral Horse Impact Monitoring



## *Consultants Project Brief*

January 1999



*This project has been jointly funded by the  
Australian Alps National Parks, Natural Heritage Working Group  
and Parks Victoria.*

# ALPINE NATIONAL PARK

## Australian Alps Feral Horse Impact Monitoring

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### 1. Introduction

#### 1.1 Environmental Management System

Parks Victoria is committed to conserving, protecting and enhancing the environmental values of Victoria's outstanding park and waterway system. As professional managers, we are building on-going relationships with a range of people with specialist skills such as biologists, soil scientists and researchers who can provide us with information to help guide park management.

Parks Victoria has developed an Environmental Management System (EMS) which will:

- support management decision making on priorities and resource allocation for ecological management;
- establish standardised reporting on ecological management performance; and
- develop targeted research, monitoring and reporting on the trend in ecological condition of Victoria's parks system.

The EMS will be applied at a state-wide and park/venue level. This system is based on a risk management framework which focuses on the protection and enhancement of environmental values. The three stage process firstly requires a clear understanding of the environmental values of a park or park area, followed by the quantification of the effects of threatening processes in terms of potential loss of environmental values. Finally, the costs and benefits of the management actions must be assessed in terms of reduction of risk to these environmental values. A thorough understanding of the nature of the environmental values in parks is, therefore, central to the success of the system. During this project, environmental values information on threatened species, vegetation diversity and legislative responsibilities will be collected and analysed in accordance with Parks Victoria's Environmental Management System. It will highlight the existing assets and environmental obligations and enable future analysis of the biodiversity and condition of vegetation on a 'within park' and state-wide basis.

#### 1.2 EMS and the Feral Horse project

The Parks Victoria Environmental Management System involves two important stages;

- Assessing environmental values such as the diversity and condition of vegetation and then;
- Assessing environmental risks.

Environmental values information on the condition of vegetation in the Alpine National Park is currently being initiated by Parks Victoria as part of the development of environmental performance indicators for Alpine Grazing. This project will focus on the second issue of environmental risk assessment.

An environmental risk assessment can be divided into three major questions "What is the extent of the risk?", "How is the risk changing?" and "What impact is the risk having on the environmental values?". Park and other natural area managers need to understand the values of a site and all of the dimensions of risk, in order to develop and prioritise management strategies.

Due to the level of funding available for this project, a comprehensive values and risk assessment of Feral Horses within the Cobberas area of the Alpine National Park is not possible at this stage. The scope of this project will be limited to the third dimension of risk, that is;

*"What impact is the risk having on the environmental values?"*

### 1.3 Australian Alps National Parks

One of the major outcomes of the Australian Alps National Parks, "Feral Horses in the Alps" workshop in 1992 was that if any feral horse control programs were to be implemented then a structured and co-ordinated monitoring program quantifying the environmental impacts of Feral Horses in the Alps should begin immediately. The Feral Horses in the Alps workshop also recognised that;

- Feral Horse management is a component of ecosystem management and the priority for management must be put in context with other potential environmental modifiers such as rabbits, feral pigs, feral goats, feral cattle and deer.
- Data collection was not seen as a research activity but part of a structured monitoring program. The use of contracted experts is the preferred method for initial data collection.
- Due to the level of public interest, it is unlikely that a single state or single agency will be able to effect long-term management in isolation.

Gaining a better appreciation or understanding of the impacts of feral horses on alpine vegetation is considered a high priority for Parks Victoria. This project will enable the Australian Alps park management agencies to understand more about the nature of the impacts on specific vegetation communities and, most importantly, will develop the foundations for long term monitoring at specific sites so that environmental changes are captured and recorded for the benefit of future management of Alpine Parks.

## 2. Background

The Friends of the Cobberas and Parks Victoria began a monitoring project to assess the environmental impact of Feral Horses in the Cobberas area of the Alpine National Park, including the installation of two 10mx10m grazing exclusion plots (Native Cat Flat and Cowombat Flat) in 1997.

A draft project proposal (see attached draft proposal) was prepared by the group and approved by the Australian Alps Liaison Committee which subsequently provided funds for the project through the Natural Heritage Working Group.

The focus of the project has now switched to directing the funds provided into setting up a monitoring process which will measure the impact that the environmental risk (feral horses) is having on the environmental values of the Alpine National Park.

A steering committee has been set up to manage the project comprising Scott Perkins (convenor / project manager) from Parks Victoria, Ian Smith or Ken Norris of the Friends of the Cobberas Group, Mick Bramwell from Flora and Fauna NRE and Brett McNamara (AALC- Program Co-ordinator)

## 3. Aims

The steering committee members have developed, from the draft project proposal of the Friends group, this brief and will oversee the establishment of a monitoring program which has the following objective

**"To use the Cobberas area to trial a monitoring program which will measure change in environmental values, with particular emphasis on vegetation condition due to a specific environmental risk- presence of feral horses"**

An important element in assessing the environmental risk is distinguishing between the risk and the sources/causes of risk. An environmental risk is a process that can directly result in the loss of an environmental value. In the case of feral horses, they are an environmental risk because they eat native vegetation, an environmental value. Questions then arise as to how much of a risk do feral horses pose to specific environmental values in the alpine environment?

This project will therefore focus on quantifying the level of impact that feral horses have on the environmental values of the Alpine National Park in the Cobberas area.

The consultant will complete the tasks listed in 'scope of the project', with consideration of the following underlying aims;

- to provide statistically valid data on the level of environmental change (or risk) with particular emphasis on vegetation (the environmental value) caused by feral horses in the Cobberas area.
- to provide an element of the project which is simple and straightforward (ie. basic plant identification) in order to facilitate the involvement of volunteers in data collection. However, there will be an element of the data collection which requires a greater level of expertise (ie. floristics) that may also be incorporated into the long term plan for data collection and monitoring.

#### 4. Study Area

The Cobberas-Tingaringy area is characterised by its remoteness from population centres, superb scenery and relatively undisturbed natural environments. The area forms part of the headwaters of the Murray River. To the east of the study area, rainshadow woodlands cover the rugged and scenic valley of the Upper Snowy River. Climatic conditions vary considerably with elevation, aspect and topography and this has a major influence on the native vegetation communities.

The specific study sites chosen for the project are at Cowombat Flat (AMG 045 269) and Native Cat Flat (AMG 916 117). These sites have been chosen due to the fact that they experience no cattle grazing pressure at any time of year, as opposed to the majority of the park area.

The study area incorporates the alpine wet heathland and snow-gum grassy woodland vegetation communities but may also be extended to other vegetation communities in order to develop a better understanding of the environmental impact on a broader range of native vegetation.

The following is a brief description of the major vegetation communities (BVC's) in the broader study area (extract from *Alpine National Park- Cobberas Tingaringy Unit Management Plan*, September 1992). These are described in more detail by Walsh et al (1984) and LCC (1974 and 1977a). These are a guide only, at specific study sites, EVC or sub-community is the preferred level for the monitoring process.

- Alpine wet heathlands occur along Limestone Creek and its tributaries, on Davies Plain, and as small isolated communities at 900-1500m elevation. These communities may occur as closed heathlands; soils are often peaty and poorly drained. The closed shrub layer commonly features Small-fruit Hakea and Alpine Bottlebrush, with Sphagnum moss forming a carpeted ground layer.
- Snow Gum woodlands are characterised by Snow Gum on the exposed ridges and Snow Gum / Candlebark on the more protected slopes. This vegetation community is located at elevations above 1100m and includes areas such as Davies Plain, Blue Hill, the Cobberas, Mt Wombargo, Rams Head Range and Big Hill.
- Rain-shadow woodlands are confined to the east of the study area, in the Snowy and Suggan Buggan River valleys. Annual rainfall is less than 700mm, less than half of the adjacent sub-alpine country. The steep gravelly slopes support woodlands of White and Black Cypress Pine and / or White Box. Close to the Rivers, a riparian form of rainshadow woodland is found.
- Alpine Ash forests occur adjacent to Snow-Gum woodland at altitudes of 1000-1400m. These tall open forests are dominated by Alpine Ash and usually have a sparse shrub understorey. Mature stands fringe Davies Plain.
- Montane sclerophyll woodlands occur mainly in the south-west of the unit, at northern aspects at 800-1100m elevation, particularly in the Cobberas area. A mixed species forest, characterised by Candlebark, Broad-leaf Peppermint and Snow Gum, merges with Snow Gum woodland at the higher altitudes and dry-sclerophyll forests at the lower altitudes.
- Rocky outcrop open scrubland is confined to rocky escarpments and exposed slopes. This community occurs as either tall shrubland with scattered trees, or closed scrubland. Where eucalypts are absent, the 'black-thorn scrub' is characterised by Rock Wax-flower or Red Wattle. Where eucalypts are present, they occur as mallee or low branching, spindly forms of Manna Gum, Tingaringy Gum and others.
- Riparian forest, dominated by Hazel Pomaderris and Blackwoodis found along the Suggan Buggan and Ingeegoodbee Rivers, and the northern Limestone and Reedy Creeks. Montane Riparian vegetation consisting of Mountain tea-tree with an understorey of ferns and sedges is located along gullies and stream margins in the Diggers Hole Creek and Reedy Creek areas.
- Wet sclerophyll forests comprise tall, open forests of eucalypts on well watered slopes (200-1200m elevation). This community is largely restricted to the Reedy Creek area where Manna Gum is the dominant species, with a tall shrub layer, tree ferns and ground ferns.
- Dry sclerophyll forests are found in the north of the area. A diverse range of foothill forests (200-900m elevation) which may be characterised by one or more of a large number of eucalypts is represented. The shrub layer is usually sparse and the ground cover consists of semi-shrubs such as Common Heath and herbs.

## 5. Scope of the Project

The table below outlines the tasks, stages and timelines involved for the duration of the project.

Stage	Description/Product	Timeline
<p><b>Stage 1</b> Literature review, development of experimental design, etc</p>	<p><b>Literature review</b></p> <ul style="list-style-type: none"> <li>a review of existing literature and monitoring techniques used to assess the impact of Feral Horses in the Australian Alps (up to four pages)</li> </ul> <p><b>Experimental design of monitoring program</b></p> <ul style="list-style-type: none"> <li>Design an environmental risk assessment monitoring program, including; assessment criteria, identification of environmental values, sampling strategy (including experimental design), protocols for data collection and analysis, and</li> <li>detail the possible future involvement of volunteers, park staff and scientists in the monitoring process.</li> </ul> <p><b>Consultation process</b></p> <ul style="list-style-type: none"> <li>Attend at least two steering committee meetings in Bairnsdale and one (overnight) field inspection of the Cobberas area.</li> <li>Informally promulgate the consultative process with various stakeholders and keep records of correspondence with those groups or individuals consulted.</li> </ul> <p><b>Report on proposal</b></p> <ul style="list-style-type: none"> <li>Provide a copy of the proposed report to the project manager on or before the 31<sup>st</sup> February, 1999.</li> </ul>	<p>To be completed by 31 February 1999 (with 40% of payment to follow)</p>
<p><b>Interim assessment of proposal</b> 'Peer review'</p>	<p><b>Assessment of proposed monitoring program</b></p> <ul style="list-style-type: none"> <li>After completion of stage one of the project ie. the experimental design of the monitoring process (grazing exclosure plots- location, size, etc), the proposed monitoring program will be assessed before implementation. The cost and arrangement for that assessment will be organised by Parks Victoria and at the cost of Parks Victoria. Commencement of stage two will proceed after the review of the proposal and at the direction of the steering committee convenor.</li> </ul>	
<p><b>Stage 2</b> development of process, Year 0 monitoring.</p>	<p><b>Modification of proposal (if required)</b></p> <ul style="list-style-type: none"> <li>Modify the proposed monitoring program (if required) under the direction and at the discretion of the project manager.</li> </ul> <p><b>Monitoring program implementation</b></p> <ul style="list-style-type: none"> <li>Establish and permanently mark and download monitoring plots (with GPS positions) onto Parks Victoria GIS system with resultant maps .</li> <li>Produce easy to complete data sheets for the monitoring program.</li> <li>Complete baseline (Year 0) monitoring, entering results onto data sheets including the time taken to complete the various monitoring tasks within the study area.</li> <li>Produce a report containing the results of the baseline monitoring, blank data sheets, maps showing the exact locations of all the plots and the methodologies of the monitoring program. The report must clearly describe the methods used so that it can be repeated in the future. The report must also give a clear justification for the methods used.</li> </ul> <p><b>Training / familiarisation</b></p> <ul style="list-style-type: none"> <li>Complete a field training session familiarising the Friends members and Park Victoria staff with the details of the data collection expected of them.</li> <li>Complete a presentation of the details of the project to the steering committee and interested stakeholders, identifying future directions.</li> </ul>	<p>To be completed by 31 May, 1999 (with 60% of payment to follow)</p>

## 6. Project Outputs

One document at end stage one, (hardcopy and electronic format) in the form of a combined literature review and monitoring proposal for review by the project manager, steering committee and an independent party.

One document at end stage two, comprising finalised monitoring program (with alterations- if required by peer review panel) including;

- an easy-to follow guide for volunteer component
- a component which incorporates 'expert' scientific' monitoring at set intervals
- A detailed presentation of the final report and future directions to interested stakeholders, including the steering committee.

The final report must clearly describe the methods used so that it can be repeated in the future. The report must also give a clear justification for the methods used.

At the completion of the project, the consultant will have provided the following to Parks Victoria;

One copy of the proposed monitoring program and literature review.

Four (4) bound copies of the final report and associated maps\*, etc

The report must be on Disk compatible with Microsoft products (e.g. Word and Excel).

*\*Mapping Note:* All consultancies/contractors engaged by Parks Victoria to provide digital copy of all data products produced. All document files to be MS Office, Windows 95 compatible. All mapping products to be GIS based and provided in MapInfo V4.5 or later (preferably 5.0) in Windows 95/98/NT format. (DOS naming conventions are no longer required).

All work, material reports and plans (including photographic material) produced throughout this project remains the property of Parks Victoria and cannot be reproduced without the consent of Parks Victoria.

## 7. Existing Information

As part of stage one of the project, the consultant is required to provide a review of existing literature and monitoring techniques used to assess the impact of Feral Horses in the Australian Alps (up to four pages). A copy of relevant Parks Victoria policies is attached to this brief. The following relevant documents will be of assistance in beginning this process;

*Feral Horses in the Alps - Report of a workshop*, Howman's Gap, Victoria 12-14 October 1992, Australian Alps National Parks.

*The Impact of Feral Horses (Equus caballus) on Sub-Alpine and Montane Environments in Australia*, Jennifer Dyring, 1990. a thesis submitted in fulfillment of the Degree of Master of Applied Science.

*The Alpine Vegetation of Victoria (excluding the Bogong High Plains Region), volume 1* N.G.Walsh, R.H.Barley and P.K.Gullan. Department of Conservation Forests and Lands 1984.

*Alpine National Park, Cobberas-Tingaringy Unit Management Plan*, Department of Conservation and Environment, September 1992

*Directions in Environmental Management*, draft for consultation, Parks Victoria, Conservation and Environment Group, September 1998.

Existing Information on the study area can be provided by Parks Victoria, including any flora and fauna survey reports, management plans, maps and aerial photography.

## 8. Key Issues

### 8.1 Floristics and Vegetation Condition Assessment

#### *Condition*

Assessment of the vegetation condition\* should include:

1. For each vegetation community / sub-community, a qualitative assessment of condition (1= poor, 10 = excellent) relative to professional knowledge of the statewide condition of communities / sub-communities within the same EVC.

For each quadrat:

2. Identification of all vascular plant species present in the quadrat
3. Weeds vs natives (number of spp/cover/abundance?)
4. Total ground cover (TGC)
5. Age classes of dominant overstorey species present
6. Overstorey dieback (for treed EVC sites)
7. Regeneration of indigenous perennial shrub species
9. Strata intactness

#### *Target Species and Communities*

In addition to common species the following categories should be targeted during the flora survey:

- Victorian rare or threatened species and communities (FFG's, VROTS and AROTS);
- endemic species to the East Gippsland District.
- species not previously recorded in the eastern half of the Alpine National Park
- species or communities regarded as important for other reasons (such as a substantial regional population depletion, edge of range, disjunct populations) by the consultant or Parks Victoria Project Manager

A list of VROTS known to occur in the Alpine National Park is provided in Appendix 2.

#### *Sampling*

The following information should be collected for each sampling area (plot) as a minimum:

- date
- location, using differentially corrected GPS to a minimum on-ground accuracy of 10m.
- locality description
- record of vegetation condition (Anon. 1998d)
- soil and substrate characteristics (including proportions of litter, bare ground, rock, etc.);
- reproductive state of any target species

#### *Survey Timing*

To maximise opportunities for identifying threatened species and greater floristic diversity, the vegetation survey will be conducted during the period December-February (depending on seasonal conditions)

#### *Taxonomy*

Nomenclature should follow the Flora Information System of the Department of Natural Resources and Environment. Any groups with taxonomic difficulties or recent revisions should be discussed in the final report.

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\* **NB:** A more detailed Interim methodology for assessing vegetation condition based on Parks Victoria standard assessment is attached (appendix 4) and should serve as a useful guide in developing monitoring protocols.

## General Issues

- Exclosure fence design will be a major practical consideration in designing a monitoring program. Any plots which are to exclude grazing will need to be designed so as to exclude horses only, as they are the target species. Other significant grazers such as macropods, rabbits, wombats, etc will need to be permitted to graze naturally through these areas in order to get an indication of the selective pressure of horses on that environment.
- How and what to measure? - must be specific to monitoring of changes to vegetation as the main environmental value. Specific consideration has been given to targeting areas where horses occur but from which cattle are absent in the selection of the study sites.
- The Friends of the Cobberas and Park Staff will carry out subsequent monitoring following year 0. The level of involvement by the group will be relative to the expertise of the group members. The data collected by the group should be useful in determining environmental change on an annual basis. Data collection related to floristics or other complex scientific issues may need to be collected by an expert at set intervals, in conjunction with the group.
- After completion of stage one of the project ie. the experimental design of the monitoring process (grazing exclosure plots- location, size, etc), the proposed monitoring program will be independently assessed and reviewed before implementation.
- Commencement of stage two will proceed after the review of the proposal and at the direction and discretion of the project manager.
- the consultant will liaise with Michelle Walter, who will, shortly, commence a study on Feral Horse densities, behaviour and population dynamics in the Australian Alps, including the study area.
- The report may include historical evidence such as grazing, fire history, horse presence / introduction, other evidence of disturbance (eg.recreation)

## 10. Consultation

The following people have been informed that this project is about to begin and may provide some useful information regarding horse (or cattle) behaviour, location, etc. All contact with the stakeholders mentioned must be documented and copies of correspondence sent to the convenor to be put on file.

These Interest groups or important contacts include;

- Feral Horse Impact monitoring steering committee, through the convenor.
- John Wright, Parks Victoria, Conservation and Environment Division.
- Ingrid Sieler, Parks Victoria, Conservation and Environment Division.
- Kate Millar, Chief Ranger, Environmental Programs, Victoria East Region, Parks Victoria.
- Alpine Brumby Management Association. Dean Backman, President.
- Alpine Grazing Licensee, John Rogers
- Michelle Walter, NP&WS, PHD Student
- Consultant - Environmental Values Assessment

## 11. Timeline

see 'Scope of Project'

## 12. Project Management

The project will be managed by the Alpine Ranger based at Buchan in consultation with the steering committee, Natural Resources and Environment, AALC, and the Friends of the Cobberas. The following person is the primary contact for this project;

Scott Perkins (Alpine Ranger)  
Alpine National Park (East Alpine Unit)  
Caves Rd  
BUCHAN Victoria 3885  
Telephone: (03) 51 559 264  
Facsimile: (03) 51 559 490  
Email: sperkins@parks.vic.gov.au

All correspondence regarding the project will be co-ordinated through the Project manager.

### **13. Project Budget**

The project has been funded by the Australian Alps National Parks program through the Natural Heritage Working Group. The nominal budget for the facilitation of the consultancy is \$8000.00. All materials and labour for fencing and practical implementation of the project, etc will be supplied by Parks Victoria at no cost to the consultant.

### **14. Conditions of Engagement**

The successful consultant will provide services to Parks Victoria in accordance with the 'consultants brief' and 'letter of engagement' prepared by the steering committee.

Parks Victoria may vary the services required from time to time by providing the successful consultant with reasonable notice of the proposed variation and provided always that the fee payable under the 'letter of engagement' and the time frame for completion of the services are modified to the reasonable satisfaction of the consultant, and subject to the agreed modifications of the brief.

The successful consultant must indemnify Parks Victoria against all losses, claims, damages and liabilities arising from actions brought by third parties which arise out of or in connection with any breach of this Agreement by the consultant, or of any negligent, unlawful or wilful act or omission by the consultant, their officers, employees or agents in the conduct of the consulting services.

#### *Termination / variation of contract*

The contract may be terminated anytime by either the Consultant or Parks Victoria giving 7 days notice in writing to the other. On termination, payment shall be made for any work completed under the consultancy to the satisfaction of Parks Victoria on a pro-rata basis (as determined by Parks Victoria).

#### *Indemnity*

The Consultant will perform all work under the consultancy at their own risk and shall indemnify and hold harmless Parks Victoria against all liabilities, losses, damages costs and expenses arising out of or in connection with the services provided by the Consultant and any act or omissions by the Consultant or his officers employees or agents. The Consultant must hold a professional indemnity insurance to the value of \$2,000,000. The Consultant must also hold a current public liability insurance of \$2,000,000 (see 'letter of engagement' coverage details).

### **15. Further Information**

Please contact Scott Perkins, Alpine Ranger, Buchan on (03) 51 559 264 for further information regarding this project.

## Appendix 1:

Original draft project proposal designed by the Friends of Cobberas. From this draft the above project brief has been developed in consultation with the steering committee.

# **FERAL HORSE EXCLUSION PLOT PROJECT**

## **1. AIMS**

To assess the effect of feral horses on:

- (a) Soil erosion by trampling and grazing adjacent to stream lines in alpine grassland and sedgeland.
- (b) Changes to native vegetation structure in alpine grassland changes in vegetation structure and floristics and bare earth cover

## **2. METHOD**

Soil erosion

2.1 Select similar vegetation types in a replication of plots for soil erosion assessment, ie: alpine sedgeland containing a drainage line.

2.2 Fence to exclude large grazing animals - feral horse/cattle. Do a soil erosion assessment and monitor fenced areas against unfenced areas at two sites.

Vegetation and fauna

2.3 Select similar vegetation type in a replication of plots for vegetation assessment, ie alpine grassland - relatively open areas.

2.4 Fence to exclude large grazing animals only  
Fence to exclude large grazing animals and rabbits  
Monitor these plots against an unfenced control plot at two sites on the basis of native flora and fauna values

2.5 Period of Monitoring  
Spring/summer annually

## Appendix 2:

### Victorian rare or threatened species known to occur in Alpine National Park (Cobberas area)

<i>Thesium australe</i>	Austral Toad Flax
<i>Deyeuxia affinis</i>	Allied Bent-grass
<i>Brachyscome obovata</i>	Baw Baw Daisy
<i>Oroemyrrhis brevipes</i>	Branched Carraway
<i>Carex capillaceae</i>	Hair Sedge
<i>Discaria pubescens</i>	Hairy Anchor Plant
<i>Prasophyllum rogersii</i>	Marsh Leek-orchid
<i>Pimelea biflora</i>	Matted Rice-flower
<i>Scleranthus singuliflorus</i>	Mossy Knawel
<i>Correa lawrenciana</i> var. <i>rosea</i>	Mountain Correa
<i>Barbarea grayi</i>	Native Winter-ress
<i>Euphrasia collina</i> sp. <i>Aff. diversicolor</i>	Purple Eyebright
<i>Deyeuxia talariata</i>	Skirted Bent-grass
<i>Gingidia harveyana</i>	Slender Gingidia
<i>Almaleea capitata</i>	Slender Parrot-Pea
<i>Coprosma nivalis</i>	Snow Coprosma
<i>Euphrasia caudata</i>	Tailed Eyebright
<i>Leucopogon piliferus</i>	Trailing Beard-heath
<i>Oschatzia cuneifolia</i>	Wedge Oschatzia

Appendix 3:

*'Parks Victoria-Directions in Environmental Management (Draft- 18/09/98)'*

**DIRECTIONS IN  
ENVIRONMENTAL  
MANAGEMENT**

**Draft for consultation**

**September 1998**

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### FOREWORD

The formation of Parks Victoria in December 1996 provided an opportunity to review the current approaches to environmental management across Victoria's parks and reserves. After the careful analysis of Parks Victoria's conservation obligations and existing environmental management programs, this document represents a first attempt to outline how Parks Victoria intends to approach its environmental management into the future.

These draft *Directions in Environmental Management* have been developed through a process involving key staff and has been produced to provide an opportunity for wider consultation with agencies, community groups and individuals. The Directions outlined build on the environmental management programs which have been successfully carried out in parks and reserves over many years, and provides a statewide framework to support Parks Victoria's on-going commitment to the conservation of Victoria's biodiversity.

I invite your comments on these Directions, and welcome suggestions and ideas for their improvement.

David Young  
Director Conservation and Environment

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### INTRODUCTION

Victoria's parks and reserves system has been established over the past one hundred years through the efforts and commitment of a wide range of organisations and individuals. As the organisation now responsible for the management of this system, Parks Victoria has a critical role both as custodian of the natural values, and as builder of a strong tradition of high quality and innovative environmental management.

Whilst Parks Victoria is responsible for the management of almost 16% of Victoria, it shares its conservation responsibilities with a range of other public and private land managers. The development of partnerships and relationships with these land managers and the community is central to Parks Victoria's approach to environmental management.

An extensive range of treaties, conventions, Acts, regulations and policies outline the objectives and obligations for park and reserve management. Parks Victoria's *Directions in Environmental Management* aim to provide a set of principles and guidelines to integrate these obligations into a coherent framework. This framework will be used to develop an effective Environmental Management Action Program to protect and enhance the unique natural values of the parks and reserves system.

Parks Victoria's approach to environmental management will draw extensively on the research carried out by universities and other institutions, combined with the specialist skills and knowledge of many individuals and community groups who have been actively involved in the conservation of flora and fauna across Victoria.

This document describes the principles and applications of Parks Victoria's Environmental Management System (EMS) as a basis for the planning and delivery of environmental management programs. It also outlines Parks Victoria's Environmental Management Framework which describes the functions and activities required to implement the EMS throughout the organisation.

## **DIRECTIONS IN ENVIRONMENTAL MANAGEMENT**

### **Parks Victoria's Vision**

*An outstanding park and waterway system, protected and enhanced, for people, forever.*

### **Parks Victoria's Purpose**

Parks Victoria exists to:

- conserve, protect and enhance environmental and cultural assets;
- responsibly meet the needs of our customers for quality information, services and experiences;
- contribute to the social and economic wellbeing of Victorians;
- provide excellence and innovation in park management.

### **Our Vision for Environmental Management**

In carrying out its role as custodian, Parks Victoria seeks to preserve and protect the natural values of parks and reserves through high quality and innovative environmental management programs, conducted in partnership with other land managers and the community.

Environmental management is defined as:

*The discipline of using consistent and comparable information about the natural environment to set priorities and allocate resources to achieve defined conservation objectives.*

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### Conservation Obligations

Under the Parks Victoria Act (1998) Parks Victoria must meet its obligation "not to act in a manner which is not environmentally sound." For any given area of land or water under its management, Parks Victoria is also required to conduct its management to achieve the conservation objectives outlined in an extensive range of treaties, conventions, Acts, regulations and policies (see Figure 1). For each park or reserve, Parks Victoria must develop an integrated environmental management program which meets these objectives.

Examples of Parks Victoria's conservation obligations include:

- the Ramsar convention on wetlands of international importance (1971);
- the Japan Australia Migratory Bird Agreement (JAMBA), (1974);
- the China Australia Migratory Bird Agreement (CAMBA), (1986);
- the *National Parks Act* (1975);
- the *Reference Areas Act* (1978);
- the *Flora and Fauna Guarantee Act* (1988);
- the *Wildlife Act* (1975);
- the Strategy for the Conservation of Biodiversity in Victoria (1997).

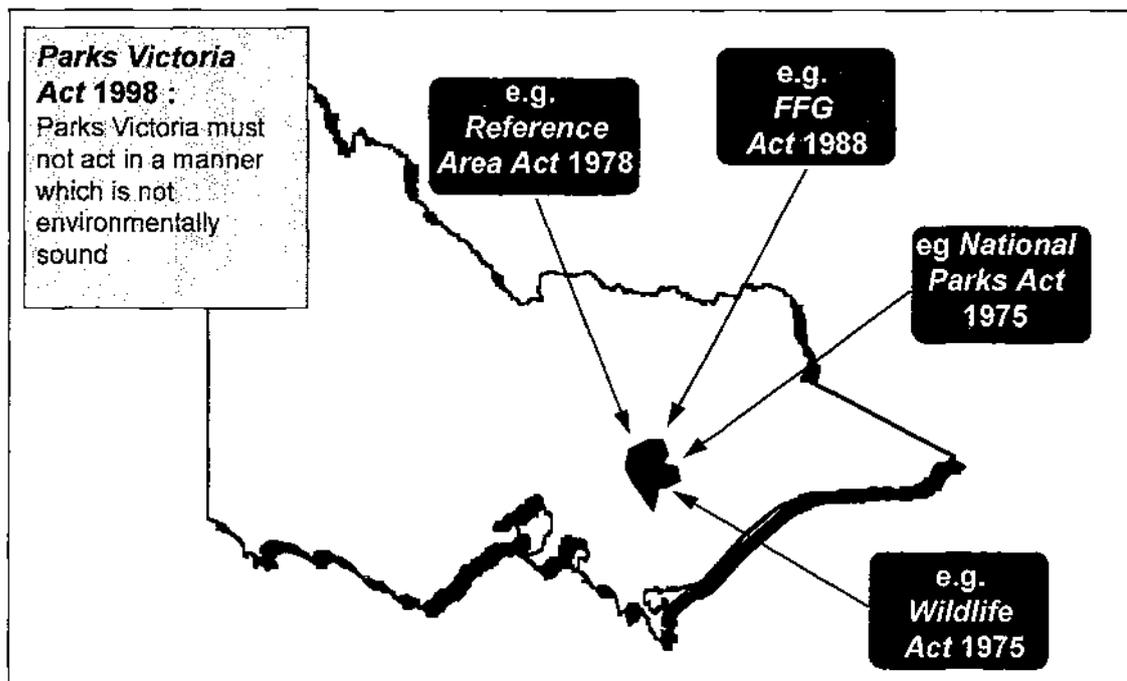


Figure 1: Examples of potential conservation obligations for a particular park.

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### ENVIRONMENTAL MANAGEMENT SYSTEM

Parks Victoria has developed an Environmental Management System (EMS) to enable the development of a proactive management program to conserve and enhance the natural values of parks and reserves, and manage the current and potential future risks to these values.

The EMS has been developed in line with the International Standard for Environmental Management Systems (ISO 14001), whilst addressing the particular challenges for biodiversity conservation.

The EMS provides a consistent approach to the development and delivery of environmental management programs, based on the systematic collection and analysis of environmental information. The EMS uses the principles of risk management and applies to all levels of planning and delivery of environmental management programs.

The cyclic nature of the EMS (see Figure 2) ensures on-going improvement of information, understanding and management techniques to enable Parks Victoria to continue to develop and refine its environmental management programs.

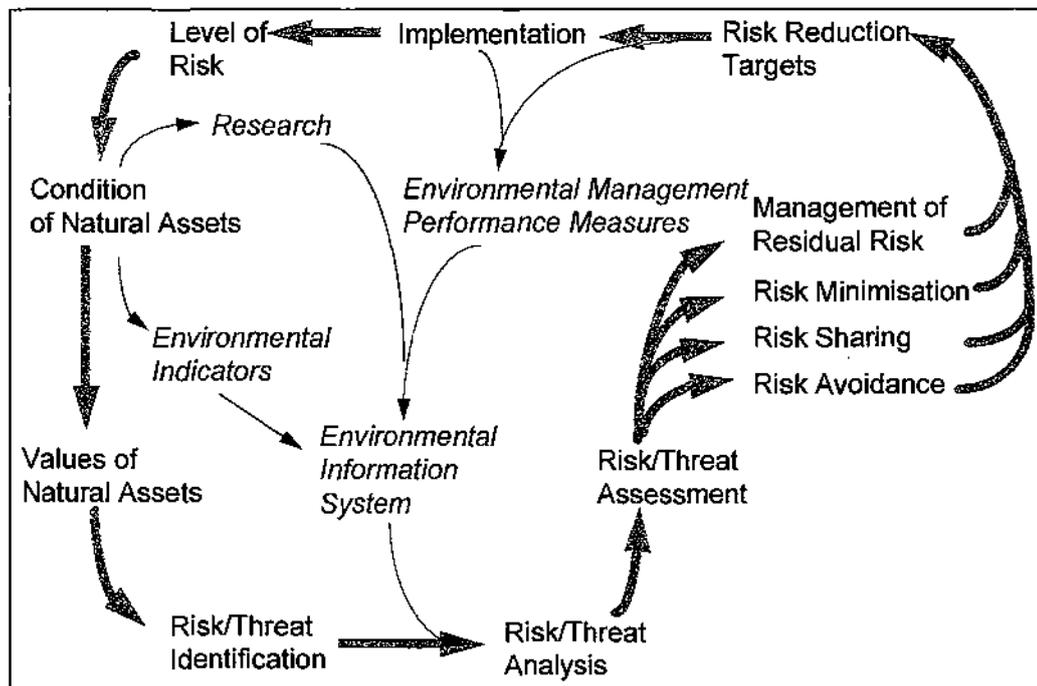


Figure 2: Environmental Management System.

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### Components of the Environmental Management System

The Environmental Management System comprises four major components :

- directions and priorities;
- program development;
- program delivery;
- information and evaluation.

A summary of these components and the elements illustrated in Figure 2 is outlined below.

### Directions and Priorities

In developing directions and priorities, the key principle is to **maximise the protection and enhancement of natural values**. An analysis of the values and their current condition is carried out to establish specific environmental management objectives for particular values, consistent with the overall conservation objectives for the park or reserve. An assessment of the environmental risks is carried out to identify which current and future risks may cause the greatest loss of values. This analysis establishes the priorities for management action.

#### *Values of Natural Assets*

A clear understanding of the specific natural values within parks and reserves is essential for the development of effective environmental management programs. It is also important to understand how these values are distributed across the state, including both their relative rarity and representation within the parks and reserves system. Environmental management objectives are then quantified for particular values in terms of the desired future condition.

#### *Risk/Threat Identification*

A range of processes have the potential to place the natural values of parks and reserves at risk. It is important that both the risks, and the way in which they may result in the loss of natural values, are identified.

#### *Risk/Threat Analysis*

An understanding of the extent of environmental risk in terms of geographic distribution, and the scale of actual and potential impact on natural values, is a key step in seeking to identify the needs for environmental management programs. Analysis of the trend in environmental risk is also important to target newly emerging or growing problems.

#### *Risk/Threat Assessment*

The process of comparing the potential loss of values, caused by different risks both within a park or reserve and across the parks and reserves system, results in priorities for environmental management action.

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### Program Development

In developing environmental management programs the key principle is to **achieve the greatest reduction in environmental risk**. Management choices are required in the selection and allocation of resources to particular environmental management actions. These choices are guided by an evaluation of the cost effectiveness of the different management actions available to reduce the total risk to biodiversity.

#### *Risk Avoidance*

Actions that prevent risk occurrence are the most effective way of protecting natural values. Where these actions are also the most efficient and practical, they will be identified as the highest priority. Examples of management actions that can avoid risk include park zoning, seasonal closures and the complete eradication of weeds from a particular area.

#### *Risk Sharing*

Many environmental risks can only be effectively managed in partnership with other land managers, park visitors and the community. Cooperative programs may also be the most cost effective way of achieving common objectives. Examples of risk sharing include revegetation on private land to create habitat corridors between reserves, and cooperative pest plant and animal control programs.

#### *Risk Minimisation*

Where risk is inevitable, actions will be identified which ensure that they are kept to a minimum. Guidelines and procedures will seek to ensure that activities in parks and reserves are carried out in a way which cause least impact on environmental values. Examples of areas for risk minimisation include control burning, dredging and flood mitigation works.

#### *Management of Residual Risk*

The impact of some threatening processes can (currently) not be avoided or minimised. In these cases ongoing management of these impacts will be required to prevent further or complete loss of values. Examples of such actions include koala relocation and blackberry control.

In many cases an integrated program combining a range of measures will be required. Each action will however be assessed to ensure that the overall conservation objectives are achieved in the most effective manner.

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### Program Delivery

For program delivery, the key principle is to meet environmental management targets in the most efficient manner possible. This will be achieved through having clear targets for environmental management programs, implemented by field staff and other specialists to protect the environmental values and improve the condition of parks and reserves.

#### *Risk Reduction Targets*

For all environmental management programs, targets will be set in terms of risk reduction that needs to be achieved to adequately protect the natural values and/or improve the condition of these values.

#### *Implementation*

Environmental management programs will be implemented in the most efficient way possible by trained staff and appropriately skilled service providers.

#### *Level of Risk*

As a result of the implementation of environmental management programs, a reduction in the actual risk level will result in an increase in the overall condition of the values in parks and reserves.

#### *Condition of Assets*

In the long term, improvement in the condition of the parks and reserves system will lead to a progressive increase in the natural values.

### Environmental Information System

The key principle for the environmental information system is **to ensure the continuous improvement of environmental information which supports management decision making.** This will be achieved through an integrated Information, Research and Monitoring Strategy.

#### *Environmental Management Performance Measures*

The (annual) short term outputs of environmental management programs will be measured and reported consistently for all parks and reserves. These outputs will be based on agreed levels of activity required to achieve conservation objectives. Examples may include the area of ecological burning undertaken, or the area from which a particular weed is eradicated.

#### *Research*

Where management decision making requires an improved understanding of the species and ecosystems which occur in parks and reserves, Parks Victoria will support and encourage appropriate scientific research carried out in partnership with research institutions. Examples of environmental research may include investigations into species response to fire and habitat preferences of endangered species.

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### *Environmental Indicators*

Environmental indicators, which measure the long term outcomes and improvement in the condition and values of parks and reserves, will be monitored through an agreed state-wide program with other land managers. Indicators may include monitoring the population of particular flora or fauna species which are particularly sensitive to change or threatening processes.

Environmental information will be collected and stored in a manner which enables Parks Victoria to actively contribute to the maintenance and improvement of state-wide data on natural resources.

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### ENVIRONMENTAL MANAGEMENT FRAMEWORK

An Environmental Management Framework has been established which describes the key functions and activities required to implement the Environmental Management System throughout the organisation.

The Environmental Management Framework outlines how Parks Victoria will :

- maintain and improve its knowledge and understanding of the relative importance of each park and reserve to state and national conservation objectives;
- define clear and achievable conservation and environmental management objectives for all land and water under its management;
- establish targets for its environmental management programs and allocate appropriate levels of resources to meet these targets;
- establish systems and standards for the coordination and improvement of Parks Victoria's performance as an environmental manager;
- measure and report on its performance in delivering the outputs of its environmental management programs;
- establish benchmarks to assess the effectiveness of its environmental management programs;
- establish and improve relationships and partnerships with agencies, stakeholders and the community to achieve conservation objectives.

Parks Victoria's key functions and activities in the areas of environmental strategy, on-ground action programs, and information and audit are illustrated in Figure 3. A summary of these functions and activities is outlined below.

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

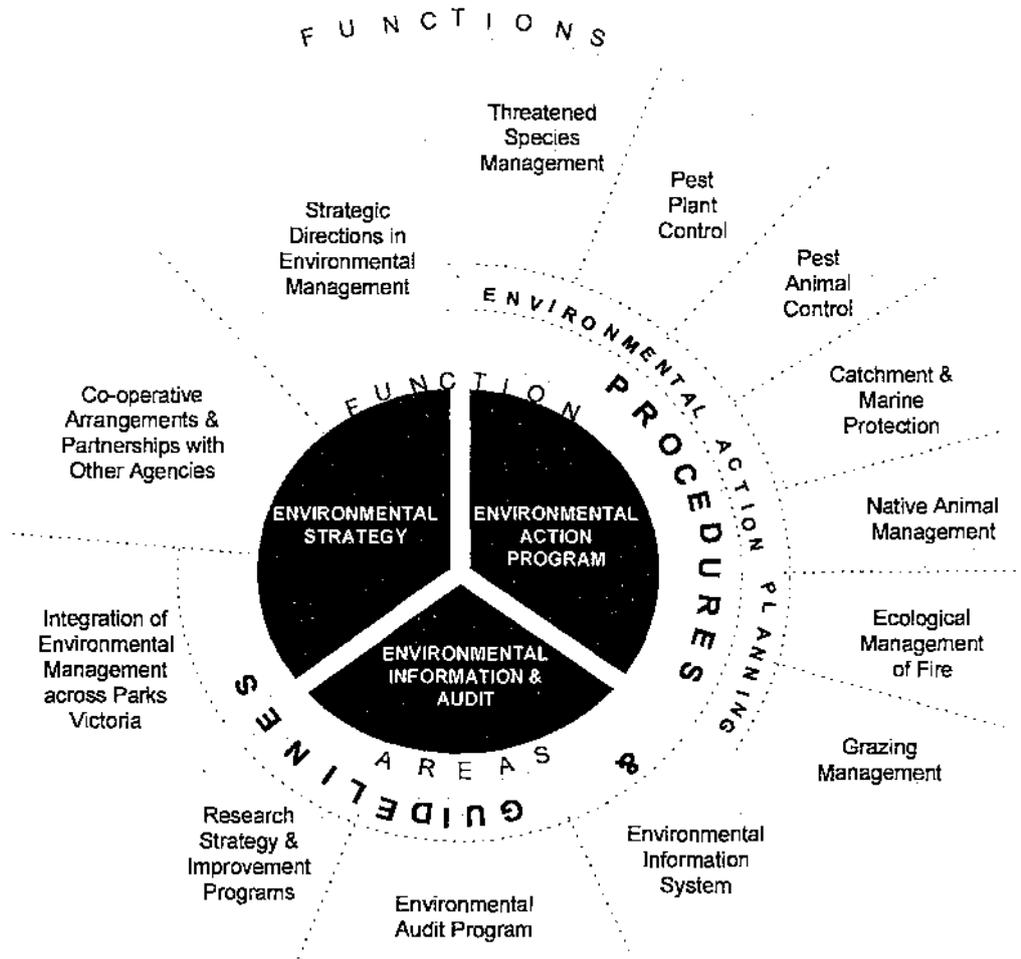


Figure 3: Environmental Management Framework.

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### ENVIRONMENTAL STRATEGY

#### **Strategic Directions**

Parks Victoria will establish strategic directions for conservation and environmental management for all land under its management consistent with National and State legislation and Victorian government policy. These directions will be reflected in Parks Victoria's three year corporate plan and annual business plan.

#### **Inter-agency Partnerships and Coordination**

Parks Victoria will establish partnerships with a range of scientific institutions, agencies and organisations to ensure that its environmental management programs are conducted using the best available knowledge, skills and resources.

Parks Victoria will coordinate its environmental management programs with those carried out on other public and private land.

Parks Victoria will establish and improve relationships and partnerships with stakeholders and the community to ensure that environmental and conservation objectives for the State's parks and reserves system are met.

#### **Integration**

Parks Victoria will ensure that environmental management is fully integrated through all activities of the organisation. In particular :

##### *Financial Management*

Environmental management expenditure will be consistently recorded and reported for all parks and reserves.

##### *Park and Reserve Planning*

Conservation and environmental management objectives will be clearly and consistently addressed in all park plans.

##### *Communication and Park Promotion*

Communication and park promotion activities will seek to maximise community perception of the conservation and environmental value of parks and reserves.

##### *Park Facilities and Services*

Standard environmental risk assessment procedures will be used for the development of all park facilities and services.

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### ENVIRONMENTAL ACTION PROGRAM

Parks Victoria's environmental action program will define the major "on-ground" environmental management actions to be achieved. The program has been divided into seven subprogram areas, which incorporate the key strategic directions and priorities required by government of Parks Victoria. Standards, guidelines and procedures for each area are being developed which will provide the tools for implementing the Framework.

Demonstrating the effective delivery of outputs in these subprogram areas is a major focus for Parks Victoria.

#### Threatened Species Management

Parks Victoria will manage threats to all native flora and fauna which occur on land and water under its control, in line with the *Flora and Fauna Guarantee Act 1988*.

Parks Victoria will:

- take a lead role to develop and implement programs to protect threatened species in parks, where they occur exclusively or predominantly on land or water under Parks Victoria's control;
- participate in state-wide programs to protect threatened species which occur across land tenure.

#### Pest Plant Control

Parks Victoria will seek to eradicate or control exotic flora in parks and reserves in line with the *National Parks Act (1975)* and the *Catchment and Land Protection Act (1994)*.

In particular Parks Victoria will :

- develop and implement programs to *eradicate* new weed infestations which have the potential to invade and substantially modify native vegetation communities;
- develop and implement programs to *control the spread* of weeds which threaten particular environmental values;
- participate in cooperative programs with land owners to control weeds which threaten economic and/or environmental values.

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### **Pest Animal Control**

Parks Victoria will seek to eradicate or control exotic fauna in parks and reserves in line with the *National Parks Act 1975* and the *Catchment and Land Protection Act 1994*.

In particular Parks Victoria will :

- develop and implement programs to *eradicate or control the population* of target pest animal species which threaten particular environmental values;
- participate in cooperative programs with land owners to control pest animals which threaten economic and/or environmental values.

### **Catchment & Marine Protection**

Parks Victoria will support the implementation of approved Regional Catchment Strategies under the *Catchment and Land Protection Act 1994*.

Parks Victoria will :

- develop and implement programs to control erosion and other processes which may impact on water quality or the overall condition of land and water resources;
- develop and implement programs to re-establish native vegetation in particular parks and reserves to improve the overall condition of land and water resources.

### **Native Animal Management**

Parks Victoria will actively manage native animal populations to avoid the impact of over-abundance on the environmental values of a park or reserve.

#### *Kangaroo Management*

Kangaroo populations will be managed in line with the *Wildlife Act (1975)* and Parks Victoria's Kangaroo Management Strategy (1998). Parks Victoria will ensure that kangaroo management is carried out in a responsible and humane manner in line with CONCOM guidelines.

Parks Victoria will :

- participate in the development and implementation of integrated kangaroo management plans where a park or reserve forms only part of the territory of the kangaroo population;
- develop and implement kangaroo management programs where overabundance is having a demonstrated long term impact on park values;

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

### *Koala Management*

Koala populations will be managed in line with the *Wildlife Act (1975)*, the *National Koala Conservation Strategy (1998)* and within Parks Victoria's *Koala Management Framework (1998)*.

Parks Victoria will :

- establish and implement koala management programs in parks and reserves where overabundance is having a demonstrated long term impact on park values;
- support the relocation of koalas from other land in Victoria, where their release in a park or reserve will have no longterm impact on park values.

### **Ecological Fire Management**

Parks Victoria will undertake all fire management activities in parks and reserves in line with the *Code of Practice for Fire Management on Public Land (1995)*. Parks Victoria will ensure that the conservation and environmental management objectives for parks and reserves are adequately addressed in *Regional Fire Protection Plans* and establish clear objectives for all ecological burns in parks and reserves. Programs to monitor the effectiveness of burning activities in achieving these objectives will be implemented.

In particular, Parks Victoria will :

- develop and implement ecological burning programs in parks and reserves to improve the condition of particular environmental values.

### **Grazing Management**

Parks Victoria will develop a statewide framework for managing stock grazing in parks, and establish grazing management systems to ensure the protection of environmental values.

Parks Victoria will :

- maintain grazing regimes in particular parks and reserves to proactively manage specific environmental values;
- develop environmental performance measures for grazing licences issued for parks and reserves;
- protect and progressively rehabilitate sensitive areas within parks and reserves where grazing is permitted.

## **DIRECTIONS IN ENVIRONMENTAL MANAGEMENT**

### **ENVIRONMENTAL INFORMATION AND AUDIT**

The Environmental Information and Audit system will provide a strong base of consistent and comparable information to guide management decision making. This will be delivered through three elements.

#### **Environmental Information System**

In line with Parks Victoria's IT strategy, an Environmental Information System will be developed and maintained as one of its key business systems. The System will provide access to existing statewide data, improve the ability to assess the benefits of future investment decisions in environmental management, and enable Parks Victoria to contribute to the whole of government approach to natural resource management information.

The system will:

- provide staff with access to information about the environmental values of each park and reserve;
- establish standards for environmental management reporting;
- enable continuous improvement of information on the environmental values of the parks and reserves system;
- assist in maintaining state-wide data on the distribution flora and fauna across the state.

#### **Environmental Audit**

Parks Victoria will take all reasonable steps to ensure compliance with environmental legislation and policy.

Parks Victoria will:

- establish and maintain an independent Environment Committee to guide the development and implementation of Parks Victoria's strategic directions in environmental management;
- undertake routine audits to assess the effectiveness of systems and processes for environmental management, and identify key areas for improvement.

#### **Research Strategy**

Parks Victoria will progressively improve the quality of information available to assist in managing the natural values of parks and reserves under its management.

Parks Victoria will:

- develop a five year research and monitoring strategy to establish priorities for baseline data collection and monitoring programs in parks;

## DIRECTIONS IN ENVIRONMENTAL MANAGEMENT

- coordinate and manage all new research and monitoring programs, and establish and implement quality control procedures through an improvement program.

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Appendix 4:

*'Parks Victoria, Interim protocol for assessing vegetation condition- alpine wet heathland and snow-gum woodland'- John Wright, Parks Victoria, Conservation and Environment Division.*

## **Interim methodology for assessing vegetation condition for use with the feral horse impact project in the Alpine National Park**

Understanding the condition of natural assets is a critical element of the risk management approach that Parks Victoria's Environmental Management System is based upon. The Draft Protocol for the Assessment of Vegetation Condition in Victoria's Parks and Reserves (Parks Victoria, 1998) describes the general approach that Parks Victoria uses to assess vegetation condition. The methodology described in that document is not intended to be a definitive methodology for assessing vegetation condition in all locations. The document does, however, describe the types of parameters that should be measured when assessing vegetation condition, and the reasons why those parameters should be measured. As such, it provides a strong foundation for designing a vegetation condition assessment program that can be applied to a specific location. The method described in the draft protocol has been used as the basis for vegetation condition assessments in a number of parks across the state, including the area of the Alpine National Park affected by the 1998 Caledonia fire.

This document describes an interim methodology for assessing vegetation condition in the Alpine National Park, in particular, for the sorts of BVTs that occur within the area where the Feral Horse Impact study will occur. The method described here is based on the draft protocol, and is similar to that used for the assessment of vegetation condition in the fire affected area.

### **1. Parameters to be measured**

A number of factors contribute to the overall condition of vegetation. These factors include the amount of vegetation present, the extent of weed invasion, the structural integrity of the vegetation and the diversity of the vegetation. In order to understand and document vegetation condition, the following parameters should be measured:

1. Total ground cover
2. Native ground cover
3. Bare ground
4. Litter cover
5. Cover by rocks, logs etc.
6. Mid-storey (i.e. shrub) cover
7. Mid-storey regeneration
8. Canopy cover
9. Age-structure of canopy
10. Floristic composition

Obviously in some types of vegetation, some of these parameters will not be relevant (e.g. canopy cover in open grasslands), but most of the parameters listed above can be measured in all vegetation types.

#### **1.1 Total ground cover**

Total ground cover refers to the percentage of the quadrat area covered by ground layer vegetation. Ground layer vegetation can be defined as all vegetation up to 1 metre in height (see McDonald *et al.*, 1984).

### **1.2 Native ground cover**

Native ground cover refers to the percentage of the quadrat area covered by native ground layer vegetation. It is important to record this information. This is illustrated by the following example. Consider two areas which have the same level of ground cover, but where in one of the areas most of the vegetation is native, while in the other area, most of the vegetation is exotic. Obviously the condition of these two areas differs.

### **1.3 Bare ground**

Bare ground is recorded as the percentage of the quadrat area where the soil is not covered by vegetation. Bare ground refers to bare soil, it does not include rocks, logs or litter.

### **1.4 Litter cover**

Litter cover is recorded as the percentage of the quadrat area covered with leaf litter, bark and twigs. It is important to differentiate between areas covered by litter and bare ground because these 2 areas differ in their susceptibility to erosion.

### **1.5 Cover by rocks, logs, etc.**

This parameter is measured as the percentage of the quadrat area covered by rocks and logs. As with litter cover, these things alter susceptibility to erosion, however unlike litter, they are less susceptible to being moved.

### **1.6 Mid-storey cover**

This parameter is measured as the percentage of the quadrat area covered by the mid-storey. The mid-storey can be considered as all vegetation greater than 1 metre in height but not forming the canopy. Projected foliage cover classes adapted from Specht *et al.* (1974) (in McDonald *et al.*, 1984) are used.

### **1.7 Mid-storey regeneration**

This parameter examines whether mid-storey species are regenerating, and the amount of regeneration there is.

### **1.8 Canopy cover**

This parameter examines the amount of the quadrat covered by canopy. Again, projected foliage cover classes adapted from Specht *et al.* (1974) (in McDonald *et al.*, 1984) are used.

### **1.9 Age-structure of canopy**

This parameter assesses the age structure of the dominant canopy-forming species and assesses abundance in terms of 4 age-classes (seedling, juvenile, mature and post-mature).

### **1.10 Floristic composition**

The time required for a survey to record all flora species present would be prohibitive. As such, it is not feasible to incorporate an exhaustive study of floristic composition into a vegetation condition

assessment. Nonetheless, floristic information is important in helping to understand vegetation condition. The method proposed in this document should detect the majority of species present and give some idea of dominance and abundance.

## 2. Methods

### 2.1 Total ground cover, Native ground cover, Bare ground, Litter cover, Cover by rocks, logs etc.

A number of the parameters outlined above require the estimation of percent cover. It would be possible to use a subjective visual approach to estimate cover for these parameters, however when such approaches are used, estimates can vary widely between observers, or even within observers, depending on how the variable of interest is distributed. Because of this, it is better to use a more reliable and quantitative approach to estimate percent cover. One such method is the point quadrat method. This method could be applied to a number of the parameters listed above. These parameters are:

Total ground cover

Native ground cover

Bare ground

Litter cover

Cover by rocks, logs etc.

(also applies to floristic composition)

The point quadrat method uses a pin inserted into the vegetation at randomly located points to estimate cover of each parameter. At each point, pins should be inserted on an incline. This is because pins inserted vertically tend to underestimate cover unless foliage is held horizontal, and this is particularly relevant for grasslands (Chesterfield *et al.*, 1995). Trials have indicated that an incline of  $32.5^\circ$  is the best compromise (Wilson, 1960). As the pin is progressed through the vegetation, each species touching the point of the pin is recorded, as is the number of times each species touches the point of the pin. The proportion of the total number of intercepts accounted for by a particular species is an estimate of the cover of that species. For example, if the pin struck vegetation 4000 times in a plot, and 800 of those times, it struck species x, then the cover of species x would be 20%.

At the point where the pin strikes the ground, what the pin strikes is recorded (i.e. is it bare ground, litter, rock, log, a plant (which species?)). The proportion of intercepts that the pin has with a particular parameter is an estimate of the percent cover of that parameter. For example, if 1000 points were used and the pin touched bare ground 280 times, the estimate of the percentage of the plot area that is bare ground would be 28%.

In order to get reliable data, it is critical that sufficient points are sampled. In a plot that is 10 x 10 m, a large number of points would need to be sampled (suggest 1000, but certainly many more than 100).

### 2.2 Mid-storey cover and canopy cover

Accurate measurement of shrub and canopy cover can be difficult and intensive, however if broad cover classes are used, then reliable data (albeit less precise than accurate measurement of percent cover) can be obtained using subjective visual techniques. McDonald *et al.* (1984) describe a system devised by Specht *et al.* (1974) of allocating shrub and canopy cover to cover classes. The table below gives the details of cover classes adapted from this system. The cover classes presented in this table should be used to determine the mid-storey cover and the canopy cover. Assessment of

mid-storey and canopy cover should be made at the scale of the entire plot, which in the case of the feral horse impact project is proposed to be 10 x 10 metres.

Cover class	Description
Closed or dense	Crowns touching to overlapping
Mid-dense	Crowns touching or slightly separated (< 0.5 x canopy width)
Sparse	Crowns clearly separated (0.5 - 2 x canopy width)
Very sparse	Crowns well separated (> 2 x canopy width)

### **2.3 Age-structure of canopy**

For the purposes of vegetation condition assessment, individuals of canopy species may be considered to belong to one of the four age classes presented in the table below.

Age Class	General description
Post-mature	Old, over-mature, with severe crown depletion
Mature	Reproductive adults
Juvenile	Pre-reproductive
Seedling	Recently germinated

Different techniques are used to assess the abundance of individuals in each age class. The abundance of juvenile, mature and post-mature individuals is measured across the whole plot. To measure seedling abundance, 1m<sup>2</sup> quadrats are used. A number of these quadrats (at least 5) should be surveyed in each plot. These quadrats should be located at random within the plot. The quadrats are searched and the number of seedlings of canopy-forming species is recorded.

### **2.4 Mid-storey regeneration**

This parameter is assessed in 2 parts. The first part of the assessment requires that the number of shrub species that are regenerating in the quadrat is recorded. The second part of the assessment, the number of species for which more than 10 regenerating individuals are present is recorded.

### **2.5 Floristic composition**

Floristic composition is also assessed in 2 parts. For the first part of the assessment, the observer stands in one corner of the plot and records all of the species that have already been noticed. The observer should then walk through the plot in a slow and systematic manner recording any additional species. In any one vegetation type, the same amount of time should be spent searching for species.

The second part of the floristic composition assessment is quantitative and is intended to determine the cover of the abundant species. As mentioned above, this information is gathered when the point quadrat surveying is done. At each point surveyed, if the point touches a plant, then the species is recorded. The proportion of points at which a species occurs gives an estimate of the cover of that species.

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