Biodiversity Action Planning

Strategic Overview for the Central Victorian Uplands Bioregion Victoria

March 2003

Ecology Australia

Executive summary

1. *This Biodiversity Action Plan for the Central Victorian Uplands translates the Victorian Biodiversity Strategy (NRE 1997) in a regional context, and provides the foundation for producing landscape-scale biodiversity action plans to direct on-ground works by private landholders, community groups, corporations and all levels of Government, with the ultimate aim of achieving broad-scale conservation of biodiversity assets across the bioregion.*

2. *The Central Victorian Uplands covers 1.2 million hectares extending over 21 local government areas and seven Catchment Management Authorities, stretching from the Grampians and Ararat in the west, to Porepunkah in the east, and from Lurg in the north, to the You Yangs and Lara in the south. It has a unique and relatively early history of European settlement due to the gold rushes in nearby regions in the 1850's and soldier settlements after World War I and II. The settlers of the gold rush period and soldier settlements were quick to recognize the productive potential of the Central Victorian Uplands' woodlands and dry grassy forest complexes and, consequently, the landscape has been radically and rapidly changed within the last 150 years.*

3. *Seventy-eight percent of the region is private freehold dominated by agriculture and there are large blocks of public land including several major national Parks and State Forests. Native vegetation covers 29% of the Central Victorian Uplands and 8.5% of this is occurs in formal reserves. Despite a relatively low percentage of extant native vegetation cover, the Central Victorian Uplands still retains examples of most of its original vegetation types. Four Ecological Vegetation Classes (EVCs) no longer exist in the Central Victorian Uplands. They include Granitic Hills Woodland/Heathy Dry Forest Mosaic, Grassy Woodland/Valley grassy Forest Complex, Plains Grassy Woodland/Creekline Grassy Woodland/Floodplain Riparian Woodland Mosaic and Riverina Plains Grassy Woodland/Plains Grassland Mosaic. One vegetation group: Wetland Formation, also no longer exists. One flora species (Mountain Swainson-pea,* Swainsona recta*) is considered extinct within the Central Victorian Uplands. No fauna species are considered extinct. Forty-eight species are considered threatened under the Bioregional Network Analysis (BNA)for the Central Victorian Uplands, including 27 plants, 4 mammals, 5 birds, 2 reptiles, 6 fish and 4 invertebrates. In total, 163 threatened flora species and 64 fauna species have been recorded throughout the Central Victorian Uplands.*

4. *Conservation of biodiversity is formally recognized at International, National, and State levels as critically important for sustainability. Action to conserve the biodiversity of the Central Victorian Uplands will need to include, among other measures:*

- ***protection*** *of viable remnant habitats and their flora and fauna;*
- ***management*** *to enhance the condition of these habitats and populations; and*
- ***restoration*** *of at least some of their former extent by revegetation.*

5. *The aims of this Biodiversity Action Plan for the Central Victorian Uplands are to:*

- *Provide a regional overview of the planning and management of biodiversity;*
- *Summarise the remaining biodiversity assets;*
- *Identify the major threatening processes and associated impacts affecting biodiversity,*
- *Identify priorities for conservation and restoration of biodiversity;*
- *Identify mechanisms for more efficiently conserving the bioregion's key biodiversity assets, including threatened vegetation communities, threatened taxa, and important remnant habitats;*
- *Provide the basis for further biodiversity planning at increasingly finer scales; and*

- *Assist communication and integration of conservation activities by private landholders, community groups, corporations and all levels of Government.*

6. *This document presents the methodology behind bioregional and landscape-scale biodiversity action planning, including:*

- *The strategic and planning framework provided by the Victorian Biodiversity Strategy (NRE 1997), Victoria's Native Vegetation Management Framework (NRE 2002a) and the* Flora and Fauna Guarantee Act *1988, and how this integrates the regional catchment strategy process of Catchment Management Authorities.*
- *Tools including DSE's Bioregional Network Analysis for identifying priority species for action, threatening processes affecting biodiversity, the habitat-hectare approach for assessing native vegetation quality, and the focal species concept whereby management targeted at particular species can be used as a cost-effective approach for broader biodiversity conservation.*
- *The scientific basis underpinning biodiversity conservation management, particularly the direct and indirect effects of habitat loss and fragmentation on local extinction, and some of the critical thresholds.*
- *Guidelines for compiling landscape-scale biodiversity action plans, which will direct on-ground actions by the community and other stakeholders, and are the next stage.*

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Introduction

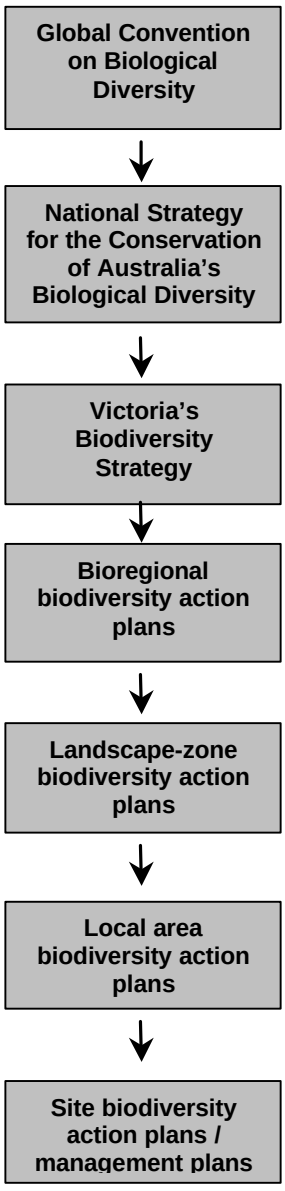
1. Introduction

1.1 The biodiversity action planning framework

Biodiversity is the natural variety of life: it is the sum of our native plants and animals, the genetic variation they contain, and the natural ecosystems that they form (NRE 1997*).*

1.1.1 Different plans for different scales of operation.

The need for biodiversity action plans is recognized as urgent by all levels of government, and there is a need for an integrated series of plans from the international scale to the local scale. Australia is already a signatory to the international Biodiversity Convention (1992), and has a National Strategy for the Conservation of Australia's Biological Diversity (Commonwealth Of Australia 1996). The State of Victoria published its state-wide strategy 'Victoria's Biodiversity' in 1997. Complementary regional, landscape-scale and local plans are also required to coordinate actions at all necessary scales.



1.1.2 The state biodiversity framework

The State biodiversity strategy *(Victoria's Biodiversity* NRE 1997) fulfils a statutory requirement under Section 17 of the Flora and Fauna Guarantee Act 1988 and provides the *top level* biodiversity action plan for the State. However, the effective planning of actions for biodiversity also requires more detailed planning at a bioregional level, and also at a local landscape level.

These subsequent bioregional and local landscape plans will complement the Victorian Government's Native Vegetation Management Framework (NRE 2002), which establishes the strategic direction for conserving the native vegetation component of biodiversity across the State, and the draft Regional Native Vegetation Plans being developed for each Catchment Management Authority (CMA) region.

The Victorian River Health Strategy (NRE 2002b) provides a complementary framework for managing and restoring rivers, streams and floodplains in Victoria.

1.1.3 Bioregional Biodiversity Action Plans

The purpose of bioregional biodiversity action plans is to summarize the key biodiversity assets of the bioregion, and the actions and tools that are required to achieve state-wide biodiversity goals.

They are intended as preliminary plans to stimulate discussions and action planning within the regional community and to identify options for intervention that the local community can select from. The plans will be developed in stages and with component parts that can be aggregated or separated depending upon the user's area of interest.

The **Strategic Overview** provides details of the framework and methodology used in developing bioregional Biodiversity Action Plans and an overview of the features and assets of the bioregion, while specific information on assets and priorities for actions within landscape zones is assembled in the **Landscape Plans**. This information may be further detailed as input into **Local Area Plans** that cover the range of natural resource issues.

1.1.4 Bioregional actions

Priority bioregional actions include:

protection of viable remnant habitats, and the flora and fauna populations they contain;

management to enhance the condition of these habitats; and

restoration of at least some of the former extent of these habitats by revegetation.

1.1.5 Bioregional tools

The above-mentioned actions will require the use of a variety of tools including:

*Legislative tool*s—e.g. the use of local government planning schemes; (Environmental Significance Overlays)

*Voluntary tool*s—e.g. voluntary agreements with landholders; and (Trust for Nature, Land for Wildlife)

*Market tool*s—e.g. new policy instruments employing social choice and market forces to encourage land use change and the development of more environmentally benign agricultural systems (rate rebates for conservation initiatives/renewable energy).

1.1.6 Bioregional biodiversity assets

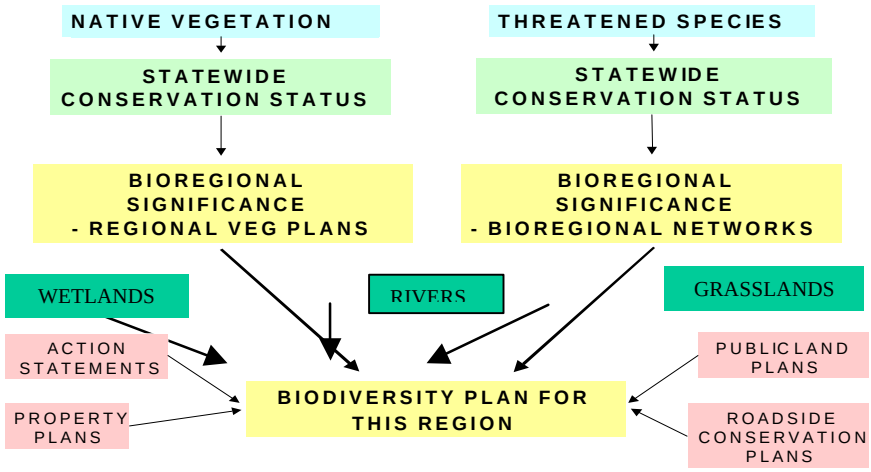
Biodiversity assets include:

Native vegetation communities;

Native species of plants and animals; and

Wetlands and rivers.

Information on these assets and priorities for actions is assembled in the Biodiversity Action Plans.



Aims

2. Aims

2.1 Aims of this Biodiversity Action Plan

2.1.1 Ultimate aim

The ultimate aim of this Biodiversity Action Plan (BAP) is to achieve broad-scale conservation of biodiversity in the bioregion.

2.1.2 Aims of this document

This BAP overview for the Central Victorian Uplands translates the principles and processes identified in Victoria's Biodiversity Strategy (NRE 1997) to the *bioregional* and *landscape* levels, defined as:

- *Bioregional* / analysis provides a view of biodiversity that relates to the ecological function of species and ecosystems; and
- *Landscape* / the level appropriate for local planning to guide and direct on-ground management tasks for biodiversity conservation.

The aims of the BAP are to:

- take a regional approach to biodiversity management;
- identify mechanisms for more efficiently conserving the bioregion's key biodiversity assets (including threatened vegetation communities, threatened taxa, and important remnant habitats) by focusing on the management of key threats across all land tenures;
- identify priorities for conservation and restoration of biodiversity;
- present priorities in spatial forms, so that they can be overlain with those of other environmental programs, such as salinity control and greenhouse amelioration, to encourage synergies; and
- assist communication and integration of conservation activities funded by private landholders, community groups, corporations and all levels of Government.

Policy

3. Policy

3.1 Context

This section covers existing government policy as developed through strategies that direct actions for biodiversity at various scales. It includes the *Flora & Fauna Guarantee Act 1988,* the state framework as laid out in Victoria's Biodiversity Strategy (NRE 1997), the Native Vegetation Planning and Management Framework (NRE 2002), River Health Strategy, Wetlands policy, Regional Catchment Strategies and Local Government planning schemes.

3.2 Legislation

3.2.1 Flora and Fauna Guarantee Act

Intent of the Act

Under Victoria's *Flora and Fauna Guarantee Act* 1988 (FFG Act), provision is made to ensure that all Victoria's native flora and fauna can survive, flourish and retain its potential for evolutionary development in the natural environment.

Objectives

The objectives of the FFG include:

- conserving flora and fauna taxa and communities (Schedule 2 lists threatened *taxa* and *communitie*s);
- managing *potentially threatening processes* (listed on Schedule 3);
- ensuring only sustainable use of flora and fauna resources;
- ensuring the maintenance of genetic diversity;
- fostering community education; and
- encouraging voluntary conservation management agreements.

It is also an objective that public authorities be informed and are aware of these flora and fauna conservation and management goals, their application and implications.

FFG Strategy

The preparation of a state-wide biodiversity strategy is a requirement under the FFG Act. '*Victoria's Biodiversity'* (in 3 volumes) was published in 1997. Volume 3 '*Directions in Management*' contains information, strategic approaches and actions for biodiversity conservation in each Victorian bioregion.

Action statements

Action Statements (an additional requirement under the Act for listed taxa, communities and potentially threatening processes) have been prepared for a number of threatened taxa (see below), and for some potentially threatening processes (see Section 7.4)

Flora and Fauna Guarantee Action Statements have been published for 13 faunal species (plus one in draft format) and for 13 floral species found within the Central Victorian Uplands, and include:

Large Ant-blue Butterfly (70)	Small Ant-blue Butterfly (71)
Bush Stone-curlew (78)	Trout Cod (38)
Brush-tailed Phascogale (79)	Powerful Owl (92)

Golden Sun Moth (106)
Eastern Barred Bandicoot (4)
Plains Wanderer (66)
Squirrel Glider (draft)
Narrow Goodenia (72)
Black Gum (84)
Buxton Gum (1)
Hairy Anchor Plant (47)
Southern Shepherd's Purse (102)
Rough Eyebright (10)
Plump Swamp Wallaby Grass (109)
Striped Legless Lizard (17)
Grey Crowned Babbler (34)
Regent Honeyeater (41)
White-bellied Sea Eagle (60)
Austral Toad-flax (56)
Brittle Greenhood (63)
Concave Pomaderris(81)
Large Fruit Fireweed (68)
Small Milkwort (96)
Button Wrinklewort (28)

Three listed Potentially Threatening Processes operating in the Central Victorian Uplands have published Action Statements - 'Predation of native wildlife by the Cat *Felis catus'* (80), 'Predation of native wildlife by the introduced Red Fox *Vulpes vulpes'* (44) and the 'Use of lead shot in cartridges for the hunting of waterfowl' (32).

3.2.2 Environment Protection and Biodiversity Conservation Act

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), came into force on 16 July 2000. The EPBC Act promotes the conservation of biodiversity by providing strong protection for:

- listed species and communities in Commonwealth areas (this includes listed threatened species and ecological communities, listed migratory species and listed marine species);
- cetaceans (all whales, dolphins and porpoises) in Commonwealth waters and outside Australian waters;
- protected species in the Territories of Christmas Island, Cocos (Keeling) Islands and Coral Sea Islands;
- protected areas (World Heritage properties; Ramsar wetlands; Biosphere reserves; Commonwealth reserves;
- conservation zones; and
- wildlife species and wildlife products subject to international trade.

The Act provides for:

- the identification of key threatening processes;
- the protection of critical habitat;
- the preparation of recovery plans, threat abatement plans, wildlife conservation plans, bioregional plans, and conservation agreements;
- the issuing of conservation orders; and
- the regulation of exports and imports of live animals and plants, wildlife specimens, and products made or derived from wildlife.

Recovery plans (under the EPBC Act 1999) have been published for 5 faunal species (1 in draft); (Eastern Barred Bandicoot, Regent Honeyeater, Bluenose (Trout) Cod, Striped Legless Lizard, and the Swift Parrot-draft), and 2 floral species (Southern Shepherd's Purse and Sunshine Diuris) found within Central Victorian Uplands.

Published Threat Abatement Plans under the EPBC Act relevant to the Central Victorian Uplands include Predation by Feral Cats, Competition and Land Degradation by Feral Rabbits, Predation by European Red Fox, and Dieback caused by the root-rot fungus *Phytophthora cinnamomi*.

Flora and fauna species listed under the FFG and EPBC Act are summarised in Table 1 below and shown in Appendix 4 and 5.

Table 1: Listed flora and fauna species occurring in the Central Victorian Uplands

	FAUNA	FLORA
No of sp. Listed under FFG	38	28
No of sp with action statement	1 draft: Squirrel Glider 12 species: Blue-nose (Trout) Cod 38 Brush-tailed Phascogale 79 Bush Stone-curlew 78 Eastern Barred Bandicoot 04 Golden Sun Moth 106 Grey-crowned Babbler 34 Plains Wanderer 66 Powerful Owl 92 Regent Honeyeater 41 Small Ant-blue butterfly 71 Striped Legless Lizard 17 White-bellied Sea-Eagle 60	13 species: Small Milkwort 96 Hairy Anchor Plant 47 Black Gum 84 Buxton Gum 1 Rough Eyebright 10 Narrow Goodenia 72 Concave Pomaderris 81 Brittle Greenhood 63 Button Wrinkle-wort 28 Large Fruit Fireweed 68 Austral Toad-flax 56 Southern Shepherd's Purse 102 Plump Swamp Wallaby Grass 109
No. of sp with Recovery Plans	6 species: Swift Parrot-Draft Recovery Plan Blue-nose (Trout) Cod Regent Honeyeater Striped Legless Lizard Small Ant-blue Butterfly (under Rec. Plan for Butterfly Comm. No.1) Eastern-barred Bandicoot	1 species: Southern Shepherd's Purse

3.2.3 Planning and Environment Act (Native Vegetation Retention Controls)

The S16 amendment to the *Planning & Environment Act 1987* recognizes that native vegetation is to be protected and conserved as it provides a range of biodiversity and catchment management benefits. Local government also has the power under the *Local Government Act 1968* to pursue any matter of importance to its community. This can include the development of municipal policies, strategies and plans for biodiversity and native vegetation conservation, or participation in other regional or local plans.

3.3 Victoria's Biodiversity Strategy

Victoria's Biodiversity (NRE 1997) provides the over-arching framework for bioregional biodiversity action plans. The volume *Victoria's Biodiversity—Directions in Management* outlines the state-wide biodiversity objectives, management approaches, community involvement, legislation and self-regulation, information systems and reporting framework. It also provides each bioregion with a summary of the bioregional landscape, natural capital, land management themes, biodiversity condition and management responses.

3.3.1 State-wide Goals

The strategy established five goals to guide actions towards achieving Ecologically Sustainable Development for biodiversity:

A reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a net gain (with the first target being no net loss by the year 2000);

Maintenance and, where necessary, restoration of the ecological processes and the biodiversity dependent upon terrestrial, freshwater and marine environments;

Maintenance or improvement of the present diversity of species and ecological communities and their viability across each bioregion;

No further preventable decline in the viability of any rare species or of any rare ecological community; and

An increase in the viability of threatened species and in the extent and quality of threatened ecological communities.

3.3.2 The advantage of a bioregional approach

Bioregions are promoted for regional-scale planning because they are based on the patterns of ecological characteristics and the underlying environmental features (See Figure 1). They therefore reflect natural boundaries and relationships between biodiversity assets and natural resource based activities (NRE 1997). It is an objective of the National Strategy for the Conservation of Australia's Biodiversity to use bioregional planning for the effective conservation of biodiversity (Commonwealth of Australia 1996).

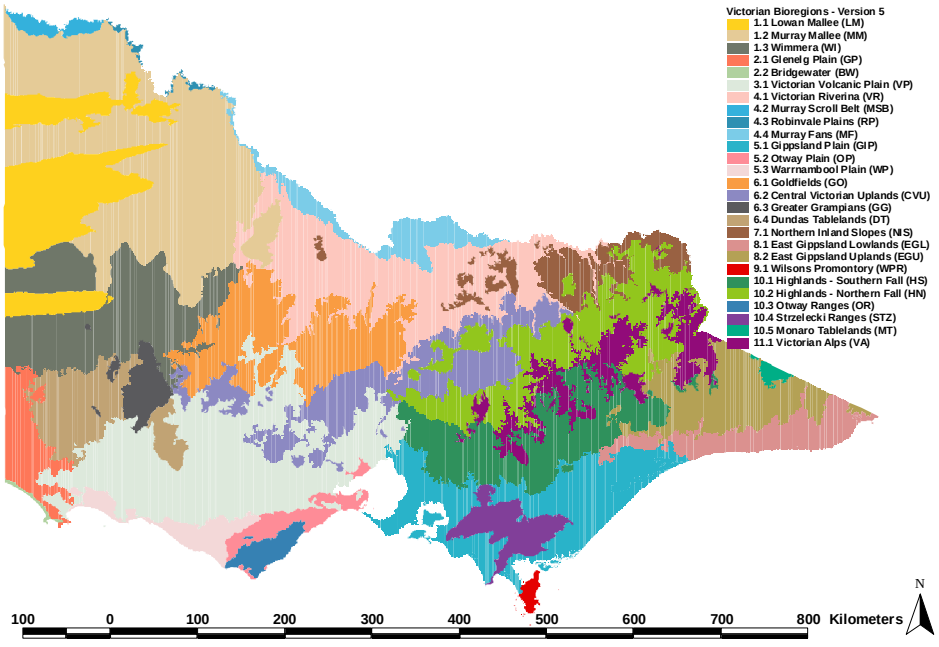


Figure 1: Bioregions found within Victoria; 6.2 shows the Central Victorian Uplands.

3.3.3 Priorities for management

The State Biodiversity Strategy (NRE 1997) provides a list of priorities for management responses at the bioregional level. For the Central Victorian Uplands, the priorities are to:

- Complete and implement the Midlands and North East Forest Management Plans, and the North East and West Regional Forest Agreements;
- Finalise the bulk water entitlement process so that adequate and timely environmental flows are established for the rivers and wetlands;
- Identify all sites of biological significance in the rural landscape in conjunction with local government and landholders and encourage appropriate use of this information in local planning schemes;
- Protect and enhance remnant vegetation on public land, including rail, water frontage and road reserves; and
- Encourage private landholders to protect remnant vegetation on their land, using a range of incentives and programs such as Land for Wildlife, targeting bio-link zones, riparian vegetation, depleted Broad vegetation Types (BVTs) such as Plains Grassy Woodland Complexes, and habitat for threatened species such as the Bush Stone-curlew.

3.4 Native Vegetation Planning Framework

3.4.1 Draft Native Vegetation Management Framework

Victoria's Native Vegetation Management – A Framework for Action (NRE 2002) provides the strategic direction for the protection, enhancement and restoration of native vegetation across the State. The Framework identifies principles and goals that apply to private and public land, but recognizes that the management approaches to achieving the goals will vary according to the tenure and the conservation value of the vegetation.

The Framework proposes that native vegetation management in Victoria is guided by the following principles:

- retention and management of remnant native vegetation is the primary way to conserve the natural biodiversity across the landscape;
- the conservation of native vegetation and habitat in a landscape is dependent on the maintenance of catchment processes;
- the cost of vegetation management should be equitably shared according to benefits accrued by the landholder, community and region; and
- a landscape approach to planning native vegetation management is required. Goals for native vegetation management will be based on bioregions, or sub-units, within the Catchment Management Authority regions. Priorities for vegetation management should be specific for each bioregion and catchment.

Goals

The primary goal identified for native vegetation management is "a reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a net gain".

Net gain is where losses of native vegetation and habitat are reduced, minimized and more than offset by commensurate gains. Losses and gains are evaluated by a combined quality-quantity measure (habitat-hectare equivalence measure) and over a specified area and period of time. Additional outcomes are identified for biodiversity, land and water quality, and climate change amelioration.

Net gain

The concept of net gain recognizes that, although "natural is best", it is possible to partially recover both extent and quality of native vegetation by active intervention and thus effect the net result. Offset criteria have been established to provide a clear link between gains and losses and in this way ensure that the commensurate requirement of net gain is met. In order to achieve the biodiversity goals for native vegetation management, application of the net gain approach needs to be linked to the conservation significance of the native vegetation in question.

Conservation significance

The conservation significance of a patch of vegetation (from Very High to Low) is determined according to:

- the conservation status of vegetation types present;
- the quality of the vegetation; and
- the conservation status of species present (and potential habitat value), and other recognized criteria.

3.4.2 Regional Native Vegetation Plans

The Central Victorian Uplands are covered by seven Draft Native Vegetation Plans—Wimmera, North Central, Goulburn Broken, Corangamite, Port Phillip, North East and Glenelg Hopkins. These plans cut across bioregional boundaries and aggregate data and principles across each CMA administrative region. They include:

- the pre-1750 and extant areas of all ecological vegetation classes in each CMA region;
- the conservation significance of remnant vegetation within each CMA region based on status within each bioregion;
- the expected outcomes of clearing applications;
- broad priorities and principles for protection and revegetation in each CMA region; and
- Aspirational targets for vegetation (See Table 2).

Table 2: Targets set for restoration of native vegetation within the Central Victorian Uplands

CENTRAL VICTORIAN UPLANDS BIOREGION	Cover targets		Quality targets		Other targets
Catchment Management Authority region	Increase in native vegetation cover		Extent of existing n.v. managed according to *BMP		
	to % of pre-1750 cover	by year	%	by year	
Wimmera	20 (total) 15 (all **BVTs)	2020 2100	90 (on private) 100 (on public)	2010 2010	▪ net gain in all EVCs from 2000 levels ▪ increase viability of threatened species and extent and quality of threatened EVCs ▪ increase community understanding of native vegetation issues (involve 75% of farmers and 30% of broader community by 2010)
Glenelg Hopkins	30 (overall) 15 (depleted EVCs)	interim 2030	see under 'other targets'	see under 'other targets'	▪ enhance and restore quality of existing remnant native vegetation ▪ achieve land and water resource protection benefits ▪ use BMP approach on all land tenures ▪ improve decisions made by stakeholders in native vegetation management
North Central	20 (total)	2020	90	2010	▪ all areas of endangered rare or vulnerable EVCs, and/or endangered, vulnerable or threatened flora and fauna (on private land) managed according to BMP by 2005
Corangamite	10% (total) 5% of threatened EVCs	2010 2010 (or 2015 where the extant cover of threatened EVCs is <2% of pre-1750)	n/a see Draft Corangamite Native Vegetation Plan 2002 (Corangamite CMA 2002)	n/a see Draft Corangamite Native Vegetation Plan 2002 (CCMA)	▪ maintain native vegetation areas at 1999 levels ▪ Enhance quality of existing native vegetation. ▪ Increase overall cover of native vegetation. ▪ Increase the viability of threatened species and the extent and quality of threatened ecological communities. (Corangamite CMA Regional Catchment Management Strategy, 1997).
Goulburn Broken	15 (all depleted BVTs) 15 (†all endangered and vulnerable EVCs)	2030 2030	90	2010	▪ net gain in all EVCs from 1999 levels ▪ increase viability of threatened species and extent and quality of threatened EVCs
Port Phillip	Vegetation cover and quality targets are currently being reviewed and are in preparation for release for public comment by early May 2003 (Dale Tonkinson, Port Phillip CMA, pers. comm.).				

North East	15% 30%	2010 2030	50% 90%	2005 2030	▪ Extent and quality of all native vegetation classes to be maintained at 1999 levels by applying Net gain principles. ▪ Compile inventory of VROTS sites and identify management opportunities. ▪ Ensure VROTS are not further depleted. ▪ Compile BMP for different vegetation classes, threatening processes and land tenures.

*BMP: Best management practice—If appropriateness of a practice can be measured, then *best* practice will occur when contributing to maximum possible positive change (Goulburn Broken CMA 2000a)

**For BVTs, such as grasslands, where this may be unattainable, double current area under BMP.

† All *endangered* EVCs are below 10% pre-1750 cover and some vulnerable EVCs are below 15% (Goulburn Broken CMA 2000a).

Local areas

The Native Vegetation Plans in turn provide strategic direction for the development of local action plans for native vegetation retention and revegetation. Examples of local areas are sub-catchments, local communities or Landcare Group areas.

3.4.3 State Planning Policy Framework

Clause 15.09 of the State Planning Policy Framework (SPPF) (Conservation of native flora and fauna) includes the objective "to assist the protection and conservation of biodiversity, including native vegetation retention and provision of habitats for native plants and animals and control of pest plants and animals". It also establishes the requirement for planning authorities to have regard to *Victoria's Biodiversity* Strategy (NRE 1997) and other instruments made under the FFG Act when preparing Municipal Strategic Statements and planning scheme amendments.

Clause 52.17 establishes the baseline native vegetation retention provisions, under which a planning permit is required to remove, destroy or lop native vegetation, except in exempted cases.

Planning schemes

Each municipal planning scheme consists of a standard state-wide section (the SPPF) plus other sections that contain local material. The *Biodiversity Planning Practice Note* (DOI 2002) outlines the way in which these local provisions can take a strategic approach to conserving the biodiversity assets of the municipality.

Local Government planning schemes can be used to support the outcomes from native vegetation management planning. It is State planning policy that native vegetation is to be protected and conserved and habitat for native plants and animals is protected and ecological processes and genetic diversity are maintained.

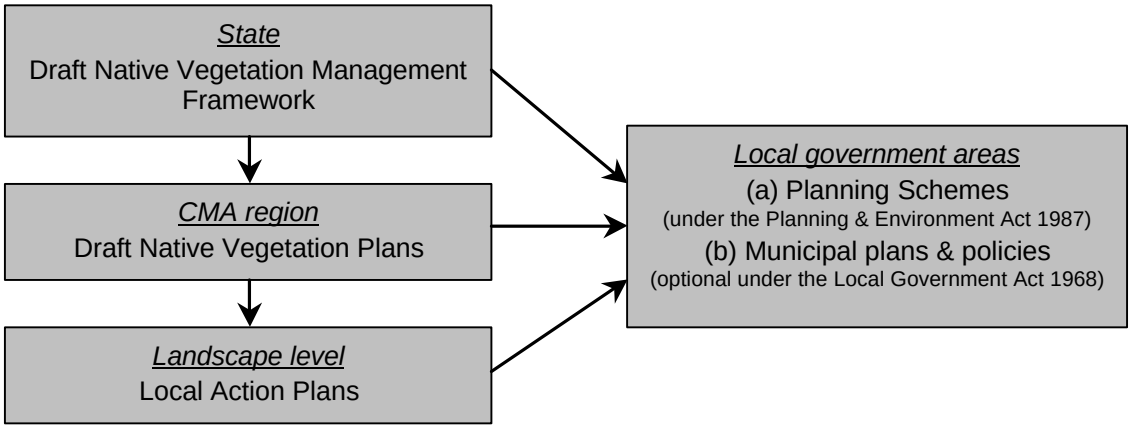
Municipal Strategic Statements and local policies

A (MSS) is intended to provide broad strategic objectives of planning schemes, which are then fleshed out in local policies and provisions that include key decision guidelines. The MSS should highlight key biodiversity issues and local policies should provide guidance to Councils and applicants in day-to-day decision making.

In the MSS, Council indicates how it will implement existing action plans and strategies (e.g. Regional Vegetation Plans prepared by CMAs, and its own Roadside Management Plans) relating to biodiversity conservation.

The MSS also justify to the application of zones and overlays. Where biodiversity values are likely to be of more than local significance, the planning scheme's baseline conservation provisions (e.g. the Native Vegetation Retention Controls) may not be sufficient to achieve the biodiversity conservation objectives. In these cases the MSS should indicate how overlays or zones will be applied and/or how local policies will be developed to achieve the stated objectives.

For example, an Environmental Significance Overlay can be included in the planning scheme to identify a significant biodiversity asset, override an exemption so that a planning permit becomes necessary, and set out decision guidelines for such a permit.



3.5 River Health

3.5.1 Victorian River Health Strategy

The Victorian River Health Strategy was released in 2002 (NRE 2002b). It provides a framework to enable Government, in partnership with the community, to make decisions on the management and restoration of Victoria's rivers. It establishes a vision that our rivers will be ecologically healthy, managed within healthy catchments whilst providing high value sustainable agriculture, clean drinking water and enjoyment opportunities.

The strategy sets state-wide targets and provides priority setting criteria for investment. It outlines an integrated and evidence based planning framework for rivers, summarizes government policy and the institutional arrangements needed to achieve this vision.

State-wide targets

The strategy established a series of targets, including:

- all heritage rivers are to be maintained to at least their current condition;
- by 2021 one major representative river reach will be in ecologically healthy condition in each river class;
- by 2021 there will be an increase of 3000 km in the length of rivers in excellent or good condition;
- by 2011 there will be an improvement in the status of designated freshwater-dependent focal species in each bioregion;
- by 2011 there will be significant improvements in environmental flows of 20 high value river reaches that are currently flow stressed; and
- by 2011 there will be an increase of 7000 ha of riparian areas under management agreements.

An ecologically healthy river

The strategy defines this as a river which retains the major features and functioning of a river prior to European settlement and which would be able to sustain these characteristics into the future. An ecologically health river will have flow regimes, water quality and channel characteristics such that the majority of plant and animal species in the river and riparian zones are native and no exotic species dominates; has natural ecosystem process; has representative major habitat features and has natural linkages along its length, with floodplain and wetlands and with terminal lakes, estuaries and the sea. Further definition is provided in the strategy.

3.5.2 Regional River Health Strategies

Five and ten year regional targets will be set for riverine (includes floodplain) protection and restoration through the development of community-driven regional River Health Strategies which will cluster under the Regional Catchment Strategies (see next section). These river strategies will:

- identify environmental, recreational, cultural, social and economic assets;
- identify threats to these assets;
- identify opportunities and requirements for restoration;
- set broad priorities for protection and restoration and actions required;

- set and integrate implementation for major river reaches; and
- include monitoring, reporting and review programs.

3.6 Wetlands Policy

3.6.1 Wetlands Policy

Victoria's wetlands program was initiated in the mid 1970's with the listing of sites under the Convention on Wetlands of International Importance, signed at Ramsar in 1971 (and hence known as the Ramsar Convention). Victoria's wetland policy is outlined in the State Biodiversity Strategy (NRE 1997).

3.6.2 Ramsar Wetlands

There are 10 wetlands in Victoria listed under the Convention (Environment Australia 2001). These wetlands are considered to be the pre-eminent wetland areas for conservation in the State. The Convention is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Contracting parties to the Convention commit themselves to:

Designate at least one site that meets the Ramsar criteria for inclusion in the List of Wetlands of International Importance (the Ramsar List), and ensure the maintenance of the ecological character of each Ramsar site. Countries are expected to include in the List as many wetlands that meet the criteria as possible (listed sites do not necessarily require protected area status, provided their ecological character is maintained through a wise use management approach);

Include wetland conservation within their national land-use planning, so as to promote the wise use of all wetlands within their territory;

Establish nature reserves on wetlands, and promote training in wetland research, management and wardening; and

Consult with other Parties about the implementation of the Convention, especially with regard to trans-frontier wetlands, shared water systems, shared species, and development projects affecting wetlands.

3.6.3 Directory of Important Wetlands

Victoria identified 159 Nationally important wetlands under this directory which took a national bioregional approach (Environment Australia 2001). These wetlands are considered to form the second tier of wetlands of conservation significance in Victoria. The criteria for nomination of a Nationally important wetland are based on those used to define Ramsar wetlands, with modifications to the criteria to suit Australian conditions. The criteria include that the wetland:

is representative of the wetlands of a particular bioregion;

plays an important ecological or hydrological role in the region;

supports more than 1% of the national population of any native plant or animal; and

supports any nationally threatened species.

3.6.4 Land and Water Audit Case Studies

Victoria is trialling additional criteria for the bioregional conservation status of wetlands under the national land and water resources audit. Trials were conducted for the Central Victorian Uplands and Victorian Volcanic Plains bioregions. This pilot is under review and may be applied across the State.

3.7 Regional Catchment Strategy

3.7.1 Role of the Regional Catchment Strategy

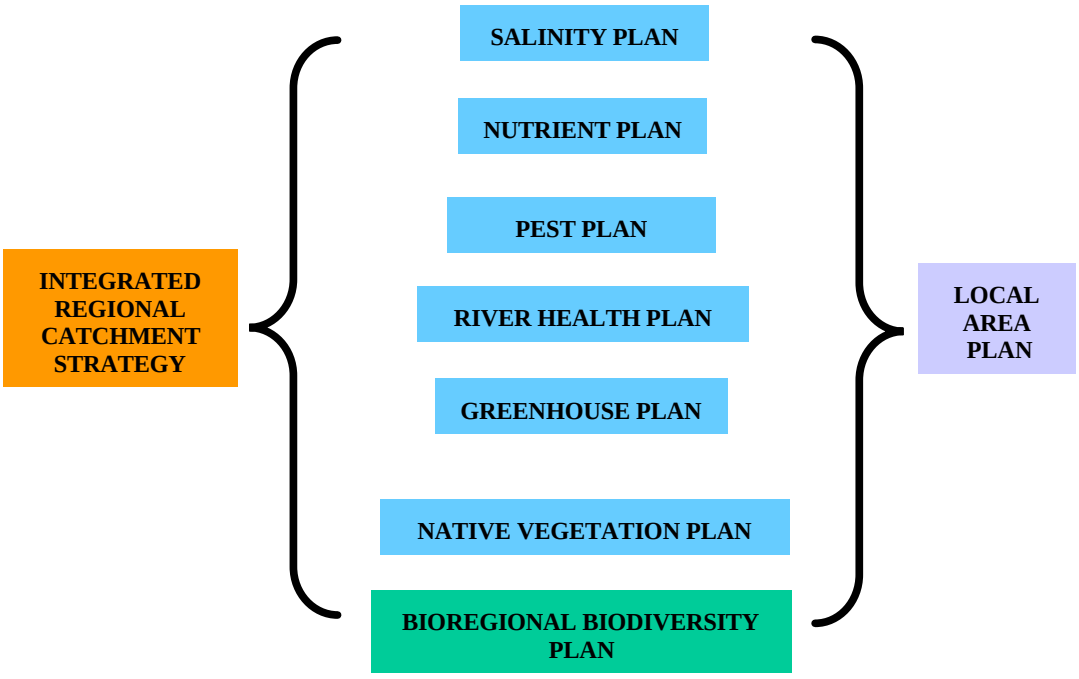
The Regional Catchment Strategy is the top-level strategic regional blueprint for coordinating, in partnership with government, the processes of sustainable land and water management and biodiversity conservation within the region, while ensuring a full opportunity for involvement of land managers, stakeholders and the wider community.

As specific biodiversity objectives are identified, they will be integrated under each relevant program and receive appropriate priority. The CMAs will have a critical coordination and resource role over all of the recommended actions, as well as ensuring that appropriate inventory, planning and monitoring activities are put in place and that these receive proper support.

Supporting plans and strategies

A raft of other regional action plans covering natural resource management issues align with and contribute detailed information to the Regional Catchment Strategy. These cover issues such as native vegetation, river health, land and water, salinity, water quality, biodiversity, pest plants, pest animals and greenhouse.

The role of Implementation Committees of the CMA's in some areas is to integrate these issues. Local area planning is also used to integrate issues within a local geographic area.



Central Victorian Uplands Bioregion

4. The Bioregional Landscape.

4.1 Location and administrative units

4.1.1 Location

The Central Victorian Uplands is located in central Victoria and covers 1.2 million hectares (5.2% of the State). It is contained within the Midlands IBRA or IMCRA Region and stretches from Ararat in the west, to Porepunkah in the east, and from Lurg in the north, to Lara in the south (Figure 2).

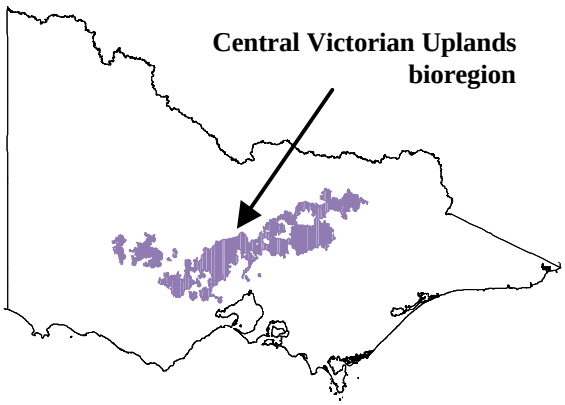


Figure 2 Location of the Central Victorian Uplands in Victoria.

4.1.2 Surrounding bioregions

The Central Victorian Uplands is surrounded by the Victorian Riverina, Northern Inland Slopes and Goldfields bioregions to the north; Wimmera, Greater Grampians and Dundas Tablelands to the west; Highlands-Northern Fall to the east; and the Victorian Volcanic Plains bioregion to the south (Figure 1).

4.1.3 Administrative units

The majority of the Central Victorian Uplands falls within the Goulburn Broken CMA area. Other large portions occur in the North Central, Corangamite and Port Phillip CALP areas, with smaller areas within the Wimmera, Glenelg-Hopkins and North East CMAs (Map 1).

There are 21 Local Government areas that are either partially or wholly included within the Central Victorian Uplands (Table 2; Map 2). In October 2002, Delatite Shire divided to form the Benalla Rural City and Mansfield Shire.

Eight Forest Management Areas (FMAs) occur within the CVU: the North East (86,000ha), Benalla/Mansfield (259,000ha), Central (277,000ha), Bendigo (44,000ha), Mid Murray (1,300ha), Dandenong (3,000ha) Midlands (529,000ha) and Horsham (17,000ha) (Cameron Taylor, DSE Melbourne, pers. comm.).

Numerous Landcare groups operate throughout each CMA in the Central Victorian Uplands. The numbers of Landcare groups for each CMA are shown in Table 14, Section 8.5.4. These groups focus upon a range of issues, including weed and rabbit management, salinity control, biodiversity protection and enhancement, and gully and stream erosion control.

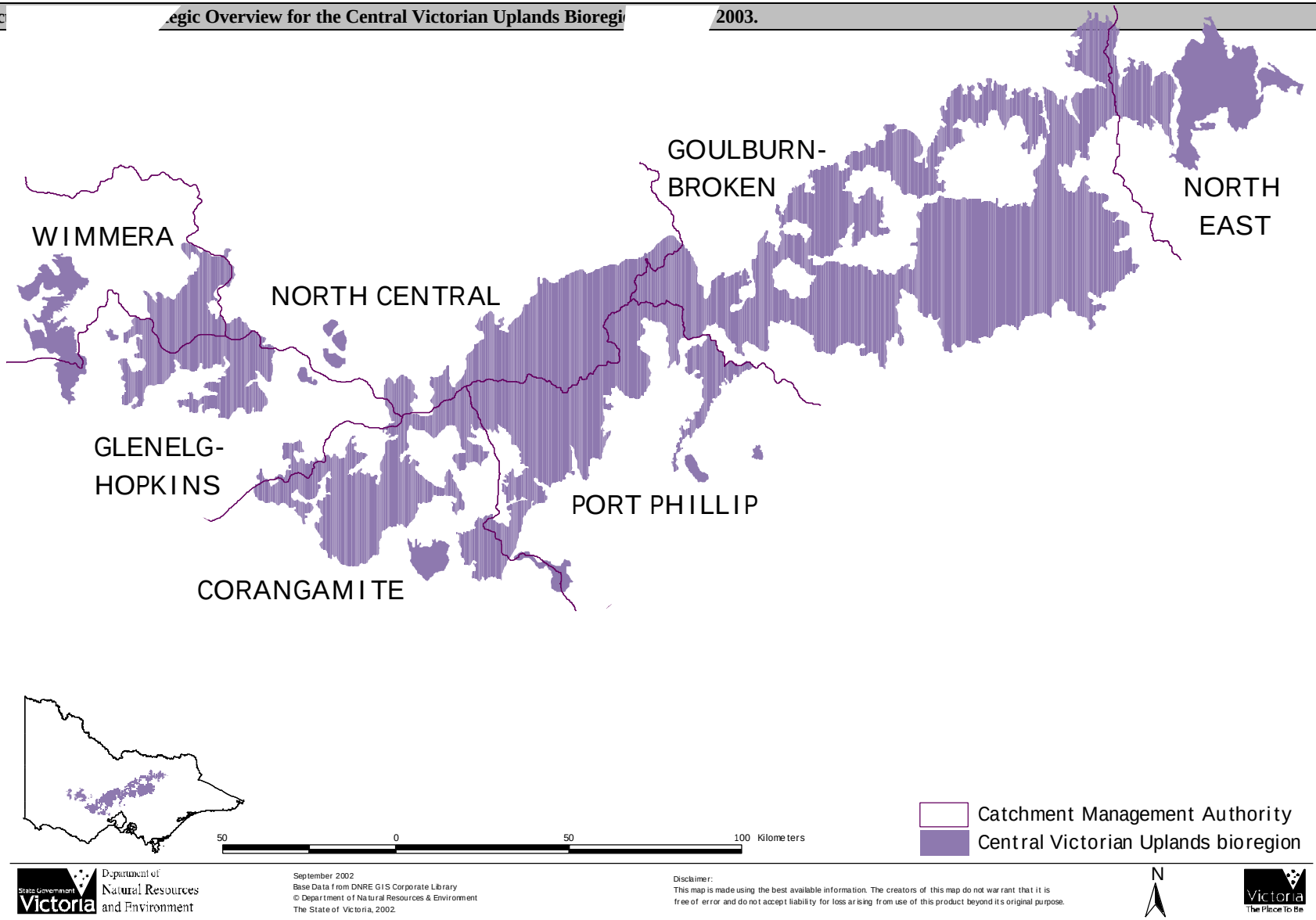
4.1.4 Public and private land

Seventy eight percent (approximately 952,337ha) of the Central Victorian Uplands is classified as freehold land (DSE corporate database, 2002).

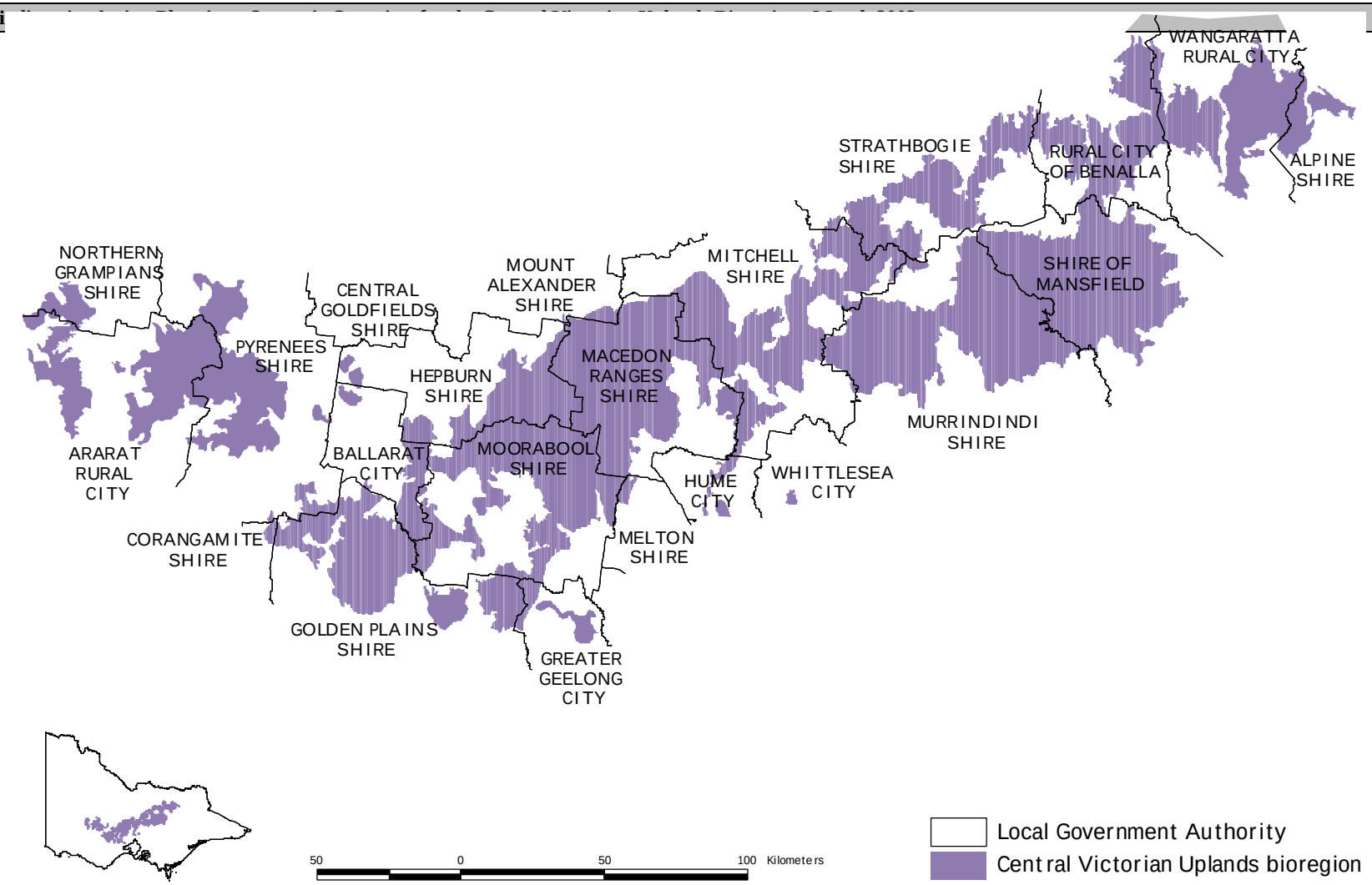
Table 3: Local Government Areas occurring within each CMA within the Central Victorian Uplands.

CMA regions	Local Government Areas
North Central (NCCMA)	Mount Alexander Shire, Ballarat City, Hepburn Shire, Macedon Ranges Shire, Mitchell Shire, Mount Alexander Shire, and Pyrenees Shire.
Goulburn Broken (GBCMA)	Mansfield[1], Murrindindi, Strathbogie, Macedon and Mitchell Shires and Benalla Rural City[1].
Wimmera (WCMA)	Ararat Rural City and Northern Grampians Shires.
Glenelg-Hopkins (G-HCMA)	Ararat Rural City, Ballarat City, Pyrenees and Corangamite Shires.
Corangamite (CCMA)	Greater Geelong City, Ballarat City, Corangamite, Golden Plains and Moorabool Shires.
Port Phillip (PPCALP)	Greater Geelong City, Hume City, Melton, Moorabool, Macedon Ranges, Nillumbik and Mitchell Shires.
North East (NECMA)	Wangaratta Rural City and Alpine City.

[1] Formerly Delatite Shire


WIMMERA
NORTH CENTRAL
GOULBURN-
BROKEN
NORTH
EAST
GLENELG-
HOPKINS
PORT PHILLIP
CORANGAMITE
50
0
50
100 Kilometers
Catchment Management Authority
Central Victorian Uplands bioregion
State Government
Victoria
Department of
Natural Resources
and Environment
September 2002
Base Data from DNRE GIS Corporate Library
© Department of Natural Resources & Environment
The State of Victoria, 2002.
Disclaimer:
This map is made using the best available information. The creators of this map do not warrant that it is
free of error and do not accept liability for loss arising from use of this product beyond its original purpose.
N
Victoria
The Place To Be

Map 1: Location of Central Victorian Uplands, showing Catchment Management Authority areas



Department of Natural Resources and Environment

Map created by Heather Anderson; October 2002
Base Data from DNRE GIS Corporate Library

Disclaimer:
This map is made using the best available information. The creators of this map do not warrant that it is free of error and do not accept liability for loss arising from use of this product beyond its original purpose.

Victoria The Place To Be

Map 2: Location of Central Victorian Uplands, showing Local Government Areas

4.2 Physical Features

4.2.1 Climate, geology and drainage

The Central Victorian Uplands is dominated by Lower Paleozoic deposits giving rise to dissected uplands at higher elevations, amongst granitic and sedimentary terrain (with Tertiary colluvial aprons). Metamorphic and old volcanic rocks have formed steeply sloped peaks and ridges. The less fertile hills support Grassy Dry Forest and Heathy Dry Forest ecosystems. Herb-rich Foothill Forest and Shrubby Foothill Forest ecosystems dominate on the more fertile outwash slopes. The granitic and sedimentary terrain (with Tertiary colluvial aprons) is dominated by Grassy Woodlands much of which has been cleared. Lower lying valleys and plains are dominated by Valley Grassy Forest and Plains Grassy Woodland ecosystems (NRE, 1997).

The Central Victorian Uplands has a temperate climate with rainfall varying from 600 to 1000 mm per annum with the southern reaches receiving less, between 400 and 500mm. Maximum January temperatures are generally between 25 and 29ºC, and minimum July temperatures range between 2-4ºC (Victorian Fauna Database, DSE.).

A number of regionally important rivers transect the bioregion, mostly from south to north, and flow into the Murray, and include the Broken and Goulburn Rivers within the GBCMA. Other major rivers include the Werribee (PPCALP); Moorabool, Leigh and Woady Yaloak (CCMA); Loddon and Campaspe (NCCMA); Hopkins (G-HCMA) and the Wimmera (WCMA).

Major towns in the bioregion include Beaufort, Creswick, Yea, Mansfield and Alexandra.

4.2.2 Landscape and land use

The bioregion consists of rugged to gently undulating terrain extending from Great Western to Carbor in the east. Towards the NECMA area of the Central Victorian Uplands, hilly and mountainous terrain of less resistant Lower Palaeozoic sedimentary rock occurs near Porepunkah. Topography is less variable in the Pyrenees in the NCCMA area of the Central Victorian Uplands where the ranges are around 660m, punctuated by Mount Avoca (760m). Throughout the GBCMA, the Central Victorian Uplands is characterized by riverine plains of the Goulburn River and dissected uplands at higher elevations (600-800m) in the Lake Eildon region.

Freehold land accounts for some 952,340 ha (78%) (DSE Corporate Database 2002) of the Central Victorian Uplands, compared with about 265,550 ha of public land. Vegetation cover on both land tenures has changed dramatically since European settlement. Sharing a common boundary with the Goldfields Bioregion, some regions of the western Central Victorian Uplands suffered extensive clearing and modification during the gold rush period of the 1800's.

The flatter and more fertile valleys have been extensively used for agriculture, primarily sheep and beef cattle grazing Sheep and cattle grazing are the major land uses on freehold, along with some cereal and seed oil cropping. There has recently been a variety of agricultural changes within the Central Victorian Uplands, (refer to Section 4.2.4) and an increase in the purchase of small acreage properties purchased for 'lifestyle' properties.

4.2.3 Implications for biodiversity conservation

The Central Victorian Uplands retains areas of high conservation value due to its relatively large percentage (about 29% or 353,848ha) (DSE Corporate Database 2002) of remnant vegetation cover, including several major National Parks and large State Forest blocks.

Many opportunities exist for biodiversity conservation on private land. Throughout the Central Victorian Uplands there are 839 registered Land For Wildlife properties. The total area of these properties is

45,013ha with 11,290ha retained for habitat and 3,650ha restored habitat. The restored and retained habitat is 33% of the total property area (Pam Clunie, DSE Bendigo, pers. comm.). Threatened species that have been recorded on some of these properties include the Nankeen Night Heron, Brolga and Brush-tailed Phascogale (P. Clunie, pers. comm.). The Central Victorian Uplands also contains seven registered Trust for Nature Covenants totaling 279ha total property area (Natalie Woodward, Trust for Nature, pers. comm.) and many Landcare Groups. Landcare projects include identification and protection of remnant native grasslands and other threatened EVCs, surveying for threatened species (e.g. Striped Legless Lizard and White-bellied Sea-eagle), as well as maintaining and enhancing habitat links with adjacent remnants and riparian corridors.

Subdivisions in areas of high rural growth (e.g. Ballarat and Greater Geelong City) as well as 'high amenity' areas closer to Melbourne (e.g. Strathbogie Ranges) require sound planning guidelines and strong voluntary conservation incentives in order to avoid an effective loss of biodiversity values through habitat degradation and fragmentation. Production and implementation of roadside management plans are imperative to protecting a suite of threatened flora otherwise depleted in the bioregion as well as providing habitat links for fauna, particularly in extensively cleared areas.

4.2.4 New and emerging land use trends

There have been significant changes in land use in recent times with the advent of new agricultural developments including viticulture and olives. An influx of people onto small holdings that were previously used for dry-land agriculture, poses a challenge for conservation and protection of remnant vegetation (North Central CMA 2000). A rise in small acreage lots for 'lifestyle' properties potentially increases the opportunity for conservation. In irrigation areas intensification of agriculture has resulted in a doubling of production every ten years while the area of land used for irrigation is declining. This will result in a significant shift in land-use patterns over the next fifty years (Goulburn Broken CMA 2002).

4.3 Pre-European Land use

4.3.1 Aboriginal groups

There are several Aboriginal Communities that have strong associations with the Central Victorian Uplands and adjoining areas, including the Wathaurong, Ballarat and District (South West and Wimmera Cultural Heritage Region), Wurundjeri, Coranderrk Koori and Camp Jungai (Kulin Nation Cultural Heritage Region). (Map 3)

Evidence of early Aboriginal occupation can be found throughout the bioregion. This is demonstrated by hundreds of places or sites of archaeological, cultural and spiritual significance.

4.3.2 Land-use

Aboriginal communities utilised the natural environment widely and efficiently for food, medicines, tools and utensils. Box-Ironbark forests and woodlands provided popular plants for a variety pf uses. Ironbarks (e.g. Red Ironbark) were used for various purposes including providing bark for canoes, wood for shields (*mulka*) and boomerangs and nectar for sweet beverages (Clark 1997, 1992).

The presence of many scar trees, particularly along the margins of streams, lakes and swamps illustrate the importance of Box-Ironbark species. Scarring may indicate the harvesting of bark for canoes, huts and bowls, but also for access to invertebrates and honey and core wood.

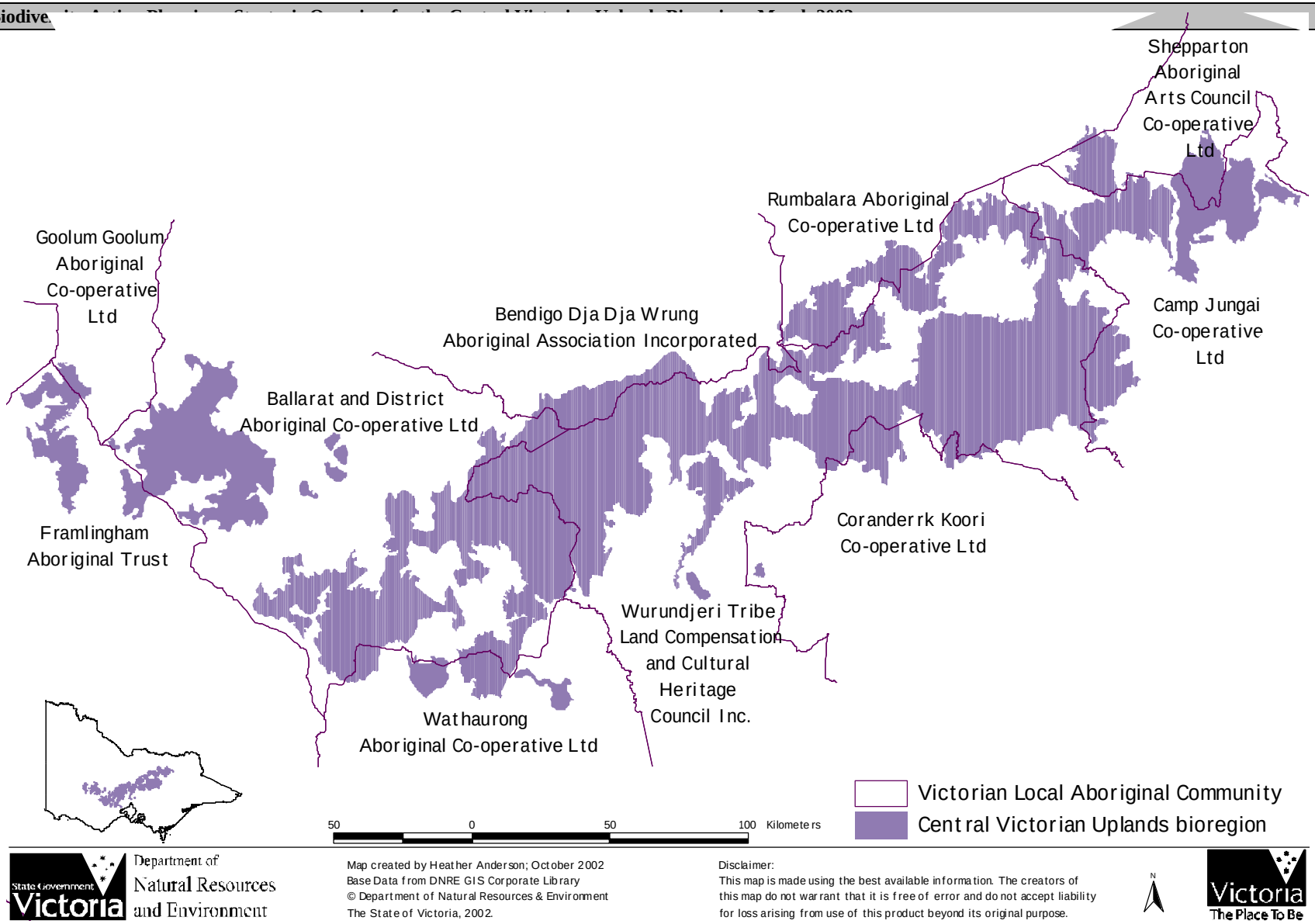
River systems and streams were also very important to aboriginal communities, often being used as trade routes across the landscape (Massola 1971), as well as providing many food resources such as fish, eels and fresh water mussels. Often, communities would move into an area in summer when the creeks and waterholes would dry up to feast on stranded fish. The river systems also provide important plants including Common Reeds[1] provided straight, strong stems for spear shafts and leaves suitable for basket and bag weaving, while Water Ribbons and Bulrush provided starchy tubers for consumption. River Red Gums along the rivers provided gum to treat burns, gnarled burls that were hollowed out to create water containers and eucalyptus leaves were used for steam baths (Gott and Conran 1991).

Other useful plants throughout the Central Victorian Uplands include several Acacias (e.g. Black Wattle, Silver Wattle, Golden Wattle and Blackwood) which provided gum for resins and adhesives, wood for spears and shields and bark for string bags and baskets (Gott and Conran 1991). Greenhood Orchids and lilies are examples of some of the many plants harvested for their tubers.

4.3.3 Influence

Fire-stick farming is likely to have resulted in a mosaic of vegetation and a relatively open landscape. Impacts of hunting and gathering on the flora and fauna are a matter of speculation. If the country was patch-burned, wildfires are likely to have been more limited in their extent and impact. The mosaic of recently burnt and older patches is likely to have supported a high diversity of species and allowed re-colonization of patches.

[1] Scientific names of non-threatened taxa are shown in Appendix 7.



Map 3: Location of Central Victorian Uplands showing Aboriginal Co-operative Areas.

4.4 History of European Settlement

4.4.1 History of settlement

The take-up of pastoral land in Victoria began when growing stock numbers put pressure on the capacity of pasture in New South Wales and Van Diemen's Land (Tasmania). Major Mitchell and other early European visitors also drew attention to the open plains and grassy woodlands of central Victoria. Squatting was legalized in 1836, and pastoral occupation spread across much of the study area.

During the gold rush period of the 1850's and then beyond, miners, market gardeners and timber workers made their homes in the forests. While the impacts of this particular era were concentrated within the Goldfields bioregion to the north (Lowe *et al*. 2002), the north western regions of the Central Victorian Uplands around Ballarat and Ararat were also affected. The landscape was significantly impacted upon in during this time, particularly in the vicinity of the major gold-mining towns (e.g. Ballarat), with much of the vegetation completely removed in some areas.

Other significant settlement periods and land use changes occurred after the first and second World Wars with two waves of soldier settlements (e.g. Dingle 1984, Lake 1987, Smallwood 1982). The aim of the settlement schemes was to reward and gainfully absorb returned soldiers, promoting agriculture, cropping, running stock as well as clearing trees to build houses and erect fences. In the first half of the twentieth century, the Victorian Government actively encouraged and regulated settlement, allocating land and promoting the ideal of a densely populated state of small family farms. Large amounts of land were made available, including the opening up of Crown land. The World War I soldier settlements during 1915-1938 were largely unsuccessful. Allocated blocks were often too small and/or infertile to sustain a living and 60% of the settlers walked off their land. This influenced the second wave of soldier settlements after the World War II and the blocks allocated from 1945 were larger and more carefully selected. The effects of these two eras in settlement have been long-standing and have strongly influenced the agricultural landscape in Victoria.

4.4.2 Influence of social history on attitudes to biodiversity

With the bioregion containing such productive plains and woodland habitats suitable for cultivation and agriculture, the historical ethos towards the land had been concerning the development of more efficient and effective methods of economic exploitation and has not previously included biodiversity conservation as a significant concern. However, some environmental groups have been established for many years (ECC 1997). The Central Victorian Uplands today has a diverse range of communities and varied characteristics to its population.

A number of Naturalist Clubs have been active in the Central Victorian Uplands for many years. There are also 'Friends of' groups associated with various reserves or National Parks and community Environmental groups in most of the larger townships. The emergence during the 1970's of many of these groups reflected the increasing interest in the natural environment. These groups were vocal participants in the review of public land use conducted by the Environment Conservation Council.

Attitudes in rural areas have not been assessed, but in recent years there has been increasing interest in (and membership of) Landcare groups as well as participation in Trust For Nature covenanting and utilization and growth of volunteer associations such as the Threatened Species Network, Greening Australia and Conservation Volunteers Australia (CVA, formerly Australian Trust for Conservation Volunteers.)

However, the historical culture of landholders' rights and subduing the land are still significant and the economic importance of agricultural industries is still prominent. The increasing settlement of the region for life-style reasons has been a mixed experience – many landowners favour reconstruction of ecosystems whilst others are poor stewards in terms of controlling weeds and introduced predators.

The role of Landcare groups is important – they have tended to focus on pest plant and animal issues and on the repair of physically degraded environments, rather than on remnant protection and enhancement. The variety of values needs to be taken into account in biodiversity planning.

Methodology

5. Methodology

5.1 Rationale

5.1.1 Structure of the methodology section

This section outlines the principles used to direct this biodiversity action plan. It is divided into three sections:

A. Information to aid planning and assessment;

B. Tools to aid planning and assessment; and

C. The planning process at landscape-scale.

Each section summarises information relevant to the bioregion. More details regarding the methodologies used are provided in the appendices.

A. Information

This part includes the types of information that identifies and maps natural assets and supports the planning process.

B. Tools

This part covers tools used to analyse information to assist in decision making and planning for biodiversity and allows the distinction between the value and condition of natural assets. It includes the Bioregional Network Analysis, the Index of Stream Condition, the habitat-hectare approach, and also the 'focal species', 'keystone species' and 'flagship species' concepts.

C. Landscape-scale planning

This part outlines the basis for biodiversity action planning at the next scale down from bioregional planning—the landscape zone. It covers the rationale, format, principles, approaches and zone selection.

5. Methodology (A: Information)

5.2 Spatial information

5.2.1 Native species

Observations of native plant and animals are stored in the DSE corporate databases; the Flora Information System and the Atlas of Victorian Wildlife. In addition to the listings of threatened species under the FFG Act, criteria developed by the International Union for the Conservation of Nature are used to classify all native species according to their State-wide conservation status (NRE 2000a).

Extracts from the species databases of threatened species records are regularly loaded into the DSE geospatial systems, which are available to registered users on-line. CD versions of these databases are available from DSE; copies of which are available under licence to CMAs and other agencies.

5.2.2 Native vegetation communities mapping

Ecological vegetation classes (EVCs) are the basic mapping units used for biodiversity planning and conservation assessment at landscape, regional and broader scales in Victoria. They are derived from large-scale forest type and plant community mapping and are based on the types of plant communities and forest types (including species and structural information), ecological information relevant to the species that comprise the communities (including life-form and reproductive strategies); and information that describes variation in the physical environment (including aspect, elevation, geology and soils, landform, rainfall, salinity and climatic zones).

Each EVC represents one or more plant (floristic) communities that occur in similar types of environments. The floristic communities within each EVC tend to show similar ecological responses to environmental factors such as disturbance (e.g. wildfire). As well as representing plant communities, EVCs can be used as a guide to the distribution of individual species and groups of species, including animals and lower plants such as mosses and liverworts.

EVC mapping was undertaken in Victoria as part of the Regional Forest Agreement process. Maps included for Victoria are for the East Gippsland, Gippsland, Western Victoria, North East Victoria and Central Highlands regions. EVC mapping for the north-west area of the State is currently underway through the National Action Plan for Salinity and Water Quality.

The mapping covers the extant occurrence of native vegetation communities and models of the pre-European distribution of EVCs. The conservation status of each EVC is determined using the degree of depletion of each EVC using these two data sources and applying the JANIS criteria. All of these data are stored as DSE corporate layers. Maps of EVCs are available at the DSE website and in the Native Vegetation Plans.

5.2.3 Bio-sites

The DSE Bio-sites database is a register of known sites of biological significance. It documents the biological assets present at those sites, what is known about potential threats and management requirements of each site, and individual biodiversity assets present. This information is given in a useful, standardized format, set for incorporation of biodiversity into planning schemes. Bio-site areas are based on recorded occurrences of a species and an informed estimate of how much of the habitat in the surrounding area is likely to be used or occupied by that species.

The bio-site database is invaluable, but identification of sites is not necessarily comprehensive and the database is continually reviewed and updated. Also, bio-site boundaries require interpretation of the likely range of the species identified there and the habitat they occupy. A lack of population and ecological data for the site may make this difficult to estimate accurately.

5.2.4 Index of Stream Condition

The Index of Stream Condition (ISC) is a tool to aid management of waterways. It can be used to:

benchmark the condition of streams (throughout the state of Victoria);

judge the long term effectiveness of management intervention in restoring and maintaining stream condition; and

aid waterway managers in setting objectives.

The ISC is a measure of a stream's change from natural or desirable conditions. It is not intended to provide all the information that may be required about stream condition, but rather will flag problems and identify where more detailed investigations are needed.

Assessment criteria

The ISC provides information on a state-wide basis. It is proposed to be reported every five years for stream reaches longer than 10 km and provides a summary of:

- hydrology (change in volume and seasonality of flow from natural conditions);
- physical form (bank stability, bed erosion or aggradations, influence of artificial barriers, and abundance of coarse woody debris);
- riparian zone parameters (species, spatial extent, width, intactness, regeneration, and conditions of wetlands and billabongs);
- water quality (by assessment of phosphorus levels, turbidity, pH and conductivity); and
- aquatic life (numbers and types of macro invertebrates).

The ISC has been developed to meet the needs of Catchment Management Authorities and River Management Authorities (RMAs) in managing and reporting on waterway condition. It is assessed using the planning units that are currently being developed for the CMAs.

Rating

A rating is provided for each of these components and the sum of the ratings is the overall value of the ISC. The ISC report includes preliminary guidelines for assessing the ISC along with sample applications. Results for the Central Victorian Uplands are shown in Section 6.

5.2.5 Wetlands information

Spatial information on wetlands is also stored as a DSE data layer including the Ramsar Convention wetlands, and the Directory of Important Australian wetlands. Links on the DSE website lead to mapping and database products for wetlands (Appendix 9).

5.3 Other information

5.3.1 Roadside management plans

Roadside conservation assessments have been carried out for most municipalities (see also section 8.4). They identify roadsides of conservation value and in some cases highlight particular threats and management issues.

Municipalities may include the road network in an overlay to their local planning provisions, which then reference roadside conservation mapping. Councils may also use the assigned conservation value as a guide to the sorts of works and management that are appropriate in those areas.

Conservation value

Roadside mapping generally assigns roadsides to one of three categories - High, Medium or Low conservation value, as follows:

- *High* conservation value typically represents intact native vegetation.
- *Medium* conservation value represents degraded native vegetation
- *Low* conservation value represents roadsides with little or no native vegetation remaining.

5.3.2 Revegetation Guides

Information on recommendations for revegetation in parts of the Central Victorian Uplands is available in guides produced by the Goulburn Broken (NRE 2001) and North Central Catchment Management Authorities. This includes information on the:

- types of native vegetation in these areas;
- typical cross-sectional profiles of the landscape;
- distribution of vegetation types; and
- gives detailed information on the native plant species most suited for revegetation.

Similar information, although not in the form of a published revegetation guide, can be found on the North East, Wimmera, Glenelg-Hopkins, Corangamite and Port Phillip websites. For example, Corangamite CMA has guidelines for the revegetation of waterways (Corangamite CMA 2002b). (for Website addresses see Appendix 9).

5.3.3 Other plans

A vast amount of information on native biodiversity in the Central Victorian Uplands is available in a number of other sources. Some of these are listed below:

- Environment Conservation Council (formerly Land Conservation Council) investigations
- Management plans for parks and other conservation reserves,
- Catchment Management Authority plans for public land water frontage and other streamside areas,
- NRE (DPI) Forest Management Plans,
- VicRoads roadside management plans

- Shire roadside management plans
- Shire bushland reserve management plans
- Other Local Government conservation strategies
- Other studies, e.g. or rail corridors and rail trail reserves.
- Environmental impact assessments for proposed developments.
- Assessments covering public and private land such studies of Sites of Zoological Significance and Botanical Significance
- Consultant's reports on particular sites, commissioned by landholders/managers.
- Reports of field naturalists clubs and other environmental groups.

5. Methodology (B: tools)

5.4 Tools for Planning and Assessment

5.4.1 Bioregional Network Analysis (BNA)

BNA is a system of bioregional assessment of threatened flora and fauna. A regional perspective on the status of each taxon across various land tenures is determined, along with an indication of required management actions and an estimate of the level of management response (outcomes) so far achieved for each taxon. The approach is based on the principle that information about a large number of threatened taxa can, when aggregated, indicate patterns or trends that are useful for broader planning purposes. Further explanation of the BNA process is given in Appendices 1, 1a, b & c).

The bioregional status and response level for each taxon is determined through five steps:

- ***Significance of the bioregion***. Estimating the percentage of the State population which occurs within the bioregion (based on records on DSE flora and fauna databases);
- ***Significance of different land tenure***s. Estimating the percentage occurrence in each land tenure in the bioregion (based on the databases plus local knowledge and expertise);
- ***Priority ranking*** Allocating a priority ranking (1, 2, 3 or 4 from most to least important) for each land tenure, based on the importance of its contribution to the overall occurrence of the taxon within the bioregion and the state;
- ***Risk ranking.*** Estimating a risk ranking (A, B or C from more concern to less concern) for each parcel (see box), based on the level of concern for the conservation status of the taxon on each land tenure within the bioregion and its estimated population trend; and
- ***Response levels.*** Allocating an *expected response* level (1-4) for each parcel based on the priority and risk ranking. Guidance as to the type of response that is required at each of the *expected response* levels is provided in the Appendix 3.

DEFINITIONS

***Taxon*:**
typically a *specie*s, but it may sometimes be a *unique form* of a species, or a closely related *group* of species.

***Parcel*:**
defined as the occurrence of a taxon on a particular land tenure—for example, a home range of a rare species which covered a park and adjacent private land would comprise 2 parcels.

The results of the BNA for Central Victorian Uplands are shown in Section 6.2.1.

5.4.2 The 'flagship' and 'focal' species concepts

Certain species may have special values for conservation management. The concepts of 'flagship species' and 'focal species' are examples and are outlined below. It is possible for one species to fall into none, one or both of these categories.

Flagship species

Flagship (or 'Icon') species are those which have particular promotional and publicity value and can increase public support for biodiversity conservation. Flagship species for the Central Victorian Uplands include the Swift Parrot, Trout Cod, Regent Honeyeater, Striped Legless Lizard, Eastern Barred Bandicoot, Brush-tailed Phascogale and the Small Ant-blue Butterfly.

The Golden Sun Moth also has value as a 'flagship species', highlighting the importance of invertebrates, grasslands and grassy woodlands (O'Dwyer *et al.* 2000). An understanding of the Golden Sun Moth will assist in appropriate conservation management of other grassland and grassy woodland species.

Focal species

Focal species are those which are useful targets for conservation actions because their requirements reflect many other associated species or communities. Therefore action for one focal species will also favour wider biodiversity conservation. Many threatened taxa are at risk if no management action is taken. For example, taxa limited by predation, grazing or inappropriate fire regimes will require management of these threatening factors. For each such factor, the taxon considered most limited is referred to as a focal species. By meeting the management requirements of focal taxa, those of other taxa affected by the same issues should also be met (Lambeck 1999, Bennett *et al*. 1999a). Freudenberger (1999) has demonstrated that the persistence or loss of particular species in formerly connected patches of remnant woodland vegetation is related to the known ecological requirements of each species. If information is available about the ecological requirements of prospective focal taxa and their occurrence in relation to patch size and connectivity, the critical parameters can be deduced and used to plan restoration works.

Freudenberger (1999) and Lambeck (1999) have found birds to be useful focal species because they move across landscapes and are relatively easy to see and identify. Native mammals including bats are exposed to similar landscape threats, but are more difficult to survey. Reptiles and invertebrates are potential focal species for finer-scale threats caused by loss of micro-habitats such as logs or bark. Plants are less useful because there is less information on their reaction to habitat area, quality and isolation and the time scales involved.

Griffioen *et al*. (2002) have developed a new method to identify focal species that are limited by the area, quality or isolation of patches of remnant habitat using data from the Birds Australia atlas. Some key thresholds are shown below.

Table 4: Key thresholds of Patch size, quality and connectivity for some passerine bird species.

Species	Patch size	Patch quality*	Patch connectivity
Striated Pardalote	< 10 ha	Habitat complexity < 7	Not necessary
Buff-rumped Thornbill	10 –100 ha	Habitat complexity 7 – 12	Isolation < 1000 m
Hooded Robin	> 100 ha	Habitat complexity > 12	Isolation < 1000 m

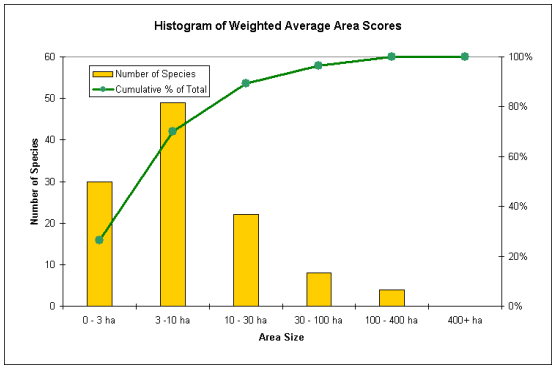
*Habitat quality score: <6 = heavily disturbed, >12 = close to natural.

These values can be used when planning on-ground enhancement and restoration works. For example, changing the grazing management of a remnant so that the patch quality is increased above a score of 6, increases the chances of the Buff-rumped Thornbill using the remnant. By also removing weeds and replanting particular plant species the score can be increased above 12 and so does the chance of the thornbill using this patch also increases.

A range of other species, such as the Hooded Robin are very unlikely to be found in patches less than 100 ha in area. Patches of this size can be restored to the landscape by fostering habitat regeneration between neighbouring smaller patches - once the area threshold is achieved the robin is more likely to use the patch (See Figure 4).

A list of Central Victorian Uplands focal species and their habitat thresholds is shown in Appendix 8.

a)



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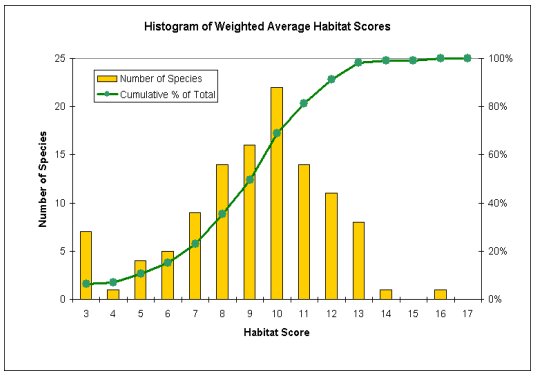


Figure 5: Histogram showing the average weighted scores of a) area and b) habitat that result in the greatest species diversity.

5.5 Native Vegetation Quality

5.5.1 The habitat hectare approach to native vegetation assessment

The habitat hectares approach is designed to assess native vegetation quality. Such assessments may assist in deciding conservation significance or priorities for action.

Aims of the approach

The Habitat hectares approach (Parkes, Cheal and Newell 2001) aims to:

- Be an objective system that is reliable and repeatable;
- Provide a measure of the 'naturalness' of the system;
- Indicate the direction and amount of potential improvement for lower quality sites;
- Allow comparison between different vegetation types;
- Combine quantity and quality assessments;
- Enable calculation of net outcomes, either for trade-offs and offsets, or to measure achievements of policies and programs;
- Be a system that can be used by a range of natural resource managers and not just specialists; and
- Present a simple and robust message to land managers about the importance of different components of native vegetation.

Calculating "habitat hectares"

NRE is developing guidelines to assist in the scoring of vegetation stands. The basic system is outlined in the table. Vegetation quality is defined as the degree to which the current vegetation differs from a benchmark based on the average characteristics of mature and long-undisturbed vegetation of the same type. Once a vegetation quality score has been obtained, the percentage (where 100% represents a mature, undisturbed example) is multiplied by the number of hectares to calculate the 'habitat hectares'.

Further information regarding the habitat hectare approach within the context of native vegetation management can be found in DSE's document: Victoria's Native Vegetation Management – A framework for action (NRE 2002a).

Table 5: Habitat hectare scoring system incorporating considerations of site quality and landscape context (Parkes, Cheal and Newell 2001).

Habitat Hectare scoring	Component	Max value (%)
Site quality	Large trees	10
	Tree (canopy) cover	5
	Under-storey (non-tree) strata	25
	Weediness	15
	Recruitment	10
	Organic litter	5
	Logs	5
Landscape context	Patch size	10
	Neighbourhood	10
	Distance to core area	5

	TOTAL	100

5. Methodology (C: landscape planning.)

5.6 Biodiversity trinity

5.6.1 Biodiversity trinity

Biodiversity actions need to be directed towards:

- *protection* of viable remnant habitats, and the flora and fauna populations they contain;
- *enhance* the condition of these habitats and populations; and
- *restoration* of at least some of their former extent by revegetation or reintroduction.

Tactics for conservation of native biodiversity can be considered as the stepwise series of protection first, then enhancement, and then restoration.

Key principles in this trinity are:

- that protection and enhancement of remnant habitat and populations is the primary way to conserve biodiversity across the landscape;
- all native vegetation, natural wetlands and rivers have some value; an adequate proportion of each type must be managed principally for conservation;
- all viable habitats and populations of threatened species should be protected through voluntary and regulatory means;
- large natural areas of remnant vegetation are of fundamental importance for nature conservation and are irreplaceable; all other things being equal large remnants are inherently more valuable than groups of small patches that total the same area.;
- multiple patches of the same vegetation community should be retained or enhanced across the landscape;
- position in the landscape affects their conservation value;
- natural is best; restoration of an asset through revegetation or re-introduction is unlikely to return the asset to its original condition with all of its inherent ecological processes and resilience; and
- restoration should be targeted to areas which maintain natural resilience / restoration efforts should harness natural resilience.

Priorities for action to conserve biodiversity are driven by the conservation significance of the biodiversity asset. Conservation significance is attributed to native vegetation communities, native species of plants and animals, natural wetlands and rivers according using the rarity of the asset type and its naturalness or natural condition (see earlier sections). Regional investments will be driven by these priorities in the following ways:

Protection - reservation, covenants, management agreements, statutory planning and fencing.

Enhancement - management by controlling threats such as weeds, introduced predators, inappropriate/uncontrolled grazing by stock, native animals, salinity natural regeneration and revegetation with understorey.

Restoration - revegetation to create corridors, buffers, patches of habitat, reintroduction of individual plants and animals into depleted populations.

5. Methodology (C: landscape planning.)

5.7 Landscape planning

5.7.1 Introduction

This document provides a strategic overview at the bioregional scale. However, bioregional overviews must translate into management at the landscape scale if they are to be adopted and acted upon by local communities of landholders and land managers. Land management at landscape scale might refer to one of the zones into which the bioregion is sub-divided or substantial portions of any of these zones. Once a landscape scale plan has been developed for a local area or district, individual landholders and land managers, with advice from CMA and other agencies or programs, will be able to decide on the type of patch or site management and/or revegetation to best supplement local biodiversity.

Bioregional priorities need to be reinterpreted for the landscape, patch and site scales so that communities and individual land managers can identify their role and appropriate actions. A number of guiding principles for protecting, managing and restoring biodiversity have been derived from recent fauna research in box-ironbark woodland habitats (Bennett *et al*. 1999b) and from revegetation issues and their relation to native fauna habitat values in rural environments (Bennett *et al*. 1999a).

5.7.2 Land management scale

A useful way of envisaging land management at different scales is based on Bennett *et al* (1999a), who defined four functional levels:

- **Regional** (or catchment) scale management is the level at which strategic planning is undertaken for sustainable land management and for revegetation for nature conservation purposes. A perspective at this level facilitates strategic planning for sustainable land management and conservation reserve systems across areas ranging from tens to hundreds of kilometres, and is likely to involve the co-ordination of organized interest groups and government agencies;
- **Landscape** scale management refers to areas from several kilometres to tens of kilometres across, usually involving a number of properties and individual land managers. At this level, consideration can be given effectively to differences in native vegetation type, vegetation coverage and quality, spatial configuration and connectivity of habitats, and other factors influencing biodiversity in the local landscape;
- **Patch** (or block) scale management usually relates to a single rural property, and focuses on the size, shape, location and diversity of vegetation types. This level permits useful insight into how revegetation may influence the value of fauna habitats; and
- **Site** scale management refers to highly localized activities which may influence the characteristics of vegetation occurring on a block or patch. Such activities include planting, direct seeding or regeneration of vegetation, as well as weed control or thinning in established vegetation.

5.7.3 Management principles at site scale

- Control and manage the disturbance processes which adversely affect habitat resources such as ground-layer components, vegetation composition and structure, and habitat-tree values.
- Ensure that revegetation is undertaken using local native plant species suited to the landform and established in natural layers (e.g. grasses and herbs, ground-cover plants, shrubs, low trees, over-storey trees).

5.7.4 Management principles at patch scale

- Ensure that patch size and shape are appropriate to accommodate the intended vegetation structure, and flora and fauna diversity

- Locate patches so as to facilitate species recolonisation, expand on or buffer existing remnants, and avoid potential sources of disturbance

5.7.5 Management principles at landscape scale

- Aim to increase habitat area, so as to support multiple populations and species with different habitat needs, above critical landscape thresholds.
- Target larger remnants as generally having greater value for faunal communities.
- Target fragments >80 ha as potentially providing stable natural habitats for avifauna (and probably other fauna groups also).
- Aim to connect habitat patches of varying configurations.
- Retain roadside and streamside vegetation networks to connect remnants and sustain good habitat quality.
- Protect and manage gullies and streams as key connective landscape elements.
- Maximize natural diversity of forest types in close proximity, restoring remnants of depleted vegetation types and re-establishing poorly represented habitats.

5.7.6 Management principles at regional (bioregion) scale

- Plan for a comprehensive and representative range of faunal habitats across the bioregion.
- Accommodate habitat needs of wide-ranging (as well as localized) taxa, both within and between bioregions.
- Identify regional ecological priorities for revegetation, and ensure that monitoring programs are part of the process.

5.7.7 Conclusion

The ultimate value of fragments (at least for fauna) is highly dependent upon appropriate site or patch level management to retain resources and habitat components which can sustain the full range of local taxa (Bennett *et al.* 1999b). This conclusion highlights the importance of capturing the interest and commitment of local land management groups, and individual land managers or landholders.

5.8 A format for a Biodiversity Action Plan at landscape scale

5.8.1 Biodiversity Action Planning

Biodiversity Action Planning is a structured approach to identifying priorities and mapping significant areas for native biodiversity at a bioregional and landscape scale. Biodiversity exists in landscapes that also support economic and social activities. Land managers require a practical system to include native biodiversity into the complex interactions and trade-offs that are made on a daily basis. Biodiversity Action Plans (BAPs) will help inform the authors of Regional Catchment Strategies and Local Area Plans of local, landscape and bioregional priorities for native biodiversity. Conservation actions can then be better co-ordinated with land protection and agricultural activities.

Guides to introduce the BAP process (NRE 2002a) and to support natural resource practitioners are available on the NRE website.

5.8.2 Contents outline

The generic format for a landscape scale BAP has the following components:

- Landform – physical description of the local landscape including major land features and local landscape boundaries;
- Land Use – summary of the significant industries operating in the local landscape, including on public land;
- Biodiversity values – a register of the key biodiversity assets including:
  Native Vegetation - types currently typical of the local landscape; priority vegetation types identified in the Draft Native Vegetation Plans; a comparison of the extant and pre-European vegetation; ecological communities that warrant listing under the Flora and Fauna Guarantee Act 1988 and Environment Protection and Biodiversity Conservation Act 1999.
- Flora & Fauna - Prominent taxa listed, as well as those that are now rarely if ever seen in the locations. Some of the latter may be selected as flagship taxa for landscape restoration actions and may usefully include nationally or State-listed taxa.
  Wetlands - Ramsar, Directory and other types.
- Major threats to the biodiversity assets; and
- Planning, management and monitoring actions required to maintain and recover priority taxa and other natural assets.

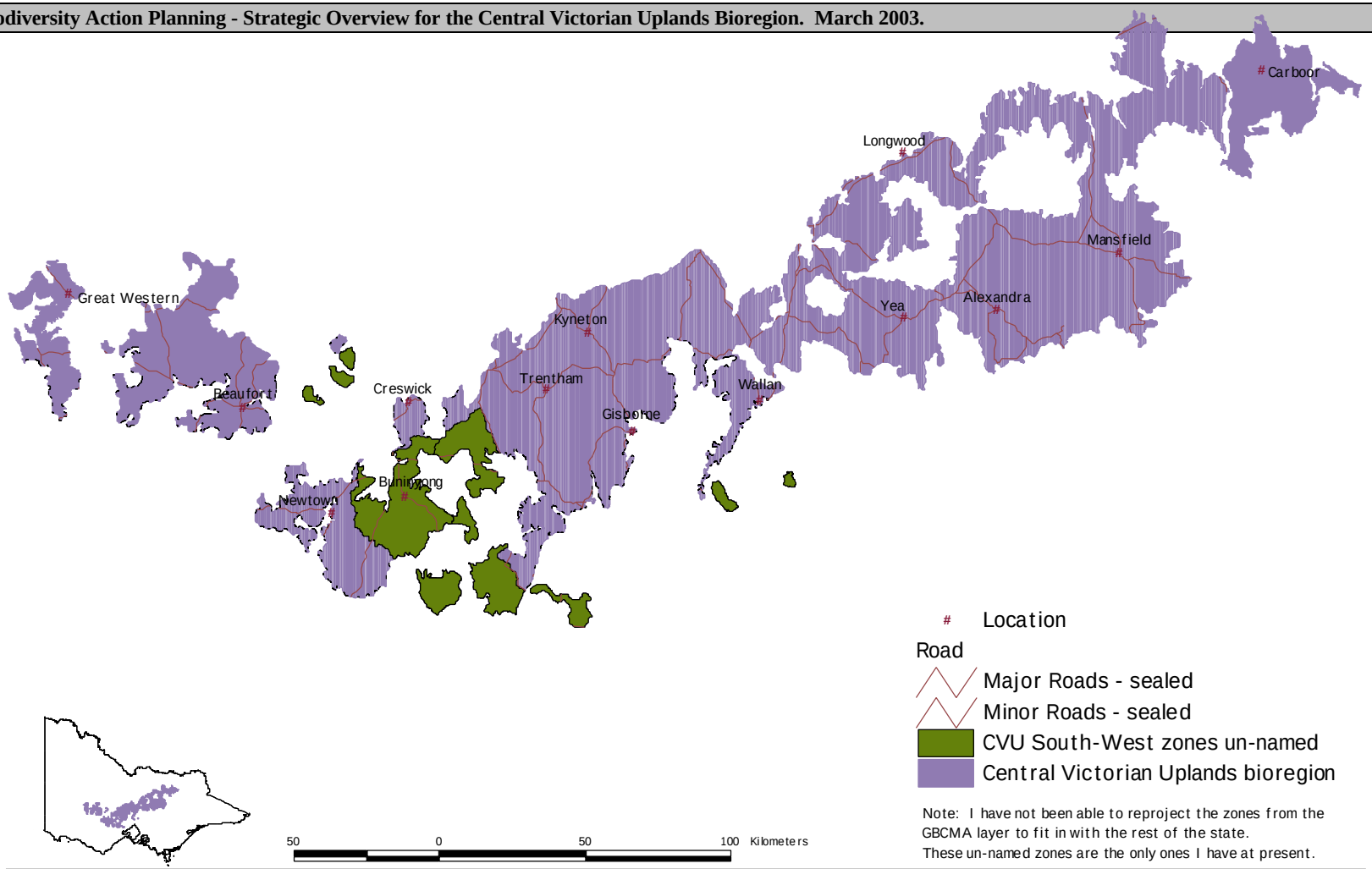
5.8.3 Landscape zone selection

In considering biodiversity across broad regions (e.g. >100 km wide), it is useful to define manageable sub-units (zones <100 km across) within which common features of landscape and biota are identifiable. This will also make it easier to identify the roles of local participants - land managers, stakeholders and the wider community - in the conservation of biodiversity. Landscape zones for the Central Victorian Uplands can be seen in Map4.

Davidson (1996) proposed the use of four main criteria:

1. Amount of remnant cover;
2. commonality of vegetation communities;
3. size of remnant areas; and
4. practical boundary features.

Biodiversity Action Planning - Strategic Overview for the Central Victorian Uplands Bioregion. March 2003.



Department of Natural Resources and Environment

Map created by Heather Anderson; October 2002
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Map 4: Location of the local landscape zones within the Central Victorian Uplands

Selection of zones in this report follows the approach of Davidson (1996). The clumped distribution of major tracts of remnant vegetation across the Central Victorian Uplands and the consequent aggregation of associated biodiversity values favour a bioregional sub-division based strongly on this characteristic.

Eight landscape zones have so far been selected for the Central Victorian Uplands. These include: Enfield, Hughes Creek, Lake Eildon, Longwood, South West Goulburn, Samaria, Strathbogie and Yea. Areas yet to be zoned within the Central Victorian Uplands occur near Great Western and Beaufort in the west, centrally near Buninyong, Creswick, Trentham and Wallan and Carboor in the east.

Detailed lists of biodiversity assets and management actions to protect, enhance and restore them are provided for each zone in companion volumes to this overview.

5.8.4 Form of publication

The local landscape plans need to be dynamic documents and comprise images and goals, coupled with map-plans and overlays, and with the planning process subject to continual updating, modification and review by all participants. Suitable computer modelling is currently being developed within DSE to assist in facilitating this kind of approach. Making the landscape plan a 'flexible concept' is far more amenable to ongoing adjustment and realignment of individual and community direction, and land management techniques. Ongoing refinement of landscape plans is a realistic expectation where continuing change can be expected in:

- the role and views of participants (government, industry and local community);
- the nature of the landscape (public and private land); and
- the technology of conservation management.

Landscape plans will be published as separate volumes to this Overview. These will include:

- Assets and action summaries for each local landscape within the bioregion.
- Local action plans developed through community processes.

Natural assets

6. Natural assets

6.1 Native Vegetation

In structural terms, the pre-1750 form of the bioregion consisted predominantly of dry forests in the steeper dissected hills, grassy and herb-rich woodlands and Plains Grassy Woodlands in the undulating grassy plains and grassy woodlands; and a series of forested foothills and rocky ridges (dominated by box and ironbark species) enveloped in extensive plains of low open woodland (dominated by box species, particularly Grey Box) with a grassy or sparse-shrubby under-storey. Today, the woodland matrix is all but removed, and the condition of the more-or-less isolated Box-ironbark remnants which remain is, in general, far from original.

6.1.1 Extent

Native vegetation now covers around 29.05% of the Central Victorian Uplands (DSE Corporate Database 2002). Modelling of pre-1750 native vegetation indicates 90 different ecological vegetation classes would have been present. Eighty-nine of these have been identified in extant native vegetation. About 2% of this extant native vegetation is classified as Endangered, 4% Vulnerable, 14 % Depleted and 10% of Least Concern in the Central Victorian Uplands (Figure 3).

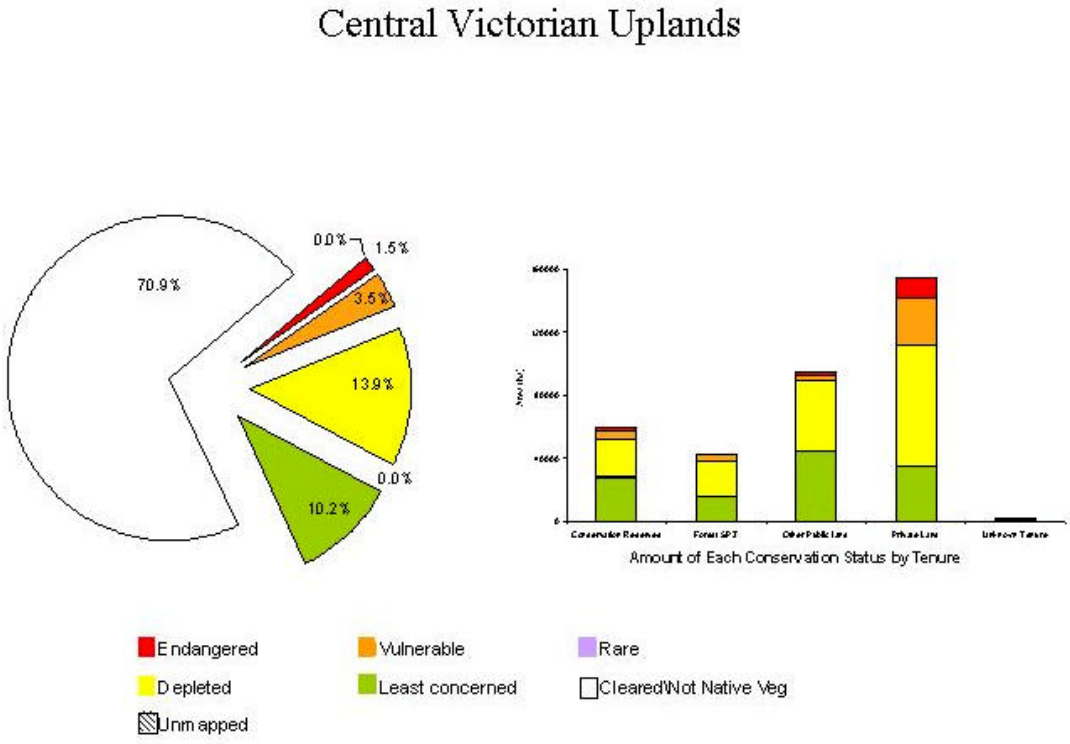
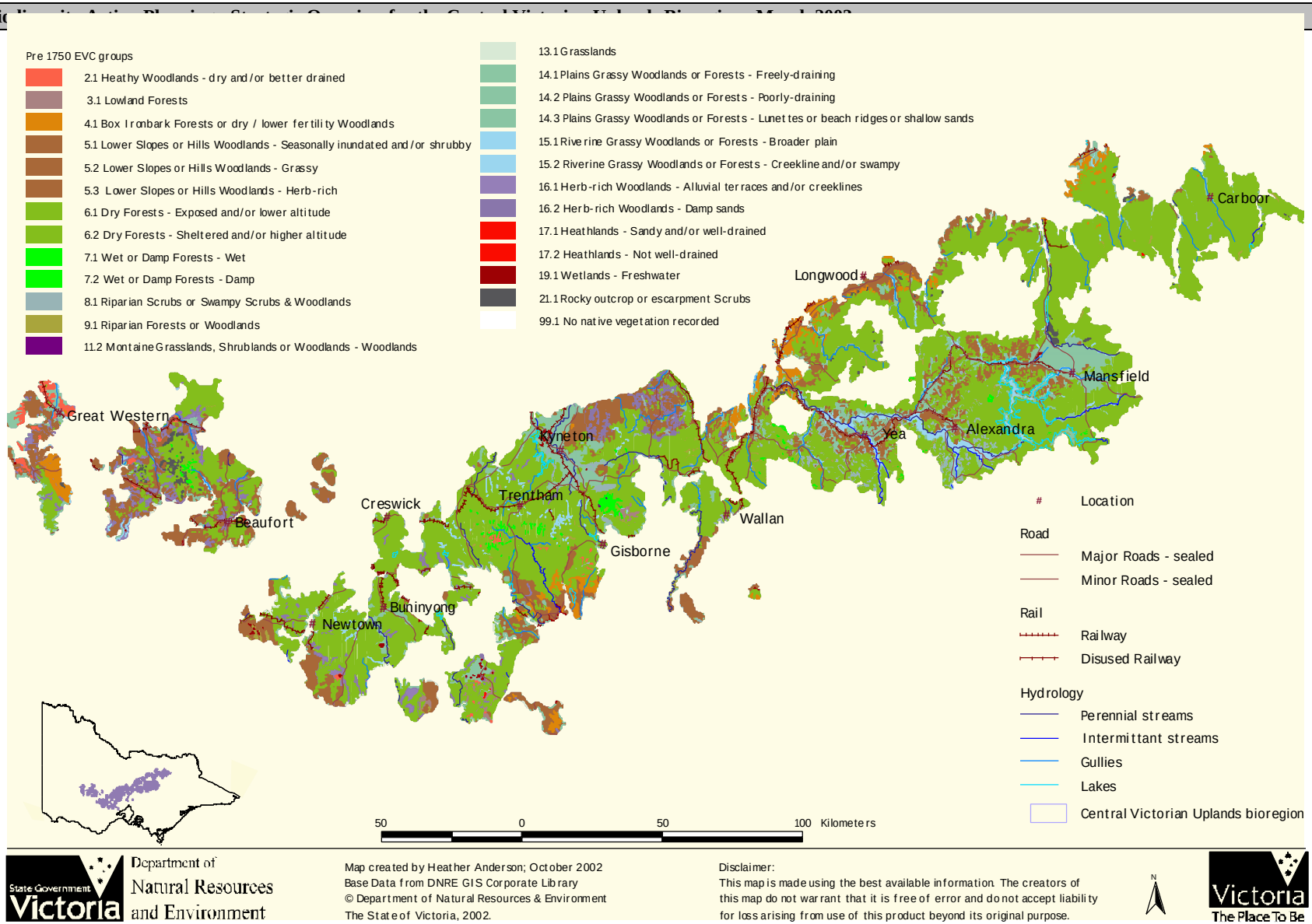


Figure 3: Remaining native vegetation in the Central Victorian Uplands according to conservation status and tenure type


Pre 1750 EVC groups
2.1 Heathy Woodlands - dry and/or better drained
3.1 Lowland Forests
4.1 Box Ironbark Forests or dry / lower fertility Woodlands
5.1 Lower Slopes or Hills Woodlands - Seasonally inundated and/or shrubby
5.2 Lower Slopes or Hills Woodlands - Grassy
5.3 Lower Slopes or Hills Woodlands - Herb-rich
6.1 Dry Forests - Exposed and/or lower altitude
6.2 Dry Forests - Sheltered and/or higher altitude
7.1 Wet or Damp Forests - Wet
7.2 Wet or Damp Forests - Damp
8.1 Riparian Scrubs or Swampy Scrubs & Woodlands
9.1 Riparian Forests or Woodlands
11.2 Montane Grasslands, Shrublands or Woodlands - Woodlands
13.1 Grasslands
14.1 Plains Grassy Woodlands or Forests - Freely-draining
14.2 Plains Grassy Woodlands or Forests - Poorly-draining
14.3 Plains Grassy Woodlands or Forests - Lunettes or beach ridges or shallow sands
15.1 Riverine Grassy Woodlands or Forests - Broader plain
15.2 Riverine Grassy Woodlands or Forests - Creekline and/or swampy
16.1 Herb-rich Woodlands - Alluvial terraces and/or creeklines
16.2 Herb-rich Woodlands - Damp sands
17.1 Heathlands - Sandy and/or well-drained
17.2 Heathlands - Not well-drained
19.1 Wetlands - Freshwater
21.1 Rocky outcrop or escarpment Scrubs
99.1 No native vegetation recorded
Carboor
Longwood
Mansfield
Great Western
Kyneton
Yea
Alexandra
Creswick
Trentham
Wallan
Beaufort
Gisborne
Buninyong
Newtown
Location
Road
Major Roads - sealed
Minor Roads - sealed
Rail
Railway
Disused Railway
Hydrology
Perennial streams
Intermittant streams
Gullies
Lakes
Central Victorian Uplands bioregion
50 0 50 100 Kilometers
State Government Victoria
Department of Natural Resources and Environment
Map created by Heather Anderson; October 2002
Base Data from DNRE GIS Corporate Library
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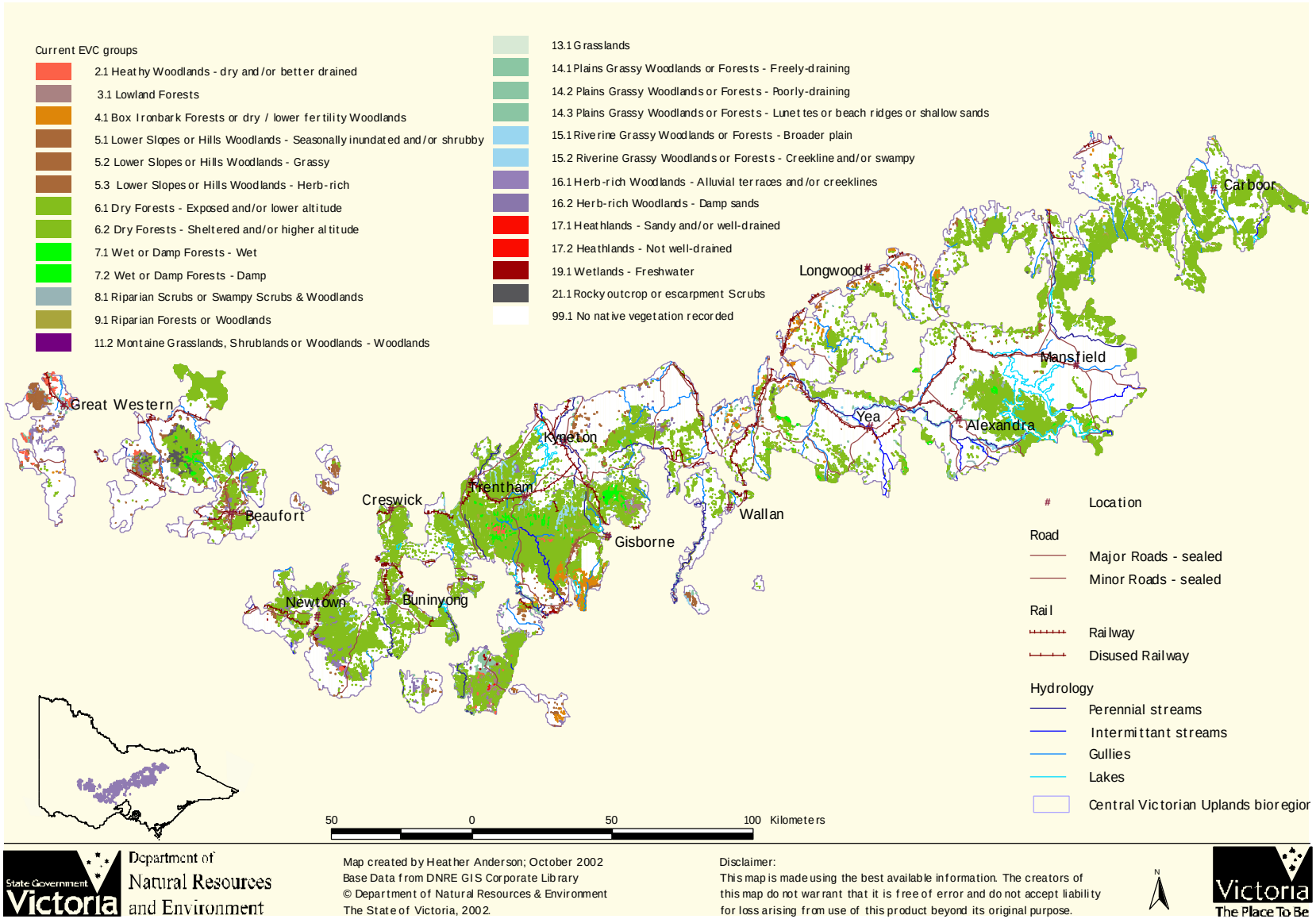

Map 5: Generalised pre-1750 Ecological Vegetation Classes of the Central Victorian Uplands.

State Government Victoria
Department of Natural Resources and Environment

Map created by Heather Anderson; October 2002
Base Data from DNRE GIS Corporate Library

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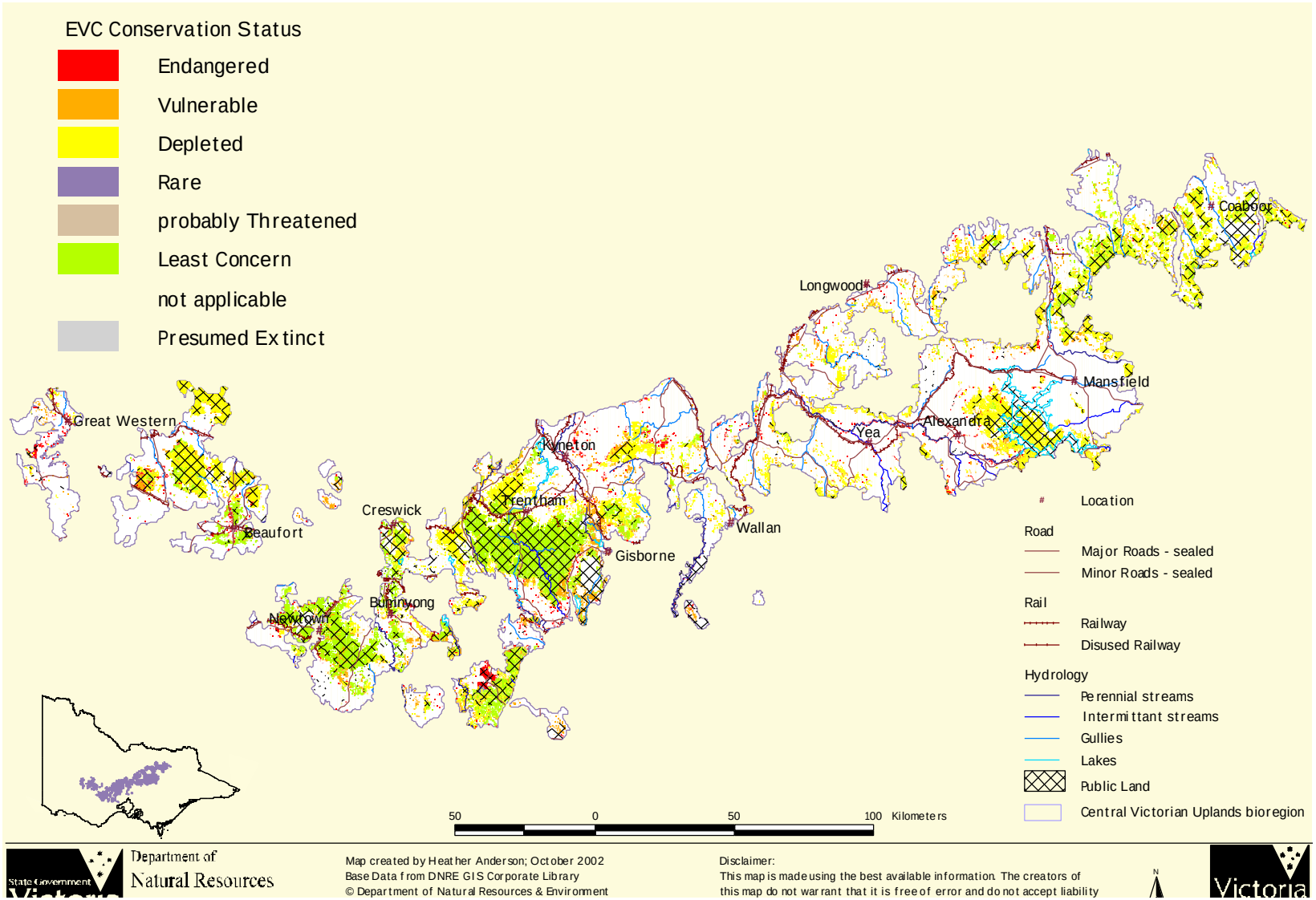


Map 6a: Generalised extant Ecological Vegetation Classes of the Central Victorian Uplands.

Map 6b: Conservation status of the current Ecological Vegetation Classes of the Central Victorian Uplands.

6.1.2 Type

Generalized Ecological Vegetation Classes typical of the bioregion include:

Plains Grassy Woodlands or Forests – freely-draining, poorly-draining, Lunettes or beach ridges or shallow sands;

Heathy Woodlands – dry and/or better drained;

Dry Forests –exposed and/or lower altitude, sheltered and/or higher altitude;

Lower Slopes or Hills Woodlands – seasonally inundated and/or shrubby, grassy, herb-rich.

Examples of vegetation profiles are shown in Figures 4 and 5.

Status	Definition
Endangered (E)	On verge of extinction. 90% or more cleared. Less than 10% of its pre-European (1750) extent remains.
Vulnerable (V)	Moving towards extinction. 70% or more has been cleared. 10-30% of its pre-European (1750) extent remains.
Depleted (D)	Likely to become threatened if clearing or other threatening processes continue. 50-70% has been cleared. 30-50% of its pre-European (1750) extent remains.
Rare(R)	Vegetation that is inherently rare and naturally restricted in range. Total range less than 10000 ha, and/or area less than 1000 ha, and/ or patch size less than 100 ha
Least Concern (LC)	More than 50% of pre-European (1750) extent remaining.

Mansfield (Lower Catchments)

Rivers and Floodplains - Plains - Valleys and Low Hills

LANDFORM	Creeklines, Rivers and Floodplains	Plains	Valleys and Low Hills
EVC	Floodplain Riparian Woodland/Creekline Grassy Woodland	Plains Grassy Woodland	Grassy Woodland/Valley Grassy Forest
GEOLOGY & SOILS	Alluvial sediments - clays and silts	Colluvium and alluvium – clays and loams	Fertile, well drained, reasonable water availability
DESCRIPTION	River Red Gum woodland	Box - Gum grassy woodland	Mixed species shrubby - grassy woodland
LOCATION EXAMPLE	No intact examples known; Drive along Maroondah Highway between Merton and Ancona	Merton roadside opposite BP Petrol Station; Howes Creek Rd – Goughs Rd area, Goughs Bay	Merton Ancona Rd; The Paps Bushland Reserve (north side, lower slopes); Monkey Gully Rd, c 2 km west of Rifle Butts Rd

Figure 4: Examples of vegetation profiles existing in the Central Victorian Uplands: Mansfield, lower catchments[1].

[1]This image can also be viewed at http://www.gbcma.vic.gov.au/revegetation/profiles/mansfield

Alexandra (Lower Catchment)

Creeklines, Rivers and Floodplains - Plains - Valleys

LANDFORM	Creeklines, Rivers and Floodplains	Plains	Valleys and Gentle Slopes
EVC	Floodplain Riparian Woodland/Creekline Grassy Woodland	Plains Grassy Woodland	Valley Grassy Forest
GEOLOGY & SOILS	Alluvium – clays, silts and sands	Colluvium – loams, clays, silts and sands	Fertile, well drained, reasonable water availability
DESCRIPTION	River Red Gum woodland	Red Gum - Box grassy woodland	Mixed species shrubby - grassy woodland
LOCATION EXAMPLE	No intact examples known; Drive along Goulburn River between Molesworth and Alexandra	Lower south east corner of McKenzie Reserve, Alexandra	East side of Maroondah Hwy, 3.1km north of Gobur-Kanumbra Rd; McKenzie Reserve, Alexandra

Figure 5: Examples of vegetation profiles existing in the Central Victorian Uplands: Alexandra, lower catchments[1].

[1] This image can also be viewed at http://www.gbcma.vic.gov.au/revegetation/profiles/alexandra

Table 6: Percentage of native vegetation according to tenure type and conservation status within the Central Victorian Uplands.

Conservation Status - native veg Tenure type	E	V	R	D	LC	Not native Veg/ unknown	Not Mapped	Total area native veg	Total area (ha)
Conservation Reserve (C)	4% (14%)	9% (13%)	0% (89%)	36% (14%)	43% (23%)	8% (1%)	0% (0%)	92	6541405 (5%)
Special Protection Zone (S)	1% (4%)	8% (9%)	0% (0%)	46% (13%)	33% (13%)	11% (1%)	0% (0%)	89	4809132 (4%)
Other Public land (O)	1% (12%)	2% (7%)	0% (0%)	30% (27%)	30% (36%)	36% (6%)	0% (4%)	64	148343 (12%)
Private (P)	1% (69%)	3% (70%)	0% (11%)	8% (46%)	4% (28%)	84% (92%)	0% (96%)	16	952340 (78%)
Unknown (U)	5% (1%)	6% (1%)	0% (0%)	12% (0%)	15% (0%)	62% (0%)	0% (0%)	38	3702 (0.30%)
Total area in bioregion (ha)	**18016 1%**	**42443 3%**	**248 0%**	**168910 14%**	**124231 10%**	**864023 71%**	**21 0%**	**353848 29%**	**1217891**

Note: This data is based on DSE work in progress, it is sourced from evc bior cons status - dp20 april ammendments.xls (DSE Corporate Database, 2002)

% = percent of conservation status and native vegetation area of each tenure of the total area of tenure (across)

(%) = percent of tenure in the bioregion of each conservation status (down)

6.2 Threatened Flora & Fauna

6.2.1 Rare and threatened flora and fauna

One flora species previously occurring in the Central Victorian Uplands and which is now considered extinct in Victoria is the Mountain Swainson-pea (*Swainsona recta)*. There are no fauna species considered extinct in this bioregion. Forty-eight species are considered threatened; including 27 plants, 4 mammals, 5 birds, 2 reptiles, 6 fish and 4 invertebrates identified from the BNA analysis (Lowe *et al*. 2000) (Table 7).

Overall, 163 threatened flora species and 64 threatened fauna species (including nine mammals, 35 birds, four reptiles, one amphibian, eight fish and seven invertebrates) have been recorded throughout the Central Victorian Uplands (DSE Corporate Database). These are listed in Appendix 4 and 5 respectively.

**% of all threatened species in Victoria have been recorded in the bioregion.

Table 7: Number of species of flora and fauna recorded in the Central Victorian Uplands according to conservation status and FFG listing.

Vertebrate conservation status has been updated to reflect DSE (2003)

Flora or fauna	*Division name*	*Extinct*	*Endangered*	*Rare*	*Vulnerable*	*Low risk/near threatened*	*Data deficient*	*Grand Total*	*FFG Listed*
Fauna									
	Birds	0	1	0	4	0	0	5	
	Fish	0	4	0	0	1	1	6	
	Invertebrates	0	2	1	1	0	0	4	
	Mammals	0	0	0	4	0	0	4	
	Reptiles	0	1	0	0	1	0	2	
Fauna total		**0**	**8**	**1**	**9**	**2**	**1**	**21**	**38**
Flora									
	Dicotyledons	1	3	1	14	0	0	19	
	Ferns and Allies	0	0	0	0	0	0	0	
	Monocotyledons	0	3	0	4	0	1	8	
	Mosses	0	0	0	0	0	0	0	
Flora total		**1**	**6**	**1**	**18**	**0**	**1**	**27**	**28**
Total		**1**	**14**	**2**	**27**	**2**	**2**	**48**	**66**

(DSE Corporate Database, 2002)

Table 8 expands the summarised information shown in Table 7 above. It lists only the species classified in the bioregional network analysis (Lowe *et al.* 2000), (which is a subset of all known threatened species in the bioregion, which can be found in Appendix 4 and 5).

Table 8: Faunal and Floral species awarded a BNA ranking in the Central Victorian Uplands.

Vertebrate conservation status has been updated to reflect DSE (2003)

Common Name	***Scientific Name***	**Aust status**	**Vic Status**	**FFG- listed**	**FFG Action statement**	**Recovery Plan (R) or Draft (D)**	**NRE Code**
Fauna							
Birds							
Barking Owl	*Ninox connivens*		e	Nom			246
Powerful Owl	*Ninox strenua*		v	L	92		248
Square-tailed Kite	*Lophoictinia isura*		v	L			230
Grey Goshawk	*Accipiter novaehollandiae*		v				220
Painted Honeyeater	*Grantiella picta*		v	L			598
Fish							
Mountain Galaxias	*Galaxias olidus*		dd				4036
River Blackfish	*Gadopsis marmoratus*		ce				4127
Bluenose (Trout) Cod	*Maccullochella macquariensis*	V	ce	L	38	R	4093
Macquarie Perch	*Macquaria australasica*		e	L			4096
Yarra Pigmy Perch	*Edelia obscura*	V	lr-nt	L			
Murray Cod	*Maccullochella peelii peelii*		e	L			4094

Invertebrates							
Golden Sun Moth	*Synemon plana*		e	L	106		5021
Small Ant Blue	*Acrodipsas myrmecophila*		e	L	71	R	5007
Large Ant Blue	*Acrodipsas brisbanensis*		r	L	70		5006
Damselfly	*Hemiphlebia mirabilis*		v				5002
Mammals							
Common Dunnart	*Sminthopsis murina*		v				1061
Brush-tailed Phascogale	*Phascogale tapoatafa*		v	L	79		1017
Common Bent-wing Bat	*Miniopterus schreibersii*		v	L			1341
Eastern Horseshoe Bat	*Rhinolophus megaphyllus*		v	L			1303
Reptiles							
Striped Legless Lizard	*Delma impar*	V	e	L	17	R	2159
Glossy Grass Skink	*Pseudemoia rawlinsoni*		lr-nt				2683
Flora							
Basalt Pepper-cress	*Lepidium hyssopifolium*	E	e	L			1903
Black Gum	*Eucalyptus aggregata*		e	L	84		1244
Brittle Greenhood	*Pterostylis truncata*		e	L	63		2821
Buxton Gum	*Eucalyptus crenulata*	E	e	L	1		1265
Clover Glycine	*Glycine latrobeana*	V	v	L			1456
Concave Pomaderris	*Pomaderris subplicata*	V	v	L	81		4532
Crimson Spider-orchid	*Caladenia concolor*	V	e	L			4347
Drooping Grevillea	*Grevillea floripendula*	V	v	Nom			1534
Enfield Grevillea	*Grevillea bedggoodiana*	V	v				3743
Euroa Guinea-flower	*Hibbertia humifusa ssp. erigens*	V	v	L			5083
Golden Cowslips	*Diuris behrii*		v				1061
Hairy Anchor Plant	*Discaria pubescens*	R	v	L	47		1072
Kidney Saltbush	*Atriplex stipitata*		v				334
Langi Ghiran Grevillea	*Grevillea montis-cole ssp. brevistyla*	V	v				4534
Large-fruit Fireweed	*Senecio macrocarpus*	V	e	L	68		3116
Mount Cole Grevillea	*Grevillea montis-cole ssp. montis-cole*	R	r				4535
Naked Sun-orchid	*Thelymitra circumsepta*		v				3383
Narrow Goodenia	*Goodenia macbarronii*	V	v	L	72		1513
Plump Swamp Wallaby-grass	*Amphibromus pithogastrus*	K	e	L	109		3624
Red-beard Midge-orchid	*Genoplesium sp. aff. morrisii (Pyrete ranges)*		v				2715

Scented Bush-pea	*Pultenaea graveolens*		v	L	2849
Swamp Everlasting	*Bracteantha sp. aff. subundulata*	V	v	L	3763?
Swamp Fireweed	*Senecio psilocarpus*	V	v		4659
Tall Wallaby-grass	*Austrodanthonia sp. (syn. Danthonia procera)*		k		?
Turkey-bush	*Eremophila deserti*		*		2237
Velvet Daisy-bush	*Olearia pannosa ssp. cardiophylla*	R	v	L	2317
Wavy Swamp Wallaby-grass	*Amphibromus sinuatus*		v		3625
Weak Daisy	*Brachyscome debilis*		v		454

Map 7: Location of the threatened flora and fauna in the Central Victorian Uplands.

6.3 Wetlands

6.3 Wetlands

Due to the upland characteristics of the Central Victorian Upland bioregion there are no wetlands of International importance (declared under the Ramsar Convention). However wetlands associated with the following rivers are listed in the Directory of Nationally Important Wetlands (Environment Australia 2000) as occurring within the Central Victorian Uplands:

- Howqua River, Ref. No. VIC 145.
- Lerderderg River, No. VIC 157

The Howqua and Lerderderg Rivers are also a recognized as Heritage Rivers, see Section 6.4, below.

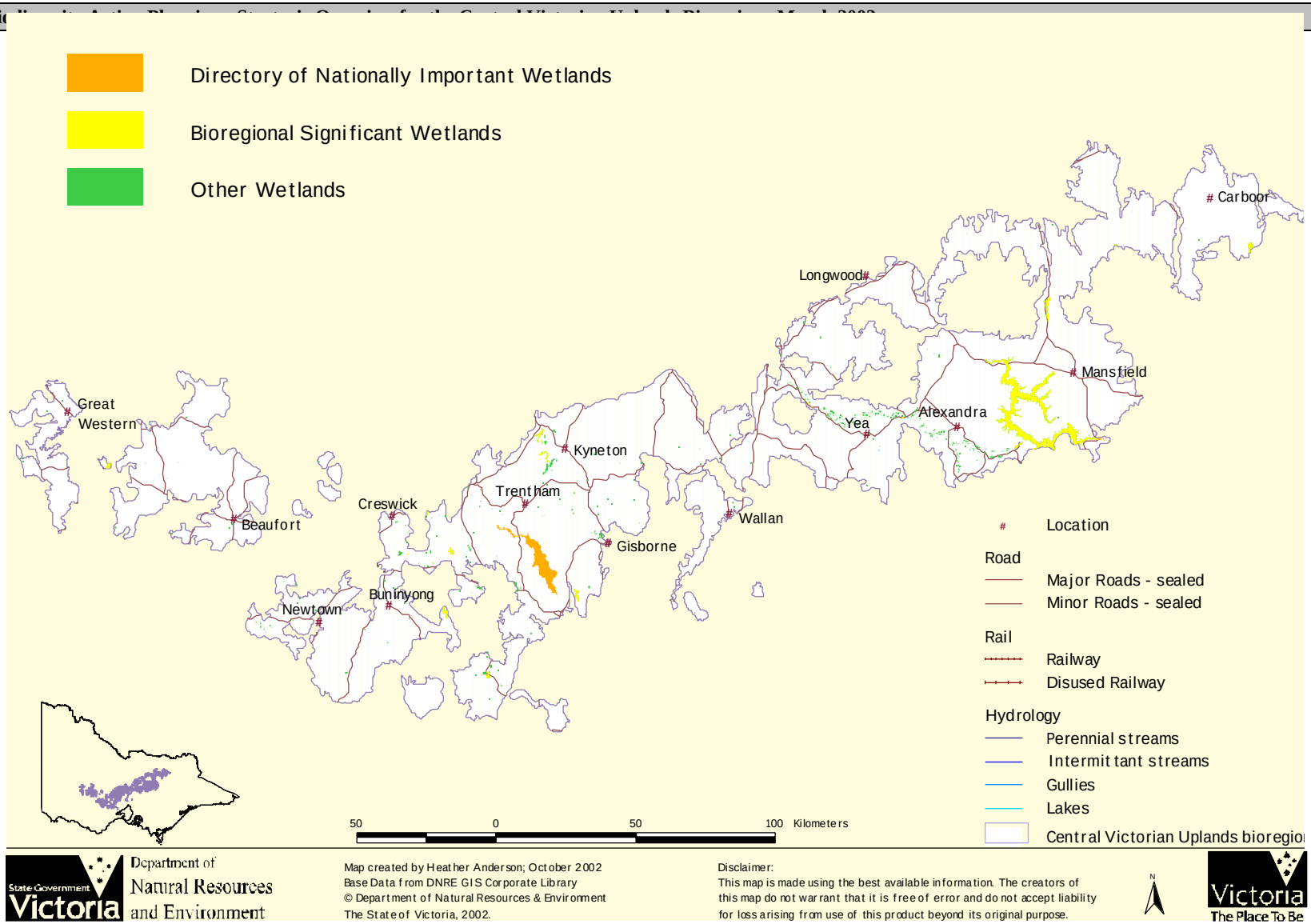
There are 14 other wetlands of bioregional significance within the Central Victorian Uplands: Greenhill Lake, Newlyn Reservoir, Malmsbury Reservoir, Lauriston Reservoir, Moorabool Reservoir, Beale's Reservoir, Merrimu Reservoir, Lal Lal Reservoir, Durdidwarrah Reservoir No.3, Horseshoe lagoon, Lake Eildon, Pondage Lake, Molesworth Wildlife Reserve (South) and Lake Buffalo. See also Map 8.

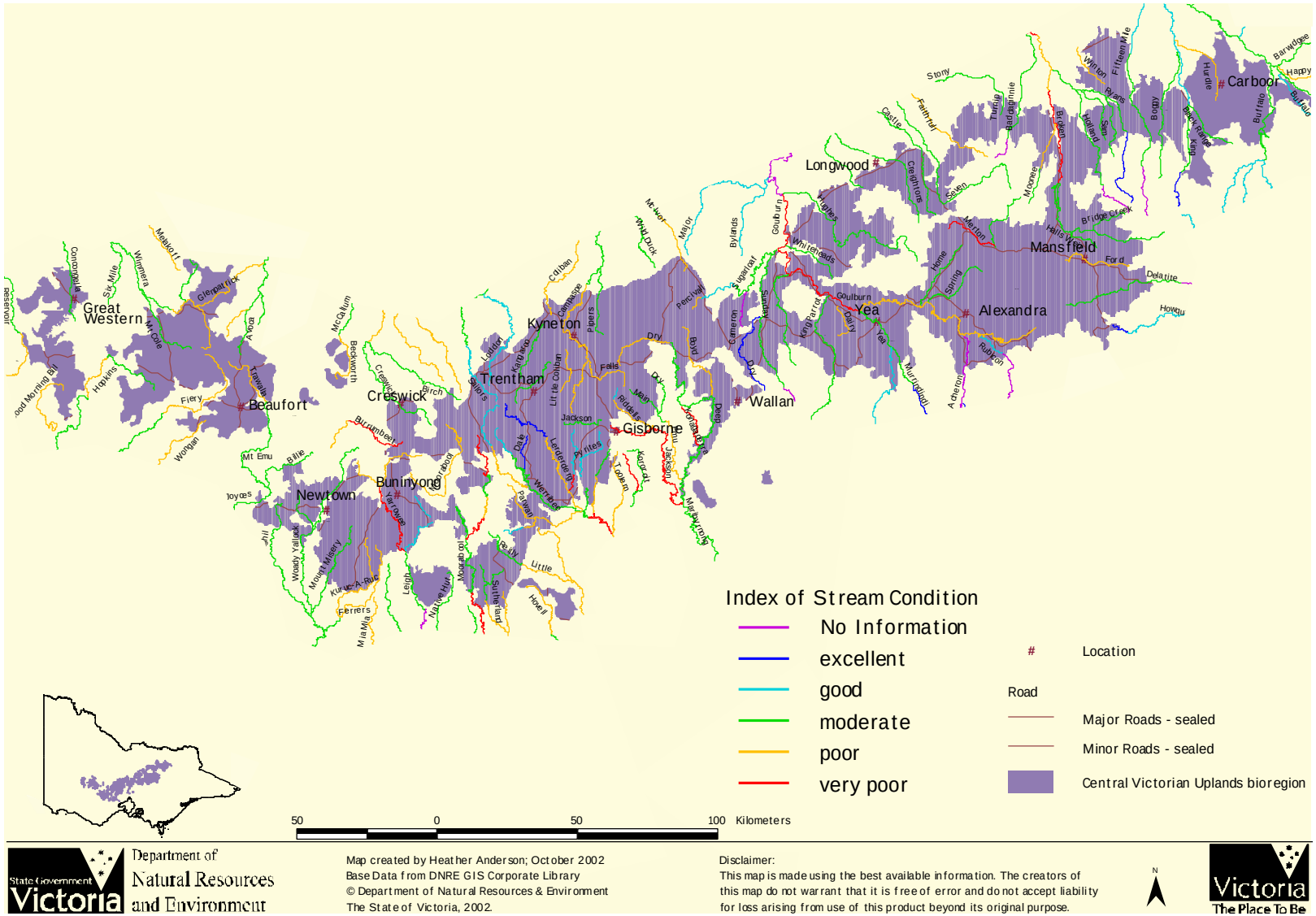
6.4 Rivers

6.4 Rivers

Four Heritage Rivers can be found within the Central Victorian Uplands and include the Goulburn, Big and Howqua Rivers within the Goulburn Broken CMA and the Lerderderg River in the Corangamite CMA. The Broken and Goulburn rivers are considered regionally important, and the major rivers include the Werribee, Maribyrnong, Moorabool, Leigh, Woady Yallock, Corangamite, Werribee, Lerderderg, Loddon, Barwon, Avoca, Broken, Campaspe, Hopkins and Wimmera rivers (See Map 9).

Only small reaches of rivers in the Central Victorian Uplands are in good or excellent condition, principally due to siltation from accelerated erosion, nutrient run-off from agricultural land, grazing and intensive forestry production in the adjoining bioregions. Most banks have been denuded of native vegetation and replaced by introduced pasture grasses and willows. Many banks are unfenced and subject to grazing by domestic stock.


Directory of Nationally Important Wetlands
Bioregional Significant Wetlands
Other Wetlands
Carboor
Longwood
Mansfield
Great Western
Yea
Alexandra
Kyneton
Trentham
Creswick
Wallan
Beaufort
Gisborne
Bunlinyong
Newtown
Location
Road
Major Roads - sealed
Minor Roads - sealed
Rail
Railway
Disused Railway
Hydrology
Perennial streams
Intermittant streams
Gullies
Lakes
Central Victorian Uplands bioregio
50 0 50 100 Kilometers
State Government Victoria
Department of Natural Resources and Environment
Map created by Heather Anderson; October 2002
Base Data from DNRE GIS Corporate Library
© Department of Natural Resources & Environment
The State of Victoria, 2002.
Disclaimer:
This map is made using the best available information. The creators of this map do not warrant that it is free of error and do not accept liability for loss arising from use of this product beyond its original purpose.
N
Victoria
The Place To Be



Map 8: Central Victorian Uplands showing extant wetlands according to type.

Map 9: Central Victorian Uplands showing Index of Stream Condition.

Threats

7.1 Threatening Processes

This section will provide short summaries of the range of threatening processes that affect the natural assets of the Central Victorian Uplands. It will describe the extent of the threat (where this can be estimated) and what types of assets the threats impacts on.

Threatening processes are rarely mutually exclusive and one threatening process (such as grazing) may cause substantial damage to create other threats (for example, salinity and water quality decline). The threatening activities and processes are grouped under the headings:

1. Competing land uses*
2. Salinity and soil deterioration
3. Introduced flora*
4. Introduced fauna
5. Waterway modification and water quality decline*
6. Inappropriate fire management*
7. *Phytopthera cinnamomi* (Cinnamon Fungus)
8. Lack of knowledge – technical and community

** These processes were also identified as major threats in the Central Victorian Uplands in NRE (1997).*

7.1.1 Competing land uses

The Central Victorian Uplands contains a mosaic of varied tenure-ship and land uses including rural and urban living, agricultural production, recreation reserves and conservation reserves. Priorities and practices in different land use areas are often incompatible, particularly with regards to biodiversity conservation. Identifying competing land uses helps to understand and manage threats to biodiversity both in a landscape context, and also at regional and local levels.

Clearing

The majority of pre-1750 native vegetation within the Bioregion has been cleared for agriculture. Large areas of native vegetation (e.g. Herb-rich Foothill Forest and Grassy Dry Forest in the Goulburn Broken CMA) have also been cleared for timber and replaced with softwood plantations. Just 29% of native vegetation remains in the Central Victorian Uplands and only 5% of this is located in conservation reserves (Table 6)(DSE Corporate Database). Remaining native vegetation is often fragmented, confined to linear strips such as roadsides and waterways or small in area and, consequently, is frequently unviable fauna habitat.

Grazing

Approximately 78% of the bioregion is privately owned. Sheep and cattle grazing are the major land uses on freehold land and have caused extensive modification to the natural landscape. Establishment of such a large agricultural industry has led to extensive clearing of grassy woodland EVCs and destruction of native grasslands through pasture improvement and grazing pressure. Riparian zones and stream frontages are more susceptible to grazing pressure and unrestricted gazing practices have caused widespread damage to waterways throughout the Bioregion, particularly within the Goulburn Broken Catchment (Robinson & Mann 1998). (See Waterway Modification below).

While many plants of grasslands and grassy woodlands are adapted to frequent low-intensity grazing by native animals, unnaturally high kangaroo population densities can threaten flora values through over browsing of native vegetation. In some areas (e.g. in the Strathbogie region of the Goulburn Broken CMA and in Corangamite CMA), native species such as Common Wombats and Eastern Grey Kangaroos are also exerting grazing pressure on native flora.

Populations of the introduced European Rabbit cause enormous damage to the landscape throughout Victoria (Williams *et al*. 1995) (See Introduced Fauna Species below).

Subdivisions and rural growth

Corangamite CMA identified increases in settlement and rural living and initiation of hobby farms as an anticipated future threat to biodiversity (Corangamite CMA 2002a). While no major towns within the bioregion are currently experience significant increases in residential subdivisions, rural development

often involves clearing, modification and degradation of native vegetation remnants and extra pressure on natural resources within the region.

Hardwood production

Numerous State Forests throughout the Bioregion are utilized for hardwood production. Firewood is also widely harvested for both private (and commercial) purposes and is a recognized threat, particularly concerning the conservation of remnant roadside vegetation (Strathbogie Shire 2002). Previous extensive timber harvesting has not allowed for the retention of trees of various age classes. This is vital to ensure the continual presence of hollow-bearing trees, an important habitat resource for many threatened fauna. These activities reduce the availability of fauna habitat. Logs, fallen timber and hollow trees are important resources providing nest-, shelter- and foraging-sites for native fauna, particularly hollow-dwelling vertebrate species (Gibbons and Lindenmayer 2002). Significant species which rely heavily upon these resources within the Bioregion include Painted Honeyeater, Swift Parrot, Barking Owl and Brush-tailed Phascogale, as well as Powerful Owl, Grey-crowned Babbler, Squirrel Glider and Lace Monitor (*threatened* at State level only).

Recreation

Forests and woodlands on public land throughout the Bioregion are widely used for both nature conservation and recreation. Some areas, such as Lake Eildon in the Goulburn Broken CMA and the Grampians National Park in the Wimmera and Glenelg-Hopkins CMA have extremely high visitation rates and tourism pressures. Challenges exist to manage public access and recreation in environmentally sensitive areas. Recreation activities such as camping, mountain biking, boating and hiking may lead to erosion, mechanical disturbance of vegetation and disturbance of wildlife. Increased public access associated with recreation on public land may also facilitate illegal removal of native species (e.g. spiders, reptiles, birds, orchids).

Many flora and fauna species, *threatened* at both State and National level, occur in State Parks or on other conservation or utility reserves established to protect or conserve particular land or natural resource features and/or their associated biotic communities. For example, the Mount Piper Education Area near Broadford in the Goulburn Broken CMA contains critical habitat for the Golden Sun Moth, Large Ant Blue and Small Ant Blue Butterfly as well as being a focus for outdoor recreation in the area.

Threatened species which are well-represented in existing conservation reserves in the Bioregion include Buxton Gum, Brittle Greenhood and Langi Ghiran Grevillea (72%, 71% and 100% of their respective records represented in Parks. (See Appendix 1a), The Small Ant Blue Butterfly (80%), Large Ant Blue Butterfly (100%), Golden Sun Moth (95%), Painted Honeyeater (50%) and Common Bent-wing Bat (50%) all have high representation in conservation reserves.

Apiculture (bee keeping)

Central Victorian Uplands contains numerous eucalypt species suitable for apiculture. Drier foothill forests of the North East region supporting Red Stringybark and Red Box are among the most valuable for honey production per unit area in Australia (LCC 1981) and honey produced from box-ironbark forests and woodlands is considered to have relatively high commercial value (ECC 2000). Apiculture is tolerated within various tenures throughout the Bioregion including State Forests, under the control of DSE.

Potential competition for nectar resources between managed hive-bees and native nectar-feeders is an issue (Schwarz and Hurst 1997). Native nectar feeders which may be affected include threatened species such as Regent Honeyeater, Swift Parrot and Squirrel Glider (Paton 1996). Feral bees are also known to swarm and form hives in tree hollows, out-competing other hollow-dependant native species (Trainor 1995, Gibbons and Lindenmayer 2002).

Infrastructure

Conflicts often arise between conservation goals and maintenance and/or upgrading of road and rail reserves (Strathbogie Shire 2002). Remnant vegetation and wildlife habitat are potentially threatened by requirements for road and other infrastructure improvements such as road widening, laying or maintenance of gas or optic cable easements, as well as maintenance procedure such as slashing

and pruning. These linear reserves are frequently the only remaining connections of native vegetation to large remnants and often have high conservation values (Laurie 1993, 1994).

7.1.2 Salinity and soil deterioration

CMAs throughout the Bioregion, particularly Goulburn Broken and Corangamite, suffer extensively from dryland salinity. Of the 21 priority areas recognised in the National Action Plan for Salinity and Water Quality (Commonwealth of Australia 2000), three are represented within the Central Victorian Uplands: Glenelg-Hopkins-Corangamite, Goulburn Broken and Avoca-Loddon-Campaspe. The majority of CMA's represented throughout the Central Victorian Uplands have produced Salinity Management Plans. These documents highlight high risk and priority areas, often using a sub-catchment approach (see Section 8.5.6).

Extensive clearing and agricultural land use throughout the Central Victorian Uplands has led to soil deterioration in many areas. Gully, sheet, bank and tunnel erosion de-stabilize soil causing loss of fertile top soil and sedimentation down-slope as well as into drainage lines, wetlands and rivers. This can in turn impact on water quality, increasing sedimentation and turbidity. Cultivation, cropping and grazing has also caused soil acidification (lowering of soil pH) and soil structure decline (North Central CMA 1997).

7.1.3 Introduced flora species

Weed invasion, together with salinity, are two of the most widespread threatening processes for native biota throughout the Central Victorian Uplands. Weed invasions are often associated with the grazing of domestic stock and are a major threat to flora and fauna throughout Australia (Carr 1993, Carr *et al.* 1992). Weed invasions are a particular threat to linear remnants such as riparian zones, roadside and rail reserves as well as small isolated remnants or conservation reserves. Widespread weeds posing a threat in the Central Victorian Uplands include: Serrated Tussock, Blackberry, Gorse, Ragwort, Sweet Briar and Patterson's Curse (Corangamite CMA 1997, Goulburn Broken CMA 2002a).

7.1.4 Introduced fauna species

The bioregion has a wide range of introduced pest plants and animals (including fish and invertebrate species). Predation upon native wildlife by foxes and cats is also widespread in the bioregion, and both are listed as *potentially threatening processes* under the FFG Act 1988 (See below). Some land managers may still be unaware that fox control on both private and public land is a legal requirement (Mansergh & Marks 1993), as is responsible cat ownership (Seebeck & Clunie 1997). Following the release of Rabbit Calicivirus Disease in 1996, rabbit numbers have greatly reduced in the bioregion. However land managers are still being urged to maintain routine control procedures in order to optimise the benefits of currently low rabbit numbers (NRE 2000d). Carp is another introduced species causing widespread impacts on the waterways and native fish of the Central Victorian Uplands. Goats are also a risk in some areas and the target of active management (e.g. Mount Piper Education Area, Goulburn Broken CMA).

7.1.5 Waterway modification and water quality decline

Waterway modification has been extensive throughout the Central Victorian Uplands and numerous rivers and their associated fauna are under significant threat from changed hydrological cycles, clearing of riparian vegetation, reduced river flows, nutrient input and increased sedimentation. Corangamite CMA also recognised inappropriate floodway control measures, such as levee bank construction, stream realignment or straightening as a threat to the natural dispersal and settlement of nutrient and sediment loads across floodplains as well as increases bed and bank erosion (Corangamite CMA 2002c). In-stream structures can disrupt the movement and dispersal of native fish species while removing natural in-stream debris such as snags can reduce habitat quality for species such as the Murray Cod. Salinity (see 7.1.2) also presents a significant threat to wetlands and waterways where irrigation and land clearing have resulted in raised saline water tables. Serious ecological changes including algal blooms and dieback of riparian vegetation (see 7.1.7) have become a problem in some wetlands and have caused substantial declines in bird and fish populations.

7.1.6 Inappropriate fire management

Many species of native flora and fauna depend on fire to some extent for certain stages in their lifecycle or for specific aspects in their ecology. Fire management throughout the Central Victorian Uplands is primarily limited to cool burns to reduce the fuel load and decrease the risk of intense, destructive wildfires, particularly within State Forests and reserves with high recreation uses. Fire management for ecological purposes is rarely practised in the bioregion - recent exceptions include sections of the Grampians National Park where heathland was burnt to improve habitat for the Heath Mouse (Parks Victoria 2001). Some biotic communities require specific frequencies of burning in order to sustain their characteristic flora and fauna components (NRE 1997) and disruption of natural fire regimes can threaten recruitment of certain species, alter species composition and therefore also impact on habitat components and structure. Examples of *threatened* species adapted to particular fire regimes include Common Dunnart, Plump Swamp Wallaby-grass, Crimson Spider-orchid, Clover Glycine, Hairy Anchor Plant, Golden Cowslips, Mount Cole Grevillia, Drooping Grevillea and Basalt Peppercress. However, unlike previously thought (Jelinek 1991), fire is no longer recognised as an ecological management tool for the Buxton Gum (White 2001).

7.1.7 *Phytopthera cinnamomi* (Cinnamon Fungus)

Cinnamon Fungus, a water-borne root pathogen is a widespread threat to Victoria's flora and is listed as a *potentially threatening process* under the FFG Act 1988. The fungus, which is commonly transmitted between sites in soil or gravel, is highly infectious, attacking a range of native and introduced trees and shrubs. Land managers need to be aware of this disease and its symptoms (primarily root rot and die-back), and be able to take relevant measures to control its spread (Davidson 1996). High risk areas within the Central Victorian Uplands include the Grampians and Brisbane Ranges National Parks and lowland foothill forests.

7.1.8 Lack of knowledge – technical and community

Understanding of biodiversity issues and sometimes even the *concept* of biodiversity varies widely throughout communities. Knowledge of land use impacts on biodiversity and the condition of biodiversity in the Central Victorian Uplands will also differ, reflecting the many different characteristics, lifestyles and priorities of different communities of the regional population. Understanding of the means to protect, enhance and restore native biodiversity also varies widely.

Enhancing community capacity to understand and to be able to act is a vital component of the Central Victorian Uplands biodiversity programs. Communication of, and access to, resources and reports need to be improved to ensure a coordinated approach and maximum implementation of management plans and goals can be achieved throughout all facets of the community, not only private land holders but local government area staff and larger State government departments as well. Collaboration and coordination between various land mangers in both state and local government departments needs to be maintained throughout the Central Victorian Uplands and between neighbouring bioregions.

Technical knowledge of the causal nature of the threats to biodiversity and the solutions to their impacts is a common barrier to nature conservation in general.

7.2 Impacts

7.2 Impacts

The principal impacts of the threatening activities described above are summarised in this section.

Threatening Process	Impacts
Competing Land Uses: Clearing Grazing Rural growth Hardwood production Recreation Apiculture Infrastructure	• Loss, fragmentation and degradation of remnant vegetation. Decreased viability of habitat remnants. • Degradation of riparian zones. • Clearing for agriculture and over grazing resulting in soil compaction, erosion and salinity as well as a decreased water quality (including increased nutrient levels (eutrophication), increased turbidity and decreased oxygen levels). • Loss of critical habitat attributes such as tree hollows and hollow-bearing trees. • Mechanical damage to vegetation and potential disturbance of threatened fauna by high human visitation in parks and reserves. • Competition between honey bees and native fauna for nectar resources and tree hollows.
Salinity and Soil Deterioration	• Loss of habitat and productive farm land. • Loss of topsoil and soil nutrients. • Soil erosion including gully, sheet and tunnel. • Decrease in water quality.
Introduced flora species	• Loss and degradation of native vegetation. • Decreased habitat quality and viability. • Loss of native flora diversity. • Decrease in agricultural production.
Introduced fauna species	• Rabbits cause direct grazing competition for native species, loss/reduction of native flora (including destruction of seedlings and revegetation) as well as contributing to soil erosion and decreasing vegetation quality, particularly around wetlands and in riparian zones. • Introduced predators such as the Red Fox, cat and dog (both feral and domestic) prey on native fauna. • Introduced fish compete for resources with native species as well as decreasing habitat quality (e.g. Carp increase turbidity levels) and preying on juveniles and adults of some native fish species.
Waterway modification	• Disruption of downstream flows to smaller tributaries and wetlands

Threatening Process	Impacts
	• Barriers to native fish movements. • Removal of in-stream debris decreases available habitat for native fish, including foraging, refuge and spawning sites. • Channel and bank erosion. • Deterioration of water quality including increased turbidity.
Inappropriate fire management	• Changes in intensity and frequency of fires can be harmful to fire sensitive or fire-dependant flora and fauna species. • Fire-dependent regeneration disrupted in some species. • Changes in habitat composition and structure.
Pytophera infections	• Loss of native vegetation and habitat and associated faunal assemblages.
Lack of knowledge	• Inadequate or ill-informed management decisions. • Confusion of priorities or issues and related causes and effects. • Duplication of management actions or incompatible management decisions. • Inefficient use of available resources and support regarding biodiversity conservation management.

7.3 Bioregional Network Analysis of threatening processes

7.3.1 Threats to priority flora and fauna

The Central Victorian Uplands Bioregional Network Analysis identified 12 main threatening processes affecting priority threatened flora and fauna and requiring management actions Those priority fauna identified in the Bioregion by the BNA are shown in Appendix 1b. The threatening processes are listed below:

- Grazing (Agricultural)
- Habitat loss, fragmentation and degradation
- Introduced flora species (weeds)
- Introduced fauna species (predators)
- Altered fire regimes
- Altered environmental flows
- Unsustainable kangaroo and rabbit populations
- Human disturbance
- Water contamination
- In-stream barriers
- Lack of education and knowledge.

The most important threats include agricultural impacts, loss of habitat, spread of environmental weeds as well as impacts from predation and fire. The impacts from these threatening processes resulted in 18% of priority threatened species within the Central Victorian Uplands requiring stock control as a management priority, 16% requiring habitat supplementation, 15% requiring the control of environmental weeds and 13% requiring predator and fire control (Figure 6).

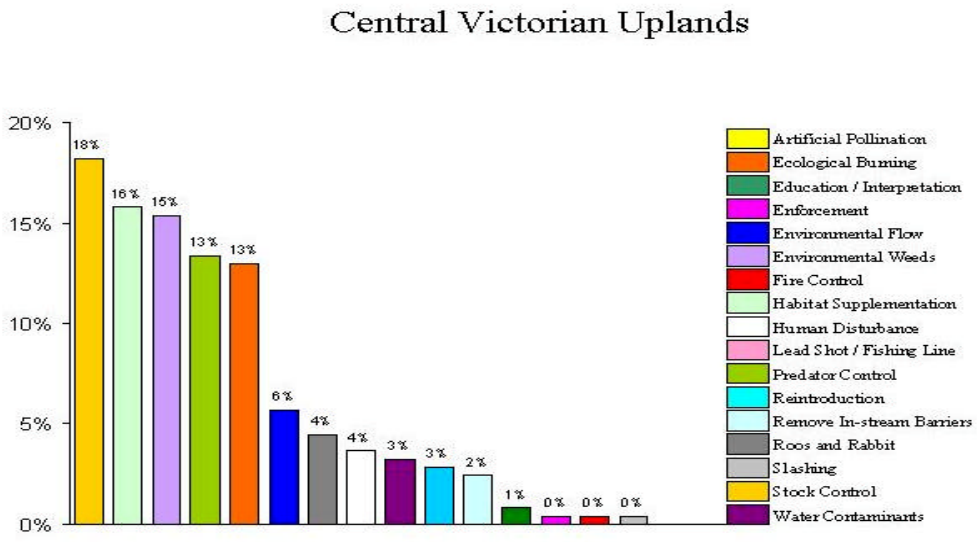


Figure 6: Percentage of threatened species requiring action as a result of each of the listed threatening processes.

7.3.2 Management actions by land tenure

The BNA recognises that different management techniques and objectives are required for each individual land tenure to best suit the processes and threats affecting the significant species in that area. Table 9 summaries the recommended BNA management actions for each land tenure category.

Table 9:The pre-eminent BNA management responses and corresponding targeted threatened species relevant for identified tenures for the Central Victorian Uplands.

Land Tenure	BNA Management Response	Threatened Species[1] Targeted
FAUNA		
Private land	Habitat supplementation	Square-tailed Kite, Painted Honeyeater, Common Dunnart, Common Bent-wing Bat, Brush-tailed Phascogale, Barking Owl
	Predator Control	Square-tailed Kite, Painted Honeyeater, Common Dunnart, Brush-tailed Phascogale, Barking Owl.
State Forest	Habitat supplementation	Bluenose (Trout) Cod, Murray Cod, River Blackfish, Painted Honeyeater, Common Dunnart, Common Bent-wing Bat,
	Predator Control	River Blackfish, Mountain Galaxias, Brush-tailed Phascogale, Barking Owl, Common Dunnart.
Parks and Reserves	Habitat supplementation	Square-tailed Kite, Golden Sun Moth, River Blackfish, Powerful Owl, Painted Honeyeater, Common Dunnart, Common Bent-wing Bat, Small Ant Blue Butterfly
	Predator Control	River Blackfish, Mountain Galaxias, Brush-tailed Phascogale, Barking Owl, Common Dunnart, Common Bent-wing Bat, Square-tailed Kite.
Other State Government	Enhanced waterway flows	Murray Cod, Mountain Galaxias, Macquarie Perch, Damsel Fly, Bluenose (Trout) Cod.
Local Government	Habitat supplementation	Brush-tailed Phascogale, Golden Sun Moth,

Land Tenure	BNA Management Response	Threatened Species[1] Targeted
	Predator control	Striped Legless Lizard. Brush-tailed Phascogale, Striped Legless Lizard.
FLORA		
Private land Private land (continued)	Grazing exclusion Grazing exclusion (continued)	Narrow Goodenia, Euroa Guinea-flower, Concave Pomaderris, Hairy Anchor Plant, Clover Glycine, Wavy Swamp Wallaby-grass, Swamp Everlasting.
	Weed control	Narrow Goodenia, Euroa Guinea-flower, Concave Pomaderris, Hairy Anchor Plant, Clover Glycine, Wavy Swamp Wallaby-grass, Black Gum, Basalt Pepper-cress, Large-fruit Fireweed.
State Forest	Ecological burn	Crimson Spider-orchid, Enfield Grevillea, Drooping grevillea, Mount Cole Grevillea, Basalt Pepper-cress
Parks and Reserves	Ecological burn	Crimson Spider-orchid, Hairy Anchor Plant, Clover Glycine, Drooping grevillea, Mount Cole Grevillea, Langi Ghiran Grevillea, Basalt Pepper-cress.
	Weed control	Crimson Spider-orchid, Hairy Anchor Plant, Clover Glycine, Basalt Pepper-cress, Brittle Greenhood
	Control of introduced herbivores and kangaroos	Crimson Spider-orchid, Clover Glycine, Drooping Grevillea, Brittle Greenhood, Naked Sun-orchid.
Other State Government	Ecological burn	Plump Swamp Wallaby-grass, basalt Pepper-cress.
Local Government	Weed Control	Narrow Goodenia, Crimson Spider-orchid, Euroa Guinea-flower, Wavy Swamp Wallaby-grass, Basalt Pepper-cress, Brittle Greenhood, Large-fruit Fireweed,

Land Tenure	BNA Management Response	Threatened Species[1] Targeted
		Swamp Fireweed, Golden Cowslips, Black Gum, Velvet Daisy-bush.
Public Transport Corporation	Weed Control	Black Gum, Clover Glycine, Concave Pomaderris.

[1] Scientific names of species are listed in Appendix 4 and 5.

7.4 FFG Listed Threatening processes

Of the potentially threatening processes listed on Schedule 3 of the FFG Act 1988, the following are those currently posing significant threats to biodiversity values in the Central Victorian Uplands. Those for which Action Statements exist are indicated, with the statement number in brackets if relevant:

- Alteration to natural flow regimes of rivers and streams;
- Alteration to the natural temperature regimes of rivers and streams;
- Collection of native orchids;
- Degradation of native riparian vegetation along Victorian rivers and streams;
- Habitat fragmentation as a threatening process for fauna in Victoria;
- High frequency fire resulting in disruption if life cycle processes in plants and animals and loss of vegetation structure and composition;
- Increase in sediment input into Victorian rivers and streams due to human activities;
- Input of toxic substances into Victorian rivers and streams;
- Introduction of live fish into waters outside their natural range within a Victorian river catchment after 1770;
- Loss of hollow-bearing trees in Victorian native forests;
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases;
- Predation of native wildlife by the Cat *Felis catus* (80);
- Predation of native wildlife by the introduced Red Fox *Vulpes vulpes* (44);
- Prevention of passage of aquatic biota as a result of the presence of instream structures;
- Removal of wood debris from Victorian streams;
- Soil erosion and vegetation damage and disturbance in the Alpine regions of Victoria caused by cattle grazing;
- Spread of *Pittosporum undulatum* in areas outside its natural range;
- The Invasion of native vegetation by environmental weeds;
- The introduction and spread of the Large Earth Bumblebee *Bombus terrestris* into Victorian terrestrial environments;
- Threats to native flora and fauna arising from the use by the feral Honeybee *Apis mellifera* of nesting hollows and floral resources;
- Use of lead shot in cartridges for the hunting of waterfowl (32); and
- Use of *Phytophthera*- infected gravel in construction of roads, bridges and reservoirs.

Management responses

8. Management Responses

8.1 Rationale

Previous sections have described the state of the natural assets of the Central Victorian Uplands, the tools that are available to provide information about these assets and assist with planning, priority setting and decision making.

This section covers what actions are in place to conserve biodiversity assets within the Central Victorian Uplands. The actions are organized according to three mechanisms. These include:

1. *protection* mechanisms - conservation reserves, forest planning, local government planning (e.g. environmental overlays), State and Federal environmental legislation, environmental and waterway grants, Trust for Nature covenants and Land for Wildlife registrations;
2. *enhancement* mechanisms - Flora & Fauna Guarantee Action Statements, Threatened Species Recovery Plans, public land management planning, Regional Catchment Strategies, research on market instruments and agricultural systems; and the
3. *restoration* mechanisms - native vegetation planning, regional action plans, farm plans, community education and community environmental activities including Landcare, Greening Australia and Australian Trust for Conservation Volunteers projects.

The actions are organized according these mechanisms of protection, enhancement and restoration of biodiversity assets as well as the institutional arrangements in place for facilitation. They also clarify understanding of accountabilities of managers and institutions involved.

The institutional arrangements that deliver these mechanisms include:

- State and Federal Governments managing public land - Parks and Reserves, State Forest, Crown Land.
- Local Government
- Private landholders and other private land managers
- Catchment Management Authorities.

8.2 Public Land

Biodiversity assets occurring on *public land* may be protected by a variety of mechanisms. Formal (statutory) mechanisms exist to conserve assets in Parks and Reserves. Assets in State Forest may be included in Special Protection or Management Zones, while those on unreserved Crown Land may be the subject of conditions on leases or licences for use of the land.

8.2.1 Conservation Reserve coverage

Parks and reserves managed by Parks Victoria cover x% of the Central Victorian Uplands (x ha). All percentages referred to below are by the total area of Victoria.

x% of Victoria's Reference Areas and x% of the State's Special Areas occur in the Central Victorian Uplands. No Victorian Ramsar sites occur within the Central Victorian Uplands. x% of Reference Areas and x% of Special Areas are located in reserves.

x sites are listed on the Register of the National Estate occur in the Central Victorian Uplands). These include the reservoir at Langi Ghiran State Park, 80km west of Ballarat *(CVU or VVP??)* as well as the nomination of the dam wall at Polly McQuinns Reserve in Strathbogie *(CVU or HNF??),* where Bluenose (Trout) Cod has been recorded (Australian Heritage Commission, Registry of National Estate database).

Special Areas
Special water supply catchment areas requiring specialized management under the Catchment and Land Protection Act (Vic)

There is minor overlap between the Central Victorian Uplands and the 'box-ironbark ecosystem' delineated and described in the Box-ironbark Special Investigation Resources and Issues report on public land use compiled by the ECC (1997) (See also Map x *Current EVC groups*).

The box-ironbark ecosystem is also referred to in earlier descriptive and strategic reports (including Muir *et al.* 1995, CNR 1995 and Davidson 1996), as well as in other research reports and reference material compiled by Bennett *et al.* (1999). Most recently, it has been the subject of a Box-ironbark Forests and Woodlands Investigation Final Report prepared by the ECC (2001).

Some increases in the number and area of parks and reserves in the Central Victorian Uplands recommended by the ECC (2001) have been accepted and the *National Parks (Box-Ironbark and Other Parks) Bill* was recently passed by both the Lower and Upper House. One hundred and five thousand hectares of additional land have now been reserved under the National Parks Act and Crown Land Reserves Act (although this does not all occur within the Central Victorian Uplands) This includes 5 new or expanded National Parks and 5 new or expanded State Parks, plus an expanded network of regional parks and conservation reserves throughout Victoria. The new bill is available from the Victorian legislation and Parliamentary Documents website at: http://www.dms.dpc.vuic.gov.au/pdocs/

Ramsar sites
Wetlands of international significance, declared under the international Ramsar Convention (named after the venue where it was held), and protected under the federal Environmental Protection and Biodiversity Conservation Act. Biodiversity Action Plan for the Gippsland Plains Bioregion — Strategic overview

Reference Areas
Reference areas are tracts of public land containing viable samples of one or more land types that are relatively undisturbed and are reserved in perpetuity. Reference Areas are protected by the Reference Areas Act *1978. (LCC 1986).*

Table 10: Number, area (ha) and % of bioregion of parks and reserves within the Central Victorian Uplands.

Type of park/reserve	Number	Area (ha)	% of bioregion
Parks			
National, State, other			
Regional Parks			
Metropolitan Parks			
Reserves			
Nature Conservation Reserves			
Natural Features Reserves			
Coastal & Fisheries Reserves			
Community Use Areas			
Historic & Cultural Features Reserves			
Total	294	59589	3.54

8.2.1 Conservation Reserve coverage (cont'd)

The concept of a Comprehensive, Adequate and Representative (CAR) reserve system is a fundamental to land-use planning for conservation within Australia (Commonwealth of Australia 1992). *Comprehensive* refers to the inclusion within protected areas of samples of each of the ecosystems discernible at the bioregional scale. *Adequate* refers to how much of each ecosystem should be included within a protected area network in order to provide ecological viability and integrity of populations, species and communities. *Representative* is comprehensiveness considered at a finer scale, and infers that the variability within ecosystems is sampled within the reserve system. These three major requirements are articulated in the Scientific Guidelines for establishing the National Reserve System which include the nationally agreed biodiversity criteria for the CAR system developed for the *National Forest Policy* (JANIS 1996). CAR principles are generally applied to vegetation types, but the concepts can also be applied to threatened species and to wetland types.

- *Vegetation types*: Ecological vegetation classes (EVCs) are an appropriate unit for the CAR assessment. x% of the EVCs which have a mapped current occurrence in the Central Victorian Uplands are reserved. Using Woinarski *et al.*'s (2000) algorithm for measuring progress towards adequacy, x% of the EVCs meet or exceed JANIS Criteria for reservation. These figures are based on reservation status as at January 2002. *Representativeness* has not been calculated for the Central Victorian Uplands.
- *Threatened species*: The Central Victorian Uplands has records of x% of all threatened species for the State, covering x% of threatened flora species and x% of threatened fauna species. Of these, x% of threatened species occur in areas managed as formal parks and reserves (x% of all threatened flora species, x% of all threatened fauna species) (ref??). There are no agreed criteria for adequacy and representativeness for species.
- *River and wetland types*: The Central Victorian Uplands contains three Heritage Rivers, protected under the *Heritage Rivers* Act 1992: the Howqua, Goulburn and Wimmera Rivers.

8.2.2 Reserve management

Parks and Reserves are managed according to Park Management Plans. There are approved management plans for Lake Eildon State Park, Brisbane Ranges National Park, Steiglitz Historical Park, Kara Kara State Park, Black Range, Lerderderg and Werribee Gorge State Park. The plans were produced by Parks Victoria or collaboration between Parks Victoria and NRE. Most can be viewed at the Parks Victoria website http://www.parks.vic.gov.au/ .

8.3 Other Public land management

8.3.1 State Forest Management

State forests managed by Forestry Victoria cover x% of the Central Victorian Uplands.

Victorian State Forests are managed according to Forest Management Prescriptions, which apply the state-wide Code of Forest Practices, strategic Forest Management Plans (FMPs) or under Regional Forests Agreements (RFAs).

The prescriptions for the North-east, Central Highlands and Western Forest Management Areas which overlap with the Central Victorian Uplands, includes retention of the following tree types:

All glider feed trees.

All trees on the NRE Register of Significant Trees for the Bendigo FMA.

All trees with diameter at breast height (over bark) larger than or equal to 80 cm.

Between six and fourteen living habitat trees per hectare (at least two greater than or equal to 60 cm diameter, plus at least two medium habitat trees (less than 60 cm. but greater than or equal to 40 cm.), and also at least two small habitat trees (less than 40 cm. but greater than or equal to 20 cm. if possible).

Management prescriptions exist for the following flora and fauna:

- Cool temperate rainforest
- Old-growth forest
- Retention of hollow-bearing trees
- Powerful, Barking, Sooty and Masked Owls
- Spotted Tree Frog
- Spot-tailed Quoll
- Squirrel Glider
- Brush-tailed Phascogale
- Common Bent-wing Bat
- Mountain Galaxias

Table 11 Relevant Forest Management Plans in the Central Victorian Uplands.

Forest Management Plan	*Relevant FMAs	Relevant CMA/CALP
Mid Murray	Mid Murray	
Central Highlands	Central, Dandenong	Goulburn Broken
Midlands	Midlands	Corangamite
North East	North East, Benalla-Mansfield	North East, Goulburn Broken

* Only those FMA's that are pertinent to the CVU are listed in this document.

8.3.2 Unreserved Crown Land

Unreserved Crown Land in the Central Victorian Uplands is the subject of X conditions on Y leases and Z licences for use of the land to protect biodiversity.

8.4 Local government management

Part of 20 local government areas (LGAs) overlap with the Central Victorian Uplands. Many avenues exist to identify, conserve and manage biodiversity assets within at the Local Government level. Key management tools are summarized below and the majority can be viewed on the respective local government areas' web sites, listed in Appendix 9.

Municipal Strategic Statements

LGAs that have Municipal Strategic Statements mentioning threatened native species and remnant native vegetation and have provided biodiversity objectives, strategies and implementation plans include Hepburn, Ballarat, Mount Alexander, Alpine, North Grampians, Pyrenees, and Corangamite.

Mitchell Shire is developing an Environmental Strategy (Mitchell Shire 2002) and Murrindindi Shire have produced a paper on flora and fauna biodiversity issues (Murrindindi Shire 2002) to aid the 2002 review of its planning scheme. Ballarat City has produced a Regional Conservation Strategy (Ballarat City 1999) and has formed an advisory committee to implement the strategy.

Planning Overlays and Environmental Rural Zones

Most councils, including Ararat, Hepburn, Ballarat, Mount Alexander, Northern Grampians, Pyrenees, Strathbogies and Corangamite, have adopted Environmental Significance Overlays (ESOs), that cover watercourses, proclaimed catchments, floodplains, wetlands, native vegetation and rural buffers.

Many LGAs throughout the Central Victorian Uplands have also adopted Vegetation Protection Overlays or have designated Environmental Rural Zones (ERZ) for protection of a variety of biodiversity assets. Some examples include:

- roadside/corridor by Hepburn;
- remnant vegetation by Hepburn and Pyrenees;
- 'VPO 1&2' by Mitchell;
- aesthetic values of native vegetation by Northern Grampians.

Details of specific ESOs can be accessed via the individual municipalities (Appendix 9).

Roadside Management Plans

Roadside Management Plans and strategies have been developed in the local government areas of Ararat, Hepburn, Alpine, Pyrenees, Ballarat City and Strathbogies (Pyrenees City 1999, Ballarat City 2000, Ararat Rural City 2000, Strathbogie Shire 2002). Roadside assessments have been carried out in Mitchell Shire (Laurie 1994). Other LGAs, such as Pyrenees, are in the process of producing a draft Roadside Conservation Strategy (Pyrenees Shire 1999) or are undertaking revegetation of their roadsides (e.g. Northern Grampians Shire).

Rebates/Incentives

Systems offering rate rebates based on biodiversity values on rated properties in the Central Victorian Uplands are operational in certain shires throughout the bioregion. Corangamite Shire, for example, offer rate rebates to landholders who have a conservation covenant on their land, while Mitchell Shire provides rebates for landholders utilizing renewable energy sources (e.g. solar power).

Environmental Officers

Not all LGAs have an environment officer dedicated to biodiversity issues. Often, biological issues are absorbed by planning and/or environmental health officers. Hepburn, Ararat, Ballarat, Corangamite, Mount Alexander, Strathbogie and Mitchell are examples of LGAs in the Central Victorian Uplands that

have dedicated environment officers. As well as an environmental officer, Mitchell and Ballarat also have an Environmental Group/ Advisory Committee made up of various stakeholders including members for council, CMAs and the local community. Community plantings and weed days and the development of bicycle paths around some of the major townships through adjoining vegetation have helped to promote management issues to urban residents.

8.5 Private land management

8.5 Private land management

With almost 80% of the Central Victorian Uplands being Private land tenure, freehold areas are an important focus of biodiversity management and identification of remaining assets. Land For Wildlife properties (839 properties) and Landcare, (see Section 8.5.4 below) are active and widespread throughout the Central Victorian Uplands. The experience of program extension officers in the Central Victorian Uplands is that landholders are generally receptive to conservation messages and willing to consider a role in programs targeting better biodiversity management. However, time, money and lack of knowledge are the primary obstacles in many cases. The following section summarizes the options for supporting private landholders in conservation works.

8.5.1 Awareness raising and community education

Flagship species such as the *Brush-tailed Phascogale and Swift Parrot* have been used successfully in the Central Victorian Uplands to increase understanding in the community about key threatening processes. DSE and CMA staff (e.g. Bushcare Officers, Land for Wildlife Extension Officers and Catchment Management Officers) provide frequent opportunities for the community to participate in field days, guided walks, tree-planting and other events focusing on the ecology and habitat requirements of these species which also serves to enhance community understanding about nature conservation and wider biodiversity issues. Excellent education material is available on websites (Appendix 9) and from DSE and CMAs.

Delivery of environmental education is identified as an important measure in community action and capacity building. Apart from mass media channels, which cater for background awareness of biodiversity issues, development is needed of methods which intensify learning and commitment, and better 'engage' the community. It is suggested that existing community networks such as "Friends of" groups, natural history groups (e.g. Field Naturalists Clubs and bird watching organizations) and service groups can provide a basis for this development (Glenelg Hopkins CMA 2000). Other suggested actions include focusing on areas within control of private land managers, making information readily available including via the internet, circulating information about possible community group projects, and building on currently funded extension programs focusing on community groups (such as Landcare and Bushcare, the latter funded by the Natural Heritage Trust see below) (Goulburn Broken CMA 2000b).

8.5.2 Voluntary agreements

Voluntary commitment to a property management plan under DSE's *Land for Wildlife* program and property covenanting under *Trust for Natur*e agreements are important means for protection of biodiversity assets on private land. This process helps identify biodiversity assets on private land and facilitates the opportunity for monitoring and protection as well as providing opportunities in information exchange via professional land managers' and extension officers' skills and expertise.

A **Trust for Nature** covenant on the property title offers long-term legal protection regardless of changes in land ownership. Covenanted sites are periodically inspected by the Trust for Nature, who can enforce the provisions of the covenant. The covenant requires Ministerial approval to revoke. Trust for Nature covenants in the Central Victorian Uplands apply to seven property titles covering 279 hectares with one 16 ha covenant still being negotiated (N. Woodward, Trust for Nature pers. comm.). More details can be found at the Trust for Nature web site at www.tfn.org.au

Membership of **Land for Wildlife** is a voluntary agreement with the current owner and places no obligation on the landholder, who may cease membership at any time. There are 839 Land for

Wildlife properties throughout the Central Victorian Uplands, totalling 45,013ha. Of this total area, 33% is retained (11,290ha) and restored habitat (3,650ha). (Table 12).

- Land owners, or groups of land owners, and local Council may covenant properties by entering into legally binding **Section 173 Agreements** under the Planning & Environment Act 1987. These require agreement between the parties to revoke.

Table 12: Details of Land For Wildlife Properties in Local Government Areas occurring within the Central Victorian Uplands.[1]

LGA	No. Properties[2]	Property Area (ha)	Area retained for wildlife habitat (ha)	Area restored (ha)
Alpine Shire	13	298	166	21
Ararat Rural City	51	18487	4149	323
Ballarat City	51	1118	688	115
Corangamite Shire	77	12933	2879	297
Delatite[3] Shire	156	19072	2988	925
Golden Plains Shire	229	25662	4703	1300
Greater Geelong City	149	7262	2115	520
Hepburn Shire	153	2656	1718	141
Hume City	17	199	68	85
Macedon Ranges Shire	173	5128	1898	430
Melton Shire	9	320	112	10
Mitchell Shire	102	4664	1911	636
Moorabool Shire	129	6436	2141	1111
Mount Alexander Shire	131	4147	1361	306
Murrindindi Shire	143	12039	3090	848
Nillumbik Shire	232	3147	2310	295
North Grampians Shire	70	14336	2147	436
Pyrenees Shire	101	22273	7726	428
Strathbogie Shire	122	17341	2281	1045
Wangaratta Rural City	68	5535	1340	204

1 Data supplied by Felicity Nicholls, State Coordinator, Land For Wildlife, NRE Bendigo.

2 Not all Land For Wildlife properties occur within the Central Victorian Uplands. These figures are for LGA boundaries only.

3 In October 2002, Delatite Shire divided to form Benalla Rural City and Mansfield Shire.

8.5.3 Incentives and market mechanisms

Funding programs coordinated through the various CMAs and DSE could be further directed towards priorities identified in this overview. New mechanisms outlined, such as conservation contracts (implemented via auction), application of environmental management systems for agriculture and rate incentive systems, could also be used. In each case, the priority actions and values likely to benefit need to be identified.

Funding programs coordinated through the CMA and DSE include:

BushTender pilot - A trial of the BushTender program developed by DSE was conducted during 2001/02 in two areas of the State - in the North-east between Wangaratta and Wodonga (primarily the Victorian Riverina and Northern Inland Slopes bioregions) and the North-central between Bendigo and Ballarat (primarily the Goldfields, but also the Central Victorian Uplands and Victorian Volcanic Plain bioregions). The BushTender pilot involves private landholders bidding for grants for the direct management and conservation of remnant vegetation on their properties. Bids are assessed on the basis of the current conservation value of the site, the amount of habitat service offered by the landholder and the cost of the landholder bid. Responses and interest in the 2001/02 trial was encouraging with 98 landholders tendering 148 bids on 186 sites. Of these, 73 landholders and 97 bids were successful and nearly 3,200 ha of significant native vegetation have been secured for protection and improved management under three-year BushTender Management Agreements. The majority of successful sites were of very high or high conservation significance and DSE field officers also recorded 24 new populations of rare or threatened plant species on offered sites. The BushTender program has the potential to be an important mechanism to achieve conservation outcomes on private land. The trials were extended into Gippsland in 2002, with other areas throughout the State potentially to be included. More information can be found at DSE's website at www.nre.vic.gov.au

Environmental Management Systems Project – Victorian Environmental Management System (EMS) projects are an initiative of NRE (1997). EMS projects are a methodical approach to continuous improvement in planning, implementation and review of an organization's (or private landholder's) efforts to manage its impacts on the environment. EMSs can provide a framework for a voluntary but systematic set of procedures for improving environmental performance based on the generic models of the international certification system of ISO 14000 suite of standards (ISO 1999). Projects involve biodiversity assessments as part of the process of developing, implementing and evaluating the biodiversity module of an EMS, following Anderson *et al.* (2001). DSE have projects in various agricultural industries including grain, cotton, viticulture and meat throughout Victoria. DSE are also currently working with Landcare groups and farmers in Victoria's south west in a National Heritage Trust funded project to develop practical methodology for incorporating biodiversity conservation into farm grazing practices through EMS for agriculture. The project aims to assess current practices across 10 issues of farm management (e.g. vegetation management) and documents improvements into a worksheet which can then be incorporated into an EMS. The assessments are to identify existing flora, fauna, habitat, conservation significance and processes threatening flora and fauna. Assessments are also needed to develop options for achieving desirable use and management of land and natural resources, and that will lead toward a net gain of biodiversity. The trial is attempting to develop a practical method for landowners to use EMS as a way to prove their claims of ecological sustainability to purchasers by being eligible for ISO 14000 standards. This may offer market advantage to such landowners through either secure market access or, less likely, premium prices. If this is achieved EMS may be another way to promote conservation.

Environmental Management Grants – Environmental Management Grants (EMGs) provide a level of financial incentive to private landholders according to a set of criteria where up to 75% of fencing and revegetation costs associated with protecting, enhancing and establishing native vegetation are subsidised. The EMGs reflect opportunities to gain on-ground environmental outcomes, particularly for salinity abatement and biodiversity conservation. EMGs are delivered through the DPI Catchment Management Officers. So far in the Goulburn Broken Catchment, EMGs have ensured a strong uptake by landholders to undertake environmental works which is indicative by the recent anecdotal surge of grants coinciding with the inception of the EMGS in the Goulburn Broken in May 2000 (Stothers, 2002).

8.5.4 Landcare groups

The first Landcare group started in Victoria in 1986. Now, Landcare groups are widespread and active across Victoria, including the Central Victorian Uplands. There are many Landcare groups operating within the Central Victorian Uplands. Each of the seven CMAs within the Central Victorian Uplands has a Landcare coordinator. Activities of Landcare groups within the Central Victorian Uplands include developing and coordinating projects to manage erosion, salinity, waterways, water quality, pest flora and fauna species and native vegetation.

Table 13 CMA Landcare Groups occurring throughout the Central Victorian Uplands.

Catchment Management Authority	No. of Landcare Groups
North East	7
Goulburn Broken	30
North Central	Not available
Port Phillip	Not available
Corangamite	15
Glenelg-Hopkins	117
Wimmera	52 (plus 4 Landcare Networks and 4 special interest groups addressing Landcare issues.)

8.5.5 Local Area Plans

Local Area Planning groups are members of the local community who, in collaboration with Landcare groups, DSE, CMAs and the Natural Heritage Trust, produce a plan to address a range of issues including land, water and biodiversity management within their local area. Local Area Plans (LAPs) are an ideal vehicle to adopt information and management recommendations from the biodiversity Action Planning process (Goulburn Broken CMA 2001a,b and c), North Central CMA 2001). The process may involve a schedule of tasks and contributions to meet conservation goals and priorities over a twenty year time-frame for the area. The aims of Local Area Planning are:

1. To enhance the rate of adoption of on ground works relating to sustainable natural resource management in the relevant Catchment Management Area

2. To create a forum for integration of action plans, which results in minimisation of duplication of effort by various agencies

3. To enhance the ownership by the community of these activities.

8.5.6 Sustainable agricultural systems

What is being practised? What is being invented? Eg ESAI grazing …Adaptive mgt farming systems by individuals??? More appropriate land use (sympathetic to biodiversity conservation???

Is data available re major ag production systems, no of farms, farm income ranges etc

Research and development in the Central Victorian Uplands area has focused on soil structure and soil health, minimum tillage and crop residue retention and the integration of Lucerne into cropping systems.

Protection of isolated paddock trees has emerged as a significant issue in areas where burning stubble is a traditional practice. Scorching of isolated trees can result in tree decline and death. The Top Crop program is proposing a public awareness campaign to promote this issue. Future projects being investigated by the Top Crop group may include "precision agriculture" – aiming to quantify amounts and types of fertilizers needed (or not needed) for certain areas using satellite imagery.

Other projects include targeting priority sub-catchments to establish perennial vegetation (lucerne, perennial pastures and trees) for salinity control in the Loddon, Avoca and Avon Richardson River catchments. These projects are funded out of the National Action Plan for Salinity and Water Quality and are managed out of the Bendigo NRE Office in partnership with the North Central CMA

8.5.7 Integration of biodiversity priorities into natural resource plans

CMAs consist of sub-areas or regions, often reflecting major land uses (such as the Shepparton Irrigation Region in the Goulburn Broken CMA) or sub-catchment areas (e.g. the Avoca, Loddon and Campaspe basins in the North Central CMA). Biodiversity actions within CMAs are integrated into regional sub-strategies and managed by the implementation committee of each region. Timelines for particular strategies have five, ten and even 30 year application timelines and goal setting. Key examples include:

- **Salinity Management Plans (SMP)** have been produced (some still in draft form) by Corangamite CMA (1993), North East CMA (Clifton *et al.* 2000 and NRE undated) and Glenelg-Hopkins CMA (Anderson 2002). Wimmera (Wimmera C&LP 1992, Wimmera CMA, in prep) and Goulburn Broken (MGIC 2002, SIRIC 2002, Goulburn Broken CMA 2002a) and North Central CMA (2002a). Port Phillip Catchment and Land Protection Board (CALP) is in the process of producing a Draft Regional Salinity Management Plan. Each SMP typically consists of an Environment Report that outlines the biological resources of the sub-region and an Inception Report that outlines the strategies involved in managing salinity within the sub-region. Corangamite CMA also has an Integrated Sub-catchment Salinity Risk and Prioritization program (ICSRP) which uses GIS techniques to identify salt affected areas for input into the SMP.
- **Floodplain Management Strategies (FMS)** have been produced by Goulburn Broken CMA (2002b), Corangamite CMA (2001a), North Central CMA (2000b), North East (1999) and Glenelg-Hopkins CMA (2002a). FMSs document measures which aim to ensure minimum flood risk and damage while maintaining environmental flow, processes and benefits of the floodplain.
- **Nutrient Management Plans (NMP**) have been produced for Corangamite CMA (Corangamite CMA 2000) and Glenelg-Hopkins CMA (2002b). North Central CMA has produced NMSs for the Avoca, Avon-Richardson sub-catchments (North Central CMA 2002d and e), as well as Nutrient Action Plans for the Loddon and Campaspe Rivers (North Central CMA 2002b and c). Nutrient Action Plans are in production for the Avoca and Avon-Richardson Rivers, and NMPS are in production for the Campaspe and Loddon sub-catchments. Goulburn Broken CMA has also produced a Water Quality Strategy (Goulburn Broken CMA 2002c)
- **Native Vegetation Management Plans (NVMP)** are in draft format for all the CMAs within the Central Victorian Uplands. Visit the various CMA websites (Appendix 9) to view the documents. NVMPs aim to document the status of native vegetation cover across all tenures, and provide a regional framework for the strategic application and assessment of native Vegetation Retention controls.
- **Waterway Health Strategies (WHS)** exist for Corangamite CMA (2001b) and Glenelg-Hopkins CMA (2002c). North East CMA has produced water quality strategies for the Ovens Basin and Upper North East (North East CMA 2000 and 2001 respectively). Port Phillip CALP has produced a Draft Port Phillip and Western Port Regional Water Quality Plan (Port Phillip CALP 2002) and a Regional Riverine Health Strategy is under development by the Goulburn Broken CMA (2002 in prep). River health plans exist for the Campaspe, Loddon, Avoca and Avon-Richardson in the North Central CMA.

- **Pest Plant and Animal Plans**. These plans for the Central Victorian Uplands include Weed Action Plans and/or Rabbit Action Plans. Plans have been produced for the Goulburn Broken CMA, Port Phillip, Corangamite, Glenelg-Hopkins CMAs.

8.6 Restoration

8.6 Restoration key actions

A range of theoretical and empirical information can be aligned to provide guidance on ways that landscape restoration in the study area can be directed to improve native biodiversity conservation outcomes. Restoration in the Central Victorian Uplands should aim to:

- **Increase the size of patches of remnant vegetation.** Island biogeographical theory (MacArthur & Wilson 1963) relates number of species to habitat area for different degrees of isolation (which affects recolonisation and extinction rates). This model has been used to identify the benefits of increasing patch sizes for retaining declining species, or restoring species to other local landscapes (Lambeck 1999, Freudenberger 1999).
- **Increase connectivity in the landscape using corridors and stepping stones of habitat.** Reducing fragmentation provides greater ability for populations to withstand catastrophic events and to recover from them (Fahrig & Merriam 1985, Bennett 1999).
- **Increase tree cover.** Bennett and Ford (1997) found tree cover at the local landscape scale was a good predictor of the number of woodland bird species in the Victorian Riverina bioregion. They concluded that below 10% tree cover bird species decline is rapid and exponential. They recommended 10% tree cover should be a minimum goal for an infrastructure of natural vegetation among productive rural landscapes. In addition, they concluded that the response of woodland birds to restoration of native vegetation may be proportionately greater in depleted landscapes. These theories can also be investigated and applied throughout the Central Victorian Uplands.
- **Give priority to restoring and reconnecting sites in the best condition.** Sites with mature trees, a native ground layer, diverse structure and floristics will support more of the priority species. They are likely to be most useful to meet local landscape targets and to provide options for more complex ecological interactions. Restoration effort should be focused around groups of remnants of very high and high conservation significance in close proximity to each other. Similarly, reaches of streams in best condition could be a focus of in-stream and riparian restoration.
- **Focus restoration in parts of the landscape that offer the best prospects and the "lowest cost" options.** These parts of the landscape offer the best prospects and are "the least cost" options for restoration. Experiment with reducing grazing by native and introduced herbivores and stock to test the potential for natural regeneration, which is a cheaper means for restoration compared with revegetation. Concentrating action at only portions of the landscapes is more likely to give good biodiversity returns than untargeted and more widespread activity.
- **Provide buffers around remnant vegetation to reduce infiltration of undesirable effects.** Factors which can adversely affect remnants include unseasonal or extreme weather, invasion by weeds, colonisation by introduced predators, and run-off of soil into wetlands and streams. Planting bands of indigenous shrubs and trees around existing patches of remnant vegetation may assist the protection of that vegetation as well as provide some additional habitat for species that may stabilise or enhance ecosystem services in the local landscape.
- **Focus on priority taxa**. Priority should go to actions for taxa with existing recovery plans, and for those which may have a strong influence on the *quality* of the vegetation community with which they are associated. The use of focal species (Appendix 8) data can be useful in identifying which species are benefited when concentrating restoration efforts to benefit focal species.

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Appendices

Appendix 1: Bioregional Network Analysis.

The background information on local management requirements of threatened taxa for this Bioregional Network Analysis (BNA) is drawn from the knowledge and experience of NRE natural resource managers, coordinated through Bioregional Networks within the Department. During 1999, the Bioregional Networks carried out a 'desk-top' analysis of threatened species for all terrestrial bioregions in the State.

BNA priority and risk ranking values have been determined for selected threatened taxa (see box) during BNA workshops run within NRE Regions. Lower-threat taxa may not have been ranked due to lack of time or inadequate local knowledge of the taxon.

BNA priority/risk ranking values provide a simple means of apportioning bioregional priorities for management actions to benefit threatened taxa. These rankings are shown after each taxon in the *threatened biodiversity assets* box of each *asset summary* (see companion volumes), where the threatened taxa are listed in ranked order. Taxa with lower priority / risk rankings for the particular land tenure type are so indicated by being assigned lesser response levels or being *unranke*d.

DEFINITIONS

***Taxon*:**
typically a *specie*s, but it may sometimes be a *unique form* of a species, or a closely related *group* of species.

***Parcel*:**
defined as the occurrence of a taxon on a particular land tenure—for example, a home range of a rare species which covered a park and adjacent private land would comprise 2 parcels.

The bioregional status and ranking (required response level) for each taxon is determined through five steps:

- **Occurrence in the bioregion**. Estimating the percentage of the State population which occurs within the bioregion (based on records on NRE flora and fauna databases).
- **Occurrence in different land tenures**. Estimating the percentage occurrence in each land tenure in the bioregion (based on the databases plus local knowledge and expertise).
- **Occurrence ranking**. Allocating a ranking (1, 2, 3 or 4) for each parcel (see box). Based on the importance of its contribution to the overall occurrence of the parcel within the state.
- **Risk ranking**. Estimating a risk ranking (A,B or C) for each parcel, based on the state-wide conservation status of the taxon and its estimated population trend in this parcel.
- **Priority level**. Allocating an expected response level for action i.e. 1 (highest priority) to 4 (lower priority) for each parcel based on the combination of the Occurrence and Risk ranking. Guidance as to the type of response that is required at each of the expected response levels.

Appendix 1A: Guidelines for Bioregional Network Analysis

Appendix 1B: Bioregional Network Analysis priority/risk rankings for threatened fauna in Central Victorian Uplands

CENTRAL VICTORIAN UPLANDS BIOREGION - THREATENED FAUNA - PRIORITIES

MORE CONCERN

RISK STATUS: LESS CONCERN

OCCURRENCE STATUS:

MORE IMPORTANT

LESS IMPORTANT

1A	Barking Owl	6%	Forest	1B	Damselfly	20%	Private	1C			
	Golden Sun Moth	38%	Park		Murray Cod	12%	Other State				
	Small Ant Blue	80%	Park		Yarra Pigmy Perch	15%	Private				
	Square-tailed Kite	11%	Forest								
2A	Bluenose (Trout) Cod	11%	Other State	2B	Brush-tailed Phascogale	7%	Forest	2C	Glossy Grass Skink	##	Private
	Powerful Owl	6%	Forest		Brush-tailed Phascogale	7%	Private		Grey Goshawk	##	Forest
	Square-tailed Kite	4%	Private		Common Dunnart	8%	Forest				
	Square-tailed Kite	3%	Private		Eastern Horseshoe Bat	5%	Forest				
					Eastern Horseshoe Bat	5%	Other State				
					River Blackfish	5%	Other State				
3A	Barking Owl	3%	Park	3B	Brush-tailed Phascogale	4%	Park	3C	Large Ant Blue	##	Park
	Barking Owl	3%	Private		Common Bent-wing Bat	3%	Park				
	Bluenose (Trout) Cod	5%	Forest		Damselfly	10%	Local				
	Macquarie Perch	5%	Other State		Damselfly	10%	Other State				
	Powerful Owl	4%	Park		Mountain Galaxias nth eastern forms	5%	Other State				
	Small Ant Blue	10%	Local		Mountain Galaxias nth eastern forms	8%	Private				
	Small Ant Blue	10%	Private		Murray Cod	3%	Forest				
					Painted Honeyeater	3%	Park				
					River Blackfish	4%	Forest				
					Striped Legless Lizard	4%	Private				
4A	Golden Sun Moth	2%	Local	4B	Brush-tailed Phascogale	2%	Local	4C	Grey Goshawk	##	Park
	Powerful Owl	2%	Private		Common Bent-wing Bat	2%	Forest		Grey Goshawk	##	Private
	Square-tailed Kite	1%	Park		Common Bent-wing Bat	1%	Other State				
					Common Bent-wing Bat	0%	Private				
					Common Dunnart	1%	Park				
					Common Dunnart	1%	Private				
					Mountain Galaxias nth eastern forms	2%	Forest				
					Mountain Galaxias nth eastern forms	1%	Park				
					Painted Honeyeater	2%	Forest				
					Painted Honeyeater	1%	Private				
					River Blackfish	1%	Park				
					Striped Legless Lizard	1%	Local				

NOT ASSESSED

	e		**?/A**
			?/B
Speckled Warbler	Vul	###	**?/A**
Warty Bell Frog	Vul	9%	**?/B**
Hardhead	Vul	5%	**?/C**
Chestnut-rumped Heathwren	Ins	###	**?/B**
Brown Quail	Ins	6%	
	r		**?/C**

Legend

1A	Full Commitment
1B, 2A, 3A	Substantive Participation
1C, 2B, 4A	Planning Awareness / Opportunistic Action
2C, 3B, 3C, 4B, 4C	Planning Awareness / Watching Brief

Appendix 1C: Bioregional Network Analysis priority/risk rankings for threatened flora in Central Victorian Uplands.

CENTRAL VICTORIAN UPLANDS BIOREGION - THREATENED FLORA - PRIORITIES

MORE CONCERN

RISK STATUS:

LESS CONCERN

OCCURRENCE STATUS:

MORE IMPORTANT

1A	Basalt Pepper-cress	30%	Other State	1B	Drooping Grevillea	27%	Forest	1C	Turkey-bush	3%	Park
	Basalt Pepper-cress	40%	Park		Drooping Grevillea	27%	Local		Turkey-bush	5%	Private
	Black Gum	65%	Private		Drooping Grevillea	36%	Park				
	Brittle Greenhood	72%	Park		Euroa Guinea-flower	20%	Local				
	Buxton Gum	71%	Park		Euroa Guinea-flower	20%	Private				
	Concave Pomaderris	95%	VPC		Golden Cowslips	25%	Local				
	Crimson Spider-orchid	9%	Local		Naked Sun-orchid	20%	Park				
	Enfield Grevillea	100%	Forest		Swamp Fireweed	25%	Local				
	Langi Ghiran Grevillea	100%	Park		Tall Wallaby-grass	9%	Private				
	Mount Cole Grevillea	80%	Forest		Velvet Daisy-bush	23%	Park				
	Plump Swamp Wallaby-grass	40%	Other State		Velvet Daisy-bush	23%	Private				
	Red-beard Midge-orchid	50%	Unknown		Weak Daisy	23%	Private				
2A	Basalt Pepper-cress	10%	Forest	2B	Black Gum	30%	Local	2C	Hairy Anchor Plant	4%	Private
	Basalt Pepper-cress	10%	Local		Clover Glycine	4%	Park				
	Basalt Pepper-cress	10%	Private		Golden Cowslips	5%	Local				
	Brittle Greenhood	9%	Local		Velvet Daisy-bush	5%	Local				
	Brittle Greenhood	9%	Private		Weak Daisy	8%	Forest				
	Crimson Spider-orchid	5%	Forest								
	Crimson Spider-orchid	5%	Park								
	Scented Bush-pea	25%	Park								
3A	Large-fruit Fireweed	5%	Local	3B	Black Gum	5%	PTC	3C	Concave Pomaderris	5%	Private
	Large-fruit Fireweed	5%	Private		Buxton Gum	4%	Private		Mount Cole Grevillea	20%	Park
	Narrow Goodenia	6%	Local		Clover Glycine	3%	Private				
	Narrow Goodenia	4%	Private		Kidney Saltbush	5%	Private				
					Swamp Everlasting	10%	Private				
					Wavy Swamp Wallaby-grass	9%	Local				
4A	Crimson Spider-orchid	1%	Private	4B	Clover Glycine	1%	PTC	4C	Hairy Anchor Plant	1%	Park
	Scented Bush-pea	0%	Private		Tall Wallaby-grass	1%	Other State				
					Wavy Swamp Wallaby-grass	1%	Private				

LESS IMPORTANT

Legend

1A	Full Commitment
1B, 2A, 3A	Substantive Participation
1C, 2B, 4A	Planning Awareness / Opportunistic Action
2C, 3B, 3C, 4B, 4C	Planning Awareness / Watching Brief

NOT ASSESSED

Green Sun-orchid	e	100%
Lanky Buttons	e	6%
Grampians Bitter-pea	v	100%
Mentone Greenhood	v	100%
Western Rat-tail Grass	v	33%
Yellow Gum	v	24%
Mueller's Bush-pea	k	100%
Yarra Gum	k	46%
Yellow Star	k	38%
Greenish-flower Vanilla-lily	k	33%
Fringed Midge-orchid	k	20%
Curved Rice-flower	k	17%
Shiny Wallaby-grass	k	14%
Dwarf Brooklime	k	13%
Ivy-leaf Duckweed	k	13%
Black Roly-poly	k	8%
Beech Nyctalis	r	100%
Forked Rice-flower	r	100%
Golden Bush-pea	r	100%
Mount Cole Grevillea	r	100%
Red-sheath Tussock-grass	r	100%
Brisbane Range Grevillea	r	94%
Heath Spear-grass	r	67%
Wiry Bossiaea	r	63%
Fragrant Saltbush	r	57%
Dense Mint-bush	r	55%
Fryerstown Grevillea	r	53%
Golden Grevillea	r	50%
Brooker's Gum	r	45%
Swamp Bush-pea	r	35%
Hoary Bush-pea	r	33%
Large Velvet Wallaby-grass	r	29%
Sharp Greenhood	r	29%
Dwarf Silver Wattle	r	28%
Hairy Beard-heath	r	27%
Creeping Grevillea	r	25%
Short-bristle Wallaby-grass	r	25%
Narrow-leaf Star-hair	r	22%
Emerald-lip Greenhood	r	20%
Western Golden-tip	r	20%
Western Golden-tip	r	20%
Slender Saw-sedge	r	15%
Cane Spear-grass	r	15%
River Leafless Bossiaea	r	14%

Tangled Pseudanthus	r	14%
Small-leaf Bush-pea	r	11%
Dark Wire-grass	r	10%
One-flower Early Nancy	r	9%
Hairy Beard-heath	r	8%
Fringed Sun-orchid	r	7%
Half-bearded Spear-grass	r	7%
Rough-barked Manna-gum	r	7%

CENTRAL VICTORIAN UPLANDS BIOREGION - THREATENED FLORA - PRIORITIES

MORE CONCERN

RISK STATUS:

LESS CONCERN

OCCURRENCE STATUS:

MORE IMPORTANT

LESS IMPORTANT

1A	Amphibromus pithogastrus	40%	Other State	1B	Austrodanthonia sp. (syn. Danthonia pr	9%	Private	1C	Eremophila deserti	3%	Park
	Caladenia concolor	9%	Local		Brachyscome debilis	23%	Private		Eremophila deserti	5%	Private
	Eucalyptus aggregata	65%	Private		Diuris behrii	25%	Local				
	Eucalyptus crenulata	71%	Park		Grevillea floripendula	27%	Forest				
	Genoplesium sp. aff. morrisii (Pyrete	50%	Unknown		Grevillea floripendula	27%	Local				
	Grevillea bedggoodiana	100%	Forest		Grevillea floripendula	36%	Park				
	Grevillea montis-cole ssp. brevistyla	100%	Park		Hibbertia humifusa ssp. erigens	20%	Local				
	Grevillea montis-cole ssp. montis-cole	80%	Forest		Hibbertia humifusa ssp. erigens	20%	Private				
	Lepidium hyssopifolium	30%	Other State		Olearia pannosa ssp. cardiophylla	23%	Park				
	Lepidium hyssopifolium	40%	Park		Olearia pannosa ssp. cardiophylla	23%	Private				
	Pomaderris subplicata	95%	VPC		Senecio psilocarpus	25%	Local				
	Pterostylis truncata	72%	Park		Thelymitra circumsepta	20%	Park				
2A	Caladenia concolor	5%	Forest	2B	Brachyscome debilis	8%	Forest	2C	Discaria pubescens	4%	Private
	Caladenia concolor	5%	Park		Diuris behrii	5%	Local				
	Lepidium hyssopifolium	10%	Forest		Eucalyptus aggregata	30%	Local				
	Lepidium hyssopifolium	10%	Local		Glycine latrobeana	4%	Park				
	Lepidium hyssopifolium	10%	Private		Olearia pannosa ssp. cardiophylla	5%	Local				
	Pterostylis truncata	9%	Local								
	Pterostylis truncata	9%	Private								
	Pultenaea graveolens	25%	Park								
3A	Goodenia macbarronii	6%	Local	3B	Amphibromus sinuatus	9%	Local	3C	Grevillea montis-cole ssp. montis-cole	20%	Park
	Goodenia macbarronii	4%	Private		Atriplex stipitata	5%	Private		Pomaderris subplicata	5%	Private
	Senecio macrocarpus	5%	Local		Bracteantha sp. aff. subundulata	10%	Private				
	Senecio macrocarpus	5%	Private		Eucalyptus aggregata	5%	PTC				
					Eucalyptus crenulata	4%	Private				
					Glycine latrobeana	3%	Private				
4A	Caladenia concolor	1%	Private	4B	Amphibromus sinuatus	1%	Private	4C	Discaria pubescens	1%	Park
	Pultenaea graveolens	0%	Private		Austrodanthonia sp. (syn. Danthonia pr	1%	Other State				
					Glycine latrobeana	1%	PTC				

Legend

1A Full Commitment

NOT ASSESSED

Thelymitra ixioides var. subdifformis	e	100%
Leptorhynchos elongatus	e	6%
Daviesia laevis	v	100%
Pterostylis X toveyana	v	100%
Sporobolus creber	v	33%
Eucalyptus leucoxylon ssp. connata	v	24%
Pultenaea muelleri var. reflexifolia	k	100%
Eucalyptus yarraensis	k	46%
Hypoxis vaginata var. brevistigmata	k	38%
Arthropodium sp. 2 (greenish flowers)	k	33%
Genoplesium ciliatum	k	20%
Pimelea curviflora var. nov. aff. subg	k	17%
	k	14%
Gratiola pumilo	k	13%
Lemna trisulca	k	13%
Sclerolaena muricata var. muricata	k	8%
Grevillea montis-cole	r	100%
Nyctalis mirabilis	r	100%
Pimelea hewardiana	r	100%
Poa sp. aff. tenera (Red-sheath)	r	100%
Pultenaea gunnii ssp. tuberculata	r	100%
Grevillea steiglitziana	r	94%
Austrostipa exilis	r	67%
Bossiaea cordigera	r	63%
Rhagodia parabolica	r	57%
Prostanthera decussata	r	55%
Grevillea obtecta	r	53%
Grevillea chrysophaea	r	50%
Eucalyptus brookeriana	r	45%
Pultenaea weindorferi	r	35%
Pultenaea daltonii	r	33%

1B, 2A, 3A	Substantive Participation
1C, 2B, 4A	Planning Awareness / Opportunistic Action
2C, 3B, 3C, 4B, 4C	Planning Awareness / Watching Brief

Austrodanthonia pilosa var. paleacea	r	29%
Pterostylis X ingens	r	29%
Acacia nano-dealbata	r	28%
Leucopogon microphyllus var. pilibundu	r	27%
Austrodanthonia setacea var. breviseta	r	25%
Grevillea repens	r	25%
Astrotricha linearis	r	22%
Goodia medicaginea	r	20%
Goodia medicaginea	r	20%
Pterostylis smaragdyna	r	20%
Gahnia microstachya	r	15%
Austrostipa breviglumis	r	15%
Bossiaea riparia	r	14%
Pseudanthus divaricatissimus	r	14%
Pultenaea foliolosa	r	11%
Aristida calycina var. calycina	r	10%
Wurmbea uniflora	r	9%
Leucopogon microphyllus	r	8%
Thelymitra luteocilium	r	7%
Austrostipa hemipogon	r	7%
Eucalyptus viminalis ssp. cygnetensis	r	7%

Appendix 2: Identifying conservation significance for native vegetation.

CONSERVN. SIGNIF.	BIODIVERSITY ATTRIBUTES			
	VEGETATION TYPES		*OR* SPECIES	*OR* OTHER ATTRIBUTES
	Conservation Status[2]	Habitat Score[3]		
VERY HIGH	Endangered Vulnerable Rare	0.4 - 1 0.5 - 1 0.6 - 1	• best 50% of habitat for each threatened species[2] in a Victorian bioregion	• sites with unique National Estate values • sites identified as being of national significance as a relict, endemic, edge of range or other non-species values • Ramsar Sites • East Asian-Australasian Shorebird Site Network sites • other wetlands of international significance for migratory waterbirds • areas identified as providing refuges (eg. during drought) for threatened species
HIGH	Endangered Vulnerable Rare Depleted	< 0.4 0.3 – 0.5 0.5 – 0.6 0.6 - 1	• the remaining 50% of habitat for threatened species[2] in a Victorian bioregion • best 50% of habitat for rare species in a Victorian bioregion	• sites with rare National Estate values • sites identified as being of state significance for relictual, endemic, edge of range or other non-species values • wetlands listed in 'A Directory of Important Wetlands in Australia' • wetlands of national significance for migratory waterbirds • areas identified as providing refuges (eg. during drought) for rare species • priority areas for the re-establishment of habitat for a threatened species (eg. as determined in a Biodiversity Action Plan)

[2] see Appendix 2 (NRE (2002) Victoria's native vegetation management: A framework for Action. Department of Natural Resources and Environment, Victoria.)

[3] Conservation status of species determined with reference to NRE Victorian Rare or Threatened Flora and Fauna lists, as supplemented by the relevant Native Vegetation Plan. The relative quality and suitability of habitat for threatened species depends on particular requirements and therefore must be estimated on a species-by-species and location-by-location basis by the relevant planning authority using the best available information.

CONSERVN. SIGNIF.	BIODIVERSITY ATTRIBUTES			
	VEGETATION TYPES		*OR*	*OR*
	Conservation Status[2]	Habitat Score[3]	SPECIES	OTHER ATTRIBUTES
MEDIUM	Vulnerable Rare Depleted Least Concern	< 0.3 < 0.3 0.3 – 0.6 0.6 - 1	• the remaining 50% of habitat for rare species[2] in a Victorian bioregion • best 50% of habitat for regionally significant species	• sites with uncommon National Estate values • sites identified as being of regional significance for edge of range or other non-species values • wetlands of bioregional significance (based on application of National Land and Water Resources Audit criteria).
LOW	Depleted Least Concern	< 0.3 < 0.6		

Appendix 3: Details of EVC in the Central Victorian Uplands.

Map Unit Description	Map Unit Type	Cons	Pre1750 Area (ha)	Total Extant Area (ha)	Cons Res	Special Prot Zone	Total Cons	
			(a)	(b)1	(C)	(S)	(C+S)	(O)
Grassy Dry Forest	EVC	D	223547	95470	17294	11779	29073	220
Herb-rich Foothill Forest	EVC	D	148601	63164	6144	7733	13877	186
Hillcrest Herb-rich Woodland	EVC	D	39	17	2	0	2	0
Seasonally-inundated Shrubby Woodland	EVC	D	11	11	11	0	11	0
Grassy Dry Forest / Granitic Hills Woodland Complex	complex	D	392	64	0	0	0	0
Grassy Dry Forest / Heathy Dry Forest Complex	complex	D	3361	1862	0	1528	1528	3
Herb-rich Foothill Forest / Shrubby Foothill Forest Complex	complex	D	5995	4094	0	475	475	302
Grassy Dry Forest / Rocky Outcrop Shrubland / Herbland Mosaic	mosaic	D	1016	185	39	0	39	0
Heathy Woodland	EVC	D	5503	1828	293	235	527	342
Sedgy Riparian Woodland	EVC	D	3283	2216	64	557	621	752
Floodplain Riparian Woodland	EVC	E	25355	2065	956	0	956	454
Grassy Woodland	EVC	E	136678	4835	205	17	222	94
Plains Grassy Woodland	EVC	E	110762	4514	715	264	980	104
Plains Grassland	EVC	E	511	13	0	0	0	0
Plains Grassy Wetland	EVC	E	237	39	0	0	0	34
Plains Sedgy Wetland	EVC	E	238	35	8	0	8	17
Red Gum Wetland	EVC	E	357	69	0	0	0	1
Riparian Scrub	EVC	E	22	3	0	0	0	0
Alluvial Terraces Herb-rich Woodland / Plains Grassy Woodland Complex	complex	E	7031	68	0	0	0	7
Grassy Woodland / Heathy Dry Forest Complex	complex	E	30184	1140	22	0	22	40
Grassy Woodland / Valley Grassy Forest Complex	complex	E	157	0	0	0	0	0
Shrubby Granitic-outwash Grassy Woodland / Plains Grassy Woodland Complex	complex	E	51	0	0	0	0	0

Map Unit Description	Map Unit Type	Cons	Pre1750 Area (ha)	Total Extant Area (ha)	Cons Res	Special Prot Zone	Total Cons	
			(a)	(b)1	(C)	(S)	(C+S)	(O)
Shrubby Granitic-outwash Grassy Woodland / Valley Grassy Forest Complex	complex	E	152	7	0	0	0	0
Slopes Box Grassy Woodland / Box Ironbark Forest Complex	complex	E	1391	71	0	0	0	0
Alluvial Terraces Herb-rich Woodland / Creekline Grassy Woodland Mosaic	mosaic	E	333	36	0	0	0	0
Aquatic Herbland / Plains Sedgy Wetland Mosaic	mosaic	E	61	51	45	0	45	0
Floodplain Riparian Woodland / Plains Grassy Woodland Mosaic	mosaic	E	704	6	0	0	0	0
Gilgai Plain Woodland / Wetland Mosaic	mosaic	E	1625	1	0	0	0	0
Low Rises Grassy Woodland / Alluvial Terraces Herb-rich Woodland Mosaic	mosaic	E	596	4	0	0	0	0
Plains Grassland / Plains Grassy Woodland Mosaic	mosaic	E	1311	79	0	0	0	0
Plains Grassy Woodland / Creekline Grassy Woodland / Floodplain Riparian Woodland Mosaic	mosaic	E	60	0	0	0	0	0
Plains Grassy Woodland / Creekline Grassy Woodland / Wetland Mosaic	mosaic	E	8	2	0	0	0	0
Plains Grassy Woodland / Creekline Grassy Woodland Mosaic	mosaic	E	273	17	0	0	0	0
Plains Grassy Woodland / Plains Grassland / Plains Grassy Wetland Mosaic	mosaic	E	173	1	0	0	0	0
Riparian Shrubland / Swampy Riparian Woodland Mosaic	mosaic	E	140	17	0	0	0	7
Riverina Plains Grassy Woodland / Plains Grassland Mosaic	mosaic	E	23	0	0	0	0	0
Riverine Grassy Woodland / Riverine Sedgy Forest / Wetland Mosaic	mosaic	E	18	4	0	0	0	0
Swampy Riparian Woodland / Spring-soak Woodland Mosaic	mosaic	E	54	8	0	0	0	0
Swampy Riparian Complex	complex	E	5243	516	4	0	4	113
Alluvial Terraces Herb-rich Woodland	EVC	E	8135	1102	113	325	438	52
Creekline Grassy Woodland	EVC	E	5511	451	9	1	10	139
Damp Sands Herb-rich Woodland	EVC	E	9695	1059	259	52	312	52
Riparian Woodland	EVC	E	1675	231	0	0	0	13
Riverine Escarpment Scrub	EVC	E	1773	51	34	0	34	0
Scoria Cone Woodland	EVC	E	1121	197	0	0	0	0
Swampy Riparian Woodland	EVC	E	4874	503	0	0	0	37
Valley Heathy Forest	EVC	E	2905	315	11	0	11	0

Map Unit Description	Map Unit Type	Cons	Pre1750 Area (ha)	Total Extant Area (ha)	Cons Res	Special Prot Zone	Total Cons	
			(a)	(b)1	(C)	(S)	(C+S)	(O)
Basalt Escarpment Shrubland	FC	E	1354	195	0	0	0	0
Riparian Shrubland	EVC	E	478	193	168	0	168	0
Sand Forest	EVC	E	53	25	0	0	0	0
Spring-soak Woodland	EVC	E	38	10	0	0	0	0
Swamp Scrub	EVC	E	775	86	0	0	0	15
Wetland Formation	veg group	E	737	0	0	0	0	0
Heathy Dry Forest	EVC	LC	119778	71640	16848	8829	25677	193
Shrubby Dry Forest	EVC	LC	10699	8366	5075	337	5412	134
Shrubby Foothill Forest	EVC	LC	38724	35611	3630	5504	9134	220
Damp Forest	EVC	LC	3123	2815	133	552	685	144
Lowland Forest	EVC	LC	4509	2986	1065	131	1195	105
Sand Heathland	EVC	LC	26	26	26	0	26	0
Valley Slopes Dry Forest	EVC	LC	14	14	14	0	14	0
Wet Forest	EVC	LC	532	514	40	160	200	234
Unclassified Foothill Forest	no EVC id.	LC	358	21	0	0	0	0
Rocky Outcrop Shrubland	EVC	LC	65	1	0	0	0	0
Rocky Outcrop Shrubland / Herbland Mosaic	mosaic	LC	2979	2236	1151	591	1742	224
No EVC assigned - need editing	no EVC id.	na	0	21	0	0	0	1
Private Land No Tree Cover	no nat TC	na	0	813927	3784	4867	8651	102
Cleared / Severely Disturbed due to Power Easement	no veg	na	0	240	63	0	63	177
Cleared Severely Disturbed	no veg	na	0	8995	704	309	1013	764
Water Body - Natural or man made	no veg	na	0	13160	642	13	655	124

Map Unit Description	Map Unit Type	Cons	Pre1750 Area (ha)	Total Extant Area (ha)	Cons Res	Special Prot Zone	Total Cons	
			(a)	(b)1	(C)	(S)	(C+S)	(O)
Plantation (undefined)	plant	na	0	27700	43	105	148	229(
Not assessed to date	unknown	na	0	0	0	0	0	0
Blackthorn Scrub	EVC	R	103	27	0	0	0	0
Shrubby Woodland	EVC	R	221	221	221	0	221	0
Box Ironbark Forest	EVC	V	19104	4411	1100	88	1188	390
Granitic Hills Woodland	EVC	V	10674	1687	339	0	339	237
Hills Herb-rich Woodland	EVC	V	18406	4685	1380	142	1523	461
Valley Grassy Forest	EVC	V	202633	21798	1342	2276	3618	1127
Montane Grassy Woodland	EVC	V	11	11	0	0	0	11
Sedge Wetland	EVC	V	9	9	0	0	0	9
Shallow Sands Woodland	EVC	V	17	5	0	0	0	0
Valley Grassy Forest / Plains Grassy Woodland Complex	complex	V	738	4	0	0	0	0
Valley Grassy Forest / Slopes Box Grassy Woodland Complex	complex	V	47	4	0	0	0	0
Box Ironbark Forest / Shrubby Granitic-outwash Grassy Woodland Mosaic	mosaic	V	210	7	0	0	0	0
Granitic Hills Woodland / Heathy Dry Forest Mosaic	mosaic	V	12	0	0	0	0	0
Granitic Hills Woodland / Rocky Outcrop Shrubland / Herbland Mosaic	mosaic	V	172	22	0	0	0	0
Montane Grassy Woodland / Rock Outcrop Mosaic	mosaic	V	9	7	0	0	0	7
Riparian Forest / Creekline Grassy Woodland Mosaic	mosaic	V	155	3	0	0	0	0
Riparian Forest / Swampy Riparian Woodland / Riparian Shrubland / Riverine Escarpment Scrub Mosaic	mosaic	V	1120	106	21	23	43	17
Riparian Forest / Swampy Riparian Woodland Mosaic	mosaic	V	471	26	0	0	0	0
Valley Grassy Forest / Grassy Dry Forest Mosaic	mosaic	V	251	98	0	0	0	0
Creekline Herb-rich Woodland	EVC	V	7561	2479	456	388	844	189
Grassy Forest	EVC	V	10080	3163	0	58	58	82
Riparian Forest	EVC	V	5156	1986	294	657	951	405

Map Unit Description	Map Unit Type	Cons	Pre1750 Area (ha)	Total Extant Area (ha)	Cons Res	Special Prot Zone	Total Cons	
			(a)	(b)1	(C)	(S)	(C+S)	(O)
Rocky Chenopod Woodland	EVC	V	1669	489	273	0	273	22
Stream-bank Shrubland	EVC	V	3627	1434	376	92	469	190
Clay Heathland	EVC	V	12	8	0	0	0	0

Appendix 4: Current threatened flora in the Central Victorian Uplands.

Data sourced from DSE Corporate GIS database, October 2002.
Arots = Australian rare or threatened species. (threatened status shown in CAPITALS)
Vrots = Victorian rare or threatened species. (NRE 2000c) (threatened status shown in lower case)
FFG = *Flora and Fauna Guarantee* Act 1988. (L= listed)
E/e – endangered, V/v – vulnerable, R/r – rare, K/k – poorly known.
Dicot = Dicotyledon
Monocot = Monocotyledon.

Common Name	Scientific Name	Arots	Vrots	FFG	
Ausfeld's Wattle	*Acacia ausfeldii*	R	v		Dicot.
Catkin Wattle	*Acacia dallachiana*	R	r		Dicot.
Deane's Wattle	*Acacia deanei*		r		Dicot.
Woolly Wattle	*Acacia lanigera var. lanigera*		r		Dicot.
Dwarf Silver Wattle	*Acacia nano-dealbata*		r		Dicot.
Hickory Wattle	*Acacia penninervis var. penninervis*		r		Dicot.
Bacchus Marsh Varnish Wattle	*Acacia verniciflua (Bacchus Marsh variant)*		v		Dicot.
Adamson's Blown-grass	*Agrostis adamsonii*	E	v	L	Monocot.
Wetland Blown-grass	*Agrostis avenacea var. perennis*		k		Monocot.
Alpine Bent	*Agrostis meionectes*	R	r		Monocot.
River Swamp Wallaby-grass	*Amphibromus fluitans*	V	k		Monocot.
Plump Swamp Wallaby-grass	*Amphibromus pithogastrus*	K	e	L	Monocot.
Dark Wire-grass	*Aristida calycina var. calycina*		r		Monocot.
Greenish-flower Vanilly-lily	*Arthropodium sp. 2 (greenish flowers)*		k		Monocot.
Narrow-leaf Star-hair	*Astrotricha linearis*		r		Dicot.
Native Orache	*Atriplex australasica*		k		Dicot.
Cane Spear-grass	*Austrostipa breviglumis*	R	r		Monocot.
Heath Spear-grass	*Austrostipa exilis*		r		Monocot.
Spurred Spear-grass	*Austrostipa gibbosa*		r		Monocot.
Half-bearded Spear-grass	*Austrostipa hemipogon*		r		Monocot.
Corkscrew Spear-grass	*Austrostipa setacea*		r		Monocot.
Southern Shepherd's Purse	*Ballantinia antipoda*	E	e	L	Dicot.
Rough Twig-sedge	*Baumea planifolia*		k		Monocot.
Pale Turpentine Bush	*Beyeria lechenaultii var. ledifolia*		k		Dicot.
Velvet Apple-berry	*Billardiera scandens var. brachyantha*		r		Dicot.
Dwarf Boronia	*Boronia nana var. nana*		r		Dicot.
Mountain Leafless Bossiaea	*Bossiaea bracteosa*		r		Dicot.
Wiry Bossiaea	*Bossiaea cordigera*		r		Dicot.
River Leafless Bossiaea	*Bossiaea riparia*		r		Dicot.
Austral Moonwort	*Botrychium australe*		v		Ferns and fern allies
Wedge-leaf Daisy	*Brachyscome cuneifolia*		k		Dicot.
Weak Daisy	*Brachyscome debilis*		v		Dicot.
Dookie Daisy	*Brachyscome gracilis*		v	L	Dicot.
Tiny Daisy	*Brachyscome ptychocarpa*		r		Dicot.
Southern Spider-orchid	*Caladenia australis*		k		Monocot.
Ornate Pink Fingers	*Caladenia carnea var. ornata*	V	v		Monocot.
Crimson Spider-orchid	*Caladenia concolor*	V	e	L	Monocot.
Small Spider-orchid	*Caladenia parva*		k		Monocot.
Twining Purslane	*Calandrinia volubilis*		r		Dicot.
Slender Beard-orchid	*Calochilus gracillimus*		k		Monocot.

Common Name	Scientific Name	Arots	Vrots	FFG	
Slender Bitter-cress	*Cardamine tenuifolia*		k		Dicot.
Green-top Sedge	*Carex chlorantha*		k		Monocot.
Tussock Sedge	*Carex iynx*		k		Monocot.
Frosted Goosefoot	*Chenopodium desertorum ssp. virosum*		k		Dicot.
Small Milkwort	*Comesperma polygaloides*		v	L	Dicot.
Hairy Correa	*Correa aemula*		r		Dicot.
Swamp Billy-buttons	*Craspedia paludicola*		v		Dicot.
Tough Scurf-pea	*Cullen tenax*		e	L	Dicot.
Golden Dodder	*Cuscuta tasmanica*		k		Dicot.
Grampians Bitter-pea	*Daviesia laevis*	V	v		Dicot.
Tufted Hair-grass	*Deschampsia caespitosa*		r		Monocot.
Slender Tick-trefoil	*Desmodium varians*		k		Dicot.
Bent-grass	*Deyeuxia imbricata*		v		Monocot.
Matted Flax-lily	*Dianella amoena*	E	e		Monocot.
Umbrella Grass	*Digitaria divaricatissima*		v		Monocot.
Spotted Hyacinth-orchid	*Dipodium pardalinum*		r		Monocot.
Hairy Anchor Plant	*Discaria pubescens*	R	r	L	Dicot.
Golden Cowslips	*Diuris behrii*		v		Monocot.
Sunshine Diuris	*Diuris fragrantissima*	E	e	L	Monocot.
Purple Diuris	*Diuris punctata var. punctata*		v	L	Monocot.
Broad-tip Diuris	*Diuris X palachila*		r		Monocot.
Hairy Hop-bush	*Dodonaea boroniifolia*		r		Dicot.
Trailing Hop-bush	*Dodonaea procumbens*	V	v		Dicot.
Moss	*Encalypta vulgaris*		r		Musci (mosses
Moss	*Encalypta vulgaris*		r		Musci (mosses
Rough-grain Love-grass	*Eragrostis trachycarpa*		r		Monocot.
Black Gum	*Eucalyptus aggregata*		e	L	Dicot.
Grampians Grey-gum	*Eucalyptus alaticaulis*		r		Dicot.
Lima Stringybark	*Eucalyptus alligatrix ssp. limaensis*	V	e		Dicot.
Brooker's Gum	*Eucalyptus brookeriana*		r		Dicot.
Yellow Gum	*Eucalyptus leucoxylon ssp. connata*		v		Dicot.
Monaro Peppermint	*Eucalyptus radiata ssp. robertsonii*		k		Dicot.
Mugga	*Eucalyptus sideroxylon s.s.*		r		Dicot.
Yarra Gum	*Eucalyptus yarraensis*	R	k		Dicot.
Silky Browntop	*Eulalia aurea*		r		Monocot.
Purple Eyebright	*Euphrasia collina ssp. muelleri*	E	e	L	Dicot.
Rough Eyebright	*Euphrasia scabra*	K	e	L	Dicot.
Summer Fringe-sedge	*Fimbristylis aestivalis*		k		Monocot.
Common Fringe-sedge	*Fimbristylis dichotoma*		v		Monocot.
Slender Saw-sedge	*Gahnia microstachya*		r		Monocot.
Tight Bedstraw	*Galium curvihirtum*		r		Dicot.
Fringed Midge-orchid	*Genoplesium ciliatum*		k		Monocot.
Sharp Midge-orchid	*Genoplesium despectans*	K			Monocot.
Large-flower Cranesbill	*Geranium sp. 1*		e		Dicot.
Clover Glycine	*Glycine latrobeana*	V	v	L	Dicot.
Narrow Goodenia	*Goodenia macbarronii*	V	v	L	Dicot.
Western Golden-tip	*Goodia medicaginea*		r		Dicot.
Dwarf Brooklime	*Gratiola pumilo*	K	r		Dicot.
Enfield Grevillea	*Grevillea bedggoodiana*	V	v		Dicot.

Common Name	Scientific Name	Arots	Vrots	FFG	
Golden Grevillea	*Grevillea chrysophaea*		r		Dicot.
Ben Major Grevillea	*Grevillea floripendula*	V	v	L	Dicot.
Mount Cole Grevillea	*Grevillea montis-cole*	R	r		Dicot.
Langi Ghiran Grevillea	*Grevillea montis-cole ssp. brevistyla*	V	v		Dicot.
Mount Cole Grevillea	*Grevillea montis-cole ssp. montis-cole*	R	r		Dicot.
Fryerstown Grevillea	*Grevillea obtecta*	R	r		Dicot.
Creeping Grevillea	*Grevillea repens*	R	r		Dicot.
Brisbane Range Grevillea	*Grevillea steiglitziana*	R	r		Dicot.
Pale Swamp Everlasting	*Helichrysum aff. rutidolepis (Lowland Swamps)*		v		Dicot.
Rising Star Guinea-flower	*Hibbertia humifusa*	R	r		Dicot.
Euroa Guinea-flower	*Hibbertia humifusa ssp. erigens*	V	v	L	Dicot.
Mt Samaria Guinea-flower	*Hibbertia sp. 1 (Eastern Highlands)*		v		Dicot.
Yellow Star	*Hypoxis vaginata var. brevistigmata*		k		Monocot.
Hypsela	*Hypsela tridens*		k		Dicot.
Victorian Club-sedge	*Isolepis victoriensis*		k		Monocot.
Sand Rush	*Juncus psammophilus*		r		Monocot.
Shiny Leionema	*Leionema lamprophyllum ssp. obovatum*		r		Dicot.
Basalt Peppercress	*Lepidium hyssopifolium*	E	e	L	Dicot.
Native Peppercress	*Lepidium pseudohyssopifolium*		k		Dicot.
Lanky Buttons	*Leptorhynchos elongatus*		e		Dicot.
Shiny Tea-tree	*Leptospermum turbinatum*		r		Dicot.
Hairy Beard-heath	*Leucopogon microphyllus*		r		Dicot.
Hairy Beard-heath	*Leucopogon microphyllus var. pilibundus*		r		Dicot.
Mount William Beard-heath	*Leucopogon neurophyllus*	R	r		Dicot.
Giant Honey-myrtle	*Melaleuca armillaris ssp. armillaris*		r		Dicot.
Plains Yam-daisy	*Microseris sp. 1*		v		Dicot.
Satinwood	*Nematolepis squamea ssp. squamea*		r		Dicot.
Beech Nyctalis	*Nyctalis mirabilis*		r		Fungi
Heath Daisy-bush	*Olearia minor*		r		Dicot.
Velvet Daisy-bush	*Olearia pannosa ssp. cardiophylla*	R	v	L	Dicot.
Netted Daisy-bush	*Olearia speciosa*		k		Dicot.
Rayless Daisy-bush	*Olearia tubuliflora*		r		Dicot.
Squat Picris	*Picris squarrosa*		r		Dicot.
Spiny Rice-flower	*Pimelea spinescens ssp. spinescens*	V	e		Dicot.
Grey Rice-flower	*Pimelea treyvaudii*		v		Dicot.
Blue-leaf Tussock-grass	*Poa sieberiana var. cyanophylla*		r		Monocot.
Red-sheath Tussock-grass	*Poa sp. aff. tenera (Brisbane Ranges)*		r		Monocot.
Blunt-leaf Pomaderris	*Pomaderris helianthemifolia ssp. minor*		r		Dicot.
Concave Pomaderris	*Pomaderris subplicata*	V	v	L	Dicot.
Clustered Poranthera	*Poranthera corymbosa*		r		Dicot.

Common Name	Scientific Name	Arots	Vrots	FFG	
Tawny Leek-orchid	*Prasophyllum constrictum s.s.*		k		Monocot.
Maroon Leek-orchid	*Prasophyllum frenchii*	E	e	L	Monocot.
Broad-lip Leek-orchid	*Prasophyllum patens*		r		Monocot.
Woodland Leek-orchid	*Prasophyllum validum*	V	k		Monocot.
Dense Mint-bush	*Prostanthera decussata*		r		Dicot.
Tangled Pseudanthus	*Pseudanthus divaricatissimus*	R	r		Dicot.
Emerald-lip Greenhood	*Pterostylis smaragdyna*	R	r		Monocot.
Brittle Greenhood	*Pterostylis truncata*		e	L	Monocot.
Sharp Greenhood	*Pterostylis X ingens*		r		Monocot.
Mentone Greenhood	*Pterostylis X toveyana*		v		Monocot.
Moss	*Ptychomitrium muelleri*		k		Musci (mosses
Small-leaf Bush-pea	*Pultenaea foliolosa*		r		Dicot.
Scented Bush-pea	*Pultenaea graveolens*		v	L	Dicot.
Golden Bush-pea	*Pultenaea gunnii ssp. tuberculata*	K	r		Dicot.
Mueller's Bush-pea	*Pultenaea muelleri var. reflexifolia*		k		Dicot.
Flat-leaf Bush-pea	*Pultenaea platyphylla*		r		Dicot.
Cupped Bush-pea	*Pultenaea vrolandii*		r		Dicot.
Swamp Bush-pea	*Pultenaea weindorferi*	R	r		Dicot.
Moss	*Racomitrium rupestre*		k		Musci (mosses
Fragrant Saltbush	*Rhagodia parabolica*		r		Dicot.
Button Wrinklewort	*Rutidosis leptorhynchoides*	E	e	L	Dicot.
Black Roly-poly	*Sclerolaena muricata var. muricata*		k		Dicot.
Large-fruit Fireweed	*Senecio macrocarpus*	V	e	L	Dicot.
Swamp Fireweed	*Senecio psilocarpus*	V	v		Dicot.
Mountain Swainson-pea	*Swainsona recta*	E	x	L	Dicot.
Leafy Templetonia	*Templetonia stenophylla*		r		Dicot.
Long Pink-bells	*Tetratheca stenocarpa*	R	r		Dicot.
Naked Sun-orchid	*Thelymitra circumsepta*		v		Monocot.
Winter Sun-orchid	*Thelymitra hiemalis*		e	L	Monocot.
Fringed Sun-orchid	*Thelymitra luteocilium*		r		Monocot.
Crimson Sun-orchid	*Thelymitra X macmillanii*		v		Monocot.
Austral Toad-flax	*Thesium australe*	V	v	L	Dicot.
Rye Beetle-grass	*Tripogon loliiformis*		r		Monocot.
One-flower Early Nancy	*Wurmbea uniflora*		r		Monocot.

Appendix 5: Current threatened fauna in the Central Victorian Uplands.

Data sourced from DSE Corporate GIS database, October 2002.
Vrots = Victorian rare or threatened species (DSE 2003).
FFG = *Flora and Fauna Guarantee* Act 1988. (L= listed)
EPBC = *Environment Protection and Biodiversity Conservation* Act 1999.
CE/ce – critically endangered, E/e – endangered, V/v – vulnerable, R/r – rare, nt –near threatened, dd – data deficient, K/k – poorly known.

Common Name	Scientific Name	FFG	EPBC	Vrots
Australasian Shoveler	*Anas rhynchotis*			v
Australian Bustard	*Ardeotis australis*	L		ce
Baillon's Crake	*Porzana pusilla*	L		v
Bandy Bandy	*Vermicella annulata*	L		nt
Barking Owl	*Ninox connivens*	L		e
Black Falcon	*Falco subniger*			v
Blue-billed Duck	*Oxyura australis*	L		e
Bluenose(Trout) Cod	*Maccullochella macquariensis*	L	E	ce
Brolga	*Grus rubicunda*	L		v
Brown Quail	*Coturnix ypsilophora*			nt
Brush-tailed Phascogale	*Phascogale tapoatafa*	L		v
Bullant	*Myrmecia sp. 17*	L		v
Bush Stone-curlew	*Burhinus grallarius*	L		e
Caddisfly	*Archaeophylax canarus*	L		r
Cape Barren Goose	*Cereopsis novaehollandiae*			nt
Chestnut-rumped Heathwren	*Hylacola pyrrhopygia*			v
Common Bent-wing Bat	*Miniopterus schreibersii*	L		v
Common Dunnart	*Sminthopsis murina*			v
Damselfly	*Hemiphlebia mirabilis*	L		v
Dingo	*Canis familaris dingo*			dd
Eastern Barred Bandicoot	*Perameles gunnii*	L	E	ce
Fat-tailed Dunnart	*Sminthopsis crassicaudata*			nt
Flat-headed Galaxias	*Galaxias rostratus*			dd
Glossy Ibis	*Plegadis falcinellus*			nt
Golden Perch	*Macquaria ambigua*			v
Golden Sun Moth	*Synemon plana*	L		e
Great Egret	*Ardea alba*	L		v
Grey Goshawk	*Accipiter novaehollandiae*			v
Grey-crowned Babbler	*Pomatostomus temporalis*	L		e
Hardhead	*Aythya australis*			v
King Quail	*Coturnix chinensis*			ce
Large Ant Blue	*Acrodipsas brisbanensis*	L		r
Lewin's Rail	*Rallus pectoralis*	L		v
Little Bittern	*Ixobrychus minutus*	L		e
Macquarie Perch	*Macquaria australasica*	L	E	e
Masked Owl	*Tyto novaehollandiae*	L		e
Mountain Galaxias	*Galaxias olidus*	L		dd
Murray Cod	*Maccullochella peelii peelii*	L		e
Murray Spiny Cray	*Euastacus armatus*			k
Musk Duck	*Biziura lobata*			v

Common Name	Scientific Name	FFG	EPBC	Vrots
Nankeen Night Heron	*Nycticorax caledonicus*			nt
Painted Honeyeater	*Grantiella picta*	L		v
Pied Cormorant	*Phalacrocorax varius*			nt
Plains-wanderer	*Pedionomus torquatus*	L	V	ce
Powerful Owl	*Ninox strenua*	L		v
Regent Honeyeater	*Xanthomyza phrygia*	L	E	ce
River Blackfish	*Gadopsis marmoratus*			ce
Royal Spoonbill	*Platalea regia*			v
Small Ant Blue	*Acrodipsas myrmecophila*	L		e
Sooty Owl	*Tyto tenebricosa*	L		v
Southern Brown Bandicoot	*Isodon obesulus*			nt
Speckled Warbler	*Chthonicola sagittata*			v
Spot-tailed Quoll	*Dasyurus maculatus*	L	V	e
Square-tailed Kite	*Lophoictinia isura*	L		v
Squirrel Glider	*Petaurus norfolcensis*	L		e
Striped Legless Lizard	*Delma impar*	L	V	e
Swamp Skink	*Egernia coventryi*			v
Swift Parrot	*Lathamus discolor*	L	E	e
Tree Goanna	*Varanus varius*			v
Turquoise Parrot	*Neophema pulchella*	L		nt
Warty Bell Frog	*Litoria raniformis*		V	e
Whiskered Tern	*Chlidonias hybridus*			nt
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	L		v
Yarra Pigmy Perch	*Edelia obscura*	L	V	nt

Appendix 6: Management roles of land managers, and interests of stakeholders, within the study area.

Manager		Land management role
Catchment Management Authority	CMA	Integration of existing advisory mechanisms related to catchment management (especially on private land). Also responsible for waterway and floodplain management, coordination of rural drainage, and aspects of Crown frontage management.
Department of Sustainability and Environment (formerly DNRE)	DSE	Management of natural resources, pest plants and animals, and Native Vegetation Retention Controls (Catchment and Agriculture Services); protection and conservation of native flora and fauna, including through establishment of Public Authority Management Agreements for sites of remnant vegetation, such as cemeteries, rail and road reserves (Parks, Flora and Fauna)
DPI Forests (formerly NRE Forests Directorate)	DPI (For)	Production forests (including eucalyptus oil harvesting) and Uncommitted land; also other categories (e.g. Historic Area, Education Area, Scenic Reserve) where designated by LCC or subsequently determined by government.
Local Government Authority (LGA)	Shires	Minor road reserves, township land, Recreation Reserves, cemeteries and other public land, including through implementation of Planning Schemes and Roadside Management Plans (Local Government municipalities)
Land Victoria (DSE)	LV	Unreserved or Uncategorised Crown Land, Gravel Reserves, Streamside Reserves, Streamside Areas, Stream beds and banks, and Public land Water Frontage (see footnote 1).
Other State agency	RWA PTC VicRds	State government managed land other than above; including Water Supply Reserves (Rural Water Authorities), Rail Reserves (Public Transport Corporation) and major road reserves (VicRoads).
Parks Victoria	PV	Parks and Conservation Reserves; also other categories (e.g. Historic Area, Education Area, Streamside Reserve) where designated by LCC or subsequently determined by government.
Private	Priv	Freehold land used for rural residential, cropping, grazing, mining, hobby farming, recreation and conservation (Landholders)
Rural Water Authorities	RWA	Provision of water for irrigation, industry, regional distribution, private diverters, and 'stock and domestic' consumers. Maintenance of relevant infrastructure.
Stakeholder		**Main role or interest in land management**
Conservation Volunteers Australia (formerly Australian Trust for Conservation Volunteers)	ACV (ATCV)	On-ground conservation services on public and private land
Botanic Guardians	BG	Vegetation protection and monitoring on public land (DSE coordinated)
Victorian Chamber of Mines	VCM	Representation of fossickers, miners and the mining industry
Country Fire Authority	CFA	Prevention and suppression of fire on lands not managed by Parks Victoria or DSE
Environment Conservation Council	ECC	Victorian Government agency for public land use determinations (see VEAC)
Farm Tree Groups	FTG	Vegetation re-establishment and land protection
Field Naturalists Clubs	FNC	Survey and monitoring of flora and fauna
Greening Australia Victoria	GAV	Sustainable vegetation management
Good Neighbour Program	GNP	Protection of private land by controlling pest plants and animals on public land boundaries
Land for Wildlife	LFW	Habitat retention and enhancement on private land (jointly coordinated by DSE and Bird Observers Club of Australia)
Landcare	LC	On-ground environmental management and revegetation in an agricultural context
Volunteer Fire Brigades	VFB	Local fire suppression and voluntary control burning
Roadside Conservation Advisory Committee	RCC	With local committees and VicRoads, assessment of roadside biodiversity values and appropriate conservation strategies for roadside management.
Salinity Implementation Groups	SIG	Co-ordination of dryland salinity on-ground control programs (under CMA)
Threatened Species Network	TSN	Coordination of 'friends of threatened species' groups
Trust for Nature	TFN	Protection of significant freehold bushland with covenanting (Victoria)
Victorian Apiarists Association Inc	VAA	Representation of bee-keepers and apiculture industry

Victorian Environment Assessment Council	VEAC	Victorian Government agency for public land use determinations and recommendations (formerly LCC then ECC).
Victorian Farmers Federation	VFF	Representation of farming community and co-sponsorship of Landcare
Victorian National Parks Association	VNPA	Advocacy group for improving parks and reserves system Victoria-wide
Weed and Rabbit Control Action Groups	WAG RAG	Weed and rabbit management on private land

Appendix 7: Other (non-threatened) taxa referred to in text.

Common Name	Scientific Name
Flora	
Black Wattle	*Acacia mearnsii*
Blackwood	*Acicia melanoxylon*
Bulrush	*Typha* spp.
Common Reed	*Phragmites australis*
Golden Wattle	*Acacia pycnantha*
Greenhood Orchids	*Pterostylis* spp
Grey Box	*Eucalyptus microcarpa*
Blackberry**	*Rubis sp.*
Gorse**	*Ulex europaeus*
Sweet Pittosporum	*Pittosporum undulatum*
Sweet Briar**	*Rosa rubiginosa*
Paterson's Curse**	*Echium plantagineum*
Ragwort**	*Senecio jacobaea*
Red Box	*Eucalyptus polyanthemos*
River Red Gums	*Eucalyptus camaldulensis*
Serrated Tussock**	*Nassella trichotoma*
Silver Wattle	*Acacia dealbata*
Water Ribbons	*Triglochin procera*
Fauna	
Buff-rumped Thornbill	*Acanthiza reguloides*
Carp*	*Cyprinus carpio*
Cat* (feral and domestic)	*Felis cattus*
Common Wombat	*Vombatus ursius*
Dog*(feral and domestic)	*Canis familiaris*
Eastern Grey Kangaroo	*Macropus giganteus*
European Rabbit	*Oryctolagus cuniculus*
Honeybee*	*Apis mellifera*
Hooded Robin	*Melanodryas cucullata*
Large Earth Bumblebee*	*Bombus terrestris*
Red Fox*	*Vulpes vulpes*

*introduced

**proclaimed a Regionally Controlled Weed in various CMAs within the CVU under the *CaLP* Act 1994 (Government of Victoria 1994)

Appendix 8: Threshold values based on 30% reporting rate for Central Victorian Uplands (Species with 20 or more observations from state-wide analysis of Birds Australia database).

Habitat Score	0 – 3 ha	3 – 10 ha	10 – 30 ha	30 – 100ha	100 – 400 ha	400+ ha
5						
6						Tree Martin
7		Noisy Miner				
8	New Holland Honeyeater Red Wattlebird		Long-billed Corella			
9	Common Starling House Sparrow Magpie-lark					
10	Red-rumped Parrot					
11	Buff-rumped Thornbill					
12	Galah Grey Shrike-thrush Welcome Swallow White-plumed Honeyeater Willie Wagtail	Striated Thornbill				
13	Black-faced Cuckoo-shrike Common Blackbird Crimson Rosella Eastern Yellow Robin European Goldfinch Little Raven Red-browed Finch					Brown Thornbill
14	Australian Magpie Australian Raven Grey Fantail Sulphur-crested Cockatoo Superb Fairy-wren Yellow-rumped Thornbill					Laughing Kookaburra Rufous Whistler Scarlet Robin Spotted Pardalote
15						
16	Eastern Spinebill					Grey Currawong White-browed Scrubwren White-eared Honeyeater White-naped Honeyeater White-throated Treecreeper White-winged Chough Yellow-faced Honeyeater
17						

Appendix 9: Sources of additional information and internet Web Addresses

	WEB ADDRESS
Catchment Management Authority	
Corangamite	www.ccma.vic.gov.au
Glenelg-Hopkins	www.glenelg-hopkins.vic.gov.au
Goulburn Broken	www.gbcma.vic.gov.au
North Central	www.nccma.vic.gov.au
North East	www.necma.vic.gov.au
Port Phillip CALP	www.calpboard.vic.gov.au
Wimmera CMA	www.wca.vic.gov.au
Local Government Authority	
Ararat Rural City	www.ararat.asn.au
Ballarat City	www.ballarat.vic.gov.au
Corangamite Shire	www.corangamite.vic.gov.au
Golden Plains Shire	www.goldenplains.vic.gov.au
Greater Geelong City	www.geelongcity.vic.gov.au
Hepburn Shire	www.hepburnshire.vic.gov.au
Macedon Ranges Shire	www.macedon-ranges.vic.gov.au
Moorabool Shire	www.moorabool.vic.gov.au
Mitchell Shire	www.mitchell.vic.gov.au
Mount Alexander Shire	www.mountalexander.vic.gov.au
Murrindindi Shire	www.murrindindi.vic.gov.au
Northern Grampians Shire	www.ngshire.vic.gov.au
Pyrenees Shire	www.pyrenees.vic.gov.au
Strathbogie Shire	www.strathbogie.vic.gov.au
Wangaratta Rural City	www.wangaratta.vic.gov.au
Government Departments	
Department of Infrastructure	www.doi.vic.gov.au
Department of Sustainability and	www.nre.vic.gov.au

Environment.

Environment Australia	www.ea.gov.au
Other	
Index of Stream Condition	www.vicwaterdata.net/isc
Trust for Nature	www.tfn.org.au

Access to biodiversity information held by Parks Flora and Fauna Division, Information Management Section of DSE including:

- Biomap
- Biosites
- Detailed site specific data
- Generalised flora and fauna distribution data
- Key biodiversity datasets in GIS format