Trust for Nature

TRUST *for* NATURE'S

STATEWIDE CONSERVATION PLAN

FOR PRIVATE LAND IN VICTORIA

In preparing this Statewide Conservation Plan, Trust for Nature acknowledges the Traditional Custodians within Victoria, their culture and their spiritual connections to country. The Trust also recognises and acknowledges the contributions and interests of Indigenous Australians and organisations in managing and maintaining natural ecosystems and biodiversity across all Victoria's water and land.

Front cover: Private property in the Grampians under negotiation for a conservation covenant. Photo: Adam Merrick

Published by Trust for Nature
Level 5/379 Collins Street, Melbourne 3000
Also published on **www.trustfornature.org.au**

Developed and written by Doug Robinson, Kelly Arbon, Andrew Cox, Lauren Fraser, Jen Grindrod, Richard MacNeill, Raewyn Montgomery, Peter Moulton, Paul Peake and Nathan Wong.

Printed on recycled paper.
For more information contact Trust for Nature on 1800 99 99 33 or visit: **www.trustfornature.org.au**

Cite this report as: Trust for Nature (2013) The Statewide Conservation Plan for Private Land in Victoria

Executive summary

Background

Of all states and territories in Australia, Victoria is the state where private-land conservation is arguably the most important. Victoria has the highest proportion (62%) of private land of any state and territory (Bennett 1995) and is the most highly altered in terms of ecological health and vegetation loss (NLWRA 2002). Its private land habitat, furthermore, continues to be lost and degraded at a rate of more than 4000 ha per year – a rate of loss that exceeds the gains being achieved through protection and management (DSE 2008). Increased protection and management of ecosystems and species found on private land is therefore critical to the conservation of Victoria's natural heritage and biodiversity.

As a conservation body with statutory functions relating to the protection of habitats, native plants and animals on private land, Trust for Nature has an important role to play in biodiversity conservation in Victoria. The preparation of a Statewide Conservation Plan was a key task identified in Trust for Nature's 2011–2016 Strategic Plan and builds on earlier reviews, landscape plans, bioregional conservation strategies and regional strategies prepared by the Trust. To enhance its effectiveness as a conservation organisation, however, Trust for Nature recognised the need for a clearly defined set of conservation priorities and priority areas at a statewide scale. The Statewide Conservation Plan provides that baseline.

This Statewide Conservation Plan is designed to complement other major planning approaches that relate to Victoria's natural resources, particularly the Regional Catchment Strategies developed by Victoria's 10 Catchment Management Authorities (CMAs) and the biodiversity planning undertaken by the Department of Sustainability and Environment (DSE).

For the first time, the Conservation Plan gives Trust for Nature a statewide perspective of the value of private land for the conservation of terrestrial ecosystems, aquatic ecosystems and threatened species in Victoria. A key outcome of the Conservation Plan has been the identification of 12 focal landscapes across Victoria. These landscapes were assessed as capable of making the greatest contribution towards nature conservation on private land.

Recognising there has not been a statewide conservation planning process focussing solely on the protection of ecosystems and species on Victorian private land, the Conservation Plan aims to provide a unique, private-land perspective.

Delivery of private-land conservation is particularly dependent on partnerships with landowners as well as on partnerships with other organisations. It is anticipated that this Conservation Plan will accordingly facilitate delivery of whole–of–landscape conservation outcomes.

Conservation priorities for action

The Statewide Conservation Plan has identified three broad classes of biodiversity asset:

- terrestrial ecosystems on private land
- aquatic ecosystems on private land, and
- threatened species on private land.

To guide the protection of these assets, the Conservation Plan presents six objectives with the aim to:

- improve the viability of ecosystems and species at a landscape scale
- improve protection of the least protected ecosystems and threatened communities
- improve protection of significant aquatic and coastal ecosystems
- improve protection of threatened species
- enhance and protect landscape connectivity, and
- enhance and protect habitat quality

Data analysis undertaken in relation to these six conservation objectives identified that:

- two-thirds of Victoria's ecosystems are under-represented in existing protected areas
- nearly 90% of all under-represented ecosystems occur on private land
- three-quarters of all native vegetation found on private land is under-represented in Victoria's protected areas
- the national target of representing 80% of bioregional ecosystems in protected areas is not met in nearly half of Victoria's bioregions (IBRA subregions)
- private land habitat represents a substantial component of all aquatic and coastal ecosystems in Victoria
- more than 200 species of threatened flora and fauna are priorities for conservation on private land, of which one-third are listed as threatened nationally, and
- 12 focal landscapes (Figure 1), covering approximately 12% of Victoria's private land area, represent high priority opportunities for improving the viability of terrestrial ecosystems and species on private land. Most of these focal landscapes overlap with priority areas for biodiversity investment identified by CMAs, DSE and the Australian Government, providing opportunities to strengthen partnerships at each of these levels.

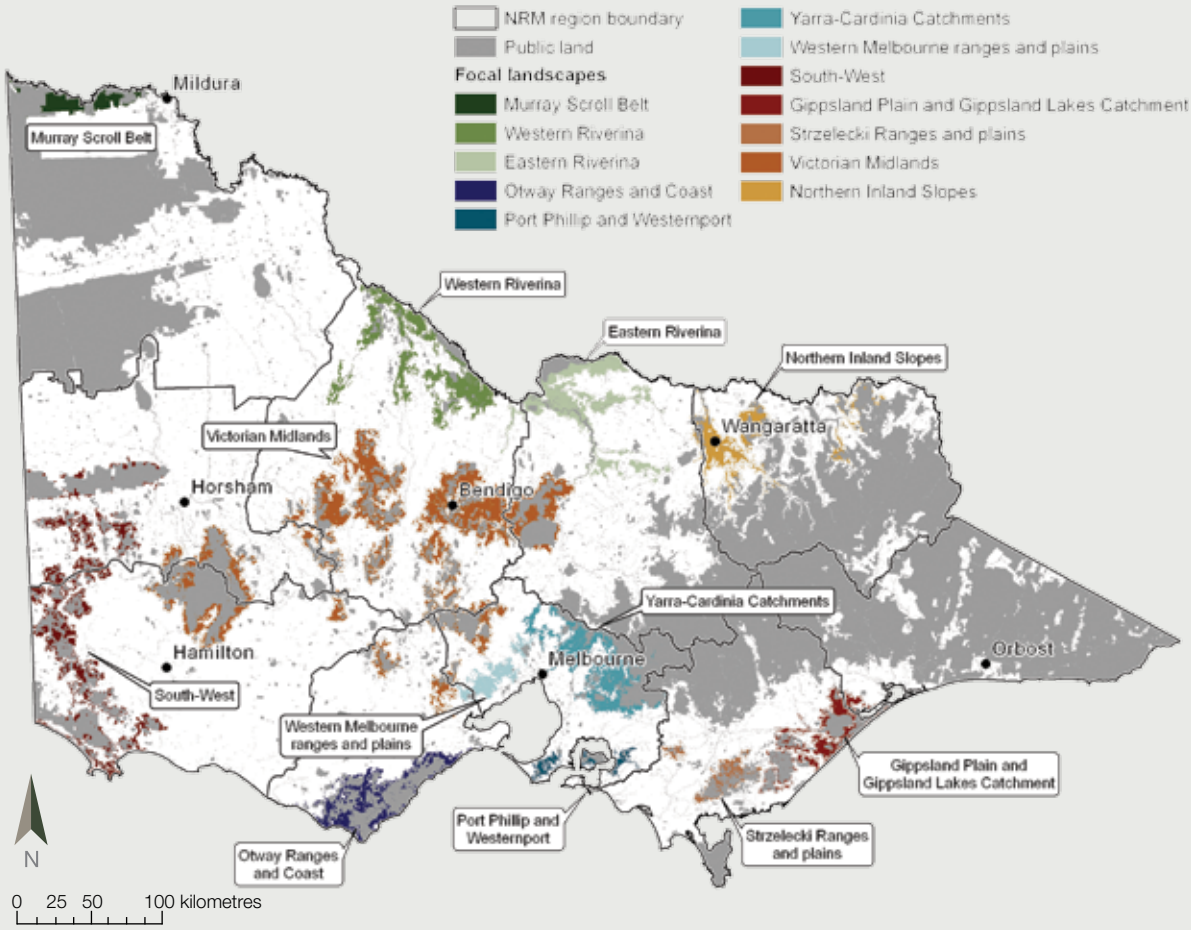

Figure. 1. Location of focal landscapes on private land

In concert with other data, these findings have many implications for Trust for Nature in relation to its future conservation programs on private land. In particular, they indicate that:

- as documented by DSE (2008), net loss of native vegetation is occurring on private land as the current rate of loss is greater than the gain in protected areas or in areas being restored. The Conservation Plan identifies significant opportunities to address this net loss and contribute to the Victorian Government's ongoing commitment to the environment by adding to and enhancing the protected area estate on private land
- despite a long history of systematic land-use planning for public land, Victoria's ecosystems are still poorly represented in protected areas overall
- nearly all of the under-represented ecosystems in Victoria occur on private land such that, across much of the state, protection of habitat on private land will be the main way of increasing the National Reserve System (NRS)
- the identification of 12 focal landscapes for private-land conservation across Victoria establishes a clear framework for setting priorities and developing collaborative projects with partners to complement the strategic planning and projects already undertaken by other NRM organisations
- additional conservation actions will still be need to be undertaken by Trust for Nature in other parts of the state to help protect important biodiversity assets not included in the focal landscapes, in particular aquatic ecosystem assets, smaller patches of under-represented ecosystems and populations of some threatened species, and
- ongoing and stronger relationships with private landowners are critical if the Trust is to increase protection of habitat and threatened species on private land.

A vision for the future

Trust for Nature's 2011–2016 Strategic Plan identified seven strategic directions to guide the organisation's business over the next five years:

1. Implement strategic landscape-wide conservation
2. Build and innovate private-land conservation practice
3. Respond to climate change
4. Intensify the role of partnerships
5. Build private and philanthropic sector investment and commitment to conservation
6. Build and modernise organisational capacity, and
7. Inspire and engage with the community.

The preparation of the Statewide Conservation Plan was recognised as a pivotal action that would provide an over-arching, statewide, scientific framework to inform the Trust's activities in line with the seven strategic directions. The next steps are to use this Conservation Plan to inform the Trust's planning and implementation of conservation programs in every region and across the state. In future, the assessments outlined in the Conservation Plan should be integrated with more detailed analysis of potential risks and opportunities in relation to localities, ecosystems and species. This will help the Trust to further articulate and prioritise its conservation actions.

Trust for Nature's vision is that:

> *Within two decades, protecting native vegetation and wildlife on private land will be recognised and valued as a central part of mainstream Australian environmental practice, just as water and energy conservation is today. There will be a shared expectation and responsibility among communities, landowners and governments that, just as national and state parks are protected, so too significant natural areas on privately owned land should be protected.*

The preparation of the Statewide Conservation Plan is an important step towards making Trust for Nature's vision a reality.

Contents

List of acronyms

BPZ	Biodiversity priority zone
CAR	Comprehensive, Adequate and Representative (reserve system)
CES	Commissioner for Environmental Sustainability
CfoC	Caring for our Country initiative (Australian Government funded initiative)
CMA	Catchment Management Authority
CMN	Conservation Management Network
DPCD	Department of Planning and Community Development
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EVC	Ecological Vegetation Class
FFG Act	*Flora and Fauna Guarantee Act 1988*
IBRA	Interim Biogeographic Regionalisation of Australia
IUCN	International Union for Conservation of Nature
JANIS	Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee
NRM	Natural Resource Management
NRS	National Reserve System
RCS	Regional Catchment Strategy
TfN	Trust for Nature
VEAC	Victorian Environmental Assessment Council
VVP	Victorian Volcanic Plain

Acknowledgements

Preparation of the Statewide Conservation Plan was only possible because of a generous bequest from Dr Marion Wanliss. Trust for Nature acknowledges its deep gratitude for that support.

The Conservation Plan was prepared by a project team consisting of Doug Robinson, Kelly Arbon, Andrew Cox, Lauren Fraser, Jen Grindrod, Richard MacNeill, Raewyn Montgomery, Peter Moulton, Paul Peake and Nathan Wong.

The project team wishes to thank all Trust staff for their support, enthusiasm and patience with regards to the project, and particularly acknowledges the oversight provided by Victoria Marles, Greg Bowers, Andrew Burns, Peter Moulton and Fiona Smith.

The Technical Reference Group made constructive and insightful comments and guidance. The Group was comprised of: Neil Barr, Department of Primary Industries, Social Researcher; Sarah Bekessy, RMIT University, School of Global Studies, Social Science & Planning; Jim Blackney, Trust for Nature, North East Regional Manager; James Fitzsimons, The Nature Conservancy, Director of Conservation; Ascelin Gordon, RMIT University, School of Global Studies, Social Science & Planning; Rod Gowans, Trust for Nature, Trustee; John Morgan, La Trobe University, Department of Botany; Paul Peake, Victorian Environment Assessment Council, Project Manager; Tony Varcoe, Parks Victoria, Manager, Research and Management Effectiveness; Craig Whiteford, Department of Sustainability and Environment, Senior Manager.

Bush Heritage Australia gave important support for the project and facilitated the secondment of Jen Grindrod and Richard MacNeill.

The Victorian Government provided much in-kind support. The Victorian Environmental Assessment Council generously supported the project through allowing a short-term secondment by Paul Peake to help develop the project plan, and through invaluable subsequent assistance and data provision. The Department of Sustainability and Environment (DSE) and the Department of Primary Industries (DPI) provided spatial data and other important information, and we thank particularly Heather Anderson, Fiona Coates, Janet Holmes, Sarina Loo, Kim Lowe, Alicia Lucas, Graeme Newell, David Parkes, Hayley Rokhar, Matt White and Paul Wilson for their assistance. BirdLife Australia staff also provided generous assistance with provision of data and expert advice.

Earlier versions of the Conservation Plan were greatly improved by the constructive editing of Astrid Judge and Tiffany Inglis. Their assistance is greatly appreciated.

Introduction

Of all states and territories in Australia, Victoria is the state where private-land conservation is arguably the most important. Victoria contains the highest proportion of private land (62%) of any state and territory (Bennett 1995). It is also the most highly altered state or territory in terms of ecological health and vegetation loss (NLWRA 2002). Victoria's private land habitat, furthermore, continues to be lost and degraded at an estimated rate of more than 4000 ha per year – a rate of loss that was calculated in 2008 as exceeding the gains being achieved through protection and management (DSE 2008). Increased protection and management of ecosystems and species found on private land is therefore critical to the conservation of Victoria's natural heritage and biodiversity.

As a conservation body with statutory functions relating to the protection of habitats, native plants and animals on private land, Trust for Nature has a critical role to play in biodiversity conservation in Victoria in partnership with private landowners. Since its establishment as a statutory conservation body in 1972 under the *Victorian Conservation Trust Act 1972*, the Trust has permanently protected more than 90 000 ha of native habitat through voluntary conservation covenants with private landowners, land purchase, donations of land, the Revolving Fund and purchase and subsequent transfer of land on behalf of the State Government.

Notable achievements for conservation during its history have included:

- permanent protection of more than 47 000 ha of natural habitat under 1100 conservation covenants in partnership with private landowners
- permanent protection of Neds Corner Station, the largest private property in Victoria
- permanent protection of more than 6000 ha of Plains Grassland in the Victorian Riverina through a mixture of conservation covenants, land purchase and partnership purchases with the Department of Sustainability and Environment (DSE)
- establishment of the first Revolving Fund for conservation properties in Australia
- establishment of the first Conservation Management Network (CMN) in Victoria, on the Gippsland Plains
- establishment of four additional CMNs, in partnership with other organisations, and collaboration in a further six
- protection of significant areas of the internationally recognised Anglesea Heathlands
- purchase of Churchill Island and subsequent transfer to the Crown
- purchase of parts of Greens Bush on the Mornington Peninsula, with subsequent transfer to the Crown, and
- establishment of income tax concessions for covenanted properties, in partnership with other conservation organisations.

Until now, Trust for Nature's conservation program has been guided by its statutory conservation objectives, a regionally structured conservation approach and by policy directions set by governments and Natural Resource Management (NRM) bodies. To improve its effectiveness as a conservation organisation, however, Trust for Nature recognised the need for a clearly defined set of conservation priorities and priority areas at a statewide scale. To do this, the Trust identified the task of developing a Statewide Conservation Plan as a key action in its 2011–2016 Strategic Plan (Trust for Nature 2011).

Recognising there has not been a statewide conservation planning process focussing solely on the protection of ecosystems and species on Victorian private land, the Statewide Conservation Plan (the Conservation Plan) aims to provide a unique, private-land perspective to complement the Regional Catchment Strategies developed in 2012 by each of Victoria's 10 Catchment Management Authorities (CMAs) and the biodiversity planning undertaken by DSE.

For the first time, the Conservation Plan gives Trust for Nature a statewide perspective of the value of private land for conservation of terrestrial ecosystems, aquatic ecosystems and threatened species in Victoria. Given Victoria's high proportion of private land (Bennett 1995) and the increasing recognition of the importance of protected areas on private land for nature conservation (Dudley 2008; Fitzsimons & Wescott 2008a, 2008b; NRMMC 2009; Coffey *et al.* 2011), the preparation of a strategic, statewide conservation plan for private land in Victoria is timely.

How to use this document

Part 1 of this document outlines the context in which the Statewide Conservation Plan for Private Land in Victoria has been prepared. It provides information about Victoria's biodiversity assets and considers them in relation to land tenure. It outlines key threats to biodiversity across the state and it concludes by describing the Trust's role in protecting Victoria's biodiversity.

Part 2 of this document outlines the approach taken to formulate the Conservation Plan. It defines the biodiversity assets to be targeted for conservation on private land, the six conservation objectives developed for the Conservation Plan and the criteria and methods used to analyse data for each objective. More detailed information about the methods is provided in Appendix 2.

Part 3 contains the major findings of the Conservation Plan for each of the conservation objectives. This part of the Conservation Plan outlines:

- the rationale for selecting each conservation objective
- a summary of key findings relating to the data analyses undertaken for each objective
- detailed assessments for each of the assessment criteria developed for each conservation objective, and
- priorities for conservation action on private land for each objective, including, where possible, particular locations where conservation action on private land should be targeted. These priorities are summarised for convenience at the start of each section.

Finally, Part 3 also considers broader principles for setting priorities for conservation action, and outlines the next stages for application of the Conservation Plan.

The appendices referred to in this document can be found on the Trust for Nature website at:
www.trustfornature.org.au

PART 1: The planning context

1.1 Biodiversity and land tenure in Victoria

1.1.1 Overview

Victoria comprises 22.7 million hectares of land. Of this area, approximately 62% (14 million hectares) is privately owned (VEAC 2010) and 15% (3.5 million hectares) is permanently protected in public-land conservation reserves. The remainder is public land but not managed for conservation.

Of Victoria's total land area, 46% (10.5 million hectares) supports native vegetation. Of the 62% of Victoria that is private land, approximately 20% (2.9 million hectares) is mapped as native vegetation. However, only 3% of the native vegetation found on private land is located in what are termed 'largely intact landscapes' (defined as landscapes of 20 000 ha or more of native vegetation with good landscape connectivity and good habitat condition, DSE 2008). The other 97% of private land with native vegetation occurs in 'fragmented landscapes' (i.e. areas of < 20 000 ha of native vegetation and/or degraded native vegetation, DSE 2008). By contrast, only 37% of native vegetation on public land is located in fragmented landscapes and the majority occurs in largely intact landscapes (Table 1, VEAC 2010). Native vegetation conservation and management on private and public land, therefore, requires very different conservation approaches because of the marked differences between native vegetation on the two land tenures in terms of landscape context, surrounding land uses, extent and levels of degradation.

Table 1. Fragmented and largely intact landscapes on public and private land in Victoria, adapted from Tables 3.2 and 4.1, VEAC 2010

	Fragmented landscapes	Largely intact landscapes	Total area
Area of Victoria (ha)	17 832 99	4 866 321	22 698 620
Area of private land in Victoria (ha)	14 045 420	18 535	14 063 955
Current area of native vegetation in Victoria (ha)	5 626 379	4 853 970	10 480 349
Area of native vegetation on public land in Victoria (ha) (and percentage of total)	2 799 460 (36.8%)	4 779 231 (63.2%)	7 578 690 (100%)
Area of native vegetation on private land in Victoria (ha) (and percentage of total)	2 826 919 (96.5%)	74 739 (3.5%)	2 901 659 (100%)
Area of native vegetation in protected areas on public land (ha)	1 057 904	2 438 099	3 496 003
Percentage of native vegetation on private land as proportion of all native vegetation in each landscape	50.2%	1.6%	27.7%

Collectively, Victoria's land and freshwater ecosystems support at least 3300 native species or sub-species of vascular plants; 750 mosses and liverworts; 99 mammals; 499 birds; 48 freshwater and estuarine fish; 136 reptiles; 53 amphibians and an unknown number of invertebrates, fungi and algae (CES 2009; DSE 2007b, 2009b).

There are few statewide data readily available on the relative occurrence of native flora and fauna species on private land versus public land, partly because of the low level of survey effort on private land (OCE 1992; CES 2009). However, an analysis undertaken by VEAC calculated that approximately 40% of land vertebrates are virtually restricted to fragmented landscapes, with another 45% relying on fragmented landscapes across much of their range (VEAC 2011). Fish and wetland birds had an even higher percentage of species reliant on remnant habitat in fragmented landscapes (VEAC 2011).

For native flora, while there are no statewide summaries of their relative occurrence on private land and public land, previous analyses have similarly indicated the significant contribution of private land to the conservation of many threatened species (DCE 1992; OCE 1992; Robinson 1998).

1.1.2 Land tenure and the bioregions

Relative to its land mass, Victoria is very biodiverse. According to the Interim Biogeographic Regionalisation of Australia (IBRA) classification, 14% of Australia's 85 terrestrial bioregions occur in Victoria (Thackway & Cresswell 1995), even though Victoria represents only 3% of Australia's land mass.

The 11 terrestrial IBRA bioregions found in Victoria are the Australian Alps, Flinders, Murray Darling Depression, Narracoorte Coastal Plain, NSW South Western Slopes, Riverina, South East Coastal Plain, South East Corner, South Eastern Highlands, Victorian Midlands and Victorian Volcanic Plain. In addition, five marine bioregions are represented along Victoria's coasts, bays and estuaries (ECC 2000).

Within Victoria, the 11 terrestrial IBRA bioregions are further subdivided into 28 subregions (Figure 2). In the Victorian context, these IBRA subregions are often referred to as 'Victorian bioregions'. However, for the purposes of this Conservation Plan, they are referred to as 'IBRA subregions' or 'subregions'. Brief descriptions of each subregion are provided in Appendix 3.

Of the 28 IBRA subregions, all but one (Wilsons Promontory) contain some private land (Appendix 4).

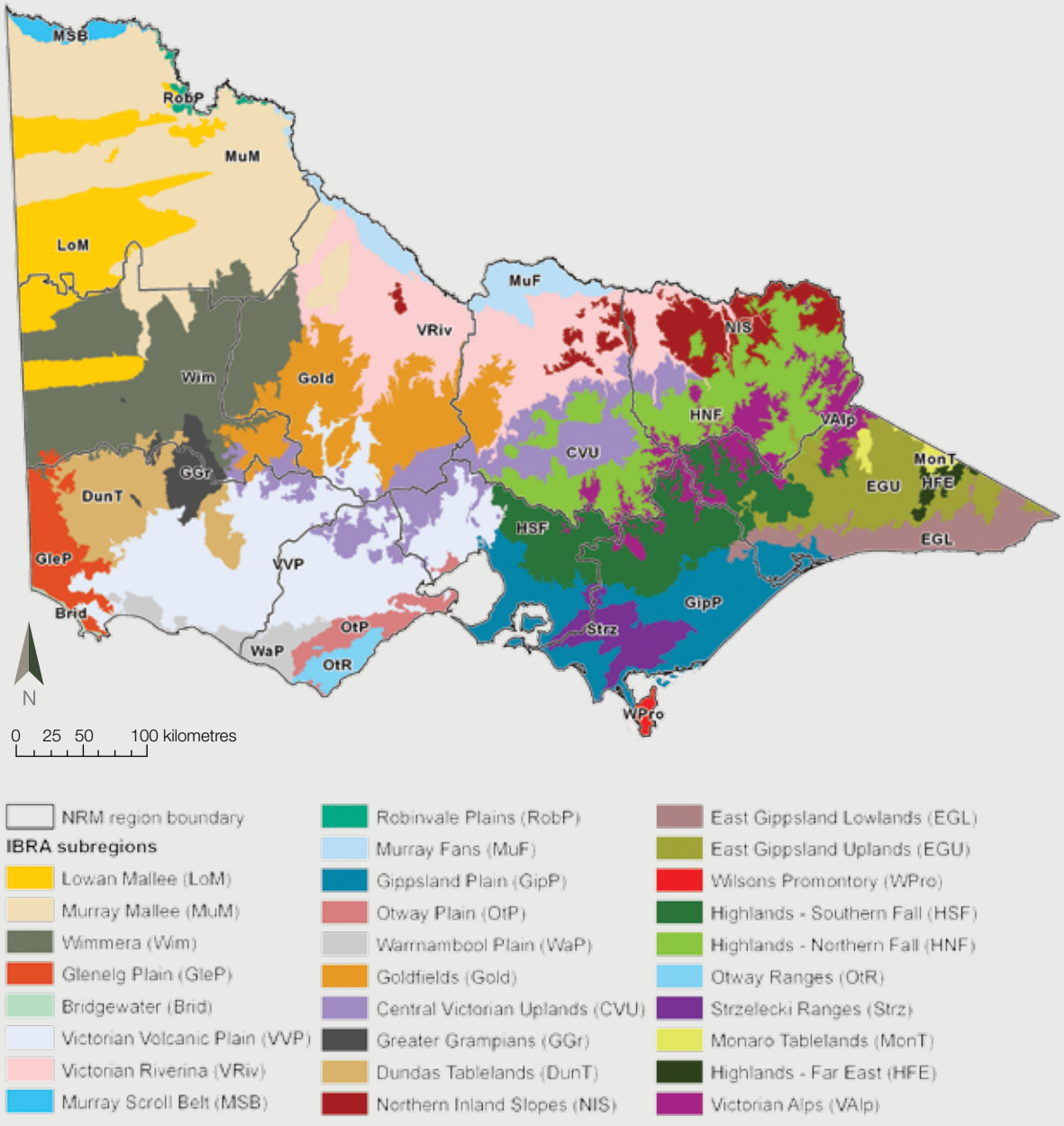

Figure 2. Distribution of Victoria's 28 IBRA subregions

1.1.3 Land tenure and ecosystems

Across the state, nearly 2000 different terrestrial and wetland ecosystems, known as Ecological Vegetation Classes (EVCs), have been identified within the 28 subregions. These 2000 EVCs have been further grouped into 20 larger 'EVC Groups' (DSE 2007) as listed in Figure 4. The estimated occurrence of these EVC Groups prior to 1750 in Australia (defined by DSE as pre-1750), is shown in Figure 3, while their current extent on public and private land is given in Figure 4. Major EVC Groups present on public land comprise Dry Forests, Mallee and Wet/Damp Forests. Major EVC Groups present on private land, based on their extent, comprise Dry Forests, Plains Woodlands, Lower Slopes Woodlands, Riverine Grassy Woodlands and Mallee.

Based on the Department of Sustainability and Environment's (DSEs) classification of the conservation status of EVCs in each IBRA subregion (DSE unpublished data 2008), 75% of the current extent of native vegetation on public land in Victoria is categorised as 'least concern' (Figure 5). By contrast, only 21% of the native vegetation found on private land is classified as 'least concern' – the other 79% is classified as either 'endangered', 'vulnerable' or 'depleted' (Figure 5).

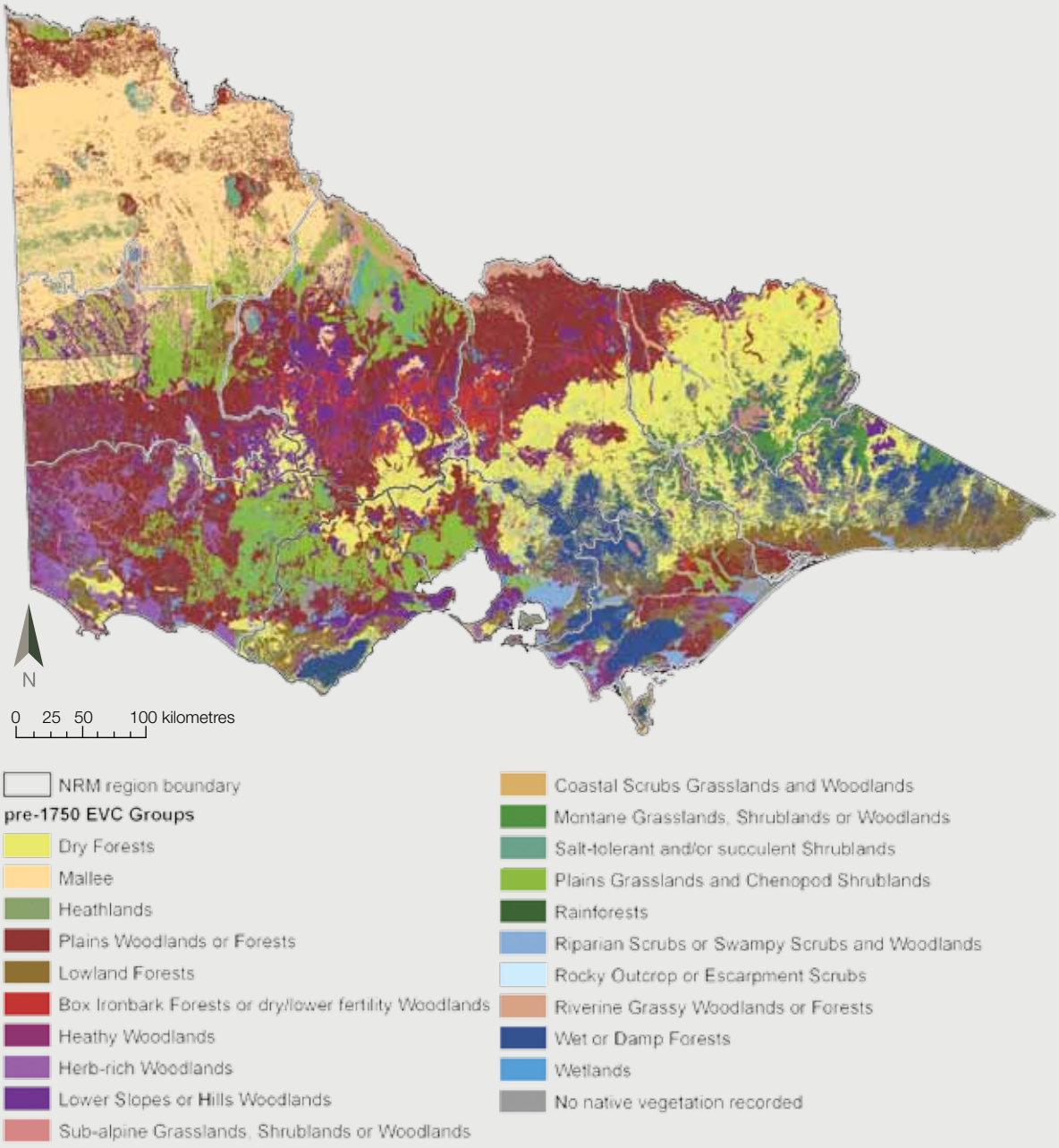

Figure 3. Estimated distribution of Ecological Vegetation Class (EVC) Groups in Victoria prior to 1750

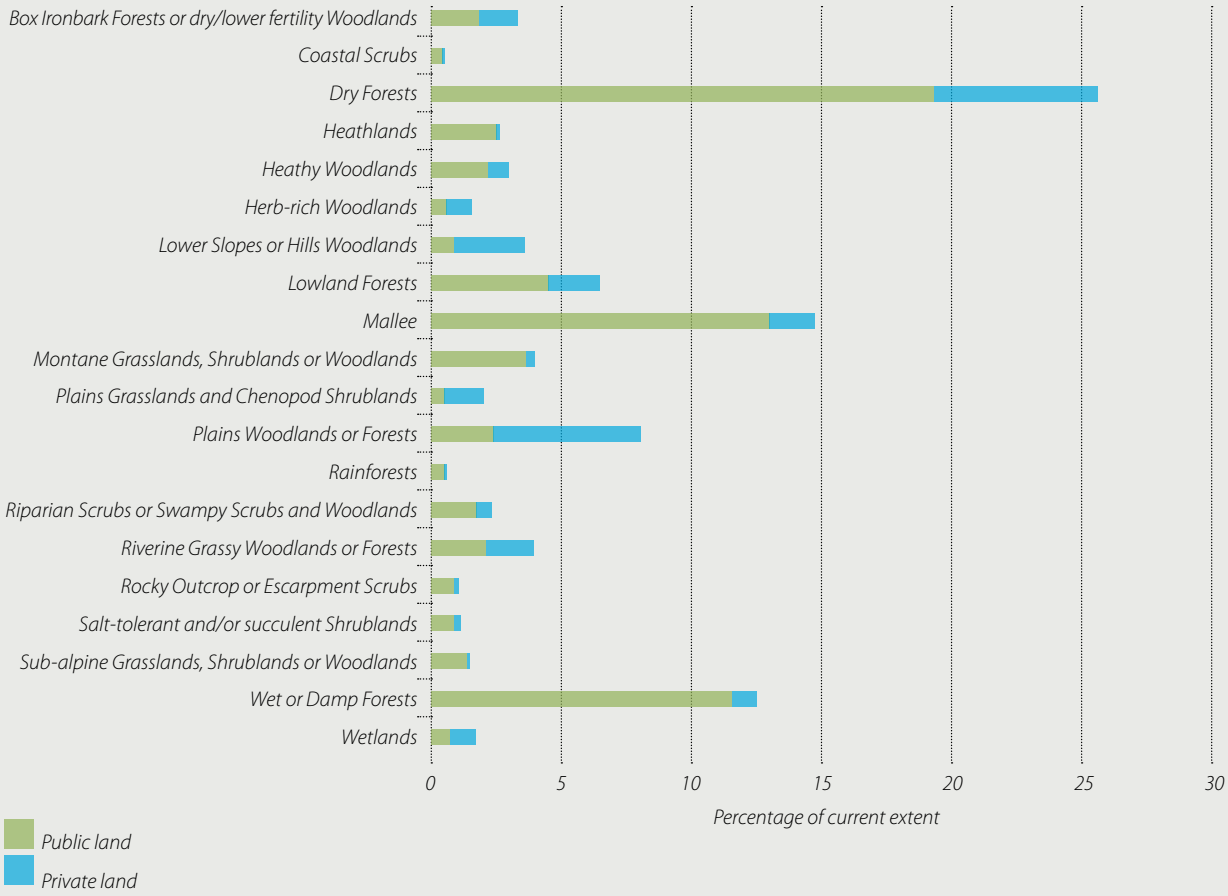

Figure 4. Percentage of the current area of each Ecological Vegetation Class (EVC) Group on public and private land and as a percentage of all EVCs

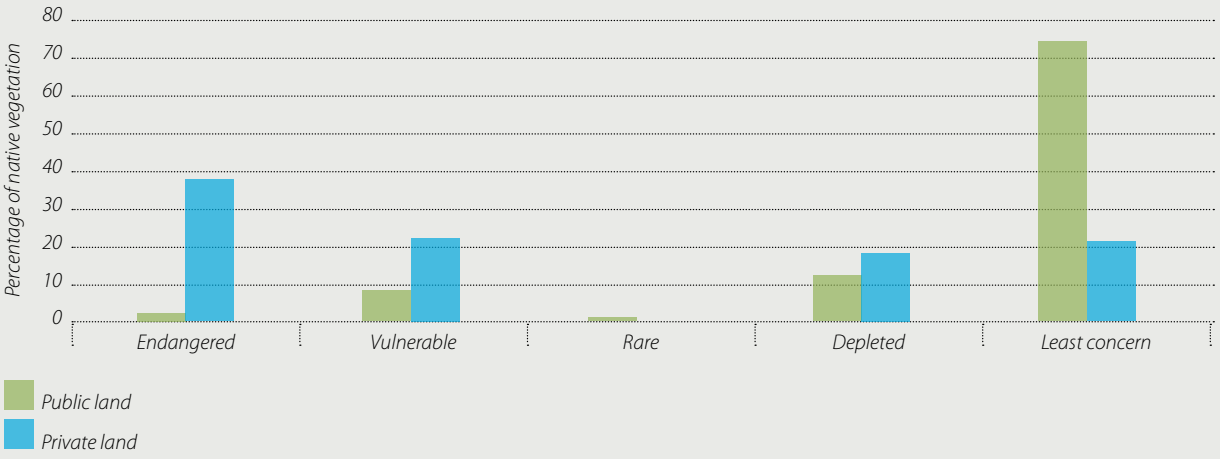

Figure 5. Percentage of native vegetation area in each conservation status category (DSE 2002a) on public land and private land

1.1.4 Catchment Management Authority regions and regional divisions of the Trust

Trust for Nature regions are aligned with the 10 Catchment Management Authority (CMA) regions in Victoria (Figure 6). These regions are broadly delineated in terms of river basins and provide an additional layer of environmental definition at both a statewide and national scale. The CMA regions also provide an important level of planning and implementation for Natural Resource Management (NRM) activities, as both the State and Australian government recognise CMA regions and CMAs as being fundamentally important to the delivery of their NRM programs. Hereafter, the CMA/Trust regions are referred to throughout the Conservation Plan as NRM regions. Table 2 summarises the land tenure and native vegetation characteristics of each of these regions. It also summarises the area of land included in Trust for Nature protected areas in each of the regions.

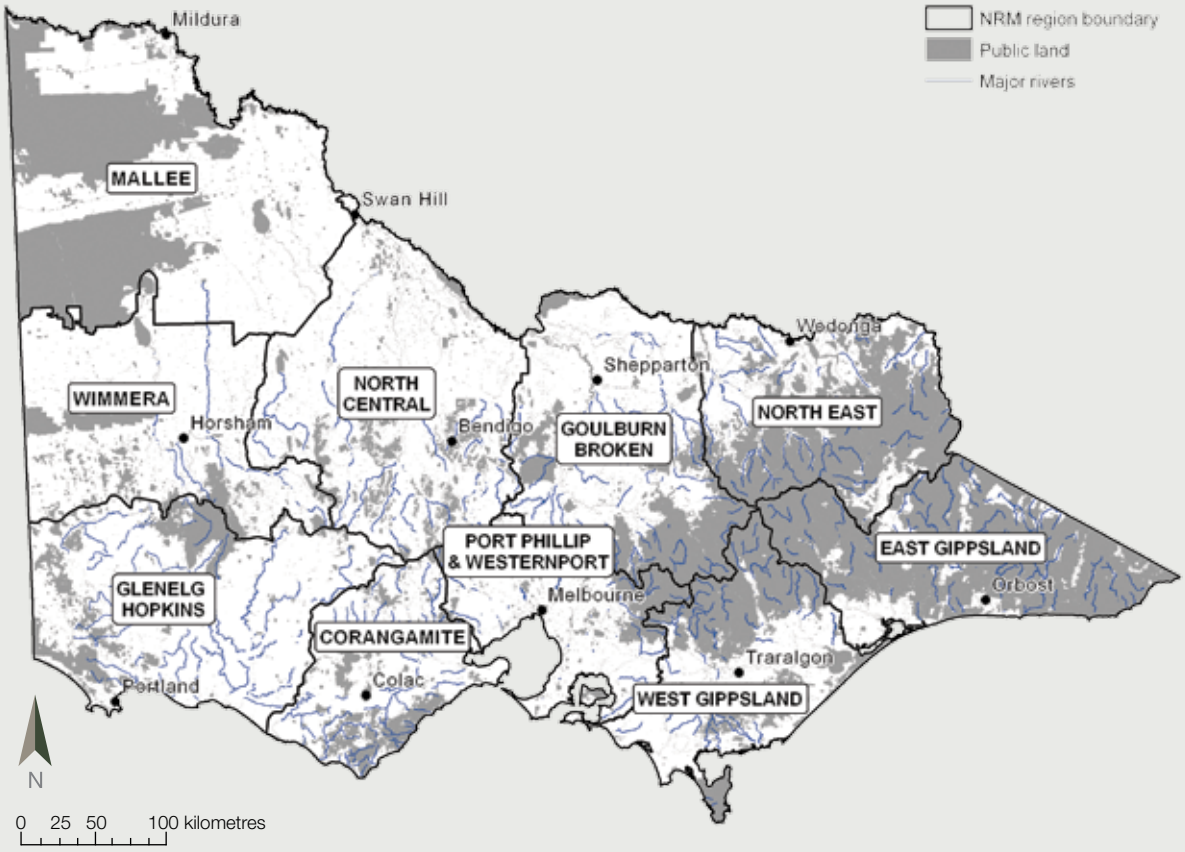

Figure 6. The 10 Natural Resource Management regions in Victoria

Table 2. Land tenure, native vegetation and Trust for Nature protected areas for Victoria's 10 Natural Resource Management (NRM) regions

NRM region	Total area (ha)	Percentage of private land	Percentage of native vegetation	Percentage of private land with native vegetation	Trust for Nature protected area (ha)	
Corangamite	1 334 666	79	27	16	2 451	
East Gippsland	2 081 643	18	87	48	3 929	
Glenelg Hopkins	2 673 094	83	27	16	3 541	
Goulburn Broken	2 407 076	71	45	29	4 890	
Mallee	3 930 693	58	47	11	32 044	
North Central	2 963 502	87	33	23	10 087	
North East	1 978 917	39	75	39	4 296	
Port Phillip & Westernport	1 278 381	77	44	24	3 289	
West Gippsland	1 715 845	54	56	23	4 505	
Wimmera	2 344 685	84	29	18	12 744	
Total	22 708 503				81 776	

1.1.5 Land tenure and the social and economic perspective

Victoria has undergone a large transformation in demography, work patterns and land use over the last 50 years and is continuing to change rapidly (Barr 2005, 2008; DPCD 2009). Changes that are especially significant in the context of rural Victoria and private-land conservation include the following:

- rural land is increasingly being purchased and owned by non-locals. These areas consequently have high land values, resulting in a declining number of land transactions
- rural land within commuting distance of large urban centres is increasingly being subdivided into smaller rural lots and purchased for lifestyle rather than agricultural production (Barr 2009)
- areas remaining in farm production are under increasing pressure to improve productivity (Barr 2009)
- landowners are increasingly purchasing marginal farming land outside amenity areas but in areas of high biodiversity value solely for the benefit of conservation (Barr 2009). Areas that fall into this category include Wedderburn and Little Desert
- in the future, farms are expected to continue to get larger and the number of farm businesses will further shrink (Barr 2009), and
- competition for scarce water in irrigation areas will intensify across Victoria, thereby impacting on the extent of viable irrigation businesses.

Based on all of these changing patterns in land use and demographics, Barr (2008) has classified Victoria into six social landscapes (Figure 7), recognising that some formerly agricultural landscapes are now mostly occupied for amenity reasons or have shifted their agricultural focus (Barr 2009). The six landscapes are named as follows:

- high amenity
- amenity
- production
- transitional
- intensive
- urban, and
- unclassified.

This approach has been further refined by some CMAs. For example, Goulburn Broken CMA has recognised that different landscapes need different conservation approaches; it has accordingly classified its catchments into social-ecological systems and developed different conservation strategies for each (GBCMA 2012).

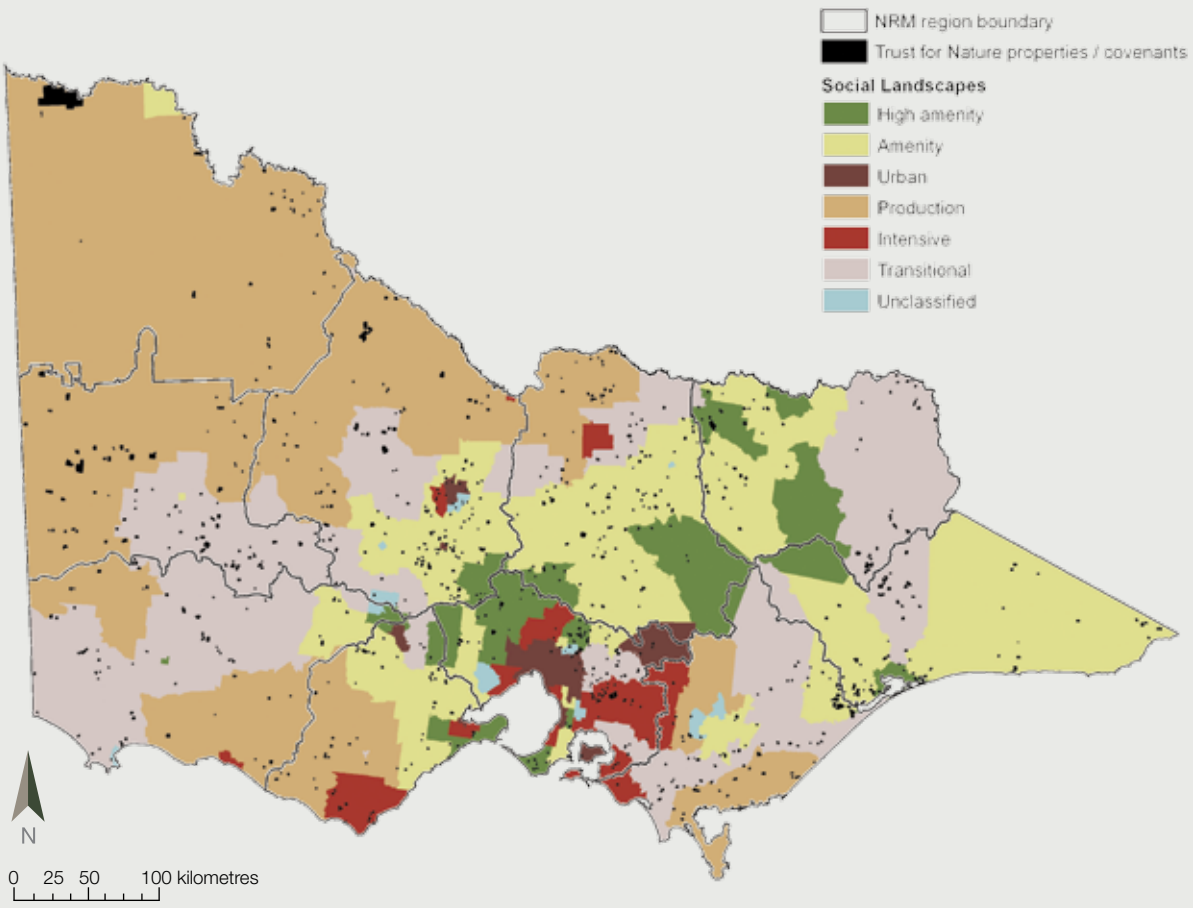

Figure 7. Distribution of Trust for Nature properties and covenants across the social landscapes identified by Barr (2008)

1.2 Current threats to Victoria's biodiversity

1.2.1 Overview

Victoria is mapped as having the highest level of continental landscape stress in Australia (NLWRA 2002). More detailed assessments, furthermore, show the same trends for the state's terrestrial systems, riparian systems, wetlands and estuaries (NLWRA 2002; VCMC 2002; CES 2009; SOEC 2011). Major causes of environmental stress comprise:

- land clearance
- destruction and modification of aquatic ecosystems
- grazing pressure from stock and other herbivores
- cropping and soil cultivation
- irrigated agriculture
- changes to hydrological regimes
- excessive water extraction
- changes to fire regimes
- loss of hollow-bearing trees and logs
- dryland salinity
- population growth
- plant and animal invasions, and
- climate change.

Altogether, forty-two Potentially Threatening Processes (PTPs) affecting Victoria's biodiversity are listed under the *Flora and Fauna Guarantee Act 1988*. They include a wide range of potential threats to biodiversity on private land, notably:

- degradation of native riparian vegetation along rivers and streams
- habitat fragmentation as a threatening process for fauna
- inappropriate fire regimes causing disruption to sustainable ecosystem processes and resultant loss of biodiversity
- increase in sediment input into rivers and streams due to human activities
- loss of coarse woody debris from native forests and woodlands
- infection of amphibians with Chytrid Fungus, resulting in chytridiomycosis
- reduction in biodiversity resulting from Noisy Miner *(Manorina melanocephala)* populations
- loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases, and
- wetland loss and degradation as a result of change in water regime, dredging, draining, filling and grazing.

1.2.2 Land clearance

Victoria represents the most highly cleared state in Australia with approximately half of its former extent of native vegetation cleared for agriculture, mining and urban development since 1750 (CES 2009, Figure 8). Across the 14 million hectares of private land (two-thirds of Victoria), 80% of the former extent of native vegetation has been removed (CES 2009), particularly grasslands, chenopod shrublands, grassy woodlands, riverine woodlands and wetlands (Figure 9). As a consequence of this extensive habitat loss, most native vegetation on private land is classified by the state government as either endangered, vulnerable, rare or depleted (see Figure 5).

While broad-scale removal of native vegetation is now regulated, approximately 1200 ha of native woody vegetation and 3200 ha of grassland vegetation continues to be removed in Victoria every year, principally in threatened woodland and grassland ecosystems (DSE 2008; CES 2009). Incremental clearing of particular vegetation communities such as the nationally threatened Buloke Woodlands Community and *Flora and Fauna Guarantee Act 1988* listed Northern Plains Grasslands Community is also having significant impacts on habitat and threatened species dynamics at regional scales (Maron & Fitzsimons 2007; Marshall & Fitzsimons 2008).

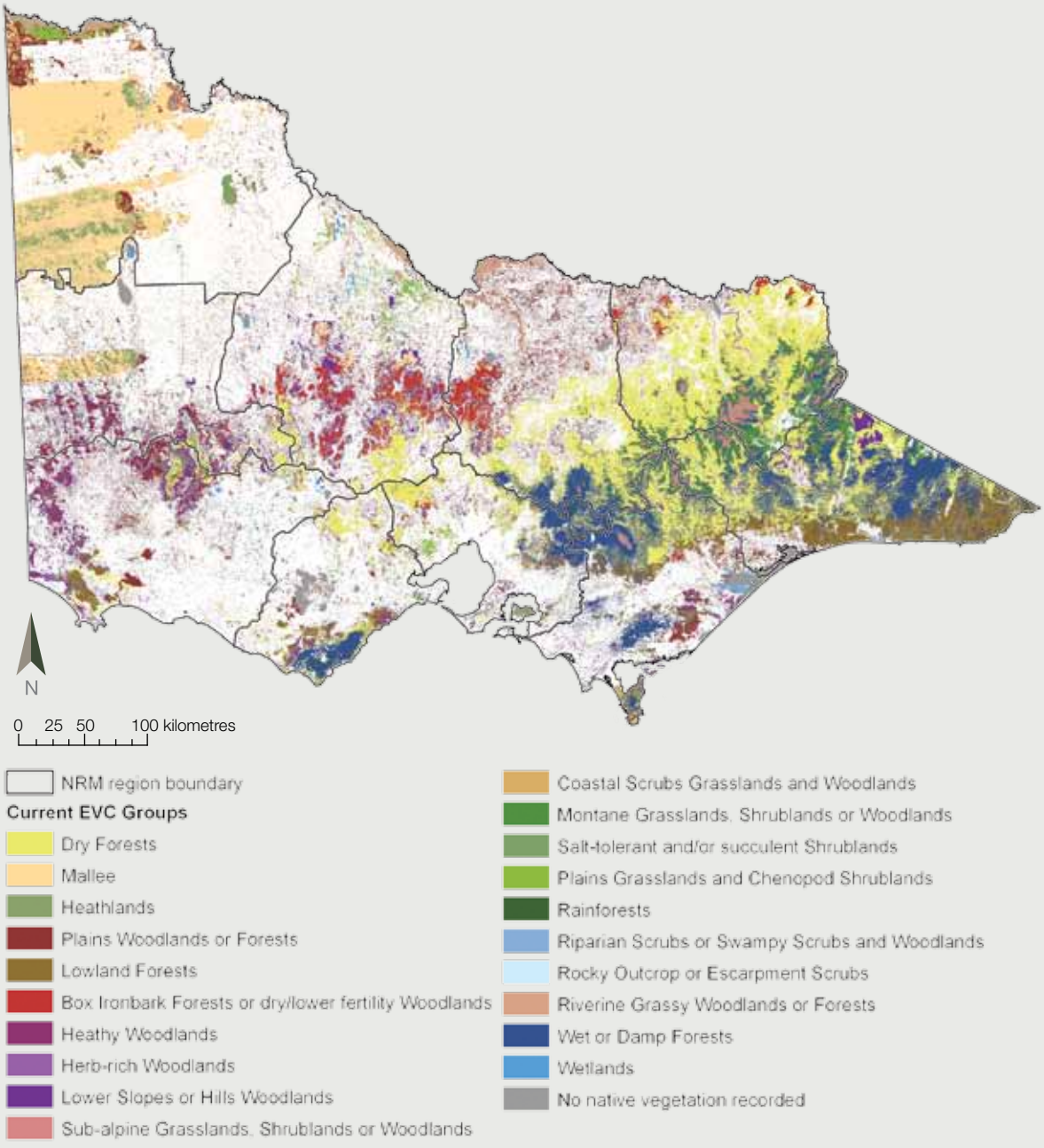

Figure 8. Current distribution of Ecological Vegetation Class (EVC) Groups in Victoria. White areas show cleared land from which native vegetation has been removed

This incremental loss of native vegetation on private land is likely to continue as new land uses develop and new technologies emerge. As has been shown repeatedly over the past 150 years, native vegetation clearance occurs in response to urban development, and development of agriculture and mining (OCE 1992; Muir *et al.* 1995; Maron & Fitzsimons 2007; CES 2009).

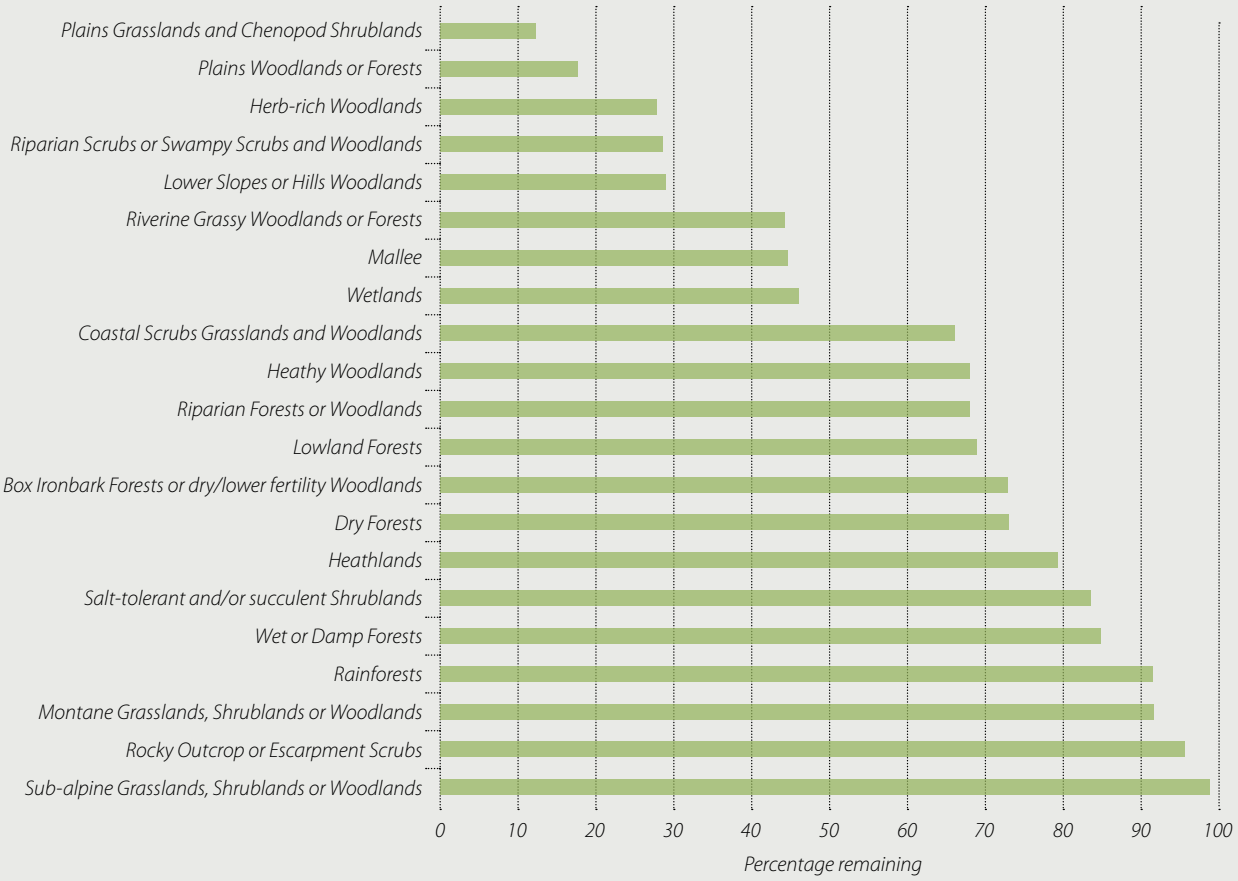

Figure 9. Percentage of pre-1750 extent of each Ecological Vegetation Group (EVC) Group remaining in Victoria

1.2.3 Degradation of aquatic ecosystems

Thirty-seven percent of Victoria's pre-1750 wetlands have been destroyed and an additional 30% have been degraded (NRE 1997), primarily as a result of drainage for agriculture, water diversions upstream, urban development, cultivation and conversion to dams. Ninety percent of this loss has been on private land, particularly in south-west Victoria and the northern Victorian irrigation regions (NRE 1997). These losses have been most substantial for those wetland types most accessible to agriculture, notably Freshwater Meadows and Shallow Freshwater Marshes (NRE 1997).

Waterways have likewise been highly modified, particularly through stock-grazing, vegetation removal and water extraction, and nearly 80% of waterways in Victoria are estimated to be in poor or moderate condition (DSE 2005). In predominantly agricultural regions, no catchments are in good condition (VCMC 2002).

The decline in health of wetlands and waterways is especially significant because these ecosystems not only support a distinct suite of aquatic or riparian plants and animals (Tzaros 2001) but they also play much broader roles in terms of maintaining and supporting ecological processes and biodiversity in terrestrial ecosystems and at a landscape and catchment scale (Bennett *et al* 2009; Thomson *et al.* 2009), roles which will be ever more crucial in the context of climate change (e.g. Mac Nally *et al.* 2009).

1.2.4 Species extinctions

Since 1750 there has been a significant loss of native species of plants and animals in Victoria. Of all the species recorded in Victoria since 1750, 44% of plants and more than 30% of animals are either extinct or threatened, with at least 49 species of vascular plant and 24 animal species considered to have become extinct (CES 2009; DSE 2010).

At the regional and local scale, extinctions and declines have been even more widespread, particularly in the more highly cleared bioregions and in grasslands and woodlands (Robinson 1991; OCE 1992; CES 2009). For woodland birds across Victoria, for example, there have been many regional extinctions, leading to decreases in many species' overall range and abundance (Robinson 1993, 1994; Lunt & Bennett 2000). Across the state, 15% of native mammals have disappeared (DSE data 2007), especially from the highly cleared Riverina and Victorian Volcanic Plains bioregions (OCE 1992).

1.2.5 Habitat fragmentation

As a consequence of extensive habitat loss in Victoria, nearly 80% of Victoria is now classified as consisting of 'fragmented landscapes' (Table 1). The ecological consequences of habitat fragmentation include a:

- decrease in the number of species
- loss of species
- change in species composition
- decrease in population size of the flora and fauna species found in the remnants
- impact on breeding success and survival, and
- disruption of ecological processes, including pollination, seed dispersal and water flow (Saunders *et al.* 1991; Bennett 1999; Bennett *et al.* 2009).

1.2.6 Plant and animal invasions

Pest plants and animals are a major threat to Victoria's natural environment as well as its agricultural economy. This includes both established pest species and new or potential invasive species that have the capacity to further degrade terrestrial, aquatic and marine ecosystems (Dunlop & Brown 2008; DPI 2010).

Predation by introduced animals is ranked as the second most important threat to threatened fauna, while environmental weed invasion is ranked as the most significant process affecting threatened native plants (CES 2009). Altogether, exotic plant species now represent about 30% of the Victorian flora, with 1282 species considered naturalised, and a further 214 species considered to be in the process of becoming naturalised (CES 2009).

The various impacts of introduced pest animals and weeds on Victoria's biodiversity are formally acknowledged and described through the *Flora and Fauna Guarantee Act 1988*. They include:

- introduction and spread of Spartina in Victorian estuarine environments
- introduction of live fish into waters outside their natural range within a Victorian river catchment after 1770
- invasion of native vegetation by Blackberry *(Rubus fruticosus L. agg.)*
- invasion of native vegetation by 'environmental weeds'
- invasion of native vegetation communities by Tall Wheat-grass *(Lophopyrum ponticum)*
- loss of biodiversity in native ant populations and potential ecosystem integrity following invasion by Argentine Ants *(Linepithema humile)*
- predation of native wildlife by the Cat *(Felis catus)*
- predation of native wildlife by the introduced Red Fox *(Vulpes vulpes)*
- reduction in biodiversity of native vegetation by Sambar *(Cervus unicolor)*
- reduction in biomass and biodiversity of native vegetation through grazing by the Rabbit *(Oryctolagus cuniculus)*
- the introduction and spread of the Large Earth Bumblebee *(Bombus terrestris)* into Victorian terrestrial environments
- spread of the plant *Pittosporum undulatum* in areas outside its natural distribution, and
- threats to native flora and fauna arising from the feral honeybee *(Apis mellifera)* nesting in hollows and using other floral resources.

Eight other impacts, listed as 'key threatening processes' under the *Environment Protection and Biodiversity Conservation Act 1999* are also relevant to pest plant and animal invasions in Victoria, including:

- competition and land degradation caused by unmanaged goats
- dieback caused by the root-rot fungus *(Phytophthora cinnamomi)*
- predation, habitat degradation, competition and disease transmission caused by feral pigs, and
- loss and degradation of native plant and animal habitat caused by invasion of escaped garden plants, including aquatic plants.

Apart from the impact of invasive introduced species on native plants and animals, an emerging management issue for conservation practitioners is the impact of invasive native species on biodiversity. Causes for concern in Victoria include:

- impacts of over-abundant macropod populations on native vegetation structure and composition (National Parks Service 1990)
- impacts of the Bell Miner *(Manorina melanophrys*), Noisy Miner *(Manorina melanocephala)* and Pied Currawong *(Strepera graculina)* on native bird communities (Loyn *et al.* 1983; Loyn 1987; Grey *et al.* 1997, 1998; Fulton & Ford 2001; Parsons *et al.* 2006)
- invasion of coastal heathlands and scrubs by Coastal Tea-tree *(Leptospermum laevigatum)* (Bennett 1994), and
- invasion of eucalypt forests by Sweet Pittosporum *(Pittosporum undulatum)*.

1.2.7 Population growth

Victoria's population is continuing to grow. It is expected to increase from 5.6 million to 6.9 million by 2031 (DPCD 2012). In this period, the regional population is projected to grow to 2 million. Areas expected to experience the most rapid growth include areas near Melbourne, major regional cities and their hinterlands, and areas with significant coastal or aquatic amenity values (DPCD 2012).

Increasing urban and peri-urban expansion around Melbourne and around regional centres is having major effects on biodiversity in the Port Phillip & Westernport and Corangamite regions and all along the coast (CES 2009; DPCD 2012). These impacts will become more severe as urbanisation and peri-urban development continue.

1.2.8 Climate change

Climate change is having major impacts on biodiversity in Victoria, and this will continue into the future. Predicted effects of climate change in Victoria include more days over 35°C, less annual rainfall, fewer frosts, more days of extreme fire danger and more extreme floods and droughts. These changes are already being shown or are predicted to impact on biodiversity through reduced water flows in rivers and wetlands, reduced groundwater recharge, increases in weeds and pest animals, and increases in fire intensity and frequency (http://www.climatechange.vic.gov.au).

A major study examining the implications of climate change for the National Reserve System has described the magnitude of environmental change predicted under continuing climate change. The composition of plant species in vegetation communities may change by more than 50% by 2070. Major structural shifts in vegetation are also predicted to occur over the same time period, with a move from woodlands to open woodlands, mallee to chenopod shrublands and tall open forests to open forests (Dunlop *et al.* 2012a). The synthesis also highlights how climate change will exacerbate the current impacts of habitat fragmentation, habitat degradation, inappropriate fire regimes, extreme climatic events and invasive species on existing ecosystems, plants and animals by increasing the overall level of environmental stress (e.g. reduced moisture availability leading to reduced food resources and decreased populations (Mac Nally *et al.* 2009).

At the ecosystem scale, climate change is already affecting or is predicted to affect most animal and plant communities by altering the availability of moisture, food resources and suitable habitat (Brereton *et al.* 1995; Olsen & Weston 2004; Chambers *et al.* 2005; Dunlop *et al.* 2012a). In turn, these changes are considered to be the driving cause of declines in the abundance of some fauna groups because of, for instance: loss of suitable habitat and subsequent contractions in range or population size; increased mortality as a result of loss of food; reduced productivity because of food shortages; or increased competition for resources by some species expanding their range in response to changed climatic conditions (Olsen & Weston 2004; Chambers *et al.* 2005; Mac Nally *et al.* 2009).

Recommended conservation management directions in the context of climate change comprise:

- ongoing habitat protection and expansion of the National Reserve System
- protection of ecological refugia (that is, areas that are likely to retain habitat and climatic conditions suitable for a species whose range is predicted to contract in the context of climate change)
- increased focus on pest plant and animal management, especially new and emerging species, and
- appropriate fire management and/or prevention (Dunlop & Brown 2008).

1.3 Trust for Nature in Victoria

1.3.1 Aims and activities of the Trust

Since 1972, the Trust has permanently protected more than 90 000 ha of private land habitat in Victoria. The primary mechanisms used to achieve its objective include:

- conservation covenants
- land acquisition: including land purchase with government support, land donations and land purchase with support from community appeals (e.g. Anglesea Heathlands, Mt Elephant)
- Revolving Fund: the purchase of land using the Trust's Revolving Fund, with the purchased land then protected with a conservation covenant and resold to conservation-minded landowners
- eco-markets: brokering financial incentives for offset agreements to permanently protect native vegetation and/or threatened species/communities
- stewardship program: ongoing assistance to landowners with a conservation covenant to manage their properties for conservation
- conservation partnerships: participation in conservation partnerships and the facilitation of conservation management networks with the aim of increasing the extent of permanently protected areas on private land in strategic landscapes, and
- policy development and technical assistance (Todd 1997; Whelan 1997; Edwards & Traill 2002; Cowell & Williams 2007).

1.3.2 The Trust's protection of private land

Most private land protected by the Trust either directly, through ownership of conservation properties, or in partnership with landowners entering into voluntary covenants on part of their land, is formally recognised as part of Australia's protected areas system (Fitzsimons 2006). These protected areas contribute to both the National Reserve System (NRS) and the global network of protected areas as defined by the International Union for Conservation of Nature (IUCN) (Commonwealth of Australia 1999; Fitzsimons 2006; Dudley 2008; NRMMC 2009). This recognition of the Trust's covenants and properties as part of the NRS distinguishes the Trust's conservation work from most other forms of on-title conservation agreements administered in Victoria (Fitzsimons 2006). It increases the value of Trust covenants and properties as mechanisms for delivering and maintaining conservation outcomes on private land working together with willing landowners. The only other recognised category of on-title agreement that contributes to the NRS in Victoria is Indigenous Protected Areas. Indigenous Protected Areas are currently recognised on five properties measuring a total of 3900 ha in the south-west of the state.

The contribution of the Trust's covenanting and land ownership programs towards the NRS is especially significant in the Victorian context, because two-thirds of the land in Victoria is privately owned and most of that private land is cleared. There are consequently few opportunities for increasing protected areas, simply by changing the tenure of existing public land (NRMMC 2009; Coffey *et al.* 2011). Increasing the NRS through permanent protection programs on private land in concert with private landowners is therefore a key conservation tool in Victoria.

At June 2012, the Trust had in place 1110 registered conservation covenants over 47 012 ha of private land. It also owned and managed 46 conservation properties (Figure 10) covering 36 162 ha (Table 3). Over the lifetime of the covenanting program, the Trust has registered on average about 43 conservation covenants each year, totalling approximately 1900 ha. As shown in Figure 11, the Trust's contribution towards protection of areas on private land has also increased steadily in the last decade highlighting the significance of the Trust's contribution towards increasing the NRS on private land.

Table 3. Summary of Trust for Nature's conservation outcomes through its permanent protection tools, from 1972 to June 2012

Conservation tool	Number of properties	Area permanently protected (ha)
Conservation covenants*	1 189	50 860
Land purchase of conservation properties	46	36 162
Revolving Fund purchases	5	1 188
Land transfers to Crown	65	6 745
Total	1 305	93 885

** Includes 33 Revolving Fund properties (4 233 ha)*

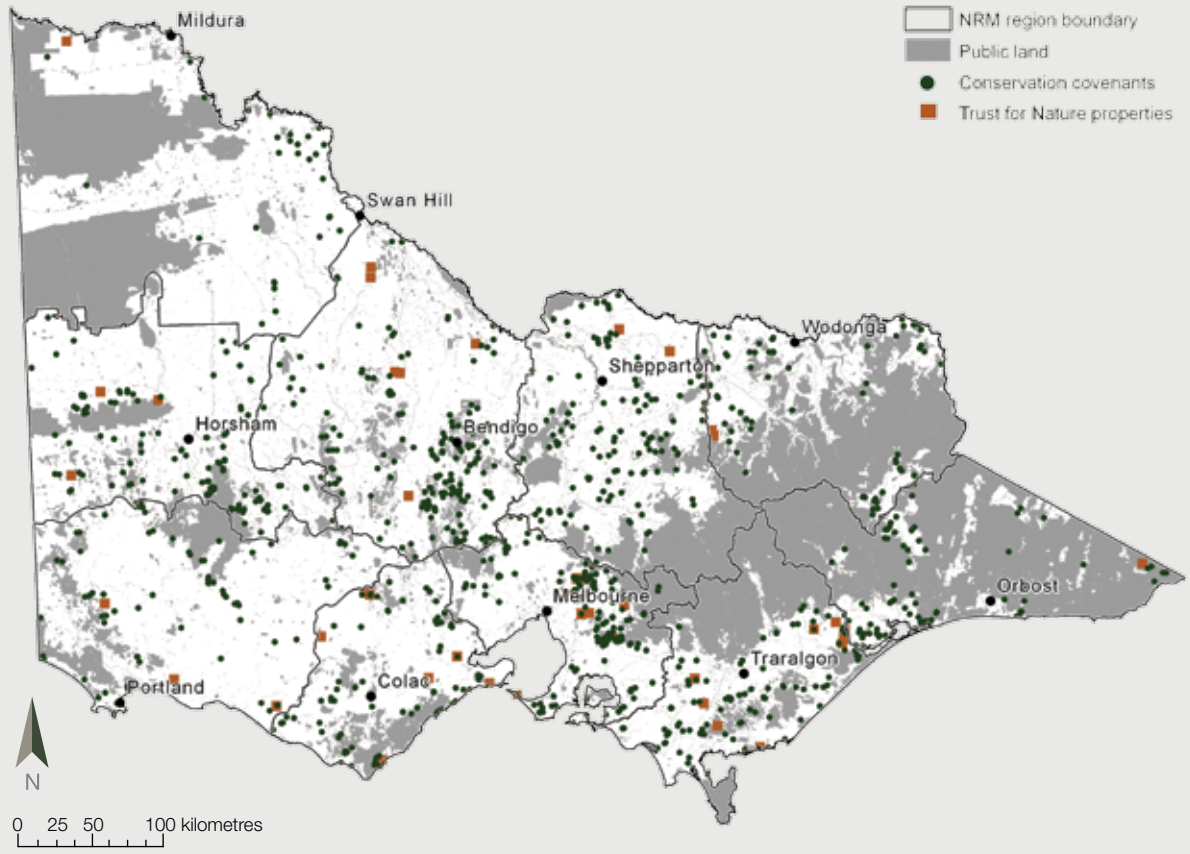

Figure 10. Distribution of Trust for Nature covenants and conservation properties as at 30 June 2012

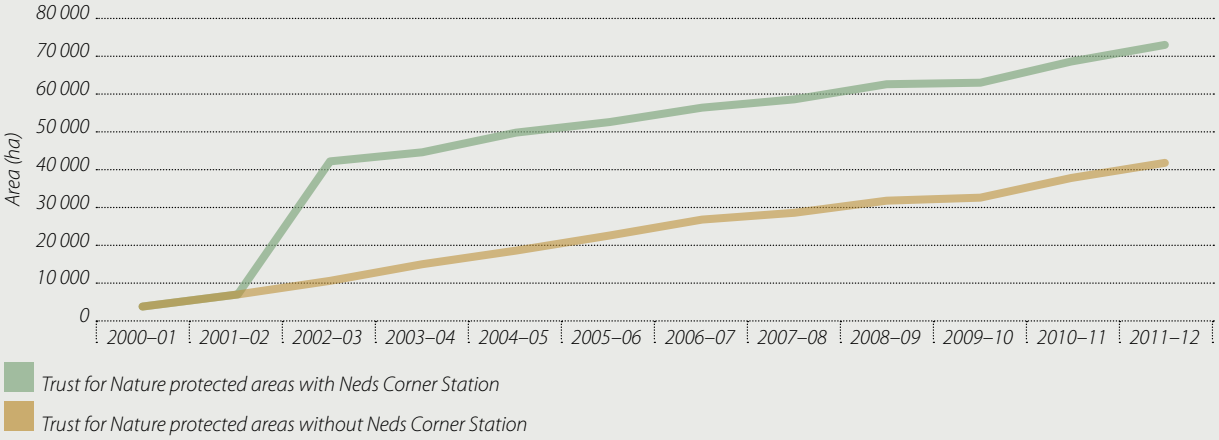

Figure 11. Cumulative growth of protected areas on private land in Victoria, between 2000–2012, through Trust for Nature's protection programs (with and without the purchase of Neds Corner Station - a 30 000 ha property in the Mallee)

1.3.3 Trust for Nature's work in a social landscape context

Trust for Nature's covenants and properties occur across all of Victoria's six social landscapes (Figures 12 and 13), with the majority of the Trust's protected area located in production landscapes (notably due to the contribution of two properties: Neds Corner Station and Wanderers Plain). Even when only covenanted land is considered, the highest percentage of covenanted land is also in production landscapes (Figure 12). The number of covenants in production landscapes has continued to increase over the past 10 years (Figure 13) as has the proportion of covenants in amenity and transitional landscapes. By contrast, the proportion of covenants in urban and intensive landscapes has decreased (Figure 13).

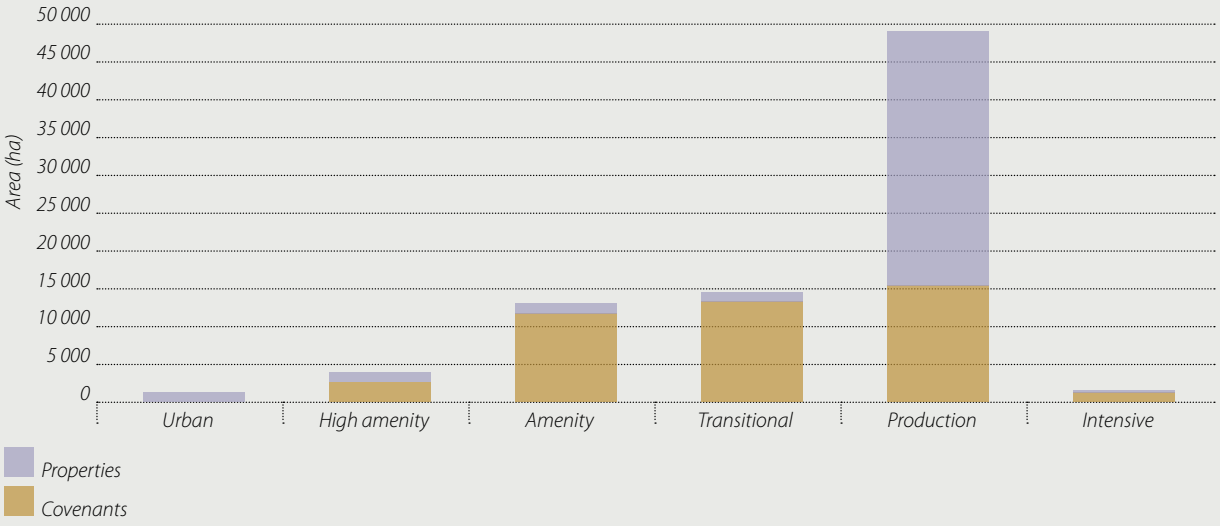

Figure 12. Area of covenants and conservation properties in each social landscape

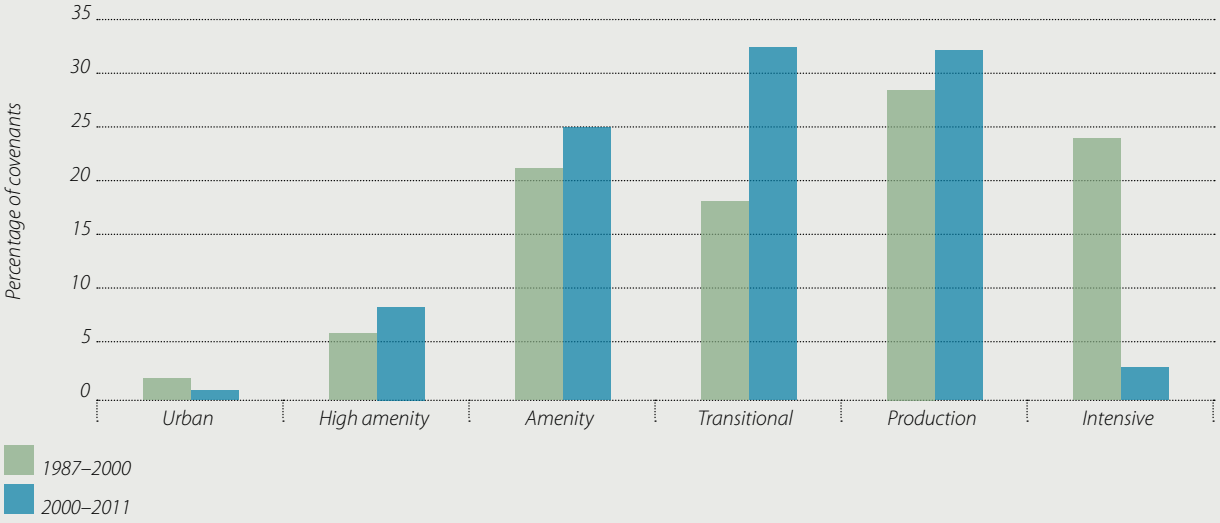

Figure 13. Percentage of covenants in different social landscapes over time

1.3.4 Trust for Nature's work in a bioregional context

The Trust's own properties and private land protected under conservation covenants include representation of 10 of the 11 IBRA bioregions and 26 of Victoria's 28 IBRA subregions (Figure 14). Overall, the Trust has protected more than 2500 ha in eight subregions, and more than 2000 ha protected by covenants in nine subregions (Figure 14; Appendix 4).

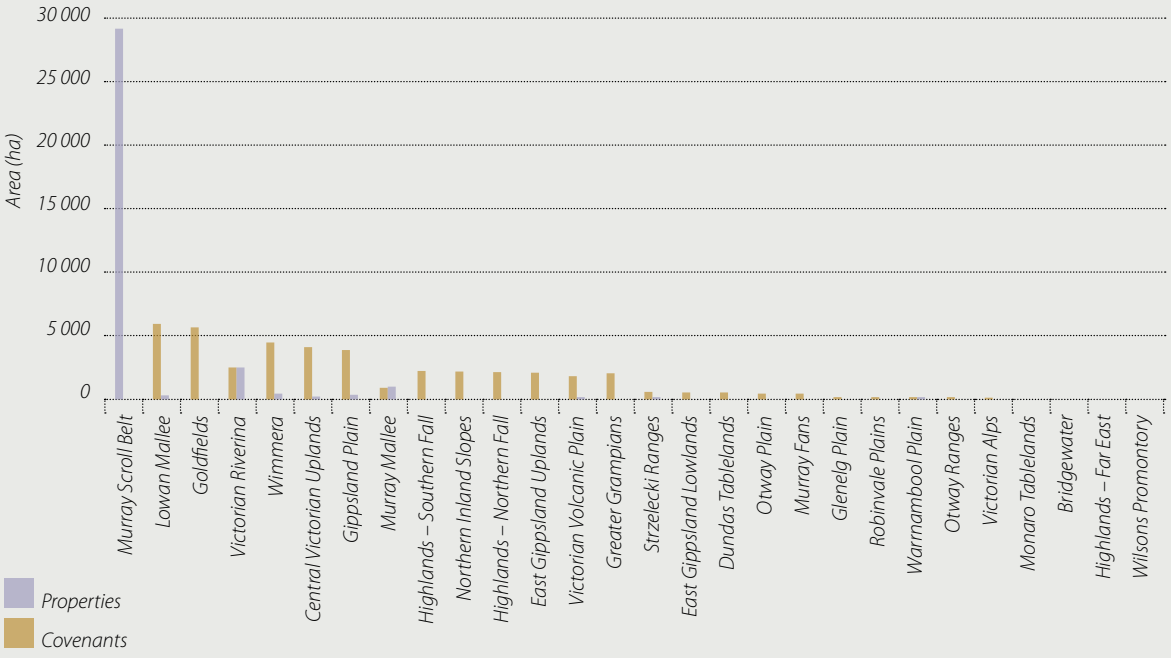

Figure 14. The area of land protected by Trust for Nature in each IBRA subregion through its covenants and conservation properties

The pattern of bioregional conservation has changed over time (Figure 15), largely due to the Trust's increased focus on under-represented bioregions and ecosystems for targeted conservation (Todd 1997), in accordance with internal policy reviews, external policy directions and investment criteria from the Australian Government, Victorian Government and CMAs. For example, the nationally under-represented Riverina and NSW South Western Slopes IBRA regions initially comprised a very small proportion of the Trust's covenanting efforts (Fitzsimons & Wescott 2001). Since 2000, however, the proportion of these bioregions protected as a part of the Trust's covenanting program has substantially increased (Figure 15).

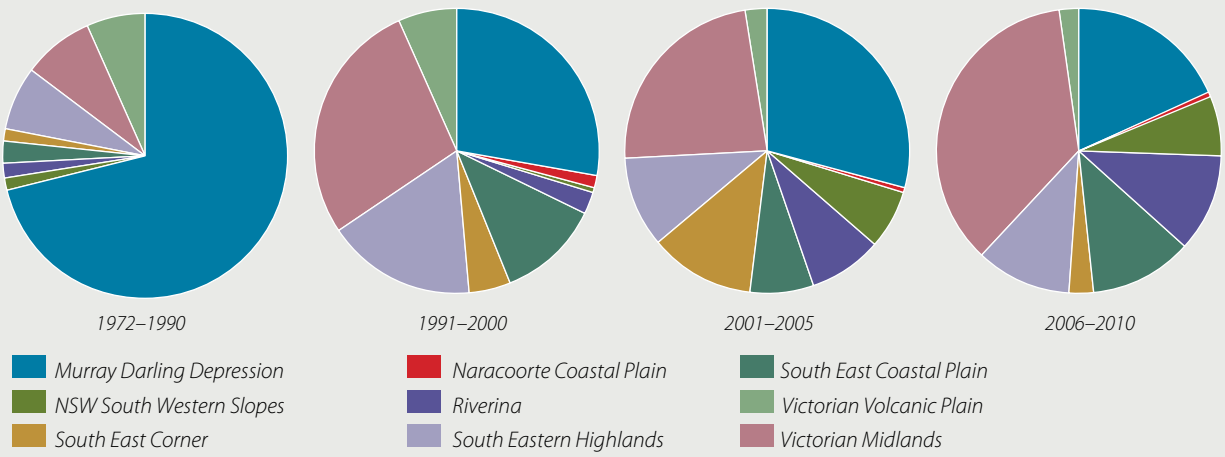

Figure 15. Changes in cumulative covenant distribution in each bioregion in each time period

1.3.5. Trust for Nature's work in an ecosystem context

Table 4 summarises the current extent and proportions of Victoria's broad ecosystem groups (Ecological Vegetation Class Groups) on private land and on Trust for Nature covenants and properties. Of the 20 EVC Groups, all have some representation on Trust for Nature land, with the most extensive being Plains Grasslands/Chenopod Shrublands (principally due to the protection of extensive Chenopod Shrublands at Neds Corner Station); Dry Forests; Plains Woodlands/Forests; Riverine Grassy Woodlands/Forests; Mallee; and Lower Slopes/Hills Woodlands.

Table 4. Current area and percentage of Ecological Vegetation Class (EVC) Groups on private land and Trust for Nature protected areas

EVC Group	Area on private land (ha)	Percentage of all private land vegetation	Area on Trust for Nature protected areas (ha)	Percentage of all Trust for Nature protected areas	Percentage of all covenanted land
Box Ironbark Forests or dry/ lower fertility Forests	148 086	5	2 761	3.9	7.1
Coastal Scrubs Grasslands and Woodlands	9 966	0	112	0.2	0.3
Dry Forests	682 158	22	8 556	12.2	20.7
Heathlands	17 514	1	1 911	2.7	4.3
Heathy Woodlands	92 580	3	3 051	4.3	7.3
Herb-rich Woodlands	112 099	4	1 369	1.9	3.0
Lower Slopes or Hills Woodlands	319 466	10	3 454	4.9	8.6
Lowland Forests	135 718	4	2 798	4.0	5.9
Mallee	217 155	7	5 641	8.0	13.1
Montane Grasslands, Shrublands or Woodlands	43 131	1	1 020	1.5	2.6
Plains Grasslands and Chenopod Shrublands	201 794	6	20 531	29.2	1.9
Plains Woodlands or Forests	607 455	20	9 787	13.9	10.6
Rainforests	3 222	0	113	0.2	0.3
Riparian Scrubs or Swampy Scrubs and Woodlands	91 870	3	1 514	2.2	3.1
Riverine Grassy Woodlands or Forests	197 325	6	4 470	6.4	4.7
Rocky Outcrop or Escarpment Scrubs	3 462	0	98	0.1	0.3
Salt-tolerant and/or succulent Shrublands	16 837	1	221	0.3	0.6
Sub-alpine Grasslands, Shrublands or Woodlands	1 999	0	32	0	0.1
Wet or Damp Forests	111 210	4	1 657	2.4	4.0
Wetlands	92 234	3	1 131	1.6	1.6
Total	3 105 281		70 227		

Significantly, the relative proportions of Ecological Vegetation Class (EVC) Groups included in protected areas on public land and the Trust's protected land differs markedly. Grasslands, Plains Woodlands, Lower Slopes Woodlands and Riverine Grassy Woodlands represent a higher proportion of Trust for Nature's protected areas than they do for public protected areas. On public land, conversely, there are proportionally much larger areas of Mallee, Dry Forests and WetForests included in protected areas (Figure 16). These differences between the relative representation of different EVC Groups in public and

private protected areas have been particularly influenced by changes in the focus of the Trust's protection program over the last decade, in response to internal policy reviews (Todd 1997; Morgan & Clarke 2008), external policy changes and investment criteria set by the Australian Government, Victorian Government and Natural Resource Management (NRM) bodies. As a result of these influences, the proportion of Plains Grasslands/Chenopod Shrublands, Plains Woodlands or Forests and Riverine Grassy Woodlands protected on Trust for Nature properties and on covenanted land has increased substantially in the past decade (Figure 17), principally due to targeted NRS purchases of properties containing these under-represented ecosystems at Neds Corner Station, in the Riverina bioregion and on the Gippsland Plains. By comparison, the relative proportion of Dry Forests, Heathy Woodlands, Lowland Forests and Mallee has decreased over the past decade (Figure 17).

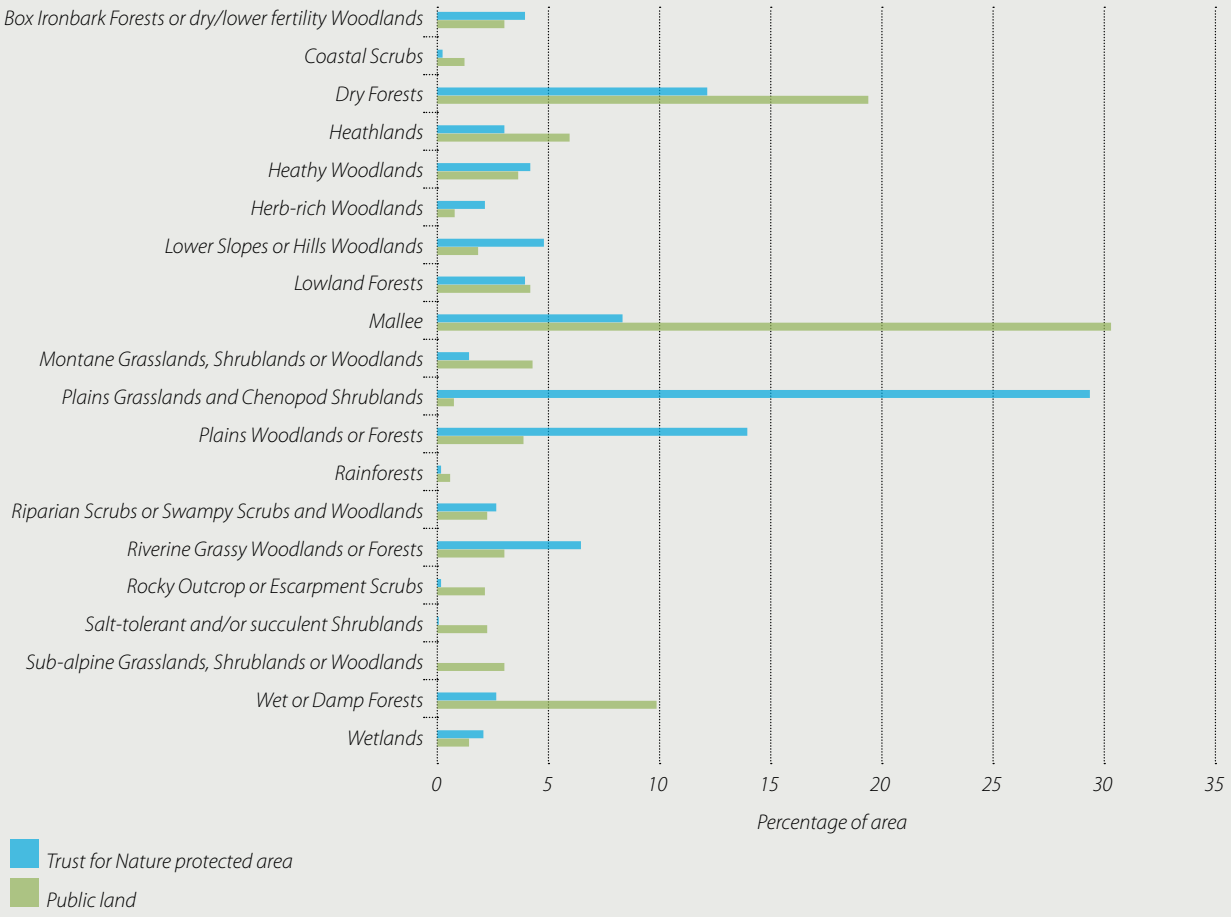

Figure 16. Percentage of protected areas on public land and in Trust for Nature protected areas in each Ecological Vegetation Class (EVC) Group. Note that the public land protected areas do not include the most recent additions to the reserve system as a result of the VEAC Red Gum investigation (VEAC 2008)

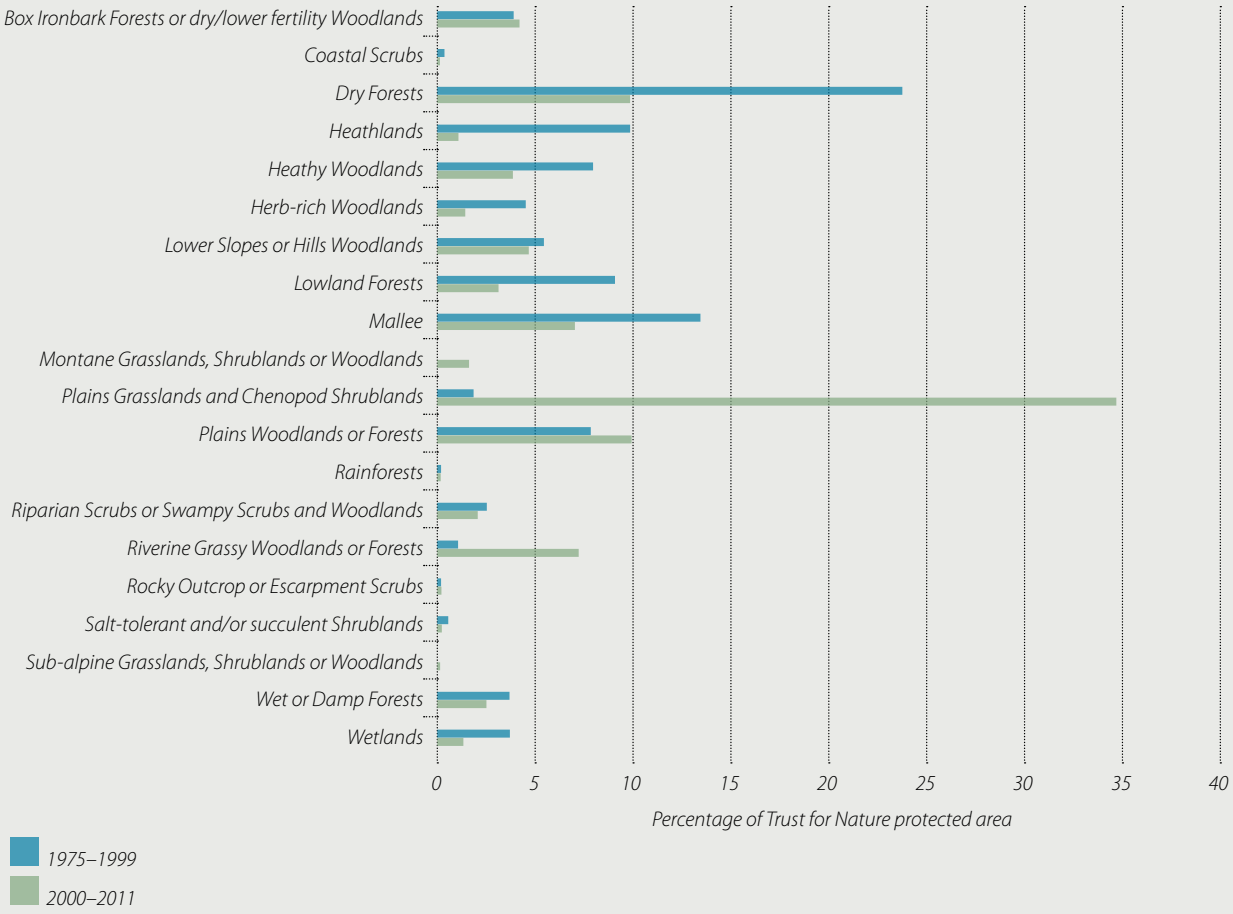

Figure 17. Changes in the percentage of different Ecological Vegetation Class (EVC) Groups on all Trust for Nature protected areas between 1975 and 2011

1.3.6 The Trust's protection of flora and fauna

Since the Trust was first established, and across all of its covenants and properties, 568 vertebrate species (68% of the statewide total) and 2767 species of vascular plant (84% of the statewide total) have been recorded. These include 417 threatened flora species and 157 threatened fauna species.

Notable fauna that have been the focus of Trust conservation programs to date have included the following species:

- Brolga *(Grus rubicunda)*
- Brush-tailed Phascogale *(Phascogale tapoatafa)*
- Eltham Copper Butterfly *(Paralucia pyrodiscus lucida)*
- Golden Sun-moth *(Synemon plana)*
- Grey-crowned Babbler *(Pomatostomus temporalis)*
- Growling Grass-frog *(Litoria raniformis)*
- Helmeted Honeyeater *(Lichenostomus melanops cassidix)*
- Hooded Scaly-foot *(Pygopus nigriceps)*
- Plains-wanderer (*Pedionomus torquatus*)
- Red-tailed Black-Cockatoo *(Calyptorhynchus banksii graptogyne)*
- Southern Brown Bandicoot *(Isoodon obesulus obesulus)*, and
- Striped Legless Lizard *(Delma impar).*

Notable flora targeted for conservation by the Trust have included the following species:

- Australian Anchor Plant *(Discaria pubescens)*
- Concave Pomaderris *(Pomaderris subplicata)*
- Dwarf Kerrawang *(Rulingia prostrata)*
- Euroa Guinea-flower *(Hibbertia humifusa erigensl)*
- Gorae Leek-orchid *(Prasophyllum diversiflorum)*
- Little Pink Spider-orchid *(Caladenia rosella)*
- Spiny Rice-flower *(Pimelea spinescens)*, and
- Swamp Sheoak *(Casuarina obesa)*.

PART 2: The planning approach

2.1 The need for a statewide conservation plan for private land

To date, Trust for Nature's conservation approach has been guided by its statutory conservation objectives and by regional priorities established through strategic biodiversity policy initiatives developed by Trust for Nature, the Victorian Government, the Australian Government and Catchment Management Authorities (CMAs). From the Trust's perspective, notable planning exercises previously undertaken in the regions have included: botanical surveys of significant woodland and grassland properties to help identify priority sites for protection (e.g. Ward 1998); development of local government and landcare actions plans for nature conservation in some regions (e.g. Raven 1997); development of regionally based landscape conservation plans (Palmer & Westbrooke 2011) and development of regional conservation strategies in 2006. Based on these earlier approaches and a review paper by La Trobe University researchers (Morgan & Clarke 2008), Trust for Nature's 2011–2016 Strategic Plan, recognised the need for a Statewide Conservation Plan to inform the Trust's conservation program, organisational planning and operations across the state. In particular, the Strategic Plan identified the need for a Statewide Conservation Plan as an essential first step towards the development of a unified, strategic conservation program.

In recommending the need for a discrete Statewide Conservation Plan, Trust for Nature fully recognised Victoria's comprehensive history of systematic conservation planning, beginning with the establishment of the Land Conservation Council in 1970 to investigate and make recommendations on public land use. Building on this public-land planning framework, the Victorian Government and its Natural Resource Management (NRM) agencies subsequently initiated systematic conservation planning across public and private land at the catchment, bioregional and local landscape scale (NRE 1997; Platt & Lowe 2002; VCMC 2007). The State Government also undertook broad ecosystem-based planning for public land in relation to waterways (LCC 1991), box-ironbark forests and woodlands (ECC 2001), River Red Gum forests (VEAC 2008) and remnant native vegetation (VEAC 2010, 2011). Concurrently, following the signing of the National Forest Policy Statement in 1992 by the Australian Government and states and territories, systematic processes and programs were developed for the establishment of a Comprehensive, Adequate and Representative (CAR) National Reserve System (NRS) (JANIS 1997; Commonwealth of Australia 1999). This policy initiative subsequently informed public land use investigations, forest planning and ecosystem protection strategies delivered by the Department of Sustainability and Environment (NRE 1997).

Notwithstanding this strong conservation-planning background in Victoria, there has never been a statewide conservation-planning process focussing solely on the protection of ecosystems and species on private land. Further, there has never been a comprehensive statewide investigation analysing priorities for increasing the NRS specifically in relation to private land, although DSE and the Trust have both undertaken regional assessments of private land to identify areas to target for permanent protection (e.g. Muir 1996; Ward 1998). There have also been many important reviews of statewide gaps in ecosystem representation and species representation in protected areas either across all land tenures and/or for public land (Frankerberg 1971; Frood & Calder 1987; LCC 1988; McDougall *et al.* 1993; Fitzsimons 1999; Traill & Porter 2001; Sattler & Glanznig 2006; Sattler & Taylor 2008; Taylor *et al.* 2011a). Accordingly, this plan aimed to provide a unique, private-land perspective on conservation priorities for Victoria.

Because of Trust for Nature's statutory functions as a covenanting authority, land acquisition body and as a charitable land trust, the starting point for the Conservation Plan was taken as the Trust's potential to contribute to the NRS through permanent protection of habitat on private land. However, it was also recognised that protected areas on private land are only part of the solution in terms of effective private-land conservation in largely cleared landscapes (Bennett 1995, 1999; NRMMC 2005; DSE 2009a; VEAC 2011). The plan's scope therefore, encompasses all conservation opportunities on private land in Victoria.

2.2 Overall aims of the Conservation Plan

The aims of the Statewide Conservation Plan are to:

- establish a strategic, statewide approach to the Trust's conservation activities on private land, focussing on protecting priority ecosystems and species
- develop an integrated approach to biodiversity conservation across the Trust's 10 operational regions, and
- develop a strategic approach to nature conservation on private land that complements the conservation measures being undertaken or funded by partner agencies on public and private land.

Four guiding principles were considered as part of the process of developing the Conservation Plan. They were that:

1. the Conservation Plan's approach and recommendations should be consistent with the Trust's statutory objectives under the *Victorian Conservation Trust Act 1972* and the strategic directions set by its 2011–2016 Strategic Plan (Trust for Nature 2011)
2. as a statutory conservation organisation, the Trust's conservation approach should be consistent with the state government's and Australian Government's approaches to biodiversity conservation, and use the same conservation planning approaches and data sources as far as possible
3. the Conservation Plan should recognise that most of the conservation activity undertaken by the Trust is done in partnership with other organisations and funded primarily by the Australian Government, State Government and through the CMAs, each of which have their own set of biodiversity priorities and objectives. The Conservation Plan's objectives should therefore be consistent with those organisations' own objectives, and
4. the strategic focus of regional Trust conservation programs should be considered in the development of the Conservation Plan.

2.3 Overview of the planning approach

The approach taken to develop the Statewide Conservation Plan was based on the Victorian Department of Sustainability and Environment's (DSE's) recommended conservation-planning method for the development of CMA Regional Catchment Strategies, which was firstly to define the biodiversity assets to be targeted for conservation and then identify priority locations to help conserve those assets (DSE 2011a). The conservation planning approach was also informed by the Open Standards for the Practice of Conservation framework – an internationally standardised framework for conservation planning (CMP 2007), which is being applied by various conservation organisations and agencies in Australia.

The Conservation Plan was developed by the Trust's Conservation Science team, with assistance from a Technical Reference Group, which consisted of representatives from universities, conservation agencies, conservation organisations and the Trust. The Trust's Conservation Committee also provided input into the development of the plan.

Figure 18 summarises the process undertaken to develop the Conservation Plan. In brief, the Conservation Plan aimed to identify:

- a set of biodiversity assets as priorities for conservation on private land
- conservation objective(s) for each of the assets
- priority locations on private land for the biodiversity assets, and
- priority areas to undertake action to help conserve the biodiversity assets, based on their distribution in relation to various social and economic factors affecting the future viability of the assets, both positively (such as landowner rates of participation in conservation activities) and negatively (such as the risk of habitat loss through clearing).

The process used to define the conservation objectives and to assess the data related to the assets followed a framework developed for Bush Heritage Australia (Mackey *et al.* 2010), which entailed:

- development of a set of conservation objectives in relation to each biodiversity asset
- development of assessment criteria for each of the objectives, and
- selection of appropriate data sources to undertake the assessments.

Using the selected assessment criteria and associated data, the Trust then generated sets of information relating to each of the biodiversity assets and objectives.

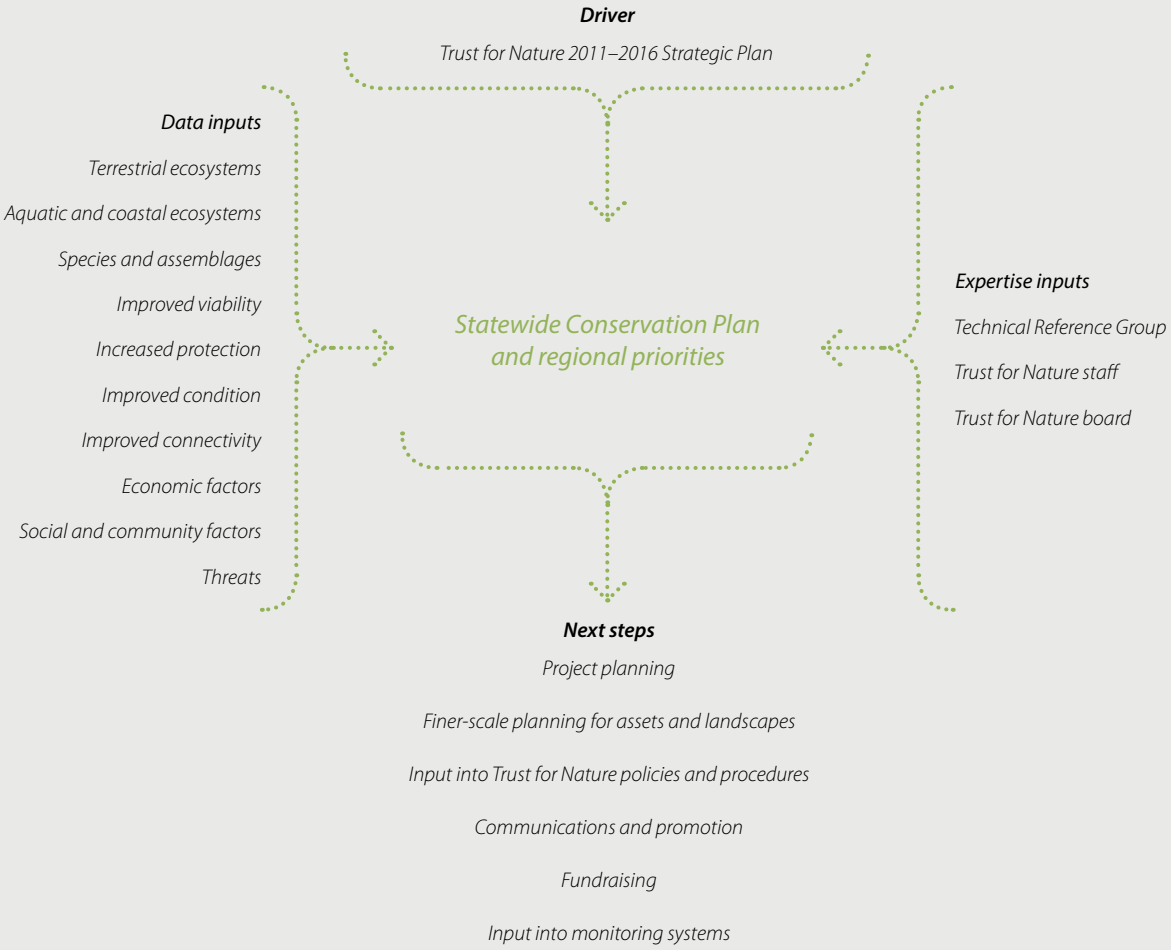

Figure 18. Process used to develop the Statewide Conservation Plan

2.4 The Conservation Plan's biodiversity assets and objectives

Identification of the Conservation Plan's biodiversity assets and objectives was based on the following inputs:

- the *Victorian Conservation Trust Act 1972*
- the 2011–2016 Trust for Nature Strategic Plan (Trust for Nature 2011)
- advice from a Technical Reference Group established to provide expert scientific advice to the project team (Appendix 1)
- National Reserve System (NRS) criteria for what constitutes an eligible contribution to a Comprehensive, Adequate and Representative (CAR) reserve system (JANIS 1997; Commonwealth of Australia 1999; NRMMC 2005, 2009; CfoC 2011)
- a literature review of the objectives and priorities of similar strategies prepared by government and non–government environmental organisations, including:
  - Australia's Biodiversity Conservation Strategy 2010–2030 (NRMMC, 2010)
  - Australia's Strategy for the National Reserve System 2009–2030 (NRMMC, 2009)
  - Securing Our Natural Future: A White Paper for Land and Biodiversity at a Time of Climate Change (DSE, 2009)
  - Victorian River Health Strategy (NRE 2002b)
  - Remnant Native Vegetation Investigation (VEAC, 2010)
  - Regional Catchment Strategies, Biodiversity Strategies and other relevant Catchment Management Authority (CMA) planning documents
  - Building Nature's Safety Net 2011: The State of Protected Areas for Australia's Ecosystems and Wildlife (Taylor *et al.* 2011), and
  - BioPrEP: A Regional, Process-Based Approach for Assessment of Land with High Conservation Value for Bush Heritage Australia (Mackey *et al.* 2010).
- regional strategies prepared for each Trust region in 2006
- consultation with scientific and regional staff within the Trust, and
- consultation with expert staff at the Department of Sustainability and Environment (DSE), Department of Primary Industries (DPI), Department of Planning and Community Development (DPCD), Victorian Environmental Assessment Council (VEAC) and BirdLife Australia.

Based on the inputs described above, three broad classes of biodiversity asset and six conservation objectives were defined for the Conservation Plan. The links between these assets, objectives and the the five key elements contributing to a Comprehensive, Adequate and Representative (CAR) reserve system, as defined by the NRS, are shown in Table 5.

The three broad classes of biodiversity asset defined for the Conservation Plan are:

- terrestrial ecosystems on private land
- aquatic ecosystems on private land (comprising wetlands, waterways and coasts), and
- threatened species on private land.

These assets are consistent with the set of standard assets developed by DSE and being used by the CMAs in the development of their Regional Catchment Strategies (DSE 2011a).

The six conservation objectives defined for the Conservation Plan are:

1. Improve the viability of ecosystems and species at a landscape scale
2. Improve protection of the least protected ecosystems and threatened communities
3. Improve protection of significant aquatic and coastal ecosystems
4. Improve protection of threatened species
5. Enhance and protect landscape connectivity, and
6. Enhance and protect habitat quality.

The rationale for each particular conservation objective is described in the relevant section of Part 3 of the Conservation Plan. More detailed descriptions of the assessment criteria, data sources and methods used to assess each conservation objective are described in Appendix 2.

Table 5. Links between National Reserve System (NRS) Comprehensive, Adequate and Representative (CAR) elements (CfoC 2011) and the Conservation Plan's conservation objectives

Element contributing to a 'Comprehensive, Adequate and Representative' (CAR) reserve system, within the NRS	Justification for including element in the CAR reserve system, within the NRS	Linked Trust for Nature asset	Linked conservation objectives in the Conservation Plan
1. Under–represented regional ecosystem	Regional ecosystems are the primary building block for the NRS. Protecting the full range and diversity of regional ecosystem types is one of the key strategies for enabling native biodiversity to adapt to a changing climate. A regional ecosystem is considered to be under–represented if less than 10% of the original extent of the ecosystem within the IBRA bioregion is protected in the NRS.	Terrestrial ecosystems Aquatic ecosystems	Objectives 1, 2, 3
2. Core habitat for listed threatened species or ecological community	Core habitat is an area in the landscape where listed threatened species or ecological communities are likely to naturally occur and survive (shelter, disperse, breed and feed).	Threatened species Terrestrial ecosystems Aquatic ecosystems	Objectives 2, 3, 4
3. Core habitat for listed marine or migratory species	Core habitat is an area in the landscape where listed marine or migratory species are likely to naturally occur and survive (shelter, disperse, breed and feed).	Threatened species Aquatic ecosystems	Objectives 3, 4
4. Place of environmental significance	Places that are key areas for the survival and evolution of Australia's native biodiversity may be considered to have environmental significance. Places of environmental significance are important for inclusion in the NRS if they are of significance at the IBRA bioregional scale. They are places that may have one or more of the following attributes: climatic refuge, species endemism, high species or ecosystem diversity, aquatic ecosystem, ecological gradient, important for migratory or nomadic species or critical for the lifecycle of key species.	Threatened species Aquatic ecosystems	Objectives 2, 3, 4, 5, 6
5. Improved adequacy	A place improves adequacy of the NRS if it helps maintain the integrity and viability of populations, species and/or ecological communities in an IBRA bioregion or improves 'ecological functionality' of the reserve system in the IBRA bioregion. Adequacy can be improved by: replicating the protection of biodiversity values, improving ecological connectivity and/or re-configuring protected area boundaries to allow for better management of threats to other CAR elements. These sites improve the NRS by increasing the resilience and capacity for adaptation to climate change.	Terrestrial ecosystems Aquatic ecosystems Threatened species	Objectives 1, 2, 3, 4, 5, 6

PART 3: The Statewide Conservation Plan: rationales, assessments and priorities for action

3.1 Conservation objective 1: Improve the viability of ecosystems and species at a landscape scale

3.1.1 Rationale for the objective

Maintaining the viability and integrity of ecosystems, species and populations is a key objective of the National Reserve System (NRS) under the Adequacy criterion (Commonwealth of Australia 1999). It is also a core objective for conservation planning (e.g. CMP 2007) generally. As noted in the NRS guidelines, however, there is no single threshold that guarantees the persistence of all ecosystems and species (Commonwealth of Australia 1999). Instead, the most common approach is to aim to protect and manage extensive areas of habitat, on the basis that larger areas:

- encompass a broader range of environments
- are more likely to be resilient to major disturbance events
- are more likely to maintain intact ecological processes
- provide greater landscape connectivity for movements of fauna and flora at different time and spatial scales
- support more species
- support larger populations of species, and
- are more likely to support higher-order species (Commonwealth of Australia 1999; Poinani & Richter 1999; Bennett & Mac Nally 2004; Bennett *et al.* 2009; Dunlop *et al.* 2012a).

Targeted conservation in areas with aggregated biodiversity assets (e.g. larger habitat patches or larger populations of threatened species) also has benefits in terms of efficiency and cost (Verboom *et al.* 2001; Moilanen & Wintle 2006).

This objective therefore identifies a series of 'focal landscapes' across Victoria that are considered to provide the best opportunities for maintaining and improving viable ecosystems and viable species' populations on private land.The focal landscapes were defined as connected landscapes of more than 20 000 ha that met the following criteria:

- the total extent of significant biodiversity assets (as identified by NaturePrint) in each focal landscape should be at least 20 000 ha
- each focal landscape should comprise at least one concentrated area of significant, statewide biodiversity assets; this area, hereafter termed a 'biodiversity priority zone' (BPZ), should measure at least 10 000 ha
- the total extent of significant biodiversity assets on private land within the constituent BPZs in each focal landscape should be at least 10 000 ha
- the proportion of significant biodiversity assets on private land in each BPZ should be at least 20%
- bioregional or catchment connections should exist between the constituent BPZs in each focal landscape, and
- additional significant biodiversity assets found in the intervening landscape between the constituent BPZs should be considered as part of the focal landscape (e.g. significant aquatic ecosystems, threatened species' locations).

The 41 BPZs were defined using the Department of Sustainability and Environment's (DSEs) NaturePrint v2.0 data (DSE 2011a, 2011b) which provided a priority ranking of biodiversity significance across the state, based on ecosystem and species modelling and records (DSE 2011b). Based on that information, the BPZs were identified as being aggregated areas of > 10 000 ha that were assessed as being of high statewide significance through NaturePrint v2.0 and:

- included > 20% of the extent of those assets on private land, and
- included a minimum of 5000 ha of all native vegetation or 2500 ha of under-represented native vegetation on private land.

More details about the method used to identify BPZs and focal landscapes are provided in Appendix 2. Appendix 5 and 6 summarise the land tenure and vegetation attributes for every focal landscape and every BPZ.

3.1.2 Key findings for the objective

Twelve focal landscapes were identified across the state to target for private land conservation (Figure 19):

- Eastern Riverina
- Gippsland Plain and Gippsland Lakes Catchment
- Murray Scroll Belt
- Northern Inland Slopes
- Otway Ranges and coast
- Port Phillip and Westernport
- South-West
- Strzelecki Ranges and plains
- Victorian Midlands
- Western Melbourne ranges and plains
- Western Riverina, and
- Yarra–Cardinia Catchments.

The focal landscapes were derived from identification of 41 biodiversity priority zones (BPZs) across Victoria (Figure 20), using the criteria described above. More detailed information about each of the focal landscapes and their constituent BPZs is provided in Appendices 5 and 6.

Collectively, the 12 focal landscapes encompass:

- nearly two million hectares of private land with significant biodiversity values out of a total private land area in Victoria of 14 million hectares
- approximately 60% of the Trust's protected areas (including both covenants with landowners and Trust conservation properties) on private land
- representation of every under-repesented IBRA bioregion and subregion in Victoria
- one-third of the remaining extent of under-represented ecosystems on private land
- inclusion of most of Victoria's internationally significant Ramsar wetlands
- occurrences of more than 50% of the species identified in the Conservation Plan as being priorities for conservation on private land, and
- nearly 50% of all private-land habitat that has high landscape connectivity in terms of landscape context and good habitat quality.

Key biodiversity assets associated with each of the focal landscapes are described in section 3.1.3 and summarised in Table 6.

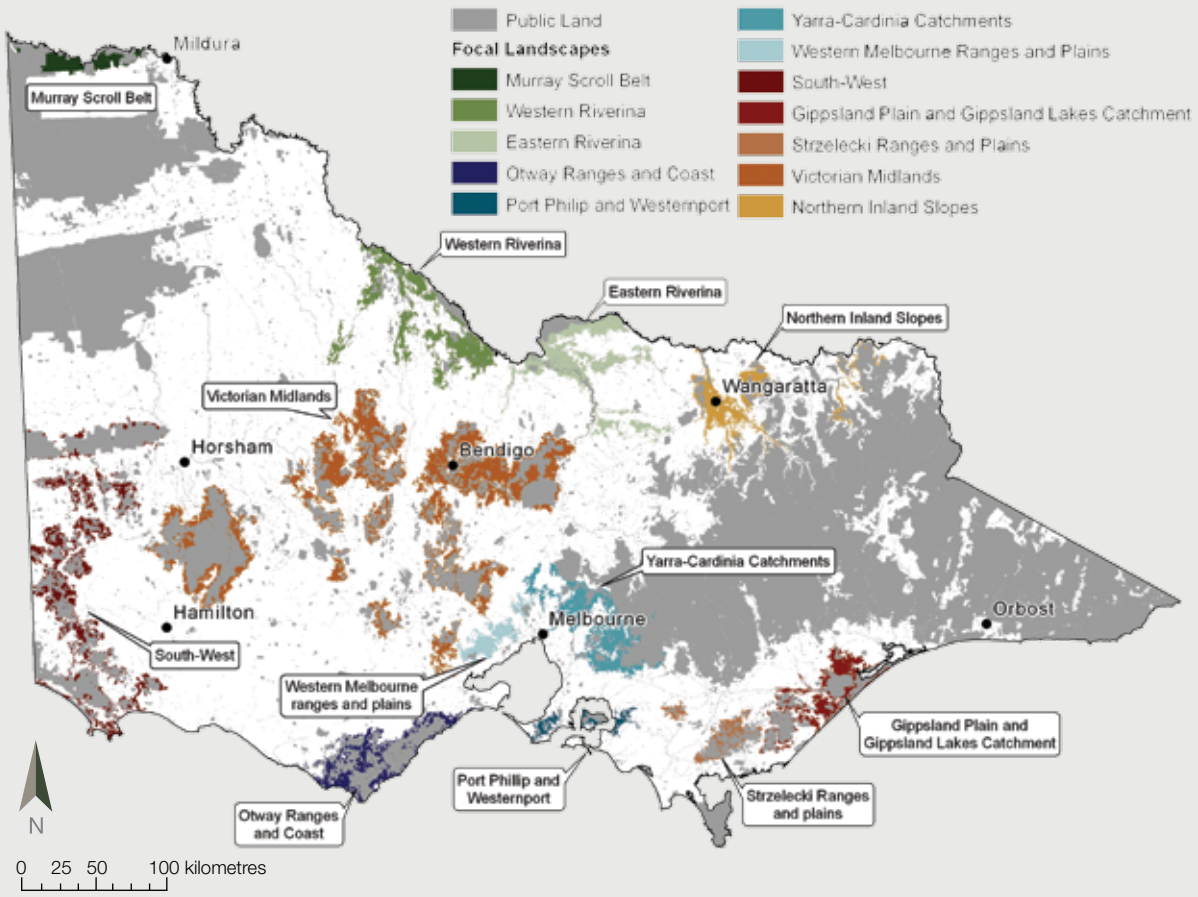

Figure 19. Location of focal landscapes on private land.

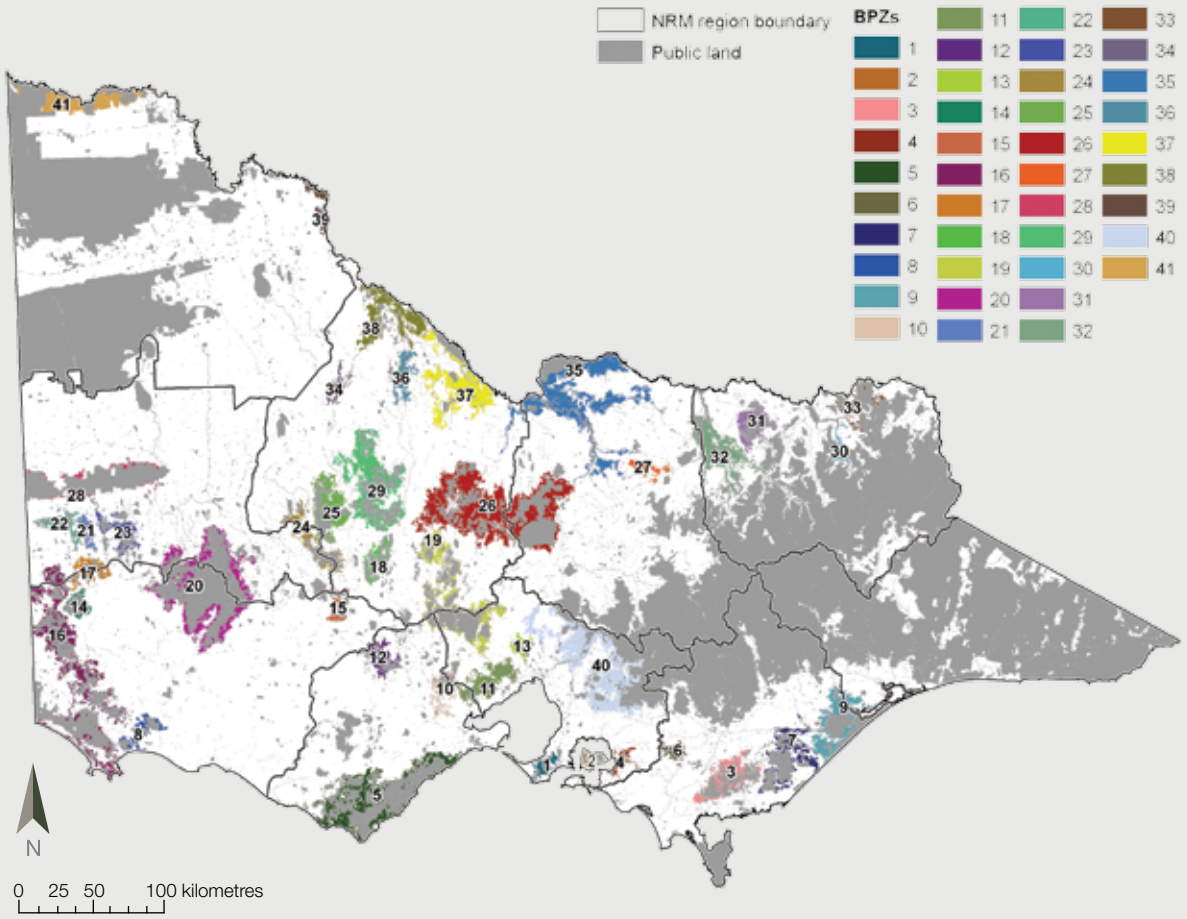

Figure 20. Private land distribution of the 41 biodiversity priority zones (BPZs). Detailed information about each BPZ is provided in Appendix 6

Table 6. Land tenure and native vegetation attributes of each focal landscape, based on measurements for each of their constituent biodiversity priority zones (BPZs)

Focal landscape	Total extent of BPZs (ha)	Extent of private land extent within BPZs (ha)	Extent of native vegetation on private land within BPZs (ha)	Extent of under-represented Ecological Vegetation Classes on private land within BPZs (ha)
Eastern Riverina	226 700	170 284	77 788	76 647
Murray Scroll Belt	138 766	51 581	48 000	1 879
Western Riverina	226 696	178 804	77 819	77 503
Otway Ranges and coast	245 291	80 983	49 822	19 617
Port Phillip and Westernport	40 249	25 231	14 006	11 195
Western Melbourne ranges and plains	63 618	57 430	25 516	25 516
Yarra–Cardinia Catchments	342 787	157 355	99 546	47 232
Gippsland Plain and Gippsland Lakes Catchment	162 219	80 068	41 946	34 466
Strzelecki Ranges and plains	75 897	36 846	27 068	27 064
South-West	547 270	179 006	108 461	73 514
Northern Inland Slopes	204 087	113 559	59 322	48 366
Victorian Midlands	1 192 805	567 270	365 581	206 168
Total	3 466 385	1 698 417	994 875	649 167

3.1.3 Descriptions of the focal landscapes

Eastern Riverina

Located in northern Victoria between Echuca, Murchison, Violet Town and Yarrawonga. Primarily located in the nationally under-represented Riverina bioregion, with smaller proportion included in NSW South Western Slopes. Contains representation of three subregions. Major geographic features comprise Barmah Forest and associated floodplain, Lower Goulburn River, Broken Creek system, Lower Broken River, Honeysuckle Creek/Seven Creeks catchments and the Koonda Hills, an outlier of the Northern Inland Slopes subregion. Contains 170 000 ha of private land with significant biodiversity assets, at a statewide scale.

Key terrestrial ecosystem assets on private land comprise extensive areas of plains woodlands, riverine grassy woodlands, lower slopes or hills woodlands and box-ironbark forests.

Key wetland assets include the Ramsar-listed Barmah–Milewa Forest (also a Living Murray icon site) and Nationally Important Wetlands along the Broken Creek, Lower Broken River, Lower Goulburn River floodplain, Kanyapella Basin and Muckatah Depression. Other aquatic ecosystem assets include significant areas of riparian habitat on private land, especially in the Riverina and Northern Inland Slopes subregions.

Priority fauna species for conservation include Golden Perch, Giant Bullfrog, Lace Goanna, Woodland Blind Snake, Intermediate Egret, Eastern Great Egret, Australasian Bittern, Australian Painted Snipe, Bush Stone-curlew, Swift Parrot, Superb Parrot, Grey-crowned Babbler and Squirrel Glider.

Priority flora species for conservation include Purple Wire-grass, Painted Diuris, Arching Flax-lily, Yarran, Slender Darling-pea, Silky Swainson-pea, Long Eryngium, Ridged Water-milfoil and Yellow-tongue Daisy.

Gippsland Plain and Gippsland Lakes Catchment

Located in western Gippsland between Yarram, Rosedale and Bairnsdale. Primarily located in the nationally under-represented South East Coastal Plain bioregion and under-represented Gippsland Plain subregion. Includes small component of the under-represented Strzelecki Ranges subregion. Major geographic elements comprise the Gippsland Lakes and associated catchment, Gippsland Plains, La Trobe River, Perry River, Thompson River, Avon River and associated floodplains. Contains 81 000 ha of private land with significant biodiversity assets at a statewide scale.

Key terrestrial ecosystem assets on private land comprise extensive areas of plains woodlands and herb-rich woodlands. Key aquatic ecosystem assets include the Ramsar-listed Gippsland Lakes, Macleod Morass, Jack Smith Lake, Latrobe River and floodplain and chains of pond systems along some of the smaller waterways. The landscape also includes significant areas of coastal ecosystems on private land.

Priority fauna species for conservation include Eastern Great Egret, Royal Spoonbill, Australasian Bittern, Lewin's Rail and Lace Goanna.

Priority flora species for conservation include Bushy Hedgehog Grass, Gaping Leek-orchid, Purple Diuris, Trailing Hop-bush, Dwarf Kerrawang and Swamp Everlasting.

Murray Scroll Belt

Located in north-west Victoria, west of Mildura and centred on Trust for Nature's Neds Corner Station. Primarily located in the nationally under-represented Riverina bioregion, with a smaller proportion included in the Murray Darling Depression. Contains representation of two subregions. Major geographic elements comprise the Murray River floodplain, the distinctive Murray Scroll Belt, Lindsay Island, Mulcra Island, Walpolla Island and dunes associated with the Murray Mallee. The only part of Victoria recognised as part of Australia's rangelands. Includes 52 000 ha of private land with significant biodiversity assets at a statewide scale, of which 28 000 ha is currently protected at Neds Corner Station.

Key terrestrial ecosystem assets on private land comprise plains grasslands/chenopod shrublands, riverine grassy woodlands and plains woodlands.

Key wetland assets comprise the Living Murray icon sites

– Chowilla Floodplain and Lindsay–Walpolla Islands – and the Murray River. Other aquatic ecosystem assets include significant areas of riparian habitat on private land along the Murray River floodplain.

Priority fauna species for conservation include Hooded Scaly-foot, Lace Goanna, De Vis Banded Snake, Red-naped Snake, Fat-tailed Dunnart, Giles Planigale, Bush Stone-curlew, Inland Dotterel, Regent Parrot and Redthroat.

Priority flora species for conservation include Spreading Angianthus, Leafless Bluebush, Narrow-leaf Emu-bush and Kneed Swainson-pea.

Northern Inland Slopes

Located in north-east Victoria between Benalla, Wodonga and the Upper Murray near Corryong. Primarily located in the NSW South Western Slopes bioregion, with smaller proportions included in the nationally under-represented Riverina bioregion, as well as Victorian Midlands and South Eastern Highlands. Contains representation of five subregions, including the under-represented Victorian Riverina, Murray Fans and Central Victorian Uplands. Major geographic elements comprise the Warby Range, Killawarra Forest, Lower Ovens River and floodplain, Chiltern – Mt Pilot area and Burrowa-Pine Mountain. Contains 114 000 ha of private land with significant biodiversity assets at a statewide scale.

Key terrestrial ecosystem assets on private land comprise extensive areas of box-ironbark forests, dry forests, plains woodlands and riverine grassy woodlands.

Key wetland assets include Nationally Important Wetlands along the Lower Ovens River and at Black Swamp. Other aquatic ecosystem assets include significant areas of riparian habitat on private land, especially in the Victorian Riverina and Northern Inland Slopes subregions.

Priority fauna species for conservation include Golden Perch, Booroolong Tree Frog, Growling Grass Frog, Lace Goanna, Eastern Great Egret, Intermediate Egret, Bush Stone-curlew, Swift Parrot, Regent Honeyeater, Speckled Warbler, Squirrel Glider, and Brush-tailed Phascogale.

Priority flora species for conservation include Umbrella Grass, Yellow Hyacinth-orchid, Purple Diuris, Yarran, Buloke Mistletoe, Warby Range Swamp Gum, Southern Sandalwood, Narrow Goodenia and Dookie Daisy.

Otway Ranges and Coast

Centred on the Otway Ranges, Anglesea Heathlands and associated coastline west of Geelong. Primarily located in the South Eastern Highlands bioregion but also includes substantial portion in the nationally under-represented South East Coastal Plain bioregion and small area of Victorian Volcanic Plain. Contains representation of Otway Ranges, Otway Plain, Warrnambool Plain and Victorian Volcanic Plain subregions. Major geographic elements comprise the Otway Ranges, Anglesea Heathlands, the coastline and south-draining waterways and estuaries. Contains 80 000 ha of private land with significant biodiversity assets at a statewide scale.

Key terrestrial ecosystem assets on private land comprise lower slopes or hills woodlands, dry forests, rainforests, riparian scrubs, coastal scrubs and the nationally recognised Anglesea Heathlands.

Key wetland assets include the Aire River and floodplain and Princetown Wetlands. Some opportunities also exist to protect riparian habitats along waterways.

Priority fauna species for conservation include Australian Mudfish, Dwarf Galaxias, Yarra Pygmy Perch, Grey Goshawk and Rufous Bristlebird.

Priority flora species for conservation include Leafy Greenhood, Merran's Sun-orchid, Wrinkled Buttons, Snow-berry and Velvet Daisy-bush.

Port Phillip and Westernport

Includes the southern Mornington Peninsula, Westernport Bay, French Island and the foothills east of Westernport around Grantville. Primarily located in the nationally under-represented South East Coastal Plain bioregion, with a smaller proportion included in South Eastern Highlands. Contains representation of two under-represented subregions – Gippsland Plain and Strzelecki Ranges. Major geographic elements comprise the Mornington Peninsula, Westernport Bay and associated saltmarsh habitat, French Island and the foothills of the Strzelecki Ranges. Contains 25 000 ha of private land with significant biodiversity assets at a statewide scale.

Key terrestrial ecosystem assets on private land include herb-rich woodlands, plains woodlands, wetlands, coastal scrubs, riparian scrubs, riverine grassy woodlands and dry forests.

Key wetland assets include the Ramsar-listed Westernport Bay and the bioregionally significant Tootgarook Wetlands. Other aquatic ecosystem assets include significant areas of riparian habitat on private land, especially along waterways draining into the west coast of Westernport Bay.

Priority fauna species for conservation include listed species of migratory shorebird, Southern Brown Bandicoot, Australasian Bittern, Eastern Great Egret, Blue-billed Duck, Latham's Snipe, Orange-bellied Parrot, Powerful Owl and Giant Gippsland Earthworm.

Priority flora species for conservation include French Island Spider-orchid, Leafy Greenhood, Clover Glycine, Purple Eyebright and Strzelecki Gum.

South-West

Located in south-western Victoria from the South Australian border to Port Fairy and north to the Little Desert. Primarily located in the Murray Darling Depression bioregion but also includes substantial areas in the nationally under-represented Victorian Volcanic Plain bioregion, plus Nararcoorte Coastal Plain and Victorian Midlands bioregions. Altogther includes representation of eight subregions of which Dundas Tablelands, Victorian Volcanic Plain, Warrnambool Plain and Wimmera are all under-represented in protected areas. Major geographic elements include the Glenelg River and associated plain, the coastline, Natimuk–Douglas wetlands, sand dune systems south of Little Desert, Black Range and volcanic outcrops such as Mt Eccles. Contains 179 000 ha of private land with significant biodiversity assets at a statewide scale.

Key terrestrial ecosystem assets on private land include plains woodlands, plains grasslands, riverine grassy woodlands, lower slopes or hills woodlands, herb-rich woodlands, mallee, wetlands, coastal scrubs and dry forests.

Key wetland assets include the Nationally Important Natimuk Wetlands, Wimmera River, Boiler Swamp, Lindsay–Werikoo Wetlands, Mundi–Selkirk Wetlands, Long Swamp and the Glenelg River. In addition, this landscape and the associated private land surrounding the high-value zones includes very large numbers of wetlands on private land. Other aquatic ecosystem assets include significant areas of under-represented riparian habitat on private land, in both the Wimmera and Glenelg Hopkins regions.

Priority fauna species for conservation include Glenelg Freshwater Mussel, Rayed Blue Butterfly, Golden Sun-moth, Variegated Pygmy Perch, Yarra Pygmy Perch, Australasian Bittern, Eastern Great Egret, Australasian Shoveler, Brolga, Bush Stone-curlew, Australian Bustard, Powerful Owl, Red-tailed Black-cockatoo, Diamond Firetail and Southern Brown Bandicoot.

Priority flora species for conservation include Limestone Spider-orchid, Mellblom's Spider-orchid, Wimmera Spider-orchid, Yellow-lip Spider-orchid, Swamp Diuris, Leafy Greenhood, Gorae Leek-orchid, Chariot Wheels, Jumping Jack Wattle, Square Raspwort, Winged Peppercress, Forked Spyridium, Swamp She-oak, Dwarf Yellowheads and Wrinkled Cassinia.

Strzelecki Ranges and plains

Located in south-east Victoria from east of Westernport Bay to Yarram and Gormandale. Primarily located in the South Eastern Highlands bioregion, with a smaller proportion included in South East Coastal Plain bioregion. Contains two subregions, both of which are under-represented – Strzelecki Ranges and Gippsland Plain. Major geographic elements comprise the Strzlelecki Ranges and associated plains, Albert River, Agnes River, La Trobe River catchment and other waterways draining to the coast and into Corner Inlet. Contains 37 000 ha of private land with significant biodiversity assets at a statewide scale.

Key terrestrial ecosystem assets on private land comprise dry forests, plains woodlands, herb-rich woodlands, rainforests, riparian scrubs, wetlands and dry forests.

Key aquatic ecosystem assets to target comprise significant areas of under-represented riparian ecosystems, including extensive areas of riparian scrubs.

Priority fauna species for conservation include Giant Gippsland Earthworm, Narracan Burrowing Cray, Strzelecki Burrowing Cray, Australian Grayling, Lace Goanna and Powerful Owl.

Priority flora species for conservation comprise Filmy Maidenhair and Strzelecki Gum.

Victorian Midlands

Located along the inland and southern fall of the Great Dividing Range from the Grampians in the west through central Victoria to Seymour–Murchison. Primarily located in the Victorian Midlands bioregion but also includes significant areas within the Murray Darling Depression and nationally under-represented Riverina and Victorian Volcanic Plain bioregions. Contains representation of seven Victorian subregions, five of which are under-represented nationally: Central Victorian Uplands, Dundas Tablelands, Victorian Riverina, Victorian Volcanic Plain and Wimmera. Key geographic elements comprise the western extension of the Great Dividing Range and associated foothills and catchments on the inland and southern fall. Contains 567 000 ha of private land with significant biodiversity assets at a statewide scale.

Key terrestrial ecosystem assets on private land comprise extensive areas of plains woodlands, lower slopes woodlands, riverine grassy woodlands, box-ironbark forests, mallee and dry forests.

Key aquatic ecosystem assets comprise significant areas of under-represented riparian ecosystems, including the upper reaches of many north-draining and south-draining rivers.

Priority fauna species for conservation include Pink-tailed Worm-lizard, Lace Goanna, Woodland Blind Snake, Swift Parrot, Powerful Owl, Barking Owl, Regent Honeyeater, Speckled Warbler, Diamond Firetail and Brush-tailed Phascogale.

Priority flora species for conservation include McIvor Spider-orchid, Elegant Spider-orchid, Stuart Mill Spider-orchid, Red-cross Spider-orchid, Lowly Greenhood, Kamarooka Mallee, Velvet Daisy-bush, Large-headed Fireweed, Clover Glycine, Purple Eyebright and Trailing Hop-bush.

Western Melbourne ranges and plains

Located west of Melbourne between Bacchus Marsh and Little River and including part of the western Port Phillip Bay coastline. Primarily located in the nationally under-represented Victorian Volcanic Plain bioregion with a smaller proportion in Victorian Midlands and South East Coastal Plain bioregions. Comprises four subregions, of which Gippsland Plain, Central Victorian Uplands and Victorian Volcanic Plain are under-represented. Major geographic elements include the plains and coastline on the western side of Port Phillip Bay, You Yang Ranges, Little River, Werribee River and upper Maribyrnong River. Contains 57 000 ha of private land with significant biodiversity assets at a statewide scale.

Key terrestrial ecosystem assets on private land comprise extensive areas of plains woodlands, plains grasslands, wetlands, dry forest, riverine grassy woodlands, lower slopes or hills woodlands and herb-rich woodlands.

Key wetland assets include the Ramsar-listed Port Phillip Bay (western shoreline) and significant areas of riparian habitat on private land.

Priority fauna species for conservation include listed species of migratory shorebird, Golden Sun-moth, Growling Grass-frog, Striped Legless Lizard, Plains-wanderer, Swift Parrot and Diamond Firetail.

Priority flora species for conservation include Matted Flax-lily, Clover Glycine, Tough Scurf-pea, Spiny Rice-flower and Small Milkwort.

Western Riverina

Centred on the Patho Plains, Murray floodplain, lower Avoca and lower Loddon floodplains between Echuca and Swan Hill. Primarily located in the nationally under-represented Riverina bioregion, with smaller proportions included in NSW South Western Slopes and Murray Darling Depression bioregions. Comprises five subregions, including the under-represented Murray Fans, Victorian Riverina and Wimmera. Major geographic elements comprise the Murray River and floodplain, Avoca and Loddon Rivers and floodplains, outlier hills of Northern Inland Slopes subregion and old dune systems. Contains 179 000 ha of private land with significant biodiversity assets at a statewide scale.

Key terrestrial ecosystem assets on private land comprise extensive areas of plains woodlands, plains grasslands/ chenopod shrublands, riverine grassy woodlands, wetlands and mallee.

Key wetland assets include private land associated with the Ramsar-listed Gunbower Forest and Kerang Lakes, and Nationally Important Bunguluke Wetlands. Other aquatic ecosystem assets include significant areas of riparian habitat on private land.

Priority fauna species for conservation include Golden Sun-moth, Hooded Scaly-foot, Eastern Great Egret, Intermediate Egret, Australian Painted Snipe, Plains-wanderer and Grey-crowned Babbler.

Priority flora species for conservation include Riverina Flax-lily, Chariot Wheels, Red Swainson-pea, Downy Swainson-pea, Slender Darling-pea and Spiny Rice-flower.

Yarra–Cardinia Catchments

Located from north of Melbourne near Whittlesea east to Gembrook and Bunyip. Primarily located in the South Eastern Highlands bioregion, with smaller areas included within the Victorian Midlands and the nationally under-represented Victorian Volcanic Plain and South East Coastal Plain bioregions. Contains six subregions, including the under-represented Gippsland Plain, Central Victorian Uplands and Victorian Volcanic Plain. Major geographic elements comprise the Great Dividing Range, a small portion of the Victorian Alps, and the upper and middle catchments of the Yarra River, Bunyip River and Cardinia Creek. Contains 157 000 ha of private land with significant biodiversity assets at a statewide scale.

Key terrestrial ecosystem assets on private land comprise plains woodlands, riverine grassy woodlands, lower slopes or hills woodlands, herb-rich woodlands, plains grasslands, riparian scrubs and dry forests.

Key wetland assets include private land along the Yarra River, a Nationally Important Wetland, and other riparian habitat on private land.

Priority fauna species for conservation include Eltham Copper, Golden Sun-moth, Dandenong Burrowing Cray, Dwarf Galaxias, Australian Grayling, Growling Grass-frog, Striped Legless Lizard, Powerful Owl, Helmeted Honeyeater and Southern Brown Bandicoot.

Priority flora species for conservation include Curly Sedge, Rosella Spider-orchid, Clover Glycine, Tough Scurf-pea, Round-leaf Pomaderris and Buxton Gum.

3.1.4 The focal landscapes as priorities for conservation

Conservation objective 1: key priorities

- use focal landscapes as the primary focus for conservation investment and effort at both the landscape scale and site scale
- as far as possible, target conservation actions relating to the priorities for other conservation objectives towards the focal landscapes
- use focal landscapes and constituent biodiversity priority zones as the backbone for landscape-scale connectivity actions, and
- identify biodiversity assets not encompassed within the focal landscapes that will need separate conservation actions on private land elsewhere in the state.

The focal landscapes comprise large areas of land (each greater than 20 000 ha) identified as being significant in a statewide context for ecosystems and species. Because of their large size and biological significance, the Trust considers that the focal landscapes, and associated corridors and habitat links, provide the most effective opportunities across Victoria for improving the viability of ecosystems, species and populations on private land. Because of the way the optimisation model used to develop the NaturePrint v2.0 spatial layer preferentially selects sites with the best site condition scores, best landscape connectivity scores and lower site-cost scores when there is a choice (DSE 2011b), the focal landscapes are furthermore considered the most cost-effective option for achieving bodiversity gains on private land in Victoria. The 12 focal landscapes will consequently comprise the Trust's primary level of prioritising landscapes and sites for conservation.

It is clear, however, that not all significant biodiversity assets found on private land occur within the focal landscapes; in particular, some of the aquatic ecosystem assets (which were not incorporated into NaturePrint v2.0-DSE 2011a), and many of the threatened species occur outside the focal landscapes. Additional conservation investment and action is required accordingly in other parts of the state. The sections following identify additional gaps and opportunities for private-land conservation by Trust for Nature in relation to the other five conservation objectives developed for the Conservation Plan.

3.2 Conservation objective 2: Improve protection of the least protected ecosystems and threatened communities

3.2.1 Rationale for the objective

Protecting native vegetation is considered a cornerstone of biodiversity conservation and has been the basis of conservation planning in Australia for more than 30 years (Dunlop & Brown 2008). The National Reserve System (NRS) guidelines for a Comprehensive, Adequate and Representative (CAR) reserve system identify the protection of under-represented regional ecosystems as one of the key actions required to build the NRS (Commonwealth of Australia 1999; NRMMC 2005). Protecting the full range and diversity of regional ecosystems – particularly those not already represented in the reserve system – is also recommended as one of the strategies for enabling native species to adapt to a changing climate (Dunlop & Brown 2008; Dunlop *et al.* 2012a, 2012b). In a statutory context, these principles have been taken further through the legislative listing of various threatened ecological communities considered to be at risk from past and current threatening processes under both Commonwealth and Victorian Acts.

Conservation objective 2 was therefore assessed firstly by analysing how well targets for a CAR reserve system in Victoria are currently being met in terms of Comprehensiveness, Adequacy and Representativeness of ecosystem protection. It was also analysed in relation to NRS targets for bioregional and subregional representation in protected areas. Finally, this objective was assessed by considering the representation on private land of threatened vegetation communities listed either under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the *Flora and Fauna Guarantee Act 1988* (FFG Act).

3.2.2 Key findings for the objective

The key findings of the Conservation Plan, in regard to protection of ecosystems and threatened communities, are that:

- nearly half of Victoria's bioregions do not meet national NRS targets for ecosystem protection
- nearly 90% of all under-represented Ecological Vegetation Classes (EVCs) in Victoria occur on private land
- most native vegetation found on private land is under-represented in the NRS
- EVC Groups that include high proportions of under-represented EVCs particularly include woodlands, grasslands, wetlands, box-ironbark forest, riparian scrubs, dry forest and mallee, and
- nearly one million hectares of vegetation in Victoria is classified as nationally threatened, and most of this area is on private land.

3.2.3 Assessment of the Comprehensiveness of current ecosystem protection

'Comprehensiveness' is defined by the NRS as representation of the full range of ecosystems within an IBRA region in the NRS (CfoC 2011).

The NRS target for meeting the Comprehensiveness criterion in terms of ecosystem protection states that at least 80% of the total number of ecosystems found in a bioregion should be included in permanently protected areas (NRMMC 2009). Of the 11 IBRA bioregions found in Victoria, only four meet the NRS threshold of 80% ecosystem representation in protected areas. These are the Australian Alps, Flinders, South Eastern Highlands and Murray Darling Depression (Figure 21 and Table 7). The bioregions with the lowest percentage of EVCs included within protected areas are the Victorian Volcanic Plain and the NSW South Western Slopes bioregion (Figure 21 and Table 7).

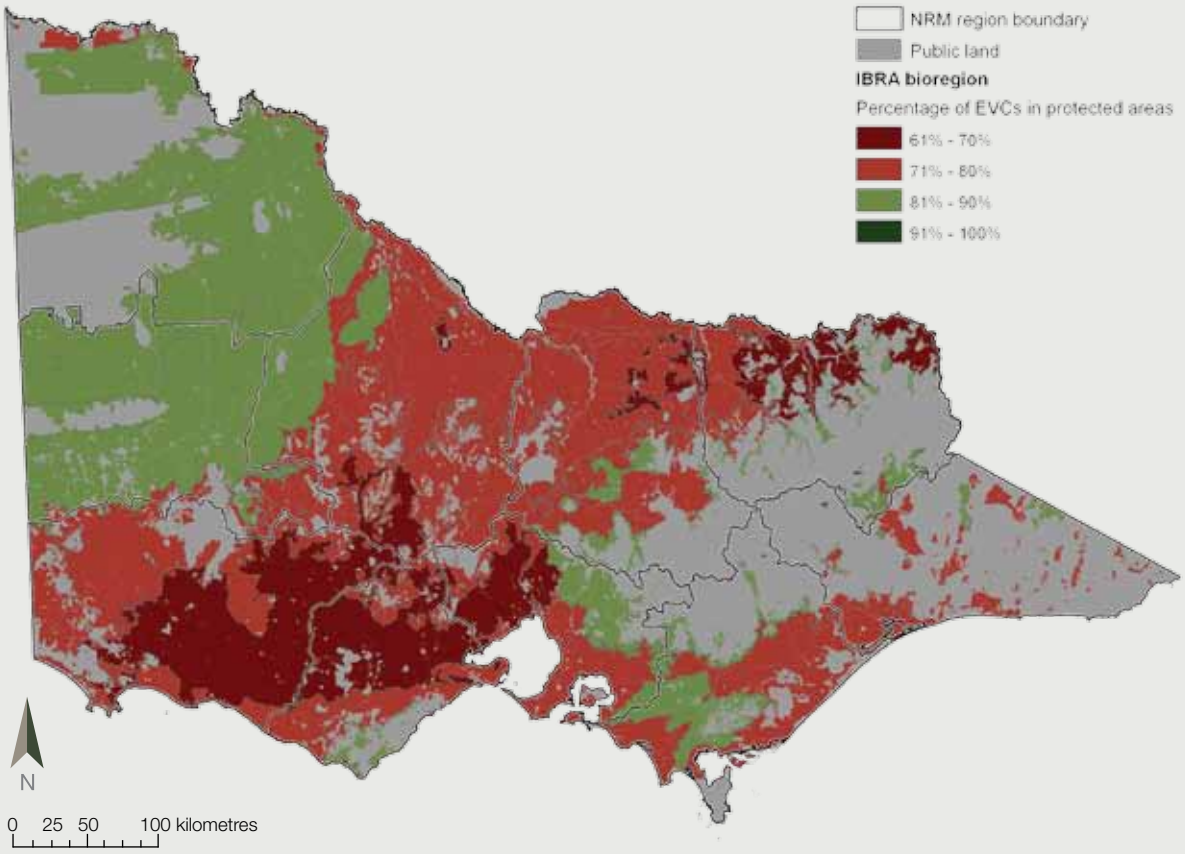

Figure 21. Comprehensiveness of ecosystem protection in Victoria, based on the proportion of Ecological Vegetation Classes (EVCs) found in each IBRA bioregion, which are included in protected areas on public and private land. Areas that are not green fall below the NRS target of 80% ecosystem representation in protected areas

Altogether, 306 Ecological Vegetation Classes (EVCs) (23% of the EVC total), are not represented in any protected areas, either on public land or Trust covenants and properties (Table 7). Eighty-two percent (252) of these unrepresented EVCs occur on private land, particularly in the Victorian Midlands, Victorian Volcanic Plain, South East Coastal Plain and Riverina bioregions (Table 7). For 61% (188) of these unrepresented EVCs, more than 70% of their current extent is on private land (Appendix 7).

Altogether, 60% of the mapped area of unrepresented EVCs across Victoria occurs on private land, with the greatest areas occurring in the Victorian Midlands, Riverina, South East Coastal Plain and Victorian Volcanic Plain bioregions (Figure 22). The total area of these unrepresented EVCs found on private land measures approximately 20 000 ha.

Table 7. Comprehensiveness of Ecological Vegetation Class (EVC) protection within IBRA bioregions, arranged in order of bioregions with the highest to lowest percentages of EVCs represented in protected areas

IBRA bioregion	EVCs present in the bioregion	EVCs represented in protected areas	Unrepresented EVCs present in the bioregion	Unrepresented EVCs on private land
Flinders	33	100	-	-
Australian Alps	48	98	1	-
South Eastern Highlands	99	88	12	9
Murray Darling Depression	147	85	22	21
South East Coastal Plain	151	77	34	32
South East Corner	73	77	17	11
Victorian Midlands	320	77	75	57
Naracoorte Coastal Plain	89	74	23	19
Riverina	194	73	52	38
NSW South Western Slopes	66	65	23	21
Victorian Volcanic Plain	123	62	47	44
Total	1343		306	252

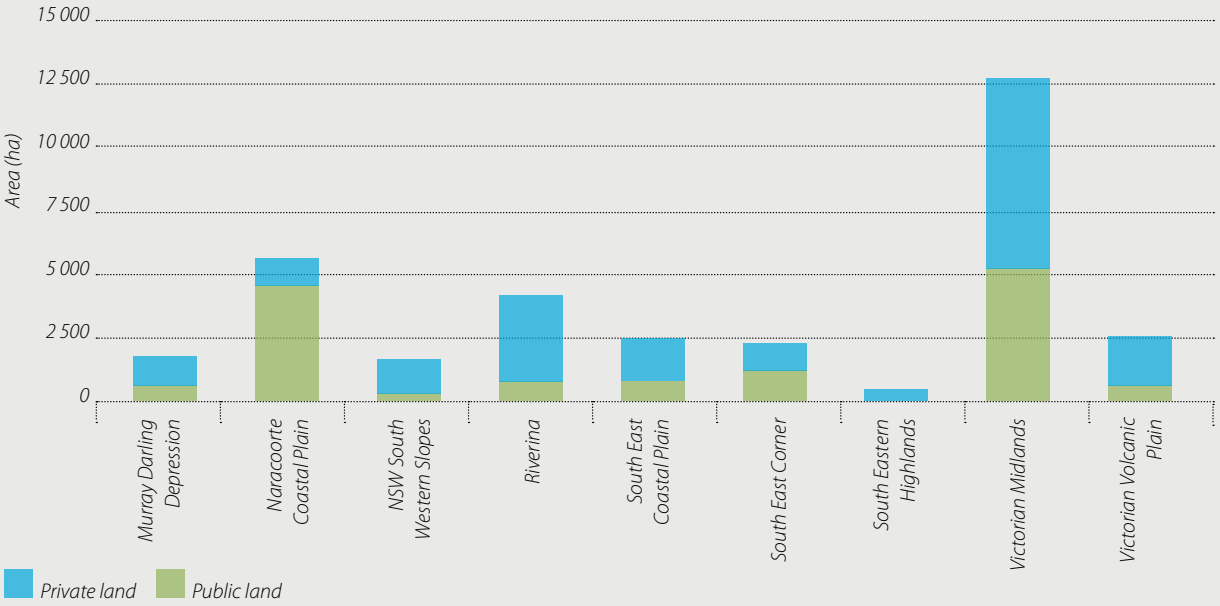

Figure 22. Area of unrepresented Ecological Vegetation Classes (EVCs) in IBRA subregions, on public land and private land. Note that the Australian Alps and Flinders bioregions are not included

The EVC Groups with the highest proportion of unrepresented EVCs found on private land are Plains Woodlands/Forests, Riverine Grassy Woodlands/Forests, Box Ironbark Forests or dry/lower fertility Forests, Dry Forests, Riparian Scrubs/Swampy Scrubs, Wetlands, Plains Grasslands/Chenopod Shrublands, Herb-rich Woodlands and Mallee (Figure 23). When assessed in terms of extent of unprotected EVCs, the EVC Groups with the greatest area of unrepresented EVCs on private land are Plains Woodlands/Forests Box-Ironbark Forests or dry/lower fertility Forests, Lower Slopes/Hills Woodlands, Riparian Scrubs/Swampy Scrubs and Wetlands (Appendix 7).

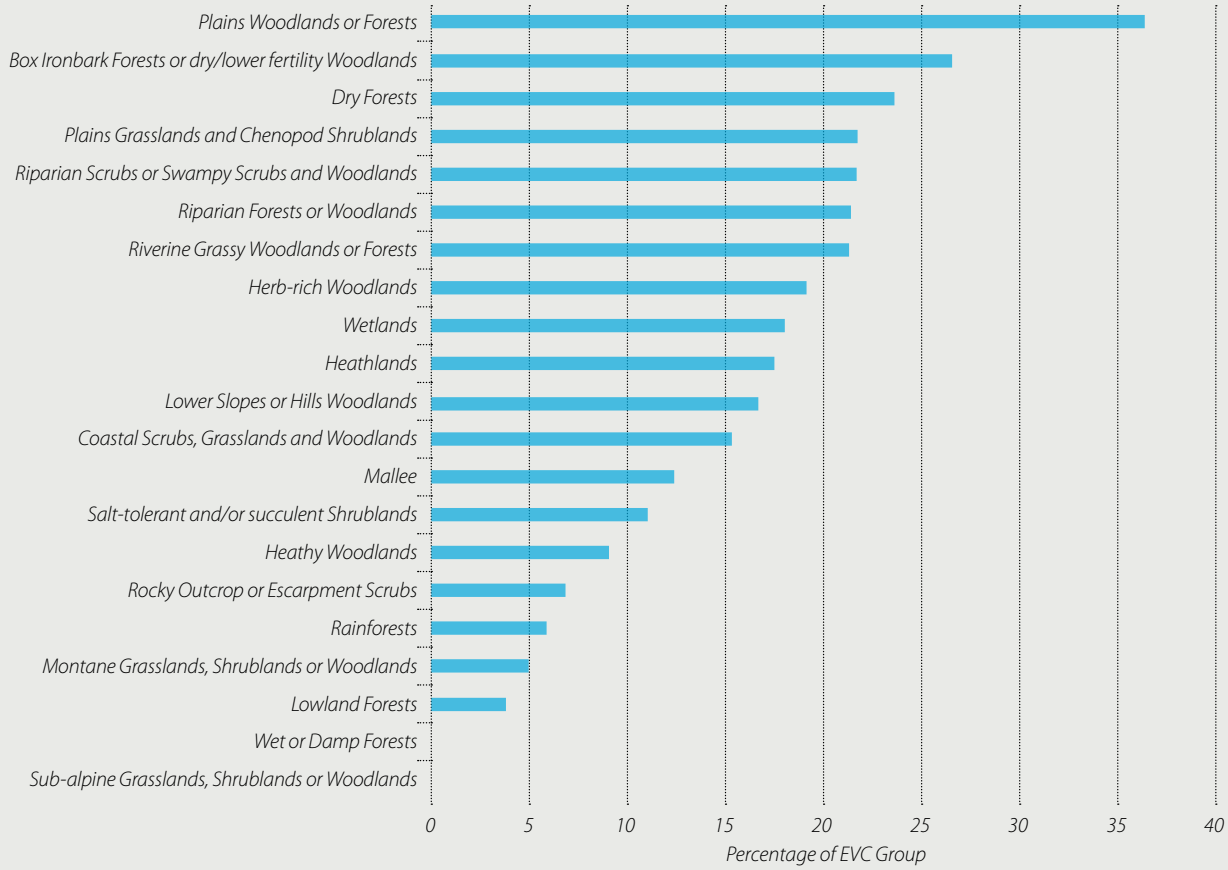

Figure 23. Percentage of the total number of Ecological Vegetation Classes (EVCs) within each EVC Group that are unrepresented in protected areas and occur on private land

3.2.4 Assessment of the Adequacy of current ecosystem protection

'Adequacy' is defined by the NRS as 'protection of at least the minimum area of ecologically functional ecosystems needed to provide the ecological viability and integrity of populations, species and ecological communities at an IBRA subregional scale in the NRS' (CfoC 2011).

Adequacy was assessed based on the following JANIS criteria:

- Criterion 1: representation of at least 15% of the pre-1750 extent of each ecosystem in protected areas
- Criterion 2: representation of at least 60% of the current extent of ecosystems classified as vulnerable in protected areas
- Criterion 3: representation of 100% of the current extent of rare and endangered ecosystems in protected areas
- Combined criteria: assessments based on all of the above criteria, excluding overlapping areas.

Based on the three combined JANIS criteria (JANIS 1997) used to assess Adequacy of ecosystem representation in protected areas, our analyses show that 67% of all EVCs found in Victoria are under-represented in protected areas on public and private land (Table 8). The vast majority (89%) of these EVCs occur on private land (Figure 24) and nearly half of them have more than 70% of their current extent on private land (Table 8).

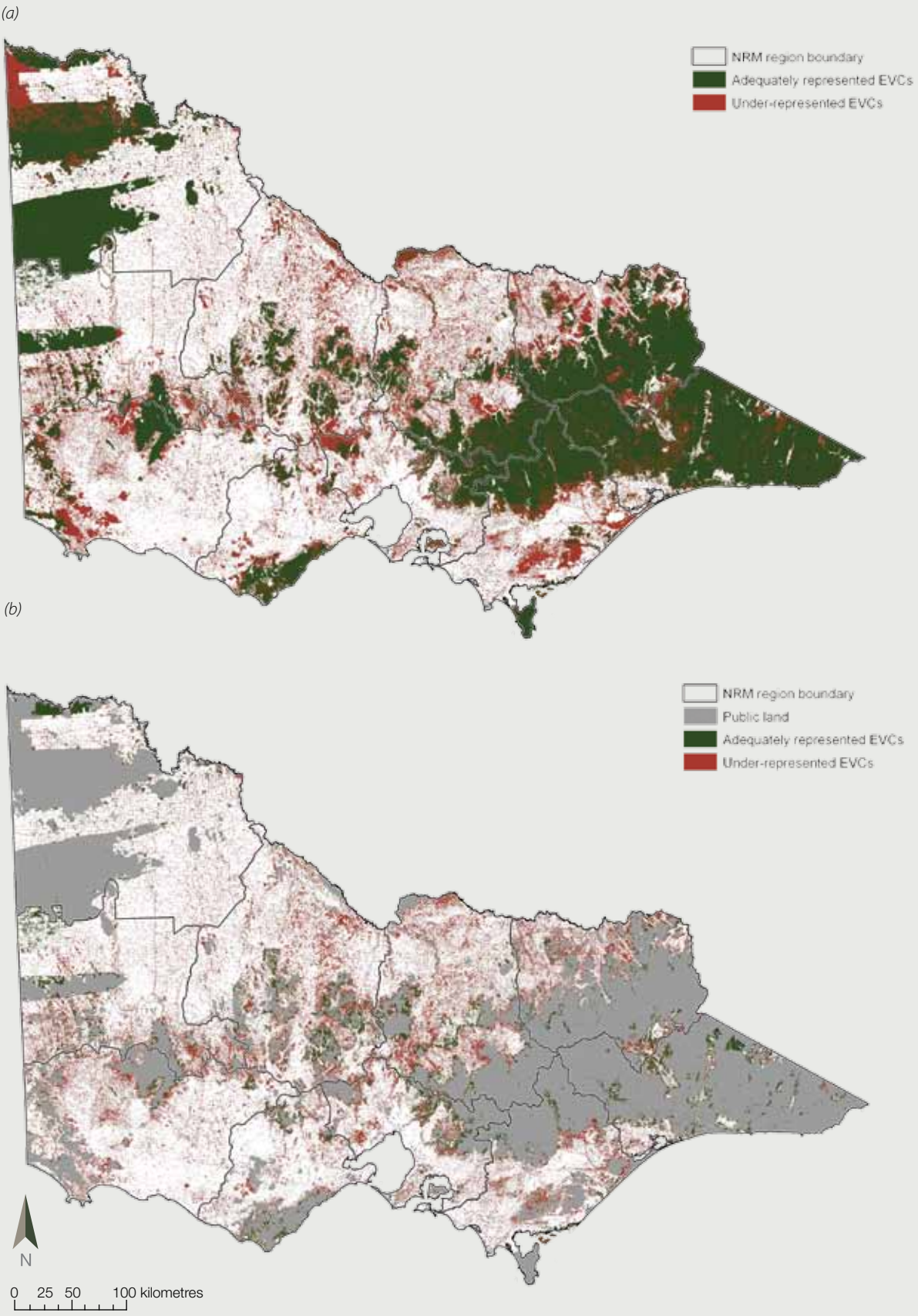

Figure 24. Distribution of under-represented and adequately represented Ecological Vegetation Classes (EVCs) in protected areas on (a) both public and private land and on (b) only private land, under combined JANIS criteria 1, 2, 3

Table 8. Statewide summary of adequacy of Ecological Vegetation Class (EVC) representation in protected areas based on both individual and combined JANIS criteria. Subregional analyses are provided in Appendix 8

	JANIS criterion 1: EVC has >15% of its pre-1750 extent in protected areas	JANIS criterion 2: EVC is classified as vulnerable, with >60% of its current extent in protected areas	JANIS criterion 3: EVC is classified as rare or endangered, with 100% of its current extent in protected areas	Combined JANIS criteria
Number and percentage of under-represented EVCs, out of total of 1883 EVCs	1058 (56.2%)	351 (18.6%)	713 (37.9%)	1271 (67.5%)
Number and percentage of under-represented EVCs on private land, out of total of 1883 EVCs	958 (90.5%)	315 (89.7%)	653 (91.6%)	1130 (88.9%)
Number and percentage of under-represented EVCs with >70% of their area on private land, out of total of 1883 EVCs	566 (53.5%)	129 (36.7%)	398 (55.8%)	579 (45.6%)
Total area of native vegetation in Victoria (ha)	10 480 349	10 480 349	10 480 349	10 480 349
Area of under-represented EVCs (ha)	3 361 640	1 115 801	1 477 165	3 719 550 (35.5%)
Total area of private land vegetation in Victoria (ha)	2 901 659	2 901 659	2 901 659	2 901 659
Area of under-represented EVCs on private land (ha)	2 155 328	648 530	1 161 991	2 245 818 (60.4%)
Total area of under-represented EVCs with >70% of their area on private land (ha)	1 406 205	340 397	1 050 495	1 409 685 (37.9%)

The subregions with the highest percentage of under-represented EVCs found on private land under combined JANIS criteria are the Victorian Volcanic Plain, Victorian Riverina, Central Victorian Uplands, Gippsland Plain, Warrnambool Plain, Strzelecki Ranges, Northern Inland Slopes, Dundas Tablelands, Wimmera and Goldfields (Figure 25).

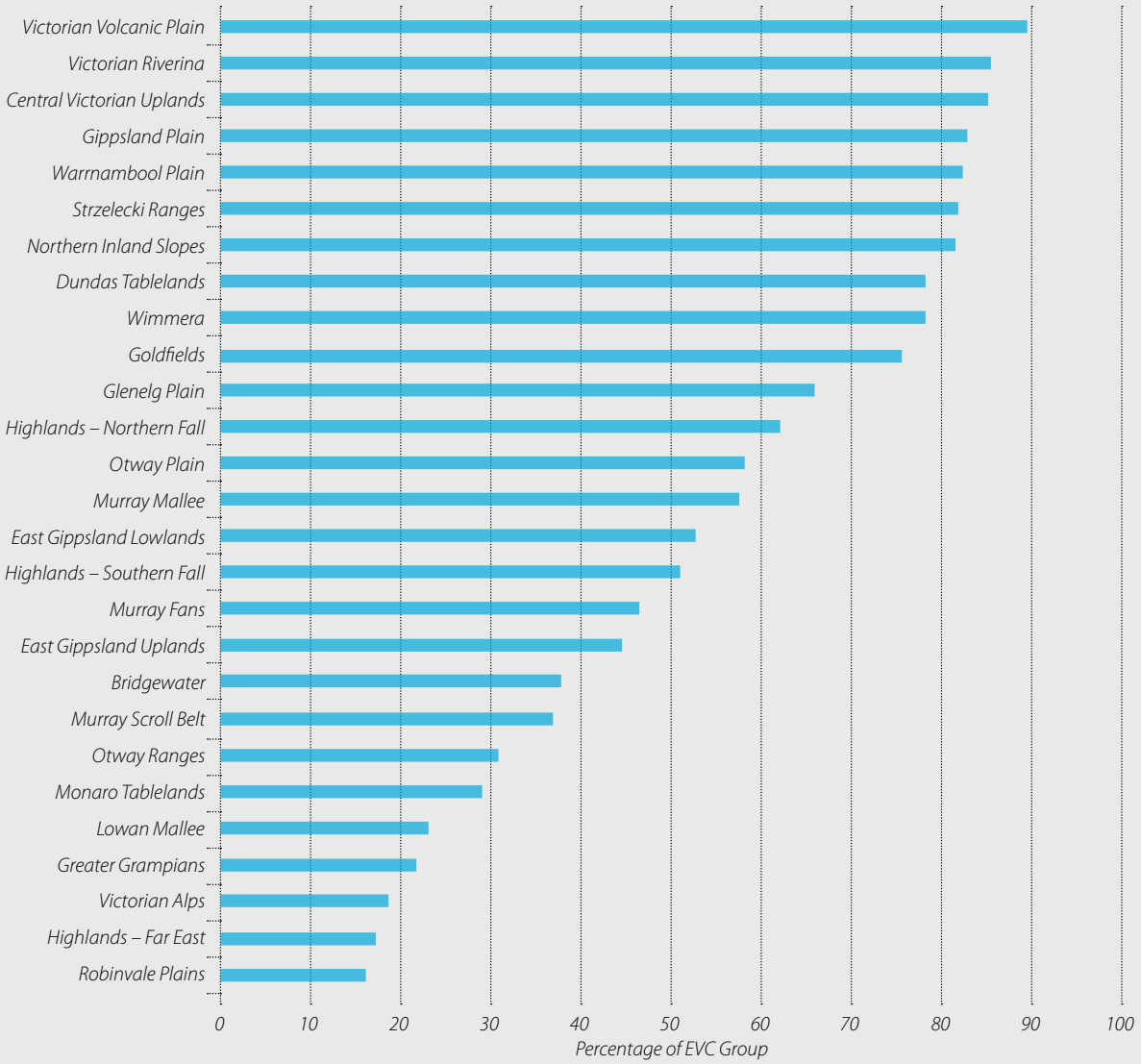

Figure 25. Percentage of Ecological Vegetation Classes (EVCs) found on private land in each IBRA subregion that are under-represented in protected areas, based on combined JANIS criteria

Altogether, the area of under-represented EVCs found on private land measures 2.2 million hectares. This represents 77% of Victoria's 2.9 million hectare total area of private-land native vegetation (Figure 26). When only under-represented EVCs that have >70% of their remaining extent on private land are considered, there are 1.4 million hectares on private land (49% of Victoria's total of private-land native vegetation). Overall, the private-land proportion of under-represented EVCs in Victoria comprises 60% of the total extent of under-represented EVCs in Victoria (Table 8).

The largest extents of these under-represented EVCs on private land occur in the Victorian Riverina, Central Victorian Uplands, Goldfields, Wimmera, Victorian Volcanic Plain, Dundas Tableland, Gippsland Plain, Murray Mallee and Northern Inland Slopes subregions (Figure 26).

Thirty percent (665 000 ha) of the private-land extent of under-represented EVCs in Victoria occurs in the 12 focal landscapes, particularly in the Victorian Midlands, Eastern Riverina, Western Riverina, South-West, Gippsland Plain and Gippsland Lakes Catchment, and Northern Inland Slopes landscapes.

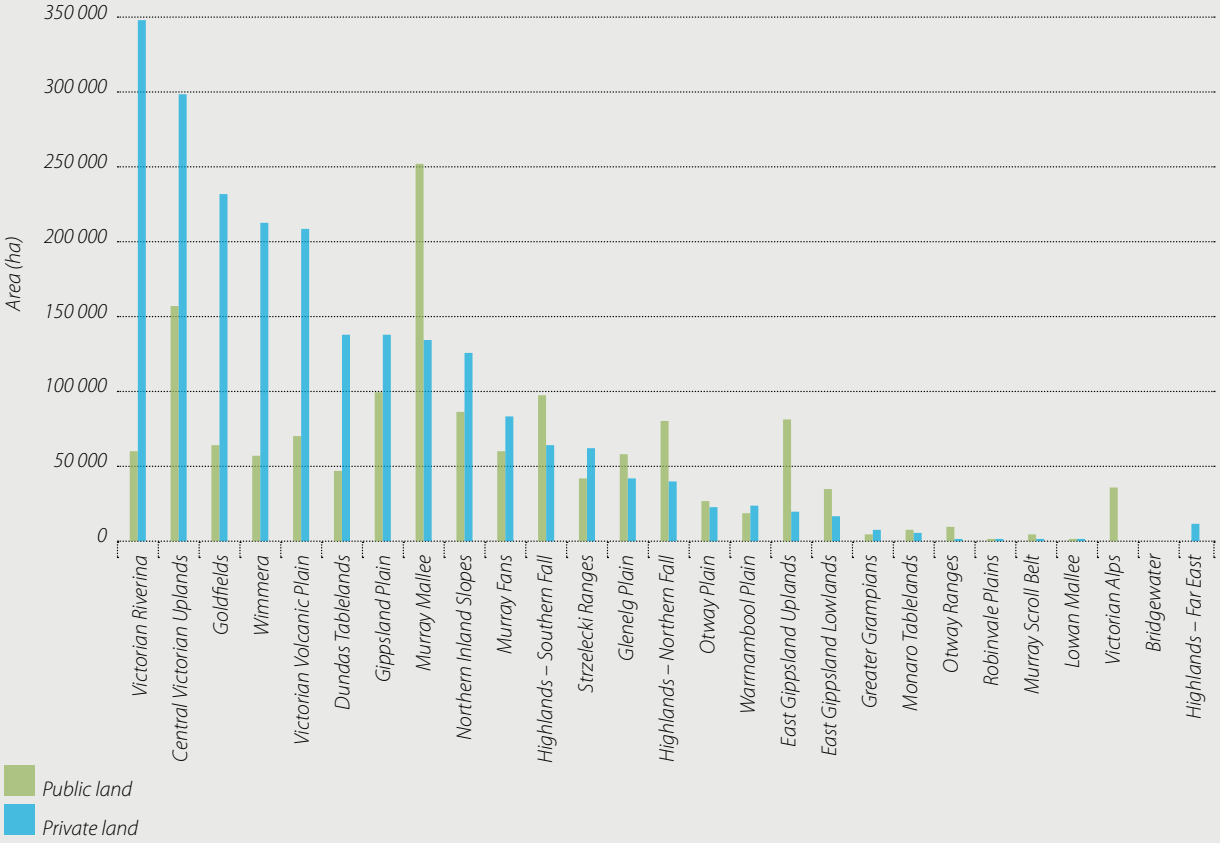

Figure 26. Area of under-represented Ecological Vegetation Classes (EVCs) on public land and private land in each IBRA subregion, based on the combined JANIS criteria (note that the Wilsons Promontory subregion is not included).

Across the state, the EVC Groups that have the highest proportions of under-represented EVCs occurring on private land are Plains Woodlands/Forests, Plains Grasslands/Chenopod Shrublands, Riparian Scrubs/Swampy Scrubs, Box Ironbark Forests or dry/lower fertility Woodlands, Lower Slopes/Hills Woodlands, Herb-rich Woodlands, Mallee, Riverine Grassy Woodlands/Forests and Wetlands (Figure 27). Overall, these same EVC Groups are the most disproportionately under-represented, regardless of which JANIS criterion they are assessed against (Appendix 9). However, it is worth noting that a relatively high proportion of EVCs found on private land within the Rainforest EVC Group and Rocky Escarpment Scrub EVC Group are classified as under-represented when assessed against JANIS criterion 3 for rare and endangered ecosystems (Appendix 9).

In terms of area, the EVC Groups with the greatest areas of EVCs that are both under-represented and occur on private land are Plains Woodlands/Forests, Dry Forests, Lower Slopes/Hills Woodlands, Plains Grasslands/Chenopod Shrublands, Riverine Grassy Woodlands/Forests, Mallee and Herb-rich Woodlands (Figure 28).

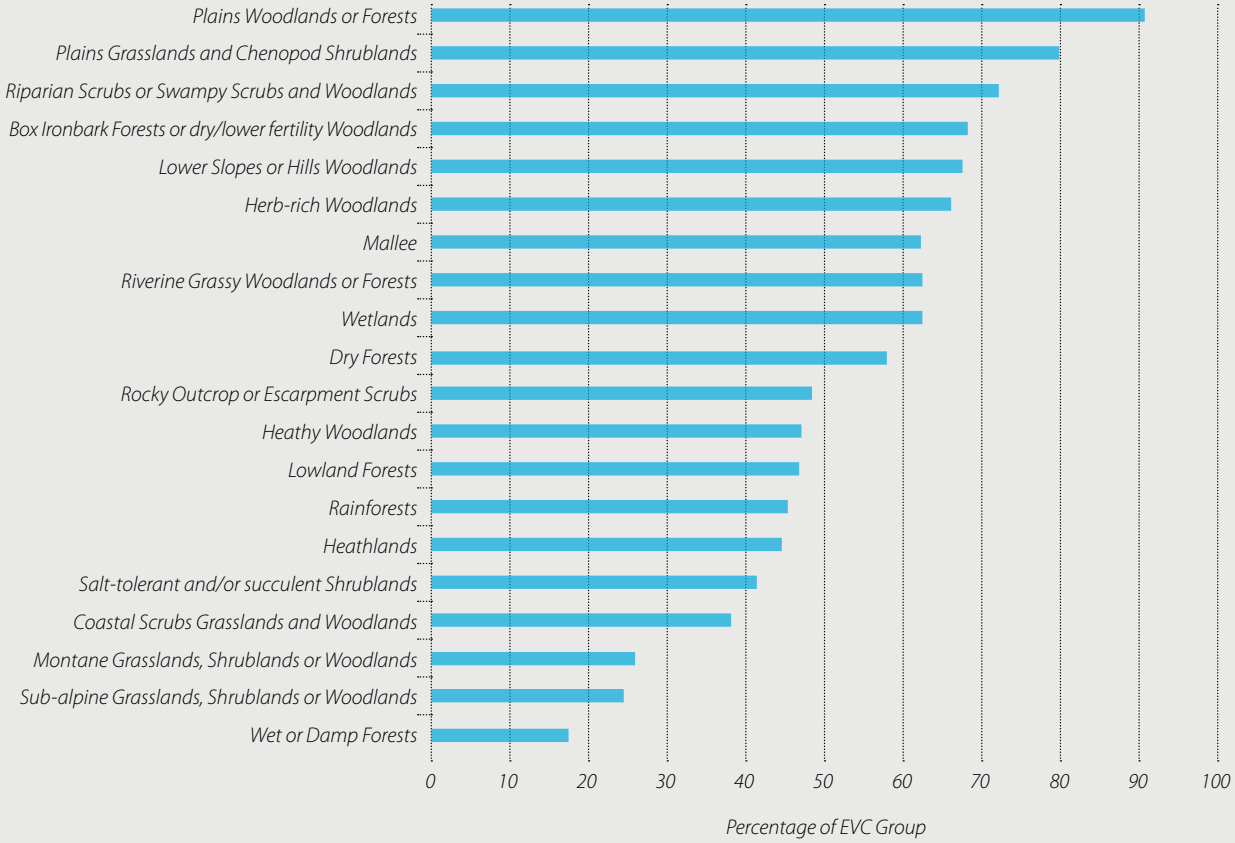

Figure 27. Percentage of Ecological Vegetation Classes (EVCs) within each EVC Group that occur on private land and are under-represented in protected areas, based on combined JANIS criteria. Additional information is contained in Appendix 9

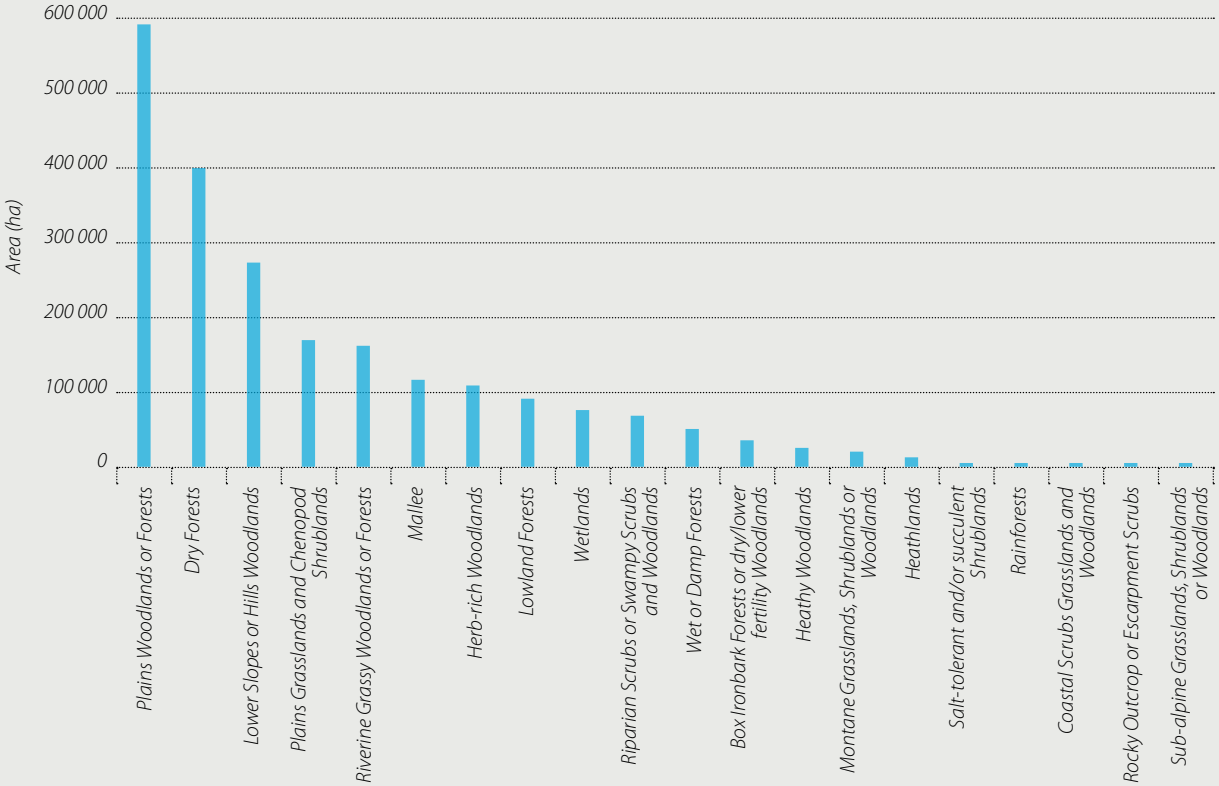

Figure 28. Area of under-represented Ecological Vegetation Classes (EVCs) within each EVC Group found on private land, based on the combined JANIS criteria. Additional information is contained in Appendix 9

3.2.5 Assessment of the Representativeness of current ecosystem protection

'Representativeness' is defined by the NRS as being representation of the variability of regional ecosystems in a bioregion by including representation of more than one example of every regional ecosystem within each constituent subregion (Commonwealth of Australia 1999; NRMMC 2009; CfoC 2011).

The NRS target for meeting the Representativeness criterion in terms of ecosystem protection states that at least 80% of the total number of ecosystems found in a subregion should be included in permanently protected areas. Of the 28 IBRA subregions that occur within Victoria, however, only 16 (57%) meet this target (Table 9). The lowest ranked subregions in terms of EVC representation in protected areas are Goldfields, Central Victorian Uplands, Victorian Volcanic Plains, Victorian Riverina, Dundas Tablelands, Warrnambool Plains and Northern Inland Slopes (Figure 29, Table 9).

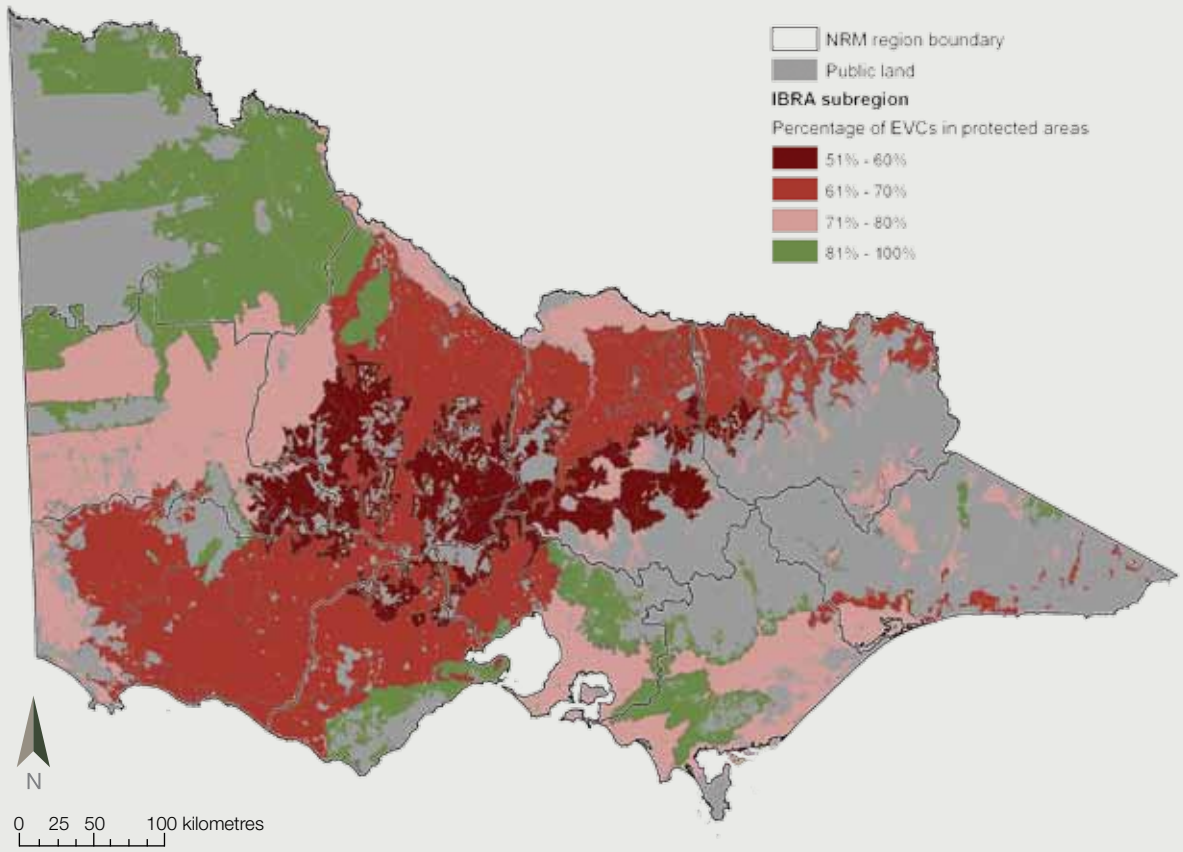

Figure 29. Subregional levels of ecosystem Ecological Vegetation Class (EVC) protection. Areas that are not green fall below the NRS target of 80% ecosystem representation in protected areas

Altogether 452 EVCs mapped at the subregional scale (24% of the total number of subregional EVCs in Victoria) are not represented in any protected area either on public land or Trust for Nature covenants and conservation properties (Table 9). Eighty-one percent of these unrepresented EVCs occur on private land and 59% of them have more than 70% of their remaining extent on private land, particularly in the Victorian Riverina, Victorian Volcanic Plain and Central Victorian Uplands subregions (Table 9). The total extent of these unrepresented EVCs is approximately 44 000 ha, of which 26 000 ha (59%) is on private land. The subregions with the greatest extent of unrepresented EVCs on private land are the Dundas Tabelands, Victorian Riverina, Central Victorian Uplands, Victorian Volcanic Plain, Goldfields, Gippsland Plain and Glenelg Plain (Figure 30).

Across Victoria, the EVC Groups with the highest percentage of unrepresented EVCs in protected areas found on private land are Plains Woodlands/Forests, Box Ironbark Forests or dry/lower fertility Woodlands, Riparian Scrubs/Swampy Scrubs, Plains Grasslands/Chenopod Shrublands, Dry Forests, Lower Slopes/Hills Woodlands, Wetlands and Riverine Grassy Woodlands/Forests (Figure 31). More information about EVC Groups in relation to the Representativeness criterion is provided in Appendix 10.

Table 9. Summary of Ecological Vegetation Class (EVC) representation and gaps in representation in Victoria's protected areas and on private land. NB: Wilsons Promontory subregional data not included

IBRA subregion	Percentage of the subregion's EVCs represented in protected areas	Number of EVCs present	Number of unrepresented EVCs present	Number of unrepresented EVCs found on private land	Number of unrepresented EVCs with >70% of their extent on private land
Goldfields	52%	69	33	23	18
Central Victorian Uplands	60%	92	37	34	29
Victorian Volcanic Plain	61%	124	48	44	33
Victorian Riverina	62%	121	46	42	34
Dundas Tablelands	63%	97	36	26	18
Warrnambool Plain	64%	42	15	15	13
Northern Inland Slopes	65%	66	23	21	15
East Gippsland Lowlands	70%	50	15	10	9
Glenelg Plain	73%	86	23	19	8
Gippsland Plain	76%	124	30	28	20
Murray Fans	77%	124	28	14	11
East Gippsland Uplands	77%	52	12	6	–
Wimmera	80%	133	27	25	16
Highlands – Northern Fall	80%	59	12	9	6
Highlands – Far East	82%	17	3	1	–
Highlands – Southern Fall	82%	71	13	8	5
Strzelecki Ranges	82%	28	5	5	3
Bridgewater	85%	13	2	2	2
Otway Plain	88%	50	6	5	2
Monaro Tablelands	88%	17	2	1	1
Murray Mallee	89%	45	5	4	3
Grampians	89%	212	23	22	17
Robinvale Plains	90%	29	3	–	–
Otway Ranges	92%	26	2	2	1
Murray Scroll Belt	95%	21	1	1	–
Lowan Mallee	97%	34	1	1	1
Victorian Alps	98%	48	1	–	–
Total		1833	452	368	265

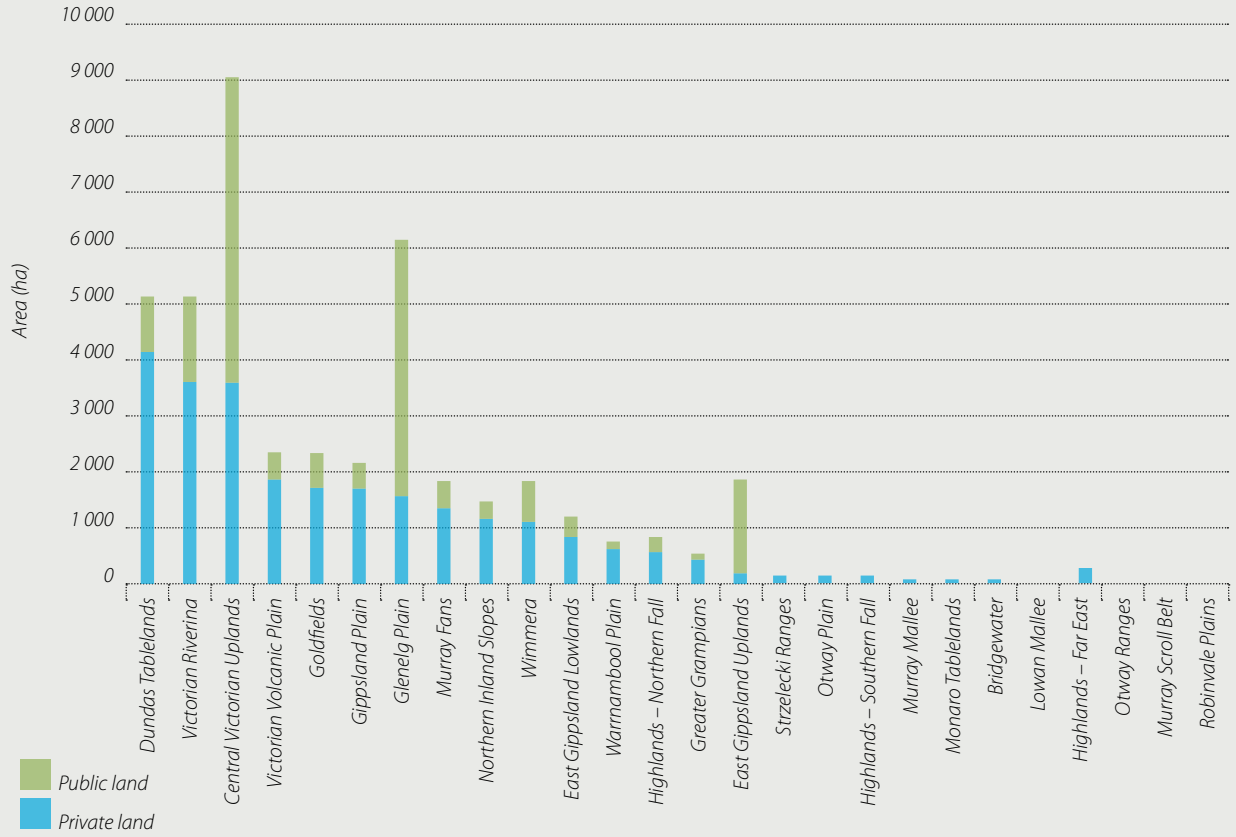

Figure 30. Extent of unrepresented Ecological Vegetation Classes (EVCs) in IBRA subregions on public land and private land. Note that the Victorian Alps and Wilsons Promontory subregions are not included

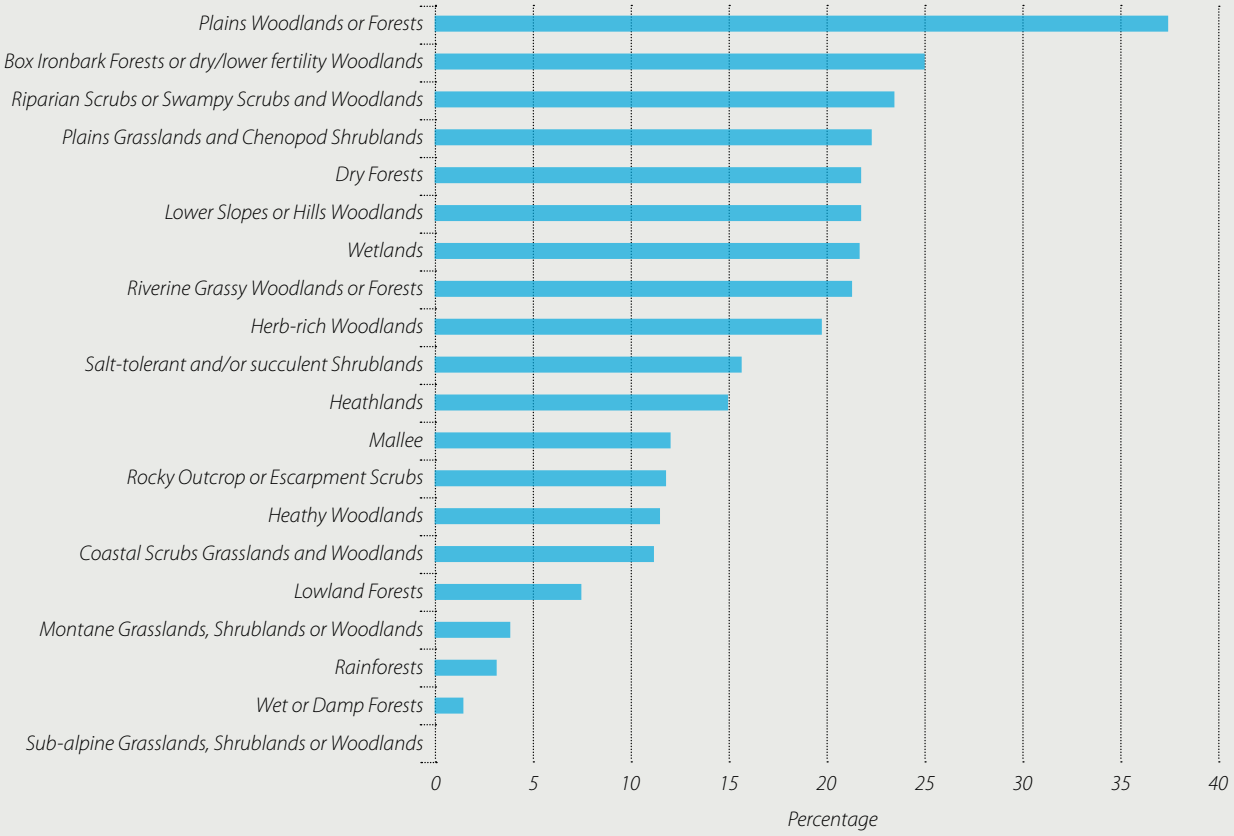

Figure 31. Percentage of unrepresented Ecological Vegetation Classes (EVCs) in each EVC Group that occur on private land

3.2.6 Assessment of the protection levels of IBRA bioregions and subregions

As part of its guidelines for achieving a CAR reserve system by 2015, the NRS has set a target of increasing protection in IBRA bioregions and subregions around Australia to at least 10% of their area (NRMMC 2009; CfoC 2011). Measured against this target, the Victorian Volcanic Plains, Riverina and South East Coastal Plain IBRA bioregions in Victoria are nationally under-represented in the NRS (Table 10). A further two bioregions that occur only partly in Victoria and extend across the state boundaries are also considered nationally under-represented by the NRS – Narracoorte Coastal Plain and NSW South Western Slopes – although they meet the 10% threshold within their Victorian extent of each bioregion (Table 10).

At the subregional scale, nearly one-third of Victoria's subregions fail to meet the 10% bioregional protection target (Figure 32), namely: Victorian Volcanic Plain, Dundas Tablelands, Gippsland Plain, Victorian Riverina, Strzelecki Ranges, Wimmera, Murray Fans, Warrnambool Plain and Central Victorian Uplands (Table 10). In addition, the Glenelg Plains, Goldfields and Northern Inland Slopes subregions do meet the NRS target, but all include only 10 to 15% of their land area in protected areas (Table 10, Figure 32).

Table 10. Percentage of the area of each IBRA bioregion and subregion that is included in protected areas on public and private land

IBRA bioregion	Percentage protected (of total area)	IBRA subregion	Percentage protected (of total area)
Australian Alps	51	Victorian Alps	51
Flinders	100	Wilsons Promontory	100
Murray Darling Depression	23	Lowan Mallee	66
		Murray Mallee	16
		Wimmera	3
Naracoorte Coastal Plain	15	Bridgewater	56
		Glenelg Plain	13
NSW South Western Slopes	12	Northern Inland Slopes	12
Riverina	6	Murray Fans	5
		Murray Scroll Belt	50
		Robinvale Plains	61
		Victorian Riverina	2
South East Coastal Plain	10	Gippsland Plain	9
		Otway Plain	16
		Warrnambool Plain	7
South East Corner	28	East Gippsland Lowlands	25
		East Gippsland Uplands	30
		Highlands – Far East	28
South Eastern Highlands	21	Highlands – Northern Fall	21
		Highlands – Southern Fall	24
		Monaro Tablelands	18
		Otway Ranges	50
		Strzelecki Ranges	2
Victorian Midlands	12	Central Victorian Uplands	7
		Dundas Tablelands	1
		Goldfields	12
		Greater Grampians	76
Victorian Volcanic Plain	3	Victorian Volcanic Plain	3

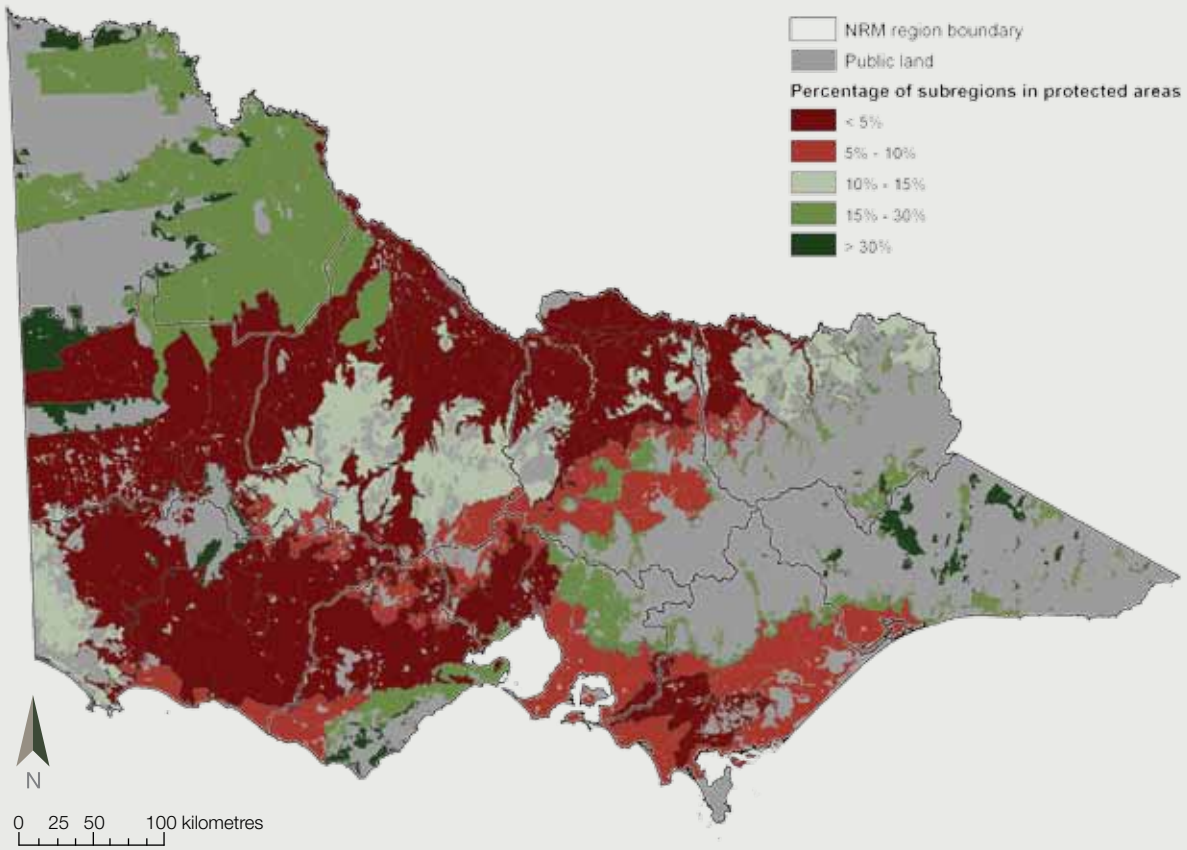

Figure 32. Percentage of land area included in protected areas in each subregion, in relation to the NRS target of at least 10% of each subregion's land area being included in protected areas. The map only shows the rankings for the private land portion of every subregion. Areas that are not green are below the 10% NRS protection target

3.2.7 Assessment of the protection of threatened ecological communities

A range of ecological vegetation communities are listed as threatened under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act). For those communities listed under the EPBC Act, the Conservation Plan identified the matching Ecological Vegetation Classes using the EPBC listing advice or other available information. It then analysed the current extent of the listed community on private land and its protected area status. For communities listed as threatened under the FFG Act, the FFG Act descriptions of the community's occurrence were used to determine which EVC Group and subregion the community was most likely to belong to, and what its distribution was on private land.

Vegetation communities listed under the *Environment Protection and Biodiversity Conservation Act 1999*

Nine vegetation communities listed as nationally threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) were assessed as occurring on private land in Victoria (as at September 2012):

- Alpine Sphagnum Bogs and Associated Fens
- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions
- Gippsland Red Gum *(Eucalyptus tereticornis* subsp. *mediana)* Grassy Woodland and Associated Native Grassland
- Grassy Eucalypt Woodland of the Victorian Volcanic Plain
- Grey Box *(Eucalyptus microcarpa)* Grassy Woodlands and Derived Native Grasslands of South-eastern Australia
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia
- Natural Temperate Grassland of the Victorian Volcanic Plain
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland, and
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains.

The total area of EPBC Act listed communities on private land in Victoria (excluding overlapping extent between different EPBC Act communities) is approximately 703 000 ha, including more than 80% of the extent of seven of the listed communities (Table 11). Of the total extent of EPBC Act listed communities in Victoria (excluding overlapping EVCs), approximately 240 000 ha occurs within the focal landscapes. The approximate distribution of these communities on private land is shown in Figure 33.

Table 11. Victorian vegetation communities listed under the Environment Protection and Biodiversity Conservation Act 1999 *(EPBC Act) and found on private land within the state as at September 2012*

EPBC Act listed community	Number of EVCs in the community	Area (ha)	Area on private land (ha) (and as a percentage of total area in Victoria)	Area reserved on public land (ha)	Area protected on Trust land (ha)
Alpine Sphagnum Bogs and Associated Fens	6	1 857	159 (8.5%)	1 309	–
Buloke Woodlands	23	317 328	258 852 (82.6%)	43 086	2 332
Gippsland Red Gum Grassy Woodland and Associated Native Grassland	7	30 498	27 212 (89.2%)	1 865	267
Grassy Eucalypt Woodland of the Victorian Volcanic Plain	4	60 575	56 126 (92.7%)	1 811	61
Grey Box Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	31	375 320	330 777 (88.1%)	20 326	1 476
Natural Temperate Grassland of the Victorian Volcanic Plain	2	65 295	61 093 (93.6%)	1 533	119
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland	9	235 384	195 402 (83.0%)	22 835	1 244
Littoral Rainforest and Coastal Vine Thickets	Not available	279	13 mapped sites (10% of total no. of mapped sites)	Not available	Not available
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	21	18 264	17 077 (93.5%)	489	28
Total for all EPBC Act communities	103	1 104 800	946 726	93 254	5 527

Note 1: The total areas vary slightly from the Victorian figures provided in the relevant listing advice, due to uncertainty about which Ecological Vegetation Classes (EVCs) to include as part of each community.

Note 2: Some EVCs have been included within the measurements for more than one community, based on listing advice criteria. The total area figures provided for each community should accordingly not be treated as independent areas.

Note 3: Littoral Rainforest data taken from Threatened Species Scientific Committee (TSSC) (2008).

Note 4: Natural Grasslands of the Murray Valley Plains was not endorsed as a listed community at the time of analyses (September 2012) and therefore not included.

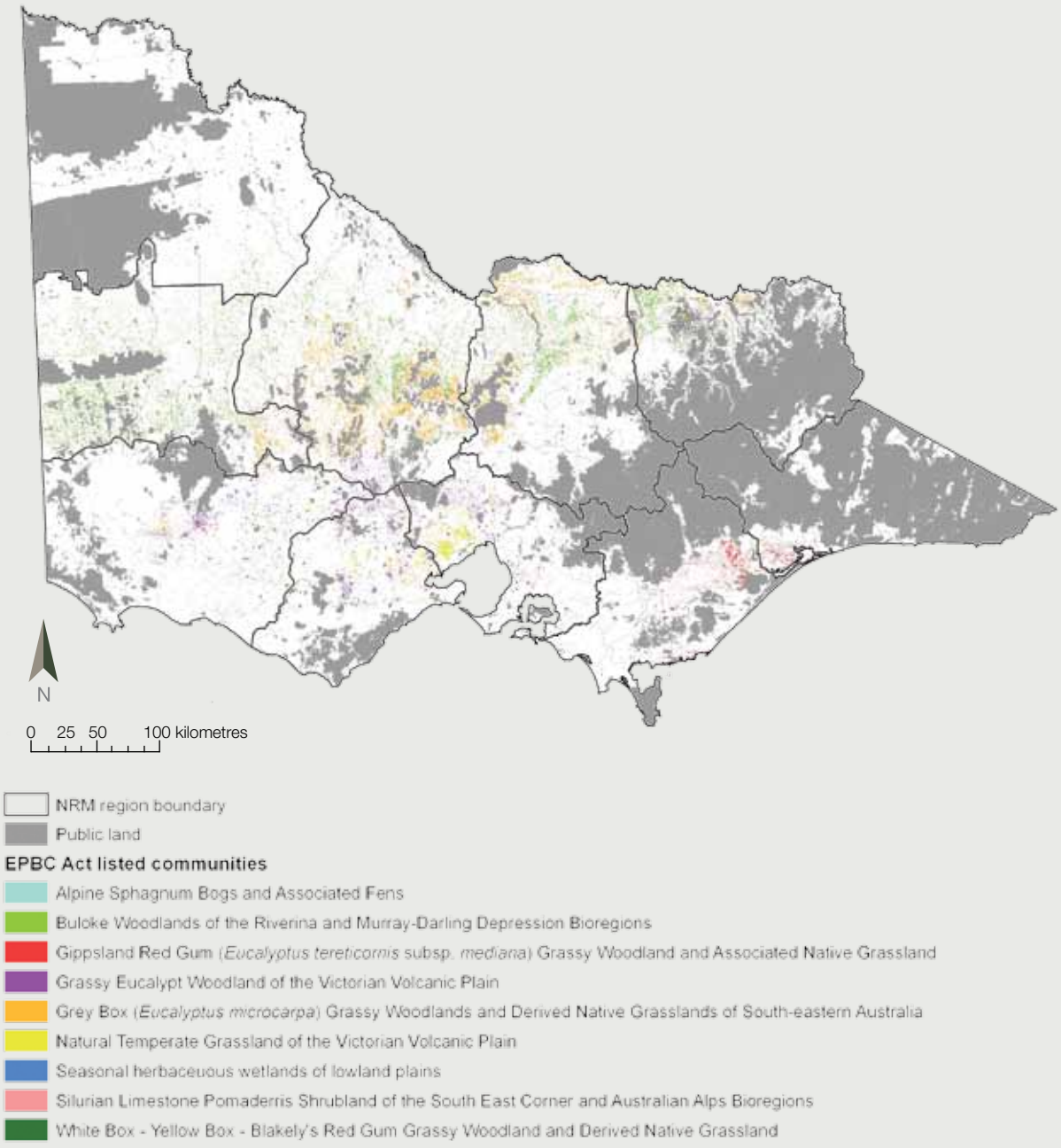

Figure 33. Current extent of Environment Protection and Biodiversity Conservation Act 1999 *(EPBC Act) listed communities on private land. Where an Ecologcal Vegetation Class is classified as belonging to more than one EPBC Act listed community, it has been classified as part of whichever community is listed first in the map's legend.*

Vegetation communities listed under the *Flora and Fauna Guarantee Act 1988*

Twenty-two vegetation communities listed as threatened under the *Flora and Fauna Guarantee Act 1988* (FFG Act) occur at least partly on private land across 19 of Victoria's subregions (Table 12). Thirteen of these listed communities are assessed as belonging to Woodland, Grassland or Wetland EVC Groups, all of which have been largely cleared and now occur substantially on private land. A further four listed communities are classified as Rainforests, an EVC Group which is still extant through most of its pre-1750 distribution but very restricted in terms of its natural distribution and therefore at high risk of local extinction and degradation (Peel 1999). Also of note in terms of private-land conservation is the Coastal Moonah *(Melaleuca lanceolata* subsp. *lanceolata)* Woodland Community, a coastal scrub community associated with many areas undergoing rapid urban development, particularly on the Bellarine and Mornington Peninsulas.

Table 12. Victorian vegetation communities listed under the Flora and Fauna Gaurantee Act 1988 *(FFG Act) and found on private land within the state*

FFG Act listed community	Corresponding EPBC Act listed community	EVC Groups contained in the community	Estimated subregional occurrence
Alpine Bog Community	Alpine Sphagnum Bogs and Associated Fens	Sub-alpine Grasslands, Shrublands or Woodlands	Victorian Alps
Central Gippsland Plains Grassland Community	Gippsland Red Gum *(Eucalyptus tereticornis* subsp. *mediana)* Grassy Woodland and Associated Native Grassland	Plains Grassy Woodlands or Forests	Gippsland Plain
Coastal Moonah *(Melaleuca lanceolata* subsp. *lanceolata)* Woodland Community		Coastal Scrubs Grasslands and Woodlands	Gippsland Plain, Otway Plain, Bridgewater, Warrnambool Plain
Cool Temperate Rainforest Community		Rainforest	East Gippsland Uplands, Highland – Southern Fall, Otway Ranges, Strzelecki Ranges
Creekline Grassy Woodland (Goldfields) Community	Grey Box *(Eucalyptus microcarpa)* Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Riverine Grassy Woodlands or Forests	Goldfields, Northern Inland Slopes, Victorian Riverina
Forest Red Gum Grassy Woodland Community	Gippsland Red Gum *(Eucalyptus tereticornis* subsp. *mediana)* Grassy Woodland and Associated Native Grassland	Plains Grassy Woodlands or Forests	Gippsland Plain
Grey Box – Buloke Grassy Woodland Community	Grey Box *(Eucalyptus microcarpa)* Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Plains Grassy Woodlands or Forests	Murray Mallee, Victorian Riverina, Murray Fans, Goldfields, Northern Inland Slopes, Central Victorian Uplands, Victorian Volcanic Plain, Wimmera
Herb-rich Plains Grassy Wetland (West Gippsland) Community	Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	Wetlands	Gippsland Plain
Limestone Grassy Woodland Community		Lower Slopes or Hills Woodlands	East Gippsland Lowlands
Limestone Pomaderris Shrubland	Silurian Limestone Pomaderris Shrubland of the South East Corner and Australian Alps Bioregions	Rocky Outcrop or Escarpment Scrubs	East Gippsland Lowlands, East Gippsland Uplands, Gippsland Plain
Northern Plains Grassland Community	Nominated for EPBC Act listing in September 2012 (now finalised as Natural Grasslands of the Murray Valley Plains)	Plains Grasslands or Chenopod Shrublands	Victorian Riverina
Plains Grassland (South Gippsland) Community		Plains Grasslands or Chenopod Shrublands	Gippsland Plain
Red Gum Swamp Community No. 1		Wetlands	Wimmera
Rocky Chenopod Open Scrub Community		Rocky Outcrops or Escarpment Scrubs	Central Victorian Uplands
Semi-arid Herbaceous Pine Woodland Community	Buloke Woodlands of the Riverina and Murray–Darling Depression bioregions	Plains Woodlands or Forests	Lowan Mallee, Murray Mallee
Semi-arid Northwest Plains Buloke Grassy Woodlands Community	Buloke Woodlands of the Riverina and Murray–Darling Depression bioregions	Plains Woodlands or Forests	Lowan Mallee, Murray Mallee, Wimmera
Semi-arid Shrubby Pine – Buloke Woodland Community	Buloke Woodlands of the Riverina and Murray–Darling Depression bioregions	Plains Woodlands or Forests	Lowan Mallee, Murray Mallee, Wimmera
Warm Temperate Rainforest (Coastal East Gippsland) Community	Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Rainforest	East Gippsland Lowlands

FFG Act listed community	Corresponding EPBC Act listed community	EVC Groups contained in the community	Estimated subregional occurrence
Warm Temperate Rainforest (East Gippsland Alluvial Terraces) Community		Rainforest	East Gippsland Lowlands, Gippsland Plain
Warm Temperate Rainforest (Far East Gippsland) Community		Rainforest	East Gippsland Lowlands, Gippsland Plain
Western (Basalt) Plains Grasslands Community	Natural Temperate Grassland of the Victorian Volcanic Plain	Plains Grasslands or Chenopod Shrublands	Victorian Volcanic Plain
Western Basalt Plains (River Red Gum) Grassy Woodland	Grassy Eucalypt Woodland of the Victorian Volcanic Plain	Plains Woodlands or Forests	Victorian Volcanic Plain

3.2.8 Priorities for improving ecosystem protection

Conservation objective 2: key priorities

- recognise that increased protection of under-represented ecosystems on private land is critical to meeting NRS bioregional, subregional and ecosystem targets in Victoria
- the Trust will continue its long-established focus on private-land protection in the nationally under-represented Riverina, Victorian Volcanic Plain and South East Coastal Plain IBRA bioregions
- recognise substantial gaps exist in ecosystem representation in protected areas in many other subregions that do not form part of the IBRA bioregions mentioned above, notably Glenelg Plain, Wimmera, Murray Mallee, Dundas Tablelands, Central Victorian Uplands, Goldfields, Northern Inland Slopes, East Gippsland Lowlands and Strzelecki Ranges. Target all of these areas for increased protection on private land
- recognise that even in those bioregions and subregions that meet national targets for ecosystem representation, there are many EVCs found principally on private land that should be targeted for increased protection
- understand that the Trust, in partnership with private landowners, has a critical role to play in improving the protection status of under-represented ecosystems and vegetation communities classified as nationally threatened in Victoria
- continue the Trust's long-standing focus on increasing protection of woodlands and grasslands should continue, especially in focal landscapes and under-represented subregions, and
- increasingly target other vegetation groups that occur principally on private land and are under-represented in protected areas; for example, wetlands and riparian scrubs.

Improving protection of under-represented ecosystems

The Conservation Plan's findings highlight the critical importance of private land in meeting NRS targets for a Comprehensive, Adequate and Representative reserve system in Victoria.

Firstly, as shown in Figure 34, increased protection of private land habitat provides the only means of attaining the NRS 10% subregional protection target in the Victorian Volcanic Plain, Victorian Riverina, Dundas Tableland, Warrnambool Plain and Wimmera subregions, as there is not enough non-protected habitat available on public land to meet the target (Figure 34). Even in other subregions, where sufficient habitat remains on public land, to achieve the 10% target, systematic land-use planning and land-tenure change have already been implemented for much of the public estate (e.g. ECC 2001; VEAC 2008). It is unlikely, therefore, that much additional public land will be transferred into the protected areas estate. Instead, private land provides the best option to increase the NRS in these subregions.

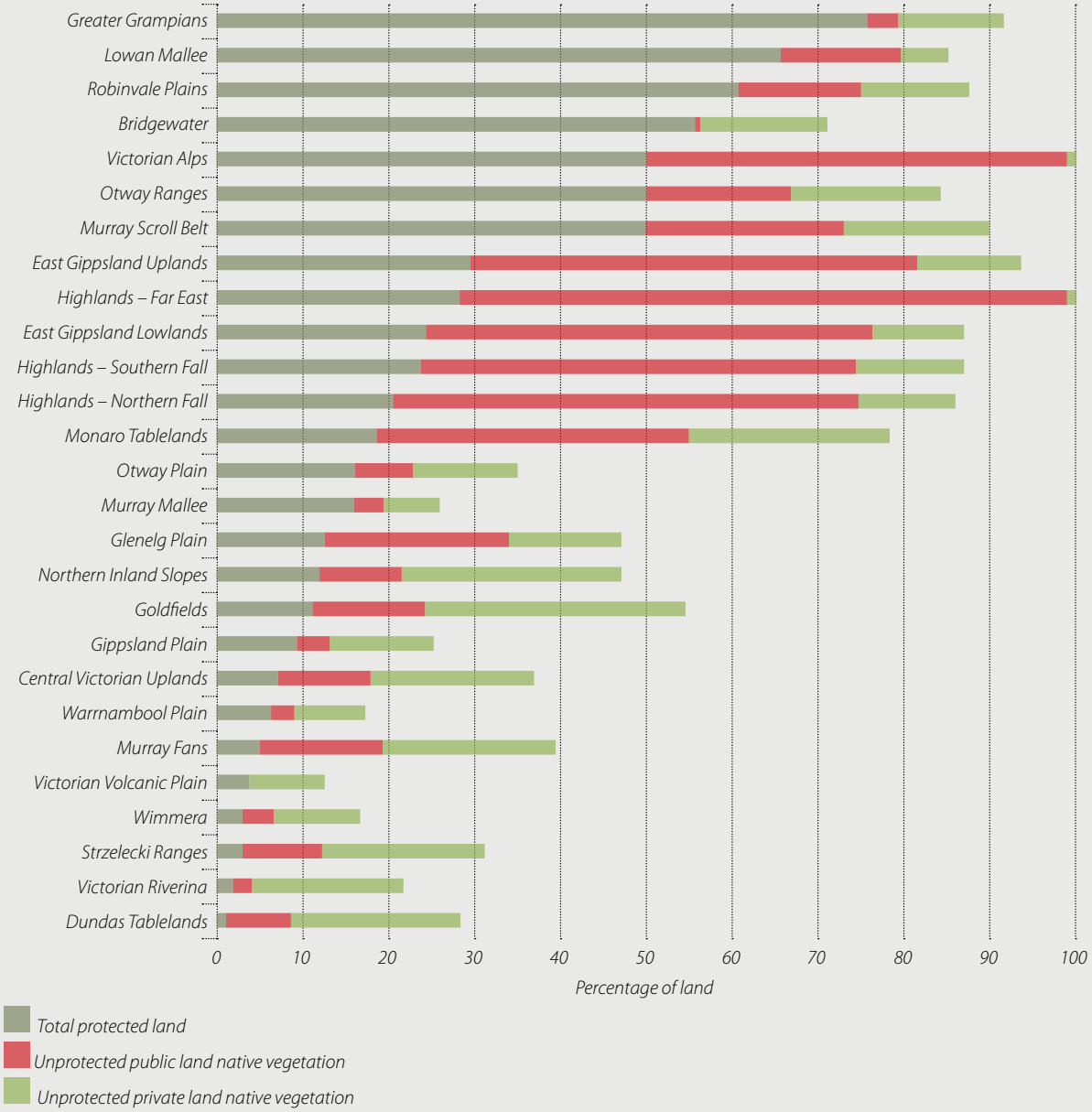

Figure. 34. Relationship between the current percentage of protected land in each subregion and the percentage of unprotected native vegetation available for additional protection on public land and private land. This graph relates to the NRS target of protecting a minimum of 10% of the area of each subregion in protected areas

Analysis of the representation of EVCs in protected areas similarly highlights the importance of additional private-land protection to help achieve NRS representation targets. Altogether, 67% of Victoria's 1883 EVCs are not adequately represented in protected areas. Of these EVCs, 89% occur on private land. In total, 60% of the total area of under-represented EVCs in Victoria is on private land.

Based on the representation of ecosystems in existing protected areas on private and public land, the Conservation Plan reiterates the recognised importance of increased private land protection in the Victorian Volcanic Plain, Riverina and South East Coastal Plain bioregions of Victoria, to meet NRS targets for a CAR reserve system (NRMMC 2009). The Conservation Plan also identifies some additional gaps in bioregional and subregional ecosystem representation in protected areas, which the Trust will target in future for increased protection on private land.

For bioregions:

- NSW South Western Slopes bioregion – below the national threshold for ecosystem representation in protected areas; only 1% above the national target for overall levels of bioregional protected areas
- Victorian Midlands bioregion – below the threshold for bioregional ecosystem representation; contains the greatest extent of unprotected ecosystems on private land; contains a large extent of under-represented ecosystems on private land; includes three subregions with less than or equal to 10% protection of their total land area (Dundas, Central Victorian Uplands, Goldfields)
- South East Corner bioregion – below the threshold for ecosystem representation in protected areas, especially in the East Gippsland Lowland subregion, and
- Narracoorte Coastal Plain bioregion – below the national threshold for ecosystem representation in protected areas, particularly in the Glenelg Plain subregion; below the national threshold for overall extent of bioregional protection (although just above when calculated only for the Victorian component).

For subregions:

- Wimmera subregion – less than 5% of its area currently protected; it has a large extent of under-represented ecosystems on private land
- Warrnambool Plain subregion – below the national threshold for ecosystem representation in protected areas at subregional scale; below national threshold for overall extent of subregion included in protected areas
- Gippsland Plain subregion – although the Trust has previously recognised this subregion as a priority for increased permanent protection, it will give higher priority to increasing protected areas in West Gippsland and Port Phillip & Westernport regions
- Murray Mallee subregion – includes 100 000 ha of under-represented EVCs on private land, and
- Strzelecki Ranges subregion – has less than 10% of its area included in protected areas.

Each of these bioregions and subregions is included in one or more focal landscapes (Table 13, Figure 35), reiterating the benefits of targeting the Trust's future conservation activity towards those landscapes to achieve more effective conservation outcomes.

Table 13. Focal landscapes to target for increasing protection of under-represented ecosystems in under-represented bioregions or subregions

Focal landscape	High priority bioregion(s) to target for increased protection	High priority subregion(s) to target for increased protection
Eastern Riverina	Riverina	Murray Fans, Victorian Riverina
Murray Scroll Belt	Riverina	
Western Riverina	Riverina	Murray Fans, Victorian Riverina
Otway Ranges and Coast	Victorian Volcanic Plain South East Coastal Plain	Victorian Volcanic Plain, Warrnambool Plain
Port Phillip and Westernport	South East Coastal Plain	Gippsland Plain, Strzelecki Ranges
Western Melbourne ranges and plains	South East Coastal Plain, Victorian Volcanic Plain	Central Victorian Uplands, Gippsland Plain, Victorian Volcanic Plain
Yarra–Cardinia Catchments	South East Coastal Plain, Victorian Volcanic Plain	Central Victorian Uplands, Gippsland Plain, Victorian Volcanic Plain
Gippsland Plain and Gippsland Lakes Catchment	South East Coastal Plain	Gippsland Plain, Strzelecki Ranges
Strzelecki Ranges and plains	South East Coastal Plain	Gippsland Plain, Strzelecki Ranges
Northern Inland Slopes	Riverina	Central Victorian Uplands, Victorian Riverina
Victorian Midlands	Riverina, Victorian Volcanic Plaiin	Central Victorian Uplands, Dundas Tablelands, Victorian Riverina, Victorian Volcanic Plain, Wimmera
South-West	Victorian Volcanic Plain	Victorian Volcanic Plain, Dundas Tablelands, Wimmera

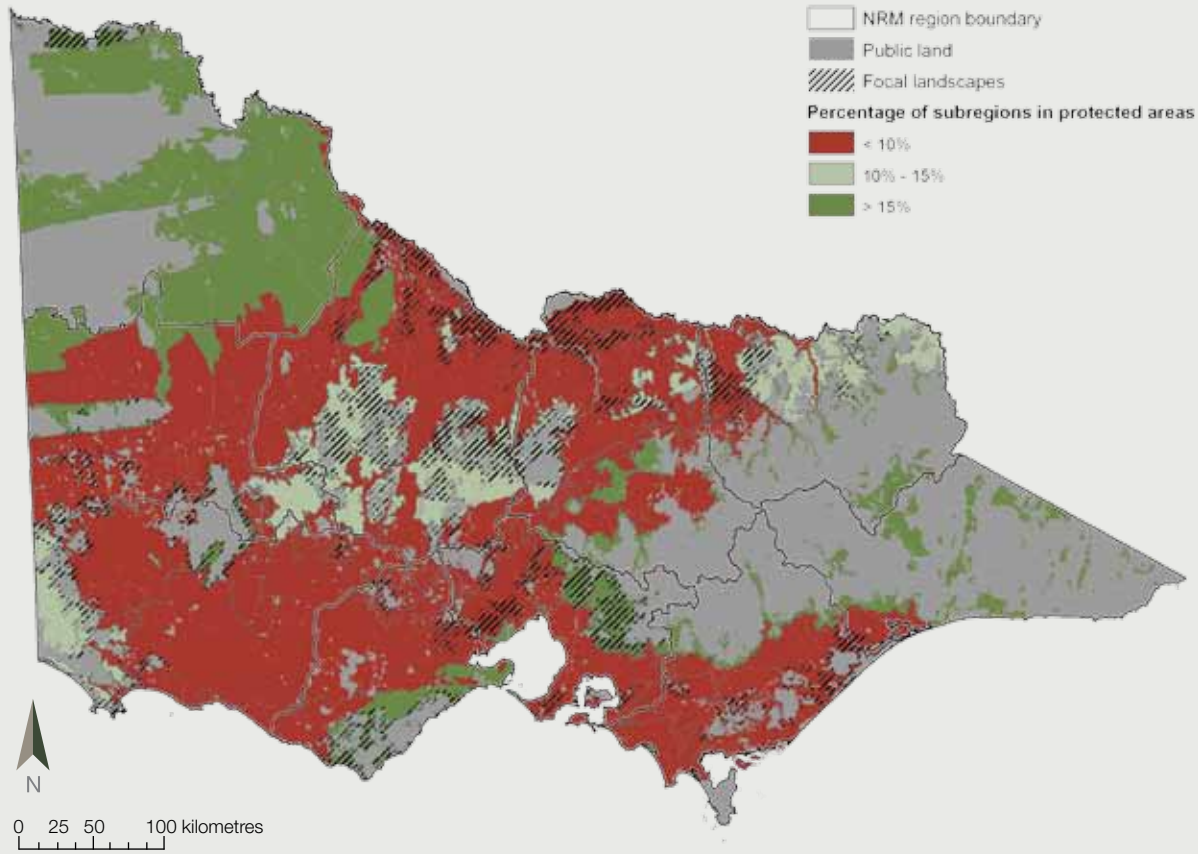

Figure 35. Location of focal landscapes in relation to level of protection in each subregion. Areas that are not green are below the 10% NRS protection target

When representation of different EVCs in Victoria's protected areas is considered, the Conservation Plan confirms that Trust for Nature's long-term focus on conservation of woodland, grassland and wetland ecosystems (Todd 1997), will continue to be a high priority. Additionally, the analyses highlight other EVC Groups that will be the target of strategic conservation programs statewide, including:

- EVCs within the Riverine Grassy Woodlands/Forests EVC Group – including not only the woodlands and red gum forests of the northern plains but creekline grassy woodlands throughout much of the state
- EVCs within the Riparian Scrubs or Swampy Scrubs and Woodlands EVC Group, and
- under-represented or unprotected EVCs included within the Dry Forest, Box-Ironbark Forests, Mallee, Rainforests and Rocky Escarpment Scrubs EVC Groups (Appendix 9).

Given the high proportion (30%) of under-represented EVCs on private land present in the focal landscapes, the Conservation Plan's findings in relation to this conservation objective further reiterate the benefits of targeting ecosystem protection programs towards these landscapes.

Improving protection of threatened ecological communities

The Conservation Plan underlines the importance of private-land conservation to help protect vegetation communities listed under both the EPBC Act and the FFG Act. Overall, more than 80% of the mapped extent of EPBC Act listed communities in Victoria occurs on private land. This means that the threat abatement and recovery actions for those communities will need to be targeted towards private land. In this context, it is noteworthy that nearly one-third of the private-land extent of these EPBC Act listed communities occurs in the 12 focal landscapes.

3.3 Conservation objective 3: Improve protection of significant aquatic and coastal ecosystems

3.3.1 Rationale for the objective

Aquatic and coastal ecosystems play a pivotal ecological role in the natural environment in terms of biological productivity, biodiversity, hydrological processes, landscape connectivity, migratory movements of aquatic and terrestrial animal species, and provision of habitat refugia during dry periods (Soule' *et al.* 2004; Bennett *et al.* 2009; CfoC 2011). For this reason, protection of significant aquatic systems forms a core element of Australia's Biodiversity Conservation Strategy (NRMMC 2010) and is also recognised as a priority action for building the National Reserve System (NRS) (NRMMC 2005, 2009; Dunlop & Brown 2008; CFOC 2011; Dunlop *et al.* 2012a, 2012b).

Priorities for conservation in relation to this conservation objective were derived from assessments, based on national and/or state criteria for assessing the significance of wetland, riparian and coastal ecosystems.

More details about the assessment criteria, methods and data sources are provided in Appendix 2.

3.3.2 Key findings for the objective

The Conservation Plan assessed three major aquatic ecosystems in terms of conservation priorities for private land: wetlands, riparian ecosystems and coastal ecosystems. The key findings in relation to each of these aquatic ecosystems are described below.

Wetlands

- nearly 200 000 ha of significant wetlands and associated buffers occur on private land, including at least 45 000 ha each in total as part of Ramsar wetlands, Wetlands of National Importance, bioregionally significant wetlands and Important Bird Areas
- of Victoria's 11 Ramsar wetlands, 10 include some private land or private-land buffers
- there are 13 Important Bird Areas that incorporate private land, and are classified as globally significant for a range of waterbirds and listed migratory shorebirds, and
- nearly two-thirds of wetland Ecological Vegetation Classes (EVCs) are under-represented in Victoria's protected areas.

Riparian ecosystems

- more than 40% of Victoria's 48 000 kilometres of waterways is bordered by private land
- just over half of private riparian land contains native vegetation; the remainder is cleared
- nearly all of the native vegetation present in riparian buffers on private land is under-represented in protected areas, and
- only 1% of riparian habitat on private land in Victoria is currently protected by the Trust, through covenants or property ownership.

Coastal ecosystems

- nearly half of Victoria's coastal land (almost 200 000 ha) is private land
- only one quarter of coastal private land contains native vegetation; the remainder is cleared
- over 40% of the native vegetation found on private land in coastal areas is under-represented in protected areas
- only 1% of privately owned coastal land is currently protected by the Trust through covenants with private landowners or through property ownership, and
- coastal areas have some of the highest rates of urban development of any private land in the state (CES 2009; DPCD 2012).

3.3.3 Assessment of the protection of wetland ecosystems

Based on DSE's Wetland Classification system, 13 000 wetlands, totalling more than 400 000 ha in extent, currently exist in Victoria, of which 80% (by number) occur on private land (NRE 1997). Wetlands on private land include a range of saline and freshwater wetlands, with Shallow Freshwater Marshes and Freshwater Meadows the most extensive wetland types found on private land (Figure 36).

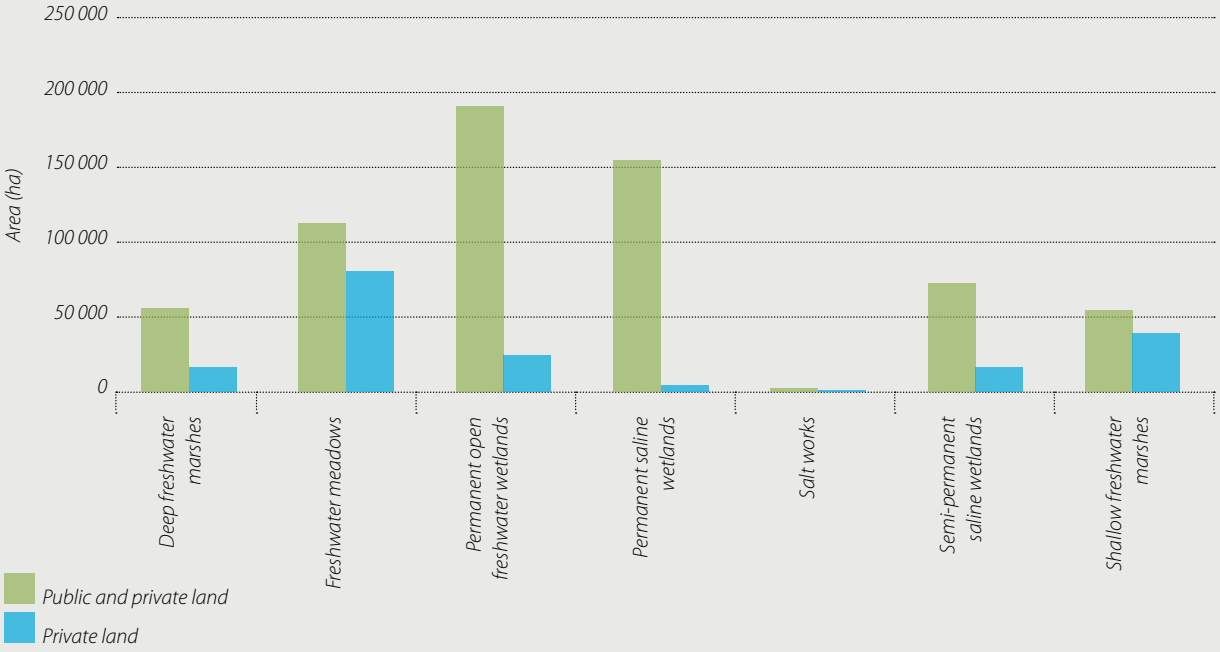

Figure 36. Current extent of major wetland types on both public and private land, and private land only

Based on the mapping of EVCs, private-land wetlands are most widespread in the Victorian Riverina, Wimmera, Victorian Volcanic Plain, Gippsland Plain, Dundas Tablelands, Glenelg Plain and Murray Fans subregions (Figure 37).

Altogether, 29% of the 246 wetland EVCs occurring in Victoria are not represented in protected areas and 61% are under-represented, according to combined JANIS criteria. The total private-land area of these under-represented wetland EVCs is approximately 86 000 ha (noting that this mapping referred only to the extent of wetlands with native vegetation, not open water).

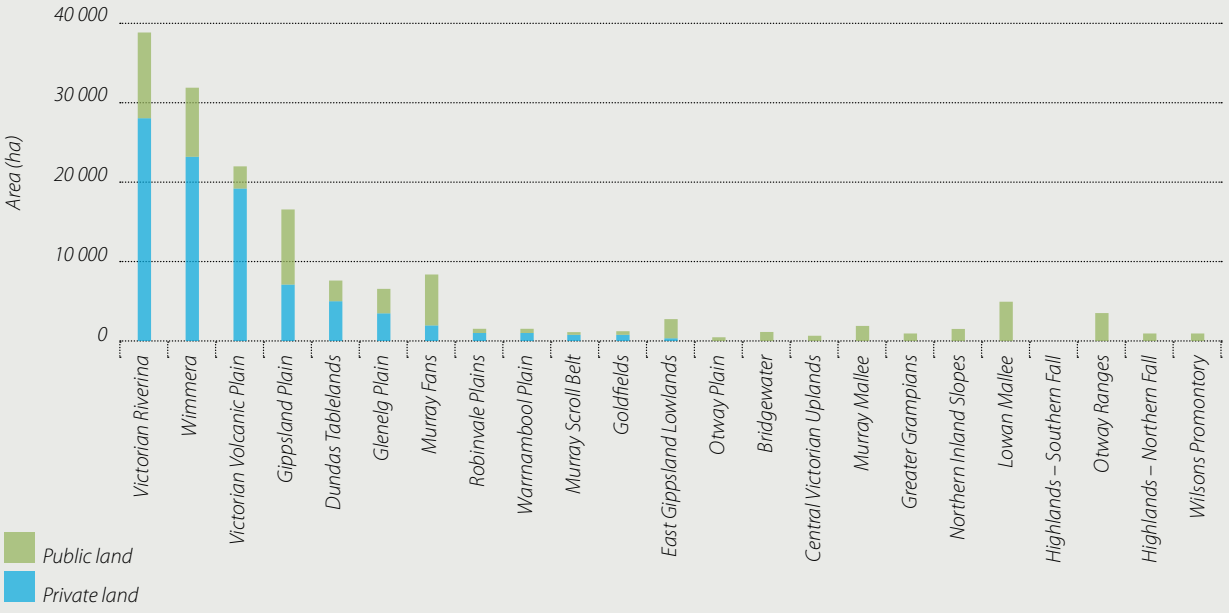

Figure 37. Area of wetland Ecological Vegetation Classes (EVCs) in IBRA subregions, on private land and public land

Significant wetlands

The Conservation Plan mapped a total of 188 100 ha of significant wetlands and associated buffers on private land in Victoria (Table 14, Figure 38). These significant wetlands and buffers consist of approximately 45 000 to 50 000 ha mapped respectively as part of Ramsar Wetlands, Nationally Important Wetlands, bioregionally significant wetlands and Important Bird Areas (IBAs) (Table 14). An additional 17 000 ha of EPBC Act listed Seasonal Herbaceous Wetland Community on private land was also identified through the wetland mapping (Table 14, Figure 38).

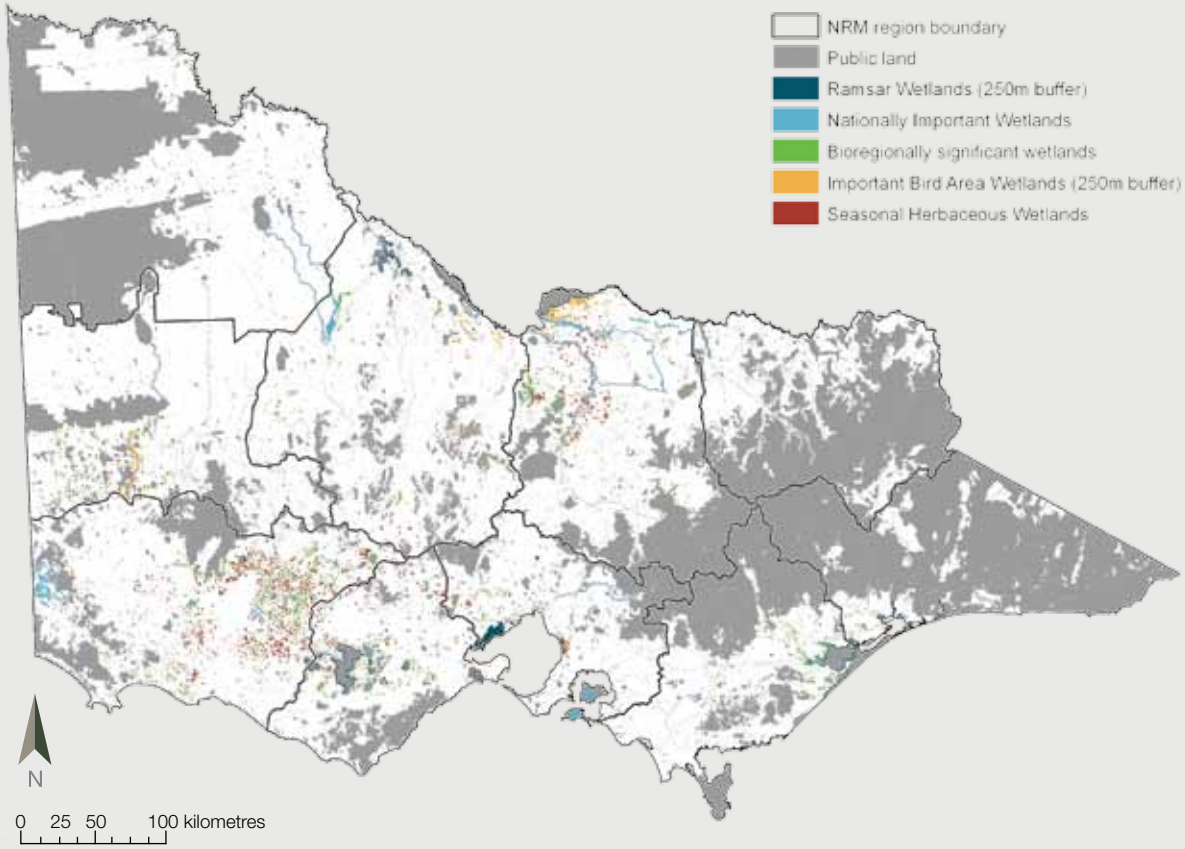

Figure 38. Private land distribution of Ramsar Wetlands and buffers; Nationally Important Wetlands; Important Bird Area (IBA) wetlands and buffers; bioregionally significant wetlands and Environment Protection and Biodiversity Conservation Act 1999 *(EPBC Act) listed Seasonal Herbaceous Wetlands. Note that the mapping only shows the non-overlapping extent of each wetland type. The wetlands on this map have been enhanced. They are not a true representation of the area*

Table 14. Summary of significant wetland area on private land in Victoria. See Appendix 11 for further information about wetlands assessment methods

Significant wetland category	Total extent on private land (ha)	Non-overlapping extent (ha)
Ramsar Wetlands (250 m buffer)	48 349	33 027
Nationally Important Wetlands	53 984	43 506
Bioregionally significant wetlands	48 652	45 722
Important Bird Areas (250 m buffer)	47 259	25 814
EPBC Act listed Seasonal Herbaceous Wetlands	17 078	12 962
Total	215 322	161 031
Total, excluding overlapping extent between categories	188 126	

Ramsar Wetlands

Ten of the 11 Ramsar-listed wetlands in Victoria include some private land as part of the mapped wetland area. The most notable wetlands in this category are wetlands managed by Melbourne Water at Edithvale–Seaford and Werribee; wetlands that are part of the saltworks along the western shore of Port Phillip Bay, and wetlands in the Westernport region (Table 15).

Collectively, the private land extent of these Ramsar Wetlands totals 14 700 ha (Table 15). When 250 m buffers around the wetlands are also considered, a total of 48 000 ha of private land is included either as part of the Ramsar Wetlands or as part of the buffer. Additional private land sites of significance, based on this analysis, comprise Gippsland Lakes, Western District Lakes, Kerang Wetlands, Gunbower Forest, Barmah Forest and Corner Inlet (Table 15).

Table 15. Occurrence and extent of Ramsar Wetlands and buffers on private land

Ramsar Wetland	Area (ha)	Area on private land without buffer (ha)	Area on private land including a 250 m buffer (ha)
Corner Inlet	67 123	216	2 643
Gippsland Lakes	61 114	116	10 067
Port Phillip Bay (Western Shoreline) and Bellarine Peninsula	22 646	12 536	15 364
Western District Lakes	32 687	31	5 817
Barmah Forest	29 521	296	2 569
Edithvale–Seaford Wetlands	260	239	692
Gunbower Forest	19 937	245	3 084
Hattah–Kulkyne Lakes	956	–	16
Kerang Wetlands	9 938	477	4 340
Lake Albacutya	5 660	4	108
Westernport	59 967	533	3 649
Total	309 810	14 693	48 349

Nationally Important Wetlands

Fifty-four thousand hectares of Nationally Important Wetlands are mapped as occurring on private land, including 43 500 ha not included in any other significant wetland category (Table 14). They occur across 25 Victorian subregions, especially the Gippsland Plain, Victorian Riverina, Victorian Volcanic Plain, Glenelg Plain, Wimmera, Murray Mallee and Murray Fans (Figure 38).

In terms of Natural Resource Management regions, the private-land extent of Nationally Important Wetlands is greatest in the Port Phillip & Westernport region (Figure 39), principally due to the extent of terrestrial private land included within the Westernport Nationally Important Wetland site. The North Central and Glenelg Hopkins NRM regions also contain substantial areas of Nationally Important Wetlands on private land. Details of these wetlands with significant private-land extents are provided in Appendix 11.

Bioregionally significant wetlands

Forty-nine thousand hectares of bioregionally significant wetlands are mapped as occurring on private land, of which 45 700 ha are not included in any other significant wetland category (Table 14). Bioregionally significant wetlands occur especially in the Victorian Volcanic Plain, Victorian Riverina, Gippsland Plain, Wimmera and Murray Mallee subregions (Appendix 11). In terms of NRM regions, the private-land extent of bioregionally significant wetlands is greatest in the Glenelg Hopkins, Goulburn Broken and North Central regions (Figure 39).

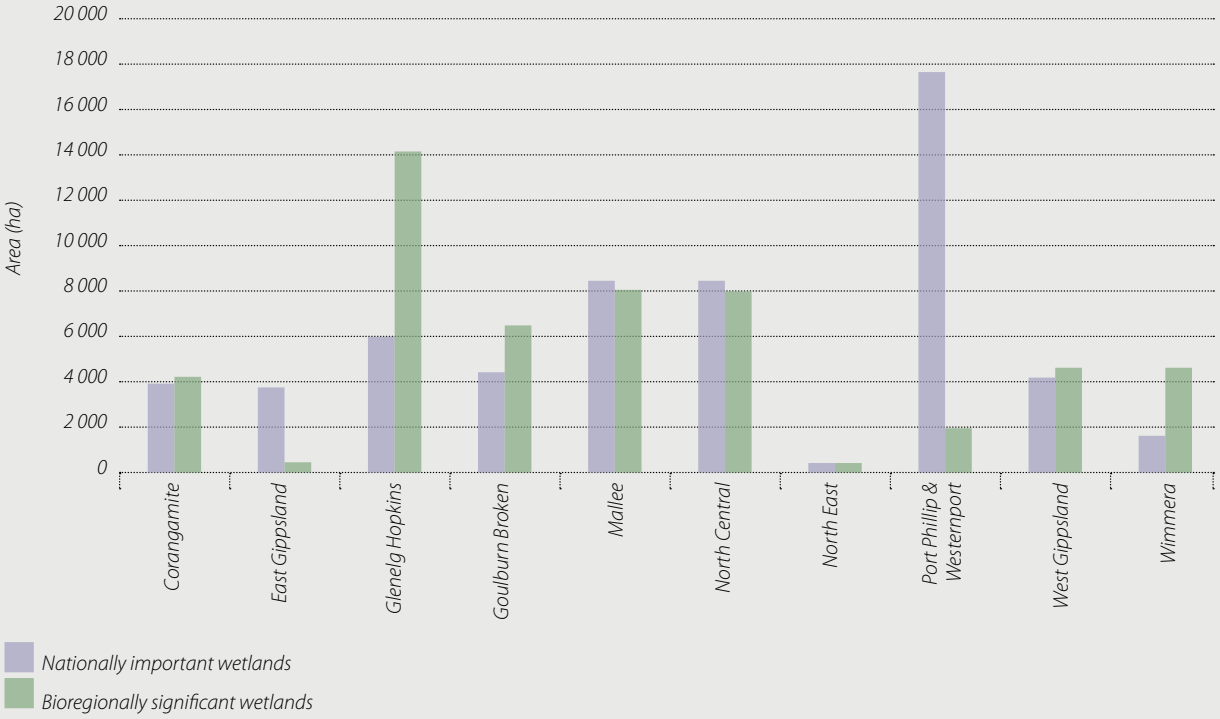

Figure 39. Private land area of Nationally Important Wetlands and bioregionally significant wetlands by NRM region. Note that some wetlands are classified in both categories; the areas shown above for each category are therefore not independent of one another

Wetland IBAs

Fourteen wetland IBAs were identified as including some private land (Table 16). These comprise 11 sites with globally significant populations of EPBC Act listed migratory shorebirds, and three sites with globally significant populations of non-listed waterbird species. The total area of private land included within the 14 IBAs measures 7458 ha without any buffer and 47 259 ha with a buffer. Noteworthy IBA wetlands not otherwise encompassed within Ramsar Wetland or Nationally Important Wetland categories include private land areas within the Bellarine Wetlands; Cheetham and Altona Wetlands; Natimuk–Douglas Wetlands and Northern Victorian Wetlands (Table 16).

***Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed Seasonal Herbaceous Wetland Community**

Seventeen thousand hectares of this listed wetland community occur on private land, representing 93% of its total area in Victoria (Table 11). Of this area, nearly 13 000 ha does not overlap with the other significant wetland categories (Table 14) and only 500 ha is currently included in protected areas (Table 11). Given the ecological significance of these ephemeral wetlands for many flora and fauna species and the ongoing threats posed to this community from drainage and cultivation (TSSC 2012), increased protection of them on private land will become a greater priority for the Trust. Subregions containing the greatest area of this community on private land are Victorian Volcanic Plain, Victorian Riverina, Murray Fans, Otway Plain, Warrnambool Plain and Gippsland Plain.

Table 16. Important Bird Areas (IBAs) for waterbirds in Victoria that include some of their extent or associated 250 m buffer on private land. The list is arranged by sites including globally significant populations of Environment Protection and Biodiversity Conservation Act *(EPBC Act) listed migratory shorebirds and then by sites that are globally significant for non-listed species of waterbird*

Important Bird Area	Listed migratory shorebird and/or other waterbird site	Area on private land, without buffer (ha)	Area on private land, including 250 m buffer (ha)	Key bird species identified with the IBA (Dutson *et al.* 2009)
Anderson Inlet	Yes	1	107	Red-necked Stint
Bellarine Wetlands	Yes	543	2 918	Chestnut Teal, Banded Stilt, Red-necked Stint, Sharp-tailed Sandpiper
Carrum Wetlands	Yes	341	947	Chestnut Teal, Blue-billed Duck, Sharp-tailed Sandpiper
Cheetham & Altona	Yes	67	478	Chestnut Teal, Red-necked Stint, Pacific Gull
Corner Inlet	Yes	410	3 625	Chestnut Teal, Pied Oystercatcher, Sooty Oystercatcher, Eastern Curlew, Red-necked Stint, Pacific Gull, Fairy Tern
Gippsland Lakes	Yes	394	8 479	Black Swan, Chestnut Teal, Musk Duck, Fairy Tern
Lake Corangamite Complex	Yes	1 184	9 452	Black Swan, Freckled Duck, Australian Shelduck, Pink-eared Duck, Australasian Shoveler, Chestnut Teal, Blue-billed Duck, Musk Duck, Hoary-headed Grebe, Straw-necked Ibis, White-headed Stilt, Banded Stilt, Sharp-tailed Sandpiper
Shallow Inlet	Yes	76	550	Double-banded Plover, Red-necked Stint
Swan Bay & Port Phillip Bay Islands	Yes	58	955	Chestnut Teal, Blue-billed Duck, Australian White Ibis, Straw-necked Ibis, Red-necked Stint, Silver Gull, Fairy Tern
Werribee & Avalon	Yes	1 682	3 349	Freckled Duck, Australian Shelduck, Pink-eared Duck, Australasian Shoveler, Chestnut Teal, Blue-billed Duck, Musk Duck, Hoary-headed Grebe, Red-necked Stint, Sharp-tailed Sandpiper
Westernport	Yes	594	6 180	Pied Oystercatcher, Eastern Curlew, Red-necked Stint, Pacific Gull, Fairy Tern
Devilbend Reservoir	No	<1	58	Blue-billed Duck
Natimuk–Douglas Wetlands	No	1 955	9 243	Australian Shelduck, Banded Stilt, Red-necked Avocet, Red-capped Plover
North Victorian Wetlands	No	154	916	Freckled Duck, Blue-billed Duck, Straw-necked Ibis, Banded Stilt, Red-necked Avocet, Black-fronted Dotterel
Total area		7 458	47 259	

3.3.4 Assessment of the protection of riparian ecosystems

Forty-one percent of riparian land along the 48 000 kilometres of named waterways mapped in Victoria was identified as being private land, particularly in the Victorian Volcanic Plains, Central Victorian Uplands, Victorian Riverina, Goldfields, Gippsland Plain, Dundas Tablelands and Highlands – Southern Fall subregions (Figure 40). In a regional context, North Central, Glenelg Hopkins, Goulburn Broken and Port Phillip & Westernport NRM regions contain the most private riparian land (Figure 41, Appendix 12).

When waterways were assessed with a nominal 60 m buffer on either side, based on standard maximum widths for public-land frontages bordering waterways, 46% of Victoria's total riparian buffer area (509 063 ha) were mapped as private land; in particular, in Glenelg Hopkins, Goulburn Broken, North Central and Port Phillip & Westernport regions (Figure 42). Of that private, riparian land extent, however, only 44% contains native vegetation (Figure 43) and less than 1% is included in Trust for Nature protected areas. By comparison, 92% of public riparian land is vegetated (Figure 43) and 31% is included in protected areas.

Significantly, though, the majority of native vegetation on public land is considered adequately represented in protected areas under combined JANIS criteria, whereas native vegetation on privately owned riparian lands mostly comprises under-represented EVCs, under JANIS criteria (Figure 43). Overall, 82% of the total area of native vegetation in private-land riparian habitat is assessed as being under-represented in protected areas (Figure 44), with the highest proportions occurring in the Glenelg Hopkins, Wimmera, North Central, Goulburn Broken and West Gippsland NRM regions (Figure 44, Appendix 12).

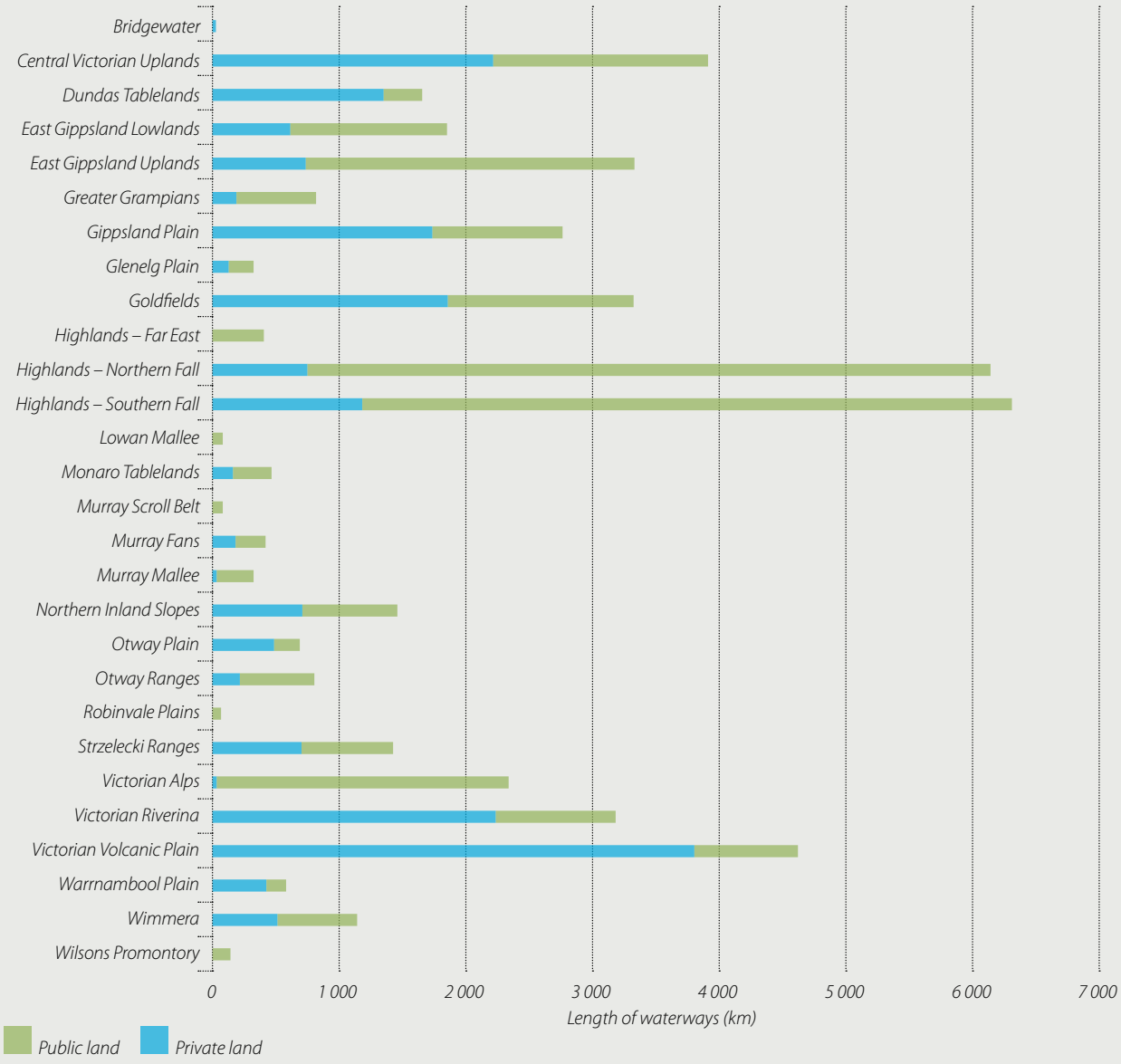

Figure 40. Length of waterways on private land and public land in each subregion

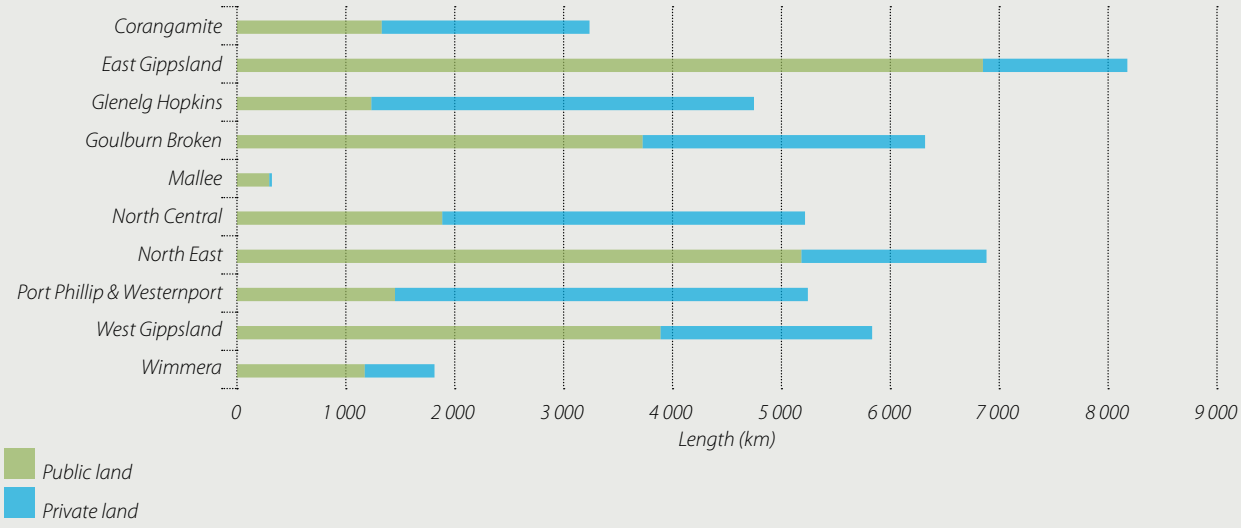

Figure 41. Length of waterway on private land and public land in each Natural Resource Management region

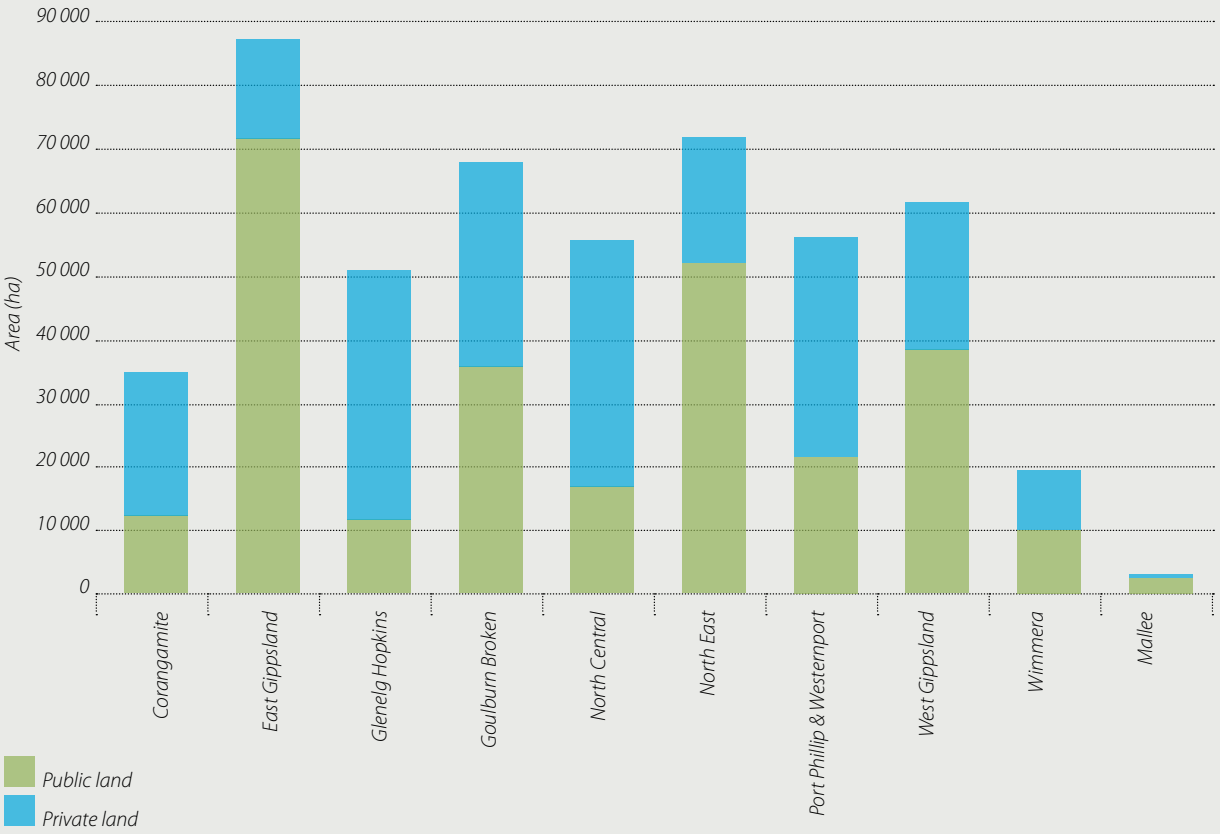

Figure 42. Area of riparian habitat on private land and public land in each Natural Resource Management region. Includes a 60 m buffer

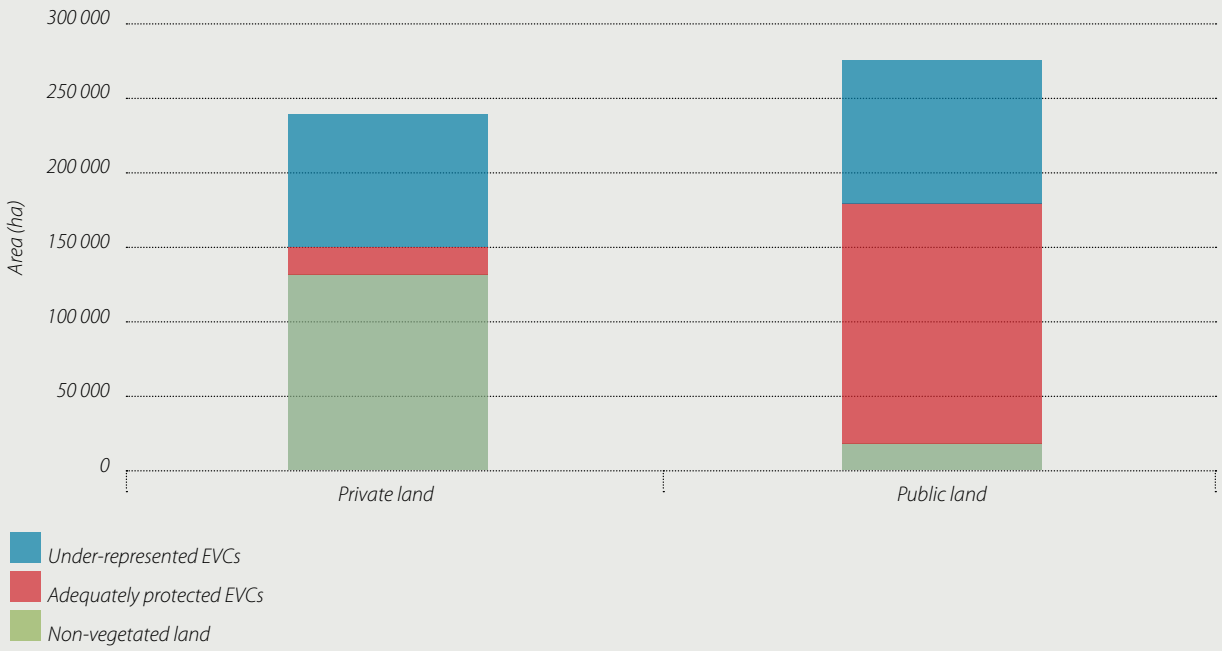

Figure 43. Area of non-vegetated land, adequately protected Ecological Vegetation Classes (EVCs) and under-represented EVCs on private and public riparian land. This includes a buffer of 60 m

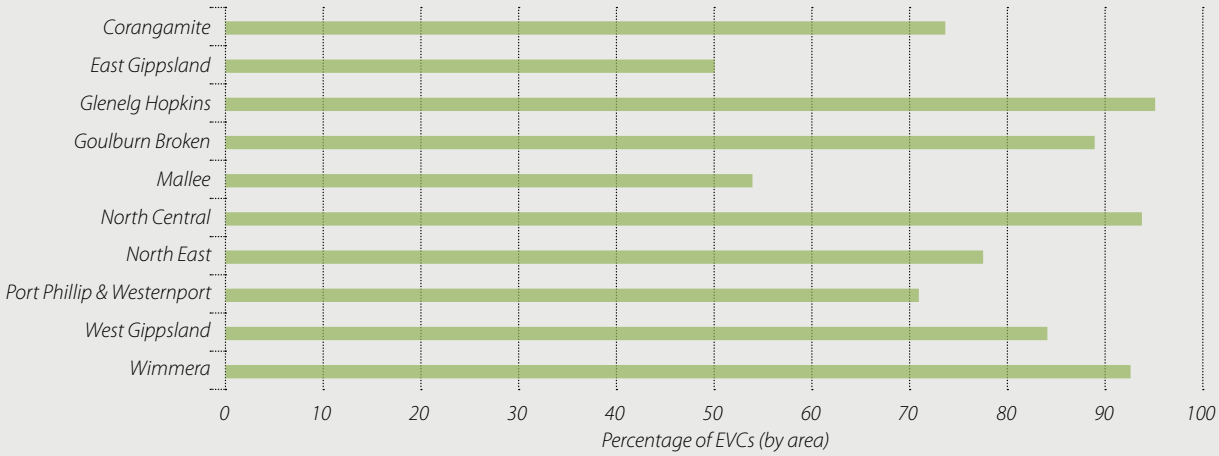

Figure 44. Percentage of under-represented Ecological Vegetation Classes (EVCs) by area, on private riparian land in each Natural Resource Management region

3.3.5 Assessment of the protection of coastal ecosystems

Mapping undertaken for the Conservation Plan indicates that 47% of Victoria's coastal land (189 381 ha) is private land (Figure 45). However, only 24% of private land comprises native vegetation and only 1% of native vegetation on private land is currently included in Trust for Nature protected areas. By contrast, 84% of public land is vegetated and 45% of public land is included in protected areas. Notably, approximately one-third of the total extent of under-represented EVCs within coastal ecosystems occurs on private land (Figure 45).

Figure 45. Area of non-vegetated land, adequately protected Ecological Vegetation Classes (EVCs) and under-represented EVCs on private and public coastal land

3.3.6 Priorities for improving protection of significant aquatic and coastal ecosystems

Conservation objective 3: key priorities

Wetlands

- increase protection of wetlands and wetland buffers on private land across the state – in particular, private land associated with Ramsar Wetlands, Nationally Important Wetlands, Important Bird Areas and wetlands listed under the EPBC Act or FFG Act
- target under-represented wetland EVCs in each subregion for increased protection, especially those at greatest risk of degradation from habitat loss, altered water regimes or human impacts (e.g. ephemeral wetlands on lowland plains and wetlands along the coast and close to urban centres)
- work with NRM partners wherever possible to protect and restore priority wetlands on private land through river health and wetlands programs, such as the Living Murray program, CMA River Health programs and the Northern Victorian Irrigation Renewal project, and
- implement a strategic approach to wetlands conservation across the state, on the basis that only 20% of significant wetlands on private land occur within the focal landscapes and that wetlands conservation will need to be targeted separately.

Riparian ecosystems

- in partnership with other NRM bodies, especially CMAs, Melbourne Water and DSE, increase permanent protection of riparian ecosystems on private land
- target under-represented EVCs and under-represented subregions for additional protection of riparian ecosystems, notably in the Glenelg Hopkins, Wimmera, North Central, Goulburn Broken and West Gippsland NRM regions, and
- encourage restoration and protection of restored riparian habitat on private land, to help address environmental impacts on water quality, ecological functioning of in-stream and riparian habitats, ecosystem diversity and habitat connectivity (Bennett *et al.* 2009; VNPA 2011).

Coastal ecosystems

- increase protection of coastal ecosystems on private land in priority areas, including coastal areas within focal landscapes, sites with under-represented EVCs and sites with significant wetlands, in particular:
  - the south-west coastline of Victoria, from the South Australian border through to Port Fairy
  - Otways coastline
  - Bellarine Peninsula and Swan Bay
  - Avalon–Werribee
  - southern coastline of the Mornington Peninsula
  - Westernport Bay, French Island and Phillip Island
  - West Gippsland coast between Inverloch and Wilsons Promontory
  - Corner Inlet, and
  - Gippsland Lakes.
- prioritise protection within these areas towards high-value sites considered to be at greatest threat from habitat loss due to urban or agricultural development, and
- work with partners to protect coastal ecosystem assets, for example by protecting and/or restoring buffers along priority waterways, estuaries or important habitat areas for listed migratory shorebirds or other threatened species.

Priorities for improving protection of significant wetland ecosystems

Throughout Victoria 185 000 ha of significant wetlands and associated buffers occur on private land. These wetlands include approximately 45 000 to 50 000 ha of Ramsar Wetlands, Wetlands of National Importance, bioregionally significant wetlands and Important Bird Areas respectively. However, most of these priority wetlands do not occur within the focal landscapes identified in this Conservation Plan, highlighting the importance of additional conservation measures to target wetlands on private land.

Key areas to target for further wetlands protection include the:

- Victorian Volcanic Plain
- Port Phillip & Westernport coastlines and wetlands
- Wimmera subregion
- Gippsland Plain subregion
- coastlines and wetlands around the Gippsland Lakes, Corner Inlet and Shallow Inlet
- Kerang Lakes and associated floodplains
- Riverina bioregion
- Murray Mallee subregion, and
- Narracoorte Coastal Plain bioregion.

Within these priority areas, those wetland sites at the highest risk of degradation through habitat loss, altered water regimes, urban development and human disturbance will be a priority for protection. Wherever possible, the Trust will also seek to work with partners to protect wetlands identified as priorities for environmental watering through the various river health and wetlands programs, such as the Living Murray, Northern Victorian Irrigation Renewal project and the water programs of DSE and the CMAs.

Priorities for improving protection of significant riparian ecosystems

One of the key findings of the Conservation Plan is that a substantial area of riparian land is privately owned (234 000 ha), with much of that land supporting under-represented ecosystems. Notably, however, 44% of riparian buffers on private land have lost their native vegetation, leading to a range of environmental impacts in terms of deteriorating water quality, disturbed ecological functioning of instream and riparian habitats, loss of ecosystem diversity and loss of habitat connectivity (Bennett *et al.* 2009; VNPA 2011). As recommended in a recent report to DSE (RMCG 2012), there is consequently a clear role for the Trust to play in terms of improving permanent protection of riparian habitats, particularly where those habitats include under-represented ecosystems. Because of the important ecological roles and values of waterways, floodplains and riparian habitat (Bennett *et al.* 2009; Lake 2012), the Trust will also work with partners to protect and restore riparian and floodplain habitats identified as being part of priority waterways and wetland systems (RMCG 2012). One potential opportunity here is to use the Trust's protection mechanisms to facilitate overbank flows onto key floodplains (Lake 2012) or to assist with delivery of environmental water to key sites (MDBA 2011).

Based on the extent of under-represented ecosystems on private riparian land, key regions to target for increased protection are the Glenelg Hopkins, Wimmera, North Central, Goulburn Broken and West Gippsland CMA regions. Wherever possible, within each of the NRM regions, the Trust will seek to work more closely with partners to protect and restore priority riparian habitats on private land.

Priorities for improving protection of significant coastal ecosystems

A key finding of the Conservation Plan is that one-third of all under-represented native vegetation found along Victoria's coast occurs on private land. Increased protection of these under-represented coastal EVCs on private land is, therefore, a priority for Trust for Nature, particularly where that protection contributes to focal landscapes or builds on existing protected areas.

Based on the distribution of the under-represented EVCs, wetland assets, focal landscapes and the locations of marine protected areas (ECC 2000), the Conservation Plan identifies the following coastal areas as priorities for additional protection:

- the south-west Victorian coastline, from the South Australian border to Port Fairy
- the Otways coastline
- the Bellarine Peninsula and Swan Bay (Figure 46)
- Avalon–Werribee
- the southern coastline of the Mornington Peninsula
- Westernport Bay, French Island and Phillip Island
- the West Gippsland coast, between Inverloch and Wilsons Promontory
- Corner Inlet, and
- the Gippsland Lakes.

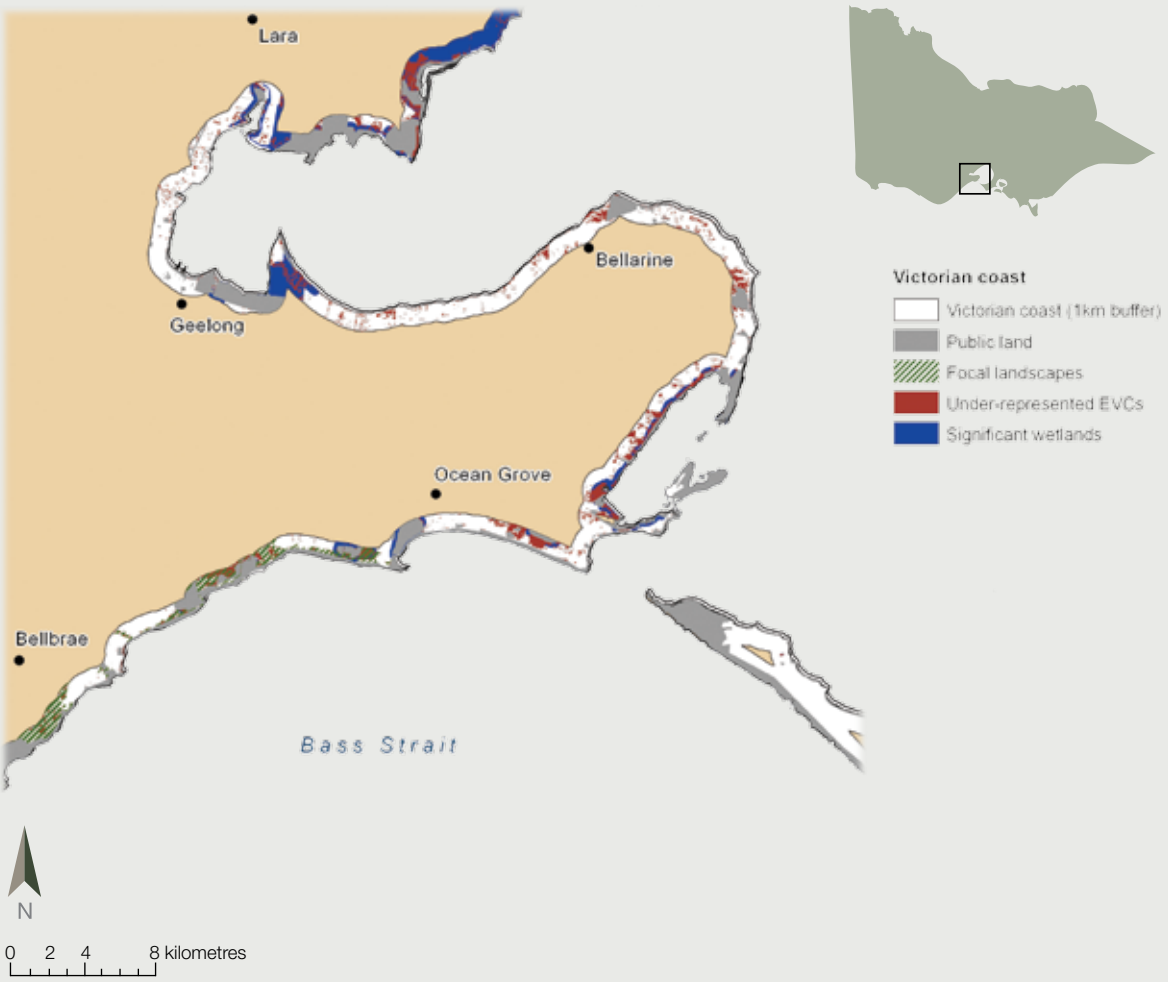

Figure 46. Example of priority coastal areas to target for conservation on the Bellarine Peninsula and adjacent coast. This indicates the locations of focal landscapes, significant wetlands and under-represented Ecological Vegetation Classes (EVCs) on private land within the 1 km coastal buffer

3.4 Conservation objective 4: Improve protection of threatened species

3.4.1 Rationale for the objective

Protection of threatened species forms a core element of Australia's Biodiversity Conservation Strategy (NRMMC 2010) and the National Reserve System's Comprehensive, Adequate and Representative (CAR) reserve system criteria (Commonwealth of Australia 1999; NRMMC 2009). Specifically, the National Reserve System's guidelines for CAR include three elements relevant to the conservation of threatened species – protection of threatened species, protection of migratory shorebirds, and protection of places of environmental significance that are important for migratory or nomadic species, or critical for the lifecycle of key species (see Table 5).

Priority threatened species for conservation on private land were identified using two Department of Sustainability and Environment (DSE) datasets that estimated the subregional proportion of flora and fauna species distributions on every land tenure. Using lists of threatened species as the starting point, it was then determined which species had substantial proportions of their estimated occurrence on private land and should be considered as priorities for conservation on private land.

More details about the assessment criteria, methods and data sources are provided in Appendix 2.

3.4.2 Key findings for the objective

The key findings of the Conservation Plan in relation to this conservation objective are that:

- for the first time, a set of 148 threatened flora species and 88 priority fauna species has been identified to target for conservation on private land
- of the priority species, nearly one-third are listed as nationally threatened and more than two-thirds are listed as threatened under Victoria's *Flora and Fauna Guarantee Act 1988* (FFG Act)
- a high proportion of priority species occur in wetland, grassland and woodland habitats
- a substantial proportion occur outside of the focal landscapes, and
- nearly 60% of the priority threatened species have been recorded to date from Trust for Nature covenants and properties.

3.4.3 Priority fauna

The Conservation Plan identifies 88 species of priority fauna that should be targeted for conservation on private land (Table 17). These comprise nine mammals, 40 birds, 14 reptiles, three frogs, nine fish and 13 invertebrates.

Notable taxa or groups of taxa include:

- four species of threatened burrowing crayfish, all with highly restricted distributions
- nine fish, one freshwater mussel and one damsel-fly associated with waterways draining both northwards and southwards from the Great Dividing Range
- the endemic Giant Gippsland Earthworm, found only in the Strzelecki subregion of West Gippsland
- two species of bat, listed on the basis that their maternity sites occur on private land: the Common Bent-wing Bat found on the Warrnambool Plains, and the Eastern Horseshoe Bat found in the East Gippsland Uplands
- a significant number of threatened and declining woodland birds, and
- six species of butterflies and moths.

Twenty-six of these species (29%) are classified as threatened nationally under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and 82% are listed under the FFG Act (Table 17).

A high proportion of the priority fauna species are furthermore classified as critically endangered or vulnerable statewide whereas few species classified as rare or near-threatened are considered priorities for private-land conservation (Figure 47).

Notably, 61 of the 88 fauna species on the 'Priority list' (69%) have been recorded to date from Trust for Nature covenants and properties, including high proportions of the critically endangered, endangered and vulnerable species (Figure 48).

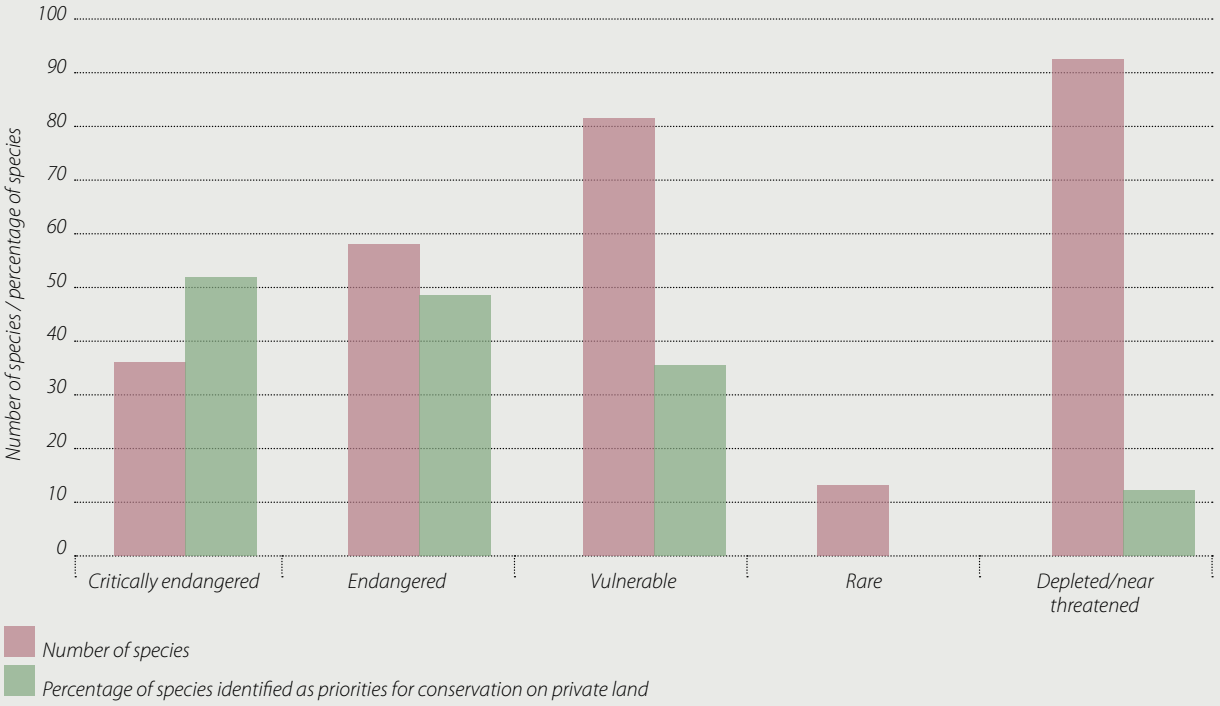

Figure 47. The number of threatened fauna species in each conservation status category, and the percentage of those species identified as priorities for conservation on private land

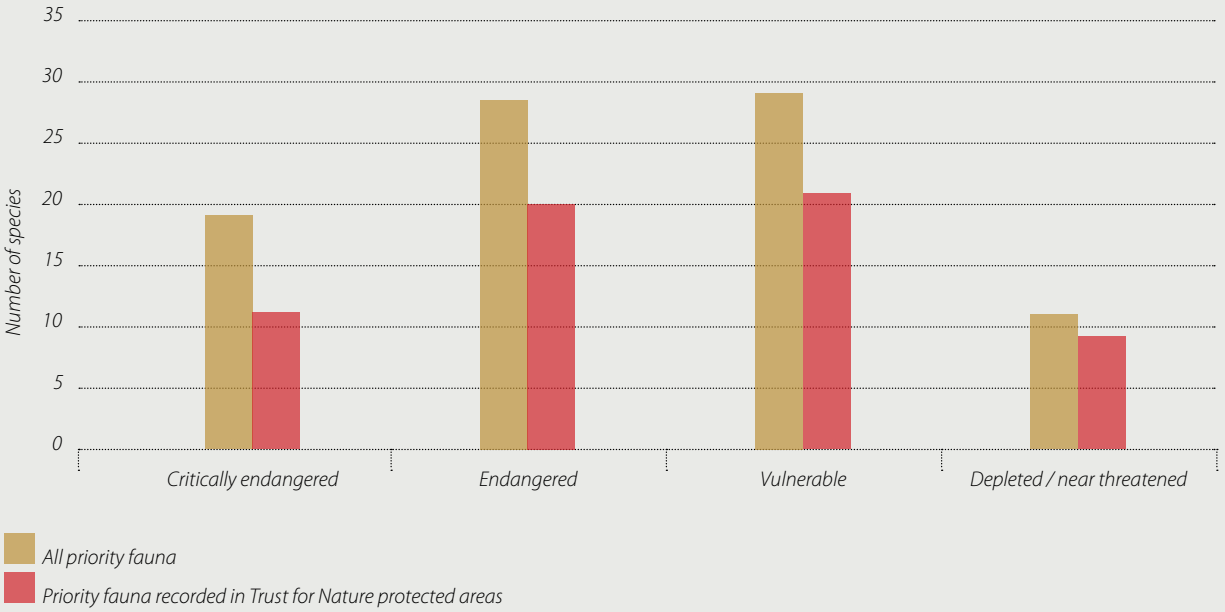

Figure 48. Number of priority fauna species recorded on Trust for Nature protected areas relative to the total number of priority species in each of the status categories

Table 17. Priority threatened fauna species for conservation on private land

Common name	Scientific name	DSE status	EPBC Act status	FFG listed?
Ancient Greenling	*Hemiphlebia mirabilis*	Endangered		Listed
Australasian Bittern	*Botaurus poiciloptilus*	Endangered	Endangered	Listed
Australasian Shoveler	*Anas rhynchotis*	Vulnerable		
Australian Bustard	*Ardeotis australis*	Critically endangered		Listed
Australian Grayling	*Prototroctes maraena*	Vulnerable	Vulnerable	Listed
Australian Mudfish	*Neochanna cleaveri*	Critically endangered		Listed
Australian Painted Snipe	*Rostratula australis*	Critically endangered	Vulnerable	Listed
Australian Pratincole	*Stiltia isabella*	Near threatened		
Baillon's Crake	*Porzana pusilla*	Vulnerable		Listed
Barking Owl	*Ninox connivens*	Endangered		Listed
Bearded Dragon	*Pogona barbata*	Depleted		
Black Falcon	*Falco subniger*	Vulnerable		
Blue-billed Duck	*Oxyura australis*	Endangered		Listed
Booroolong Tree Frog	*Litoria booroolongensis*	Critically endangered		Listed
Broad-shelled Turtle	*Macrochelodina expansa*	Endangered		Listed
Brolga	*Grus rubicunda*	Vulnerable		Listed
Brush-tailed Phascogale	*Phascogale tapoatafa*	Vulnerable		Listed
Bush Stone-curlew	*Burhinus grallarius*	Endangered		Listed
Common Bent-wing Bat	*Miniopteris schreibersii bassanii*	Endangered	Critically endangered	Listed
Corangamite Water Skink	*Eulamprus tympanum marnieae*	Critically endangered	Endangered	Listed
Crimson-spotted Rainbowfish	*Melanotaenia fluviatilis*	Depleted		Listed
De Vis' Banded Snake	*Denisonia devisi*	Vulnerable		
Diamond Firetail	*Stagonopleura guttata*	Vulnerable		Listed
Dwarf Galaxias	*Galaxiella pusilla*	Vulnerable	Vulnerable	Listed
Eastern Barred Bandicoot	*Perameles gunnii*	Critically endangered	Endangered	Listed
Eastern Great Egret	*Ardea modesta*	Vulnerable		Listed
Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	Vulnerable		Listed
Eltham Copper	*Paralucia pyrodiscus lucida*	Vulnerable		Listed
Fat-tailed Dunnart	*Sminthopsis crassicaudata*	Near threatened		
Flat-headed Gudgeon	*Galaxias rostratus*	Vulnerable		
Freckled Duck	*Stictonetta naevosa*	Endangered		Listed
Freshwater Catfish	*Tandanus tandanus*	Endangered		Listed
Giant Bullfrog	*Limnodynastes interioris*	Critically endangered		Listed
Giant Gippsland Earthworm	*Megascolides australis*	Endangered	Vulnerable	Listed
Gile's Planigale	*Planigale gilesi*	Near threatened		Listed
Glenelg Freshwater Mussel	*Hyridella glenelgensis*	Critically endangered	Critically endangered	Listed
Golden Perch	*Macquaria ambigua*	Vulnerable		

Common name	Scientific name	DSE status	EPBC Act status	FFG listed?
Golden Sun Moth	*Synemon plana*	Critically endangered	Critically endangered	Listed
Grassland Earless Dragon	*Tympanocryptis pinguicolla*	Critically endangered	Endangered	Listed
Grey Falcon	*Falco hypoleucos*	Endangered		Listed
Grey Goshawk	*Accipiter novaehollandiae*	Vulnerable		Listed
Grey-crowned Babbler	*Pomatostomus temporalis*	Endangered		Listed
Grey-headed Flying-fox	*Pteropus poliocephalus*	Vulnerable	Vulnerable	Listed
Ground Cuckoo-shrike	*Coracina maxima*	Vulnerable		Listed
Growling Grass Frog	*Litoria raniformis*	Endangered	Vulnerable	Listed
Gull-billed Tern	*Gelochelidon nilotica*	Endangered		Listed
Hardhead	*Aythya australis*	Vulnerable		
Helmeted Honeyeater	*Lichenostomus melanops cassidix*	Critically endangered	Endangered	Listed
Hooded Scaly-foot	*Pygopus schraderi*	Critically endangered		Listed
Inland Dotterel	*Charadrius australis*	Vulnerable		
Intermediate Egret	*Ardea intermedia*	Critically endangered		Listed
Lace Goanna	*Varanus varius*	Vulnerable		
Latham's Snipe	*Gallinago hardwickii*	Near threatened		
Lewin's Rail	*Lewinia pectoralis*	Vulnerable		Listed
Lined Earless Dragon	*Tympanocryptis lineata lineata*	Endangered		Listed
Little Egret	*Egretta garzetta*	Endangered		Listed
Mallacoota Burrowing Cray	*Engaeus mallacoota*	Vulnerable		Listed
Masked Owl	*Tyto novaehollandiae*	Endangered		Listed
Mildura Ogyris	*Ogyris subterrestris subterrestris*	Vulnerable		Listed
Murray River Turtle	*Emydura macquarii*	Depleted		Listed
Narracan Burrowing Cray	*Engaeus phyllocercus*	Endangered		Listed
Orange-bellied Parrot	*Neophema chrysogaster*	Critically endangered	Critically endangered	Listed
Pink-tailed Worm-lizard	*Aprasia parapulchella*	Endangered	Vulnerable	Listed
Plains-wanderer	*Pedionomus torquatus*	Critically endangered	Vulnerable	Listed
Powerful Owl	*Ninox strenua*	Vulnerable		Listed
Rayed Blue	*Candalides heathi (Wimmera form)*	Critically endangered		Listed
Red-chested Button-quail	*Turnix pyrrhothorax*	Vulnerable		Listed
Red-naped Snake	*Furina diadema*	Vulnerable		Listed
Red-tailed Black-Cockatoo	*Calyptorhynchus banksi*	Endangered	Endangered	Listed
Redthroat	*Pyrrholaemus brunneus*	Endangered		Listed
Regent Honeyeater	*Anthochaera phrygia*	Critically endangered	Endangered	Listed
Regent Parrot	*Polytelis anthopeplus*	Vulnerable	Vulnerable	Listed
Royal Spoonbill	*Platalea regia*	Vulnerable		
Rufous Bristlebird (Otways ssp.)	*Dasyomis broadbenti caryochrous*	Near threatened		Listed
Samphire Skink	*Morethia adelaidensis*	Endangered		Listed

Common name	Scientific name	DSE status	EPBC Act status	FFG listed?
Southern Brown Bandicoot	*Isoodon obesulus obesulus*	Near threatened	Endangered	Listed
Speckled Warbler	*Pyrrholaemus sagittata*	Vulnerable		Listed
Squirrel Glider	*Petaurus norfolcensis*	Endangered		Listed
Striped Legless Lizard	*Delma impar*	Endangered	Vulnerable	Listed
Strzelecki Burrowing Cray	*Engaeus rostrogaleatus*	Endangered		Listed
Sun Moth	*Synemon sp c.f. collecta*			
Sun Moth (5091)	*Synemon sp c.f. selene*	Critically endangered		
Superb Parrot	*Polytelis swainsonii*	Endangered	Vulnerable	Listed
Swift Parrot	*Lathamus discolor*	Endangered	Endangered	Listed
Variegated Pygmy Perch	*Nannoperca variegata*	Endangered	Vulnerable	Listed
Warragul Burrowing Cray	*Engaeus sternalis*	Critically endangered		Listed
Woodland Blind Snake	*Ramphotyphlops proximus*	Near threatened		
Yarra Pygmy Perch	*Nannoperca obscura*	Near threatened	Vulnerable	Listed

Threatened species assessments found that priority fauna species occur in most subregions across the state, particularly in the Victorian Riverina, Victorian Volcanic Plain, Murray Mallee and Wimmera subregions (Figure 49). The Natural Resource Management (NRM) regions with the highest number of priority fauna species are the Goulburn Broken and North Central regions (Figure 50). More detailed information on the subregional occurrence of priority fauna species is provided in Appendix 13.

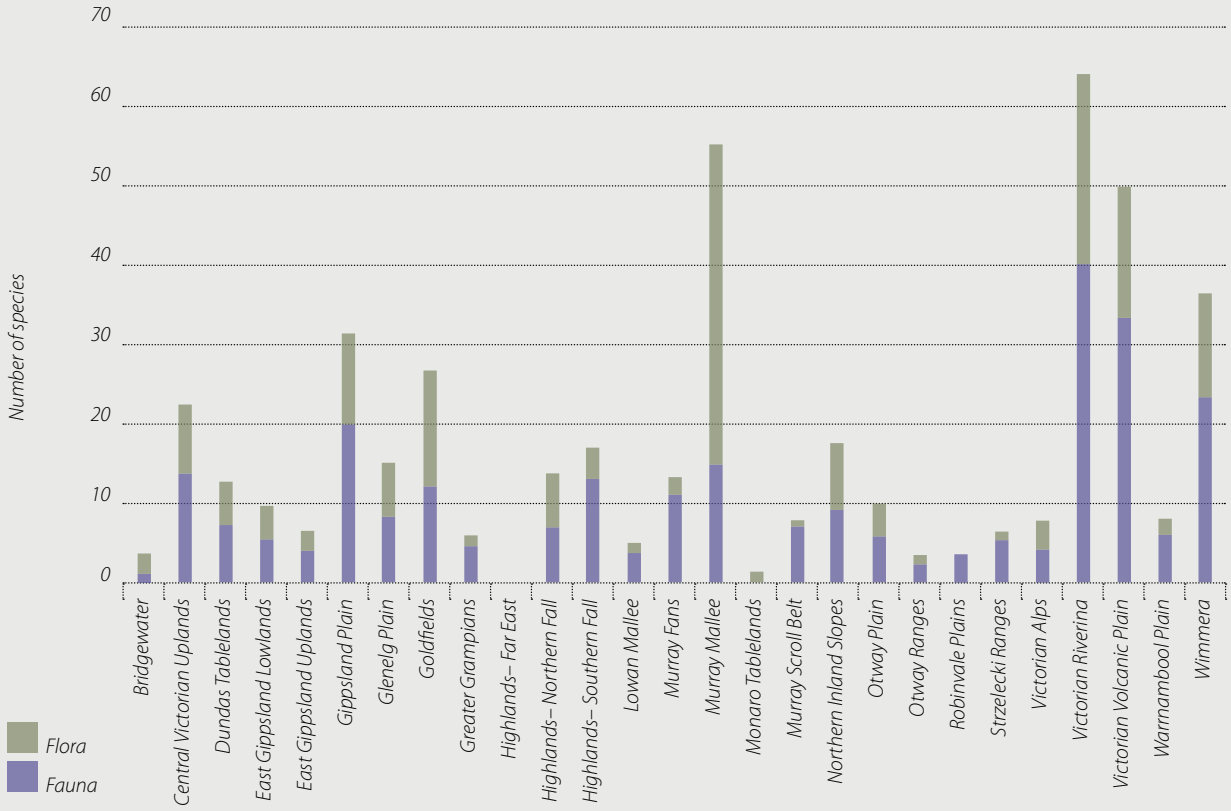

Figure 49. Number of priority fauna and flora species in each IBRA subregion. NB: Wilsons Promontory not included as it has no private land

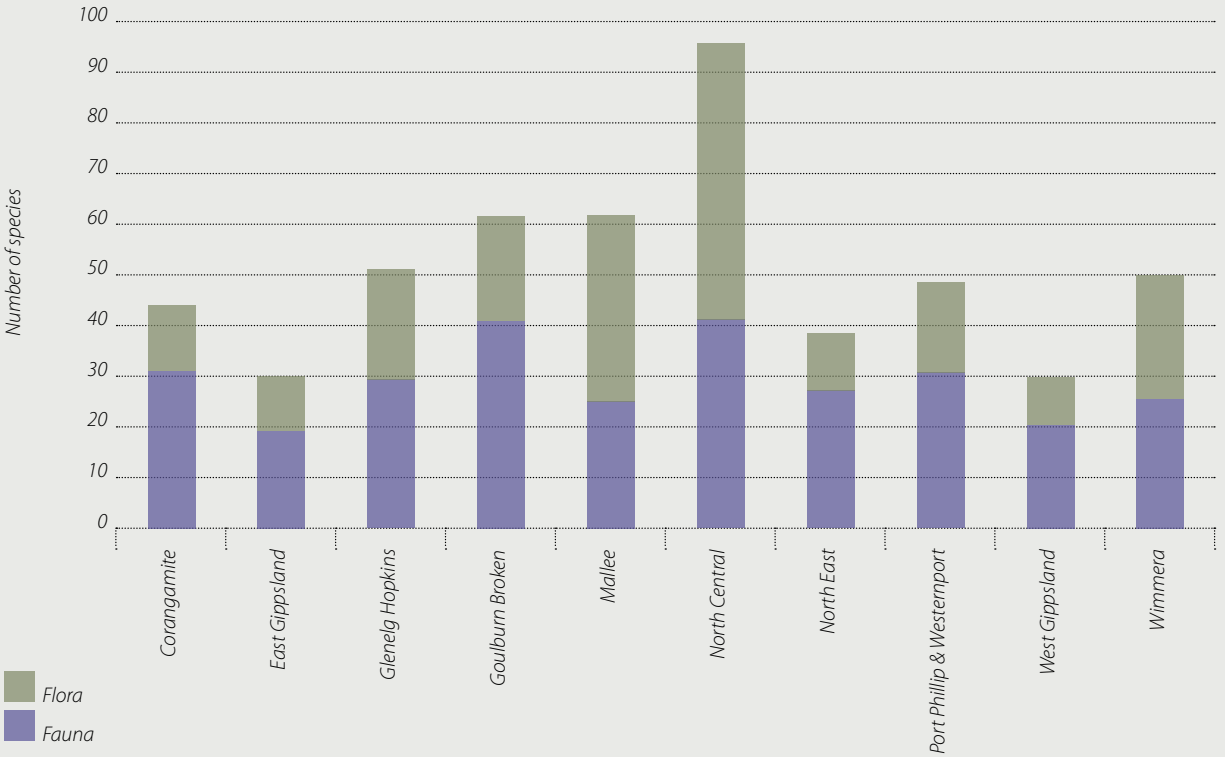

Figure 50. Number of priority fauna and flora species in each Natural Resource Management region

In terms of broad habitat relationships, the threatened species assessments show that more than one-third of priority fauna species are associated with wetlands and waterways (Figure 51). A substantial proportion are also found in grassland and woodland habitats, with relatively few threatened species found on private land associated with mallee, heathland or wet forest habitats (Figure 51).

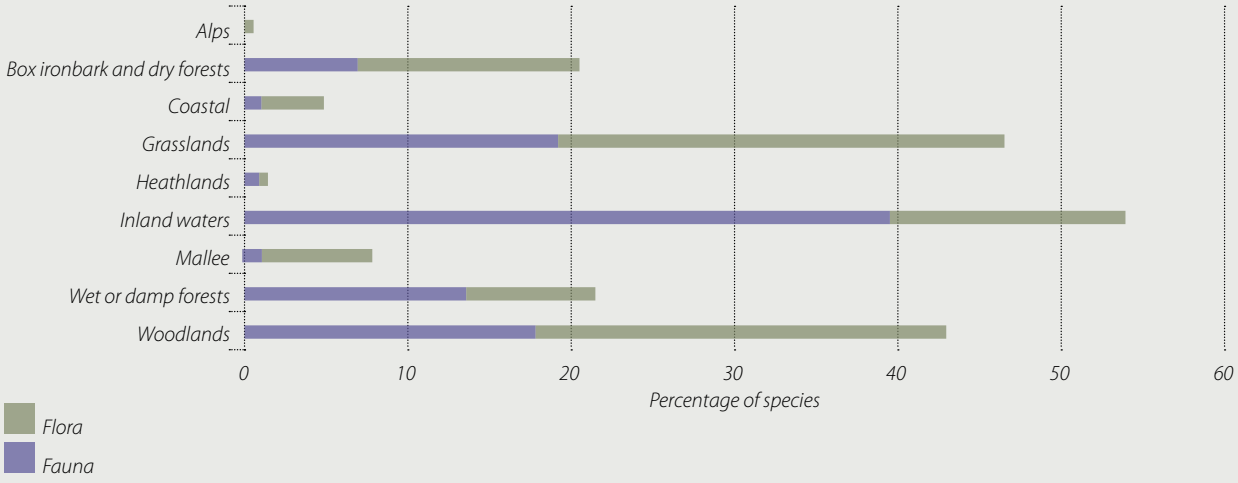

Figure 51. Percentage of priority fauna and flora species in different broad habitat types (based on Parks Victoria classification of natural ecosystems in Victoria – see Appendix 2)

3.4.4 Priority flora

The Conservation Plan identifies 148 priority species or sub-species of vascular plant that should be targeted for conservation on private land (Table 18). Of these species, 36% (54 species) are classified as threatened nationally and 65% are listed under the FFG Act (Table 18). A high proportion of them occur in grassland and woodland habitat types (Figure 51).

Threatened species assessments found that priority flora species on private land occur in most subregions, with particularly high numbers of species in the Murray Mallee, Victorian Riverina, Victorian Volcanic Plain and Goldfields subregions (Figure 49). For NRM regions, the highest number of priority species occur in North Central and Mallee regions (Figure 50). More detailed information on the subregional occurrence of priority flora species is provided in Appendix 14.

Of the 148 plant species on the 'Priority list', 73 (49%) have been recorded to date on Trust for Nature protected areas (Figure 52).

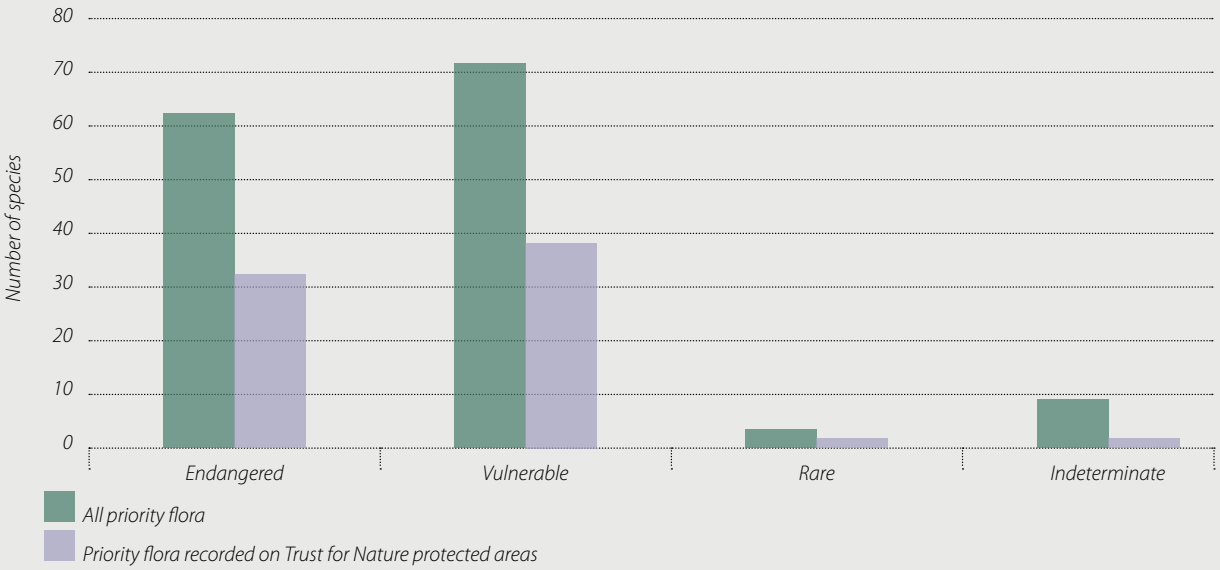

Figure 52. Number of priority flora species recorded on Trust for Nature protected areas relative to the total number of priority species in each of the status categories

Table 18. Priority threatened flora species that are a priority for conservation on private land in Victoria

Common name	Scientific name	DSE status	EPBC Act status	FFG listed?
Adamson's Blown-grass	*Lachnagrostis adamsonii*	Vulnerable	Endangered	Listed
Arching Flax-lily	*Dianella* sp. aff. *longifolia* (Benambra)	Vulnerable		
Ausfeld's Wattle	*Acacia ausfeldii*	Vulnerable		
Austral Doubah	*Marsdenia australis*	Vulnerable		
Austral Toad-flax	*Thesium australe*	Vulnerable	Vulnerable	Listed
Australian Anchor-plant	*Discaria pubescens*	Rare		Listed
Black Gum	*Eucalyptus aggregata*	Endangered		Listed
Bog Saw-sedge	*Gahnia subaequiglumis*	Vulnerable		
Bristly Love-grass	*Eragrostis setifolia*	Vulnerable		
Buloke Mistletoe	*Amyema linophylla* ssp. *orientale*	Vulnerable		
Bushy Hedgehog-grass	*Echinopogon caespitosus*	Endangered		
Buxton Gum	*Eucalyptus crenulata*	Endangered	Endangered	Listed
Chariot Wheels	*Maireana cheelii*	Vulnerable	Vulnerable	Listed
Charming Spider-orchid	*Caladenia amoena*	Endangered	Endangered	Listed
Clover Glycine	*Glycine latrobeana*	Vulnerable	Vulnerable	Listed
Concave Pomaderris	*Pomaderris subplicata*	Vulnerable	Vulnerable	Listed
Curly Sedge	*Carex tasmanica*	Vulnerable	Vulnerable	Listed
Delicate New Holland Daisy	*Vittadinia tenuissima*	Vulnerable		
Dense Greenhood	*Pterostylis* sp. aff. *bicolor* (Woorndoo)			Listed
Dookie Daisy	*Brachyscome gracilis*	Vulnerable		Listed
Downs Nut-grass	*Cyperus bifax*	Vulnerable		
Downy Swainson-pea	*Swainsona swainsonioides*	Endangered		Listed
Dwarf Amaranth	*Amaranthus macrocarpus* var. *macrocarpu*	Vulnerable		
Dwarf Kerrawang	*Rulingia prostrata*	Endangered	Endangered	Listed
Dwarf Myall	*Acacia ancistrophylla* var. *lissophylla*	Vulnerable		
Dwarf Yellow-heads	*Trichanthodium baracchianum*	Vulnerable	Vulnerable	Listed
Eastern Spider-orchid	*Caladenia orientalis*	Endangered	Endangered	Listed
Elegant Spider-orchid	*Caladenia formosa*	Vulnerable	Vulnerable	Listed
Euroa Guinea-flower	*Hibbertia humifusa* ssp. *erigens*	Vulnerable	Vulnerable	Listed
Fern-leaf Baeckea	*Babingtonia crenulata*	Vulnerable	Vulnerable	Listed
Filmy Maidenhair	*Adiantum diaphanum*	Endangered		Listed
Fin-fruit Fireweed	*Senecio laticostatus*	Vulnerable	Vulnerable	
Forked Spyridium	*Spyridium* sp. 1	Endangered	Endangered	Listed
French Island Spider-orchid	*Caladenia insularis*	Vulnerable	Vulnerable	Listed
Frosted Goosefoot	*Chenopodium desertorum* ssp. *rectum*	Vulnerable		
Fused Glasswort	*Halosarcia syncarpa*	Vulnerable		
Gaping Leek-orchid	*Prasophyllum correctum*	Endangered	Endangered	Listed
Golden Cowslips	*Diuris behrii*	Vulnerable		Listed
Gorae Leek-orchid	*Prasophyllum diversiflorum*	Endangered	Endangered	Listed
Grampians Duck-orchid	*Paracaleana disjuncta*	Endangered		Listed
Hoary Scurf-pea	*Cullen cinereum*	Endangered		Listed
Jerry Water-fire	*Bergia ammannioides*	Vulnerable		
Jerry-jerry	*Ammannia multiflora*	Vulnerable		

Common name	Scientific name	DSE status	EPBC Act status	FFG listed?
Jumping-jack Wattle	*Acacia enterocarpa*	Endangered	Endangered	Listed
Kamarooka Mallee	*Eucalyptus froggattii*	Rare		Listed
Kneed Swainson-pea	*Swainsona reticulata*	Vulnerable		Listed
Large-headed Fireweed	*Senecio macrocarpus*	Endangered	Vulnerable	Listed
Late Helmet-orchid	*Corybas* sp. aff. *diemenicus* (Coastal)	Endangered		Listed
Leafless Bluebush	*Maireana aphylla*	Vulnerable		
Leafy Greenhood	*Pterostylis cucullata*	Vulnerable	Vulnerable	Listed
Lima Stringybark	*Eucalyptus alligatrix* subsp. *limaensis*	Endangered	Vulnerable	Listed
Limestone Blue Wattle	*Acacia caerulescens*	Vulnerable	Vulnerable	Listed
Limestone Spider-orchid	*Caladenia calcicola*	Endangered	Vulnerable	Listed
Long Eryngium	*Eryngium paludosum*	Vulnerable		
Long Tails	*Ptilotus polystachyus* var. *polystachyus*	Endangered		
Long-awn Spear-grass	*Austrostipa tenuifolia*	Endangered		
Low Bush-pea	*Pultenaea subspicata*	Vulnerable		
Lowan Phebalium	*Phebalium lowanense*	Vulnerable	Vulnerable	
Lowly Greenhood	*Pterostylis despectans*	Endangered	Endangered	Listed
Maiden's Wattle	*Acacia maidenii*	Endangered		Listed
Mallee Hemichroa	*Hemichroa diandra*	Endangered		Listed
Mallee Pellitory	*Parietaria cardiostegia*	Vulnerable		
Matted Flax-lily	*Dianella amoena*	Endangered	Endangered	Listed
McIvor Spider-orchid	*Caladenia audasii*	Endangered	Endangered	Listed
Mellblom's Spider-orchid	*Caladenia hastata*	Endangered	Endangered	Listed
Merran's Sun-orchid	*Thelymita X merraniae*	Endangered		Listed
Midlands Spider-orchid	*Caladenia clavescens*			Listed
Mountain Correa	*Correa lawrenciana* var. *genoensis*	Endangered	Endangered	Listed
Naked Beard-orchid	*Calochilus imberbis*	Rare		
Narrow Duckweed	*Wolffia angusta*	Indeterminate		
Narrow Goodenia	*Goodenia macbarronii*	Vulnerable	Vulnerable	Listed
Narrow-leaf Emu-bush	*Eremophila sturtii*	Endangered		Listed
Oat Kangaroo-grass	*Themeda avenacea*	Indeterminate		
Open Summer-grass	*Digitaria diffusa*	Vulnerable		
Painted Diuris	*Diuris tricolor*	Endangered		Listed
Pale Golden Moths	*Diuris ochroma*	Endangered	Vulnerable	Listed
Pale Spike-sedge	*Eleocharis pallens*	Indeterminate		
Papery Goosefoot	*Chenopodium erosum*	Vulnerable		
Pink Gum	*Eucalyptus fasciculosa*	Vulnerable		
Plains Spurge	*Euphorbia planiticola*	Endangered		Listed
Pointed Flat-sedge	*Cyperus subulatus*	Vulnerable		
Purple Blown-grass	*Lachnagrostis punicea* subsp. *filifolia*	Rare		Listed
Purple Diuris	*Diuris punctata* var. *punctata*	Vulnerable		Listed
Purple Eyebright	*Euphrasia collina* ssp. *muelleri*	Endangered	Endangered	Listed
Purple Love-grass	*Eragrostis lacunaria*	Vulnerable		
Purple Swainson-pea	*Swainsona purpurea*	Endangered		Listed
Purple Wire-grass	*Aristida personata*	Endangered		Listed
Red Microcybe	*Microcybe multiflora*	Vulnerable		

Common name	Scientific name	DSE status	EPBC Act status	FFG listed?
Red Swainson-pea	*Swainsona plagiotropis*	Endangered	Vulnerable	Listed
Red-Cross Spider-orchid	*Caladenia cruciformis*			Listed
Ridged Water-milfoil	*Myriophyllum porcatum*	Vulnerable	Vulnerable	Listed
Rock Orchid	*Thelychiton speciosus*	Endangered		Listed
Rosella Spider-orchid	*Caladenia rosella*	Endangered	Endangered	Listed
Rough-seed Wire-grass	*Aristida obscura*	Endangered		Listed
Round-leaf Pomaderris	*Pomaderris vacciniifolia*	Endangered		Listed
Silky Swainson-pea	*Swainsona sericea*	Vulnerable		Listed
Slender Darling-pea	*Swainsona murrayana*	Endangered	Vulnerable	Listed
Slender Leek-orchid	*Prasophyllum parviflorum*	Vulnerable		
Slender Sunray	*Rhodanthe stricta*	Endangered		Listed
Small Golden Moths	*Diuris basaltica*	Vulnerable	Endangered	Listed
Small Milkwort	*Comesperma polygaloides*	Vulnerable		Listed
Small Nut-heads	*Haegiela tatei*	Vulnerable		
Small Sickle-Greenhood	*Pterostylis lustra*	Endangered		Listed
Snow-berry	*Gaultheria hispida*	Endangered		Listed
Southern Sandlewood	*Santalum leptocladum*	Endangered		Listed
Spear-fruit Copperburr	*Sclerolaena patenticuspis*	Vulnerable		
Spiny Peppercress	*Lepidium aschersonii*	Endangered	Vulnerable	Listed
Spiny Rice-flower	*Pimelea spinescens* ssp. *spinescens*	Endangered	Vulnerable	Listed
Spreading Angianthus	*Angianthus brachypappus*	Vulnerable		
Spreading Water-mat	*Lepilaena patentifolia*	Vulnerable		Listed
Square Raspwort	*Haloragis exalata* subsp. *exalata* var. *exalata*	Vulnerable	Vulnerable	
Star Cucumber	*Sicyos australis*	Vulnerable		
Stiff Groundsel	*Senecio behrianus*	Endangered	Endangered	Listed
Striate Spike-sedge	*Eleocharis obicis*	Vulnerable		
Strzelecki Gum	*Eucalyptus strzeleckii*	Vulnerable	Vulnerable	Listed
Stuart Mill Spider-orchid	*Caladenia cretacea*			Listed
Swamp Buttercup	*Ranunculus undosus*	Vulnerable		
Swamp Diuris	*Diuris palustris*	Vulnerable		Listed
Swamp Everlasting	*Xerochrysum palustre*	Vulnerable	Vulnerable	Listed
Swamp Fern	*Thelypteris confluens*	Endangered		Listed
Swamp Greenhood	*Pterostylis tenuimissima*	Vulnerable	Vulnerable	
Swamp Leek-orchid	*Prasophyllum hygrophilum*	Endangered		Listed
Swamp She-oak	*Casuarina obesa*	Endangered		Listed
Tough Scurf-pea	*Cullen tenax*	Endangered		Listed
Trailing Hop-bush	*Dodonaea procumbens*	Vulnerable	Vulnerable	
Tucker's Spear-grass	*Austrostipa tuckeri*	Vulnerable		
Turnip Copperburr	*Sclerolaena napiformis*	Endangered	Endangered	Listed
Umbrella Grass	*Digitaria divaricatissima*	Vulnerable		
Veined Pepper-cress	*Lepidium phlebopetalum*	Endangered		
Velvet Daisy-bush	*Olearia pannosa* ssp. *cardiophylla*	Vulnerable		Listed
Venus-hair Fern	*Adiantum capillus-veneris*	Endangered		Listed
Violet Town Spider-orchid	*Caladenia* sp. aff. *rosella*			Listed

Common name	Scientific name	DSE status	EPBC Act status	FFG listed?
Warby Range Swamp Gum	*Eucalyptus cadens*	Vulnerable	Vulnerable	Listed
Wavy Swamp Wallaby-grass	*Amphibromus sinuatus*	Vulnerable		
Weak Daisy	*Brachyscome debilis*	Vulnerable		
White Sunray	*Leucochrysum albicans* subsp. *albicans* var. *tricolor*	Endangered	Endangered	
Wilga	*Geijera parviflora*	Endangered		Listed
Wimmera Spider-orchid	*Caladenia lowanensis*			Listed
Winged New Holland Daisy	*Vittadinia pterochaeta*	Endangered		
Winged Peppercress	*Lepidium monoplocoides*	Endangered	Endangered	Listed
Woolly Plover-daisy	*Leiocarpa tomentosa*	Endangered		
Wrinkled Buttons	*Leiocarpa gatesii*	Vulnerable	Vulnerable	Listed
Wrinkled Cassinia	*Cassinia rugata*	Vulnerable	Vulnerable	Listed
Yarran	*Acacia melvillei*	Vulnerable		
Yarran Wattle	*Acacia omalophylla*	Endangered		Listed
Yellow Hyacinth-orchid	*Dipodium hamiltonianum*	Endangered		Listed
Yellow-lip Spider-orchid	*Caladenia xanthochila*	Endangered	Endangered	Listed
Yellow-tongue Daisy	*Brachyscome chrysoglossa*	Vulnerable		Listed

3.4.5 Priorities for improving protection of threatened species

Conservation objective 4: key priorities

- recognise that private land conservation is critical to the conservation of many of Victoria's most threatened species of plants and animals
- understand that increased permanent protection of private land habitat is critical to the survival of these threatened species (Taylor *et al.* 2011)
- targeted conservation in the focal landscapes will not be enough to secure populations of many of the priority species. Undertake additional conservation actions on private land in other parts of the state where significant populations of these species occur
- based on numbers of priority species, target key areas for additional threatened species protection or management on private land include the Murray Mallee, Victorian Riverina, Victorian Volcanic Plain, Wimmera and Goldfields subregions, and
- the Trust will build on existing work helping protect threatened species by increasingly targeting the threatened species conservation program towards key private-land populations of the identified priority species.

The Conservation Plan highlights the fact that private land conservation is critical to the conservation of many of Victoria's most threatened species of plants and animals, and identifies, for the first time, a set of 148 threatened flora species and 88 threatened fauna species in Victoria which are priorities for conservation on private land. Of these species, nearly one-third are listed as nationally threatened under the EPBC Act, and more than two-thirds are listed as threatened under the FFG Act. Key subregions for conservation of these priority threatened species comprise Murray Mallee, Victorian Riverina, Victorian Volcanic Plain, Wimmera and Goldfields.

Of the priority species, just over 50% have been recorded to date from the 12 focal landscapes. However, many of them also occur outside of the focal landscapes (Figure 53) and their long-term survival will require additional conservation actions on private land in those non-focal landscapes where key populations occur. The identification of this discrete set of 236 priority species provides the Trust with the basis for identifying key sites on private land to target for threatened species conservation.

In addition, the identification of a discrete set of priority species for conservation on private land will help refine the Trust's approach to threatened species conservation by increasing the focus on those threatened species' particular conservation needs rather than just assisting them through more generalised ecosystem protection approaches. In this regard, the identification of a discrete set of priority species to target for conservation on private land makes the Trust's approach more consistent with the criteria

established by the NRS for a Comprehensive, Adequate and Representative reserve system (CAR), as these identify protection of critical habitats for threatened species as one of the core elements of a CAR National Reserve System (NRS) (Commonwealth of Australia 1999; CfoC 2011).

An important outcome from the Conservation Plan is the finding that aquatic ecosystems support the highest proportion of priority fauna and flora species. Previous analyses of habitat preferences of threatened fauna and flora across all land tenures have not shown aquatic ecosystems to support many threatened species but have identified grasslands and woodlands as the habitats with the highest proportions of threatened species (Robinson 1991; DCE 1992; OCE 1992). The Trust's analyses likewise show grasslands and woodlands to be important for a relatively high proportion of priority threatened species found on private land but additionally highlight the importance of aquatic habitats for priority species on private land. These findings underline the need to target wetlands, riparian habitats and coastal ecosystems on private land for additional permanent protection – not only to increase their representation status in the NRS but to assist with the conservation of more than 50 species of priority flora and fauna. Increased protection of these aquatic ecosystems will also help contribute to the conservation of listed migratory shorebirds at key sites, as discussed in Section 3.3.3.

Having identified this set of priority flora and fauna for conservation on private land, the next steps for the Trust are to:

- prioritise which species can benefit most from habitat protection or habitat management, based on assessments of threats to each species and the capacity of the Trust and partners to help reduce those threats, and then
- identify key localities to target either for additional protection or for ongoing management.

Recent research has demonstrated the effectiveness of protected areas in maintaining or improving the population trends of nationally threatened species (Taylor *et al.* 2011b). However, it has also highlighted the deficiencies of the existing NRS in providing adequate representation of threatened species in protected areas (Watson *et al.* 2010). Threatened species programs on private land, therefore, need to fill the gaps in protected areas for threatened taxa and be targeted towards actions that will improve the viability of threatened species populations.

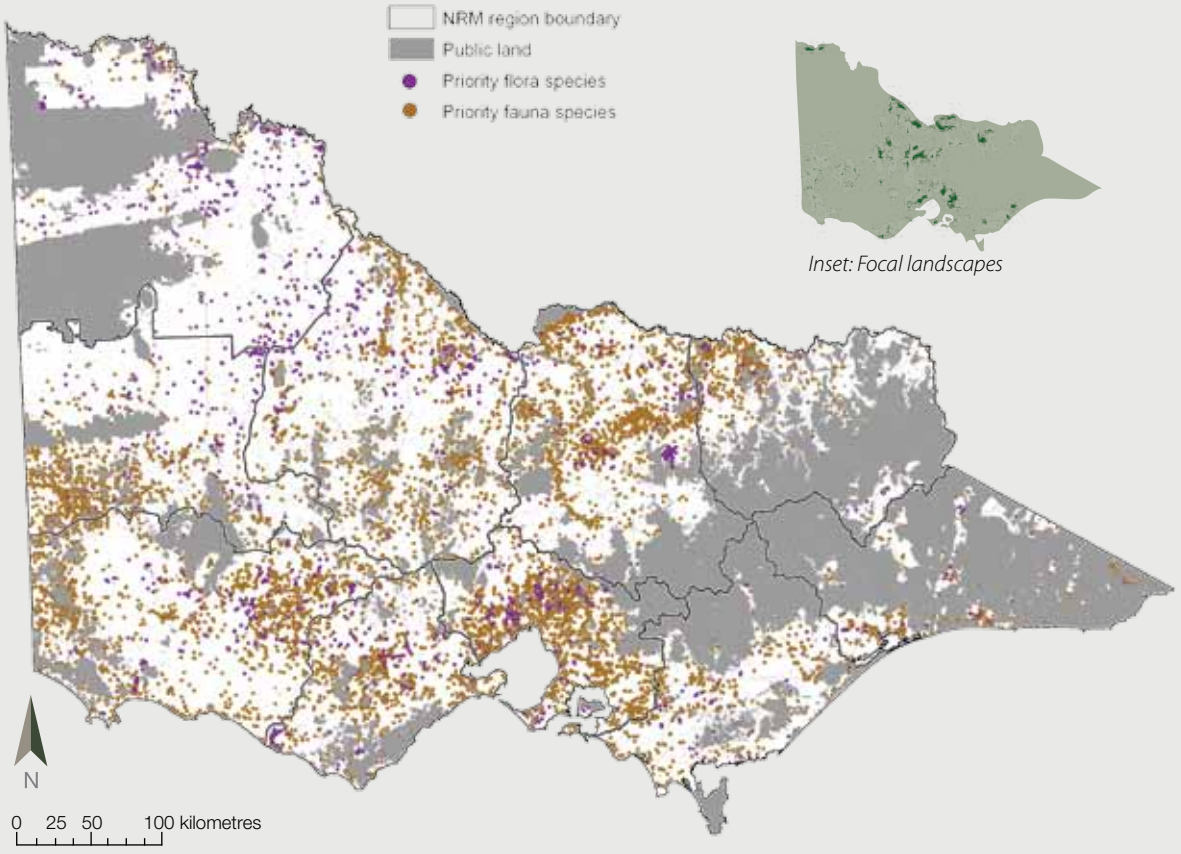

Figure 53. Occurrence of priority threatened flora and fauna on private land showing the focal landscapes

3.5 Conservation objective 5: Enhance and protect landscape connectivity

3.5.1 Rationale for the objective

Conservation objective 5 addresses three key conservation planning principles in relation to landscape conservation:

- patches of native vegetation should be as large as possible for species diversity and population viability
- landscape connectivity is critical to the movement of species and individuals at different spatial scales (e.g. local up to continental) and time scales (e.g. daily, seasonal, long-term) (Bennett 1999; Soule *et al.* 2004; Bennett *et al.* 2009); it is critical to maintaining genetic diversity among species, and
- landscape connectivity is critical to the conservation of biodiversity in human-dominated landscapes where reservation alone will not be sufficient or feasible to conserve biodiversity values and a whole-of-landscape approach is needed for effective conservation (Bennett 1995, 1999; NRMMC 2005; Soule' *et al.* 2004; Bennett *et al.* 2009; DSE 2009a).

Additionally, increased landscape connectivity is recognised as a critical action to help maintain biodiversity in the context of climate change by:

- increasing the diversity of ecosystems in protected areas and facilitating movements of organisms and individuals across the landscape
- increasing connectivity between diverse habitats and between areas with steep environmental gradients
- reducing gaps between protected areas
- maintaining or restoring landscape-scale ecological processes, for example hydrological flows, and
- increasing the area of habitat available for plants and animal species and populations (Dunlop *et al.* 2012a, 2012b).

Based on these conservation-planning principles, two criteria for enhancing and protecting landscape connectivity were developed:

- identification of private-land native vegetation with medium to high landscape context to target for additional enhancement and protection, and
- identification of cleared private land with medium to high landscape connectivity to target for habitat restoration and protection.

Both of these criteria were assessed using DSE layers for site context and landscape connectivity respectively. More details about the method are provided in Appendix 2.

3.5.2 Key findings for the objective

Key findings derived from the Conservation Plan are that:

- the focal landscapes include nearly 50% of private land vegetation identified as having high landscape connectivity in Victoria
- the focal landscapes all sit either within the two major corridors recognised by the Australian Government in 2012 in its National Wildlife Corridors Plan (Habitat 141, Great Eastern Ranges) or within other landscapes where there are benefits from increasing connectivity in accordance with the guiding principles for identifying major corridors outlined in the Corridors Plan
- the native vegetation found on private land between constituent biodiversity priority zones (BPZs) within each focal landscape and between focal landscapes primarily consists of under-represented EVCs. Increased protection and restoration of that vegetation therefore contributes both to building the NRS and building landscape connectivity, and
- native vegetation found on Trust for Nature covenants and properties has higher landscape context than private-land vegetation overall.

3.5.3 Improving landscape context of remnant vegetation

In general, landscape context scores for private land vegetation were found to be higher in those subregions with a higher percentage of native vegetation on private land, notably Murray Scroll Belt, Victorian Alps, Otway Ranges, Greater Grampians, East Gippsland Uplands and Highlands Far East (Figure 54). Landscape context scores for private land also tend to be higher where the private land buffers large areas of public land, for example the borders of Little Desert, Gariwerd (Grampians), Brisbane Ranges and Chiltern – Mt Pilot National Parks, and public land through the Goldfields subregion, South Eastern Highlands bioregion and Otway Ranges (Figure 55).

Across Victoria, the median score for landscape context on private land is 13.0 out of a potential maximum of 20.0 (unpubl. data, VEAC). This compares with a statewide median for public land of 18.2. Subregions with particularly low scores are those with only small proportions of native vegetation, namely Victorian Volcanic Plain, Warrnambool Plain and Murray Mallee.

Overall, private land vegetation was found to represent only 11% (872 277 ha) of all land with high landscape context scores in Victoria. Notably, though, a much higher proportion of Trust for Nature protected private land was assessed as having high landscape context scores than private land vegetation in general (Figure 56). Fifty percent of private land with high landscape context was also found to occur within the 12 focal landscapes.

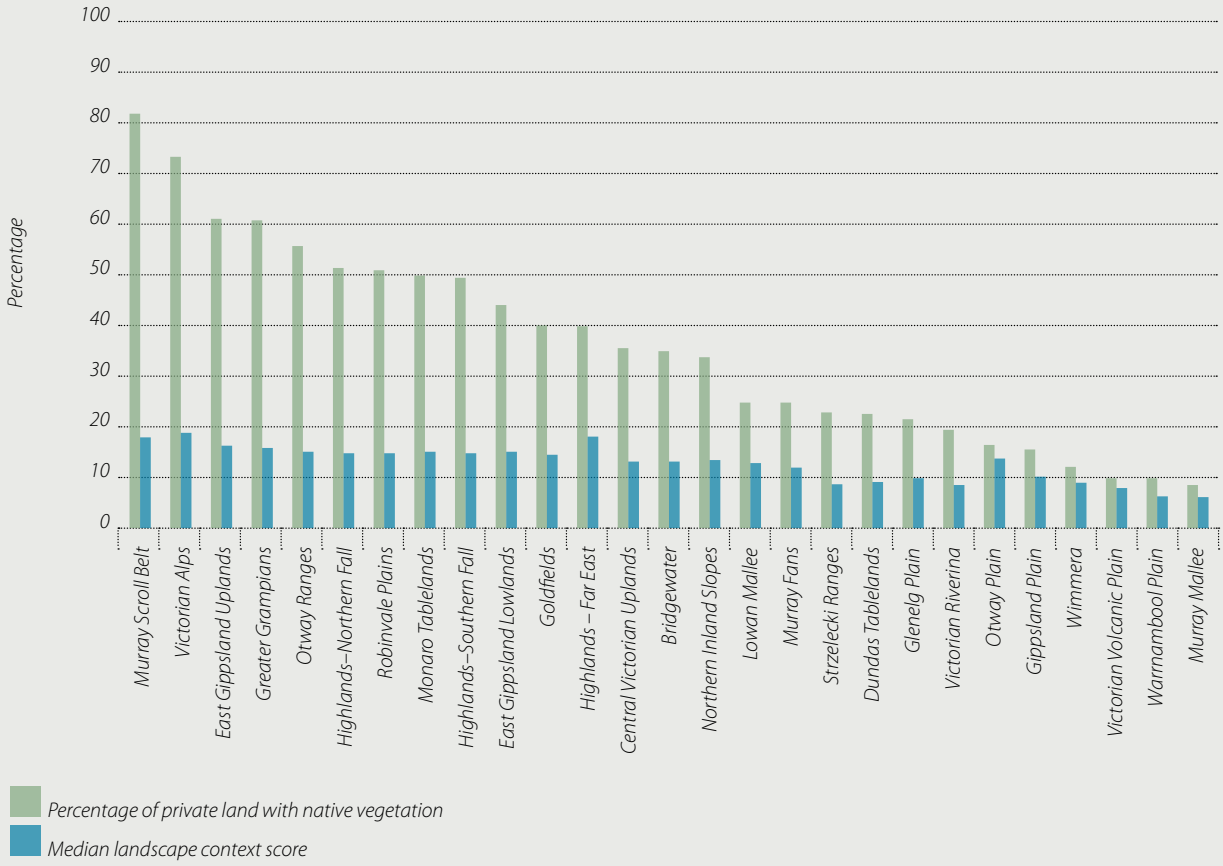

Figure 54. Median landscape context scores for private-land native vegetation out of a maximum potential score of 25, and percentage of private land with native vegetation in each subregion. Landscape context scores were derived from VEAC (2010)

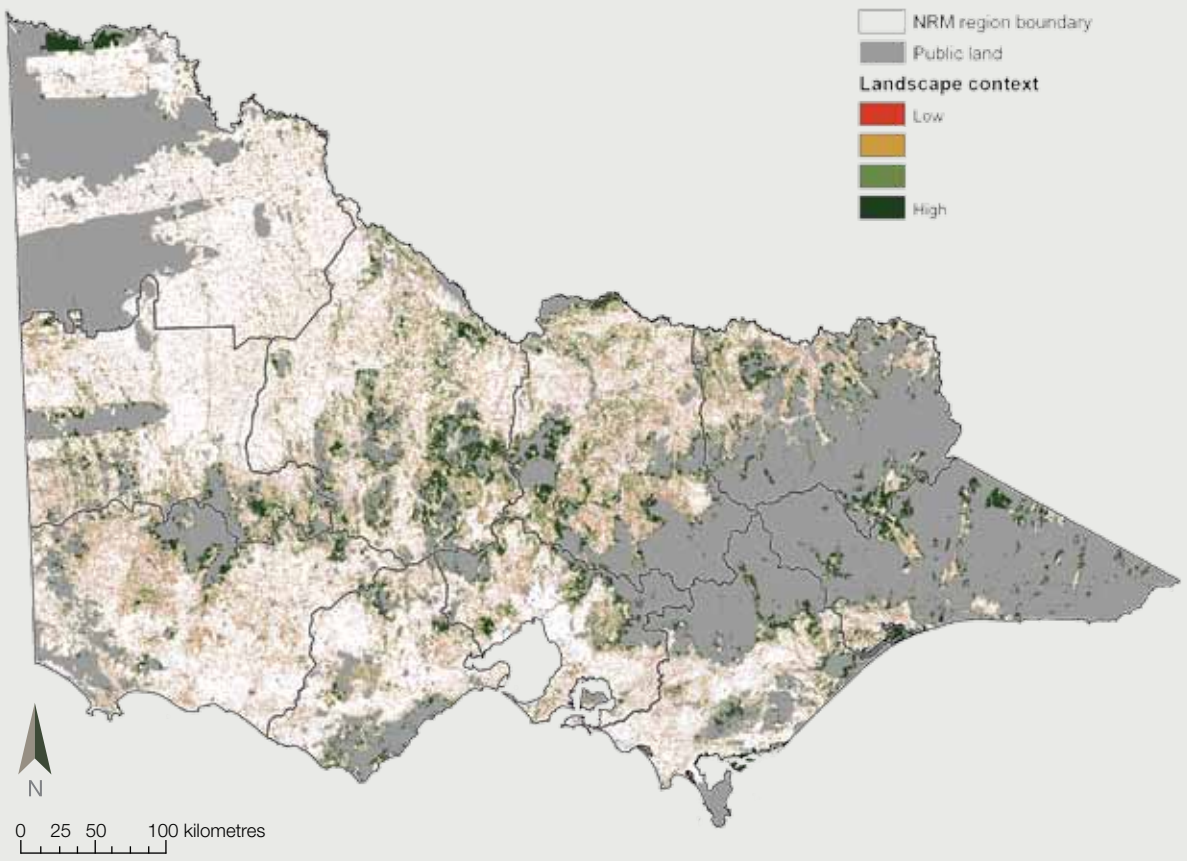

Figure 55. Landscape context rankings for private-land native vegetation in Victoria based on the Department of Sustainability and Environment's site context layer NV2005_QUAL.

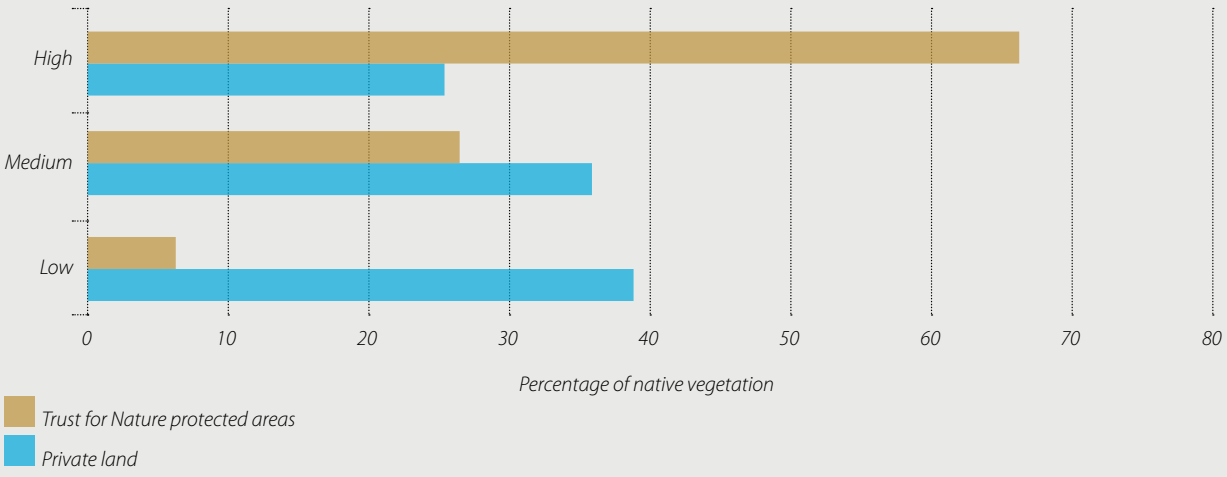

Figure 56. Percentage of native vegetation in different landscape context categories for all private-land vegetation and for Trust for Nature protected areas. Data derived from analysis of the Department of Sustainability and Environment NV2005_QUAL layer.

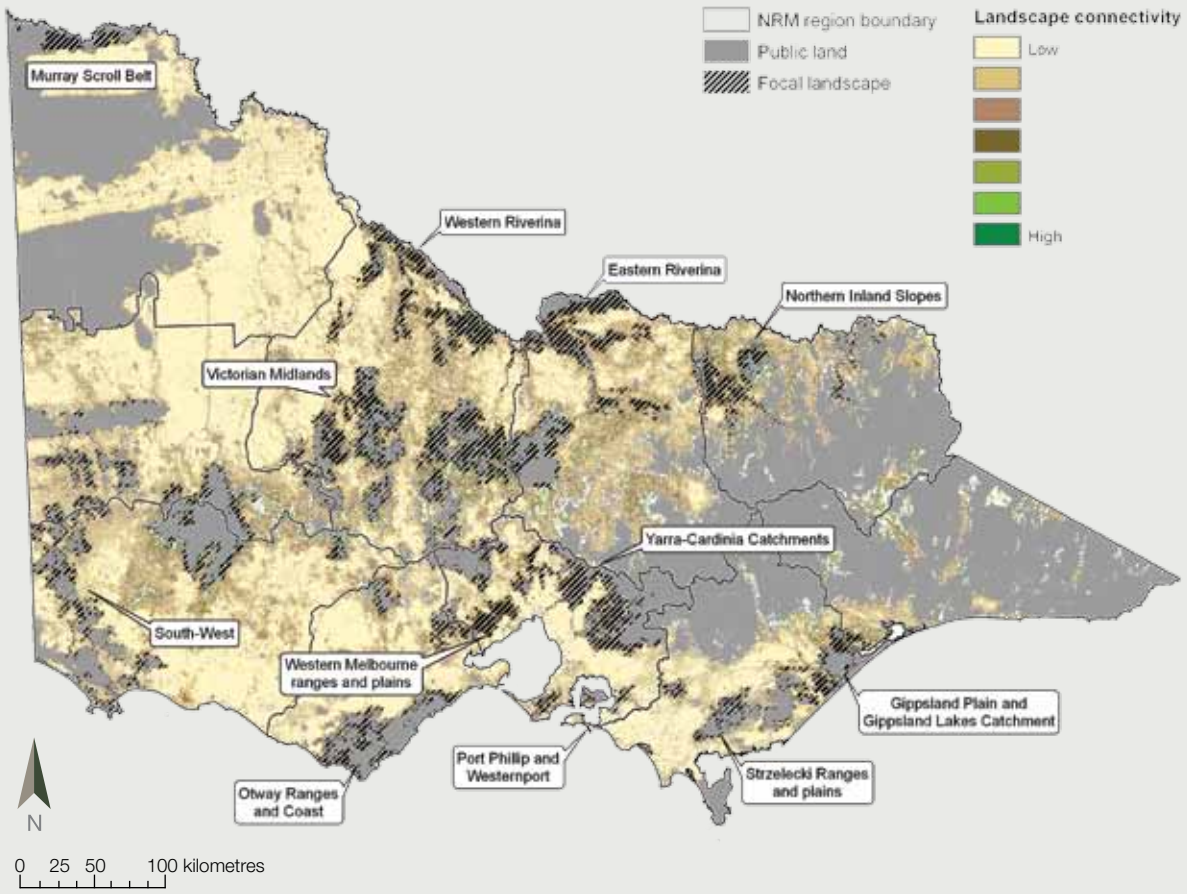

Figure 57. Modelled landscape connectivity for cleared areas on private land across Victoria in relation to the distribution of the focal landscapes on private land. Mapping based on the Department of Sustainability and Environment's modelled landscape connectivity layer (DSE NV 2005_CONN10)

3.5.4 Improving landscape connectivity

Based on mapping done using the Department of Sustainability and Environment's landscape connectivity layer (NV2005_CONN10; see Appendix 2 for more detailed information), a number of areas were identified on private land across Victoria that provide substantial opportunities for improving connectivity at a broad, landscape scale (Figure 57). These fall into three broad categories (Table 19):

- those connecting the biodiversity priority zones (BPZs) within focal landscapes
- those connecting between focal landscapes, and
- those providing landscape connectivity at a regional scale in other parts of the state.

Table 19. Identified areas with medium to high landscape connectivity on private land, categorised in relation to opportunities for increasing connectivity within focal landscapes, between focal landscapes or within regions. Assessments based on Department of Sustainability and Environment connectivity modelling

Connectivity category	District name	Focal landscape(s)	Trust for Nature region(s)
Connectivity within focal landscapes	Dergholm–Little Desert	South-West	Glenelg Hopkins, Wimmera
	Avoca–Loddon floodplains	Western Riverina	North Central
	Grampians – St Arnaud	Victorian Midlands	Wimmera, North Central
	St Arnaud – Nagambie	Victorian Midlands	North Central
	Maldon–Castlemaine–Eppalock	Victorian Midlands	North Central
	Numurkah-Tungamah- Dookie	Eastern Riverina	Goulburn Broken
	Warby Range – Lower Ovens and Black Dog Creek floodplains	Northern Inland Slopes	North East
	Chiltern – Mt Pilot	Northern Inland Slopes	North East
	Mt Worth – Tarra Valley – Bulga	Strzelecki Ranges and Plains	West Gippsland
Connectivity between focal landscapes	Portland-Dundas Tablelands	South-West, Victorian Midlands	Glenelg Hopkins
	Pyalong – Broadford-Tooborac	Victorian Midlands, Yarra-Cardinia Catchments	Goulburn Broken, Port Phillip & Westernport, North Central
	Murray Valley	Northern Inland Slopes, Eastern Riverina, Western Riverina, Murray Scroll Belt	North East, Goulburn Broken, North Central, Mallee
	Patho–Kamarooka	Western Riverina, Victorian Midlands	North Central
	Longwood Plains	Victorian Midlands, Eastern Riverina	Goulburn Broken
	Briagalong–Bairnsdale–Meerlieu	Gippsland Plain and Gippsland Lakes Catchment	East Gippsland, West Gippsland
Regional landscape connectivity	Little Desert-Big Desert	South-West	Wimmera
	The Western District Lakes and Stony Rises	N/A	Corangamite
	Lake Buloke	N/A	North Central
	Lerderderg–Gisborne–Toolern Vale	Victorian Midlands, Western Melbourne Ranges and Plains	Port Phillip & Westernport
	Alexandra–Merton–Strathbogie	N/A	Goulburn Broken
	Upper Murray	Northern Inland Slopes	North East
	Omeo Plains	N/A	North East, East Gippsland

3.5.5 Priorities for enhancing protecting landscape connectivity

Conservation objective 5: key priorities

- work with partners to help improve landscape connectivity, particularly within each of the focal landscapes and as part of the identified National Wildlife Corridor initiatives where action can help protect and restore under-represented ecosystems
- at more local scales, work with regional delivery partners and community organisations to improve landscape connectivity in key areas through habitat protection and ecological restoration
- establish an additional national wildlife corridor along the Murray Valley
- work more closely with partners to protect and restore riparian habitat on private land, both along priority waterways and in the focal landscapes, and
- incorporate the findings of the CSIRO reports described in previous sections into conservation planning processes to improve the effectiveness of the NRS in the context of climate change.

Priorities for improving landscape connectivity in a national context

The recently published National Wildlife Corridors Plan (National Wildlife Corridors Advisory Committee 2012) establishes principles for the identification of potential national wildlife corridors and provides examples of existing initiatives that are considered national wildlife corridors. Some of the 41 biodiversity priority zones and 12 focal landscapes identified for this Conservation Plan contribute to two of these existing wildlife corridor initiatives: Habitat 141 and the Great Eastern Ranges (Figure 58). Based on the framework for identifying potential wildlife corridors outlined in the Corridors Plan, it is considered that the focal landscapes along the Murray Valley could also form the basis of an additional national wildlife corridor along this river system. There are also recognised benefits from establishing corridors connecting between the Great Dividing Range to the coast and also along the coast, both in the context of current movement patterns of terrestrial and aquatic fauna (e.g. Drew 2008) and in the context of climate change (DSE 2009; Dunlop *et al.* 2012a).

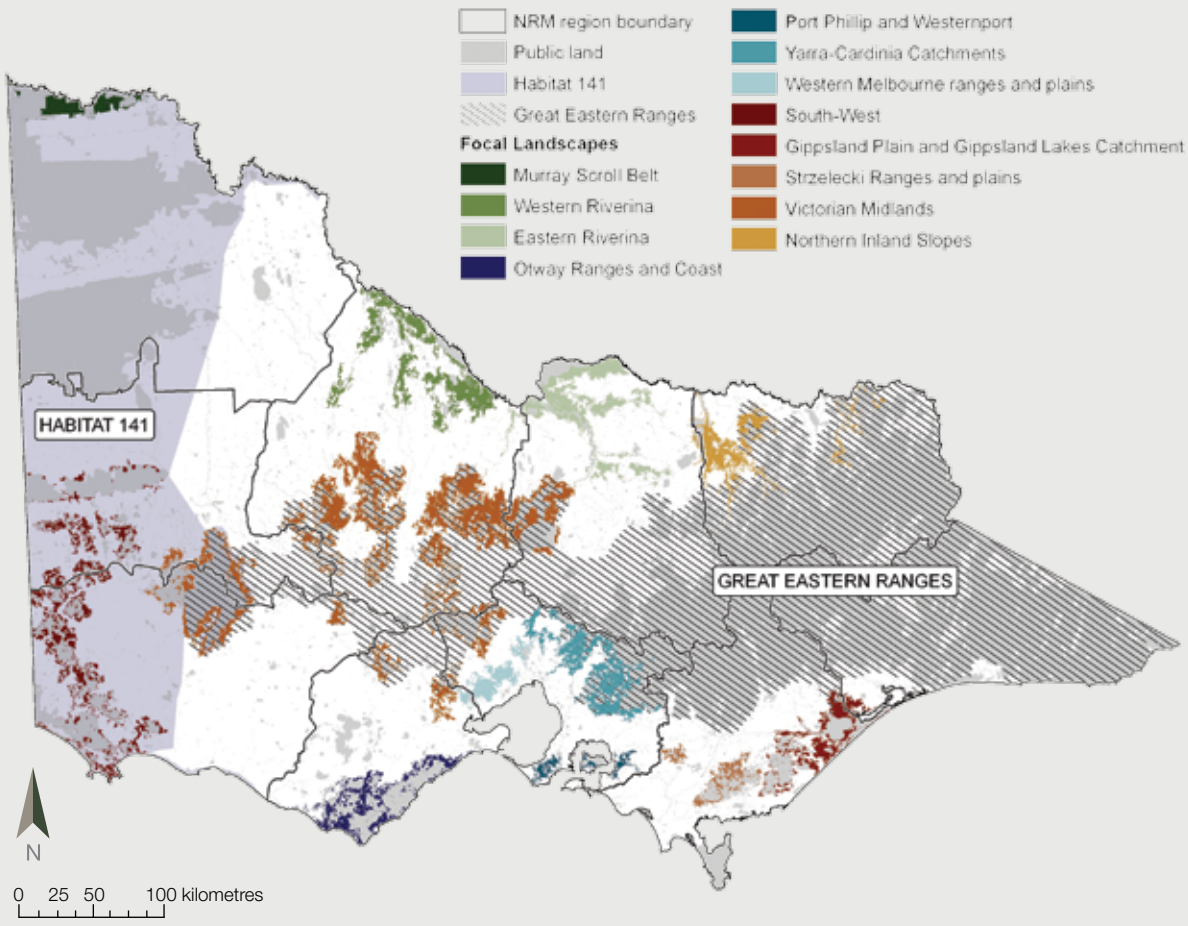

Figure 58. Location of focal landscapes on private land within wildlife corridors identified in the National Wildlife Corridors Plan

Priorities for improving connectivity based on the focal landscapes

In a focal landscape context, the contribution of private-land protected areas towards increased connectivity between protected areas on both public and private land has previously been demonstrated within the Gippsland Plain and Gippsland Lakes Catchment focal landscape (Fitzsimons & Wescott 2008b). These findings underline the connectivity benefits of the Trust's focus on increasing the extent and condition of protected areas in key landscape areas (e.g. Edwards & Traill 2002; Koch 2011; Trust for Nature 2012a, 2012b; Edwards & Fox in press).

The findings further suggest that prioritising private land within the focal landscapes for habitat restoration and protection will build on the Trust's existing core area of significant biodiversity assets, particularly given that 60% of the Trust's protected areas on private land are located in the focal landscapes. This approach closely matches the planning approach recommended in the National Wildlife Corridors Plan (National Wildlife Corridors Advisory Committee 2012, p. 3).

In this context, it is worth noting that most of the private-land native vegetation occurring between biodiversity priority zones (BPZs) and between or within focal landscapes is under-represented in protected areas. Restoration and protection of these under-represented ecosystems in the intervening landscapes provides significant opportunities for increasing both the connectivity and representation of ecosystems in protected areas.

In line with recommendations to increase the effectiveness of protected areas, however, finer-scale planning at more local scales is required to clearly identify where additional protection or restoration activities will augment, buffer and connect existing protected areas (Moilanen & Wintle 2006; Dunlop *et al.* 2012a). This approach is already being undertaken by Trust for Nature in the Riverina IBRA region (Figure 59) and parts of the South-West focal landscape (Trust for Nature 2012a, 2012b).

Other priorities for improving connectivity

At more local scales, the Trust recognises that other Natural Resource Management (NRM) bodies are targeting the protection of under-represented ecosystems by developing habitat links. For instance, biolinks or habitat links have been identified by DSE (2009), and by the CMAs as part of their current Regional Catchment Strategy development. Wherever possible, the Trust's work will complement the work of these other NRM organisations that are developing habitat links.

There is also increasing recognition within conservation science of the need to improve landscape connectivity or habitat connectivity to maintain particular ecological processes; for instance along waterways and associated riparian habitat; between waterways and floodplains; between marine and terrestrial environments; or between scattered trees or selected fertile sites (Soule' *et al.* 2004; Vesk *et al.* 2008; Bennett *et al.* 2009; Thomson *et al.* 2009; Lake 2012). As already identified in the Conservation Plan, there are many opportunities for Trust for Nature to help protect, connect and restore significant wetlands, coastal habitats and riparian habitats on private land across much of the state, particularly where these actions also contribute to improved representation of ecosystems in Victoria's protected areas (see Section 3.3 of the Conservation Plan). A recent report to the Department of Sustainability and Environment has also highlighted the importance of permanently protecting habitat restoration works along waterways, in part to help restore ecological condition and connectivity of those aquatic and riparian ecosystems (RMCG 2012).

The presence of multiple subregions and different environments within each of the focal landscapes also provides scope to identify in more detail where additional protected areas can best complement the range of ecosystems and environments currently represented in protected areas on public land or private land, particularly in the context of climate change.

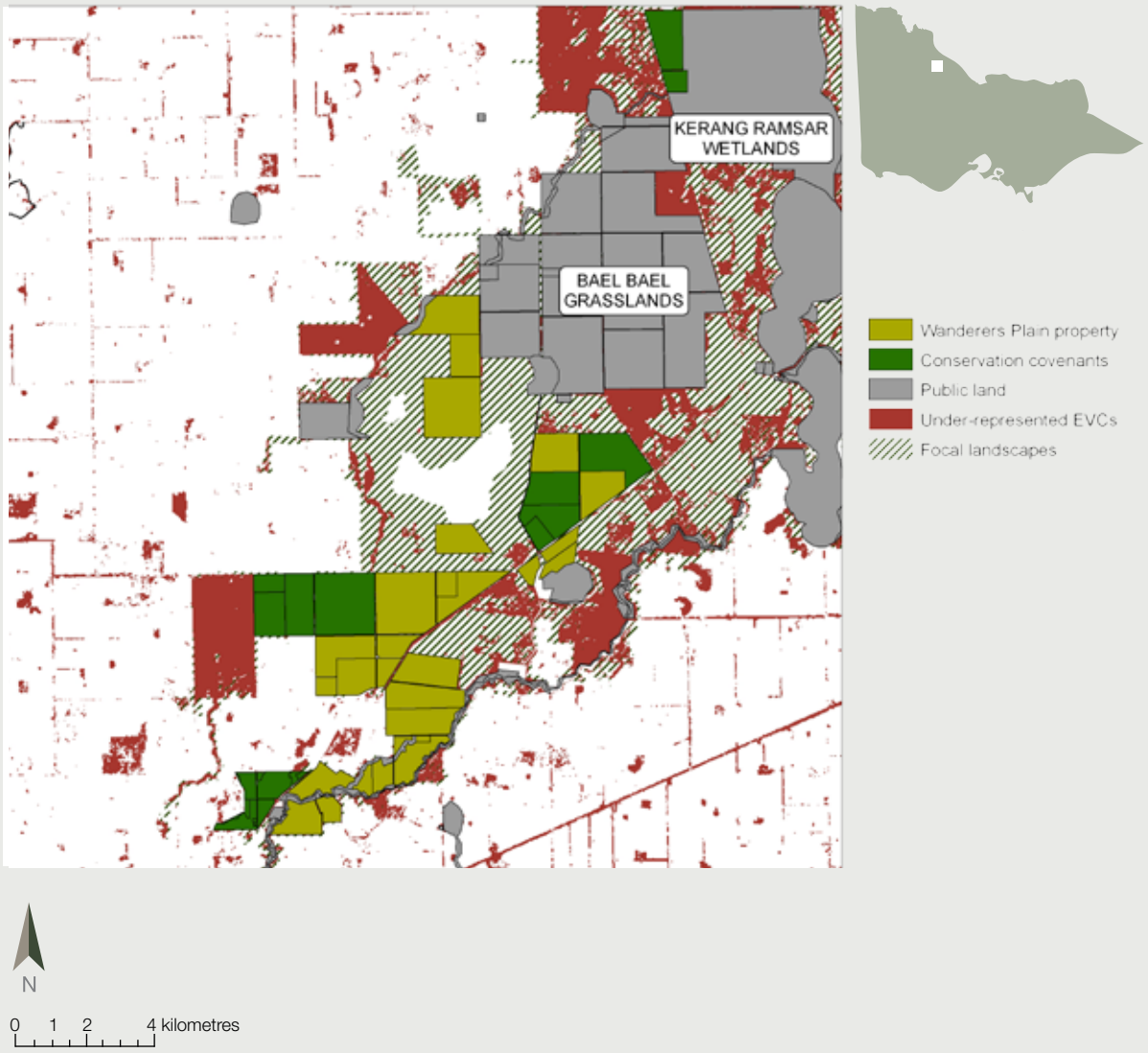

Figure 59. Finer-scale conservation planning at Wanderers Plain in the Western Riverina focal landscape. White shows private land. Note the habitat links provided by the covenants protecting native vegetation and the additional opportunities for protection and connectivity provided by non-protected areas of under-represented Ecological Vegetation Classes (EVCs) on private land

3.6 Conservation objective 6: Enhance and protect habitat quality

3.6.1 Rationale for the objective

Habitat quality, or vegetation condition, is known to positively influence species richness, population size and breeding success for a range of wildlife (Gilmore 1985; Loyn 1987; Arnold 1988; Ford & Barrett 1995; Hadden & Westbrooke 1996). Habitat quality also represents a surrogate measure for the health of the internal and ecological processes affecting an ecosystem (Saunders *et al.* 1991; Bennett *et al.* 2009), such that protection of intact ecosystems is generally considered a priority action for maintaining or enhancing ecological processes (Commonwealth of Australia 1999; Dunlop & Brown 2008; Bennett *et al.* 2009).

Additionally, it is recognised that improvement of vegetation condition is a key conservation action to improve and restore biodiversity values and ecosystem functioning (Martin & Green 2002; Montague-Drake *et al.* 2009; Gibbons 2010), particularly in fragmented landscapes where most native vegetation patches are small and in only poor to medium condition (VEAC 2010).

This objective seeks to identify priority areas for both protection of habitat and enhancement of habitat.

These two sub-objectives were assessed using DSE layers for vegetation quality. More details about the methods used are provided in Appendix 2.

3.6.2 Key findings for the objective

The key findings informing the Conservation Plan are that

- the focal landscapes include nearly half of the high-quality native vegetation found on private land in Victoria
- most high-quality vegetation on private land occurs on land adjacent to large protected areas on public land
- native vegetation on private land in Victoria has lower habitat quality than native vegetation on public land (VEAC 2010), making habitat improvement a key biodiversity action for private land, and
- native vegetation on Trust for Nature covenants and properties has higher habitat quality than private-land vegetation overall

3.6.3 Assessment of habitat quality

In general, habitat quality scores for private land vegetation are higher in subregions with a higher percentage of private land supporting native vegetation, notably the Murray Scroll Belt, Victorian Alps, East Gippsland Uplands, Greater Grampians and Otway Ranges (Figure 60). Notable anomalies are the Goldfields and Dundas Tablelands, both of which have lower median habitat condition values than expected on the basis of their extent of native vegetation. Median habitat scores are generally lower in those subregions with less remnant native vegetation (Figure 60), which also tend to be subregions with low proportions of protected land. These subregions include Warrnambool Plain, Victorian Volcanic Plain, Victorian Riverina, Wimmera and Dundas Tablelands (Figure 60).

Across the state, high-value sites on private land measure 131 000 ha in extent – only 4% of the total extent of modelled high-quality vegetation in Victoria. The most extensive areas of high-quality vegetation on private land occur in East Gippsland and West Gippsland in the highlands and montane subregions and East Gippsland Lowlands (Figure 61). Other significant areas of high-quality vegetation on private land include the Murray Scroll Belt, private land bordering the Little Desert and Big Desert, the Highlands – Southern Fall subregion in the Port Phillip & Westernport NRM region, the Upper Murray Valley district, the Goldfields subregion in the Goulburn Broken NRM region, around St Arnaud, and in the Otway Ranges (Figure 61).

Altogether, the median value for habitat condition on private land is 31.8 out of a potential maximum of 75 (unpubl. data, VEAC). This compares with a statewide median for public land of 49.3. Notably, though, a higher proportion of private land protected by the Trust was assessed as having high-quality and medium-quality habitat condition scores than private land vegetation in general (Figure 62). Forty-seven percent of private land with high habitat quality occurs within the 12 focal landscapes.

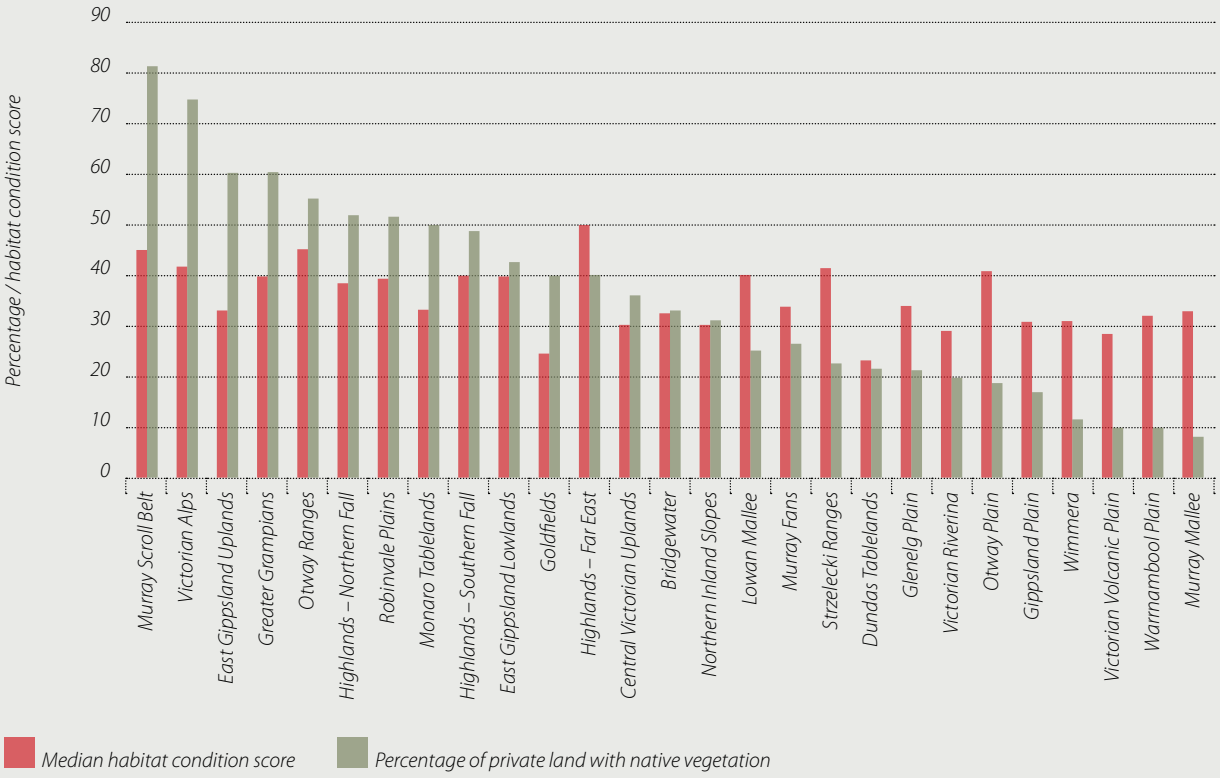

Figure 60. Median habitat condition scores for private-land vegetation (out of 75), and percentage of private land with native vegetation in every subregion. Habitat condition scores were derived from VEAC (2010)

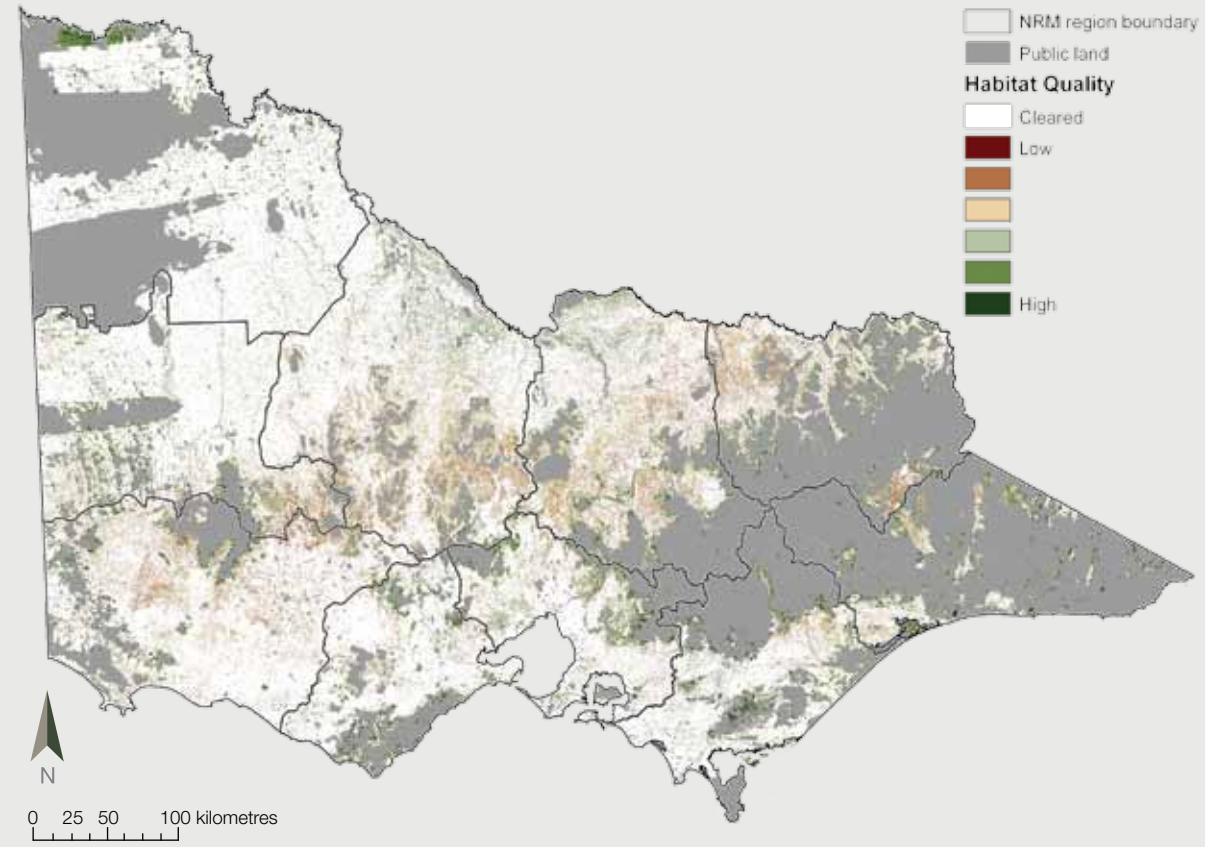

Figure 61. Statewide map of habitat quality on private land based on DSEs site condition layer (NV2005_QUAL)

Figure 62. Percentage of native vegetation in different site-condition categories for all private land vegetation and for Trust for Nature protected areas. Data derived from analysis of the DSE NV2005_QUAL layer

3.6.4 Priorities for enhancing and protecting habitat quality

Conservation objective 6: key priorities

The Conservation Plan outlines the following priorities for enhancement and protection of habitat quality in Victoria:

- engage in conservation actions in the focal landscapes to prioritise protection of high-quality habitat on private land
- target high-quality, viable habitat patches outside the focal landscapes for protection, because of the importance of intact native vegetation in maintaining biodiversity and ecological processes (Bennett *et al.* 2009), and
- place additional emphasis on improving the habitat quality of already existing privately owned protected areas to increase their biodiversity and ecological value.

Because of the importance of intact native vegetation in maintaining biodiversity and ecological processes (Bennett *et al.* 2009), the permanent protection of high-quality native vegetation on private land (131 000 ha) should be a priority for action, especially where the land builds on and complements an existing protected area or strengthens the NRS in the context of climate change. But, in general, habitat quality on private land is mostly only considered to be of medium or poor quality. This means that the Trust will prioritise private land areas with the highest quality habitat for permanent protection. It also highlights the need to maintain and improve the condition of habitat on already permanently protected areas of private land, to increase their value for biodiversity.

Analyses show that the 12 focal landscapes encompass 47% of mapped high-quality native vegetation found on private land in Victoria. This reinforces the advantages of targeting sites in these areas for permanent protection.

The Trust will likewise target habitat improvement and restoration towards protected areas that form part of a focal landscape, or are part of some other existing network of protected areas. In addition, private-land protected areas that belong to an under-represented subregion will be targeted for habitat enhancement, as most of the under-represented subregions were found to have low median scores for vegetation condition on private land.

As part of the focus on improving habitat quality in permanently protected areas, the Trust will give more consideration to maintaining or restoring ecological processes as a component of improved ecosystem condition. Examples of such actions include the restoration or reinstatement of appropriate fire regimes, grazing regimes and hydrological regimes (Lunt *et al.* 2007; Bennett *et al.* 2009; Halliday *et al.* 2012; Lake 2012).

3.7 Setting priorities for conservation action

Conservation prioritisation and the allocation of resources to different conservation actions is not only contingent on the ecological values of any particular location or asset but also requires there to be prioritisation of effort based on both the level of threat to the asset without intervention, the effectiveness of the conservation action and the probability of success (Pressey & Taffs 2001; Possingham 2001; CMP 2007; Wintle 2008). Accordingly, in addition to the specific priority actions and areas identified for each of the conservation objectives in the preceding sections, five broader factors are identified that should also be considered as part of decision-making about conservation prioritisation:

- the risk of habitat loss and modification without intervention
- the need for conservation effectiveness
- the impacts of climate change
- social and economic influences, and
- complementary conservation programs and opportunities.

These are discussed in more detail below.

3.7.1 The risk of habitat loss and modification without intervention

Ongoing habitat removal for agriculture and urban development is estimated to result in the loss of approximately 4 000 ha of native vegetation per year. In the period between 1989-1995 and 1998-2005, approximately 1 200 ha of woody vegetation and 3200 ha of grassy vegetation was estimated to have been lost per year - nearly all of it on private land and nearly all of it in already fragmented landscapes (DSE 2008). Some other recent investigations have also documented the continuing loss of grassy and woodland ecosystems on private land (Maron & Fitzsimons 2007; Marshall & Fitzsimons 2008), underlining the urgent need to protect those habitats and sites identified as being at high risk of loss.

Figure 63 indicates those areas considered to be at greatest risk of habitat loss in Victoria over the next 10 years, based on the distribution of the vegetation groups known to be undergoing the greatest current loss (grassy vegetation, woodland vegetation; DSE 2008) and predicted urban-growth areas along the coast (DPCD 2012). Based on this mapping, the areas at greatest risk of habitat loss in the next decade include the Eastern Riverina, Western Riverina, Gippsland Plain, South-West, Western Melbourne and Northern Inland Slopes focal landscapes. Additionally, all native vegetation close to Melbourne, on the Victorian Volcanic Plains, close to major regional centres and along Victoria's coast is under severe threat of loss or disturbance as a result of changes in agricultural land use, urban growth and infrastructure development (e.g. CES 2009; DPCD 2009). In all of these areas, decisions to protect additional land or undertake other conservation actions will need to be considered in the context of the future likelihood of a given area, species or population remaining viable if the surrounding land remains available for development ((Williams *et al.* 2006; Hale *et al.* 2012).

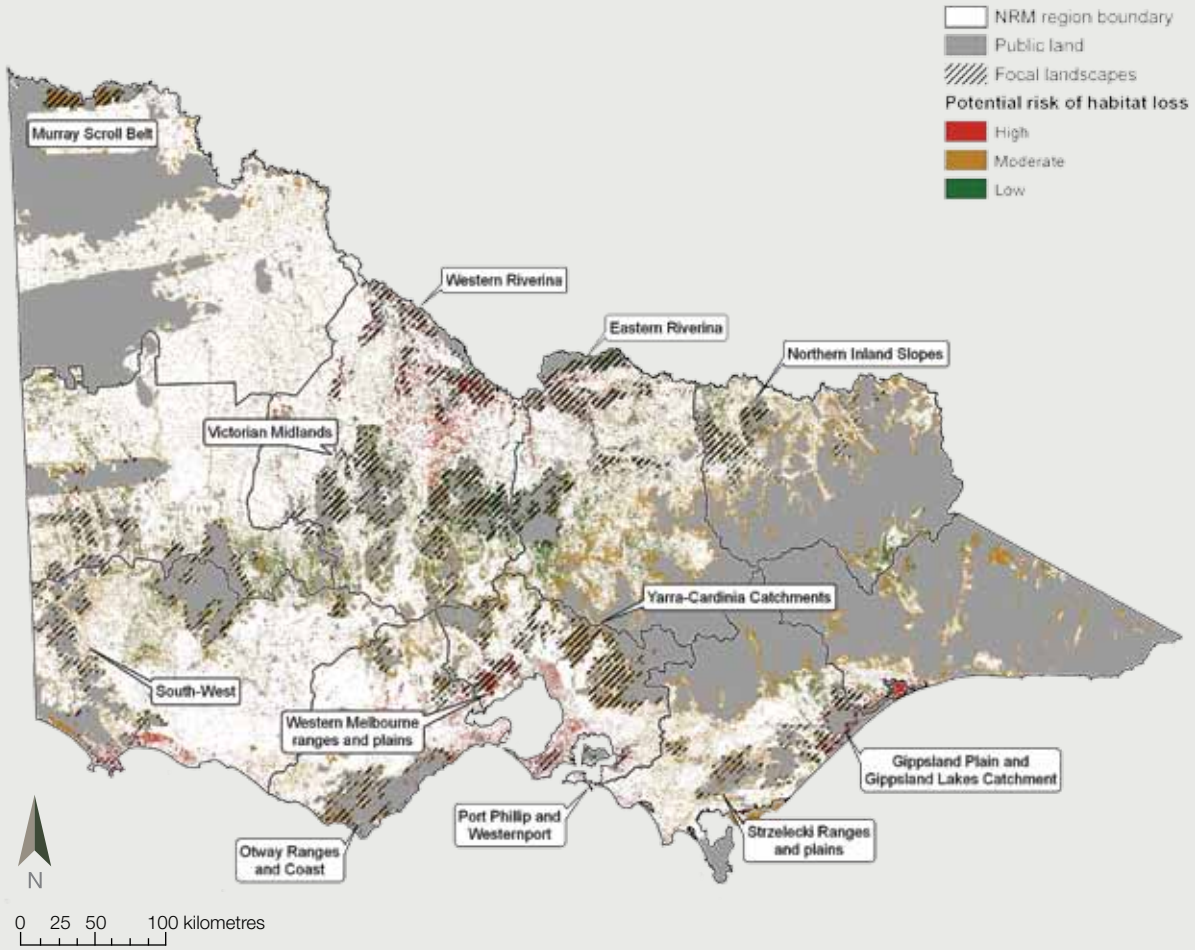

Figure 63. Potential risk of future habitat loss and modification on private land due to land clearing and urban development. Data based on analyses of rates of clearing for different vegetation types (DSE 2008) and on statistics on urban development and population growth (DPCD 2012)

3.7.2 The need for conservation effectiveness

Conservation programs need to be as efficient as possible to ensure that limited resources are allocated appropriately to achieve the greatest biodiversity gains (Possingham 2001; Wilson *et al.* 2007; Carwardine *et al.* 2008; Wintle 2008). Over the past two decades, a large body of research has been developed to assist with both systematic conservation planning for protected areas (e.g. Margules & Pressey 2000; Pressey & Taffs 2001) and decision-making to evaluate the predicted effectiveness of alternative conservation actions (e.g. Pressey *et al.* 2004; Carwardine *et al.* 2008; Wintle 2008; Moilanen & Arponen 2011; Pouzols *et al.* 2012). In addition, extensive work has been done on developing principles to help with the design of reserve networks to make them as effective and efficient as possible (Commonwealth of Australia 1999; Verboom *et al.* 2001; Moilanen & Wintle 2006; Dunlop *et al.* 2012a).

Key principles derived from this body of research, which should be considered when setting priorities for conservation action, include:

- the need to include a measure of cost as part of the planning to be able to evaluate the predicted conservation return on investment
- the need to evaluate and compare the likely effectiveness of different conservation actions in relation to a particular objective, and
- the need to build on and complement existing protected areas.

3.7.3 The impacts of climate change

Modelling done as part of recent reports into the implications of climate change for the National Reserve System (NRS) (Dunlop *et al.* 2012a, 2012b) demonstrated that the overall level of environmental representation within the existing NRS did not differ substantially between current climate scenarios and future climate scenarios (Dunlop *et al.* 2012a). The report consequently concluded that the current approach, which focuses on ecosystem representation as the basis for building the NRS, is a robust strategy in the context of climate change. However, the report also identified ways in which the effectiveness of the NRS could be improved under climate change. These recommendations include targeting the conservation of:

- large areas of habitat at risk of fragmentation or degradation
- refuges from environmental disturbance, especially those areas that may provide long-term refuge from changing climate
- areas with high connectivity between diverse habitats and places with steep environmental gradients
- areas that reduce the largest gaps between existing protected areas, and
- areas that support landscape-scale ecological processes, including hydrological processes (Dunlop *et al*. 2012a, 2012b).

Importantly, from the point of view of those involved in the conservation of private land, the NRS report also emphasised the need for cross-tenure, landscape-scale approaches to nature conservation, and it emphasised the need for a complementary suite of off-reserve conservation measures to protect biodiversity.

The approach taken in the Conservation Plan – to identify focal landscapes, continental-scale wildlife corridors, significant aquatic ecosystems and gaps in the protected areas system – is consistent with the recommendations in the NRS report on climate change (Dunlop *et al.* 2012a, 2012b). Based on the recommendations in that report, however, the Trust will do further analyses to identify priority areas on private land that contain mesic environments, climate and habitat refugia, key localities in terms of landscape-scale processes (e.g. riparian habitats, old-growth vegetation), and locations which complement and buffer existing protected areas in terms of ecosystem representation (e.g. Sharafi *et al.* 2012).

3.7.4 Social and economic factors

Understanding the social and economic factors that affect private-land conservation is important, especially as it is increasingly recognised, in Australia and in other Western nations that, firstly, private-land conservation is critical to the future protection of biodiversity and, secondly, the traditional focus on securing publicly owned protected areas will not be enough to protect biodiversity (Hale & Lamb 1997; Figgis 2004; Donald & Evans 2006; Fitzsimons & Wescott 2008a; Cooke *et al.* 2011).

As noted in Section 1.1.5, rural Victoria has undergone a large transformation in land use, social patterns and demography over the last 50 years. Victoria can now be divided broadly into six different social landscapes (Barr 2008; see Section 1.1.5 for definitions of the social landscapes), and even finer social-ecological units at the catchment and regional scale (e.g. GBCMA 2012). Within each of the six social landscapes, different economic drivers are present – the demographics within communities are different, the work and life patterns are different, and land use is different (Barr 2008). Different conservation mechanisms and different approaches are accordingly needed in different parts of the state, depending on demographics, the rate of turnover of land, land values and landowner access to funding for environmental works (e.g. GBCMA 2012).

Private land conservation has also been transformed over the past 40 years, evolving from a largely voluntary activity to one in which the role of landowners in providing a range of ecosystem services is increasingly recognised, and funded or otherwise supported through grants, tender programs, rate concessions and the ecosystem market (e.g. Binning & Young 1997; Stoneham *et al.* 2000; Figgis 2004). These changes have implications for future conservation on private land, especially as landowners have their own set of preferences in regard to the design and implementation of conservation programs operating on their land (Cooke *et al.* 2011). Trust for Nature research has shown, for example, that in the Victorian Volcanic Plains bioregion there are many landowners interested in protecting habitat on their land in perpetuity, but these landowners are unwilling to set up conservation covenants if the covenant precludes them from subsequently being able to negotiate native vegetation or threatened species offset agreements (and associated payments) with the Australian Government (Trust for Nature 2010). Future conservation programs will need to reconcile such policy shortcomings if they wish to secure additional protected areas on private land.

Accordingly, it is essential that private-land conservation bodies understand in detail the economic and human dimensions of the landscapes where they operate, to develop appropriate conservation strategies (e.g. Cooke *et al.* 2011; Moon & Cocklin 2011).

3.7.5 Complementary conservation programs and opportunities

Conservation in fragmented, mostly private landscapes requires a range of actions across the whole landscape, in addition to the establishment and management of dedicated protected areas (Bennett 1995; NRMMC 2006, 2009; Cooke *et al.* 2011; VEAC 2011; Wyborn 2012). These actions include work in non-protected areas, actions to soften the impacts of the agricultural matrix (Vickery *et al.* 2004; Donald & Evans 2006; Attwood *et al.* 2009; Lindenmayer *et al.* 2011) and actions to encourage sustainable farming practices (McIntyre *et al.* 2002; Platt & Lowe 2002; Sutherland 2004; DSE 2009a).

Critically, private-land conservation depends on partnerships with landowners and with other organisations which can provide some of the services or resources needed for a whole-of-landscape approach (CMP 2007; Context 2008; Cooke *et al.* 2011). Across the state, the influence of Trust programs and other private-land conservation programs varies substantially. For example, the Trust has more land under private-land agreements than Land for Wildlife in the Lowan Mallee subregion and more land under agreement than BushTender in the Goldfields, Gippsland Plain, Wimmera and Murray Mallee subregions. Conversely, Land for Wildlife has more land under agreement than the Trust in many subregions (Figure 64), particularly some of the more highly cleared parts of the state outside of the Trust's identified focal landscapes (Figure 65). The types of landowners being engaged through various programs and the types of services being offered also may differ (e.g Cooke *et al.* 2011; Schirmer *et al.* 2012). Important opportunities exist to build on these programs to achieve greater conservation outcomes.

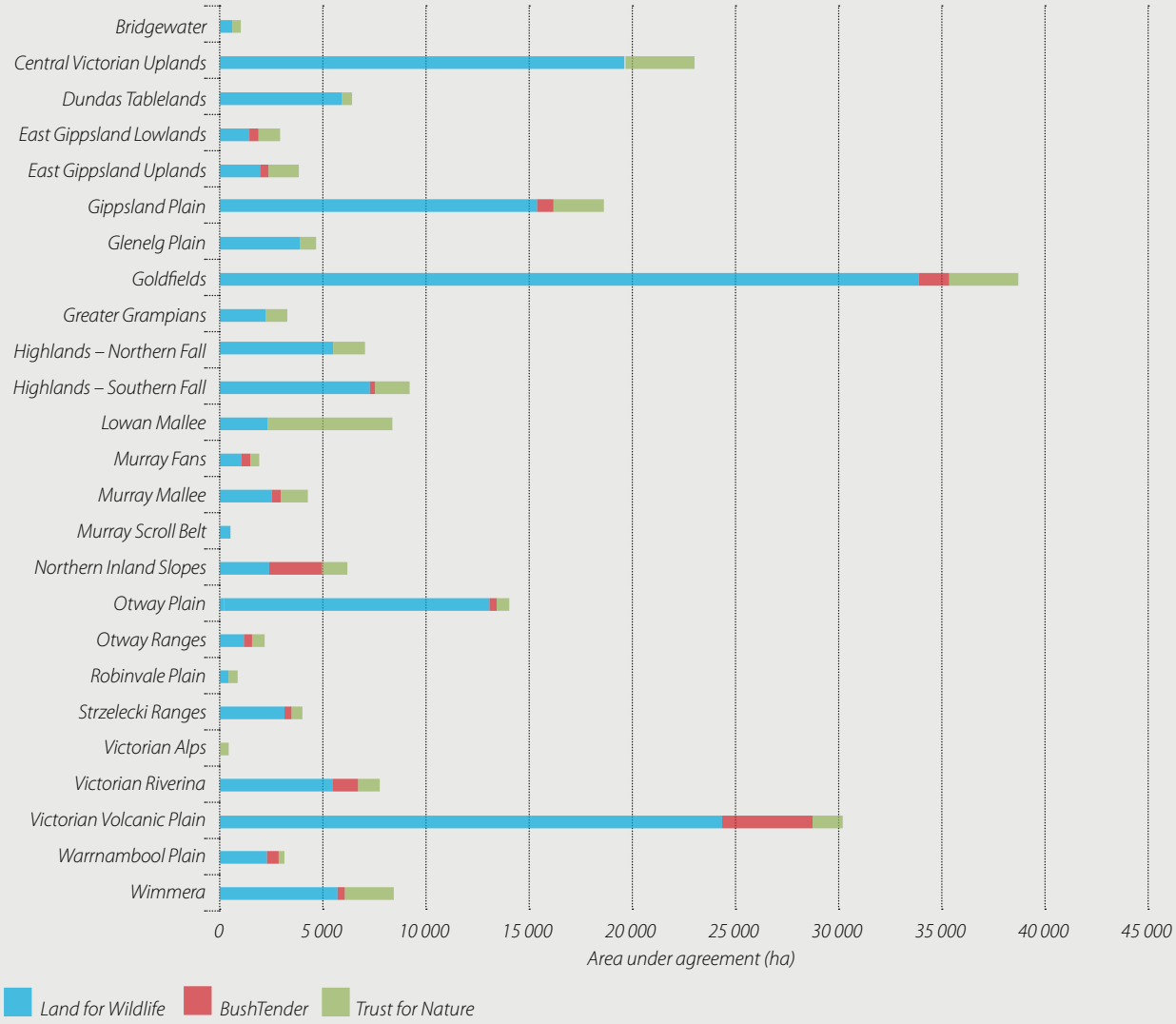

Figure 64. Area of private land in Victoria that is subject to conservation agreements with Land for Wildlife, BushTender or Trust for Nature. Data taken from the State of Environment Report 2008 (CES 2009)

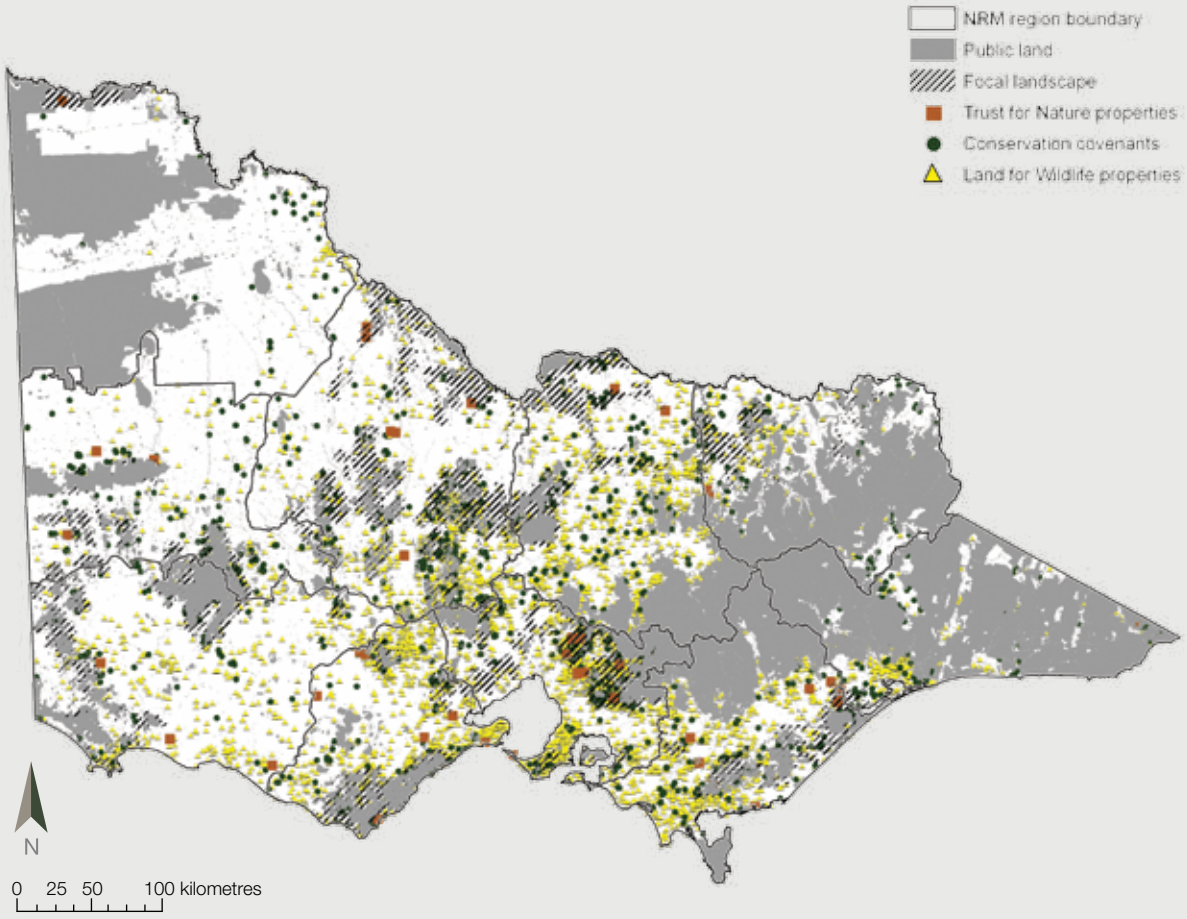

Figure 65. Distribution of Trust for Nature covenants and conservation properties, and Land for Wildlife properties, in relation to locations of the focal landscapes

3.8 Future use and review of the Statewide Conservation Plan

The Conservation Plan's findings have many implications for Trust for Nature in relation to its future conservation programs on private land. The findings demonstrate that despite a long history of systematic land-use planning for public land, Victoria's ecosystems are still poorly represented in protected areas overall. Furthermore, in much of the state, additional protection of habitat on private land will be the principal means of increasing the National Reserve System (NRS).

It is vital that the Trust continues its work to reduce habitat loss on private land – both by adding to permanently protected areas and through restoration and improvement. Achieving these gains in protected areas and habitat quality on private land clearly requires closer partnerships with other Natural Resource Management (NRM) bodies, community groups and landowners. In particular, the Trust will encourage the adoption of permanent protection as a more mainstream and standardised component of all NRM projects.

The Trust's 2011–2016 Strategic Plan identifies seven strategic directions to guide the organisation's business over the next five years:

1. Implement strategic landscape-wide conservation
2. Build and innovate private-land conservation practice
3. Respond to climate change
4. Intensify the role of partnerships
5. Build private and philanthropic sector investment and commitment to conservation
6. Build and modernise organisational capacity, and
7. Inspire and engage with the community.

The preparation of this Statewide Conservation Plan was recognised as a pivotal action that would provide an over-arching, statewide, scientific framework to inform the Trust's activities in line with the seven strategic directions. The next steps are to use this Conservation Plan to inform the Trust's planning and implementation of conservation programs in every region and across the state. In future, the assessments outlined in the Conservation Plan should be integrated with more detailed analysis of potential risks and opportunities in relation to localities, ecosystems and species. This will help the Trust to further articulate and prioritise its conservation actions.

The Trust's Strategic Plan expressed the organisation's vision that:

> *Within two decades, protecting native vegetation and wildlife on private land will be recognised and valued as a central part of mainstream Australian environmental practice, just as water and energy conservation is today. There will be a shared expectation and responsibility among communities, landowners and governments that, just as national and state parks are protected, so too significant natural areas on privately owned land should be protected.*

The preparation of this Statewide Conservation Plan is an important step towards making the Trust for Nature's vision a reality.

Glossary

Adequate representation: refers in this Conservation Plan to ecosystems that meet combined JANIS criteria (see below) for assessing the representation of ecosystems in protected areas at either the bioregional or subregional scale. Ecosystems that are adequately represented in protected areas meet the JANIS criteria; ecosystems that are under-represented do not.

Adequacy: 'Refers to how much of each ecosystem should be sampled to provide ecological viability and integrity of populations, species and ecological communities at a bioregional scale. The concept of adequacy incorporates ecological viability and resilience of ecosystems for individual protected areas and for the protected area system as a whole' (NRMMC 2009).

Bioregion: See *IBRA bioregion* below.

Comprehensiveness: 'Refers to the aim of including, within protected areas, samples of the full range of regional ecosystems recognisable at an appropriate scale within and across each IBRA bioregion' (NRMMC 2009).

Conservation covenant: a permanent, legally-binding agreement placed on a property's title to ensure native vegetation on the property is protected forever. The agreement is voluntary and negotiated between Trust for Nature and each individual landowner. Trust for Nature's covenanting program falls under the *Victorian Conservation Trust Act 1972*.

Ecological Vegetation Class (EVC): vegetation units mapped at scales of 1:25 000 up to 1:100 000 and defined by a '…combination of floristics, lifeform, position in the landscape, and an inferred fidelity to particular environments. Each EVC includes a collection of floristic communities (i.e. groups based on co-occurring plant species) that occur across a biogeographic range, and although differing in species, have similar habitat and ecological processes operating' www.dse.vic.gov.au). For the purposes of spatial mapping and classification in terms of conservation status, EVCs are further classified in terms of their sub-regional occurrence (i.e. Box-ironbark Forest, Wimmera Box-ironbark Forest) and assigned a conservation status within that subregional context.

Ecosystem: broadly defined as 'a dynamic combination of plant, animal and micro-organism communities and their non-living environment (e.g. soil, water and the climatic regime) interacting as a functional unit. Examples of types of ecosystems include forests, wetlands, grasslands (NRMMC 2010).

In relation to the National Reserve System criteria for Comprehensiveness, Adequacy and Representativeness, 'ecosystem' has a more precise spatial definition, as 'A unique unit comprising a recognisable floristic composition in combination with substrate (lithology/geology layers) and position within the landscape, and including their component biota (where known). An ecosystem map unit should normally be discriminated at a scale of 1:100 000 to 1:250 000 (Commonwealth of Australia 1999).

EVC Group: simplified native vegetation groups derived from EVC mapping and based on the same criteria of lifeform, floristics, landscape position and environment.

Habitat: The physical space within which a species lives, including living (e.g. vegetation) and non-living components (e.g. rocks).

IBRA: 'The Interim Biogeographic Regionalisation for Australia provides a broad level break-up of the Australian landmass into 85 biogeographic regions and 403 subregions. The IBRA bioregions were derived by compiling information on climate, lithology/geology, landform, vegetation, flora and fauna. IBRA provides the national and regional planning framework for developing the National Reserve System' (NRMMC 2009).

IBRA bioregion: the major biogeographic regions across Australia, as defined above.

IBRA subregion: biogeographic areas defined at a finer scale than IBRA bioregions, on the basis of climate, lithology/geology, landform, vegetation, flora and fauna. Most IBRA bioregions comprise multiple IBRA subregions.

JANIS criteria: national criteria developed under the National Forest Policy Statement implementation process for establishment of a 'comprehensive, adequate and representative' reserve system for forests in Australia.

National Reserve System: Australia's network of parks, reserves and protected areas on indigenous land and on private land, all of which meet the International Union for Conservation of Nature (IUCN) definition of what constitutes a 'protected area' (see below Includes private land protected under conservation covenant).

Protected Area: a parcel of land that meets the IUCN's definition of 'a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values' (Dudley 2008).

Representativeness: 'Comprehensiveness considered at a finer scale (IBRA subregion), and recognises that the regional variability within ecosystems is sampled within the reserve system. One way of achieving this is to aim to represent each regional ecosystem within each IBRA subregion' (NRMMC 2009).

Subregion: See *IBRA subregion* above.

Trust for Nature protected areas: refers to all land which is protected and managed for conservation by Trust for Nature and landowners in accordance with the IUCN/National Reserve System (NRS) definitions of what constitutes a 'protected area'. For the Trust, these areas comprise conservation properties owned and managed by the Trust and land protected under voluntary conservation covenants.

Under-represented: an ecosystem that is not adequately represented in protected areas according to various or combined JANIS criteria (see *Adequate representation*) above.

Unrepresented: an ecosystem that is not represented in protected areas at either a bioregional scale (Comprehensiveness criterion) or subregional scale (Representativeness criterion).

References

Arnold, G.W. (1988). The effects of habitat structure and floristics on the densities of bird species in Wandoo woodland. *Australian Wildlife Research* 15: 499–510

Attwood, S.J., Park, S.E., Maron, M., Collard, S.J., Robinson, D., Reardon-Smith, K.M. & Cockfield, G. (2009). Declining birds in Australian agricultural landscapes may benefit from aspects of the European agri-environment model. *Biological Conservation* 142: 1981–1991.

Barr, N. (2008). The social landscapes of rural Victoria, Pp. 327–350 in *Landscape Analysis and Visualisation: Spatial Models for Natural Resource Management and Planning* (C. Pettit, W. Cartwright, I. Bishop *et al.*). Springer, Berlin.

Barr, N. (2009). *The House on the Hill: the Transformation of Australia's Farming Communities*. Melbourne, Halstead Press.

Bennett, A. F. (1995). Wildlife conservation and management on private land – facing the challenge. Pp. 119–127 *in People and Nature Conservation: Perspectives on Private Land Use and Endangered Species Recovery* (eds A. Bennett, G. Backhouse and T. Clark). Royal Zoological Society of New South Wales, Sydney.

Bennett, A. F. (1999). *Linkages in the Landscape. The Role of Corridors and Connectivity in Wildlife Conservation*. IUCN, Gland, Switzerland.

Bennett, A.F. & Mac Nally, R. (2004). Identifying priority areas for conservation action in agricultural landscapes. *Pacific Conservation Biology* 10: 106–123.

Bennett, A. F, Haslem, A., Cheal, D. C., Clarke, M. F., Jones, R. N., Koehn, J. D., Lake, P. S., Lumsden, L. F., Lunt, I.D., Mackey, B. G., Mac Nally, R., Menkhorst, P. W., New, T. R., Newell, G. R., O'Hara, T., Quinn, G. P., Radford, J. Q., Robinson, D., Watson, J. E. M & Yen, A. L. (2009). *Ecological processes: a key element in strategies for nature conservation. Ecological Management & Restoration* 10: 192–199.

Bennett, L.T. (1994). The expansion of *Leptospermum laevigatum* on the Yanakie Isthmus, Wilsons Promontory, under changes in the burning and grazing regimes. *Australian Journal of Botany* 42: 555–564.

Binning. C. & Young, M. (1997). *Motivating People: Using Management Agreements to Conserve Remnant Vegetation*. CSIRO, Canberra.

Brereton, R., Bennett, S. & Mansergh, I. (1995). Enhanced greenhouse climate change and its potential effect on selected fauna of south-eastern Australia; a trend analysis. *Biological Conservation* 72: 339–354.

Carwardine, J., Wilson, K. A., Watts, M., Etter, A., Klein, C.J. & Possingham, H. P. (2008). Avoiding costly conservation mistakes; the importance of defining actions and costs in spatial priority setting. *PLoS One* 3: 1–6.

CES (2009). *State of the Environment Victoria 2008.* Commissioner for Environmental Sustainability, Melbourne.

CfoC (2011). *Minimum requirements for contributing to the comprehensiveness, adequacy and representativeness of the National Reserve System through Caring for our Country funding.* Caring for our Country Initiative, Australian Government, Canberra.

Chambers, L. E., Hughes, L. & Weston, M.A. (2005). Climate change and its impact on Australia's avifauna. *Emu* 105: 1–20.

Clode, D. (2006). *As if for a Thousand Years*. Victorian Environmental Assessment Council, Melbourne.

CMP (2007). *Open Standards for the Practice of Conservation. Version 2.0*. Conservation Measures Partnership.

Coffey, B., Fitzsimons, J. A. & Gormly, R. (2011). Strategic public land use assessment and planning in Victoria, Australia: four decades of trailblazing but where to from here? *Land Use Policy* 28: 306–313.

Commonwealth of Australia (1999). *Australian Guidelines for Establishing the National Reserve System.* Commonwealth Government of Australia, Environment Australia, Canberra.

Context Pty Ltd (2008). Strategic Plan for Conservation Management Networks in Victoria: Working together to protect biodiversity. Report to DSE. Context Pty Ltd, Brunswick, Victoria.

Cooke, B., Langford, W. T., Gordon, A. & Bekessy, S. (2011). Social context and the role of collaborative policy making for private land conservation. *Journal of Environmental Planning and Management*, 2011, 1–17. DOI; 10.1080/09640568.2011.608549.

Cowell, S. & Williams, C. (2006). Conservation through buyer diversity; a key role for not-for-profit land-holding organizations in Australia. *Ecological Management & Restoration* 7: 5–20.

DCE (1992). *Draft Conservation Program for Native Grasslands and Grassy Woodlands in Victoria.* Department of Conservation and Environment, East Melbourne.

Donald, P. F. & Evans, A.D. (2006). Habitat connectivity and matrix restoration: the wider implications of agri-environment schemes. *Journal of Applied Ecology* 43: 209–218.

DPCD (2009). Delivering Melbourne's newest sustainable communities. Program Report, Department of Planning and Community Development, Melbourne.

DPCD (2012). *Victoria in Future 2012: Population and Household Projections 2011–2031 for Victoria and its regions.* Department of Planning and Community Development, Melbourne.

DPI (2010). Invasive Plants and Animals Policy Framework. Department of Primary Industries, Melbourne.

Drew, M. M. (2008). A guide to the management of native fish in Victorian coastal rivers, estuaries and wetlands. Department of Sustainability and Environment and Corangamite Catchment Authority, Victoria.

DSE (2005). Index of Stream Condition; the second benchmark of stream condition. Department of Sustainability and Environment, East Melbourne.

DSE (2007a). Bioregional conservation status, native vegetation groupings and mapping units – November 2007. http://www.dse.vic.gov.au/conservation-and-environment/native-vegetation-groups-for-victoria/simplified-native-vegetation-groups

DSE (2007b). *Advisory list of threatened vertebrate fauna in Victoria – 2007.* Department of Sustainability and Environment, East Melbourne.

DSE (2008). Native vegetation net gain accounting; first approximation report. Department of Sustainability and Environment, East Melbourne.

DSE (2009a). *Securing Our Natural Future: A white paper for land and biodiversity at a time of climate change.* Department of Sustainability and Environment, East Melbourne.

DSE (2009b). Advisory list of threatened invertebrate fauna in Victoria – 2009. Department of Sustainability and Environment, East Melbourne.

DSE (2010). *Biodiversity is Everybody's Business: Biodiversity Strategy 2010–2015 Consultation Draft,* Department of Sustainability and Environment, East Melbourne.

DSE (2011a). *NaturePrint and biodiversity monitoring, evaluation and reporting. Guidelines for Regional Catchment Strategies.* Department of Sustainability and Environment, East Melbourne.

DSE (2011b). *NaturePrintv2.0: Elements and Integration. A technical explanation of the NaturePrintv2.0 analysis.* Department of Sustainability and Environment. East Melbourne.

Dudley, N. (ed.) (2008). *Guidelines for Applying Protected Area Management Categories.* IUCN, Gland, Switzerland.

Dunlop, M. & Brown, P.R. (2008). *Implications of Climate Change for Australia's National Reserve System – A Preliminary Assessment.* Report to the Department of Climate Change, and the Department of the Environment, Water, Heritage and the Arts, March 2008.

Dunlop, M., Hilbert, D. W., Ferrier, S., House, A., Liedloff, A., Prober, S. M., Smyth, A., Martin, T. G., Harwood, T., Williams, K.J., Fletcher, C. & Murphy, H. (2012a). *The implications of climate change for biodiversity conservation and the National Reserve System: final synthesis*. A report prepared for the Department of Sustainability, Environment, Water, Population and Communities, and the Department of Climate Change and Energy Efficiency. CSIRO Climate Adaptation Flagship, Canberra.

Dunlop, M., Hilbert, D. W., Stafford Smith, M., Davies, R., James, C. D., Ferrier, S., House, A., Liedloff, A., Prober, S. M., Smyth, A., Martin, T .G., Harwood, T., Williams, K. J., Fletcher, C. & Murphy, H. (2012b). *Implications for policymakers: climate change and the National Reserve System.* CSIRO Climate Adaptation Flagship, Canberra.

ECC (2000). *Marine, Coastal and Estuarine Investigation: Final Recommendations.* Environment Conservation Council, Melbourne.

ECC (2001). *Box-ironbark Forests and Woodlands Investigation Final Report.* Environment Conservation Council, Melbourne.

Edwards, R. & Traill, B. (2002). Getting beyond field days: targeting extension to protect threatened ecosystems on private land. *Ecological Management & Restoration* 3: 229–231.

Edwards, R. & Fox, T. (in press). Conservation management networks: the Gippsland Plains story. In *Linking Australia's Landscapes: Lessons and Opportunities from Large-scale Conservation Networks* (eds J. Fitzsimons, I. Pulsford and G. Wescott). CSIRO Publishing, Collingwood.

Figgis, P. (2004). *Conservation on private lands: the Australian experience.* IUCN, Gland, Switzerland, and Cambridge, UK.

Fitzsimons, J. (1999). Reservation status of Broad Vegetation Types in Victorian IBRA regions – 1999. Report for DNRE. Dept of Natural Resources and Environment, Melbourne.

Fitzsimons, J. A. (2006). Private protected areas? Assessing the suitability for incorporating conservation agreements over private land into the National Reserve System: A case study of Victoria. *Environmental Planning Law Journal* 23: 365–385.

Fitzsimons, J. A. & Wescott, G. (2001). The role and contribution of private land in Victoria to biodiversity conservation and the protected area system. *Australian Journal of Environmental Management* 8: 142–157.

Fitzsimons, J. A. & Wescott, G. (2008a). Ecosystem conservation in multi-tenure reserve networks: the contribution of land outside of publically protected areas. *Pacific Conservation Biology* 14: 250–262.

Fitzsimons, J. A. & Wescott, G. (2008b). The role of multi-tenure reserve networks in improving reserve design and connectivity. *Landscape and Urban Planning* 85: 163–173.

Ford, H. A. & Barrett, G. (1995). The role of birds and their conservation in agricultural systems. Pp. 128–134 in *People and Nature Conservation: Perspectives on Private Land Use and Endangered Species Recovery* (eds A. Bennett, G. Backhouse and T. Clark). Royal Zoological Society of New South Wales, Sydney.

Frankenberg, J. (1971). *Nature Conservation in Victoria. A Survey.* Victorian National Parks Association, Melbourne.

Frood, D. & Calder, M. (1987). *Nature Conservation in Victoria. Study Report Vol. 1.* Victorian National Parks Association, Melbourne.

Fulton, G. R. & Ford, H.A. (2001). The Pied Currawong's role in avian nest predation: a predator removal experiment. *Pacific Conservation Biology* 7: 154–160.

GBCMA (2012). *Draft Regional Catchment Strategy 2012–2018.* Goulburn Broken Catchment Management Authority, Shepparton.

Gibbons, P. (2010). Prioritising conservation in temperate woodlands. Pp. 15–21 in *Temperate Woodland Conservation and Management* (eds D. Lindenmayer, A. Bennett and R. Hobbs). CSIRO, Collingwood.

Gilmore, A. M. (1985). The influence of vegetation structure on the density of insectivorous birds. Pp. 21–31 in *Birds of Eucalypt Forests and Woodlands: Ecology, Conservation, Management* (eds A. Keast *et al.*). RAOU and Surrey Beatty & Sons, Chipping Norton, NSW.

Grey, M. J., Clarke, M. F. & Loyn, R. H. (1997). Initial changes in the avian communities of remnant eucalypt woodlands following a reduction in the abundance of Noisy Miners *(Manorina melanocephala). Wildlife Research* 24: 631–648.

Grey, M. J., Clarke, M. F. & Loyn, R. H. (1998). Influence of the Noisy Miner (*Manorina melanocephala)* on avian diversity and abundance in remnant Grey Box woodland. *Pacific Conservation Biology* 4: 55–69.

Hadden, S. A. & Westbrooke, M. E. (1996). Habitat relationships of the herpetofauna of remnant buloke woodlands of the Wimmera Plains, Victoria. *Wildlife Research* 23: 363–372.

Hale, P. & Lamb, D. (eds). *Conservation Outside Nature Reserves.* Centre for Conservation Biology, University of Queensland, Brisbane.

Hale, J. M., Heard, G. W., Smith, K. L., Parris, K. M., Austin, J. J., Kearney, M. & Melville, J. (2012). Structure and fragmentation of Growling Grass Frog metapopulations. *Conservation Genetics.* DOI 10.1007/s10592–012-0428-9.

Halliday, L., Castley, J .G., Fitzsimons, J. A., Tran, C. & Warken, J. (2012). Fire management on private conservation lands: knowledge, perceptions and actions of landowners in eastern Australia. *International Journal of Wildland Fire* 21: 197–209.

JANIS (1997). Nationally agreed criteria for the establishment of a comprehensive, adequate and representative reserve system for forests in Australia. A report by the Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee. Commonwealth of Australia, Canberra.

Koch, P. (2011). Neds Corner Conservation Action Plan. Unpublished report to Trust for Nature. Greening Australia, Melbourne.

Lake, P.S. (2012). Flows, floods, floodplains and river restoration. *Ecological Management & Restoration* 13: 210–211.

LCC (1988). Statewide Assessment of Public Land Use, Victoria. Land Conservation Council, Melbourne.

LCC (1991). Rivers and Streams Special Investigation. Final Recommendations. Land Conservation Council, Melbourne.

Lindenmayer, D. B. *et al.* (2011). *What Makes a Good Farm for Wildlife?* CSIRO Publishing, Collingwood.

Loyn, R. H. (1987). Effects of patch area and habitat on bird abundances, species numbers and tree health in fragmented Victorian forests. pp. 65–77 in *Nature Conservation: the Role of Remnants of Native Vegetation* (eds. D. A. Saunders, G. W. Arnold, A. A. Burbidge and A. J. M. Hopkins). Surrey Beatty & Sons, Chipping Norton, Sydney.

Loyn, R. H., Runnalls, R. G., Forward, G. Y. & Tyers, J. (1983). Territorial Bell Miners and other birds affecting populations of insect prey. *Science* 221: 1411–1413.

Lunt, I. & Bennett, A. F. (2000). Temperate woodlands in Victoria: distribution, composition and conservation. Pp. 17–31 in *Temperate Eucalypt Woodlands in Australia: Biology, Conservation, Management and Restoration.* (Eds R.J. Hobbs and C. J. Yates). Surrey Beatty & Sons, Chipping Norton, NSW.

Lunt, I. D., Eldridge, D. J., Morgan, J.W. & Witt, G. B. (2007). Turner Review. A framework to predict the effects of livestock grazing and grazing exclusion on conservation values in natural ecosystems in Australia. *Australian Journa;l of Botany* 54: 401–415.

McDougall, K., Barlow, T. & Appleby, M. (1993). Grassland communities and significant grassland sites: Western basalt plains, Lake Omeo, Murray Valley riverine plains and the Wimmera. Pp. 87–108 in *Conservation of Lowland Native Grasslands in South-eastern Australia* (eds. K. McDougall & J. Kirkpatrick). World Wide Fund for Nature, Sydney.

McIntyre, S., McIvor, J. G. & Heard, K. M. (eds) (2002). *Managing and Conserving Grassy Woodlands.* CSIRO Publishing, Melbourne.

Mac Nally, R., Bennett, A. F., Thomson, J. R., Radford, J. Q., Unmack, G., Horrocks, G. & Vesk, P. A. (2009). Collapse of an avifauna: climate change appears to exacerbate habitat loss and degradation. *Diversity and Distributions* 15, 720–730.

Mackey, B., Gilmore, S., Pringle, H., Foreman, P., van Bommel, L., Berry, S. & Haseler, M. (2010). BioPrEP – a regional, process-based approach for assessment of land with high conservation value for Bush Heritage Australia. *Ecological Management and Restoration* 11: 51–60.

Margules, C. R. & Pressey, R. L. (2000). Systematic conservation planning. *Nature* 405: 243–253.

Maron, M. & Fitzsimons, J. A. (2007). Agricultural intensification and loss of matrix habitat over 23 years in the West Wimmera, south-eastern Australia. *Biological Conservation* 135: 603–609.

Marshall, D. & Fitzsimons, J.A. (2008). Challenges for native grassland conservation on Victoria's Northern Plains.' *Australasian Plant Conservation,* Vol. 16 No.4, March–May 2008.

Martin, T. G. & Green, J. G. (2002). Wildlife and core conservation areas. Pp. 111–142 in *Managing and Conserving Grassy Woodlands* (eds S. McIntyre, J. G. McIvor & K. M. Heard). CSIRO Publishing, Melbourne.

MDBA (2011). River management – challenges and opportunities. Murray Darling Basin Commission, Commonwealth of Australia, Canberra.

Moilanen, A. & Wintle, B. (2006). Uncertainty analysis favours selection of spatially aggregated reserve networks. *Biological Conservation* 129: 427–434.

Moilanen, A. and Arponen A. (2011). Administrative regions in conservation: balancing local priorities with regional to global preferences in spatial planning. *Biological Conservation* 144: 1719–1725.

Morgan, J. and Clarke, M. (2008). Trust for Nature State-wide Priorities Project. Unpublished report to Trust for Nature. La Trobe University, Bundoora.

Montague-Drake, R. M., Lindenmayer, D. B. & Cunningham, R. B. (2009). Factors affecting site occupancy by woodland bird species of conservation concern. *Biological Conservation* 142: 2896–2903.

Moon, K. & Cocklin, C. (2011). A landowner-based approach to the design of private-land conservation programs. *Conservation Biology* 2011, 1–11. DOI: 10.1111/j-1523–1739.2010.01639.x

Muir, A. (1996). Significant grassland and grassy woodland sites of the Victorian volcanic, coastal and riverine plains. Preliminary Report – Stage one – to ANCA. DNRE, Melbourne.

National Parks Service (1990). Restoring the balance; the kangaroo control program to save Hattah–Kulkyne National Park. National Parks Service, Melbourne.

National Wildlife Corridors Plan Advisory Committee (2012). National Wildlife Corridors Plan: a framework for landscape-scale conservation. Department of Sustainability, Environment, Water, Populations and Communities, Commonwealth of Australia, Canberra.

NRE (1997). Victoria's Biodiversity: Directions in Management. Department of Natural Resources and Environment. State Government, Melbourne.

NRE (2002a). Victoria's native Vegetation Management: a Framework for Action. Department of Natural Resources and Environment. State Government, Melbourne.

NRE (2002b). Healthy Rivers, Healthy Communities and Regional Growth; Victorian River Health Strategy. Department of Natural Resources and Environment, Melbourne.

NRMMC (2005). *Directions for the National Reserve System – a Partnership Approach.* Natural Resource Management Ministerial Council, Commonwealth of Australia.

NRMMC (2009). *Australia's Strategy for the National Reserve System 2009–2030.* Natural Resource Management Ministerial Council, Commonwealth of Australia.

NRMMC (2010). *Australia's Biodiversity Conservation Strategy 2010-2030*. Australian Government, Department of Sustainability, Environment, Water, Population and Communities, Canberra.

OCE (1992). *Agriculture and Victoria's Environment: 1991 State of the Environment Report.* Office of the Commissioner for the Environment, Melbourne.

Olsen, P. & Weston, M. (eds). (2004). *The state of Australia's birds 2004: water, wetlands and birds.* Supplement to *Wingspan* 14(4). Birds Australia, Melbourne.

Parsons, H., Major, R. E. & French, K. (2006). Species interactions and habitat associations of birds inhabiting urban areas of Sydney, Australia. *Austral Ecology* 31: 217–227.

Palmer, G. & Westbrooke, M. (2011). *Neds Corner Management Plan.* Prepared for Trust for Nature. Centre for Environmental Management, University of Ballarat.

Peel, B. (1999). *Rainforests and cool temperate mixed forests of Victoria.* Department of Natural Resources and Environment, Melbourne.

Platt, S. & Lowe, K. (2002). *Biodiversity Action Planning: action planning for native biodiversity at multiple scales – catchment, bioregional, landscape, local.* NRE, Melbourne.

Poiani, K. & Richter, B. (1999). *Functional landscapes and the conservation of biodiversity*. Working Papers in Conservation Science No 1. The Nature Conservancy.

Possingham, H. P. (2001). *The Business of Biodiversity.* Tela Report to Australian Conservation Foundation. ACF, Melbourne.

Pouzols, F. M., Burgman, M. A. & Moilanen, A. (2012). Methods for allocation of habitat management, maintenance, restoration and offsetting, when conservation actions have uncertain consequences. *Biological Conservation* 153:41–50.

Pressey, R. L. & Taffs, K. H. (2001). Scheduling conservation action in production landscapes: priority areas in western New South Wales defined by irreplaceability and vulnerability to vegetation loss. *Biological Conservation* 100; 355–376.

Pressey, R. L., Watts, M. E. & Barrett, T. W. (2004). Is maximizing protection the same as minimizing loss? Efficiency and retention as alternative measures of the effectiveness of proposed reserves. *Ecology Letters* 7; 1035–1046.

Raven, L. (1997). *Local Government and Landcare Action Plan for Nature Conservation in the Goulburn Broken Catchment.* Trust for Nature, Melbourne.

RMCG (2012). Investigating options for including landholder agreements on title for freehold riparian land and wetlands. Report to Department of Sustainability and Environment. RMCG, Bendigo.

Robinson, D. (1991). Threatened birds in Victoria: their distributions, ecology and future. *Victorian Naturalist* 108: 67–77.

Robinson, D. (1993). Toolern Vale vale: the decline of our woodland birds. *Wingspan* 9: 1–3, 20–21.

Robinson, D. (1994). Research Plan for threatened woodland birds in southeastern Australia. *ARI Tech. Rep*. No. 133. Department of Natural Resources and Environment, Melbourne.

Robinson, D. (1998). Priorities for nature conservation reservation and management in the eastern Northern Plains of Victoria. A report prepared under the National Estates Grant Program of the Australian Heritage Commission. Goulburn Valley Environment Group, Shepparton.

Robinson, D. & Mann, S. (1996). Natural values of the public lands along the Broken, Boosey and Nine Mile Creeks of northeastern Victoria. A report to the Australian Heritage Commission. Goulburn Valley Environment Group, Shepparton.

Sattler, P. & Glanznig, A. (2006). *Building Nature's Safety Net: a review of Australia's terrestrial protected area system, 1991-2004.* World Wildlife Fund, Sydney.

Sattler, P. & Taylor, M. (2008). *Building Nature's Safety Net 2008: progress on the directions for the National Reserve System.* World Wildlife Fund, Sydney.

Saunders, D. A., Hobbs, R. J. & Margules, C.R. (1991). Biological consequences of ecosystem fragmentation: a review. *Conservation Biology.* 5: 18–32.

Schirmer, J., Dovers, S. & Clayton, H. (2012). Informing conservation policy design through an examination of landholder preferences: a case study of scattered tree conservation in Australia. *Biological Conservation* 153: 51–63.

Sharafi, S. M., Moilanen, A., White, M. & Burgman, M. (2012). Integrating environmental gap analysis with spatial conservation prioritization: A case study from Victoria, Australia. *Journal of Environmental Management* 112: 240–251.

SOEC (2011). State of the Environment 2011 Committee. *Australia state of the environment 2011.* Independent report to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities. DSWEWPAC, Canberra.

Soule', M. E., Mackey, B. G., Recher, H. F., Williams, J. E., Woinarski, J. C. Z., Driscoll, D., Dennison, W. C. & Jones, M. E. (2004). The role of connectivity in Australian conservation. *Pacific Conservation Biology* 10: 266–279.

Stoneham, G., Crowe, M., Platt, S., Chaudhri, V., Soligo, J. & Strappazzon, L. (2000). *Mechanisms for biodiversity conservation on private land.* Department of Natural Resources and Environment, Melbourne.

Sutherland, W. J. (2004). A blueprint for the countryside. *Ibis* 146 (Supplement): 230–238.

Taylor, M. F. J., Sattler, P. S., Fitzsimons, J., Curnow, C., Beaver, D., Gibson, L., and Llewellyn, G. (2011a) Building Nature's Safety Net 2011. *The state of protected areas for Australia's ecosystems and wildlife.* World Wildlife Fund, Sydney.

Taylor, M. F. J., Sattler, P. S., Evans, M., Fuller, R. A., Watson, J. E. M. & Possingham, H. P. (2011b). What works for threatened species recovery? An empirical evaluation for Australia. *Biodiversity Conservation* 20: 767–777.

Thackway, R. & Cresswell, I.D. (1995). *An Interim Biogeographic Regionalisation for Australia.* ANCA, Canberra.

Thomson, J. R., Moilanen, A. J., Vesk, P. A., Bennett, A. F. & Mac Nally, R. (2009). Where and when to revegetate: a quantitative method for scheduling landscape reconstruction. *Ecological Applications* 19: 817–828.

Todd, J. A. (1997). Victoria's conservation covenant program; how effective has it been at achieving private land conservation? Pp. 173–175 in *Conservation Outside Nature Reserves* (eds P. Hale and D. Lamb). Centre for Conservation Biology, The University of Queensland, Brisbane.

Traill, B. & Porter, C. (2001). *Nature Conservation Review Victoria 2001.* Victorian National Parks Association, Melbourne.

Trust for Nature (2010). PAPL 2 – Integration of private and public land conservation. Final report to Caring for our Country National Reserve System program, Canberra. Trust for Nature, Melbourne.

Trust for Nature (2011). *Strategic Plan 2011–2016.* Trust for Nature, Melbourne.

Trust for Nature (2012a). *Conservation Strategy for Private Land in the Riverina Bioregion of Victoria.* Trust for Nature and the Caring for our Country National Reserve System Program, Melbourne.

Trust for Nature (2012b). Strategic plan for targeting works as part of the 'Linking Landscapes and Community in the Wimmera's Buloke Woodlands and Biolink' Project. Prepared as part of the funding agreement under the Caring for our Country initiative. Trust for Nature, Melbourne.

TSSC (2008). Commonwealth Listing Advice on Littoral Rainforest and Coastal Vine Thickets of eastern Australia. Threatened Species Scientific Committee, Canberra.

TSSC (2012). Commonwealth Listing Advice on Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains. Threatened Species Scientific Committee, Canberra. http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=97&status=Critically+Endangered.

Tzaros, C. L. (2001). Importance of riparian vegetation to terrestrial avifauna along the Murray River, south-eastern Australia. MSc Thesis, Deakin University, Melbourne.

VCC (2008). *Victorian Coastal Strategy 2008.* Victorian Coastal Council, Melbourne.

VCMC (2002). *The Health of our Catchments; a Victorian report card 2002.* Victorian Catchment Management Council, Melbourne.

VCMC (2007). *State of the Catchments 2007,* Victorian Catchment Management Council, Melbourne.

VEAC (2008). *River Red Gum Forests Investigation.* Final Report. Victorian Environmental Assessment Council, Melbourne.

VEAC (2010). *Remnant Native Vegetation Investigation – Discussion Paper,* State Government of Victoria, Victorian Environmental Assessment Council, East Melbourne.

VEAC (2011). *Remnant Native Vegetation Investigation – Final Report.* State Government of Victoria, Victorian Environment Assessment Council, East Melbourne.

Verboom, J., Foppen, R., Chardon, P., Opdam, P. & Luttikhuizen, P. (2001). Introducing the key patch approach for habitat networks with persistent populations; an example for marshland birds. *Biological Conservation* 100: 89-101.

Vesk, P. A., Nolan, R., Thomson, J. R., Dorrough, J. W. & Mac Nally, R. (2008). Time lags in provision of habitat resources through revegetation. *Biological Conservation* 141: 174–186.

Vickery, J. A., Bradbury, R. B., Henderson, I. G., Eaton, M. A. & Grice, P.V. (2004). The role of agri-environment schemes and farm management practices in reversing the decline of farmland birds in England. *Biological Conservation* 119: 19–39.

VNPA (2011). *Riverside Rescue – Solutions for Riparian Land in Victoria.* Victorian National Parks Association, Melbourne.

Ward, P. (1998). Flora survey of grasslands and woodlands on private property in North East Victoria. Trust for Nature, Melbourne.

Watson, J. E. M., Evans, M. C., Carwardine, J., Fuller, R. A., Joseph, L. N., Segan, D. B., Taylor, M. F.J ., Fensham, R. J. & Possingham, H.P. (2010). The capacity of Australia's protected-area system to represent threatened species. *Conservation Biology* 10.1111/j.1523–1739.2010.01587.x

WGCMA (2012). *West Gippsland Regional Catchment Strategy 2012–2018 (draft).* West Gippsland Catchment Management Authority, Traralgon.

Whelan, B. (1997). The advantages of a Trust in Conservation for private land holders. Pp. 190–195 in *Conservation Outside Nature Reserves* (eds P. Hale and D. Lamb)*.* Centre for Conservation Biology, The University of Queensland, Brisbane.

White, A. K. (2010). Ecosystem Conceptual Models for Victorian Ecosystems. Unpublished report to Parks Victoria. University of Melbourne, Melbourne.

Williams, N. S. G., Morgan, J. W., McCarthy, M. A. & McDonnell, M .J. (2006). Local extinction of grassland plants; the landscape matrix is more important than patch attributes. *Ecology* 87: 3000–3006.

Wilson, K. A., Underwood, E. C., Morrison, S. A., Klausmeyer, K. R. *et al.* (2007). Conserving biodiversity efficiently; what to do, where, and when. *PLoS Biology* 5: 1850–1861.

Wintle, B. (2008). A review of biodiversity investment prioritization tools. A report to the Biodiversity Expert Working Group toward the development of the Investmrnt Framework for Environmental Resources. Australian Government, Canberra.

Wyborn, C. (2011). Landscape scale ecological connectivity: Australian survey and rehearsals. *Pacific Conservation Biology* 17: 121–130.

Trust for Nature
Level 5/379 Collins Street,
Melbourne VIC 3000
Phone: (03) 8631 5888 Fax: (03) 9614 6999
Freecall: 1800 99 99 33 (Australia only)
Email: trustfornature@tfn.org.au
www.trustfornature.org.au