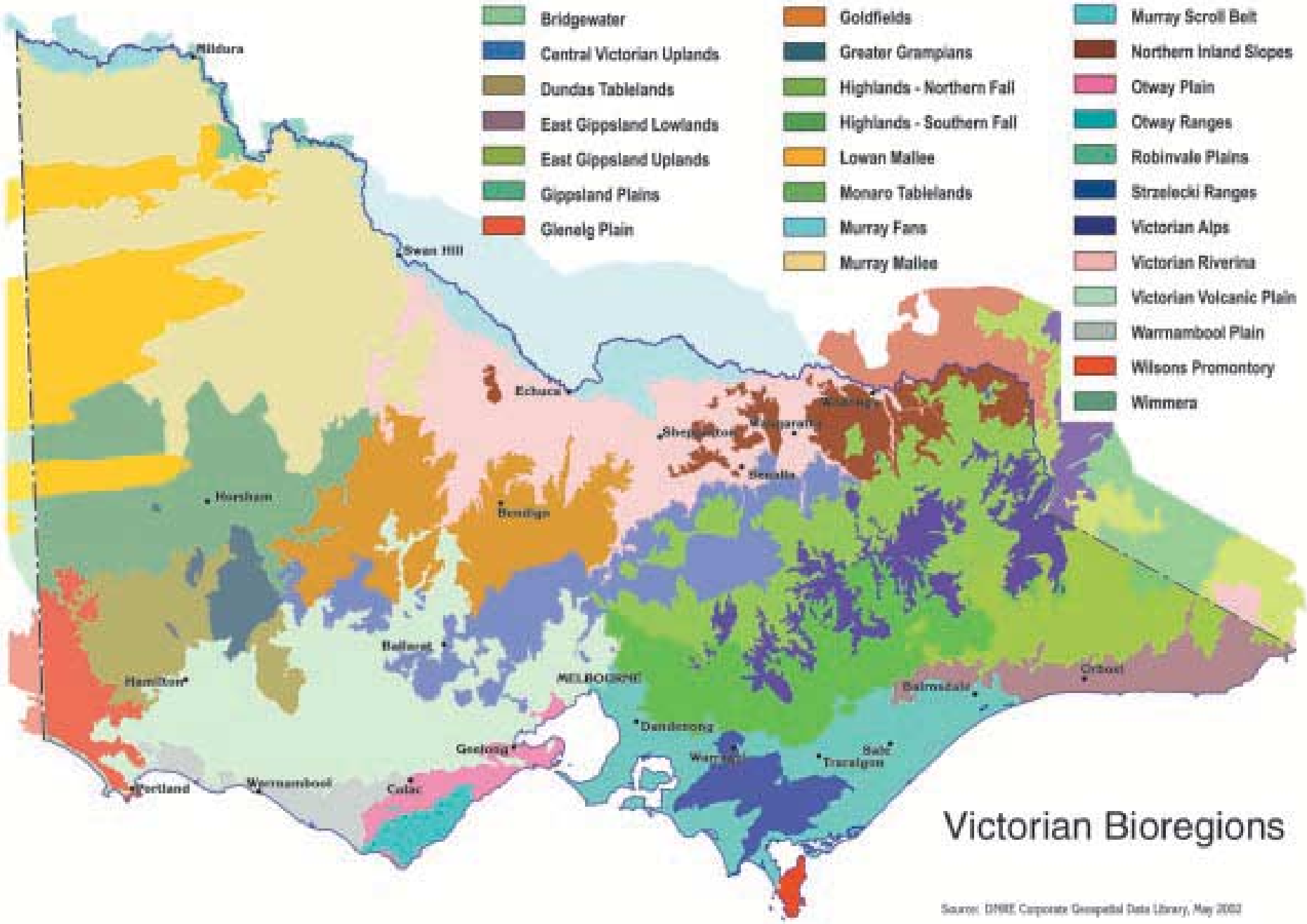
How to plan wildlife landscapes

a guide for community organisations

State Government Victoria
Department of Natural Resources and Environment

LAND FOR WILDLIFE

Natural Heritage Trust
A better environment for Australia in the 21st Century



Victorian Bioregions

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Front cover landscape photograph—Sharon Downes, Rear cover—Felicity Nicholls, Illustration this page—Peter Trusler, with the kind permission of the Trustees of the Australian Bird Environment Foundation, the conservation trust of Bird Observers Club of Australia.

Introduction

Imagine our landscape without the Australian bush—no native birdsong, no wild places for a picnic or stroll, no blue eucalypt haze on the mountains. The bush is central to our national identity and culture as Australians. It makes where we live different from other places around the world.

Increasingly, we have come to know and understand the special qualities of our native plants and animals and the ecosystems of which they are a part. We understand that ecosystems provide us with many of the natural services that sustain our health and economy such as clean water, stable soils and unique experiences. As Australians we sing of a land that 'abounds with nature's gifts'. This guide is about those gifts and how to protect them for present and future generations.

In recent times we have rediscovered our love of Australia's natural history and demonstrated our preparedness to act to protect these values. Rural communities are playing a particularly important role through Landcare, Land for Wildlife and in many other ways. We have gained a more sophisticated understanding of this land and its limitations and are attempting to overturn negative trends caused by previous misunderstandings.

All this is none too soon. It is predicted that we could lose up to half our terrestrial bird species in the next century if nothing is done to prevent their decline[1]. Salinity could affect up to 22%, or 12 million hectares of our landscapes. One third of Australian rivers are in extremely poor condition and, without action, within 20 years the city of Adelaide's drinking water will fail World Health Organisation salinity standards in two days out of five[2].

This booklet aims to assist local communities to understand some of the principles that can be applied to planning at the landscape scale, to help maintain native biodiversity* and thus our lifestyles and wellbeing. In this case, a 'landscape' is the area you might see from a hilltop in your district.

Planning is necessary if we are to ensure our actions will achieve what we desire and this guide is about planning on-ground actions. Of course, there will be different views of the future and what it should look like. Having those discussions now, within your community, about the future of your locality, will help to ensure that more people realise their vision of the future and that choice is not cast away to chance.

Alex Campbell, Chair of Land and Water Australia, recently described the early pastoral settlement of Australia. Our economy didn't 'ride on the sheep's back' we 'rode on the back of our fragile native vegetation'[3]. It is time to re-evaluate the uses we put our landscapes to, to better fit our agricultural, tourism and living systems to the Australian landscape and set about controlling our future.

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[1]Recher, H.F., (1999). *The State of Australia's Avifauna: a personal opinion and prediction for the new millennium,* Australian Zoologist 31(1), pp11-27.
[2]*Our Vital Resources: a national action plan for salinity and water quality in Australia, (2001).* Agriculture, Fisheries and Forestry Australia, Canberra.
[3] Alex Campbell, Fenner Conference on Future Landscapes, Canberra, 1999.
*for definitions see Glossary, page 62.

Contents

This guide is arranged in four sections. *General considerations* are placed first and include social, economic and environmental perspectives. This is followed by some planning principles for *landscape design*, with examples. The next section suggests a *strategic planning* model for putting the principles into practice and is followed by a number of appendices. Each section is colour-coded.

General Considerations

Landscape Design

Planning

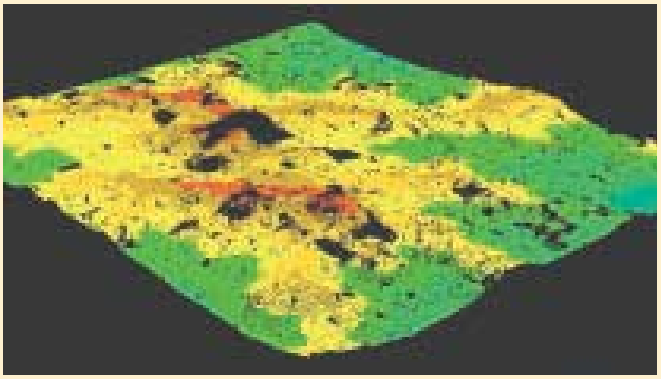
Appendices

Boxes

Boxes

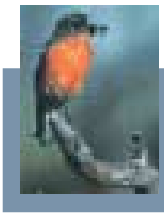
Box 1: Why parks and reserves cannot conserve all biodiversity

In rural landscapes, the native vegetation of relatively fertile, agriculturally useful soils at lower elevation was cleared by settlers more extensively than that of poorer soils. The vegetation types associated with these soils and the wildlife utilising these habitats have thus been dramatically affected. Many of our nature reserves, including national parks, are limited by this selective sampling of the natural variation in the landscape and conserve ecosystems of high elevation non-arable environments.



Jeremy Wallace, CSIRO

Remnant vegetation (dark green) is largely confined to high-elevations (red and yellow) in this computer model of a real landscape.



About this guide

Who is this guide for?

This publication is written to assist community organisations, private landholders and others with an interest in planning wildlife landscapes. It aims to help them understand the planning principles for including native flora and fauna in *landscapes* and develop an action plan. Other levels of planning include the *catchment, patch, site* and *species.* These are equally important but not covered herein.

A biodiversity view

This guide looks at landscapes from the point of view of conserving native plants and animals. Flora and fauna considerations are, of course, just one layer of landscape planning that must also include other environmental, economic and social considerations. This integrated view is essential to nature conservation. For example, native vegetation low in the landscape can be destroyed if groundwater salinity is not controlled. Similarly, who will manage native vegetation if rural communities diminish? One way of achieving integration is to decide how an area of land will be used. This guide helps identify areas where nature conservation might be the priority landuse.

About restoring rural landscapes

This guide is mainly based on knowledge about the needs of wildlife and is primarily written for the largely cleared, rural landscapes of south-eastern Australia. The objective is to give a concise overview of general principles of landscape protection and restoration. Some specific examples are given to illustrate greater levels of detail. The principles it advocates should not be used as the basis for further clearing.

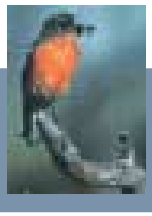
Problems caused by wildlife

Some species of wildlife do cause problems for human activities. Damage to crops, safety from potentially dangerous species and nuisance are issues that landholders have to deal with. Although there is some research that suggests there are opportunities to design landscapes to address some of these issues, this topic is not taken up in this guide-book. This guide takes the view that in most situations wildlife is an asset that we should strive to retain and that problems can be managed. Readers are referred to Temby (1992) for more information on controlling wildlife damage (see Further Reading, p60).

Knowledge limits

Our understanding of the needs of nature conservation are still evolving and much is yet to be learnt. Readers are encouraged to seek further information and critically assess the thinking behind each idea presented here. A precautionary approach is advisable. Land managers should discuss and test ideas before applying them widely. Spend time evaluating actions and modify your approach with new learning. Learn about the requirements of individual species and how they occupy specific niches within a habitat.

NB References are included as footnotes with the text to enable easy access to the science underlying content.



GENERAL CONSIDERATIONS

Visions of landscape

The past

Looking back in time, it's quite incredible how much change has occurred in the way people perceive the Australian bush and its plants and animals. Some saw the bush as a battleground in which to carve out a living whilst others utilised the resources it offered for profit. Yet others marvelled at its beauty, tranquillity and spiritual qualities. This section sets the scene for thinking about the future–can we develop a vision for the landscapes in which our children's children will live?

Ian Temby

Waterhole with Emu tracks. Aboriginal petroglyphs identify water and wildlife as key landscape features.

'We're still settling Australia' Stephen Dovers, 1999

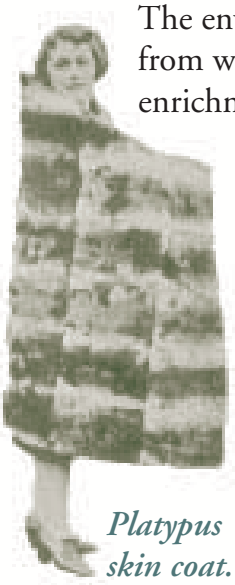
The European impact on Australia is very recent in world terms, a mere 200 years. A great deal of change has occurred in a short time but we are fortunate that the fabric of pre-European landscapes remains, often as tiny remnants of native vegetation on roadsides or hilltops. It is an historically unique time where we have the choice to retain the elements of this landscape or to lose it forever.

'Landscapes are socially constructed.' AndrewCampbell, 1999.

Aboriginal Australians saw the landscape as being crucial to their survival and their unique culture. They described landscapes in songlines, identified and revered sacred sites and managed their environment with fire. The environment offered food, shelter from weather and predators and spiritual enrichment.

John Seebeck

A handbag made from the skins of the Eastern Quoll. Fur is out of fashion and this source, once abundant, is now extinct in Victoria.



Unknown

Platypus skin coat.

'trees, quite free from underwood, appeared like plantations in a gentleman's park'.
James Cook, HMS Endeavour, 1770 in Flannery 1997 p348.

Newly arrived European settlers saw opportunities for agricultural enterprises based on farming systems imported from the northern hemisphere. They sought to construct landscapes that were conducive to human settlement and employed machine-assisted and scientific methods of utilising resources. In 1892,

NRE

Taming the landscape was hard work. Did we fully consider the consequences?

Samuel Dixon wrote 'The farmer, the squatter, the miner, and the swagman all cause extensive conflagrations (fires), and by their oft-recurrence the arborescent growths are reduced to mere scrubs, and the more tender plants . . . are utterly destroyed with a recklessness which can only be fittingly described as insane.'[1]

'If it lives, we want it' [2a] *Edward Wilson*

At the turn of the century, acclimatisation societies sought to introduce new species to Australia such as monkeys, so that they 'would delight [the traveller] as he lay under some gum-tree in the forest on a sultry day', Boa Constrictors and South American Agouti[2b]. Many species that subsequently became pests and caused enormous environmental and economic loss were deliberately introduced, including rabbits and foxes. This approach continues, with bumblebees, a threat to native pollinators and ecosystems, and native to Europe, being illegally introduced to Tasmania as recently as 1992[3].

State Library of NSW

'Bullio', Mittagong, NSW, 1907. Wildlife was 'fair game'.

It took some time for European artists to adapt to their new Australian environment (picture, p11). They depicted landscapes as English gardens and as tidy settlements with regular boundaries in a chaotic wilderness before moving on to portray the rich red earths of an unforgiving desert continent and the olive greens and blue hues of our eucalypts[4].

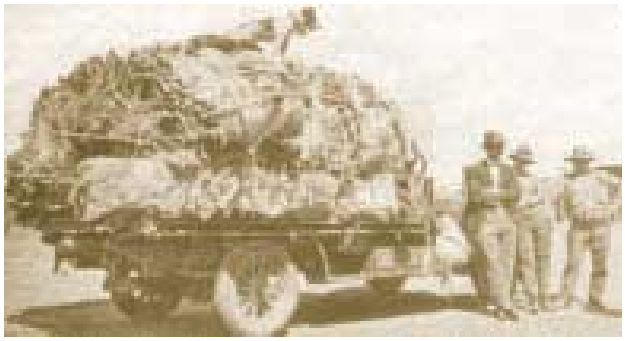
Galbraith family

Natural settings have always provided opportunities for recreation and enjoyment, such as this 1916 outing on the Tyers River complete with violin.

In the early days of European settlement, native plants and animals were a resource to be used for their products or to be eradicated as pests. 'Five miles from Cobden was Mr. Elliott's homestead on which he

[1]Dixon, S., (1892). *The effects of settlement and pastoral occupation in Australia upon the indigenous vegetation.* Proc. Roy. Soc. South Australia. [2]Rolls, E., (1984). *They all ran wild–the animals and plants that plague Australia*. Third edition. Angus and Robertson, Melbourne. a) p275 b) p278. [3]Semmens T. D., Turner E. and Buttermore R. (1993) *Bombus terrestris* (L.) (Hymenoptera: Apidae) *now established in Tasmania*. Journal of the Australian Entomological Society 32: 346. [4]Daniel Thomas (pers. comm.)

principally ran cattle but also raised pigs on boiled marsupial flesh and had an orchard'[1]. In the 1880s, lyrebird tails were hawked in baskets around the Sydney suburbs. By around 1825, prices around Sydney had risen to 30s due to increasing rarity. At an ornithologists conference in 1911 it was claimed that 2000 Superb Lyrebird tails had been exported to London in the previous three years at a price of 2s 6d (25 cents) a tail[2]. 'A bounty of ten shillings per scalp was applied to wombats in 1925, and remained in force until 1966 when it was suspended'.[3] It was only in 1975 that we adopted the basic principle of protecting *all* native wildlife in Victoria (Wildlife Act 1975).



Unknown

Three thousand koala skins ready for market. From the open season in Queensland in the 1920s. Does this scene reflect the future you wanted to inherit?

Private collection

We conquered the wilderness, about which we knew very little, with order and tidiness. 'The farm of Mr. Perry on the Yarra, 1855' Eugene Von Guerard.

The present

Today we understand a great deal more about the nature of Australia. However, we are suffering the consequences of a lack of foresight and understanding by our forebears. These include rising saline watertables, soil acidification, extensive erosion and loss of many native plant and animal species. We also realise that many of the agricultural systems introduced from elsewhere were not suited to the Australian environment *in the long term*. Do we have more foresight? This guide attempts to develop such an approach.

Unknown

Plentiful resources can easily be depleted if managed unsustainably. Murray Cod of this size are far less common today than in the 19th century.

Pioneering attempts to address the problems have been courageous and of great merit. In rural areas, twenty or so years ago, a few brave families double-fenced and planted 'natives' though they may have been native to the other side of the continent. These people persisted despite the sometime frowns of their neighbours. They introduced a new era. Now we have organised Landcare groups and indigenous (local provenance, native) plantings.

[1]Fletcher, J.S., (1985). *The Infiltrators: A History of the Heytesbury 1840-1920.* Shire of Heytesbury. [2]MacDougall, T. (ed.) (1996). *The Australian Encyclopaedia*, 5:395. Australian Geographic. [3]Seebeck, J., (1995) *The Conservation of Mammals in Victoria–development of legislative controls.* J. Aust. Studies 45: 53-65.

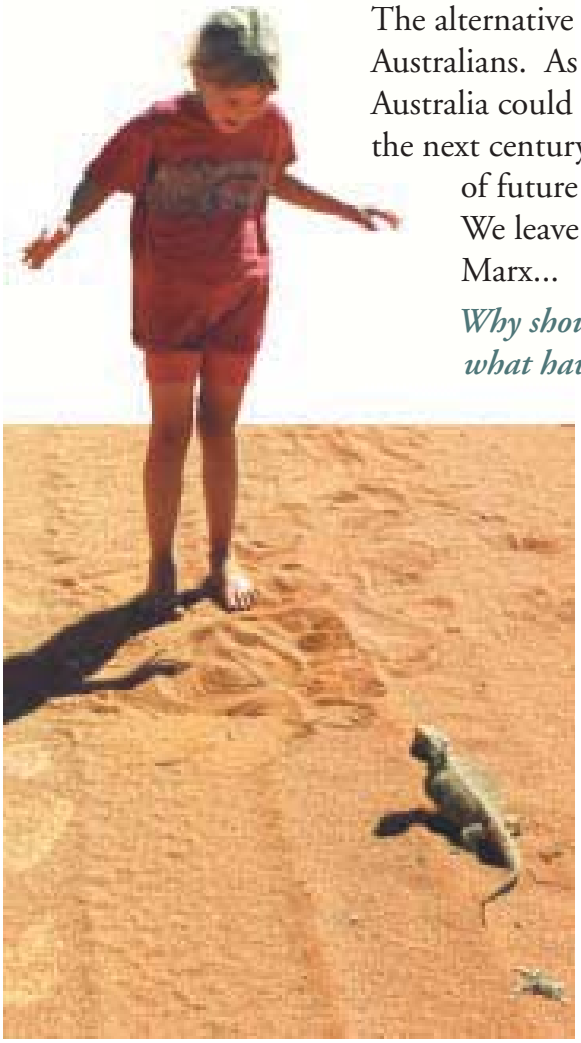
Wildlife conservation is no longer just the prerogative of government agencies but embraces community activity. There are many examples of wonderful initiatives being undertaken such as fencing remnant vegetation and removing barriers in waterways. Improved local planning, to organise these activities, is an important component of the future.

The future

Predicting the future is no easy task but to some extent the outcomes are in our hands and, for rural landscapes, very much dependent on private landholders. It is critical that we develop a vision of the future, wrought from the values of the community that will participate in and inherit that future.

Take the time to think about your vision of the future for landscapes that are important to you. You might like to consider what you will see in your district in twenty years time–what activities and income sources will exist and how these will contribute to your wellbeing and that of your children and community?

There are opportunities to include a variety of visions. However, if nature is to be part of the vision then its specific requirements must be provided. This includes suitable habitats, a need which necessarily challenges our view of what constitutes a healthy property or landscape. It is far from the tidy park-like surrounds of an English garden.



Stephen Platt of Carolyn Platt

The alternative outcome is unacceptable to most Australians. As stated earlier (p5), it is predicted that Australia could lose up to half its terrestrial bird species in the next century if no action is taken now. Is this the kind of future we want to leave as our legacy?
We leave the last word to the insight of Groucho Marx...

Why should I care about future generations, what have they ever done for me?

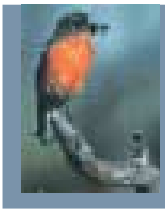
Further reading:

Hamblin, A., (ed.) (2000). *Visions of future landscapes: Proceedings of the 1999 Australian Academy of Science Fenner Conference on the Environment 2-5 May 1999, Canberra*. Bureau of Rural Sciences, Canberra.

Flannery, T., (1997). *The Future Eaters*. New Holland, Sydney.

Hobbs, R.J. and Hopkins, J.M., (1990). From frontier to fragments: European impact on Australia's vegetation. *Proc. Ecol. Soc. Aust.*,16, 93-114.

Rolls, E., (1984). *They all ran wild–the animals and plants that plague Australia*. Third edition. Angus and Robertson, Melbourne.



Perceptions of native vegetation

Do our human preferences affect the way we view native vegetation? A study of 568 rural landholders and 664 Melbourne residents by Kath Williams, John Cary and Bob Edgar of the University of Melbourne[1] concluded that there is a preference among respondents for 'more open woodland with a smooth or lightly textured understorey'. Woodlands dominated by eucalypts were preferred over those dominated by buloke or sheoak. That is, respondents favoured park-like surroundings.

Figure 2

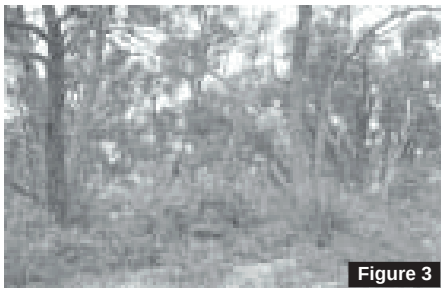


Figure 3

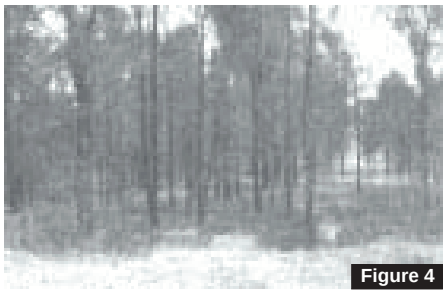


Figure 4

University of Melbourne

Respondents liked the look of the upper picture but weren't so keen on the other environments, though the latter may indeed provide equally (or more) valuable habitat for other species.

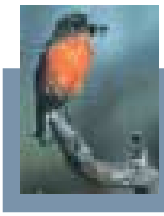
This is not surprising given human biology. We don't like areas that are visually crowded and may conceal threats. Our predecessors probably evolved in grassy woodland environments.

These 'landscape preferences' of humans are real and important. However, we must recognise that other species may require habitats that differ from our preferences. This may involve accepting that some areas of the landscape may have to be managed to look 'scrubby', 'swampy', 'impenetrable' or 'dank and coarse'. Ecological processes such as fire, though a threat to human life and property, can be rejuvenating to ecosystems. Fire is a process that needs to be accommodated in wildlife landscapes.

Some wildlife species prefer the dense understorey layers normally present in bushland, others the open plains of the treeless grasslands and yet others, freshwater environments that may be full of 'habitat logs' rather than clear and free-flowing as *we* might desire. Understanding the specific habitat requirements of species is essential to including them in future landscapes. For example, misguided attempts to manage weeds in native grasslands by using *autumn* fires led to the death of endangered Striped Legless Lizards that naturally seek shelter from fire in the cracks that appear in basalt soils in *summer*. To reinstate wildlife in a landscape it is necessary to understand the specific habitat requirements from the perspective of the species concerned.

Aim–to respond to wildlife preferences where wildlife habitat is the principle landuse.

[1]Williams, K., Cary, J. and Edgar, R., (1998). *Perception of Native Vegetation in Rural Landscapes: Implications for Ecosystem Protection and Sustainable Land Use*. University of Melbourne, Parkville.



Why include nature?

Does nature contribute to the things you really value? Many people value nature for its intrinsic worth and require no more justification. Others see merit in its historical value, for artistic or spiritual inspiration or direct economic benefit.

A small survey of rural landholders taken in 2000 indicated that well-being, friends and relationships, sustainability and wealth are values that are regarded highly[1]. So how does nature contribute to these values?

Well-being

Nature *is* the basis for life providing clean water, fresh air and food. It also provides for our spiritual well-being. We recite bush stories, stand in awe of towering eucalypts, relax listening to the sounds of birds singing. In addition, natural systems and cycles contribute to our well-being. For example, they 'keep the balance' in pest control and soil stability. Nature is a shared wealth that is generally available to everyone, irrespective of current economic circumstances.

Friends and relationships

Nature provides us with a huge range of opportunities to share experiences and participate in activities with others. Camping, bushwalking, birdwatching, fishing, picnicking and gardening are but a few examples.

Sustainability

The essence of sustainability is that we utilise resources at a rate at which they can replace themselves, so that we leave them intact for future generations.

Graham Pizzey

Tourism in rural areas contributes $1.7 billion to the Victorian economy (1995 figures) and is a growth industry. Grampians region, Victoria.

Since European settlement, one in four of our mammal species has either become extinct or is threatened and ninety four percent of the forest cover on private land in Victoria has been cleared[2]. Of 3,158 native vascular plant species, at least 613[3] are threatened and 33 are thought to be extinct[4]. Land and water degradation, excluding weeds and pests, resulting from changes in vegetation cover and disturbance of natural systems costs the Australian community in the order of $3.5 billion per year[5]. Salinity, soil erosion, acidification of soils, algal blooms and similar problems are indicators of breakdown in natural systems. A return to more natural systems of farming and an increased native vegetation cover offers hope for the future.

[1] *Living Systems Update* No. 2 (2000), Department of Natural Resources and Environment, Melbourne. [2] *1991 State of the Environment Report: Agriculture and Victoria's Environment: Resource Report*, Office of the Commissioner for the Environment, Melbourne. [3] Traill, B., and Porter, C., (2001). *Nature Conservation Review Victoria 2001*. Victorian National Parks Association, Melbourne. [4] Ross, J.H., (2000). *A Census of the Vascular Plants of Victoria*. Sixth edition. Royal Botanic Gardens, Melbourne. [5] *Our Vital Resources: National Action Plan for Salinity and Water Quality*, (2001). Agriculture, Fisheries and Forestry Australia, Canberra.

Box 2a: The role of nature in providing clean water for human consumption

Water enters the catchment

Plants and logs stabilise catchments and waterways, regulate watertables, reduce overland runoff, filter out airborne pollutants such as pesticides and trap nutrients that cause pollution

Phytofall (leaf litter) protects soils and provides filtration*

Aquatic invertebrates break down plant material

Beneficial micro-organisms assist decay, break down some harmful substances and maintain diversity thereby preventing proliferation of harmful organisms

Wetlands act as sediment and nutrient traps

Clean, healthy, potable water

Gone wrong–blue-green algal blooms are a symptom, the cause is a collapse of natural cycles.

Blue green algae, Darling River 1991, Murray Darling Basin Commission

Little Snowy Creek, Upper Murray Basin, Index of Stream Condition, Waterways Unit, NRE

Wealth

Nature's contribution to wealth, whilst not always obvious, is enormous.

'The economy is a wholly-owned subsidiary of the environment' Paul Hawkins

Nature provides humans with the fundamental products we need to survive. Air and water are produced and purified by the interactions of plant, animal, microbial and fungal species with their environment (Box 2). These 'ecosystem services' (p 15) are provided free of charge but not free of an obligation of maintenance[1]. It has been estimated that ecosystems provide $300 billion worth of free services to the US economy[2]. Water filtration and purification provided by vegetation in catchments around New York were estimated to be worth $8 billion. At the farm scale, these services are just as important. For example, large quantities of nitrogen are 'fixed' from the atmosphere by soil microbes per year (free fertilizer).

Nature is the basis for agriculture. All agricultural products are ultimately derived from natural ecosystems. *Genes* are the tools-of-trade of agriculture. They are used to build products as *species* be they varieties of corn, kinds of orange or heavier livestock. *Ecosystems* are the control mechanisms that maintain the balance and sustain ongoing production. They influence the critical cycles of water, nutrients, and atmosphere; they regulate pests and diseases and help prevent land degradation.

[1]See Cork, S. and Shelton, D., (2000) full reference p16. [2]Pimental, D., et al., (1977). *Economic and environmental benefits of biodiversity.* BioScience 47(11): 747-757. *The term phytofall has been coined here as a positive-sounding alternative to the standard term 'leaf litter' which consists not just of leaves and is of enormous value, unlike refuse (Gk, phyton: plant).

Australia's natural environment is unique. This quality attracts tourists and holiday-makers to rural areas. Internationally, it offers a competitive advantage that others cannot copy, that today contributes many millions of dollars to our economy and offers options to traditional rural commodities. It also provides future opportunities for rural communities in areas such as Earth repair (e.g. revegetation industry), tourism, and 'clean and green' production (see p17).

But of course 'wealth' is not just about dollars in the bank

'The three 'pillars of prosperity' for future communities are ways of living that are economically profitable, ecologically sustainable and socially desirable'

R. Beeton and E. Barlow.

Aim–to design wildlife landscapes to fulfill personal and community values.

Felicity Nicholls

Restoring the environment is an investment in well-being, through building relationships.

Box 2b: Ecosystem Services

Ecosystem Services are the services provided by nature that benefit humans and include:

Production of Goods

Food: Terrestrial animal and plant products, forage, seafood, spice.
Pharmaceuticals: Medicines, precursors to synthetic drugs.
Durable materials: Natural fibre, timber
Energy: Biomass fuels, low-sediment water for hydropower.
Industrial products: Waxes, oils, fragrances, dyes, latex, rubber, precursors to many synthetic products.

Regeneration processes

Cycling and filtration processes: Detoxification and decomposition of wastes, renewal of soil fertility, purification of air and water.
Translocation processes: Dispersal of seeds necessary for revegetation, pollination of crops and native vegetation.

Stabilising processes

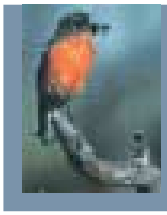
Coastal and river channel stability, compensation and substitution of one species for another when environments vary, control of the majority of potential pest species, moderation of weather extremes, shade and shelter, partial stabilisation of climate, regulation of the hydrological cycle (mitigation of floods, droughts, salinity), soil stability.

Life-fulfilling functions

Aesthetic beauty, cultural, intellectual and spiritual inspiration, existence value, scientific discovery, serenity.

After Cork, S. and Shelton, D., (2000)[1]

[1] Cork, S., and Shelton, D., (2000). The Nature and Value of Australia's Ecosystem Services: A Framework for Sustainable Environmental Solutions in *Sustainable Environmental Solutions for Industry and Government: Proceedings of the 3rd Queensland Environmental Conference, May 2000.* Environmental Engineering Society, Queensland.

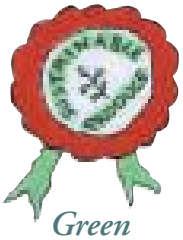


Future economic opportunities

"70% of the products of 2020 are yet to be created" Peter Ellyard, 1999

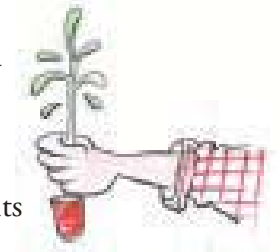
In developing a regional plan for biodiversity, consider how biodiversity can play a role in the local economy. What are the opportunities and what relationships and infrastructure are needed to support 'green' industries? Bush food cultivation, ecotourism and environmental restoration are examples of employment opportunities that might be created by strategically including biodiversity*.

Opportunities might include:



Green credentials

- Obtaining a marketing advantage for agricultural produce by entering into an Environmental Management (quality assurance) System that includes biodiversity criteria[1].
- Growing and selling 'environmentally sustainable' food or 'bush' food.
- Becoming involved in biotechnology and indigenous plant production (e.g. developing an indigenous plant seed orchard and selling the seed).
- Selling the credit of carbon stored in vegetation on the property, including bushland areas or sustainable firewood from plantations.
- Taking advantage of employment in the 'Earth repair' industry by developing and selling skills in environmental management and restoration or supplying materials such as local native plants.
- Providing opportunities for people to relax in natural environments on the property or to engage in adventure or outdoor activities.
- Providing environmental education to schools and city dwellers.
- Contracting for activities associated with providing ecosystem services (e.g. clean water) or managing significant vegetation.
- Accessing ethical investment funds, because of your environmental performance, for business development.
- Providing alternative energy sources including sales of 'green' power or lease of land for green power generation.

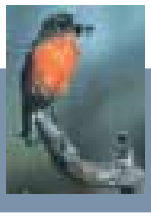


An emerging opportunity: the 'Earth repair' industry.

Selling well-being

Aim–to plan wildlife landscapes so that they contribute to future economic activity appropriate to the region.

[1]Refer to Anderson, S., Lowe, K., Preece, K. and Crouch, A., (2001). *Incorporating Biodiversity into Environmental Management Systems for Victorian Agriculture: A discussion paper on developing a methodology for linking performance standards and management systems.* Department of Natural Resources and Environment, Melbourne.
Source: 'Future Opportunities', Living Systems Project Resource Kit, Department of Natural Resources and Environment, Melbourne. *Readers are advised to seek professional advice before acting on any of the broad opportunities outlined above. Some of the above opportunities may not be appropriate for your circumstances.
An information sheet on this subject is available from the Department of Natural Resources and Environment, Living Systems Project. Please note that whilst these opportunities offer potential value from retaining biodiversity, they may also have some negative impacts if undertaken inappropriately. All cartoons: Phil Sparnenn.



Why that vegetation?

The vegetation present at a particular site is the result of *regional and landscape* factors, such as rainfall, temperature, altitude and topography, *local* factors such as the soil type, geology, slope, aspect and prevailing weather conditions and individual factors such as breadth of environmental tolerance. It is also the result of *historical* factors. These include short-term effects, such as previous disturbances (fire, disease and human impact) and long-term effects, such as which plants evolved in the region and which arrived from elsewhere. *Chance* events also play a role. For example, the probability that seeds will reach a locality is partly due to chance events such as carriage during a storm or being caught in the fur or feathers of a mammal or bird.

In Victoria, broad-scale biological regions (bioregions) are recognised and plant associations are classified according to a system of Ecological Vegetation Classes (EVC). This classification attempts to take account of both the site and historical factors influencing vegetation type. Ecological Vegetation Classes are a good basis for landscape planning, although floristic variation within Ecological Vegetation Classes must also be taken into account when planning at the local level.

Victoria has a diverse flora. There are some 3,221 *native* species recognised[1] and around 220 Ecological Vegetation Classes have been mapped.

A vision for your landscape might be to conserve representative tracts of all the Ecological Vegetation Classes that are present or establish examples of all those present prior to European settlement.

Stephen Platt

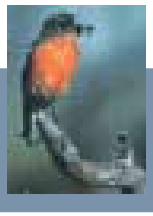
Sandy heathland vegetation near Airey's Inlet on the Victorian coast after the 1983 Ash Wednesday bushfires.

Usually, local information is valuable in identifying unique features that might go unnoticed in broadscale mapping. This information will be found among local residents, libraries and natural history societies.

Maps of pre-European and current distribution of Ecological Vegetation Classes are available from the Department of Natural Resources and Environment (NRE) at a scale of 1:100,000 and 1:25,000. NRE is establishing the Bioregional Conservation Status of all EVCs in Victoria and can advise on the status of threatened species.

Aim—to use Bioregions and Ecological Vegetation Classes as the basis of planning.

[1]Ross, J.H., (2000). *A Census of the Vascular Plants of Victoria.* Sixth Edition. Royal Botanic Gardens, South Yarra.



Planning considerations

Consider these general factors when setting out to maintain or create wildlife habitats.

Integration of land uses

To achieve an outcome that meets *all* of your needs and also enhances biodiversity requires consideration of all factors that affect landuse decisions. Property Management Planning (strategic level) and Whole Farm Planning (property layout) courses use methods that encourage an integrated approach to landuse. Integrated Local Area Plans are also being developed by some Catchment Management Authorities.

Thresholds

Thresholds are critical points below which no result, such as species presence, may be recorded. For example, in some districts in Victoria, Hooded Robins are only recorded in habitat patches that exceed 25 ha[1] (Box 7, p27. Refer also to thresholds on p25 for 'species-area' and p47 for 'tree cover').

Quality

The quality of the habitat and degree of degradation, such as weed invasion, affect the significance of a site and its priority for protection or restoration. Quality includes the amount of understorey vegetation and its ecological integrity (how well it functions–are pollinators doing their job? Are nutrients being recycled?).

Time

Time is required for habitats to develop and for 'pioneer' species to be replaced by species typical of older stages. Over 70 years may be required for trees to mature and to develop hollows. Seasonal differences affect such things as variation in nectar production (Boxes 3,4). Migratory species may only be present at certain times of the year. Extinction is a process which can have a substantial time lag between actions that cause habitat change and their effects. For example, Sulphur-crested Cockatoos may live up to 70 years of age, potentially masking a loss of suitable breeding hollows.

Peter Menkhorst

Space

Space is essential to provide areas where wildlife conservation is a primary aim of management. It is needed to allow for different habitats on different land systems and to enable linkages between habitats. Landscapes need to be both *adequate* in size to provide immediate resources for species survival and *viable* in the long term[2]. Both the physical layout of the landscape and how this affects function (e.g. fire movement) is important.

Aim:

- for integration of all land uses
- to develop habitats that are representative in space and time
- to develop habitats that are of high ecological quality

[1]Kim Lowe (pers. comm.) [2]Lambeck, R.J., (1999). *Landscape Planning for Biodiversity Conservation in Agricultural Regions: A case study from the wheatbelt of Western Australia.* Biodiversity Paper No. 2. Department of the Environment and Heritage, Canberra.

Box 3: Nectar production in Box-Ironbark Forests - how space and time affect resources used by wildlife

Nectar from flowering eucalypts is an important food source for many wildlife species that inhabit Box-Ironbark Forests in northern Victoria.

The amount of nectar available to animals varies:

In space: The extent of flowering of Red Ironbark trees has been found to vary greatly in different stands across a forest. In some areas Red Ironbark does not flower at all in a particular year whereas in others many trees are in flower.

McCann collection, NRE

Red Ironbark in flower. This is an uncertain event that affects wildlife relying on the nectar supply as a food source.

In time: At Rushworth Forest in 1997 only 19% of Grey Box and 1% of Red Ironbark trees flowered, whereas in 1998 both flowered profusely with 86% and 95% of trees flowering respectively.

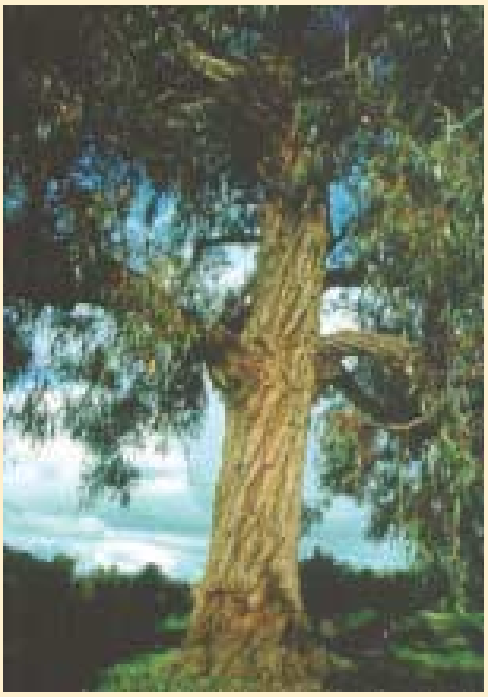
By tree size: Larger trees (> 40 cm diameter at breast height) were found to flower for longer periods and more prolifically (more flowers) than smaller trees.

Nectarivorous species (those feeding on nectar) need a series of habitats over a broad geographic range. Larger old trees are a particularly rich and reliable food source and deserve special status in conservation attention.

Aim:

- to provide sufficient habitat resources to cater for uncertainty
- to provide some habitat on fertile soils with reliable water
- to retain large old trees

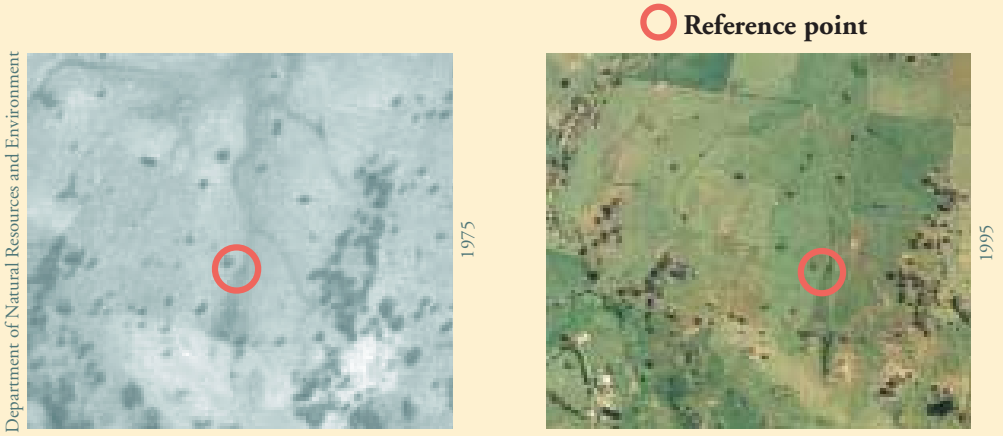
Large old trees provide both a greater quantity and more reliable year-to-year supply of nectar for wildlife. Survivors in the landscape, large old trees have had the time to develop root systems that exploit available water and nutrient resources. There's as much tree under the ground as above. Keep them, they are precious.



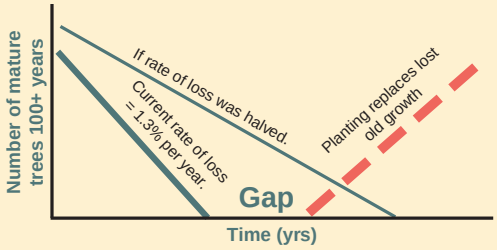
McCann collection, NRE

[1]Bennett, A. and Wilson, J. (1999). 'A Patchy Resource...Wildlife and Nectar' in Stothers, K., (ed.), *Wildlife in Box-Ironbark Forests...Linking Research and Biodiversity Management.* Department of Natural Resources and Environment, Melbourne.

Box 4: Tree decline in central Victoria - how time affects the landscape pattern



Comparison of aerial photographs has been used to calculate the insidious rate of loss of old trees from this landscape near Warrenbayne in central Victoria.



Old trees are declining in our natural landscapes. The rate of mortality in one landscape was measured by wildlife biologist Doug Robinson using aerial photographs. Doug compared recent (1993) photographs with historical ones (1971) for 3,300ha of land at Warrenbayne (near Benalla) in Victoria and plotted tree loss over time (above). The result is an estimate that all large old trees will disappear in around 77 years, thus changing the landscape for centuries and removing a critical resource for many species.

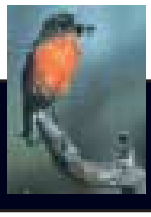
As trees become older and larger, they provide a whole range of food resources, nest sites and shelter not available from younger trees[1].

For example, tree hollows are a prerequisite for the survival of one-third of Victorian mammals and one-third of land birds. However, large trees with hollows are in short supply in some areas. Tree hollows only begin to form in trees more than about 30 cm diameter and only become common in trees more than 70 cm across. Such trees (more than 70 cm diameter) are usually at least 100 years old, and may take a further 100 years before they develop hollows large enough to provide nest sites for larger animals such as owls, possums and cockatoos, or specialised roost sites for some species of bats.

The gap between the loss of old individual trees and replacement of the resources they provide by new plantings can be reduced by protecting those large old trees that remain. This includes saving large trees in bushland, fencing off those in paddocks, and revegetating the surrounding area. The sooner you start to replace them, the better.

Aim–to protect existing large native trees and mature natural habitat as a priority in conservation actions.

[1]Robinson, D. (1994) see Land for Wildlife News Vol. 2, No. 3, p 14 and Note 18: Old Trees for Wildlife.



LANDSCAPE DESIGN

DESIGN PRINCIPLES

A typical rural Victorian landscape consists of native vegetation arranged as *patches* of differing shapes and sizes connected by *linkages* as part of a *matrix* of different land uses. All parts of the landscape can provide some degree of habitat for different species of wildlife, even areas used primarily for production purposes.

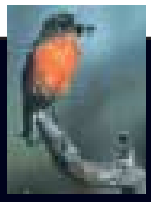
The following section describes general planning principles that apply to the design of wildlife landscapes including patches, sites of special interest, linkages, and the matrix in which they all occur. These factors do not stand alone but come together to varying degrees to create a heterogeneous environment. To survive, a species needs to find the resources it requires in the short-term for all stages of its life cycle. It must also withstand the test of time including catastrophic events, such as fire, and environmental extremes, such as drought.

The three Rs

The priority for conserving flora and fauna is to *retain* the priority remnant vegetation that remains, *restore* the quality of degraded habitats and then *revegetate* cleared areas.

DESIGN PRINCIPLES

Issue	Principle(s)
Patches	
Quality	Protect the best native vegetation first (p24)
Size and number	The bigger the better (p25)
	The more types of habitat, the better (p28)
Shape and edges	The more compact, the better (p29)
	Consider 'edge effects' (p30)
	Include buffers (p31)
Position	Include all land classes (p32)
Sites	
Local significance	Include watercourses (p34)
	Provide for threatened species (rare, vulnerable, endangered, p35).
Linkages	
Connectivity and corridors	The more connected, the better (p36)
	Include corridors (p37)
	Provide stepping stones (p38)
Matrix	
Mosaics	Integrate nature conservation areas with surrounding landuse (p39)



Protect the best native vegetation first

NRE

A typical aerial view of remnant vegetation on farmland in Victoria. Which patch is best for quality and quantity?

Remnant native vegetation that is in good condition is extremely valuable and should be the initial focus of protection and management.

You will recognise the best areas of native vegetation as being those in which:

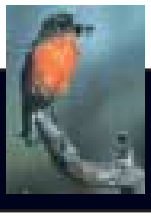
- most layers of vegetation are still present (canopy trees, understorey shrubs, ground-layer grasses and herbs, and soil lichen and moss crusts).
- many native species typical of the habitat are represented.
- the vegetation is relatively free of disturbance, including introduced weeds.
- there is a lot of faunal activity indicating ecosystem function (e.g. pollination, wood decay, breeding populations).

Aim–to identify the best examples of each type of vegetation (Ecological Vegetation Class) in the landscape, and rank other areas of vegetation according to their condition and threatened status (see pages 40, 49).

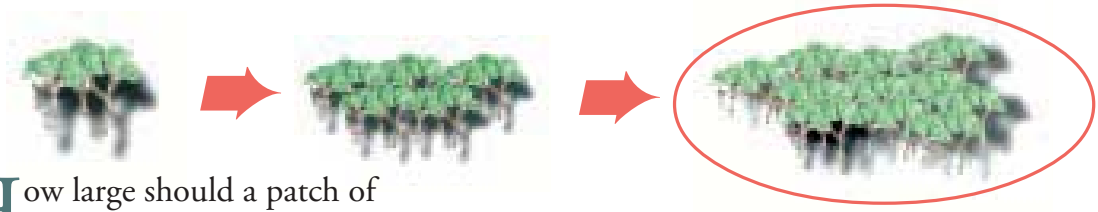
Suggestion: You can use Land for Wildlife Note 40 'How healthy is your bushland?' to assess native vegetation in your district (available from NRE, p63). Pay particular attention to roadsides, cemeteries, rail reserves and other locations where native vegetation may have survived in relatively good condition.

Best involves

Quantity
+
Quality



The bigger, the better



How large should a patch of vegetation be? The rule of thumb is 'the bigger, the better'. Unfortunately, one size does not fit all species when it comes to habitat.

Larger patches of vegetation are valuable because they can support:

- A greater diversity of habitats.
- A greater number of species because of the wide range of habitats and potential quantity and diversity of resources (Box 6, p25).
- Larger populations of wildlife species. This is an important factor in avoiding extinction.
- A greater core area, away from edge disturbances.

Larger patches:

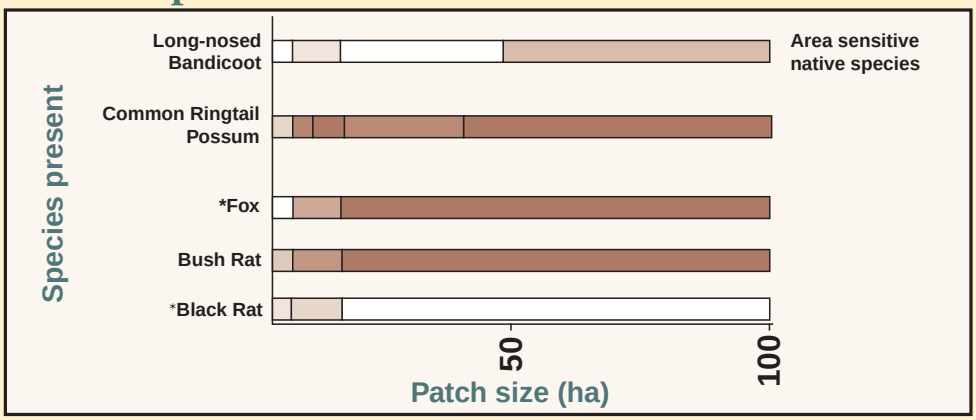
- Are more resilient to disturbance. For example, a fire is less likely to burn the entire patch.

Species' needs differ (Box 5, below). Individual Koalas have a home range of approximately two hectares but Powerful Owls, whose main diet is possum, require 800-1000 hectares. However, be aware that size isn't everything. For example, along with remnant area, shrub cover was found to be important in providing habitat for birds in woodland remnants. For some species shrub cover compensates for remnant area[1](Box 7, p26). Small patches are valuable for some species[2] (e.g. Bush Thick-knee) though this is related to the nature of the surrounding 'matrix' (see p38) and historical factors.

Aim–to find big areas of native vegetation and restore their quality.

[1]Seddon, J., Briggs, S. and Doyle, S., (2001). *Birds in Woodland Remnants of the Central Wheat/Sheep Belt of New South Wales–Report to the Natural Heritage Trust (Project AA1373.97): Predicting biodiversity of woodland remnants for on-ground conservation.* New South Wales National Parks and Wildlife Service, Sydney. [2]Fischer, J. and Lindenmeyer, *D.B. (in press). Small Patches can be Valuable for Biodiversity Conservation: two case studies on birds in southeastern Australia.* Biological Conservation.

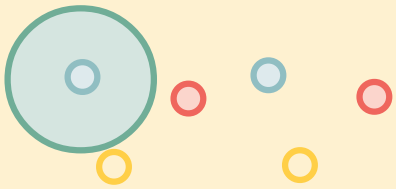
Box 5: How patch size affects wildlife in south-west Victoria.



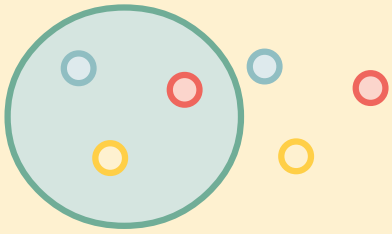
*Comparison of patches, ranging from 2-50 hectares, of remnant forest vegetation at Naringal, in south-west Victoria[3]. Bar shaded to percent species occurrence. White represents species absent. *indicates introduced species.*

[3]Bennett, A.F., (1987). Conservation of Mammals within a Fragmented Forest Environment: The Contributions of Insular Biogeography and Autecology. Pages 41-52 in *Nature Conservation: The Role of Remnants of Native Vegetation.* Ed's D.A. Saunders, G.W. Arnold, A.A. Burbidge and A.J.M. Hopkins. Surrey Beatty and Sons, Chipping Norton, New South Wales.

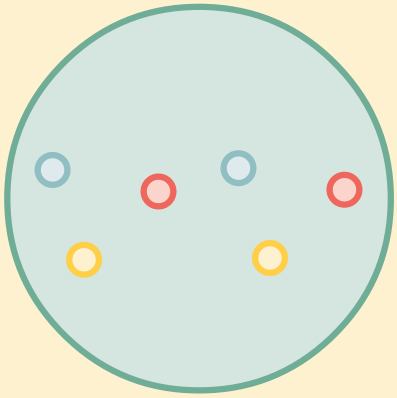
Box 6: How patch size affects resources available to wildlife



A small patch is less likely to contain a variety of resources needed by a species. However, if movement beyond the patch is not an issue then the resources may be available in the wider landscape.



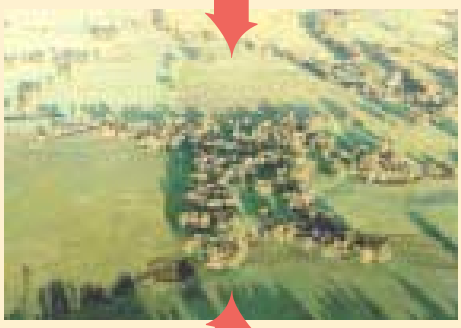
A medium-sized patch may contain all the resources required by a species, but in limited quantities thereby only supporting a small and vulnerable population of the species.



A large patch may contain all the resources required by a species in sufficient quantities to support a large and viable population.

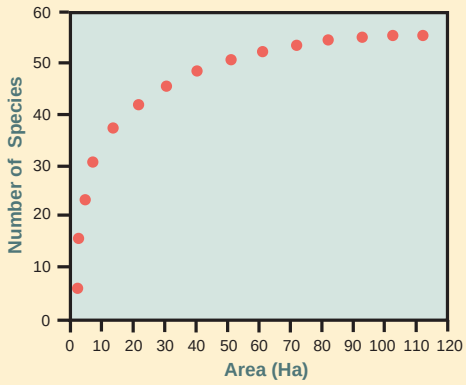
Area is not the only factor affecting wildlife patches

Threat of Destruction
Affects area, isolation, resources



Felicity Nicholls

Threat of Degradation
Affects quality. [e.g. introduced predators and competitors (weeds, foxes), grazing, firewood removal].



Typical species-area relationship[1,2]. Note the rapid decline in species as area reaches a critical threshold, around 10-15ha in this example.

Aim–to create patches large enough to support the quantity and range of resources required by each species over time.

Further reading: Clark, T.W., Warneke, R.M. and George, G.G., (1989). *Management and Conservation of Small Populations: Proceedings of a conference held in Melbourne, Australia, September 26-27, 1989.* Chicago Zoological Society, Illinois.

[1]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.* Ed's D.A. Saunders, G.W. Arnold, A.A. Burbidge and A.J.M. Hopkins. Surrey Beatty and Sons, Chipping Norton, New South Wales. [2]Reid, J.R.W., (2000). *Threatened and Declining Birds in the New South Wales Sheep-wheat Belt: II. Landscape relationships - modelling bird atlas data against vegetation cover.* CSIRO Sustainable Ecosystems, Canberra.

Box 7: Finding size thresholds using focal species

One method of determining the size of a patch to aim for in protection or restoration is to select the most area-limited species and determine its needs as the basis for a *minimum* patch area[1]. This assumes that existing vegetation patches are indicative of former landscapes and that such data is available or obtainable for your locality. A complicating factor is that minimum patch size may vary throughout a species' range so reliable local information is needed.

Example 1: Hooded Robin

Hooded Robin territories throughout Australia are between 5ha and 50ha in size. Small territories are defended in the breeding season with larger territories occupied throughout the rest of the year.[2] In the ACT, the Hooded Robin is the most sensitive species to patch size, structural complexity and isolation[2] (see Box at right). However, the same species at Armidale, NSW was found to use low quality habitats including heavily grazed paddocks[4]. Local knowledge of species' behaviour is important.

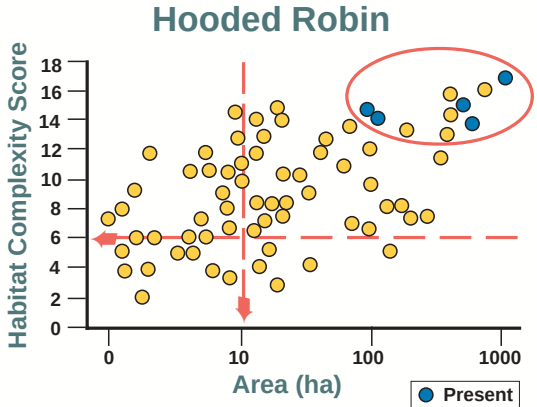
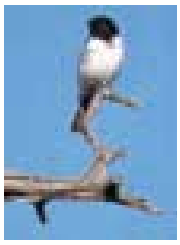


Diagram courtesy D. Freudenberger.



McCann collection, NRE

Hooded Robin

Example 2: Fuscous Honeyeater

On the northern plains of Victoria, Fuscous Honeyeaters in large intact remnants have been found to occur at densities four times greater than those in small fragments. Thus, whilst small fragments may support a species, taken alone they may not support healthy and secure populations of that species.[3]

Example 3: Rufous Whistler

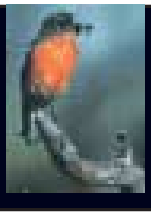
Size is not independent of other variables. David Freudenberger of CSIRO modelled the probability of a Rufous Whistler occurring in a 1ha remnant with no shrubby understorey as 1.4%, but found there is a 15.6% chance that it will occur in a 10ha remnant with a 20% cover of understorey shrubs.[2] If patch size is not able to be increased, there may be alternative management strategies, such as restoring shrub cover and connectivity, to improve habitat for a species.

McCann collection, NRE

Rufous Whistler

Aim–to determine which species (mammal, bird, reptile, amphibian, fish, invertebrate) are most sensitive to, and indicative of, environmental thresholds in your district.

[1]Lambeck, R.J., (1999). *Landscape Planning for Biodiversity Conservation in Agricultural Regions: A case study from the wheatbelt of Western Australia.* Biodiversity Technical Paper No. 2, Department of Environment and Heritage, Canberra. [2]Freudenberger, D. (1999). *Guidelines for Enhancing Grassy Woodlands for the Vegetation Investment Project.* CSIRO Wildlife and Ecology, Canberra. p14. [3]Stothers, K. ed., (1999), *Wildlife in Box-Ironbark Forests...Linking Research and Biodiversity Management,* Department of Natural Resources and Environment, Melbourne. [4]Fitri, L.L., (1993). *Ecology and Behaviour of Hooded Robins* (Melanodryas cucullata) *in the Northern Tablelands of New South Wales.* Unpub. M.Sc. Thesis, University of New England, Armidale.



The more types of habitat, the better

Andrew Corrick

Wetland

Leigh Ahern

Forest

John Seebeck

Grassland

Stephen Platt

Streamside

The single most important factor in determining how many species will be present in a landscape is the range of habitats present. Most plants and some wildlife species are habitat specialists and rarely occur beyond their preferred habitat.

As discussed earlier (page 14), plant associations vary because of many factors. For example, the fertile volcanic plains of southern Victoria supported a diverse grassland flora and wildlife such as Eastern Barred Bandicoot, Striped Legless Lizard and Eastern Quoll. The attributes of many grassland species prevent them from surviving in alternate habitats–they are specialists that can cope with frequent fire, severely dry summers and heavily cracking clay soils. Grazing by native herbivores is another important component of grassland ecosystems.

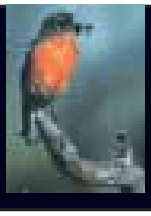
A study of birds at 195 large sites in the Forbes area of New South Wales found that vegetation type had a more pronounced effect on the bird community than the area effect.[1]

Include the range of habitat types in the local landscape—hilltops, slopes, creeklines, wetlands—to enhance the range of species for which habitat is provided. It can be better to protect two large patches of different vegetation types than one enormous patch of the same type.

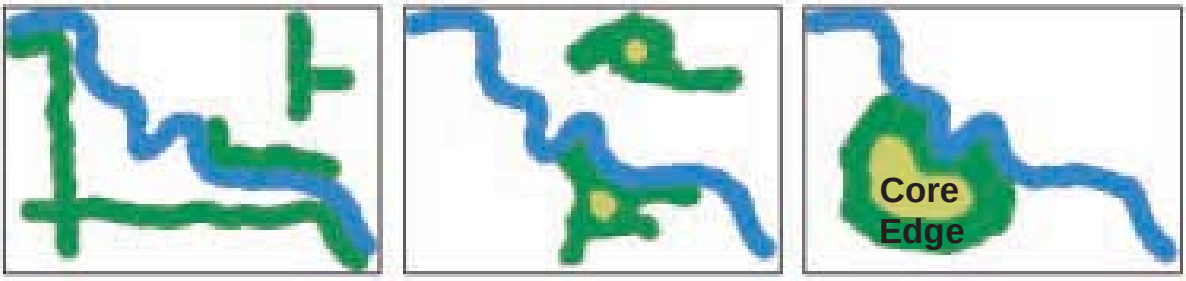
In rural landscapes, the habitats in most urgent need of conservation are the grasslands, grassy woodlands, shallow freshwater wetlands and lowland riparian types. These are the habitat types associated with the more fertile agricultural areas.

Aim–to retain, restore or recreate a range of habitat types consistent with local landscape conditions and to use pre-1750 EVC maps, available from NRE or your local CMA, to determine habitat type.

[1]Major, R., Christie, F. and Gowing, G., (1998). *The Value of Remnant Vegetation for Birds in the New South Wales Wheatbelt: Final report for the Environmental Trusts.* Australian Museum, Canberra.



The more consolidated, the better



Linear, no core areas | *Irregular, minimal core areas* | *Circular, maximum core areas*

The same amount of habitat arranged in different ways affects the amount of core area.

Compact patches of vegetation have less edge and a greater 'core' area. Core areas–areas free of edge disturbances—suit some species that are affected by edge disturbances such as surrounding agricultural land uses, or the activities of the species that occupy surrounding habitats (e.g. predators, competitors). In one study, nest predation in linear strips of habitat (62% of nests) was nearly twice that in large remnants (34%)[1]. Some species, such as kangaroos, benefit from increased edge habitat that provides shelter near pasture. Most of rural Victoria suffers from an overabundance of edge species. Large compact areas of habitat are needed to provide for those species affected negatively by edges, particularly in agricultural areas. A reduction in the amount of edge assists management by minimising invasion by weeds and reducing disturbance from surrounding land uses.

Aim–to provide core habitat areas away from edge disturbances.

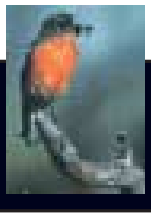
Box 8: How Noisy Miners dominate linear habitats

The Noisy Miner is a native bird that lives in groups of 6-30 individuals. Together, a group of Noisy Miners defend their territory by aggressively attacking other birds. Noisy Miners often dominate small bushland remnants (<10 ha) and are a common feature of linear strips of native vegetation, such as occur along many roadsides. They are less abundant in larger blocks of vegetation (>40 ha)[2].

The exclusion, through group aggression, of small insectivorous birds by Noisy Miners[3], and their communal relationship with sap-sucking scale-like psyllid insects, is considered a factor in the dieback of trees in rural areas. Miners also compete for territory with declining woodland birds (see p57), such as the Grey-crowned Babbler. Noisy Miners prefer not to forage in remnants with a dense understorey of shrubs or grasses[2].

Peter Menkhorst

[1]Major, R.E., Christie, F.J., Gowing, G. and Ivison, T.J., (1999). *Elevated Rates of Predation on Artificial Nests in Linear Strips of Habitat.* J. Field Ornithol. 70(3): 351-364. [2]Stothers, K. (ed), (1999). 'A Dominant Bird...Habitat Alteration and Noisy Miners in *Wildlife in Box-Ironbark Forests...Linking Research and Biodiversity Management Information Kit'.* Department of Natural Resources and Environment, Melbourne. [3]Grey, M., Clarke, M.F. and 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. Surrey Beatty & Sons, Sydney.



Consider edge effects

Edges

Edges are unique environments which affect different species in different ways - positively and negatively. Expect to see more Mistletoe plants, more weeds and more Noisy Miners at edges.

Where one kind of habitat meets another there will be an edge. Edge habitats are subject to different environmental conditions than core areas surrounded by similar habitat. Edges offer a greater variety of resources to those species that are able to utilise different elements of adjacent habitats. In natural situations, this can mean that edges have high species diversity. However, where native vegetation abuts unfavourable land uses, as in many rural agricultural situations where paddock or crop meets native vegetation, edges can affect some native plant and animal species negatively. Species near edges may be influenced by increased light penetration, salt-laden winds, increased rates of predation, competition, weed invasion, noise, and adjacent landuse including chemical spray drift and soil disturbance[1].

Ian McCann collection, NRE.

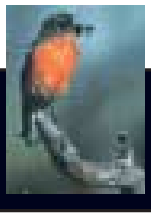
A male Mistletoebird

Edge effects can exert an influence on different species for varying distances. For example, in one study *vegetation structure* was affected for less than 13 metres from the forest edge but the *distribution of bird nests* indicated an edge influence of from 9 to 64 metres[2]. Typical edge species in rural Victoria are Eastern Grey Kangaroos, White-winged Choughs and Noisy Miners. Populations of edge-liking species tend to be higher in rural environments because of the high degree of fragmentation present. Thus, providing for species that need larger patches of vegetation with 'core' habitat is usually a higher priority.

Edges, connectivity, isolation, buffers and fragmentation are inter-related concepts.

Aim–to develop core areas for edge sensitive species by reducing the edge-to-area ratio (i.e. make the area consolidated rather than long or convoluted). It's worth remembering that there are few straight lines in nature and reducing edge doesn't mean making perfect circles.

[1]Rowley, L., Edwards, R., and Kelly, P. (1993). *Land for Wildlife Note 23 'Edges - their effect on vegetation and wildlife'.* Department of Conservation and Natural Resources, Melbourne. [2]Gates, J.E. and Mosher, J.A., (1981). *A Habitat Approach to Estimating Habitat Edge Width for Birds.* Am. Midl. Nat. 105:189-92.



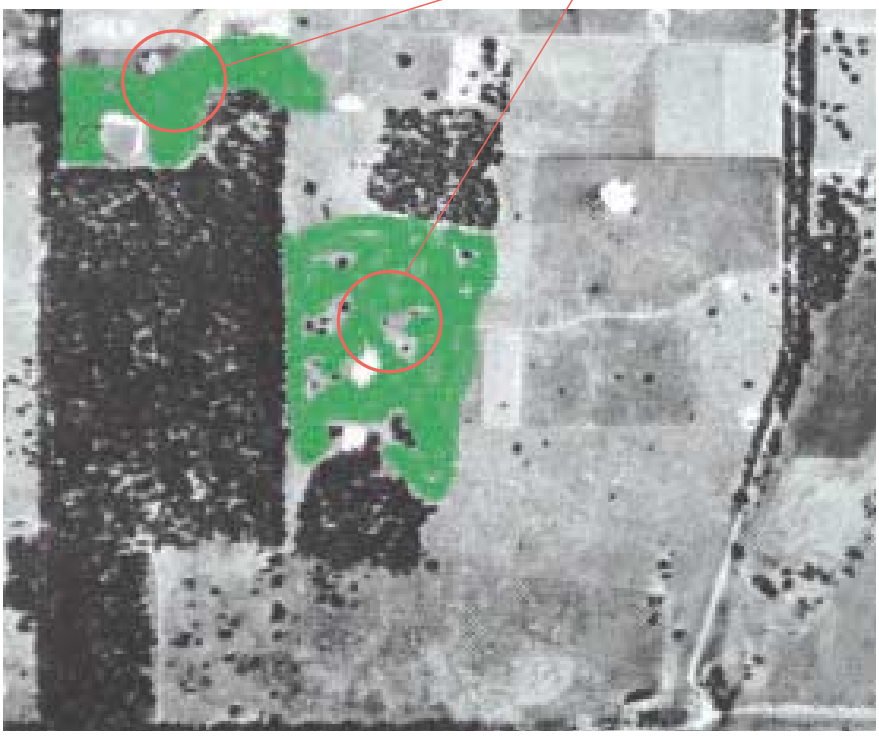
Include buffers

The role of a buffer is to separate two differing and potentially incompatible landuses with an intermediate complementary landuse.

Buffers can have many uses, such as reducing the rate of weed infestation, intercepting nutrient flow, reducing salt or solar intrusion, or removing an edge along which predators operate.

Buffers need to be designed to suit a particular purpose. For example, a 100m buffer has been recommended to protect breeding waterbird colonies from disturbance.[1] In another study, a buffer of 275m around a wetland was recommended to protect 100% of freshwater turtle habitat or 73m to protect 90%[2]. A minimum 30m buffer alongside permanent and temporary streams and standing waterbodies is recommended, in one review, for protecting water quality and stream biota in forests.[3] The buffer might simply be a set-back area from a waterbird colony where disturbance by people or machines is restricted.

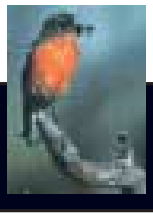
Aim–to place compatible landuses side-by-side.



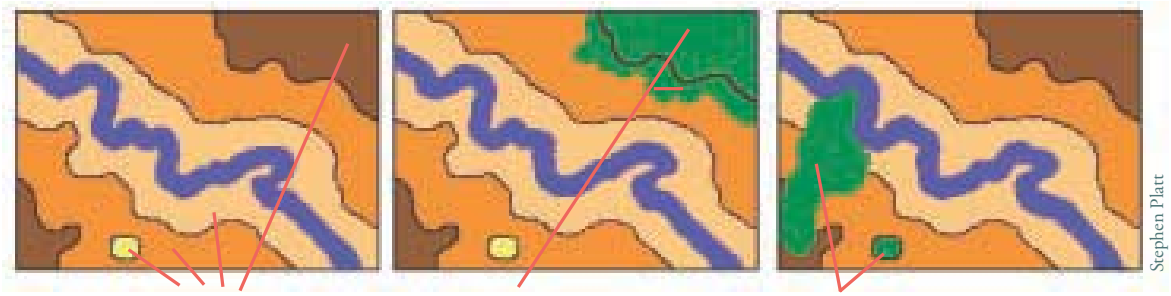
Department of Natural Resources and Environment

This diagram indicates how a buffer might be used to protect remnant vegetation from pastoral or cropping uses on this property. The buffer could be a woodlot or agroforest involving non-environmental weeds or may simply be a permanently fallow paddock that is never sprayed, fertilised or otherwise used in a way that might damage the bush. Space has been left for enlarging the bush area and joining it with outliers.

[1]Rodgers, J.R. and Smith, H.T., (1994). *Set-back Distances to Protect Nesting Bird Colonies from Human Disturbance in Florida.* Conservation Biology, 9:1, 89-99. [2]Burke, V.J. and Gibbons, J.W., (1995). *Terrestrial Buffer Zones and Wetland Conservation: A Case Study of Freshwater Turtles in a Carolina Bay. Conservation Biology,* 9:6, 1365-69. [3]Dignan, P., Kefford, B., Smith, N., Hopmans, P. and Doeg, T., (1996). *The Use of Buffer Strips for the Protection of Streams and Stream Dependent Biota in Forested Ecosystems.* Centre for Forest Tree Technology, Department of Natural Resources and Environment, Melbourne.



Include all land classes



Stephen Platt

Four land classes around a watercourse

Habitat created on two land classes

Native vegetation

The same amount of habitat created on all four land classes.

Much of Victoria's remnant vegetation is confined to hilltops and rocky areas that are unproductive for agriculture. Exceptions to this are many roadsides, river frontages and public lands, such as cemeteries and military areas, where natural areas still occur at lower elevations.

Inclusion of more sites with higher natural nutrient status, such as near rivers, along gullies, and alluvial fans, will not only provide for plants and plant communities that occur in these areas but can also provide resource-rich wildlife habitat for species with high energy requirements (Box 9, p32).

Less fertile sites also have their own set of values and support particular species. For example, Brush-tailed Phascogale nest trees and Spotted Nightjar nests are often found on ridges, and diverse communities of rainforest plants can occur on relatively infertile soils. However, for the same habitat type, the more favourable areas, those where nutrients and water are bountiful, are most likely to remain productive when others are not. This enables species with high energy requirements to survive in tough times.

Naturalists have observed that, during events such as severe droughts, birds under stress tend to congregate and persist in resource-rich sites that remain productive. These special sites ('drought refuges') often coincide with fertile soils, where large established plants have tapped into permanent water reserves.

Many of the most threatened plant communities in Victoria, such as grasslands, grassy woodlands and shallow freshwater wetlands, are associated with fertile soil types. Though these areas will also often be the most productive for agriculture, it is worth considering where circumstances may permit fertile sites to be managed primarily for wildlife. For example, a bend in a river that is subject to flooding or rock-strewn paddock on the volcanic plains may be less suitable for agriculture but ideal for other values.

Aim–to include fertile land classes as priority areas for wildlife habitat.

Box 9: Rich habitats support more wildlife

a) *Koalas:* The distribution and population dynamics of Koalas is linked to the nutrient status of soils. Eucalypts, especially those growing in nutrient poor soils, produce chemical defences (toxins) as protection against being eaten[1]. Most of the optimum Koala habitat has been cleared.

b) *Box-Ironbark gullies:* Gully habitats in Box-Ironbark Forest harbour a different and richer bird community than the surrounding ridges[2]. Possums and antechinus are also more abundant in gullies. Possums mainly breed in gully habitats.

c) *Small mammal abundance:* A survey[3] in 1995 of the small mammal fauna at 13 sites within 500 000 hectares of public forest in south-eastern New South Wales found that the highest *abundance* of small mammals coincided with lithology of medium to high nutrient status, but there was wide variation. An earlier (1984) study of arboreal mammals[4] found that the fauna was concentrated in particular eucalypt communities, mostly those on soils of one geological type producing soils of high fertility.

Heatheranne Fumi

Extensive clearing of low altitude habitats means that we can't necessarily rely upon current distributions as being true to former ranges of a species such as the Koala (above).
(Left) Rufous Fantail

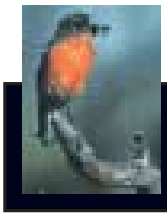
d) *Breeding birds - success in fledging:* Though it is tempting to think that richer habitats might mean increased breeding success of birds (more food for the young), breeding success in birds is primarily determined by predation. Losses due to predation exceeded 80% in several studies[5]. Site conditions are just one of many factors affecting wildlife populations. However, stable and resource-rich environments are likely to support denser populations of many species.

McCann collection, NRE

McCann collection, NRE

Small mammals, such as this Long-nosed Potoroo, are not evenly distributed across the landscape. Higher population densities occur where food, shelter and other resources they require coincide. Long-nosed Potoroos occur in dense heathy forests, which are often on relatively low nutrient soils. Each species is adapted to its environment. Soil fertility is not the only factor.

[1]Creagh, C. (1992). *Soil Clues to Koala Country.* Ecos 73: 11-13. [2]McNally, R. and Soderquist, T., (1999). *The High Points of Low Areas...Forest Gullies.* In Wildlife in Box-Ironbark Forests Kit. Department of Natural Resources and Environment, Victoria. [3]Catling, P.C. and Burt, R.J., (1995). *Studies of the Ground-dwelling Mammals of Eucalypt Forests in South-eastern New South Wales: the Effect of Environmental Variables on Distribution and Abundance. Wildl. Res.*, 22, 669-85. [4]Braithwaite, L.W., Turner, J. and Kelly, J., (1984). *Studies on the Arboreal Marsupial Fauna of Eucalypt Forests being Harvested for Woodpulp at Eden, N.S.W. III. Relationships Between Faunal Densities, Eucalypt Occurrence and Foliage Nutrients, and Soil Parent Materials. Aust. Wildl. Res.* 11, 41-8. [5]Ford, H. A., (1989). *Ecology of Birds–an Australian perspective.* Surrey Beatty & Sons Pty Limited, Chipping Norton.



Include watercourses

Watercourses and wetlands are special environments. Water is such a critical element in the lifecycle of most species, including humans, that they are highly dependent on water availability and quality. For example, many species require wet environments for egg-laying (e.g. frogs, dragonflies, fish) or are adapted to feeding on aquatic fauna (e.g. platypus). The availability of water determines whether individuals of a species can survive drought, a frequent natural phenomenon in Australia. The importance of water is illustrated by an example from south-western Queensland where a drought in 1979/80 killed up to 63% of Koalas. It was the Koalas living in better quality habitat near watercourses that survived[1].

Watercourses and wetlands are habitats that have their own suite of species. These occur in the water and along the banks where riparian or wetland vegetation exists. This adds to the overall diversity of species in the landscape. Some wetlands are permanent, some seasonal, some freshwater, some naturally saline.

The Birds on Farms Survey[2] (see p58) found that bird diversity was 22% greater on farms that have a river or major creekline, compared to farms without them.

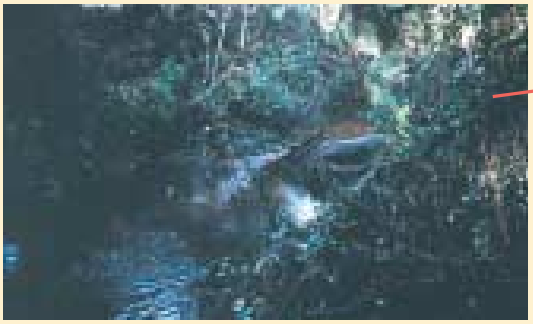
Watercourses are also particularly sensitive areas in terms of land management. They can be subject to extreme conditions caused by flooding or flow alteration. Protecting and managing watercourses with native vegetation is an integrated solution that provides both wildlife habitat and prevents land degradation. The combination of water, soil fertility and edge diversity can make riparian areas particularly rich for wildlife.

Aim–to include watercourses and wetlands as areas managed primarily as wildlife habitat.

[1]Martin, R. and Handasyde, K., (1999). *The Koala–Natural history, conservation and management.* 2nd edition. University of New South Wales Press, Sydney, p33. [2]Barrett, G., (2000). *Birds on Farms: Ecological management for agricultural sustainability.* Supplement to Wingspan, Vol. 10, No. 4. Birds Australia, Hawthorn.

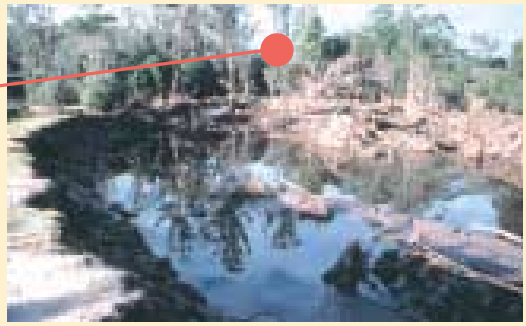
NRE

Barred Galaxias, one of our beautiful native freshwater fish.



Bill O'Connor

Cabbage Tree Creek after the 1999 floods. Bankside vegetation provides erosion protection.



Bill O'Connor

100 metres upstream from the site at left. Lack of bankside vegetation corresponds with erosion and loss of tonnes of topsoil.

Provide for threatened species

Some species, some sites and some habitats have special qualities and are deserving of particular attention. Private land is important for the conservation of threatened species and threatened vegetation types. In Victoria, over half (53%) the area of endangered Ecological Vegetation Classes in the State is on private land. In some bioregions, up to 98% of the remaining vegetation on private land is endangered, vulnerable or depleted[1]. In Victoria, threatened species and communities are classified according to IUCN categories (see www.iucn.org/).

If the aim is to protect all threatened plant and animal species in a landscape then it is necessary to know where they occur and where habitat needs to be provided or management undertaken to support them (Box 10). Some species may be visitors to the area and so only observed occasionally (e.g. Superb Parrot) or may appear seasonally (e.g. orchids). Declining species are also important to consider (p57).

Several sources of assistance are available for identifying which threatened species need attention in local landscapes (see p42). These include:

- BioMaps (these can show the location of recorded threatened species of flora and fauna) and Biodiversity Action Plans. Contact your local Department of Natural Resources and Environment office.
- Information available from your local Shire or Catchment Management Authority office.
- Local flora and fauna survey reports, including those prepared for development proposals. These may be lodged in your local library or Shire office.
- Local naturalists.

Because the management of threatened species is unforgiving of mistakes, it is always best to work with the expertise of a professional biologist. For the same reason, the exact location of a threatened species may be kept secret.

You may also wish to record other important sites such as a tree that is the last of its kind or on the edge of its range, or bushland associated with local aboriginal culture.

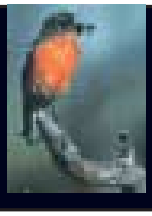
Aim–to identify threatened species, threatened ecological communities and sites of significance in the landscape.

Box 10: Sunshine Diuris– a grassland specialist

Sunshine Diuris *(Diuris fragrantissima)* is a highly endangered orchid on the verge of extinction. It occupies grassland habitats of the Victorian Volcanic Plains. Insect pollinators, such as native bees and beetles, fire and fungal associations, are components of its ecosystem.

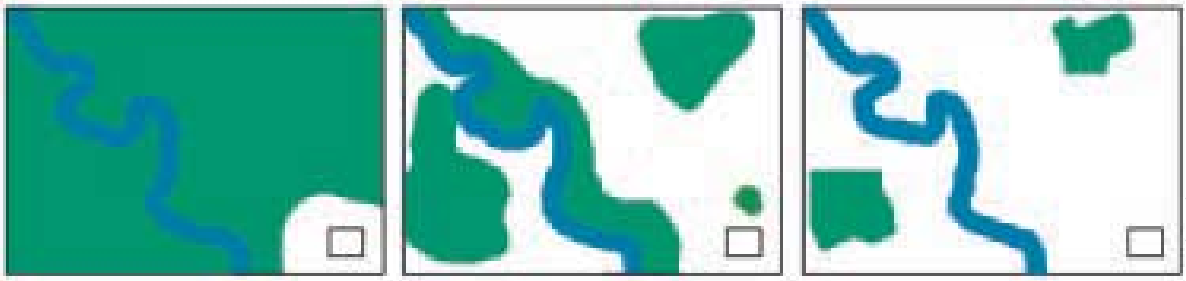
Stephen Platt

[1] Lowe, K.W., Preece, K., Amos, N. and Parkes, D. (2000). *Victoria's Biodiversity Reporting System: a bioregional approach to refining priorities and partnerships for biodiversity conservation,* in 'The Second Southern Hemisphere Ornithological Conference, Griffith University, Brisbane'. Birds Australia Report Series Number 9. Birds Australia: Melbourne.



The more connected, the better

Link-



Stephen Platt

Time 1 *Time 2* *Time 3*

Less habitat, decreasing patch size and increasing distance between patches are all consequences of fragmentation.

Fragmentation is the process of continuous habitat being broken into smaller pieces with an intervening, often inhospitable, environment separating patches[1]. Fragmentation over time results in direct loss of habitat, smaller-sized patches and an increasing distance between patches (see diagram). It affects ecological processes and the composition of the fauna (see Edges, p29). In Victoria, the intervening environment is usually a farm paddock of introduced pasture species. Wildlife species are affected in different ways. In terms of movement, to a small gecko the paddock may be a total barrier to movement, whereas to a parrot farmland may be flown across but there is an increased risk of being attacked by predators. To a Wedge-tailed Eagle, it may have minimal consequence for travel. *Area-limited* and *dispersal-limited*[2] species are particularly affected by fragmentation.

Species are likely to become extinct in small isolated patches of habitat, because of the impact of random events on small populations. Small populations have a smaller gene pool and thus are less able to cope with change, such as the introduction of a disease, skewed sex ratios, and individual deaths. Catastrophic events, such as a fire, flood and drought are more likely to affect all individuals in a small patch than a large one. Thus, fragmentation can lead to species loss. Studies on the Northern Plains of Victoria indicate a rapid decline in bird species richness when total tree cover falls below 10%[3] of the landscape (see p47).

Aim to:

- expand the overall area of habitat
- maximise the quality of existing habitat
- increase connectivity with linkages
- minimize the impact of surrounding landuse

Sharon Downes

How can road and stream sides, and patches, contribute to linkages in the landscape?

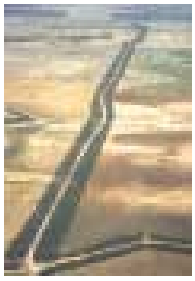
[1]Saunders, D.A., Hobbs, R.J., Margules, C.R., (1991). *Biological Consequences of Ecosystem Fragmentation: A Review.* Conservation Biology 5:1 pp18-28. [2]Lambeck, R.J., (1999). *Landscape Planning for Biodiversity Conservation in Agricultural Regions: A case study from the wheatbelt of Western Australia.* Biodiversity Paper No. 2. Department of the Environment and Heritage, Canberra. [3]Bennett, A.F. and Ford, L.A., (1997). *Land Use, Habitat Change and the Conservation of Birds in Fragmented Rural Environments: a landscape perspective from the Northern Plains, Victoria, Australia.* Pacific Conservation Biology, Vol. 3: 244-61, Surrey Beatty and Sons, Sydney.

Include corridors

Designing an effective wildlife corridor that meets a particular purpose is not as easy as it might seem (Box 11). The first step is to identify the purpose of the corridor. This requires identifying the species it is designed to benefit and understanding their needs. For example, a corridor designed to assist Carpet Pythons will need to account for relatively slow dispersal whilst Eastern Rosellas (pictured with Peregrine Falcon) may benefit from a simple upper canopy flight path. Where possible, corridors should be designed to include all the habitat features typical of the vegetation type. Minimum corridor widths are determined by the needs of the species they are to serve. Patch widths of 40 m were found to provide habitat accessible to Regent Honeyeaters, otherwise in competition with Noisy Miners (p 28), in central Victoria[1].

Some important principles include[2,3]:

- The wider, the better.
- Corridors should provide habitat as well as a pathway for movement.
- Narrower corridors can be supplemented by regular enlarged areas of habitat or 'nodes'.
- Context is important. For example, corridors linking gully to ridge have been found to support more species than in a single land system but may not provide continuity of suitable habitat for some species to move through a landscape.
- Corridors may have negative impacts and so need to be carefully assessed and monitored. An example of a corridor that may be harmful is one that encourages wildlife to travel toward a busy road.
- Corridors should be planned to complement regional conservation goals.



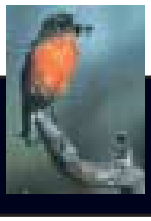
(L) McCann collection, NRE (R) NRE

(L) Corridors must be interpreted according to species' needs. (R) A typical linear roadside corridor in the Mallee.

Box 11: Wildlife of corridors in central Victoria (cover photo & p35)

The wildlife inhabiting corridors of vegetation in the Strathbogie Ranges was investigated by comparing forest blocks (20-80ha), corridors 'near' to blocks and 'distant' corridors[4]. In the forest blocks, up to 8 Common Ringtail Possums, 9 Koalas and 6 Mountain Brushtail Possums were found per hectare*. Common Brushtail Possums were absent in the forest block. In the 'near' corridors, the density of animals increased, including more Sugar Glider and Common Ringtail Possums, and the Common Brushtail Possum was observed. In distant corridors the number of species declined. Long-nosed Bandicoot, Bush Rat, Eastern Grey Kangaroo and Black Wallaby were no longer observed. In contrast, the density of animals increased being made up mainly of Common Ringtail and Common Brushtail Possums. Interestingly, Greater Gliders were present in near and distant corridors but only if distant corridors were greater than 32m wide. Unlike in the forest, most Brown Antechinus found in corridors were male.

[1]Mann, S. and Davidson, I., (1993). *The Mollyullah to Glenrowan District Regent Honeyeater Project.* Preliminary report for the Department of Conservation and Natural Resources, Benalla. [2]Wilson, A. and Lindenmeyer, D., (1996). *Wildlife Corridors–their potential role in the Conservation of biodiversity in rural Australia.* Aust. J. Soil and Water Conservation 9 (2): 22-27. [3]Bennett, A.F., (1990). *Habitat Corridors: their role in wildlife management and conservation.* Department of Conservation and Environment, Melbourne. [4]Downes, S.J., Handasyde, K. and Elgar, M., (1997). *The Use of Corridors by Native Mammals in Fragmented Australian Eucalypt Forests.* Conservation Biology 11:718-726. *This density is many times higher than recorded in other studies.



Provide stepping stones

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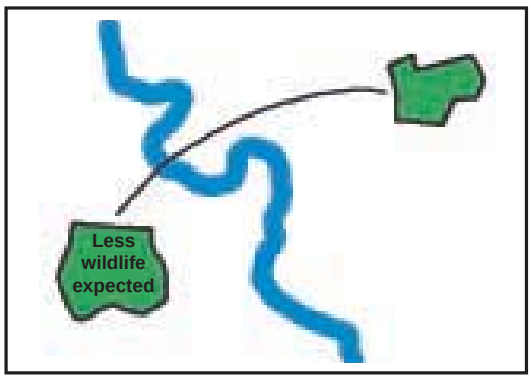


Stephen Platt

Providing stepping stones between patches assists dispersal-limited species.

Stepping stones are patches of habitat positioned such that they increase connectivity of habitat in the landscape. Research indicates that the amount of surrounding vegetation affects the wildlife present in a patch. A patch surrounded by a number of other patches is expected to contain more wildlife than one without. Larger stepping stones of high habitat quality have less edge effects and can provide longer-term habitat for more species. Roadside and streamside patches of habitat often provide stepping stones between larger habitat patches, particularly for migratory species (Box 12) or those with minor dispersal limitations.

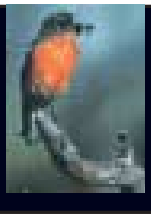
In the Holbrook region of New South Wales, focal species (see p26) were used to determine how the space between habitat patches and patch quality affects woodland birds[1]. Patches of at least 6ha with relatively complex habitat (e.g. understorey shrubs, large trees, mixed species) were required for the majority of woodland birds, with the exception of the most sensitive species. Patches that were smaller than 6ha, but not further than 1km from another patch, were more likely to support a diversity of moderately sensitive woodland birds than more isolated patches. A similar study on birds in ACT and NSW recommends establishing patches of habitat within 500-1000m of each other[2].

Aim–to create a system of habitats across the landscape.

Box 12: How stepping stones help rainforest pigeons

Rainforest frugivores (fruit-eaters) in northern New South Wales move between 'habitat islands' in search of fruit[3]. These stepping stones enable dispersal along the coast and between low and high altitude forests in the absence of continuous 'corridors' of vegetation. Prior to clearance, rainforests were fragmented by eucalypt forests so rainforest pigeons have a long history of movement between islands of sought-after vegetation.

[1]Collard, S. (2000). *'Re-birding' the Holbrook Landscape - A revegetation strategy for the Upper Billabong Catchment.* Holbrook Landcare.
[2]Freudenberger, D. (1999). *Guidelines for Enhancing Grassy Woodlands for the Vegetation Investment Project.* CSIRO Wildlife and Ecology, Canberra. [3]Date, E.M., Ford, H.A. and Recher, H.F., (1991). Frugivorous Pigeons, Stepping Stones, and Weeds in Northern New South Wales. In *Nature Conservation 2: The Role of Corridors* ed. by D. A. Saunders and R. J. Hobbs. Surrey Beatty & Sons, Chipping Norton.



Integrate with surrounding landuse

Matrix

A patchy landscape is likely to support more wildlife species. Patchiness is created by both the type of habitat or landuse and the way it is managed. Consider a paddock. Depending on whether it is regularly grazed or intermittently grazed with grasses allowed to form a dense ground-layer and run to seed, it is quite a different patch to wildlife. Landholders know only too well how some species are attracted to patches such as crops and orchards which provide abundant food resources.

Birds see natural habitats as consisting of a range of patches of varying quality[1] and, even in degraded landscapes, they can use a wide range of sites (see Box 13).

Surrounding landuses impinge directly on wildlife habitat in various ways. These include as sources of environmental weeds, pesticide drift or noise disturbance. They may provide refuge for introduced predators and competitors. Indirect effects also occur. For example, overuse of water for primary production may reduce the amount available for the environment.

Thus, we can envisage a future rural landscape consisting of specific areas in which nature conservation is the *primary* objective within a landscape in which sympathetic agricultural and other practices are conducted. The Birds on Farms study[2] recommends a minimum of 30% continuous tree cover across the farm for sustainability with at least 10% managed primarily as wildlife habitat.

A challenge ahead of us is to develop agricultural systems that are compatible with native biodiversity conservation.

Box 13: How patches provide resources

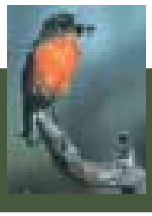
Within native vegetation: Common woodland birds at New England, New South Wales are spread patchily through a forest. For example, over a four year period the breeding territories of Rufous Whistlers were found to occupy only 40% of the available area.[1]

Beyond native vegetation: Noisy Friarbirds may undertake long excursions from their communal nesting areas with radio-tracked birds detected at scattered trees 3 kms distant and, another bird, in a garden 9 kms away.[2] In this case the garden is a useable patch within the landscape. Bats in northern Victoria utilise isolated paddock trees in foraging journeys[3].

David Tarnall & Birds Australia

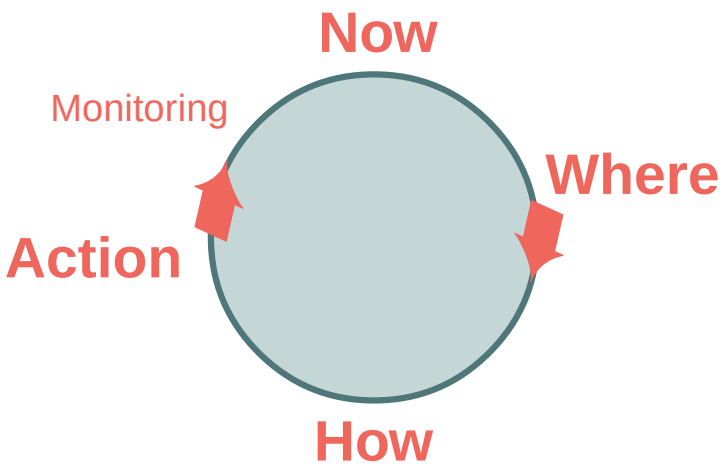
An aerial view of the landscape shows it quilted with patches of habitat of differing value to various species. Natural habitats provide the core area for nature conservation. Unfortunately they are missing in this scene.

[1]Ford, H. and Barrett, G., (1995). The Role of Birds and their Conservation in Agricultural Systems. In Bennett, A., Backhouse, G and Clark, T., *People and Nature Conservation: Perspectives on Private Land Use and Endangered Species Recovery.* Trans. Roy. Zool. Soc. NSW, Surrey Beatty and Sons, Chipping Norton, pp128-134. [2]Barrett, G., (2000). *Birds on Farms: Ecological management for agricultural sustainability.* Supplement to Wingspan, Vol. 10, No. 4. Birds Australia, Hawthorn. [3]Lumsden, L.F., Bennett, A.F., Krasna, S.P. and Silins, J.E., (1995). The Conservation of Insectivorous Bats in Rural Landscapes of Northern Victoria. In A. Bennett, G. Backhouse and T. Clark (ed's) *People and Nature Conservation: Perspectives on Private Land Use and Endangered Species Recovery.* Royal Zoological Society of New South Wales, Sydney. pp. 142-8.



PLANNING

DEVELOPING A PLAN



A strategic planning cycle

Planning is an essential precursor to undertaking effective land management. The urge to get in there and make change needs to be resisted until experience with the area and knowledge of its special characteristics are understood. Landscape planning involves being the detective and investigating people and places. It involves bringing people together, such as landholders, community group representatives and local and regional government, to think about the future and what it could be like and to make joint decisions. The planning process used in this guide is summarised below:

Now ..... involves a stocktake of existing resources. These might include remnant vegetation, sites of significance, species lists and so on.

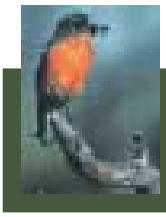
Where... is a description of where you want to get to, your vision. It may set targets for the area of land to be managed as wildlife habitat (e.g. 30% of the landscape) or for the requirements of particular species.

How ..... is an assessment of what needs to be put in place to achieve the vision. It includes consideration of barriers to success.

Actions.. are the final but critical stage. Develop an action plan that states what will be done, when and allocate sufficient resources (e.g. 'Fence Remnant A in December this year. Budget for $500 materials and labour.').

Monitoring should be ongoing and integrated throughout. It is part of an adaptive management (adapt to what is learnt) approach, giving feedback on what is working and where change may be required. The cycle repeats itself.

The following pages look at each of these steps in more detail.



A birds-eye view

Now

NRE

A typical landscape in south-eastern Australia is composed of a mosaic of fragments of pre-European (pre-1750) vegetation, topography including hills and watercourses, agricultural areas and material assets such as homesites, utilities and roads.

Some questions to ask about your landscape include:

- Is the area high or low in the catchment?
- Where are the large areas of remnant native vegetation?
- Does a river or stream run through the area?
- Does roadside vegetation offer potential linkages?
- Can a system of habitats be created?
- How can neighbours work together? For example, to gether they may develop larger areas than one property could support alone or they could co-operate to link habitats in different areas.

Resources:

Aerial photographs, at different time periods, are available (see Getting Help, page 63).

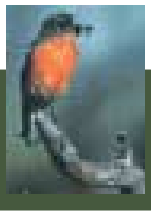
Suggestions:

- Take a flight over your landscape. Share the cost with neighbours.
- Use a grid overlay to estimate the current percentage of native vegetation cover (see p46).

10% plus

To maintain woodland birds in agricultural landscapes it has been estimated that 30% native tree cover, a *minimum* of one third managed to promote wildlife, is required.

Barrett, G., (2000). *Birds on Farms: Ecological management for agricultural sustainability.* Supplement to Wingspan, Vol. 10, No. 4. Birds Australia, Hawthorn.



Stocktaking

Now

A stocktake involves assembling information on the native flora and fauna and ecosystems of the region and the issues that affect them.

Gather information on:

- Ecological Vegetation Classes and vegetation associations.
- The location and quality of remnant vegetation. Record 'old growth' areas. In rural landscapes, these might be individual relict trees.
- Threatened and focal species and other locally significant species.
- Sites of Significance.
- Threatening processes (see page 59)
- Benchmarks–these are values relating to the expected diversity or quality of the site such as number of shrub species and shrubs/ha typical of the habitat.

Sources include–Department of Natural Resources and Environment*, Catchment Management Authority, Local Government, Non-Government Organisations including naturalist clubs, libraries and local residents (Box 14, p42). Contact details are listed on page 63.

Aim–to place all the information on biodiversity assets onto one map. Acetate sheets can be used to separate your stocktake (now) from future actions (where).

*A valuable reference is the local Biodiversity Action Plan.

Keep what you've got

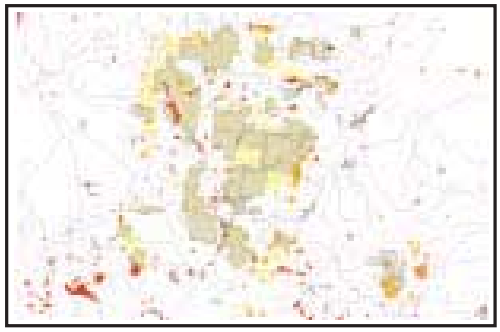
The first rule-of-thumb is to keep what pre-1750 native biodiversity you have got left.

Bioregional Conservation Status

Ecological Vegetation Classes can be allocated a 'threatened status' similar to that for threatened species. For more information see Victoria's Draft Native Vegetation Management Framework.

- Presumed extinct
- Endangered <10% remaining
- Vulnerable 10-30%
- Depleted 30-50%
- Least concern >50% & no degradation, etc.

Public land hatched



Department of Natural Resources and Environment, Geospatial Library

NRE maps showing pre-1750 and current EVCs for the same region classified by Bioregional Conservation Status. Note the dramatic decline in the EVC shown in red.

Box 14: Biological data sources

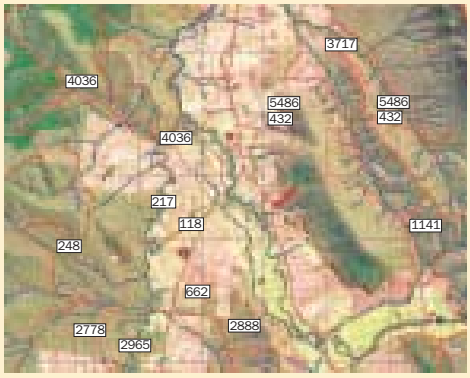
Information	Source (see Getting Help, p63)
Satellite Imagery	Biomap NRE (see below)
Aerial Photography	Qasco VicImage (see 'aerial photography' in Yellow Pages)
Vegetation type (EVC)	
current	Biomap NRE, field survey
pre-1750	Biomap NRE
Plant species	Flora Information System NRE
Vegetation quality	assessment using NRE's Habitat Condition Assessment Form or Land for Wildlife Note 40
Wildlife species	Atlas of Victorian Wildlife, Aquatic Fauna Database, Victorian Wetlands Database NRE, field survey
Benchmarks	NRE (see pages 41, 44 re: benchmarks)
Sites of biological significance	Biosites NRE, local Shire, local naturalists
Sites of aboriginal significance	Aboriginal Affairs Victoria, local Shire, local communities
Threatened species	Biomap, Bioregional Network Analysis, Atlas of Victorian Wildlife, Flora Information System, Aquatic Fauna Database, Victorian Wetlands Database NRE, local Shire, local naturalists, field survey
Geology soils	Victorian Soil and Land Survey Directory at Victoria's Resources Online http://www.nre.vic.gov.au/web/root/Domino/vro/soilsurv.nsf/HTML/Index?Open, Land Conservation Council reports (library)
Sites of geological significance	Land Conservation Council, Environment and Conservation Council and regional reports (library)
Hydrology	Biomap NRE, local Catchment Management Authority

About Biomap

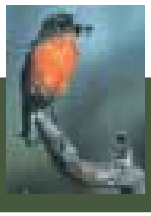
BioMaps are available from NRE regional offices at 1:100 000 or 1:25 000 scales and can show, in addition to roads, streams, locations, railway lines and contours:

- Background - land management, vegetation, Landsat imagery (satellite).
- Management - Local Government Area, Forest Management Area, Catchment Management Authority, Victorian Bioregion, Parcel (of land).
- Biodiversity - threatened species, BioSites, wetlands.

A charge to cover the costs of supplying the map usually applies.



Part of a Biomap (Buxton 1:25 000) showing satellite imagery as background with threatened species sites labelled with the species number. Biomaps are available from regional offices of the Department of Natural Resources and Environment (contact details page 63). A fee to cover the cost of production usually applies.



Where to?

This is a difficult step and one where the services of a professional facilitator can be valuable. Local landholders, landholder groups, council and state government, Catchment Management Authorities, non-government organisations and the general community usually need to be involved. Local plans need to be developed in the context of regional strategies. In Victoria these include Regional Catchment Strategies, Regional Vegetation Strategies and Regional River Health Strategies (available from CMAs, p63).

A vision

Think about the future of the landscape. What is the desirable outcome, in terms of including native vegetation and wildlife, in 10-20 years time? This step aims to help you focus on outcomes (Box 15, p44).

Related questions include:

- What wildlife will be present? Will the remnants of pre-European bushland continue to exist and who will be managing them?
- How will people be making a living? Could nature play a role in future economic activity?
- What kind of properties will there be and who will be managing them?
- What opportunities will exist for experiencing adventure and discovery?
- What will provide for spiritual needs? Will the special natural places be protected?
- How will compromises be achieved, such as integrating fire safety and native biodiversity?

This is a difficult step and should not be rushed. There will obviously be different opinions about what a future landscape will look like. Seek out the agreed goals. Deal with differences by looking for compromises that everyone can accept.

Goals

From this vision, you need to establish some realistic goals. They should be **s**pecific, **m**easurable, **a**chievable, **r**ealistic and **t**ime-bounded, that is S.M.A.R.T. (**see p54**).
For example:

'To achieve a 10 percent gain in the quantity and quality of native vegetation in the landscape within 5 years' and/or

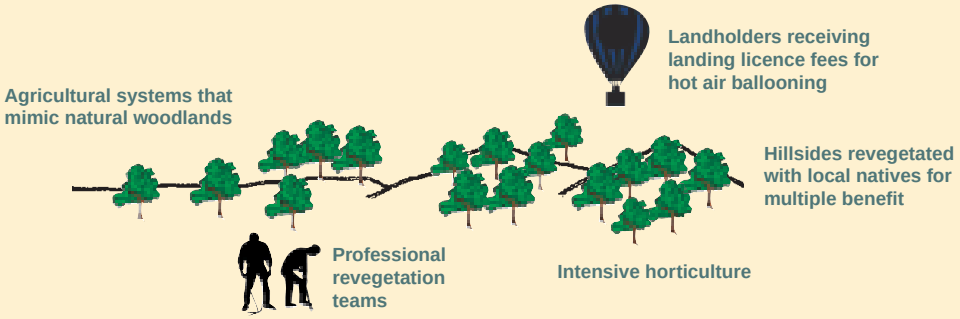
'To ensure that there is at least one patch of each Ecological Vegetation Class of 25ha or greater across the landscape within 10 years' and/or

'To increase the population size of Superb Parrot, measured by the number of juveniles counted annually, by 50 percent within 5 years'.

Aim–to write down 4 to 5 specific goals to be achieved in your first planning period.

Box 15: Practical ways of seeing future landscapes

1. *Drawing future landscapes can help identify what it is that people value about their landscape and how it will look in the future.*



2. *Take photographs of elements of the landscape that you want to keep or create for present or future generations.*


Stephen Platt


Stephen Platt

3. *Get your group to brainstorm what they can see in a future landscape. Each person is asked to write a couple of their best ideas on a piece of paper. Get each person to explain their idea to the group. Collect all the ideas and organise them into groups of common ideas. Name the groups. A professional facilitator will be able to assist you.*

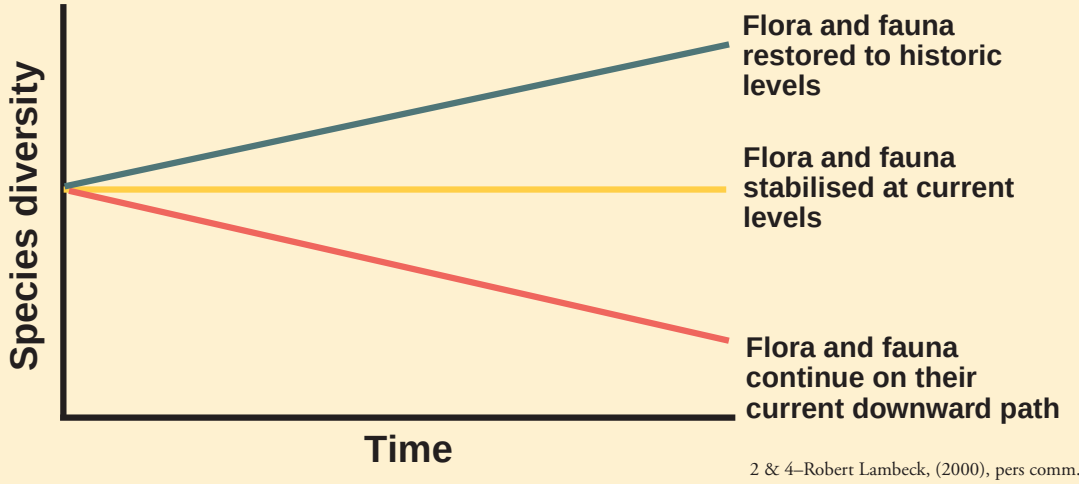
4. *Select a goal from one of the three possible outcomes for flora and fauna shown below.*

Decide whether your vision is to:

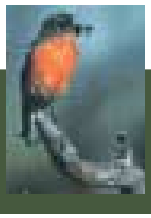
- Retain the existing range of species?
- Allow current trends to continue?
- Aim for general improvement?
- Improve conditions to allow reintroduction of species?

Benchmarks

NRE is currently developing 'benchmarks' of the former condition of Victorian vegetation types (EVCs). This will allow prediction of, for example, the number of birds you could expect to find in the habitat if it were fully restored.



2 & 4–Robert Lambeck, (2000), pers comm.



How to get there?

How to get there is the most difficult question of all. We are constrained by the amount of knowledge we have of individual species' requirements, ecosystem restoration and the practicalities of implementing actions. There are few models available. Ideally, the plan should contribute to multiple objectives such as preventing erosion and controlling salinity as well as providing wildlife habitat.

This is a good time to again involve professional biologists and others who understand the requirements of particular species and how ecosystems might operate in your district. Obtaining advice from others who know how vegetation can contribute to sustainability would also be valuable.

Consider and apply the general design principles aiming for pre-1750 conditions (p46)

Use the principles outlined earlier in this guide. Consider both the physical layout of the landscape and how it functions. Place an aerial photograph or satellite image of the landscape, covered with a clear plastic overlay, on a suitable table. Sources of biological data are listed on page 42 and aerial photographs on page 63.

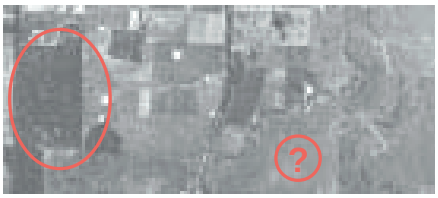
1. Initially focus on the high quality large remnants, particularly those of an endangered vegetation type (see Boxes 17a-e, p48-53). Where are they and which ones could be expanded to ensure that one or more examples of each habitat type is represented and that minimum ecological thresholds for focal species have been met?
2. Next, work on improving the quality of degraded vegetation. Which areas have the potential to be restored to a level where they can cater for species of concern?
3. Thirdly, consider revegetation works (Box 16, p47). How can revegetation contribute to creating a system of habitats? Which habitat types are missing and might be reinstated?
4. Finally, check that significant sites have been included.
   Once the draft landscape plan is completed you can test it against the needs of particular species of interest/concern and use the checklist on page 55 or tests p46.

A focal species approach (Box 17a, p48)

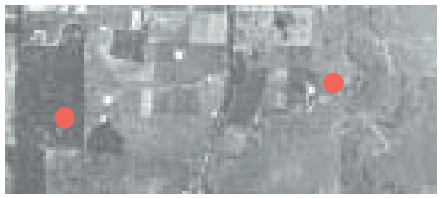
This method involves identification of the landscape scale threats to native biota in the region. Species most vulnerable to those threats and thus indicators of thresholds, focal species, are identified and minimum habitat requirements specified according to their needs (p26). Sensitive mammals, birds, reptiles, amphibians, fish and invertebrates can be selected and their minimum needs catered for. This will require investigating what is known of the species' biology. The assistance of a professional biologist is generally required. Otherwise, 'best guesses' can be made by duplicating size, spacing and quality of known occurrences (i.e. if a focal species is regularly seen in your neighbour's similar patch of bush but not yours, perhaps it can be used as a guide to refurbishing your patch). Limitations of this approach include lack of reliable data and lack of information on former landscape conditions, including the needs of locally extinct species.

How to consider and apply the general principles

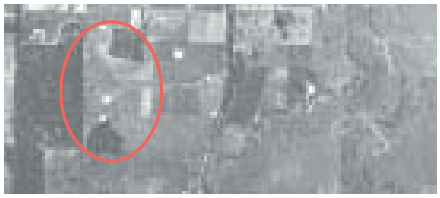
Where are the largest and best quality remnants of each habitat type? Which types are missing? What threshold size?



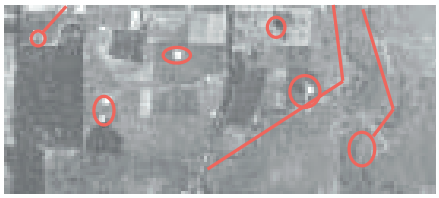
Where are known locations of threatened species? significant sites?



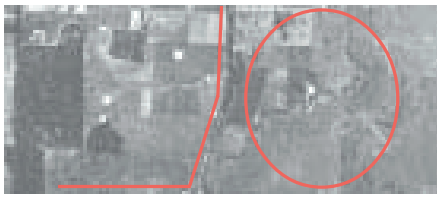
How could existing vegetation remnants be enlarged?



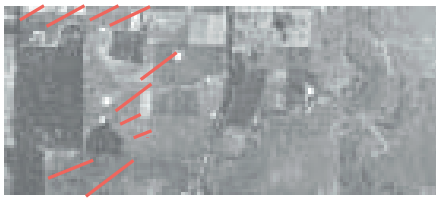
Where are the watercourses and wetlands?



Where could stepping-stones and corridors be placed to increase connectivity?



Where could buffers or alternative agricultural systems be placed to minimise the effects of surrounding landuse?

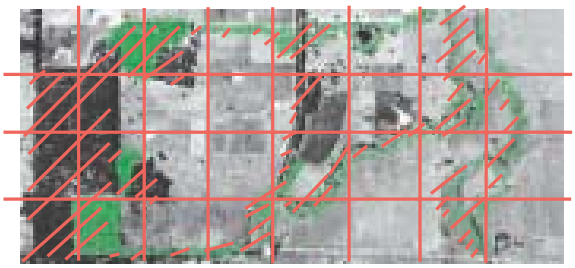


These stream systems and roadside remnants could be protected and expanded to develop wide linkages.

Transfer these details to an acetate layer over your map or aerial photograph of the landscape.

Some basic tests

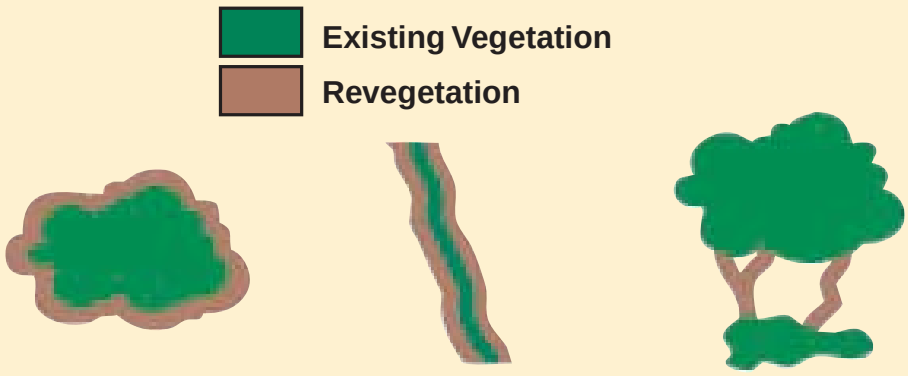
1. **Percentage cover (approximate)** –Use a square grid overlay. Estimate the number of squares covered by native vegetation. Where necessary add incomplete squares to make up whole squares.



A cover in the range 10-30% is a desirable minimum.

2. **Dispersal distance**–Measure the distances between blocks of vegetation of the same type. Where could revegetation be used to reduce the isolation of wildlife populations?
3. **'Focal' species**–With an understanding of the most sensitive species' biology, check whether its home range, feeding, shelter, breeding and dispersal requirements are met by the plan.

Box 16: Revegetation options



Enlarging remnant vegetation patches

Widening linear strips such as along rivers and roadsides

Creating linkages

Diagram adapted from Hobbs, R.J., (1993). *Can revegetation assist in the conservation of biodiversity in agricultural areas?* Pacific Conservation Biology, Vol. 1:29-38.

Whilst the priority should be on retention and restoration of existing remnants, revegetation also plays an important role.

In many rural areas, revegetation is the simplest way to create habitat. Natural regeneration is preferable to planting but planting may be the only practical option if existing seed sources are gone.

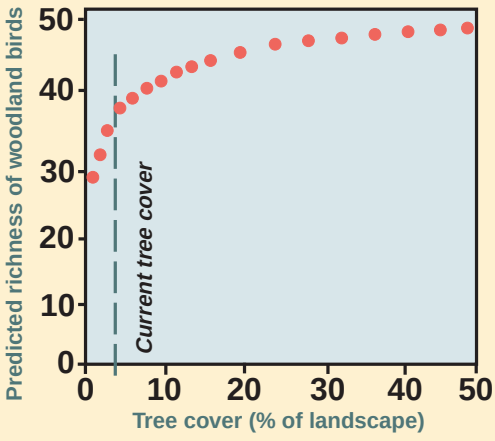
In some cases it is possible to include isolated paddock trees or other existing habitat features in revegetation projects (e.g. planting trees and shrubs around an old paddock tree).

There are many difficulties with revegetation. The propagation requirements of some species are unknown. Resources rarely allow for the full range of species to be restored, let alone the full 'web-of-life' interactions between species.

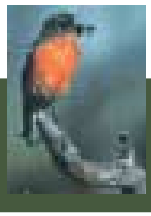
Basic principles include the use of a diversity of indigenous species and imitating the natural structure of the vegetation (of which trees or perennial grasses, shrubs, groundcovers and soil-hugging plants, such as some lichens and mosses, may be a part).

Box 17: Tree cover thresholds

As tree cover declines across a landscape so the rate of species loss accelerates as fragmentation, isolation and other effects become more significant. The original data is based on landscapes of 277 km^2 across the Northern Plains, Victoria.



Bennett, A.F. and Ford, L.A., (1997). *Land Use, Habitat Change and the Conservation of Birds in Fragmented Rural Environments: a landscape perspective from the Northern Plains, Victoria, Australia.* Pacific Conservation Biology. 3:244-61. Surrey Beatty & Sons, Sydney.



Principles into actions

Action

There is, of course, no benefit to native plants and animals in planning until it leads to action on the ground. With a knowledge of your objectives, the landscape and its potential for including wildlife habitats, as well as social and economic constraints, you are now in a position to develop an action program.

Your first set of actions should have a timeframe of two to three years and be targeted at your highest-ranked objectives. For example, if your aim is to provide for the maximum diversity of species you might develop a number of projects as described in the hypothetical example in Box 17a, p49. For each project there will be a range of actions depending on what activities, such as physical works, planting activities, control measures or consultation is appropriate at each site.

An action plan needs to identify the activity, materials, labour, cost, timeline and responsibilities. In other words:

- What's going to be done?
- What materials are required?
- Who's going to do it?
- How much will it cost?
- When will it be done?
- Who's responsible for making sure it happens?

Actions need to be specific and practical as in the case study for woodland birds (Box 17b, p51).

Actions will involve maintenance and restoration of habitat and addressing threats (Boxes 17c and 17d) at the patch scale.

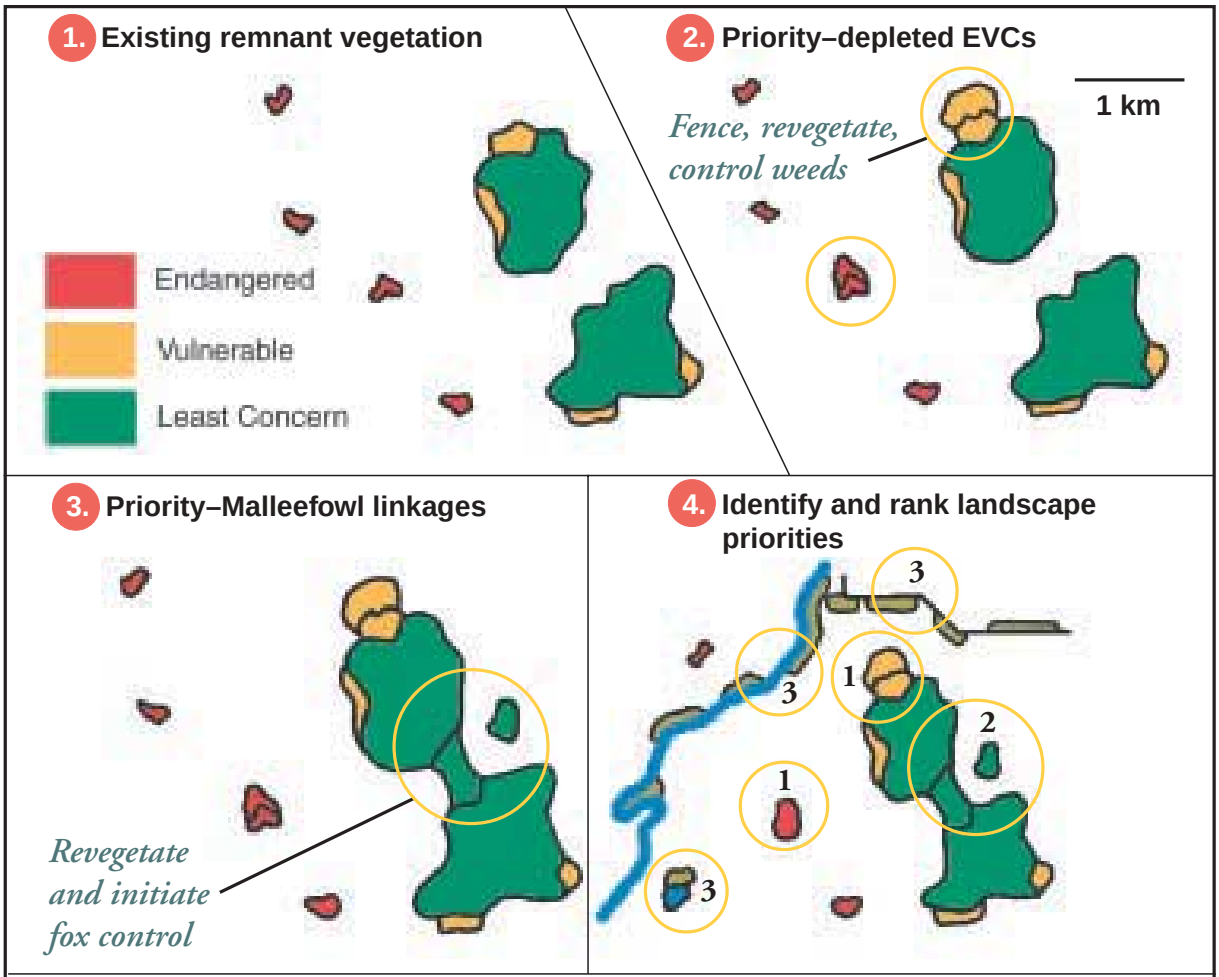
Once a specific project has been defined and the above questions answered, it is likely to be much easier to obtain the necessary support from organisations and individuals committed to nature conservation.

Felicity Nicholls

From the point of view of native plant and animal communities, improved extent and quality of habitat 'on-the-ground' are the only changes that count.

Box 17a: Identifying priorities–a hypothetical case study

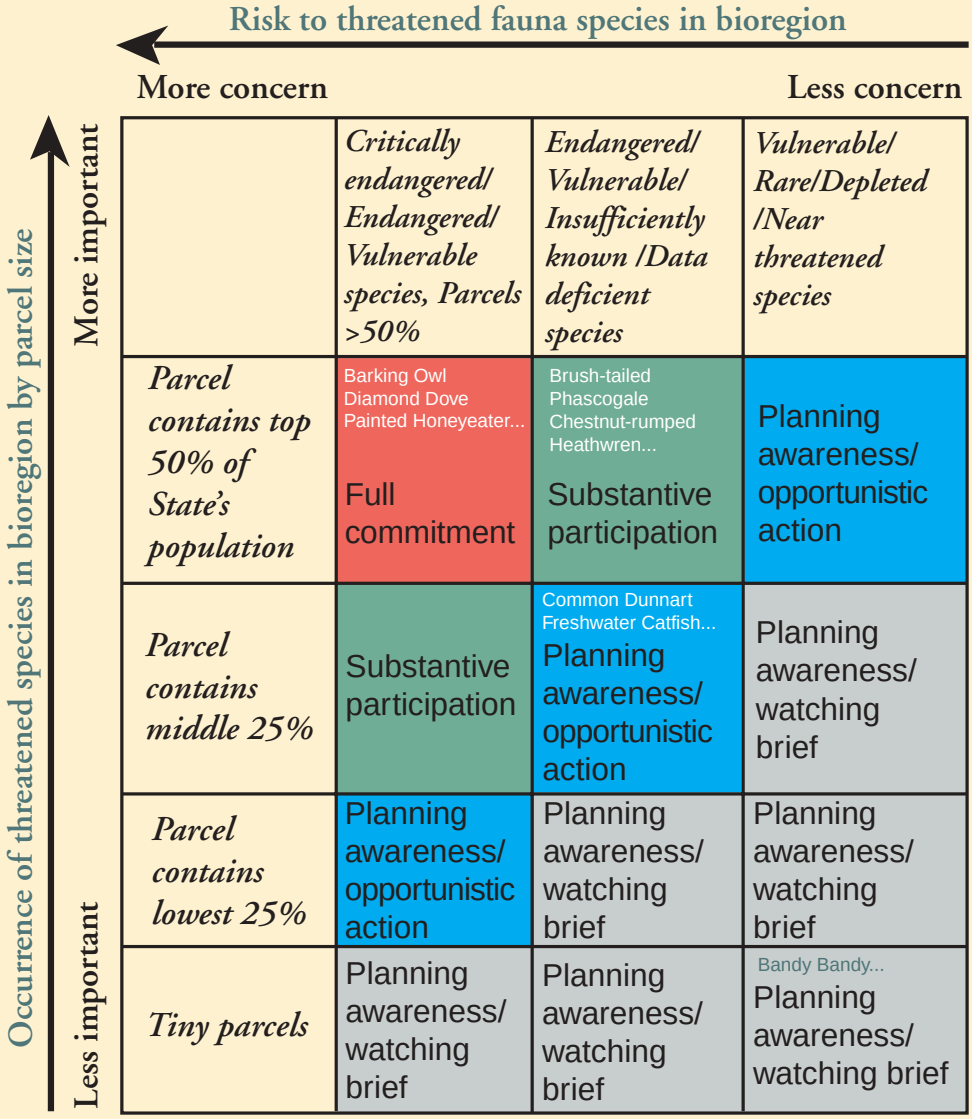
Diagram 1. shows a scene typical of south-eastern Australia. Among the scattered remnants, three Ecological Vegetation Classes (EVC) are present–Broombush-Mallee (green) which is the habitat of Malleefowl, Hillcrest Herb-rich Woodland (yellow) where Hooded Robins occur and Plains Grassy Woodland (red), home to many threatened grassland plant species. The conservation status of these EVCs in the Bioregion is—least concern (green), vulnerable (yellow) and endangered (red). This data was obtained from the Department of Natural Resources and Environment. So what priority actions are appropriate to conserve flora and fauna in this situation? Remember to consider the 3Rs for determining priority–retention, restoration, revegetation (p22). *Aim 1: To provide for the maximum diversity (number of species).* Action–Target the poorly represented vegetation types. Select the best remnants for size and quality. If necessary, increase their size to at least meet the minimum ecological threshold requirements of the most sensitive species that utilises the habitat 2. Note the limitation of pre-1750 extent. Control threatening processes affecting the habitat. *Aim 2: To protect the Malleefowl.* Action–develop corridor and stepping stone linkages to increase the effective population size in Broombush-Mallee, the preferred habitat type. Control foxes and other threats 3. Priority actions have been identified in NRE's Bioregional Network Analysis (Box 17b, p50). Note that the action depends on your aim and the practicality of implementation 4.



[1]Ahern, L., Lowe, K., Moorrees, A., Park, G. and Price, R., (in prep.). *Biodiversity Action Plan for the Goldfields Bioregion, Victoria: strategic overview.* Department of Natural Resources and Environment, Melbourne. Refer to Biodiversity Action Planning on NRE's website www.nre.vic.gov.au and follow the links from the 'Conservation and Environment' theme.

Box 17b: Identifying priorities–bioregional analysis

The Department of Natural Resources and Environment has developed a method for determining the Bioregional Conservation Status of a land parcel for the conservation of species[1]. The method measures two factors—the level of risk to the species and the significance of the bioregion to the species. Assuming that resources are limited and activities need to be prioritised, the level of management response is then based upon these factors.



	Critically endangered/ Endangered/ Vulnerable species, Parcels >50%	*Endangered/ Vulnerable/ Insufficiently known /Data deficient species*	*Vulnerable/ Rare/Depleted /Near threatened species*
Parcel contains top 50% of State's population	Barking Owl Diamond Dove Painted Honeyeater... Full commitment	Brush-tailed Phascogale Chestnut-rumped Heathwren... Substantive participation	Planning awareness/ opportunistic action
Parcel contains middle 25%	Substantive participation	Common Dunnart Freshwater Catfish... Planning awareness/ opportunistic action	Planning awareness/ watching brief
Parcel contains lowest 25%	Planning awareness/ opportunistic action	Planning awareness/ watching brief	Planning awareness/ watching brief
Tiny parcels	Planning awareness/ watching brief	Planning awareness/ watching brief	Bandy Bandy... Planning awareness/ watching brief

Diagram simplified from Ahern et al. (in prep.)

Contact the Department or your local Catchment Management Authority for more information about bioregional priorities and how local landholders can contribute. Remember that larger areas of higher quality native vegetation *of the right ecosystem (EVC) type* are generally more important. Secondly, all areas of remnant native vegetation, including small parcels, have a role to play. For example, in central Victoria, threatened Bush Thick-knees (*Burhinus grallarius* - a ground bird) are often found in small remnants of woodland vegetation on farms.

[1]Ahern, L., Lowe, K., Moorrees, A., Park, G. and Price, R., (in prep.). *Biodiversity Action Plan for the Goldfields Bioregion, Victoria: strategic overview.* Department of Natural Resources and Environment, Melbourne. Refer to Biodiversity Action Planning on NRE's website www.nre.vic.gov.au and follow the links from the 'Conservation and Environment' theme.

Box 17c: Case study–woodland birds

The following recommendations were developed for landscape restoration to benefit woodland birds in the Australian Capital Territory. They are provided as an example of the types of actions that could be developed.

McCann collection, NRE

Diamond Firetail

- Revegetate so that areas of woodland patches are increased to *at least* **10 hectares** and introduce at least a **20% shrub cover** within each patch.
- Enhance patches that are larger than 10 ha, first by controlling grazing then introducing or increasing shrub cover; second, by increasing the area of the patch; and third, by reducing the isolation of the patch by creating intermediate patches within 500-1000m ('stepping stones').
- Revegetation should simultaneously address as many threats to the environment as possible, such as dryland salinity and erosion, as well as habitat loss.
- Conservation of large (>100ha) and structurally diverse woodland remnants (abundant ground cover, a mixture of low shrubs, middle-sized shrubs and wattles and eucalypt overstorey) is a high priority for vulnerable woodland birds. Enhancement of large patches of remnant vegetation by patch planting of shrubs may be warranted.
- A longer-term goal should be to create enough structurally-diverse patches, each larger than 10 ha and within at least 500-1000m of each other, to develop an effectively connected network of patches that function like a series of large and complex patches (>100 ha).

McCann collection, NRE

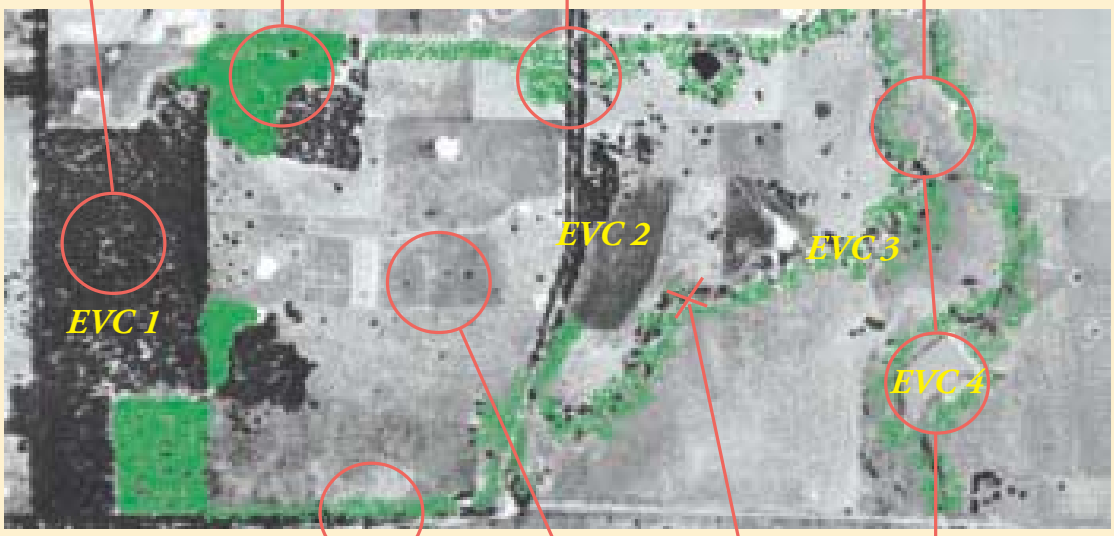
Apostlebird, a threatened woodland bird.

- Linear plantings should have first priority along riparian systems. Linear plantings should be of lower priority for connecting patches that are larger than 10ha. Linear plantings should be at least 25m wide and should contain a range of tree and shrub species.

Recommendations are based on the use of birds as focal species.

Reference: Freudenberger, D., (1999). *Guidelines for Enhancing Grassy Woodlands for the Vegetation Investment Project.* CSIRO Wildlife and Ecology, Canberra.

Box 17d: The physical landscape - opportunities to allocate space for native plants and animals



EVC = Ecological Vegetation Class

An example of how the landscape shown on page 41 could be enhanced. Vegetation remnants have been enlarged, linkages formed, linear strips along watercourses and roadsides widened and enlarged with nodes of vegetation, and places of special interest included. Large blocks of native vegetation of each of the former vegetation types are needed to provide for sensitive species. Linear strips will provide for species' movement. The quality of the vegetation, and in particular the presence of understorey vegetation, is also important.

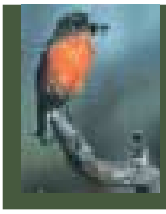
In a regional context, this area now has greater potential to make a positive contribution to ecological sustainability.

Box 17e: Management of the landscape - managing threats

It's one thing to plan the physical layout of the landscape and allocate space where wildlife habitats are the primary landuse, but another to make that landscape suitable for wildlife by managing threats (see also Box 6 p 25).

Threatening processes are the second major landscape issue to deal with. A list of threatening processes that affect native plants and animals is on page 59. Threats arise in many ways but most relate to human activity and its impacts.

Management should be prioritised to protect the most important assets from threats. The best quality large remnant (area A) might be a focus for control of introduced predators and weeds. Other significant sites, such as where threatened species occur (Area B), may warrant actions such as priority for fencing and hand weeding.



Monitoring and Evaluation

Purpose

Monitoring is used to check that your project is on track and evaluation to determine whether you have achieved your goals.

Defining the objective

It is essential that you define the objectives from the outset. Monitoring will help the project to keep steering in the right direction but that requires the endpoint of this journey to be clearly specified from the outset. Objectives need to be S.M.A.R.T., that is **S**pecific—what will be achieved is clearly defined, **M**easurable—there is some way of measuring what will be achieved, **A**chievable—the objective is realistic given the resources available, **R**elevant—the objective is relevant to the project vision and goals, **T**ime-framed—there is a time by which the objective will be achieved.
For example:

> *'To achieve a 10 percent gain in the quantity and quality of native vegetation in the landscape within 5 years'.*
>
> *'To ensure that there is at least one patch of each Ecological Vegetation Class of 25ha or greater across the landscape within 10 years'.*
>
> *'To increase the population size of Superb Parrot, measured by the number of juveniles counted annually, by 50 percent within 5 years'.*
>
> *'That all streamsides will be fenced within four years'. 'To protect and restore all waterways of high conservation value within 10 years'.*
>
> *'That 90% of members of my group can list the five most endangered species in the region and measures for their conservation by the end of this year'.*

Methods

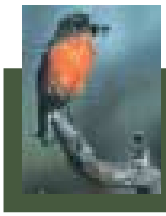
There is a great range of techniques that can be used and no doubt you will think of many yourself. The questions to ask are 'If that's what I want to achieve (see your objectives), how will I know that I have achieved it?' How is this measured?

Some methods that may be useful include:

- recording sightings, photopoints, trapping (under permit),
- transects and quadrats to determine plant and animal species composition.
- surveys and questionnaires for determining people's attitudes.

Further reading:

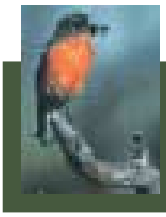
Platt, S.J. and Thomas, R., (1996). *How healthy is your bushland?* Land for Wildlife Note 40 and Hussey, P., (2002). *Photographic Monitoring of Vegetation,* Note 43. Department of Natural Resources and Environment, Melbourne. Available on the web (see p60).



Checklist

Does your plan: ✓

- Give consideration to vegetation types (EVCs) that are poorly represented in the landscape? (Bioregional Conservation Status) ☐
- Give priority to threatened species? ☐
- Give priority to high quality remnant vegetation? ☐
- Provide for wildlife habitat in each land class/area/zone, across the landscape? ☐
- Include some sites with high natural fertility? ☐
- Include large blocks (>50ha) of each type of native vegetation? ☐
- Include
  - streams? ☐
  - gullies? ☐
  - drainage lines? ☐
  - wetlands? ☐
- Represent the range of habitat features that occur naturally including:
  - provision for understorey and ground cover vegetation ☐
- Include some wide corridor links? ☐
- Include stepping stones that address the minimum dispersal needs of target species? ☐
- Include vegetation in a range of age classes? ☐
  - give priority to areas with existing large old trees? ☐
  - protect dead trees? ☐
- Provide at least 10% of the landscape to be managed primarily for nature conservation and a minimum 30% tree cover? ☐
- Contribute to the Regional Catchment Strategy and Regional Vegetation Plan for your catchment? ☐
- Overall, have you considered setting up a process to integrate wildlife with other property uses/values/issues (e.g. fire safety)? ☐



Future landscapes

In the 1960s, the Milne family observed the problems besetting their 524ha farm, including red gum dieback and erosion of watercourses (top left). Their actions since then have transformed the landscape into one which is sympathetic to nature, people and ongoing economic production (clockwise from top left, all photos from the windmill). The property is a Potter Demonstration Farm with works carried out between 1985 and 1988 and has recently been sold to similar-minded owners[1].

What will future landscapes be like? Only time will tell. However, the actions we take now will in part determine whether our children inherit 'nature's capital'.

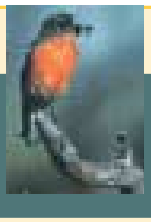
Though we have much to learn about ecological restoration, there are many success stories to encourage our efforts. For example, patches of rainforest vegetation have been established in East Gippsland with mixed indigenous species and then enriched by the arrival of wind, water and bird-dispersed plant species. At 'Lanark'[2], near Branxholme, fewer than 40 birds species were recorded in 1956, compared to 155 today. Species have been successfully reintroduced to former parts of their range. New economic activities, such as recycling, ecotourism and revegetation, have arisen that are based on environmental protection.

This generation's challenge is to protect our natural heritage for future generations. We all have a role to play.

No generation has a freehold in the Earth. All we have is a life-tenancy– with a full-repairing lease"

Margaret Thatcher 1988.

Further reading: [1]Milne, L., (2001). *Jigsaw Farms: Working on the sustainable farming puzzle.* Landscape Australia 3-2001, pp10-14. [2]O'Neill, G., (1999). *Renaissance on Lanark.* Supplement to Wingspan 9:1, Birds Australia, Hawthorn.



APPENDICES

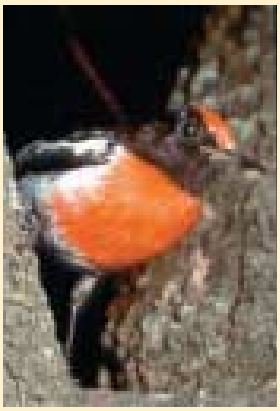
Declining woodland birds

A number of recent studies have pointed to the decline of a large number of woodland birds[1-4]. These species are heading toward being declared as threatened. The opportunity exists for private landholders to make a significant contribution to prevent the further decline of these species by taking appropriate remedial actions now. Some of the birds in decline are:

- Blue Bonnet
- Brown Treecreeper
- Chestnut-rumped Thornbill
- Crested Bellbird
- Crested Shrike-tit
- Diamond Dove
- Dusky Woodswallow
- Emu
- Gilbert's Whistler
- Grey-crowned Babbler
- Jacky Winter
- Little Button-quail
- Painted Button-quail
- Red-capped Robin
- Restless Flycatcher
- Rufous Whistler
- Southern Whiteface
- Speckled Warbler
- Varied Sittella
- White-browed Babbler

Hooded Robin

Speckled Warbler



McCann collection, NRE (all this page)

Red-capped Robin

Diamond Firetail

Of course, these birds may be frequently observed in some localities and thus appear not to be in trouble. If you have healthy populations in your district you are fortunate because observations over the geographic range of these birds tell another story.

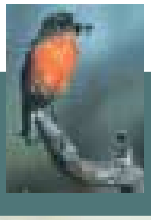
Threatened woodland birds:

- Apostlebird
- Australian Bustard
- Diamond Firetail
- Ground Cuckoo-shrike
- Hooded Robin
- Spotted Bowerbird
- White-browed Treecreeper

[1]Bennett, A.F. and Ford, L.A. (1997). *Land Use, Habitat Change and the Conservation of Birds in Fragmented Rural Environments: a landscape perspective from the Northern Plains, Victoria, Australia.* Pacific Conservation Biology 3:214-261.

[2]Reid, J.R.W., (2000). *Threatened and Declining Birds in the New South Wales Sheep-wheat Belt: II. Landscape relationships - modelling bird atlas data against vegetation cover.* CSIRO Sustainable Ecosystems, Canberra.

[3]Robinson, D. and Traill, B.J., (1996). *Conserving Woodland Birds in the Wheat and Sheep Belts of Southern Australia.* RAOU Conservation Statement No. 10. Supplement to Wingspan 6:2, June 1996. Royal Australasian Ornithologists Union, Hawthorn. [4]Robinson, D. (personal communication).



Birds on Farms

The Birds on Farms project run by Birds Australia involved landholders across Australia in measuring the variables that potentially affect bird populations on farms[1].

Bird diversity declined in patches of woodland smaller than 10 ha.

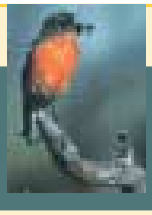
Recommendations

1. Local native vegetation should cover at least 30 per cent of the total farm area.
2. Re-create local conditions.
3. Exclude high-impact land uses from at least 30 per cent of the farm area.
4. Maintain native pastures and avoid heavy grazing.
5. Native vegetation cover should be in patches of at least 10 ha and linked by strips at least 50m wide.
6. Manage at least 10 per cent of the farm area for wildlife.
7. Maintain a range of tree ages.
8. Leave fallen trees to break down naturally.
9. Maintain shrub cover over at least one-third of the area within a patch of farm trees.
10. Maintain native vegetation around water.

Total bird diversity decreased by 25% in sites where much of the ground cover had been removed, leaving smooth, lawn-like tufts.

Noisy Miners were 78 per cent less likely to occur in sites where understorey shrubs were present (see Box 8, p28).

[1]Barrett, G., (2000). *Birds on Farms: ecological management for sustainability.* Supplement to Wingspan 10:4, December 2000. Birds Australia, Hawthorn.



Potential threats

Below is a list of potential threats that affect landscape biodiversity. Those marked with an [L#] relate to Potentially Threatening Processes formally listed under the Flora and Fauna Guarantee Act 1988. Further information from NRE (see p63).

1 Habitat clearance (clearance of native vegetation).

2 Habitat degradation/ecological change (e.g. loss of hollow-bearing trees L100 or understorey, degradation of riparian vegetation L354, dredging a river, grazing and trampling).

3 Habitat fragmentation L377 (e.g. dieback, susceptibility to disease, loss of dispersal corridors, edge effects).

4 Introduced predators and competitors (fox L131, cat L355, rabbit, goat, carp, bumblebee L505, exotic invertebrates, biological control agents, etc.).

5 Invasion of native vegetation by 'environmental weeds' (L360, L282 Pittosporum).

6 Land degradation/soil changes/road construction including erosion, compaction, nutrient change, disturbance, movement that spreads disease and weeds; salinisation, acidification, rock removal, increased sedimentation of streams L181.

7 Harmful chemicals - pesticides, pollutants (e.g. entanglement & strangulation of platypus by plastic rings), toxins L313, 315, 263, lead shot L186.

8 Disease/dieback (e.g. use of phytophora infected gravel L41, myrtle wilt L453, leaf-feeding insects).

9 Alteration to natural flow (L197), flood and temperature (L230)regimes of aquatic environments (water regulators such as dams and weirs L292, desnagging L118, channelisation, bank destabilisation).

10 Drainage of wetlands.

11 Barriers/Instream structures (e.g. exclusion fences, weirs).

12 Removal of wood debris from rivers and streams.

14 Inappropriate fire regimes (e.g. habitat destruction or degradation, direct mortality, weed invasion).

15 Grazing (by livestock and other introduced herbivores L211–alpine).

16 Collecting (e.g. orchids L280, bird eggs).

17 Transport & recreation (e.g. soil compaction, spread of weeds).

18 Disturbance (e.g. affecting breeding).

19 Firewood collection, where inappropriate.

20 Timber harvesting, where inappropriate.

21 Genetic influences (e.g. hybridisation of Black Duck with Mallard Duck), inbreeding, outbreeding.

22 Incidental catch (e.g. during fishing L424).

23 Destructive mining (e.g. marble L48).

24 Recreational activities (e.g. inappropriate 4WD, horseriding, boating).

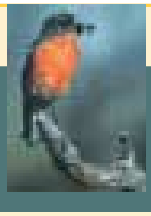
25 Use of fauna as bait (e.g. frogs).

26 Land use change (e.g. subdivision/ urbanisation, industrialisation).

27 Pollution (e.g. increased nutrient input, insecticides, herbicides, garbage, air pollution & acid rain)

28 National and global changes (e.g. greenhouse gases L472).

Note that most threats relate to human activity.



Further reading

Landscape ecology

[1]Ahern, L., Lowe, K., Moorrees, A., Park, G. and Price, R., (in prep.). *Biodiversity Action Plan for the Goldfields Bioregion, Victoria: strategic overview.* Department of Natural Resources and Environment, Melbourne. Refer to Biodiversity Action Planning on NRE's website www.nre.vic.gov.au and follow the links from the 'Conservation and Environment' theme.

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Birds

Ford, H. A., (1989). *Ecology of Birds–an Australian perspective.* Surrey Beatty & Sons Pty Limited, Chipping Norton.

Keast, A., Recher, H.F., Ford, H. and Saunders, D. eds., (1985) *Birds of Eucalypt Forests and Woodlands.* Surrey Beatty & Sons and Royal Australasian Ornithologists Union.

Reptiles and Amphibians

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Invertebrates

Yen, A.L. and Butcher, R.J. (1997). *An Overview of the Conservation of Non-marine Invertebrates in Australia.* Environment Australia, Canberra.

Fish

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Plants

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Websites:

The International Association for Landscape Ecology–www.crle.uoguelph.ca/iale/main.htm

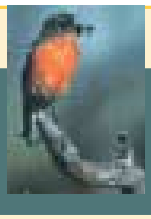
Land for Wildlife–www.nre.vic.gov.au/plntanml/native/landfor/index.htm

The Nature Conservancy (US)–http://nature.org/aboutus/howwework/

Periodicals such as *Wildlife Research, Herpetofauna, The Emu and Ecological Management and Restoration.* See also references in text.

Department of Natural Resources and Environment, Biodiversity Action Planning –http://www.nre.vic.gov.au (select Conservation and Environment theme, then Biodiversity Action Planning)

English Nature (UK), Biodiversity Action Planning–http://www.english-nature.org.uk/baps/intro.htm



Ecological thresholds

Ecological thresholds are key turning points around which population and ecosystem viability may pivot (see Box 17, p47, Box 6 p25 & Box 7 p26). More research is required to understand their significance for Victorian ecosystems. In the absence of specific threshold data, some information on species requirements is given below. For more information contact the local NRE office.

Densities and ranges–general examples

The following list provides a selection of published densities and ranges for various species. Note the breadth in figures for a species. These reflect regional and habitat quality variation. Variation between species reflects species' biology including different survival strategies. *Local* data is necessary for use in landscape planning.

Birds

Superb Fairy-wren ..... 0.19-1.7 birds/ha
Yellow-faced H'eater .... 0.03-3 birds/ha
Malleefowl ..... .03-.05 birds/ha
Powerful Owl ..... 800-1000 ha/pair

Mammals

Brown Antechinus ..... 21 indiv/ha
Sugar Glider 2.9-6.1/ha
Brush-tailed Phascogale .. male 1/100 ha
..... female 1/20-70 ha
Koala ..... 1/2 ha
Echidna 1/40-70ha
Platypus
average movement ..... male 5.3km,
..... female 0.9km
(breeding male max. recorded movement) 48km[1]

Reptiles

Tree goanna ..... 1/65 ha

Fish

Murray Cod (breeding max.) .... 120km upstream then return[2]

Useful references for species' ecological requirements:

Emison, W.B., Beardsell, C.M., Norman, F.I., Loyn, R.H. and Bennett, S.C., (1987). *Atlas of Victorian Birds.* Department of Conservation, Forests and Lands and the Royal Australasian Ornithologists Union, Melbourne.

Blakers, M., Davies, S.J.J.F. and Reilly, P.N., (1984). *The Atlas of Australian Birds.* Melbourne University Press, Melbourne.

Handbook of Australian, New Zealand and Antarctic Birds, Vols. 1-4. Oxford University Press, Melbourne.

Menkhorst, P.W. (1995). *The Mammals of Victoria: distribution, ecology and management.* Oxford University Press, Melbourne.

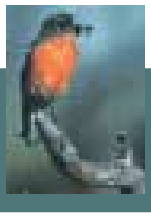
[1]Anon, (2001). *Platypus on the move.* Ripples, Issue 18, Summer 2001. Australian Platypus Conservancy, Melbourne.

[2]Koehn, J.D., (1997). *Habitats and Movements of Freshwater Fish in the Murray-Darling Basin.* Pp 27-32 in Banens, R.J. and Lehane, R. eds, (1995). Riverine Environment Research Forum. Murray Darling Basin Commission, Canberra.

Excellent practice for largely cleared rural landscapes

Aim for:

- Minimum tree cover 30% (in appropriate habitats)
- Area managed primarily as wildlife habitat minimum10-15%
- Retention of all threatened Ecological Vegetation Classes (no loss in extent or quality)
- Retention of all threatened species with the aim of supporting viable populations
- No net loss of non-threatened habitat as a minimum standard leading to a net gain (any unavoidable loss offset by gains in extent and quality elsewhere)



Glossary

Biodiversity–The variety of all life. The different plants, animals and micro-organisms; the genes they contain; and the ecosystems they form. Biodiversity is usually considered at three levels: genetic diversity; species diversity; and ecosystem diversity.

Native biodiversity–Biodiversity native to a particular locality.

Bioregion–Biogeographic regions (bioregions) capture the patterns and ecological characteristics in the landscape or seascape providing a natural framework for recognising and responding to biodiversity values.

Catchment Management Authority–One of ten regional bodies responsible for strategic planning and co-ordination of Victoria's land and water resources.

Earth repair industry–Business activities associated with restoration of native biodiversity such as revegetation with indigenous species.

Ecosystem Services–refers to the goods, regeneration and stabilizing processes and life-fulfilling functions provided by ecosystems. The term describes the processes and conditions by which natural ecosystems sustain and fulfill human life.

Ecological Vegetation Class–Components of a vegetation classification system derived from groupings of vegetation communities based on floristic, structural and ecological features.

Ecological Threshold–a turning point at which resource or ecosystem limitations determine species or ecosystem viability.

Focal Species–the species identified as most sensitive to a threat in a particular landscape is termed the focal species for that threat. This information is used to define the configuration and composition of habitats that must be present in a landscape.

Habitat–The place or environment in which an organism naturally occurs.

Indigenous vegetation–Vegetation native to a particular location.

Interim Biogeographic Regionalisation of Australia (IBRA)–A regional framework delineating natural regions based on biophysical, environmental and vegetation considerations (e.g. climate, soils, landform, vegetation, flora and fauna, and land use).

Land class–a method of classifying land according to topography and soil characteristics.

Landscape–A landscape is made up of basic elements – climate, geology, topography, vegetation, fauna and humans – biophysical characteristics that can be used to identify differences between different landscapes. While nature may offer the raw material of scenery unaided, it is our perception that shapes how we see landscapes. In short, the human landscape is the totality of all the elements of a part of the natural environment where we live that is larger in scale than ourselves. A landscape approach to conservation emphasises that all components of the landscape are important, not just single (usually rare or threatened) species or communities[1].

Niche–the position or function of an organism in a community of plants and animals.

Phytofall–used herein as an alternative to leaf litter, meaning fallen plant material.

Private landholder–Private landholders may include individuals, corporations, non-government bodies, trusts and not-for-profit organisations and other bodies, who have a role in land management. The term encompasses individuals or entities with freehold, native or other forms of title, leaseholders and tenants. The term landholder is preferred over land manager as it signifies the true relationship people have in being privileged to 'hold' land on behalf of future generations.

Revegetation–The process of reintroducing vegetation to a site through planting.

Regeneration–The process of reintroducing vegetation to a site by natural regenerative processes, which may include human intervention but exclude planting.

Remnant vegetation–The remains of native vegetation associations uncleared since European settlement.

Restoration–The process of reintroducing components of the flora or fauna to a site by either revegetation, regeneration or reintroduction.

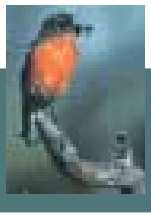
Riparian–Of or pertaining to the bank of a river or other body of water (cf. Aquatic, Terrestrial).

Terrestrial–Of or pertaining to the land (cf. Aquatic).

Wildlife–native fauna.

Keywords–These words may help in searching the internet–Nature conservation on private land, stewardship, off-reserve conservation, countryside conservation, land for wildlife, private conservation, nature conservation and agriculture, set-aside, community wildlife conservation and partners/partnership.

[1]ANZECC Working Group on Nature Conservation on Private Land.



Getting help

Aboriginal Affairs Victoria (AAV)
PO Box 515, East Melbourne, 3002.
☎ (03) 9637 8000 or 136 186

Aerial photographs:
Qasco VicImage
PO Box 331, 171 Clarendon St.,
South Melbourne, 3205.
☎ (03) 9682 3330, Fax: 9682 3335

Conservation Volunteers Australia(CVA)
PO Box 423, Ballarat, 3353.
☎ (03) 5333 1483. Email:
info@atcv.com.au, Web: www.atcv.com.au

Birds Australia (BA)
415 Riversdale Road, Hawthorn East, 3123.
☎ (03) 9882 2622.
Email: mail@birdsaustralia.com.au,
Web: www.birdsaustralia.com.au

Bird Observers Club of Australia (BOCA)
PO Box 185, Nunawading, 3131.
☎ (03) 9877 5342.

Catchment Management Authorities (CMAs)
Contact your local CMA.

West	☎(03)
Glenelg-Hopkins	5571 2526
Wimmera	5382 1544
Mallee	5022 4368
Corangamite	5232 9100
Central	
North Central	5448 7124
Goulburn-Broken	5822 2288
Port Phillip	9785 0187
East	
North East	02 6055 6133
West Gippsland	5175 7800
East Gippsland	5153 0462

Department of Natural Resources and Environment (NRE)
Contact your local NRE office or the Customer Service Centre
☎ 136 186
Web: www.nre.vic.gov.au

Environment Defenders Office (EDO)
PO Box 416, North Melburne, 3051.
☎ (03) 9328 4811, Fax: 9326 5687
Email: edovic@edo.org.au
Web: www.edo.org.au

Environment Australia (EA)
GPO Box 787, Canberra, ACT, 2601.
☎ (02) 6274 1111, Fax: 6274 1123
Web: www.ea.gov.au

Greening Australia Victoria Inc. (GAV)
PO Box 525, Heidelberg, 3084.
☎ (03) 9457 3024.
Email: general@gavic.org.au
Web (national site):www.greening australia.org.au/contacts/contacts.html

Land for Wildlife (LFW)
Contact the NRE Customer Service Centre ☎ 136 186, your local NRE office or the Statewide Land for Wildlife Co-ordinator ☎ (03) 5430 4363.
Web: www.nre.vic.gov.au and enter via plants and animals, native plants and animals and then Land for Wildlife.

Local Government
Contact your local shire office or the Municipal Association of Victoria

Trust for Nature (TFN)
Level 2, 385 Lt Lonsdale Street, Melbourne, 3000.
☎ (03) 9670 9933.
Email: trustfornature@tfn.org.au,
Web: www.tfn.org.au

What landscape do we gift to our children?