Farm planning and wildlife

...RY
...RTMENT OF
...STERN AUSTRALIA

Land for Wildlife Note No. 22 *January 1993*

Key words: Whole Farm Planning, farm planning, roadsides, rivers, W: 12-Ex-22 advice, mapping, corridors, wetlands, monitoring wildlife

Area: Statewide

Author: Andrew Bennett, Stephen Platt

This *Note* considers the wildlife aspects of property planning, with emphasis on farms, and should be used as a supplement to other texts describing the full integration of additional farm planning goals (see references page 8). In particular, readers are directed to "From the ground up: a manual of property management planning" edited by Peter Dixon (1993) and soon to be published by the Department of Conservation and Natural Resources (from which this text is drawn). This *Note* compliments LFW *Note* 2 "22 ways to integrate wildlife conservation with farm management". Whole Farm Planning and Property Management Planning are other terms in current usage describing a holistic approach to farm planning.

Introduction

In recent years, there has been a growing awareness of the role of native vegetation in the sustainable management of agricultural land. Protection of remnant vegetation and re-vegetation of selected areas with indigenous species offers the potential for long-term solutions to problems of land degradation. Native vegetation also provides habitat for wildlife species. Many landholders are now recognising the value and place of wildlife in a healthy rural environment and are looking for ways to encourage wildlife on their property. The key to conserving wildlife on farms is to maintain habitats that provide animals with the resources they need (food, shelter and nesting or breeding sites) and sufficient living space for viable populations. The purpose of this *Note* is to discuss ways in which wildlife and wildlife habitats can be integrated with sound farm management and production as part of the process of 'Whole Farm Planning'. Three basic principles underlie this discussion, as follows:

(i) Conservation of native vegetation and wildlife offers a range of benefits to farm enterprises

Changes in bird species visiting a wheat and sheep property were recorded over a seven year period as wildlife habitats were re-established. One hundred and six bird species were eventually recorded of which 67% were largely or exclusively insectivorous. (Anon. 1991)

"Studies ... suggest that in healthy eucalypt woodland birds may take about half of the insects produced (of the order of 30 kg per hectare per year). Small mammals, like sugar gliders, and predatory insects and spiders take a significant proportion of the rest. The average level of attack by insects and the frequency of outbreaks would be much higher without these natural predators." (Ford).

Wildlife populations can make an important contribution to the sustainability of agricultural lands. As suggested above, many species are insectivorous and may play an important role in maintaining a balance in insect populations in farmland. For example, Australian Magpies feed in paddocks on the larvae of scarab beetles (e.g. cockchafers); ibis take large numbers of crickets and grasshoppers from pastures; honeyeaters, thombills and pardalotes feed on insects that live on the foliage of trees, especially sap-sucking lerp and scale insects; Sugar Gliders take Christmas beetles and other invertebrates from tree foliage; and bats flying at night through farm woodlands consume moths, beetles and bugs. Research has shown that woodland suffering severe defoliation and dieback has only 10% of the birds of healthy woodland (Ford and Bell 1981). Wildlife may also aid dispersal of insect predators, diseases and parasites.

Native vegetation contributes to sustainable land management and farm production in other ways. These include:
- protection of soils from erosion and nutrient losses;
- protection of water quality in streams;
- salinity control;
- timber for firewood, posts or commercial sale;
- shelter for stock and pastures;

There are other, less tangible, benefits from maintaining wildlife in the rural environment:
- the sights and sounds of wildlife, and the pleasure of encountering animals on a daily basis add to, and are part of, the quality of rural life in Australia;
- wildlife is a significant part of our heritage as Australians and a unique part of the heritage of each local district;
- natural vegetation contributes to a more pleasant farm landscape in which to live;
- properties with bushland habitat and wildlife are more attractive than those with bare paddocks, and so will often command higher real estate values;
- wildlife can be an important component of farm tourism (e.g. kangaroos in the back paddock, koalas in a gum tree).

(ii) Wildlife conservation on farms can make a valuable contribution to overall conservation goals;

"Emus and kangaroos on our arrival were plentiful in all parts of the district; also the bustards in large flocks of from ten to twenty or forty, or perhaps more. The bustards now are scarce, and only met with in distant places." (Captain Fyans 1853, in Middleton 1984).

"It is 45 years since they [native cats] were abundant in the Warrnambool district... I was offered a bonus of 1/2 d a scalp... to trap these native cats ... but I caught so many that the contract was ended." (Unnamed correspondent 1934, in Seebeck 1984).

There have been marked changes to the wildlife of Victoria. "Bustards" (Australian Bustard) and native cats (Eastern Quoll) are among those species, once common in Victoria, that have long gone. However, many other species are still present, although some no longer occur in large areas of Victoria where once they were common. The major reasons for the decline of native species are the loss of habitats, degradation of remaining habitats, and the impacts of introduced species (e.g. Fox, Cat, Rabbit).

With more than 60% of Victoria owned by private landholders (Woodgate and Black 1988), farm environments have a very important contribution to make to the goal of maintaining viable populations of all species throughout their range. In many districts this is simply not possible by relying solely on the few reserved areas such as National Parks or Flora and

Fauna Reserves. It can only be achieved by a district-wide system of habitats that includes those on farms, as well as Crown lands such as streamsides, roadsides, and other small blocks.

All farms can play an important role in providing for a range of species (birds, mammals, reptiles, frogs, invertebrates) that are not necessarily regarded as rare or threatened. Experience has shown that the best way of conserving species is to maintain large populations, spread throughout their geographic range. However, in some districts, farm habitats are also important for the conservation of rare or threatened species. Victorian examples include native grasslands that support the Striped Legless Lizard and Plains Wanderer, wetlands that provide nesting sites for Brolga, and remnant coastal forests that are used by Rufous Bristlebirds. Without the assistance of private landholders, many species are likely to continue the process of decline, eventually ending in local extinction.

(iii) Wildlife and wildlife habitats can be integrated with sound farm management in practical ways.

Shelter can increase livestock production by increasing the supply of pasture and by reducing environmental stress ...". "...there seems little doubt that at least 10% of the farm can be profitably devoted to trees in the higher rainfall grazing areas of southern Australia". (Bird 1990)

Many of the measures that protect or create habitats for wildlife can be developed and carried out as part of other farm activities (e.g. land protection, water supply, pasture production, etc). Some examples of farm activities that involve management of native vegetation and also provide the basic elements of habitat for wildlife are listed in Table 1.

Table 1. Farm activities with which wildlife habitats can be integrated

Farm activity	Habitat for wildlife
Provision of shade/shelter for stock	bush blocks, shelter belts, isolated trees or clusters in paddocks, roadside or laneway vegetation
Shelter for pastures	shelter belts
Provision and protection of water quality	streamside vegetation, protected wetlands, farm dams
Protection from erosion	vegetation along gullies, creeks, and steep slopes
Combat rising saline groundwater	vegetation in saline re-charge and discharge areas
Supply of firewood, posts etc	bush block, plantation, agroforestry plots
Fire protection	windbreaks, radiation shields, native grasses (low fuel)

Planning for wildlife should preferably be carried out in the initial stages of developing a Whole Farm Plan so that the greatest range of options can be considered, and there is the greatest potential for integrating wildlife plans with other farm management activities. Successful integration of wildlife habitats into the Whole Farm Plan is dependent on the successful resolution of other farm issues - wildlife considerations should not be handled in isolation. This note can be used in conjunction with comprehensive texts on the subject of Farm Planning.

The following sections describe some stages in the incorporation of wildlife into a Whole Farm Plan.

- gathering information and taking stock of your property;
- developing and mapping specific plans for wildlife;
- management of wildlife habitats;
- monitoring wildlife on the farm.

Gathering information

An important first stage in incorporating wildlife into farm planning is to consider all relevant information. Three levels of information will be useful:

- information on the surrounding area in which the farm is located;
- information on your property;
- general information on wildlife, wildlife management, problem animals, and activities or issues that could affect wildlife conservation on the property.

(i) The surrounding area

Begin by taking an "aerial view" of the property and its surroundings. Every property is part of a regional landscape - it does not stand alone. Land management and activities on one property will have consequences, of varying extent, for neighbouring properties. Wildlife conservation can be enhanced by careful planning in relation to habitats present on surrounding properties, on adjacent roadside reserves, streams or other Crown lands. Further, working together with neighbouring property owners (e.g. as part of a Landcare or Farm Trees group) has enormous potential for conservation by creating a co-ordinated *system of habitats* through the whole landscape.

When considering what can be done on your own property, it is worth considering some of the opportunities that are afforded by habitats nearby.

Large area of forest or woodland nearby

Nearby bushland can often provide insights into the natural forest types, the plant communities and plant species that formerly occurred in the area, and to which the local wildlife is adapted. This can be used as a guide for revegetation on your farm, and perhaps as a natural source of seed. Large bushland areas often act as a 'reservoir' for wildlife populations, and an indicator of the local species that might be expected in the area and on your property. Maintaining or creating effective corridor links from the bushland to habitats on the farm will increase the likelihood of these species occurring on the farm.

River or stream passing through, or near, the property

Maintaining existing vegetation, or revegetating along the banks of streams, can contribute to the development of an overall stream corridor system which may extend for many kilometres. Streamside vegetation is a rich habitat for wildlife and it can be an effective corridor for many species, linking across and through numerous properties. Vegetation along stream banks also serves to reduce erosion and to protect water quality throughout the catchment, not just within one property. Where a stream passes nearby, but not through the property, there may be opportunities to link in with the stream corridor by revegetating seasonal drainage lines or gullies that feed into the stream.

Roadside vegetation adjacent to the property

In many districts, roadside vegetation forms extensive networks of remnant bushland, providing corridors across the

landscape. It also acts as a habitat for many species of wildlife (e.g. birds, possums, gliders, lizards), especially where the roadside vegetation is wide. Linking bush blocks, shelter belts, or plantations on the farm with the roadside vegetation is an excellent way to join this existing corridor system, and to improve the connectivity of the wildlife habitats on the farm. Roadside vegetation also serves as a reminder of the local indigenous vegetation, and as a natural source of seed. Fencing a strip of paddock adjacent to roadside vegetation can be a cheap and effective means of natural revegetation that can include not only tree species, but local understorey shrubs that are present on the road reserve.

Important questions to ask when considering the area surrounding your farm are:

- how can activities on this property contribute to developing a *system of habitats* throughout the wider area?
- what natural linkages are there between this property and other nearby habitats?
- are there opportunities for working co-operatively with other landholders on a catchment or regional basis?
- are there species of wildlife in the area that might conflict with other management aims?
- do the neighbours understand the improvements you would like to make, and why you wish to do so?

(ii) On your property

The location of your property and its topography, climate, soil types and water regimes will influence the type of habitats that can be represented. However, every property has potential to develop wildlife habitats and to encourage wildlife to live on the farm. A useful first step is to make an inventory of those parts of the farm that presently provide habitat, or could do so in the future with appropriate management. Remnants of natural habitats will generally be of greatest value to wildlife. For example, woodlands or forests can be used by possums and gliders, forest birds, bats, small lizards and many other species; rocky outcrops are habitat for reptiles and some small mammals; wetlands are important for waterbirds, frogs, fish and aquatic invertebrates, and so on. New habitats, such as farm gardens and farm dams, will also be used by wildlife, notably birds. Clearly, the opportunities will differ between properties. The following list (Table 2) sets out some possibilities; a close look around your property, or inspection of an aerial photograph or topographic map, could add further alternatives.

Useful questions to ask about your property include:

- what types of habitats are present on this property now?
- what types of vegetation will the soils on my property support?
- are there opportunities for using natural regeneration?
- which species, or types of wildlife, would I like to encourage on the property?
- what are the advantages and disadvantages of encouraging wildlife here?

Table 2. Habitats for wildlife that may be present on farms in Victoria

Remnants of natural habitats

Patches of remnant native vegetation (e.g. bush blocks, open woodlands)
Isolated trees, clusters of trees or shrubs in paddocks
Native grasslands
Rocky areas (e.g. outcrops, 'stony rises')
Wetlands (e.g. swamps, lakes), either seasonal or permanent
Rivers, creeks, intermittent water-courses
Mature trees (living or dead) with hollows
Fallen timber, logs and other tree litter

New or artificial habitats

Farm dams (and associated vegetation and islands)
Shelterbelts
Plantations
Farm gardens
Farm buildings and other structures
Lightly-grazed pastures

(iii) Sources of information and advice

There are numerous sources for obtaining information that can help in managing natural vegetation and planning for wildlife on your property (see below). A list of useful references, including guides for identifying wildlife, is provided at the end of the chapter. If you are a member of a group, it may be valuable to arrange an information day, with speakers or displays from some of the sources suggested below.

Department of Conservation and Natural Resources (CNR)

Land for Wildlife

Land for Wildlife is a program that provides encouragement and advice to private and community landholders who voluntarily conserve wildlife, or integrate the conservation of wildlife with other objectives on their property. Free advice is given through a network of extension officers, a series of technical 'Notes', regular newsletters and events such as field days. Information can be obtained on many matters related to flora and fauna conservation on private land, the availability of incentive grants and other assistance. Enquire at your local CNR Regional office.

Flora and Fauna Guarantee

In each CNR Region, a Flora and Fauna Guarantee officer is available who can provide information on threatened species.

Atlas of Victorian Wildlife

A list of wildlife recorded in your area can be obtained from the Atlas, a computer data base with over one million records. Breeding records, recent sightings, the occurrence of threatened species, and other details of distribution and abundance can be provided (e.g. Fig. 1). Enquiries to: Atlas of Victorian Wildlife, P.O. Box 137, Heidelberg, 3084. Ph. (03) 450 8600. (A small fee may apply for commercial applications.)

Wildlife Damage Control

Advice and information on problems caused by wildlife is available from CNR. Following contact with staff in your local Region, assistance may also be sought from the Wildlife Damage Control Officer, CNR, P.O. Box 137, Heidelberg, 3084.

CNR can also assist with advice on a wide range of other matters related to management of natural resources (e.g. wetland conservation, vermin control, seed collection etc.). Officers in CNR will also be able to provide comments, and advise on wildlife issues during the development of your Whole Farm Plan.

Department of Food and Agriculture

Staff can assist with information and advice on soils, pasture improvement, tree establishment, and other complementary aspects of preparing a Whole Farm Plan.

Neighbours

Neighbours may have information or experience to share on local wildlife and habitats, historical information, or solutions to problems. There may be opportunities to work co-operatively on projects that extend across several properties (e.g.

establishing a wildlife corridor). Neighbours may also have concerns or suggestions about your plans that need to be discussed.

Local 'experts'
A tremendous resource. In most communities there are people with expert local knowledge of wildlife, vegetation, tree growing, seed collection, fencing techniques, etc.

Shires or Councils
Shire staff can give advice on any local government planning controls covering your area. There may be roadside assessment information available or a local conservation strategy. Some authorities employ a conservation officer or similar adviser.

Library
The local library will have books for identifying wildlife and may have reports on the flora and fauna of your district. Historical references may help to piece together the natural history of the area. Libraries are frequently points of contact for local groups. The librarian may be able to put you in touch with natural history groups or local experts.

Field Naturalists Clubs
Local branches of the Field Naturalists Club of Victoria have been established in most regions of Victoria. Individuals in such groups with a keen interest in natural history are often very willing to share their knowledge. Enquiries to: Hon. Secretary, Field Naturalists Club of Victoria, C/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

Bird Observers Clubs
The Bird Observers Club of Australia has several branches throughout Victoria, and members of these groups may also be a source of local knowledge. Enquiries to: Hon. Secretary, Bird Observers Club of Australia, P.O. Box 185, Nunawading, 3131. Ph. (03) 877 5342.

Victorian Wetlands Trust Inc.
The trust aims to conserve wetlands throughout Victoria. Enquiries to: Secretary, Victorian Wetlands Trust Inc., PO Box 550, Dandenong, 3175. Ph. (03) 797 1555.

Landcare and Farm Trees groups
Members of these groups usually have valuable local expertise and experience in many aspects of land management and vegetation establishment. They are generally property owners and understand the realities and practicalities of farm management. CNR can provide contacts for local groups.

Friends groups
A variety of Friends groups (e.g. Friends of the Brolga, Friends of the Eastern Barred Bandicoot, Friends of the Grampians) operate throughout Victoria. They are community groups made up of people with a shared interest in some particular aspect of the natural environment. Enquiries to: Friends Co-ordinator, Victorian National Parks Association, 10 Tasma Tce., Parliament Place, East Melbourne, 3002.

Greening Australia (Victoria)
GAV assists community groups with tree-planting and revegetation projects. Facilitators are based in country areas throughout Victoria. Enquiries to: C/- National Herbarium, Birdwood Avenue, Sth Yarra, 3141. Ph. (03) 654 1800.

Consultants
A number of consultants provide services that may be relevant to your needs (e.g. habitat restoration, flora and fauna surveys). Substantial fees may apply. Staff of CNR may be able to assist with contacts.

Developing and mapping plans for wildlife

The following steps suggest a practical way of planning for wildlife as part of the preparation of a Whole Farm Plan. The key aim is to identify areas for the retention, restoration or re-establishment of habitats within which wildlife can live.

Firstly, identify and plot existing areas of wildlife habitat on a map or overlay of the property (a brightly coloured pen could be used). This might include a range of areas (see Table 2) such as a seasonal swamp, scattered trees in a back paddock, or a patch of bush, already known to be important to wildlife.

Then, identify and draw in potential areas of wildlife habitat. These are areas that could be further protected or restored, or where the re-establishment of habitats could begin. They may include, for example:
- expansion of existing bushland areas,
- corridor links between bushland habitats
- areas to be revegetated along gullies or streams,
- revegetation around the edges of a swamp or lake,
- revegetation adjacent to existing roadside vegetation.

Consider the surroundings of the property, and ask:
- How can existing or potential areas of habitat on the property be integrated with that in the surrounding landscape. - Can links be developed with nearby bushland or with roadside vegetation? - Are there streams, wetlands or bushland that extend across several properties? - Can local bushland areas be used as a source of seed and a guide to which species to plant?

Examine other activities planned for the property, and consider how these objectives can be integrated with your goals for wildlife conservation. For example,

can plans for revegetating a saline or eroding gully be modified (e.g. by widening the revegetated strip) to create additional habitat for wildlife? Can local tree species and shrubs be used in shelter belts instead of exotics?

Work out priorities for developing wildlife habitats over the short term (e.g. 1-5 years) and the longer term. An achievable goal in the short term may be to build on the existing strengths of the property by protecting and enhancing those habitats already present. Examples could include: fencing an existing bushland area to protect tree regeneration, or fencing a wetland. Different areas on the property will warrant different priorities for management (Table 3). In some areas, wildlife conservation will become the primary focus for management, while elsewhere it may be secondary to other considerations. To encourage a diversity of habitats and wildlife, try to ensure that each of the potential habitat types (e.g. woodland, wetlands, streams) that can be represented on the property appear in your Plan.

Table 3. Priorities for management of wildlife habitats on the farm

(i) Areas where wildlife conservation may be the primary aim of management.
Remnant vegetation
Vegetation along creeks and rivers
Natural wetlands
Roadsides
Strategic corridors linking fragmented habitats
Older trees (live or dead) with hollows
Rocky areas with low agricultural potential

(ii) Areas where wildlife conservation could be integrated with other objectives

Saline recharge and discharge areas
Shelterbelts
Farm dams
Areas prone to erosion requiring revegetation
Agroforestry plots
Homestead areas
Rough pastures
Vegetation established for shade and shelter
Vegetation established on driveways and laneways

Once you have some ideas on paper, it may help to get comments from others with similar plans, from neighbours, or from those with specialist knowledge of particular aspects. Staff of the Department of Conservation and Natural Resources may be able to assist. Incorporation of wildlife and wildlife habitats into Whole Farm Planning is a new and developing concept, and there is much to be learned with regard to the most effective techniques and plans. Keeping records is important as it will help in sharing successes or solutions to problems with others at a later date. It is also likely that your plans will change and evolve over time as practical experience is gained.

Managing farm habitats for wildlife

Protecting and managing remnant bushland
Few native Australian animals are able to survive solely in cleared farmland - most will only persist where there is natural vegetation. Consequently, the amount of remnant bushland and how it is managed are critical to the survival of wildlife in rural landscapes. Field studies suggest four key points for managing remnant vegetation as wildlife habitat:

* maximise the size of individual remnants (the larger the better), and the total area of remnant bushland;
* incorporate a diversity of vegetation communities, when ever possible;
* protect all layers of vegetation (e.g. tree canopy, tall shrubs, low shrubs, ground cover, logs, litter);
* maximise the connections between habitats supporting wildlife populations.

It is worth considering these four points, in turn.

(i) Size of the bushland is important
Fragmentation of bushland into progressively smaller and more isolated patches has implications for both the number of species and the type of species that remain. A consistent finding from many studies is that the larger the area the greater the number of species that it can support. Smaller patches of bushland (e.g. < 5 ha) at Naringal, in south-western Victoria, tended to have only the most common species (e.g. Bush Rat, Common Ringtail Possum), while rarer species in this locality (e.g. Long-nosed Bandicoot, Red-necked Wallaby) are more likely to occur in larger blocks where there is a larger area to support a sparse population (Bennett 1987).

The size of bushland also influences the ability of species to withstand disturbance, such as drought or fire. For example, during the Ash Wednesday fires at Naringal, small blocks were often totally consumed, but there was a greater chance of an unburnt area remaining in a large block (e.g. along a creekline) as a refuge for animal populations.

(ii) Diversity of habitats encourages diversity of wildlife
Some species of animals (e.g. Echidna, Grey Shrike-thrush) are widespread in many forest types, but many species favour particular vegetation communities. Where a range of different types of habitat are present, it is more likely that a wide range of species will occur. For example, a combination of streamside vegetation with adjacent drier woodland or forest, will provide for those species that require moist habitats (e.g. frogs, waterbirds, etc.) as well as those more widespread in open and drier forest.

(iii) All layers of vegetation are important
Different species of animals live or forage in different layers of the vegetation. For example, in relation to mammals in bushland at Naringal East:

* Common Ringtail Possums and Koalas generally feed on foliage in the tree canopy layer;
* Sugar Gliders forage for insects and plant exudates both in the canopy and on the upper limbs and trunks of trees;
* Brown Antechinus forage for insects at ground level amongst logs and litter, and also above ground by climbing shrubs and trees;
* Long-nosed Potoroos live in dense undergrowth at ground level, feeding mainly on fungi that they dig from the litter and subsoil; and
* bats (e.g. Little Forest Eptesicus, Chocolate Wattled Bat) forage in open spaces amongst forests and woodlands for moths and beetles, and roost during the day in small tree holes.

A similar pattern can be described for forest birds, with different species foraging or living in different layers of the vegetation. For many lizards, frogs and invertebrates, the micro-habitats provided by logs, leaf litter and rocks at ground level are the most important.

Clearly, a tree layer alone is not enough if the full range of species is to be encouraged and conserved in remnant bushland. When shrub or ground layers are altered or destroyed, the species that live and depend on those habitats will also decline and disappear. For example, Long-nosed Potoroos do not survive in bushland areas that are heavily grazed by cattle, as the dense ground layer of shrubs and sedges in which they shelter is destroyed. Fencing all (or part) of a bushland area to protect understorey vegetation is an important investment for conservation.

(iv) Isolation creates problems
Populations of animals that are isolated are more likely to decline and disappear than those where regular movements can be made to and from nearby populations. For many species, such isolation can be reduced by maintaining or restoring corridors and 'stepping stones' of natural vegetation (see below).

Design and management of corridors for wildlife
Movement is a fundamental feature of animal life. Animals move to find food and shelter, and for breeding. Some species move seasonally to follow local changes in food availability, and others undertake long-distance migrations. Young animals generally disperse to establish their own home ranges after achieving independence. Fragmentation and isolation of natural habitats can make these movements difficult, or impossible, by imposing barriers of inhospitable land (e.g. open cleared paddocks).

The primary purpose of wildlife corridors is to improve and restore the connectivity between natural habitats, and in so doing to increase the survival of wildlife populations in isolated habitats. Different types of corridors which can be recognised include the following.

Natural corridors - such as vegetation along creeks and rivers follow natural topographic contours. Such riparian vegetation may extend for many kilometres with minor tributaries and creeks joining with larger streams to make up an extensive connected network across a district.

Remnant corridors - such as vegetation along roadsides or rail lines, are the result of clearing the adjoining vegetation.

Roadside vegetation can be used by many species. For example, over a two year period Middleton (1980) recorded 85 species of birds from a 2.5 km length of roadside in the Wimmera, and 30 species nested there. At Naringal, roadside vegetation was used by some 80% of the mammals in the area, and at least six species of small mammal lived in, and moved through, roadsides (Bennett 1988).

Planted corridors - such as shelter belts, are those that have been deliberately created by humans. As yet little information is available on the values of such corridors to wildlife, but casual observations suggest that they are used by a range of birds.

Movements along corridors can occur in various ways. Large mobile mammals (e.g. wallabies) and many birds may move through a short corridor in a single movement. However, for many less-mobile species corridors will be most effective when they provide habitat in which animals can live, either in the short or long term.

Some practical principles in the design and management of corridors.

* Highest priority should be given to preserving or restoring natural corridors, such as gully lines, minor tributaries, and vegetation along creeks and rivers.
* Whenever possible, restore or build on to existing corridors of natural vegetation, rather than creating new corridors. These will already have components of natural ecological processes, such as soil micro-organisms, invertebrates, fungi, understorey plants etc, which will take longer to develop in new vegetation.
* Corridor width is important, and the wider the corridor the better. Compared with narrow strips, wide corridors provide greater variety of habitats, greater protection from disturbance along edges, and a larger area of habitat in which animals can live. Single lines of trees will have little value for most species; strips from 30 m to 100 m wide will be much more effective as a local corridor network.
* Corridors are most effective when they 'link up' with other larger habitats, with few or no gaps.
* Locally indigenous species of trees, shrubs and ground cover are the best plants to use when establishing new corridors, as it is to those that the local wildlife is adapted.
* Preserving (or establishing) a 'network' of corridors, wherever possible, will generally be more effective than a single corridor link.
* Patches or 'nodes' of bushland along a corridor can increase the area of corridor habitat and support more individuals.
* Fencing to prevent damage to understorey vegetation from grazing stock is probably the single most important, ongoing management required for corridors (and other vegetation managed for wildlife).

Protecting streams as wildlife habitat

The value of creek and river environments as wildlife habitat is greatest when they are bordered on each side by natural vegetation. Water quality and the condition of the aquatic habitat are closely related to the presence of streamside vegetation. Vegetation provides shade, contributes nutrients, supplies invertebrates as food for fish, helps stabilise stream banks, and filters sediments and other runoff from surrounding areas. Stream habitats are used both by aquatic fauna (e.g. various fish, Platypus, Water Rat) and wetland fauna (e.g. herons, ducks, spoonbills, reed warbler), while forest wildlife occur in the creekside bushland The bushland along creeks and rivers is a rich habitat for wildlife because the moist environment and fertile alluvial soils contribute to high productivity. Riparian vegetation along streams frequently has high structural complexity (e.g. tall canopy trees, several layers in the understorey, smooth-barked eucalypts with hanging bark, and tree hollows), that provides resources for a wide range of species. Further, the creekside habitat may extend as a continuous strip for kilometres, providing a large total area as well as connectivity for populations.

Measures that will enhance aquatic and streamside habitats for wildlife.

* Revegetating gullies and stream banks where vegetation has been cleared.
* Fencing to prevent grazing of vegetation and erosion of stream banks.
* Widening the overall strip of vegetation to provide a greater total area of habitat, and greater diversity of vegetation (e.g. riparian Manna Gum forest plus adjacent drier forest or woodland).
* Incorporating wider patches of habitat in the streamside corridor (e.g. at bends in a creek).
* Having a range of micro-habitats in the stream (e.g. deep pools, rocky riffles, submerged logs and snags).
* Preventing the run-off of chemicals, fertilisers and sediments into streams.

Tree-hollows for hollow-nesting wildlife

Many species of birds and mammals require tree hollows for diurnal shelter and for nesting and breeding. Some 36 species (20%) of common Victorian birds (33% of threatened bird species, Robinson 1991) are dependent on hollows for nesting. These species include parrots, owls, cockatoos, kingfishers and treecreepers. For many mammals, such as possums, gliders and small insectivorous bats, hollows are essential. Different species require hollows of different dimensions. The size of the hollow entrance is particularly important. For example, Sugar Gliders select hollows with an entrance diameter of approximately 3 cms; they are likely to be excluded by larger species (e.g. Brushtail Possums) from hollows with larger entrances. Species may also require a number of hollows within their home range, moving between these on an irregular basis.

As eucalypts generally do not develop hollows until at least 70-80 years of age, and there are many wildlife species potentially competing for hollows, it is not surprising that the availability of hollows can be a limiting factor for animal populations. This is particularly likely in forest areas dominated by regenerating trees where older trees are sparse or absent.

Practical measures to assist hollow-dependent wildlife.

* Protection of existing older, hollow-bearing trees (live or dead). These trees are likely to be used by a wide range of species when present in bushland amongst other trees, but isolated trees in paddocks are also used by a number of species (e.g. bats, Red-tailed Black Cockatoo).
* Leaving some older living trees (e.g. when felling timber for firewood, posts, etc.) to develop hollows over the next few decades. Smooth-barked eucalypts such as River Red Gum and Manna Gum tend to form hollows more readily than other species.

Nest boxes or artificial hollows can be provided for wildlife in some circumstances where natural hollows are in short supply. These can be a useful measure in localised areas and provide opportunities to view wildlife, but they should not be seen as a substitute for natural hollows in the environment. Little is known of the long-term use and value of nest boxes or artificial hollows to wildlife populations. A variety of designs have been used; several are described and illustrated in the Land for Wildlife Technical Note No. 14 'Nest Boxes for Wildlife', and in a brochure prepared by the Bird Observers Club of Australia entitled 'Nest Boxes for Australian Birds' (1986, second

edition).

Managing habitats for ground-dwelling animals
Habitats used by ground-dwelling animals are often the most easily disturbed on farms when areas are grazed, ploughed, or modified in other ways (e.g. logs burned). For ground-dwelling birds, mammals, reptiles and frogs to survive in farmland, food, shelter, refuge and breeding sites must be available.

Food: Invertebrates (insects, spiders, worms, etc) play an important role in the breakdown of detritus and the recycling of nutrients in the natural environment. They also form the base of the food chain and are eaten by many species. Small lizards (e.g. Garden Skink, White's Skink, Striped Legless Lizard), mammals (Brown Antechinus, Fat-tailed Dunnart, Echidna) and birds (Superb Fairy-wren, Grey Shrike-thrush, Yellow-rumped Thornbill) all forage for invertebrates on the ground, or amongst leaf litter, grass tussocks and logs. Other species (e.g. Brown Thornbill, White-browed Scrub-wren, Yellow Robin) search for invertebrates amongst low shrubby foliage as well as on the ground. Some species (e.g. Long-nosed Potoroo, Bush Rat) feed on fungi in the litter and subsoil, and others (e.g. Swamp Rat) feed on stems and leaves of ground plants.

Shelter and refuge: A variety of micro-habitats at ground level are used for shelter and refuge. Frogs and small lizards often shelter under or within logs, or under rocks or loose bark. Echidnas also take shelter under and within large logs. Small forest-dwelling mammals need thick vegetative cover (e.g. Bush Rat, Brown Antechinus, bandicoots); while the Fat-tailed Dunnart, living in open grasslands, shelters under rocks, logs, or posts. Small forest birds require shrubby low cover, while grassland birds (e.g. Richard's Pipit, Stubble Quail) shelter amongst long grass and tussocks.

Nest sites: The habitats used for shelter and refuge are often the same ones used for breeding sites. For example, birds such as Superb Fairy-wren and Yellow-rumped Thornbill nest in low shrubs, while pipits and quail nest at ground level amongst grass.

The management required to provide these food, shelter and nesting requirements will vary between areas and habitat types. For example, in coastal forests where dense ground vegetation is the natural pattern, fencing to exclude stock is generally required to protect the ground layer component. Exclusion of stock will also be of benefit, but may not always be necessary in some open habitats (e.g. open grassy woodlands, stony rises) where numerous logs, rocks or other shelter persists and shrubs are typically sparse. Leaving logs and fallen branches (instead of "tidying up" under trees), and rocks on the ground will also be of benefit.

Wetland habitats
Wetland habitats occur on many farms, though a large number have been modified by changes in water regime or drainage and through removal of surrounding vegetation, especially as a result of grazing. A 'wetland' may be an area of pasture that is seasonally covered by water, or a deeper, more permanent body of water. Both are important for wildlife. Re-instatement of natural water regimes, exclusion of stock (at least during sensitive periods) and restoration of natural vegetation around wetland areas will all contribute to improving this habitat for wildlife. Nutrient enrichment is also an important factor to consider. Fertiliser runoff, stock faeces and other sources of nutrients can reduce wetland quality and cause serious health risks. Other chemicals, such as herbicides, can also be detrimental to wetlands and their wildlife. Wetlands can contribute to the quality of water on a farm, to containment of water and flood mitigation and can be an attractive and pleasant feature with abundant plant and wildlife.

Revegetation and re-establishment of new habitats
On many properties, revegetation of selected areas will be a priority for the Whole Farm Plan. Often the primary objective will be to establish shelterbelts, prevent erosion, reduce salinity, or implement other land protection works. It will be beneficial to wildlife to revegetate areas so that they build onto, or link with, existing natural vegetation where components of natural ecological processes are already present (e.g. litter, invertebrates, soil fungi). Natural revegetation from existing trees or vegetation (e.g. adjacent bushland or roadside vegetation) can be an effective way to establish habitats and will usually be cheaper than planting seedlings.

Wherever possible, use locally indigenous plants or seed stock, appropriate to the location. These are the plants and vegetation types to which the local fauna is adapted. Be aware of plants that could become environmental weeds; for example, native species that are not locally indigenous and may proliferate.

A useful method of determining which plant species are suitable for your property is to visit remnant areas of native vegetation in the district and select suitable plants, matching your location and soil type, from these remnants. Care must be taken to have the plants correctly identified to ensure that they are local native species. If you wish to purchase plants from a nursery, then choose one that stocks local native species or is prepared to grow seed you collect from local remnants. *Land for Wildlife* extension officers can help with contacts.

Strategies can be developed to attract particular species of wildlife and limit others by provision of suitable habitats including feeding, breeding and shelter requirements suited to the species. These strategies could be employed to encourage some wildlife species to frequent the home (e.g. honeyeaters) and discourage others (e.g. snakes). However, it is always important to remember that species and their environment are inter-related and that an abundance of one species may be at the expense of others which may also have useful functions. Therefore, in most farm situations the aim should be to develop a diverse natural ecosystem of plants and animals including invertebrates.

Dealing with problems caused by wildlife
Particular species of native wildlife can, at times, cause genuine problems for farm enterprises. Usually this occurs when natural processes that regulate population numbers are disturbed. For example, numbers may increase when a natural predator is no longer present, or when an artificial food source allows an unnaturally high survival over critical times. Problems can also occur when a favoured food (e.g. a grain crop) is grown in close proximity to the species habitat.

Advice on dealing with problems caused by wildlife will vary, depending on the species concerned and the particular circumstances. Information should first be sought from the nearest Regional office of the Department of Conservation and Natural Resources.

Monitoring wildlife on the farm

In the years following preparation and early implementation of a Whole Farm Plan, observations of the changes that take place on the property will be most rewarding. In addition to the pleasure gained from a growing list of species sighted on the property, monitoring can be used as a measure of the success of farm planning activities, and as a measure of the 'ecological health' of the property. It will also be a source of continuing education, as seasonal changes in wildlife populations, reproductive patterns, animal behaviour, and plant-animal interactions are noted. Monitoring can be carried out on a casual or a systematic basis, depending on the skills, enthusiasm, and needs of the property owner. Several suggestions are as follows:

Photopoints
Fixed photopoints are the simplest way to record changes in vegetation over time. Select a number of points and photograph at regular intervals (e.g. same time each year) from exactly the same location. An aerial view from the farm windmill, or a view looking straight down at some grassland might also be considered.

Farm diary
Making regular notes in a farm diary of birds, mammals, frogs or reptiles that are seen around the farm is a good way of recording observations. It is worth noting the date, the number seen and where they were. Records of breeding will be of particular interest. For example:

Koala - single animal in Red Gum, roadside near front gate, 2nd June 1992.
Brown Tree Frogs (2) and Striped Marsh Frog (1) calling at farm dam, 8/4/91
Blotched Bluetongue - one seen basking in sun, edge of shelterbelt, 10/11/91
New plant - found beside west paddock gate - sent to CNR for identification.

Over time, these records build up an invaluable picture of the range of species occurring on the farm, when they were present, and which habitats they use. The presence and spread of pest plants and animals, and the success and health of plant regeneration could also be noted.

Lists of wildlife species
A simple way of recording the species occurring on the property is to keep a list of those sighted, preferably noting dates and frequency of occurrence. It will be surprising how many species, especially birds, will be recorded over time. Perhaps separate lists could be kept for different parts of the property, such as a list for those seen around the homestead, and a list for those seen in a bush patch. Local naturalists may be interested in assisting in this monitoring activity.

Standardised observations or censuses
Carrying out standardised observations of wildlife takes greater effort and discipline, but the quality of the information recorded is much greater. The important points are to make observations on each occasion at the same place, for about the same amount of time, using the same technique. Some examples could be:

* a regular (e.g. monthly) count of all waterbirds on a particular wetland;
* a regular count of all birds seen or heard while following the same track through a bushland area, or along a section of creek.
* a regular count of the species and numbers of frogs calling at a swamp.

Further information and references

Identifying wildlife

Birds:

Pizzey, G. (1980). 'A Field Guide to the Birds of Australia', (Collins: Sydney.)

Simpson, K. and Day, N. (1986).'The Birds of Australia', (Lloyd O'Neil: Victoria.)

Reader's Digest (1976). 'Readers Digest Complete Book of Australian Birds'. (Reader's Digest Services: Sydney.)

Mammals:

Strahan, R. (ed.).(1983). 'The Australian Museum Complete Book of Australian Mammals' (Angus and Robertson: Australia.)

Triggs, B. (1984). 'Mammal Tracks and Signs. A Field Guide for South-Eastern Australia', (Oxford University Press: Melbourne.)

Reptiles and Amphibians:

Coventry, A.J. and Robertson, P. (1991).'The Snakes of Victoria', (Department of Conservation and Environment: Victoria.)

Hero, J-M., Littlejohn, M.J. and Marantelli, G. (1991). 'Frogwatch Field Guide to Victorian Frogs', (Department of Conservation and Environment: Victoria.)

Cogger, H.G. (1983). 'Reptiles and Amphibians of Australia', (Reed: Sydney)

Further reading

Bennett, A.F. (1990). 'Habitat Corridors: Their Role in Wildlife Management and Conservation', (Department of Conservation and Environment: Victoria).

Butz, M. 1985. 'Trees and other wildlife' in 'Think Trees - Grow Trees'. (Dep't Arts, Heritage & Environment) AGPS. pp 51-67.

Breckwoldt, R. (1983). 'Wildlife in the Home Paddock', (Angus and Robertson: Australia).

D.C.E. (1990-ongoing). 'Land for Wildlife Notes' (Department of Conservation and Environment: Victoria). (A series of technical information sheets available free of charge from CNR outlets).

Dixon, P. (ed.)(1993 - in publication) 'From the ground up: a manual of property management planning'. (Department of Conservation and Natural Resources).

Johnston, P. & Don, A. (1990). 'Grow Your Own Wildlife, How To Improve Your Local Environment', (Greening Australia Ltd.).

Pizzey, G. (1988). 'A Garden of Birds', (Viking-O'Neil).

Temby, I. (1992). 'A Guide to Living With Wildlife. How to Prevent and Control Wildlife Damage', (Department of Conservation and Environment: Victoria).

References cited

Anon. (1991). Land for Wildlife study *Land for Wildlife News* 1(1): 7

Bennett, A.F. (1987). Conservation of mammals within a fragmented forest environment: the contributions of insular biogeography and autecology. In 'Nature Conservation: The Role of Remnants of Native Vegetation'. (Eds. D.A. Saunders, G.W. Arnold, A.A. Burbidge and A.J.M. Hopkins). (Surrey Beatty and Sons: Sydney).

Bennett, A.F. (1988). Roadside vegetation: a habitat for mammals at Naringal, south-western Victoria. *Victorian Naturalist* **105**: 106-13.

Bird, R. (1990). Sheltering the farm - an economic assessment of trees. *Rural Quarterly* **1(4)**: 12-13.

Ford, H. (undated). 'Farm Birds. Nature's Pest Controllers' (pamphlet) (Department of Arts, Heritage and Environment: Canberra).

Ford, H.A. and Bell, H. (1981). Density of birds in eucalypt woodland affected to varying degrees by dieback. *Emu* **81**: 202-8.

Middleton, W.G.D. (1980). Roadside vegetation, a habitat for wildlife. In 'Roadsides of Today and Tomorrow', (Roadsides Conservation Committee: Victoria).

Middleton, W. (1984). Birdlife of the lakes and plains. In 'The Western Plains - A Natural and Social History'. (Eds. D. Conley and C. Dennis). pp. 55-61 (Australian Institute of Agricultural Science: Melbourne).

Robinson, D. (1991). Threatened Birds in Victoria: their distribution, ecology and future. Victorian Naturalist, Vol 108(3), pp 67-74.

Seebeck, J.H. (1984). Mammals of the plains or, where have all the wombats gone? In 'The Western Plains - A Natural and Social History'. (Eds. D. Conley and C. Dennis). pp. 39-53. (Australian Institute of Agricultural Science: Melbourne).

Woodgate, P. and Black, P. (1988). 'Forest Cover Changes in Victoria 1869-1987'. (Department of Conservation, Forests and Lands: Victoria).