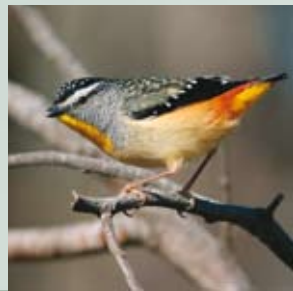


Strips of planted vegetation along creeks and fence lines, and blocks of trees in farm paddocks, have become a common sight in rural Australia. While landholders and community groups carry out revegetation for many reasons, there is a strong expectation that it will also help native wildlife to survive in farm landscapes.



“ Revegetation in farm landscapes

Are there benefits for wildlife?”

But does revegetation on farms provide new opportunities for wildlife? Which species benefit? How do wildlife respond to different types of revegetation? Does revegetation add value to farm landscapes where some native bushland is still present?



Revegetation in farm landscapes

Revegetation is changing the face of rural landscapes. Ribbons of green extend along drainage lines and creeks, stands of young trees grow along fence lines, and blocks of new vegetation 'build on' to remnants of native bush. The excessive loss of native vegetation and its consequences for soils, water, agricultural production and environmental values, have stimulated many landholders and community groups to become involved in revegetation activities.

Frequently, revegetation is undertaken to improve agricultural production; by providing shelterbelts for stock, to reduce or prevent soil erosion, or to combat the threat of salinity. Revegetation along streams helps to stabilise river banks, protect water quality, and improve aquatic environments. Revegetation can also create a more pleasant environment in which to live and work. A common expectation is that revegetation will also benefit native wildlife and allow a greater number of species to persist in rural environments. Often, the goal of revegetation is to achieve multiple objectives – to assist farm productivity and conserve biodiversity.

An astonishing variety of native wildlife occur in rural environments; frogs, lizards, birds and mammals; butterflies, beetles and other invertebrates. However, the changes that have occurred in farm landscapes mean that many species are now scarce, or have disappeared locally. Among those that have experienced the greatest decline in rural environments are species described as *woodland dependent*, species that rely on native vegetation for their daily requirements. Sugar Gliders, Rufous Whistlers and Eastern Yellow Robins are common examples. Can revegetation provide for these species? Will restoration in cleared landscapes 'bring back' these species, or will it simply benefit the common species that have survived in cleared farmland?

Restoring vegetation in different ways

Revegetation is often carried out by planting trees and shrubs or by direct seeding into prepared ground. It can also occur by natural regeneration, where single trees or remnant bushland provide a seed source from which new plants grow.

Alternatively, commercial plantations of fast-growing eucalypts occupy increasingly larger areas in many regions, and agro-forestry plots add wooded vegetation to some farms. Although such plantings may provide habitat for wildlife, they were not the focus of this research.





Investigating the benefits of revegetation

Researchers at Deakin University have recently investigated the benefits of revegetation for birds and other native wildlife in farm landscapes in western Victoria. In total, 43 landscapes, each 8 km² in size (800 ha), were studied. These included:

- landscapes cleared of native forest and woodland;
- landscapes with *increasing* amounts of revegetation (1% up to 19% of the landscape);
- landscapes with *decreasing* amounts of remnant vegetation (18% down to 1%);
- landscapes with both remnants and revegetation.

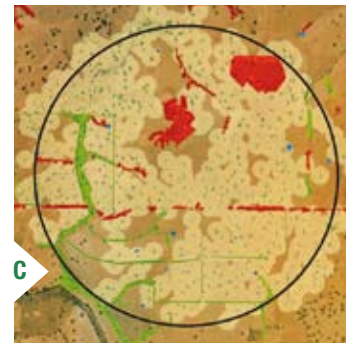
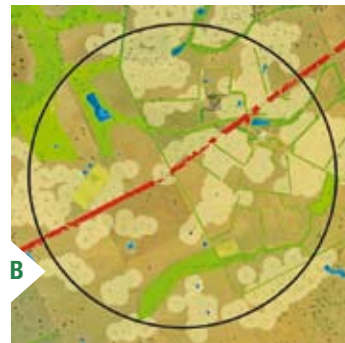
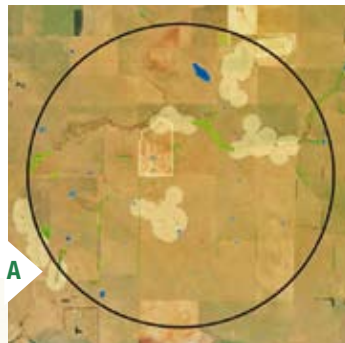
Many landscapes also have extensive areas of scattered trees among farm paddocks, typically large River Red Gums that occur at a rate of 5 or more trees per 15 ha.

Birds were systematically surveyed at 12 sites in each landscape in areas of remnant native vegetation, revegetation, pasture with scattered trees, open farm paddocks and wetlands. Mammals, frogs and butterflies were surveyed in subsets of the same 43 landscapes.



Study landscapes, shown by circles, were selected to represent differing amounts of revegetation (light green) and remnant vegetation (red).

- A.** low cover revegetation (1.8%);
- B.** higher cover revegetation (16.1%) and
- C.** mixed cover of remnants and revegetation (10.1% in total). Areas of scattered trees are shown by light shading.



Why study 'landscapes'?

Single patches of bushland or revegetation, on their own, are not sufficient to support viable populations of wildlife species. Wildlife need networks of habitat through the landscape. Further, many species move between different parts of the landscape on a daily or seasonal basis and others, such as migratory species, move at even larger scales.

The landscape is also an appropriate scale for planning the management and restoration of rural environments. Land managers are faced with issues such as the effects of different types of land use on natural environments, the most effective location and arrangement of vegetation, and the total amount of vegetation required to achieve conservation goals.



The greatest influence on the number of woodland birds is the **total amount** of wooded vegetation in the landscape



Birds are a conspicuous component of the wildlife observed in rural environments. Here, surveys recorded from 40 to 78 species per landscape, with 152 species in total.

Numerous species were associated with wetlands (e.g. Black Swan, Dusky Moorhen) or open farmland (Richard's Pipit, Stubble Quail), or occur in farmland but use trees for nesting (Australian Magpie, Brown Falcon, Sulphur-crested Cockatoo). Revegetated habitats were used by many species. Excluding waterbirds, 85% of bird species were recorded in revegetation, including 48 (80%) of the 60 species that depend on forest or woodland.

Many species distinctive communities

The composition of bird communities differed between landscapes with remnant bushland compared with those with mostly revegetation. Species that favoured remnant landscapes included birds that forage on the bark and trunks of trees (Brown Treecreeper, Varied Sitella, Crested Shrike-tit), whereas many species favouring revegetated landscapes forage in shrubby foliage (Golden Whistler, Brown-headed Honeyeater, Superb Fairy-wren).

The importance of wooded vegetation

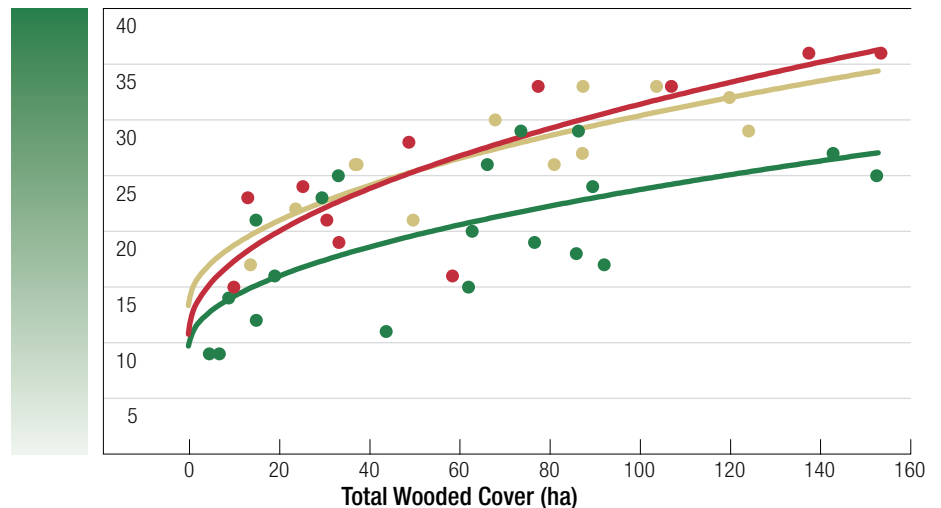
The number of species (species richness) of woodland birds was most strongly influenced by the total amount of wooded vegetation in the landscape.

Species richness *decreases* as remnant native vegetation (red) is lost from farm landscapes.

Species richness *increases* as the amount of revegetation (green) in the landscape increases.

However, for the same overall amount of vegetation, landscapes with remnant vegetation or a mix of remnant and revegetation (beige) have more species than a landscape with revegetation alone.

Species Richness

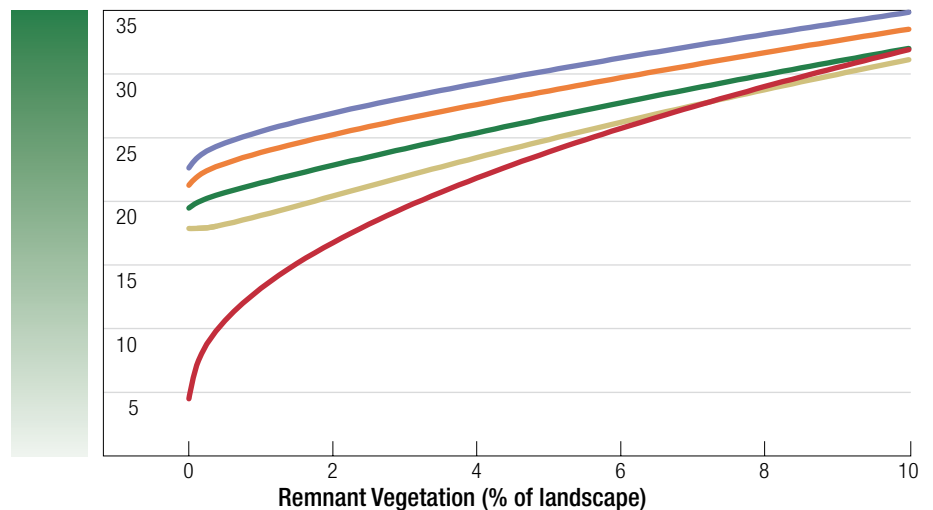


Revegetation 'adds' species to farm landscapes

Revegetation has its greatest immediate impact on woodland birds in landscapes in which little native vegetation remains. This graph, based on a multivariate statistical model, shows the relationship between the number of woodland bird species and percent cover of remnant vegetation in the landscape when:

- there is no revegetation (red line); and
- when revegetation provides additional tree cover equivalent to 2% of the landscape (beige), 5% (green), 10% (orange) and 15% (purple).

Species Richness





What's best for woodland birds?

At the 'site' scale, there were significant differences in species richness of woodland birds between four types of habitats surveyed: remnants, revegetation, pasture with scattered trees and open paddocks. The number of species from remnant and revegetated sites was similar, but two to three times greater than that recorded in pasture with scattered trees, and almost five times more species than that in open paddocks.

Despite similar numbers of bird species, the composition of bird communities differed between remnant and revegetated sites. For example, the Striated Pardalote, Crimson Rosella and White-plumed Honeyeater were a feature of remnant vegetation but less common in revegetated sites. Conversely, two shrub-loving species, Brown Thornbill and Superb Fairy-wren, were more prevalent in revegetation.

Revegetated sites with high, compared with low, diversity of tree species supported more species of woodland bird. The shape of the revegetation plot was also important; more compact blocks displayed higher species richness than linear strips such as shelterbelts.



Revegetated habitats are used by many species of birds, including most woodland-dependent species.

The cumulative number of woodland bird species increases with increasing number of survey sites. Accumulation curves represent species counts in remnant (red), revegetated (green), scattered tree (beige) and paddock (purple) sites.

Revegetation and remnant vegetation – similar but different

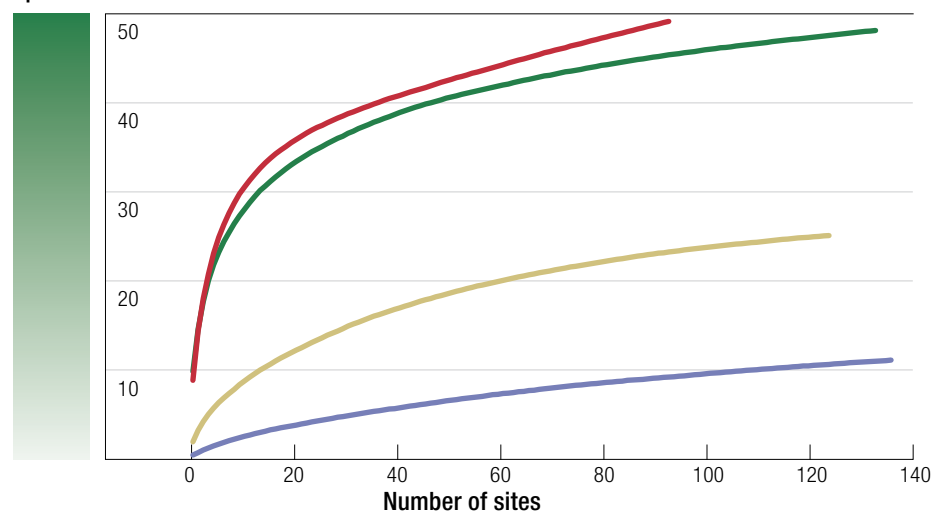
Remnant vegetation and revegetated sites showed marked differences in the structure and composition of their vegetation.

Remnant sites in farm landscapes had more extensive canopy cover, taller trees and supported more old hollow-bearing trees. At ground level, remnant vegetation had a higher cover of native grasses, while much fallen timber provides shelter for small native species. In contrast, revegetated sites typically had larger numbers of small to medium-sized trees and shrubs.

As trees grow, many characteristics of revegetated sites converge with those of remnant sites - but there are significant time lags. Habitat features such as tree hollows may take more than 100 years to develop!



Species Richness



Great scenery – benefits for wildlife too!

Old River Red Gum trees, scattered across farm paddocks, have great visual appeal. Less appreciated is their value for wildlife.

Scattered trees influence the occurrence of woodland birds; as the total area of scattered trees increases, so too does the number of bird species. Surveys at sites among scattered trees recorded more than 25 woodland species: distinctive birds included the White-plumed Honeyeater, Brown Treecreeper and Varied Sitella.

Scattered trees help woodland birds in many ways:

- as 'stepping stones' for movement through farmland;
- by providing refuge and shelter;
- as a place to forage amongst foliage, on trunks and fallen logs, and the ground beneath these trees.

Ongoing loss of scattered trees is of great concern. Not only does it change the appearance of farmland, but it also makes it harder for wildlife to persist.



Tree hollows are essential for many birds and mammals



The Growling Grass Frog is a declining species, detected at only 4 of 128 wetlands.

Wetlands are the key for frogs!

The sound of frogs at dusk is a distinctive feature of rural Australia, especially on mild spring evenings when wetlands and dams are typically full. But do frogs benefit from revegetation?

Eight species of frogs were recorded during surveys at wetlands, dams and creeks, across 16 landscapes with different amounts of remnant and revegetation cover.

Neither the number of species nor the occurrence of particular species, was related to the overall amount of wooded vegetation in a landscape. Rather, frogs are more strongly influenced by the type of wetland and the aquatic environment that it provides for breeding.



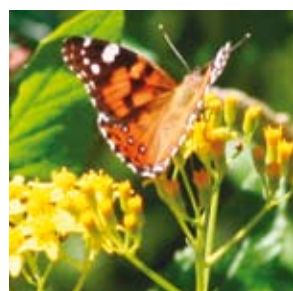
Bats, (native) rats and echidnas

Widespread clearing of native vegetation combined with pressures from feral predators has resulted in the loss of native mammals in many agricultural regions. Western Victoria is no exception; just 11 species of native mammal were detected in farm landscapes during this study. Widespread species included the Common Brushtail Possum, Short-beaked Echidna and White-striped Free-tail Bat.

Importantly, revegetation *does* provide habitat for the mammals that remain – all species were detected at both revegetated sites and in remnant patches. Notable species included the Koala, Sugar Glider and the native Swamp Rat.

The number of mammal species at a site was positively influenced by the presence of large remnant trees (that contain hollows), ground cover that includes native grasses, mosses and lichens, and fallen timber.

For arboreal species, such as the Sugar Glider (pictured) and the locally rare Yellow-bellied Glider, corridors of trees assist movements between patches of vegetation without the need for these gliding marsupials to travel on the ground.



The Australian Painted Lady is a migratory butterfly that undertakes regular movements of hundreds of kilometres.

Butterflies in farm landscapes

For butterflies, the caterpillar phase is a critical stage in life because many species have particular host plants on which the larvae feed. Changes to host plants most likely explain why butterflies are scarce in modified farm landscapes.

Only 11 species were detected during surveys; most observations were of four common butterflies, including the introduced Cabbage White. Almost all these species can use exotic plants as hosts for their larvae, and 76% of adult butterflies feeding at flowers did so from exotic plants. One exception, the Satin Azure *Ogyris amaryllis*, was recorded on just five occasions, always associated with native mistletoe - its host plant.

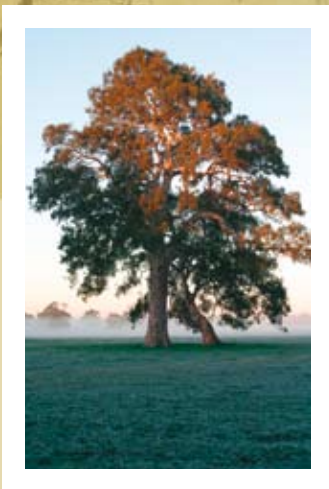
The scarcity of native grasses, small flowering plants, sedges, and nectar-bearing shrubs appears to limit butterflies. Revegetated areas can assist butterflies by providing suitable host plants, while flowering eucalypts and other native plants provide nectar for adults. Protecting vegetation along drainage lines, by excluding grazing, will also assist as flowering is often restricted to these refuges in drier summer months.



Restoring farm landscapes

There is no single solution to restoration of farm landscapes. The results from this research help provide signposts towards more effective solutions. We summarise below six broad conclusions.

1. Revegetation in farm landscapes does benefit wildlife. Not only are revegetated sites used by a wide range of species (including birds, mammals, reptiles and butterflies), but more importantly revegetation reverses the detrimental effects of the loss of native vegetation. As revegetation is added to cleared farm landscapes, the bird community 'recovers', with new species attracted back into the landscape.
2. The strongest influence on woodland birds is the total amount of wooded vegetation in the landscape. By adding to the total tree cover, revegetation actions enhance the overall bird community, particularly in landscapes where little native vegetation remains. Further, each individual planting is important; they each add incrementally to the total cover.
3. Protecting remnant native vegetation is paramount. It provides resources that are scarce in younger revegetation and supports species that depend on mature trees. The composition of bird communities differ significantly between landscapes with remnant vegetation and those only with revegetation.
4. Scattered trees across farmland have a positive influence on wildlife and enhance the conservation values of farm landscapes in diverse ways.
5. Revegetation can be established in strategic ways (see below) to supplement native vegetation. A long-term goal of a connected network of remnants and revegetation of around 30% of the landscape, should support healthy populations of many indigenous species.
6. Landscape restoration requires a long-term perspective. The composition and structure of planted vegetation changes through time, with a lengthy time-lag before the full benefits of revegetation are realised.



Getting the most out of revegetation for woodland birds

Approaches to revegetation at individual sites that will benefit woodland birds include:

- planting a diversity of locally sourced trees and shrubs
- aggregating revegetation into blocks; these have higher value as habitat than linear strips (but corridors do have other benefits)
- planting larger rather than smaller patches

- maintaining small open areas within plantings; this space is an important feeding area for some species
- revegetating along creeks and rivers (sites with the highest species richness), but a diversity of on-farm locations (creeks, flats, slopes and ridges) is of value.

The quality of revegetation as habitat for birds increases with age. Revegetation is an investment in the future.

Time lags and change!

Trees go through multiple stages as they grow from young sapling to large old veteran. Many habitat features important to wildlife are associated with large old trees:

- a large spreading canopy with dense foliage;
- trunks and limbs with bark for foraging;
- large branches that fall and become hollow logs;
- large and small hollows in branches and spouts

It will take decades for young trees, planted now, to grow to the stage where they produce these resources. That is, there is a time lag between when revegetation occurs and when its full benefits will be achieved.

Time lags mean that long-term planning is needed. We must plan now for the kind of environment we wish to see in 20, 50 or 100 years time!

It will take many decades before trees planted now become the 'big old trees' of the future





Image: James Pevitt Photography



Positive change is happening! The actions of many landholders, community groups and agencies do make a difference. A key step in the highly modified environments of rural Australia is to first protect what we have – to look after the remaining natural areas of bushland, wetlands, streams and native grasslands. Revegetation and restoration build on this base and work toward a more sustainable environment for native flora and fauna.

Making a difference

Individual actions are important; together they have a cumulative effect at the landscape scale that achieves wider benefits. However, strategic planning to guide and co-ordinate such activities is necessary to ensure that the many individual efforts achieve their greatest collective potential.

Revegetation of trees and shrubs has many benefits for wildlife, especially birds. However, landscape restoration also requires other actions to provide for species that have different needs. Management of creeks, wetlands and streams will benefit aquatic species, such as frogs, fish and invertebrates. Some species require particular components; for example, butterflies and their need for specific host plants (sedges, grasses, herbs).

Revegetation and restoration involve a long-term commitment. It will take decades for the full benefits to wildlife and the environment to be achieved. Change is gradual, and so monitoring restoration actions and their outcomes through time is essential if we are to appreciate the gains that are made.

The vision and aspirations of the community for a healthy and sustainable environment is a global challenge for the 21st century. Revegetation and restoration in farm landscapes are positive responses to that challenge and an investment in the future for all Australians.



Image: James Pevitt Photography

Other useful publications:

- Claridge, A., Lindenmayer, D., Hazell, D., Cunningham, R. and Michael, D. (2003) *Wildlife on Farms: How to Conserve Native Animals*. CSIRO Publishing, Collingwood.
- Law, B.S., Chidel, M., and Turner, G. (2000) The use by wildlife of paddock trees in farmland. *Pacific Conservation Biology* 6, 130–143.
- Munro, N.T., Lindenmayer, D.B. and Fischer, J. (2007) Faunal response to revegetation in agricultural areas of Australia: A review. *Ecological Management and Restoration* 8, 199–207.
- Vesk, P.A., Nolan, R., Thomson, J.R., Dorrough, J.W. and Mac Nally R. (2008) Time lags in provision of habitat resources through revegetation. *Biological Conservation* 141, 174–186.

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