

TANGIBLE BENEFITS OF NATIVE VEGETATION

RESTORING THE BALANCE AND SAVING A DOLLAR

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with case studies by Neil Marriott



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Chapter 1. INTRODUCTION

"Everything is connected to everything else."

Barry Commoner

In any natural ecosystem everything is connected to everything else and everything is recycled. Types of soils present and moisture available will determine what plant species grow. Plant species will then determine what animal species will be found.

Green plants take in carbon dioxide and, through photosynthesis, will split carbon and oxygen molecules. Plants use carbon molecules to build trunks, stems and leaves, and release oxygen molecules back into the atmosphere.

Animals use oxygen molecules in cellular respiration, producing heat and energy needed to function, and giving off carbon dioxide as a waste product. Plants also provide food for first-order consumers (herbivores), which in turn may become food for second and third-order consumers (carnivores). Without green plants to recycle these gases and to provide food, animal life would soon become extinct.

When plants and animals die, molecules from which they were constructed are recycled for future generations of plants and animals. Calcium, iron, phosphate, nitrogen and many other elements used during their lifetime are also recycled.

An undisturbed natural ecosystem will contain a great number of organisms and features, all working together to create a balance and, over time, will remain stable. Eventually, a natural event such as fire may destroy that stability and bring about 'secondary succession', where many changes occur over varying time frames.

Initially, fire may remove much vegetation and may kill many animals that cannot escape its destructive force. But fire will also bring about germination of new plants. Grasses may be first to appear and, for a time, will provide good grazing for herbivores.

Then, wattles and other shrubs will appear, providing food and shelter for many species of insects on which birds, mammals, reptiles and amphibians can feed. In time, slower-growing eucalypts will appear and, over time, the fire-ravaged area will be restored to its former condition and once again become a stable ecosystem.

When Aboriginal man first arrived on the Australian continent 50,000 years ago, he brought with him 'firestick ecology' – the practice of frequently burning areas to remove scrub to make for easier hunting and flush out game animals. Frequent burning over many years changed many shrublands into grasslands, permanently altering the ecology of vast areas.

A little over 200 years ago, European man arrived, bringing with him new technology, new plants and new animals. Huge tracts of forest and woodlands were cleared for agriculture and many introduced plants and animals became serious pests, to the detriment of many native species.

Where once large natural ecosystems existed, with a huge diversity of plant and animal life, there were now paddocks that contained a single species of plant such as wheat or oats. Many plants and animals that once lived there died out, reducing the biodiversity and natural stability of the area.

Australia now has the dubious distinction of being the country that has caused the greatest number of native species' extinctions in the shortest time. Fortunately, in recent years, there has been a realisation that many native plants and animals can benefit farmers and graziers.

That realisation has brought about a conservation ethic among many landholders, leading to formation of Landcare groups and a growing sense of urgency to restore some natural balance that once existed.

Consequently, we see huge numbers of native plants being established along roadsides, in corners of paddocks and around wetlands in the hope that they will: help reduce erosion, wind velocity and evaporation; control or reduce salinity; bring birds, mammals, reptiles and amphibians back; and go some way towards increasing the biodiversity of the local area.

Conservation, and the desire to restore some measure of biodiversity, are noble goals in their own right and may be 'feel good' activities for country and city people alike. They may also bring about some economic benefits to local landholders.

In the following pages, examples are given of how replanting and maintaining native vegetation could result in economic benefits for landholders; how they can help restore the balance and maybe save a dollar or two while doing so.



Remnant woodlands can provide many benefits to landholders.
Photo: Clive Crouch

Chapter 2. PRECIOUS PLANTS

Two basic requirements for life are sunlight and water. These two commodities occur in greatest abundance at the equator and so equatorial regions support the greatest abundance and diversity of life on Earth.

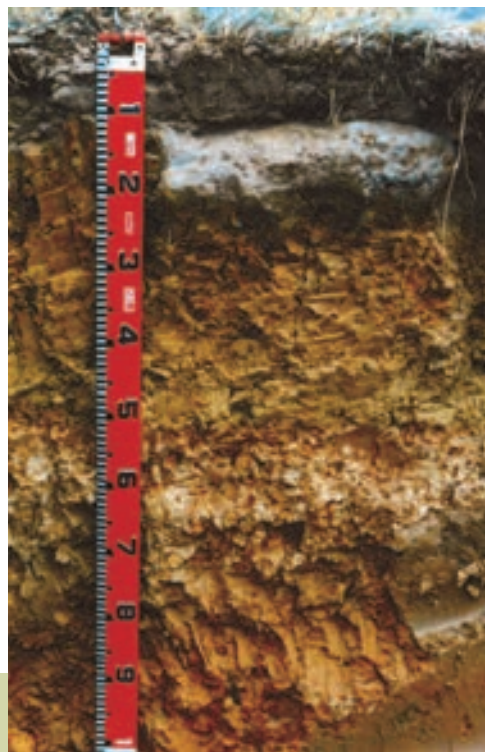
As we move away from the equator, sunlight and moisture varies and the abundance and diversity of life varies accordingly. Each organism has adapted to its own unique environment and moisture and temperature variations.

Provided that each organism's unique requirements for moisture and temperature range are met, the next most important commodity for its survival is linked to the soil. Structure and type of soil present determines what plant life will be found and, in turn, plants determine which animal species are found.

Australia has the oldest soils on Earth and topsoil, on which plants depend, averages only 100 millimetres (mm) in thickness. Topsoil forms at the rate of around 0.2 mm per year and so our 100 mm of topsoil has taken at least 500 years to form.



A soil pit on a Nhill farm, showing layers of soil to a depth of two metres.
Photo: Clive Crouch



The precious 10 cm of topsoil is clearly visible in this soil pit.
Photo: Clive Crouch

If soil is not protected and bound together by plants, much of it can be washed away by heavy rain or blown away by strong winds. Many will remember February 1982, when 300,000 tonnes of Wimmera and Mallee topsoil was dumped on Melbourne in one afternoon!



A farm north of Nhill, during the February 1982 dust storm. In that one afternoon, 300,000 tonnes of topsoil from the Wimmera-Mallee was dumped on Melbourne.
Photo: Clive Crouch



Roadside vegetation and shelterbelts on farms can slow the wind and help reduce erosion of the topsoil, which is the farmer's most valuable asset.
Photo: Clive Crouch

Those catastrophic events caused by the 1982 drought made many landholders rethink their farming practices and caused many to radically change the way they managed their land. Many realised how important it was to have shelter belts of trees in and around their properties to protect the fragile topsoil.

As an increasing awareness of benefits of plants (other than for cash crops) developed, landholders adopted new methods of looking after soils on which their livelihood depended. Many formed or joined Landcare groups, began improving their land management, and developing an awareness of the importance of native plants in their surrounding areas.

We now see many landholders actively involved in Landcare activities, planting biolink corridors, shelter belts and wildlife refuges on their properties and restoring degraded wetlands with the intention of restoring some biodiversity to the area.

WHAT ARE PLANTS GOOD FOR?

Plants perform a vital role in any ecosystem – natural or artificial. In our man-made agricultural ecosystems, plants are the main source of income – whether as a cash crop of wheat, canola, beans, etc. or as pasture for wool and fat lamb production.

Most farmers today realise the value of diversifying land use and nowadays most produce income from a wide range of crops and stock. Many would now appreciate the environmental principle ‘Diversity means Stability’ – the more diverse their income stream, the more stable their income will be over an extended period.

In a natural ecosystem, the more diverse the populations of plants and animals, the more stable the ecosystem will be in the long term. So, having native plants on and around a property will help to maintain the area’s biodiversity and may bring benefits to landholders.

THE BENEFITS OF PLANTS

Precious Plants:

- Are essential to survival of animals.
- Are essential to creation of income for farmers and graziers.
- Help bind topsoil and prevent it from being washed or blown away.
- Add humus to the soil, making it more friable and more productive.
- On roadsides and shelterbelts, reduce wind velocity and help reduce erosion and evapotranspiration, thereby benefiting nearby crops and pasture.
- Help control salinity by lowering or maintaining saline groundwater levels.
- Provide shade and shelter for livestock.
- Provide food, homes and shelter to a wide range of native wildlife, many of which are beneficial to landholders.
- Allow people to gain income from collecting and selling seeds from selected species for revegetation projects.
- Provide landholders with the opportunity to establish tree farms and woodlots.
- Provide landholders with the opportunity to profit from sale of carbon credits.
- Soak up carbon dioxide, helping reduce the greenhouse effect.

- On roadsides and in shelterbelts, help slow the spread of grass fires and give fire fighters a better chance of controlling or extinguishing fire.
- Add to the area's biodiversity, making local ecosystems more stable in the long term.
- Provide landscape and aesthetic values to otherwise barren areas.

Soil is the farmer's most valuable asset. Without that vital 100 mm of topsoil there would be no money in agriculture. Plants are inexorably linked to the soil – without plants much of the fragile topsoil, which may have taken more than 500 years to form, may be washed or blown away in one heavy downpour of rain or in a severe dust storm.

Plants, which the farmer grows as a cash crop or as food for livestock, are essential to economic wellbeing, while native plants on and around his property provide foods, homes and shelter for an abundance of wildlife. Much of this wildlife is beneficial and may well save a dollar or two by reducing needs for herbicide or pesticide or other pest control measures. Caring for soil and the plants which bind it together and protect it will help the farmer maintain productivity.

With an increasing awareness of the importance of biodiversity, many farmers are now fencing and protecting patches of remnant native vegetation on their properties. In some cases, farmers are ensuring that native vegetation and its associated wildlife are protected for all time by placing a conservation covenant on it.

Some rural shires, such as Hindmarsh Shire, are now recognising efforts of farmers who protect remnant native vegetation on their properties by giving rate rebates on the protected land.

The farmer not only benefits financially from reduced annual property rates, but may also benefit from biological control of pest species from many native animals making their homes in the protected native vegetation. And, of course, everyone benefits from the native vegetation's landscape and aesthetic values.

Plants are indeed precious – we can't live without them!



Even on a badly eroded area, a young Red Gum has taken root and, in time, will help to stabilise the hillside.

Photo: Clive Crouch

CASE STUDY 1: SHELTERBELTS AND ALLEY FARMING

When Thomas Belcher and Dugald Macpherson became the first Europeans to discover the vast West Wimmera Plains in 1864, they waxed lyrical about the region's 'parklike' landscape; open woodlands with extensive areas of abundant native grasses and herbs which made perfect grazing land for sheep and cattle.

When squatters and settlers moved in, they took up huge leases and began clearing the land in the mistaken belief that trees competed with native grasses. They thought that by ringbarking or removing trees, they would produce even better pastures for their stock.

Little did they know that beneficial relationships between trees and native grasses and herbs had evolved over tens of thousands of years. Their actions in ringbarking and clearing trees upset the delicate natural balance and, with added grazing pressure from their stock and compaction of soil from hard hooves, much natural pasture was destroyed.

In time, landholders began to replace natural pastures with introduced grasses and clovers, 'improving' land for their stock and bringing about a serious decline in native plant species. In later years, they began adding fertilisers to their improved pastures, bringing about a further decline in native plants.

Then cropping was introduced. Tree clearing was carried out on a large scale and the land was ploughed, ready for sowing grain crops. While this was necessary for the fledgling country's economy and for landholders' continued existence on the land, it resulted in local extinctions of many plant and animal species.

As new, bigger and better machines were developed, more and more land was brought into production. Once again, native vegetation was perceived as a competitor with crops so many landholders embarked on systematic removal of almost every tree on and around their land.

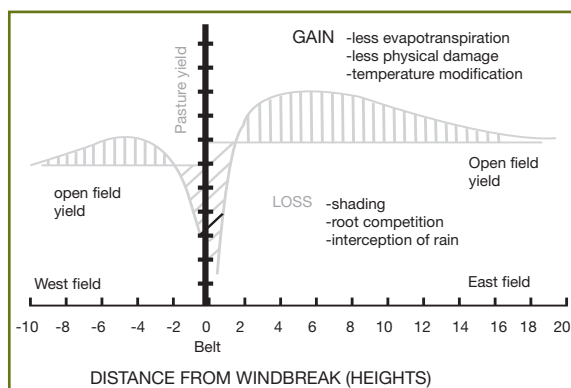
Trees can be a nuisance to today's modern broadacre farmer with massive wide-span machinery. Even individual trees in paddocks are removed to save inconvenience of having to work around them.

Perhaps the 1982 drought, as much as anything, brought about an awareness that excessive land clearing was not in best interests of long-term sustainable farming. This was vividly emphasised to many landholders when they watched television news on the night of that February 1982 duststorm which dumped 300,000 tonnes of their valuable topsoil on Melbourne in just one afternoon! Following that horrendous duststorm, many country roads were impassable because they were covered with a metre or more of the adjoining farmer's topsoil. Farmers and rural councils had to spend thousands of dollars removing soil from roads before traffic could use them again.

But in places where remnant native vegetation still existed on roadsides, damage was nowhere as severe and a few farmers noticed that crops growing near roadside vegetation produced higher yields than in the middle of the paddock. This caused a few 'thinking' farmers to explore the possibility that shelterbelts may be beneficial, rather than detrimental, to their crops.

In Western Australia, some farmers took it a step further. They began planting rows of trees at intervals across their paddocks and developed the concept of 'alley farming'. Although some land was taken out of production, there were benefits such as reduced erosion, reduced wind velocity (and therefore reduced evapotranspiration) and increased habitat for wildlife, of which several species may benefit the farmer particularly in pest control.

FIGURE 1 SHELTERBELT EFFECTS

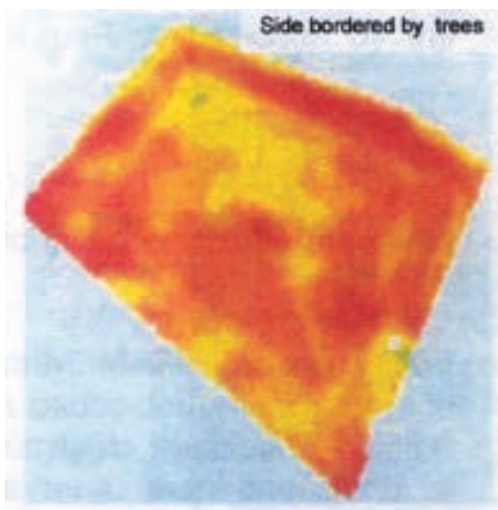


A generalised representation of possible shelter effects on pasture yield, indicating factors that may influence losses in the competitive zone and gains in the shelter zone on both sides of the windbreak.
(Source: Bird, 1998, and quoted in Corr, 2002.)

Putting the concept of shelterbelts to the test, Netherby farmer and Southwest Regional Manager of Greening Australia Victoria Ron Dodds began planting extensive shelterbelts of native trees and shrubs around his farm. Although some land was taken out of production, Ron was keen to test effectiveness of shelterbelts.

Apart from obvious benefits of reduced wind velocity (therefore less erosion and less evapotranspiration) and increased habitat for wildlife, Ron was keen to discover other benefits. He was particularly interested in 'yield mapping', which involved connecting a computer to a header and linking it to Global Positioning Satellites (GPS) to allow the landholder to produce maps, showing yields from each part of the paddock.

FIGURE 2 EFFECT OF SHELTER ON YIELD



An example of the shelter effect pattern on a yield map. The dark orange band in the shelter zone indicates yields considerably higher than the average open field yield, which more than outweighs yield losses caused by competition along the tree line (shown in yellow). (Source: Dodds, undated, and quoted in Corr, 2002.)

Producing yield maps for the same paddock, with different crops over a few years, will help the farmer determine which parts of the paddock are most productive and what may be the best use for different parts. For example, there is not much point planting crops on yellow sections of the paddock in Figure 2 if cost of production is going to be greater than returns from the harvested crop.

It may make good sense to fence that section of paddock and plant trees, either as a shelterbelt, as a woodlot than can be harvested for firewood in future or simply as habitat for wildlife. The best use of such sections of paddock would depend on location, soil type, average annual rainfall and goals and strategies included in the owner's 'whole farm plan'.

Obviously, in planting shelterbelts, some land is taken out of production and considerable effort and expense goes into such a project. Financially, it may be several years before any increased yields that result from the shelterbelts or alleys reach break-even point.

If grant money or government incentives are available, the break-even point may be reached much sooner. Apart from financial reward, there may be many other benefits that could make such a project worthwhile such as increasing biodiversity, improving landscape and aesthetic values, amelioration of erosion and salinity control.



One of the shelterbelts planted on Ron Dodds' farm near Netherby.
This shelterbelt is seven years old.
Photo: Clive Crouch



One of the more mature shelterbelts on a Perenna property, north of Nhill, Victoria, with the adjoining paddock prepared, ready for cropping.
Photo: Clive Crouch



Planting lower-growing trees on the windward side of shelterbelts helps lift wind over taller trees. As a general rule, it is 10 times the height of trees out into the paddock before wind comes to ground again, and so it is over this distance that shelterbelts have a beneficial effect on crops.
Photo: Clive Crouch



Farmers fortunate enough to have native vegetation growing on roadsides adjoining their properties are saved the time and expense of establishing shelterbelts.
Photo: Clive Crouch

CASE STUDY 2: BENEFITS OF NATIVE PASTURES

From the time of European settlement, native grasses were vital for farmers to survive and provided the start and subsequent massive growth of our sheep industry. In fact, it is clear that the nation's economy rode on the back of the sheep which thrived on our native pasture. If it had not been for our high quality native grasses, the sheep industry would never have taken off.

Tragically, early pioneer graziers did not know that native grasses will not tolerate continuous grazing and before long, vast areas of the inland were stripped of their most valuable asset. Today, those farmers with areas of native pasture on their farms have a priceless asset that should be cherished and looked after.

Recent research into native grasses has revealed why early graziers became so prosperous – native grasses have evolved over tens of thousands of years to survive in poor soils and to survive droughts, severe winter frosts, floods and fires. They require no fertilisers, no annual sowing, no watering or spraying.

All they require is a chance to flower and set seed during spring-early summer, as well as a program of occasional rest to allow them to recover from spells of grazing. Given these simple management requirements, native pasture will continue to provide free high-quality stock feed for many generations to come.

Benefits of native grasses speak for themselves – native pasture will never make big returns that exotic 'improved' pasture can make. But they do not cost the time, financial outlays on fertilisers, sprays or rejuvenation works that exotic pastures demand. In fact, they are free of all costs. As long as you care for them, they will always be there.

A large variety of plant species in native pasture means that well-managed stock actually do better on native pastures. By grazing on different plants, they gain a great variety of nutrients and trace elements. Native pasture also has a clear antibacterial and anti-parasitic effect on stock – sheep on native pasture rarely require drenching.

Native grasses are highly nutritious, with Native Weeping Grass *Microlaena stipoides* having up to 24% protein levels, Wallaby Grasses *Austrodanthonia spp.* around 16% and Spear grasses *Austrostipa spp.* around 12%.

The widely-promoted exotic Phalaris may have up to 20% protein levels while it is actively growing, but then drops to around 8%. While native grasses provide habitats for native wildlife species, few, if any, live in pastures consisting entirely of introduced grasses.

Recent economic studies have shown it is simply uneconomic to invest scarce capital into replacing native grasses with introduced grasses. This is especially so now that we know how to manage native grasses for productivity and persistence. Now, more than ever, farmers should care for their native pastures as one of their most valuable assets on the farm!



Native pastures provide excellent feed for stock. They are also vital habitats for many rare species of native fauna. The Wallaby Grass (*Austrodanthonia setacea*) shown, is the food plant for several endangered Sun Moths. Less than 0.05% of our native grasslands still exist in Victoria.

Photo: Clive Crouch



The Golden Sun Moth (*Synemon plana*) was once common and widespread throughout southeast Australia. As the Wallaby Grass (on which it feeds) disappeared, it also declined to the point where it is now a nationally-endangered species.

Photo: Fabian Douglas

CASE STUDY 3: HELPING CONTROL SALINITY

Kennedy Miller, a wheat farmer from Narembeen in Western Australia, has clearly proven that retaining remnant native vegetation on 25% of his farm has protected the remainder of his farm from rising water tables and associated salinity problems. As a result, Kennedy's returns on his farm have been around 12% - compare this with the national farming average of 3%!

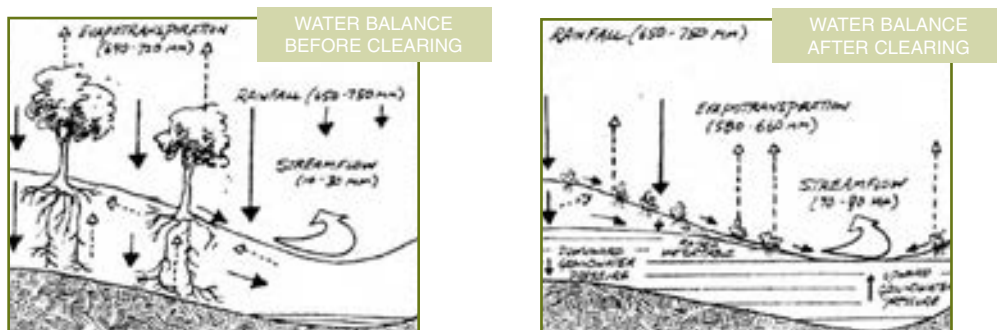
Kennedy has also had benefits of free pest control by native birds, mammals and reptiles, shelter for his stock and water purification, as well as aesthetic and landscape values that increase his farm's capital value.

Native trees, shrubs and grasses are nearly all deeply-rooted perennials, capable of not only seeking water deep down in the subsoil, but also developing a dense and fibrous layer of feeder roots in the top 30 to 40 centimetres. This layer has proven essential in trapping and slow release of vast amounts of rainwater. It results in a system where rainwater never reaches the deep groundwater but instead slowly moves through the upper layers, filtering and purifying, until it reaches streams and springs where it is crystal clear and pure.

Compare this with the usual situation on most farms – bare hills denuded of their trees, shrubs and native grasses allow large quantities of rainwater to enter the soil, causing a rise in groundwater levels. This results in salt scalds, firstly along creeks and gullies, then gradually spreading out across paddocks, reducing yields and eventually making large areas of land useless.

Bare hills also mean much more run-off, resulting in rapid downhill flow of water, carrying with it much more of the farm's valuable topsoils. This fills streams with nutrient-rich silts, causing stream blockages, algal blooms, water contamination, turbidity and a severely degraded water supply further downstream.

Clearly, large blocks of strategically-located trees, shrubs and native grasses are essential on all farms to ensure the threat of salinisation does not arise. To ignore this danger is to threaten the long-term viability of your farm.



As the diagram shows, removing deep-rooted plants from the landscape allows the groundwater table to rise, leading to saline discharge and losses of productivity.
(Source: Victorian Salinity Program - Saltwatch, 1996, 4)



A salt scald near Dimboola – the result of over-clearing by previous generations of farmers.
Photo: Clive Crouch



Restoration works by Gordon Klinge on a salt-damaged paddock near Dimboola. Rising water tables killed the trees many years ago but planting out with salt-tolerant plants, such as Saltbush, will help lower the water table as well as provide useful feed for stock.
Photo: Clive Crouch

Chapter 3. BENEFICIAL BIRDS

Birds play a vital role in ecosystems. More than 600 species of birds are found in Australia and each species performs an important function. Many are beneficial to landholders in helping control various pests, many are benign and a few may themselves become pests. But some of these may be pests only at certain times of the year or may bother only certain types of producers.

WHAT ARE BIRDS GOOD FOR?

Birds often benefit man in many ways. Examples include:

- Ibis and herons help control pests such as plague locusts, crickets, grasshoppers and other insect pests.
- Hawks, falcons and kites help control locusts, crickets, grasshoppers, rats and mice.
- Falcons, sparrowhawks and goshawks help control pest species of birds such as sparrows, starlings and blackbirds.
- Owls, frogmouths and nightjars help control locusts, grasshoppers, crickets and rats and mice.
- Long-billed Corellas, which can themselves be a pest for the first few weeks of newly-sown crops, can benefit pastures later in the year by digging up and eating the introduced Onion Grass.
- Eagles, buzzards and falcons help keep rabbit and hare numbers in check.
- Magpies help keep pasture pests such as locusts, crickets, grasshoppers, cockchafer and beetles in check.
- Bustards eat large numbers of locusts, crickets and grasshoppers.
- Many species help control harmful caterpillars and leaf-eating beetles.
- Performing a vital role in maintaining the biodiversity of natural ecosystems.
- Providing an aesthetic value to man through their beauty and song.



The Bustard, a most beneficial bird for farmers, was once common on the Wimmera Plains but has now all but disappeared from the area.
Photo: Clive Crouch

A GALLERY OF BENEFICIAL BIRDS

THE MAGNIFICENT 'WEDGIE'



Wedge-tailed Eagles perform a valuable service by helping keep rabbits and hares in check. Rising to great heights on thermals, their incredible vision allows them to spot prey from two or more kilometres away.

Photo: Clive Crouch



Although some farmers claim that 'Wedgies' sometimes take new-born lambs, there is some doubt as to whether they actually kill lambs or just scavenge on those that have died. Whatever the case, 'Wedgies' are now a protected species under the Wildlife Act.

Photo: Clive Crouch

THE NIGHT WATCHMEN



Tawny Frogmouths feed on mice and night-flying moths, performing a wonderful 'free of charge' overnight service to farmers.
Photo: Clive Crouch



This Spotted Nightjar is not injured – it is 'roosting' on the ground as Nightjars do and relying on its camouflage to protect it from predators. Like the Tawny Frogmouth, Nightjars feed on nocturnal moths.
Photo: Clive Crouch



The little Owlet Nightjar hawks night-flying moths on the wing. It needs mature trees with hollows to roost and nest in. Sometimes, when you are walking through a patch of woodland, if you knock on a hollow tree with a stick, an Owlet Nightjar will pop its head out to see what is going on.
Photo: Clive Crouch

CASE STUDY 4: IBIS – THE FARMER’S FRIEND

“The Straw-necked Ibis *Threskiornis spinicollis* is found only in Australia. It has an insatiable appetite for grasshoppers and other insects. This bird is a valuable asset to Australia and yet thoughtless farmers used to shoot it. Two naturalists came upon a flock of ibises breeding in the Riverina. They estimated the flock to contain 240,000 birds. They found each bird shot contained on average 2000 young grasshoppers. Think of it; 480,000,000 grasshoppers in a day! Where are those birds now when needed to stem a locust plague?” (Leach, 1950, 123).

As Leach reports, ibis can be beneficial to farmers. If a farmer had the misfortune to encounter a locust plague on his property, it could prove quite costly. As a rough guide, the cost of suitable chemicals could amount to around \$8.00 per hectare and hiring a spray plane would cost a similar amount.

Should a farmer need to aerial spray 100 hectares of crop to control plague locusts, it could cost him around \$1600 for just one spraying and he could need to spray several times as more locusts emerge, or are borne in on prevailing winds. Unfortunately, many insecticides kill beneficial insects as well as pest insects.

Also, birds and mammals that eat poisoned insects may also die, thus breaking a vital link in the food web, leading to proliferation of other pests and exacerbating the farmer’s problem. But, if the farmer is fortunate enough to have flocks of ibis move in and do the job free of charge, it could save a lot of money.

Sadly, loss of wetlands where ibis breed, reduction in numbers from eating poisoned insects and alteration to their habitat has had a deleterious effect on this valuable species. Nevertheless, large flocks of ibis can still be seen in places where their preferred food is available and they are quick to move in on plagues of locusts and crickets, thus indeed proving to be ‘the farmer’s friend’.

Straw-necked Ibis, roosting for the night in a wetland. Early in the morning they will fly out to feed on grasshoppers and other insects on surrounding farmland.
Photo: Clive Crouch



CASE STUDY 5: NEW ENGLAND DIEBACK

As you drive from Tamworth to Armidale in northeastern New South Wales, you steadily climb up onto the New England Tableland. One of the first things that strikes you when you reach the tableland, is severe dieback on nearly all of the mature trees. New England Dieback has been a concern to landholders and conservationists for many years and a good deal of research has gone into causes and possible methods of combating it.

Several researchers from the University of New England at Armidale have devoted much time and effort into investigating the problem. They have begun to gain an understanding of its causes and have come up with some suggestions of how to deal with it. Their research has shown many factors causing the dieback and several potential ways of controlling or reducing it.

Their research has led them to the following conclusions:

- In early days of European settlement in the New England region, farmers thought that trees competed with pasture on which their stock grazed and so they ring-barked or removed many of the trees. In time, this resulted in a rising water table that brought saline ground water into contact with roots of the remaining trees, putting them under stress.
- Compaction of soil under and around remaining trees by hard-hoofed sheep and cattle prevented rainwater from penetrating soil around root zones of surviving trees, thus depriving them of moisture needed for health and growth.
- The compacted soils shed water, causing erosion, which resulted in loss of topsoil and nutrients from around root zones of the trees, placing them under greater stress. In some cases, erosion was so severe that it exposed tree roots, further stressing the trees.
- Over-grazing by stock resulted in bare ground, which then suffered from wind erosion, removing more topsoil and nutrients.
- Over-clearing and over-grazing resulted in loss of understorey and groundcover plants, severely reducing the amount of suitable habitat for native fauna such as birds, mammals, reptiles and beneficial insects that helped keep insect pests under control.
- Leaf-eating insects (particularly beetles) attacked the stressed trees and in some cases, defoliated them. Without any natural predators to control them, the insects ate leaves faster than the trees could grow new ones, and severe dieback resulted.

To address the problem of New England Dieback, the researchers made the following suggestions:

- Plant several species of deep-rooted native plants, to help lower the water table through evapotranspiration, and move saline groundwater below the tree's root zone.
- Reduce grazing pressure to allow for regeneration of native plant species. Or, where areas were severely degraded, replant with grasses, particularly native grasses. This would not only help reduce erosion but would add humus to the topsoil, making it more friable and better able to absorb rainwater.
- Plant a hectare or two of native understorey plants and groundcovers in corners of paddocks to provide habitat for native fauna and particularly for insect-eating birds.

Researchers found that where landholders had adopted these measures, affected trees began to recover. Success of the remedial measures was mainly due to birds that occupied and proliferated in planted understorey and fed on leaf-eating insects.

Better land management and adopting practices that restored some of the area's original biodiversity helped farmers reduce the problem of New England Dieback and in almost every case, improved productivity of the land.

Dieback in Eucalypts is usually caused by a number of factors, but can sometimes be reversed by planting understorey species of native plants along fences or in corners of paddocks, to provide habitat for insectivorous birds.

Photo: Clive Crouch



CASE STUDY 6: THE GOOD OLD 'MAGGIE'

The Australian Magpie is an abundant and wide-spread species. It is probably one of the few native species that may have benefited from clearing land for agriculture, for it feeds mainly on invertebrates in pastures.

One thing magpies do need is patches of tall trees in which to nest and raise their young. While they may nest in single, isolated trees, their young will be exposed to predators while parents are out feeding.

Also, because magpies live in small family groups and will vigorously defend their territory against other magpies, they need a reasonable area to feed in. This makes clumps of trees an important component of each group's territory.

Magpies feed largely on scarab larvae found under pastures and lawns but also feed on a variety of invertebrates. They will switch from one food source to another, depending on the seasonal variation of insects available.

Davidson, (1992, 85), states: "Here is the perfect biological control – a native bird that feeds on a variety of invertebrates including ants, weevils, scarabs, grasshoppers and caterpillars – a most adaptable bird that will find food even when pest numbers are low, and will switch between prey as pests increase."

On one property, researchers found that an average square metre of pasture contained 10 scarab larvae, 145 weevil larvae, 13 earth worms and 40 others such as spiders and millipedes. In any year on this property magpies would have eaten most of the large scarab grubs and probably a large proportion of adult weevils when they emerged.

In a year of high scarab numbers more magpies would be needed to reduce the pest to an acceptable level, but more trees would be needed to provide more breeding places and territories (Davidson, 1992, 86).



Australian Magpies (*Gymnorhina tibicen*) are an abundant species in the Wimmera, but they need trees in which to nest and roost. Photo: Clive Crouch

CASE STUDY 7: HYPOTHETICAL SCENARIO

(But based on real events in the past)

Dichloro-diphenyl-trichloroethane (DDT) is one of the most effective insecticides ever produced and has helped save millions of people who would have otherwise died from starvation due to crop loss from insect attack or disease spread by insect vectors. Sadly, this remarkable insecticide has serious side effects.

It is a persistent chemical – this means it does not break down quickly but remains in bodies of organisms that ingest it. Effects are also cumulative so, as more DDT is ingested, its effects become more pronounced, eventually resulting in death for organisms that have ingested it.

Once scientists and governments became aware of problems associated with use of this insecticide, it was banned in most developed countries. Regrettably for our environment and its unique wildlife, it was 17 years after DDT was banned in America before Australian politicians got around to banning its use here.

OUR HYPOTHETICAL CASE – ‘RESIDUAL POISON IN THE FOOD WEB’

Many years ago, grapegrowers in the Riverina were plagued by thrips – small sucking insects that can at times be serious pests in fruit and vegetable crops. In an effort to control thrips, vines were sprayed with DDT. This killed thrips and eliminated the problem for the grapegrowers.

Soon after spraying, some heavy rain fell in the area. DDT was washed from vines and, along with poisoned thrips, was carried into creeks that flowed into the Murray River. In the river, water-borne DDT was absorbed by aquatic plants and animals that ate the plants ingested the DDT.

Water beetles, small fish and small crustaceans such as shrimp, fed on poisoned aquatic plants and on poisoned thrips and in doing so, also ingested the DDT. In turn, larger organisms fed on these creatures and so levels of DDT accumulated in their bodies, eventually poisoning them.

Before long, fish were dying, floating to the surface and being carried along by the river's currents. They were carried into a rookery, where thousands of ibis were nesting. They capitalised on a plentiful and easily-obtained supply of dead fish, ate them and fed them to their chicks.

Levels of the persistent poison built up in their bodies, killing both chicks and adult birds, thus removing from the area an efficient and effective controller of pasture pests such as crickets and plague locusts.

Not long after, a serious problem with plague locusts occurred in southwestern New South Wales and with no ibis to keep them in check, they quickly proliferated to plague proportions. It became necessary to bring in aircraft to spray the locusts with DDT.

Unfortunately, many other birds such as hawks, kestrels, kites and owls had flown into the area to capitalise on the abundant food supply provided by the locusts. But, after the spray planes had done their work, the birds began feeding on poisoned locusts, ingesting the persistent poison and eventually succumbing to it themselves.

As summer approached and wheat crops ripened in northwest Victoria, the introduced house mouse began to become a serious pest. Without hawks, kestrels, kites and owls around to control them, they soon reached plague proportions and it was necessary to control them by aerial baiting with strychnine-laced baits.

This quickly killed any mice that ate the bait but it also killed anything else that ate the baits or the poisoned mice, further reducing populations of beneficial predators and causing a serious breakdown of the natural food web.

There are now so many people on the planet that there would be massive famine, pestilence and starvation without use of pesticides. It is imperative that we develop and use pesticides that do not affect non-target species, become inert in a very short time and cause no damage to natural ecosystems.

Better still, we need to provide much more funding for research that focuses on biological control to solve problems caused by pest plants and animals.

Chapter 4. INCREDIBLE INSECTS

Insects are the most successful and diverse group of organisms on earth. Over one million species have been described and there are probably as many again still to be discovered and described, particularly in tropical rainforests of the world.

Insects have an innate capacity to proliferate and some researchers have suggested that, without predators to control them, they would cover the entire world, both land and sea, to a depth of two kilometres in only one year.

While a few species such as plague locust and malaria-carrying mosquito are serious pests, most insects are harmless and a few are beneficial to man. Some help aerate the soil, some prey upon or parasitise harmful species. Most are an important food supply for many species of birds, mammals, reptiles and amphibians and thus form a vital part of the food web in ecosystems.

Some human races use several species as an important source of protein in their diet, including termites, locusts and witchetty grubs. Others are utilised in other ways, such as in commercial production of silk from silk worms, or as agents for biological control of other insect pests. And of course, much of the world's food production is dependent upon insects to pollinate plants.

Even species responsible for spreading dangerous diseases to humans can sometimes be useful. The mosquito, which is responsible for spreading serious diseases such as Malaria, Encephalitis and Ross River Fever, has been used to our advantage as the vector for spreading Myxoma virus among rabbit populations.

Fleas, which spread bubonic plague killing more than 10 million people in Europe and India between 1898 and 1918, have also been beneficial as a vector to spread Calicivirus amongst rabbit populations in recent years. This has been a successful example of biological control, killing only the target species and nothing else.

But it is the few species of insects that become serious pests in crops and pastures that gain the most attention, as they may limit production and reduce profitability for landowners. Regrettably, the most effective method of controlling these few pest species is by using pesticides. Many of these are organophosphates, which also kill non-target species of insects.

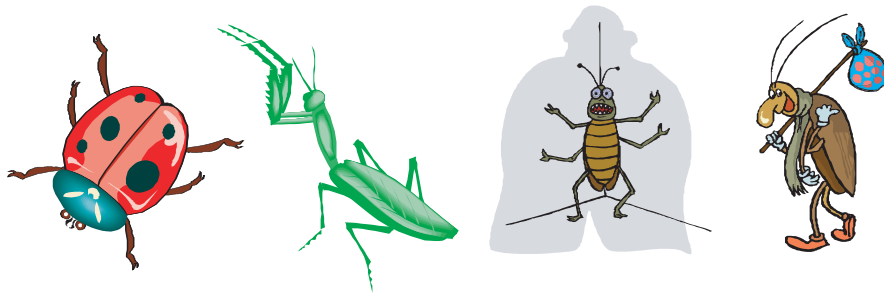
Organophosphate insecticides can persist in the environment for considerable amounts of time and can have a deleterious effect on many species of native fauna, including beneficial insects, birds, mammals, reptiles, amphibians, fish and crustaceans. More funding is needed for research into effective biological control of insect pests if we are to control only pest species without harming non-target and beneficial species.

In a natural ecosystem, populations are maintained and balanced by predator-prey relationships. As the population of one species increases, it provides more food for its predators, so they also increase. As predators consume more of their prey, the species on which they are preying declines. As its food supply diminishes, predators begin to die of starvation.

This cycle may continue over several generations, until a natural event, such as fire, flood or drought reduces the prey's food supply and their population crashes, followed by a subsequent crash in population of predators.

In a natural ecosystem, everything is in balance over time. But once man alters the natural ecosystem, such as by clearing native vegetation for agriculture, the balance is destroyed. This brings about local extinction of some species but allows other species to proliferate to the extent that they become serious pests.

CASE STUDY 8: LADYBIRD BEETLE AND PRAYING MANTIS VERSUS APHIDS AND SCALE INSECTS



Aphids are small sucking bugs that can become a serious pest in crops, pastures, vegetable gardens and flower gardens, while the Scale Insect can be a serious pest in citrus groves. Aphids and scale insects are preyed upon by larvae of the ladybird beetle. If enough ladybird beetles are around, they can control or eliminate aphids and scale insects. Praying mantises feed on aphids as well and help control this pest in crops, pastures and gardens.



Despite appearances, the praying mantis is not praying, but is ready to strike with its specially-modified forelegs and capture any unfortunate victim that may venture within range.
Photo: Clive Crouch

Ladybird beetles have been used for many years in biological control of aphids and scale insects. They can be easily bred in a laboratory in huge quantities for biological control of these pest species. In places like California, where there are large areas of citrus groves, scale insects can at times be a serious problem for orchardists.

When such a problem arises, all the orchardist has to do is turn up at the biological supply laboratory and purchase a five or 10-litre container of ladybird beetles which are then released in citrus groves. When the ladybird beetles (or their larvae) have eaten all the scale insects, they disperse.

By using biological control measures such as this, no harm is done to the environment – no residual poisons are involved, no non-target species are affected, the orchardist has fixed the problem and can look forward to a bountiful harvest.

Ladybird beetles are very important allies, often used in biological control of aphids and scale insects.
Photo: Clive Crouch



CASE STUDY 9: FLOWER WASPS AND COCKCHAFERS

On roadside reserves and bush blocks in western Victoria, where native vegetation still occurs, Sweet Bursaria (*Bursaria spinosa*) may be found. Sweet Bursaria is a rather spindly shrub that grows to a height of about two metres.

In the bad old days, when farmers regularly grazed their stock on roadside vegetation, the Sweet Bursaria (and many other native plants) was almost wiped out. But with greater awareness of the importance of protecting our remnant native vegetation, the Sweet Bursaria is slowly making a comeback, along with many other native plant species.

Larvae of the Eltham copper Butterfly feed exclusively on Sweet Bursaria. As grazing pressure mounted, the Sweet Bursaria went into serious decline. As its food plant declined, so too did the Eltham copper butterfly, to the point where it became a nationally-endangered species.

But Sweet Bursaria is also an important food plant for many other species of insects. When in flower it produces nectar that flower wasps feed upon. Flower wasps parasitise the larvae of cockchafer, which can be a serious pest in crops and pastures.

Because flower wasps do not travel very far, landholders would need to plant patches of Sweet Bursaria and other native understorey species every 200 metres or so along fence lines, so that wasps would be in position to parasitise cockchafer.

If they were to carry out such plantings, with help and support from Greening Australia and local Landcare groups, farmers could not only increase populations of flower wasps, but also populations of many insect-eating birds, mammals and reptiles.

While flower wasps alone may not control infestations of cockchafer, they can certainly help and, along with magpies, lizards, dunnarts and a host of other natural predators and parasites, may save the cost of spraying affected paddocks.



The Eitham Copper Butterfly.
Photo: Fabian Douglas

CASE STUDY 10: SPIDERS—ARACHNIDS - NOT INSECTS BUT WE’LL TELL THE STORY ANYWAY!

Spiders are everywhere and many people have a morbid fear of them, so it might be hard to convince some people that spiders may be a beneficial species. Australia is home to hundreds of species of spiders, ranging from tiny flower spiders to huntsman and wolf spiders to the huge Bird-eating spider of Queensland.

While many people ‘freak out’ when they see a spider, most species are harmless and only a few, such as the red-back, the Sydney funnel-web and some of the mouse and trapdoor spiders are dangerous.

A few others, such as the white-tailed and wolf spiders, can cause skin destruction (necrotising arachnidism) in some people, but not everyone who is bitten by these species is affected. It seems a bit like bee sting – some people have an adverse reaction, while others suffer only a little discomfort.

Spiders prey on a great number of insect pests. Some trap their prey in large silken ‘wagon wheel’ webs, while some make a small net which they hold with their front legs and cast like a fish net. Many forage on the ground for their prey, some scurry around on the bark of trees and others, such as trapdoor spiders, ambush their prey as it walks past their burrow in the ground.

Although spiders perform a vital service for us in helping keep insect pests under control, they are themselves an important source of food for many species of birds, mammals, reptiles and amphibians, and so an important part of the food chain.

So next time you see a spider, before you stomp on it, consider for a moment that it might be a useful ally- a friend rather than a foe.

Wolf spiders (*Lycosa spp.*) are very common in the Wimmera. When walking around with a spotlight at night, one sees their bright blue-green eyes shining on the ground everywhere.
Photo: Clive Crouch



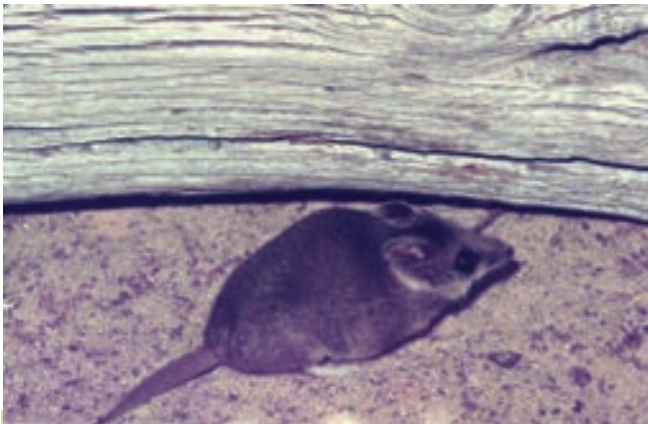
Chapter 5. MARVELLOUS MAMMALS

When Europeans first arrived in western Victoria, many native mammals were in the area. Sadly, loss of habitat through clearing for agriculture, competition from introduced stock and excessive predation from introduced cats and foxes, brought about local extinction of many native mammals.

Only a few species have increased in numbers after the arrival of Europeans. These include brush-tailed possums and kangaroos, which have benefited from planting of crops, orchards and pastures, and from supply of permanent water in farm dams.

A few other species still remain in the district, but in much-reduced numbers. These include fat-tailed dunnarts and yellow-footed antechinuses (marsupial mice), sugar gliders, pygmy possums and at least eight species of insectivorous bats.

Dunnarts and antechinuses are small carnivorous nocturnal marsupials that prey on beetles, spiders, moths and a host of other small creatures. They are beneficial mammals but, due to habitat loss, are now too few in number to have a major impact on insect pests. They are still a vital component of the food web in ecosystems.



A fat-tailed dunnart, sometimes incorrectly referred to as a 'marsupial mouse', is a mammal.
Photo: Clive Crouch



A fat-tailed dunnart making a meal of a cockchafer caterpillar. Dunnarts are voracious little carnivores that prey on beetles, grubs, moths and even on the introduced house mouse. We are lucky that Dunnarts are not as big as dogs – if they were, they would probably eat humans too!
Photo: Clive Crouch

Sugar gliders and pygmy possums also consume a variety of insects, thus benefiting farmers, but are also only present in small numbers. Loss of habitat and predation by cats and foxes has all but eliminated them from most of their former range. Nevertheless, the few that remain play a vital role in the food web.



Sugar gliders, a beneficial nocturnal mammal, have almost disappeared from much of their former range due to predation from cats and foxes, as well as loss of suitable habitat.

Photo: Clive Crouch



The beautiful little western pygmy possum has also disappeared from much of its former range, but is still found in the Little and Big Deserts.

Photo: Clive Crouch

Insectivorous bat populations have also declined due to loss of habitat – particularly from loss of old mature trees with hollows in which they roost. Despite this, bat populations in the region are enormous – far greater than most people could imagine. They play a vital role in controlling many species of insects, including several serious pests.

By maintaining suitable habitats for these beneficial mammals, farmers could save much time and money through having these marvellous mammals control insect pests for them free of charge instead of having to use expensive insecticides.

Dunnarts and Antechinus inhabit woodlands and forests and need a lot of groundcover in the form of fallen timber, hollow logs and slabs of bark, to provide the habitat they need. Such habitat is also vital to survival of many beneficial or benign insect species, which become food for many beneficial insectivorous birds.

While good areas of woodlands still exist on many properties in the district, most farmers have a tendency to 'tidy up' fallen timber, hollow logs and slabs of bark, thus depriving beneficial birds, mammals, reptiles and insects of their homes and shelter and exposing them to predation by cats and foxes.



By resisting temptation to 'tidy up' fallen timber and logs in paddocks, farmers can maintain the habitat for many species of beneficial birds, mammals, reptiles and insects.
Photo: Clive Crouch

Since 'tidying up' reduces insect populations, it also reduces the variety and number of insect-eating birds in the area. As a result, once-common species such as willie wagtails and brown treecreepers are declining in numbers, while the Stone Curlew is nearly extinct in much of western Victoria.

Similarly, many farmers see no value in old hollow trees and so bulldoze them, cut them down for firewood or heap fallen branches around their base and burn them. One old hollow tree could have several hundred (or even several thousand) bats sheltering in it. This deprives the bats of their homes as well as beneficial birds such as owls, hawks, kestrels, kites and falcons that might have been living there.

Maintaining these important habitats will help to maintain biodiversity of our local ecosystems.

Dead trees no longer provide shade for stock
but if they contain hollows, they provide
nesting and roosting sites for birds and bats.

Photo: Clive Crouch



While large mature trees in paddocks may be inconvenient for today's broadacre farmers with wide machinery, they are vital to survival of many beneficial species of native fauna. By leaving trees in place, beneficial animals that live in them may well reward farmers by controlling insect pests in crops and pastures and save spraying expense.

Many trees are at least 200 years old before hollows form in them, yet it can take only a few minutes work with a bulldozer or chainsaw to remove them. Even though many of us support revegetation of our roadsides and sections of farms, we need to be conscious of the fact that it may be many generations down the line before our descendants see the full value of our good work.

Isn't it better to leave our old, mature trees in place?

CASE STUDY 11: FANTASTIC BATS

Bats are fantastic animals. They are the only mammals that can fly. In addition, insectivorous bats use echolocation to navigate their way through trees and to hone in on insects they feed on. The hearing range of most humans is between 500 and 12,000 Hertz, while bats use frequencies up to 100,000 Hertz – far beyond the hearing range of humans.

Although we often use the term 'blind as a bat', bats do have good eyesight. But, being nocturnal, their eyes are not as important to them as echolocation. Even if their eyes are taped over, bats can still find their way around using their echolocation. Laboratory tests have shown that blindfolded bats can avoid single strands of cotton hanging from rafters in a large hall.

Even more surprising is that bats can locate insects as small as midges and hone in on them while flying at high speed through and around trees. Different species of bats employ different methods to catch prey. Some species have a scoop-shaped membrane on their tails in which they trap prey and, while still in flight, bend over, take the insect in their jaws and eat it.

Other species have a hinged joint in their wings, which allows the bats to form a scoop with either wing to trap insects in. They also bend over, take the trapped insect in their jaws and consume it while still in flight.

Bats eat a variety of insects including beetles, moths and mosquitoes. Needle-sharp teeth allow them to firmly grip hard-shelled beetles, as well as soft-bodied nocturnal moths. During warmer months bats are voracious feeders, consuming up to one-and-a-half times their own weight in insects each night.

As winter approaches, bats go into torpor in their homes in hollow trees, or occasionally in farm buildings and even in farm machinery. A few years back a Rainbow district farmer decided to start one of his vintage tractors that had been stored in a shed. After trying unsuccessfully to start it for some time, the tractor made an almighty bang and blew 85 bats out of its exhaust pipe!

Farmers who grow peas are often troubled by heliothis moths, which can wreak havoc, necessitating a spraying program to control them. Some farmers are lucky enough to have large woodlands or swamps on or near their properties and do not have to spray for heliothis moths. This is because huge numbers of bats that live in woodlands and swamps are voracious predators of heliothis moths and eat them before they have a chance to lay eggs in the farmer's pea crop. It saves the farmer a good deal of money and protects beneficial non-target species of insects that would be killed had he needed to spray his crop.

Bravo for bats!



At least eight species of insectivorous bats are found in the Wimmera region of northwest Victoria. Gould's Wattled Bat (*Chalinolobus gouldii*) is the most common species in this area.
Photo: Department of Sustainability and Environment, McCann



Old, mature trees that contain hollows such as this, may be home to hundreds, even thousands, of insectivorous bats. Several species of beneficial bird, such as owls, hawks, kites, kestrels and falcons may also shelter or nest in this tree. Dead trees with hollows are equally important and should not be felled or burnt.
Photo: Clive Crouch

Chapter 6. RECLUSIVE REPTILES

Most people don't give reptiles a second thought, although they might get a bit agitated when they encounter a snake. But reptiles, including snakes, play an important role in ecosystems; helping keep some species in check and becoming prey themselves for larger predators.

Despite what most people think, many species of reptiles are beneficial to humans in that they help to control pest species of animals.

Tiny nocturnal Geckoes ('Drop-tail Lizards') and small skinks often seen scurrying around gardens, feed on small moths, beetles and other insects, many of which may be pests in crops and pastures. They also feed on larvae and pupae of house flies, bush flies and blow flies, thus helping keep these annoying pests under control.



The dozen or so species of skinks found in our local area help to keep many insect pests under control.
Photo: Clive Crouch

Goannas eat a wide variety of things including young rabbits, rats, mice, beetles, and caterpillars. They also scavenge on dead animals, thus depriving blow flies of food sources for their maggots. A reduction in the blow fly population reduces incidence of fly strike in sheep.

Shingle-backed lizards ('Stumpies') and bearded dragons ('Jew Lizards') also eat many pest species such as moths, beetles, caterpillars and snails.



The shingle-backed or stumpy-tailed lizard helps keep a number of pest species of invertebrates under control.
Photo: Clive Crouch

Rarely-seen blind snakes feed on termites and legless lizards (often mistaken for small snakes) feed on a variety of insects, many of which are pests in crops and pastures.

Several species of snakes exist in western Victoria. Most species are small and harmless to humans, but play an important role in helping keep insects under control; benefiting farmers by eating beetles, crickets, grasshoppers and other pest species.

Three large, dangerous snakes that occur in the area are the eastern brown snake (the third deadliest snake in the world), tiger snake and Red-bellied Black Snake. While we may not enjoy occasional encounters with large snakes, they usually try to get out of our way as quickly as possible.

Unless they are too close to our homes, we should generally leave snakes alone because they perform an important role in keeping rats and mice under control, as well as helping maintain an important link of the food web in natural ecosystems.

Although reptiles are often a much-maligned group of animals, they are important members of any natural ecosystem. Because they are often reclusive, we may not understand the role they play in maintaining a balance in the web of life. The more we begin to understand them, the more we begin to appreciate what they do.

Even if we have a morbid fear of reptiles and have no wish to understand them better, we would do well to adopt the approach of 'if you leave me alone, I will leave you alone'. At least this way we may minimise any danger to ourselves and may allow a few more individuals to continue their existence on earth.

If we do get to understand and appreciate reptiles, we may even begin to do something for them such as leaving fallen timber on the ground to provide homes and shelter for them, maintaining existing areas of native vegetation or planting areas of native understorey plants in corners of paddocks.

Such strategies would certainly benefit reptiles on our land and would also benefit many species of birds, mammals and insects. We may not have a great love for reptiles but remember that '*Everything is connected to everything else*' and reptiles are an important part of the overall web of life.



Goulds goanna (*Varanus gouldii*) is a common and widespread species in western Victoria. Goannas benefit us by eating rats, mice, small rabbits and beetles. They also eat carrion, denying blowflies the opportunity to lay their maggots on dead animals and helping reduce fly strike in sheep.

Photo: Clive Crouch

Chapter 7. AMOROUS AMPHIBIANS

We often overlook frogs when we think about maintaining or restoring our environment, yet they play a vital role in the overall scheme of the web of life. Perhaps the only time we are aware of frogs is when they are amorous – when we have had good rains, wetlands are flooded and frogs are frantically trying to attract a mate with loud and persistent calls.

Frogs rarely cause problems for farmers (apart from keeping them awake at night with persistent calling), but they may benefit them by eating grasshoppers, crickets, beetles and other species of insects, many of which are pests in crops and pastures.

Frogs themselves are an important food source for other animals too, including snakes, and birds such as Herons, Egrets and Spoonbills.

Frogs are also an important 'indicator species'. When healthy populations of a variety of frog species exist in wetlands, it indicates that our wetlands are in good health and the ecosystem is functioning as it should.

But when frog populations decline, or disappear from the area, it indicates something is seriously wrong with our aquatic environment, and probably our terrestrial environment too.

The decline of frog species and populations may be due to a number of causes, including:

- Pollution from pesticides and herbicides entering wetlands.
- Residual pesticides and herbicides in bodies of organisms that they eat.
- Nutrients, such as phosphates, being washed into wetlands.
- Heavy metals and other toxins entering the water.
- Outbreaks of blue-green algae.
- Eutrophication of the aquatic environment.

Recent research has suggested that frog decline may be a result of increasing ultraviolet radiation, caused by depletion of the ozone layer. Another cause appears to stem from a fungus, which attacks mucous that covers their skin, protecting them from infection and keeping their skin moist.

The fungus appears to have entered Australia on tropical fish, imported for the aquarium trade. When some fanciers lost interest in aquarium fish, they released them illegally into wetlands, allowing the harmful fungus to escape into the water where it attacked and killed native frogs.

We have many species of frogs in western Victoria, ranging in size from the tiny 15mm-long Sign-bearing Frog *Crinia signifera*, to the beautiful 100mm-long Growling Grass Frog *Litoria raniformis*, which is now, sadly, an endangered species.

Thankfully, when the Nhill Swamp, located at Nhill in Western Victorian, has water in it, growling grass frogs make their presence known with their calls – a long drawn-out *craaaark*. Apart from the fact that it is good to know this endangered species still lives in the area, its presence also indicates Nhill Swamp is in good condition and not affected by any pollution.

Wetlands are important, not only for survival of frogs and other forms of aquatic life, but to survival of many species of birds, mammals, reptiles and insects that live and feed in them. They are also important to humans for aesthetic values and recreation.

Maintaining and restoring wetlands in our local area can help maintain and restore some biodiversity that is essential to the ongoing health of our environment.

In doing so, we may increase numbers of creatures that are beneficial to us. Perhaps this could save us considerable costs (and possible environmental damage) from having to resort to use of chemicals to do the job that beneficial allies are already doing free of charge.

So, next time you see a wetland, spare a thought for amorous amphibians – they do us no harm, they help to control some insects that may be pests in crops and pastures, and they do us a great service by letting us know about the general health of our wetlands.



Apart from their aesthetic and recreational value to humans, wetlands are essential to survival of frogs and other aquatic life. They are also important for survival of many species of birds, mammals, reptiles and insects that find food and shelter in them.

Photo: Clive Crouch

Chapter 8. 'SO WHAT' IF WE LOSE A FEW SPECIES ANYWAY?

There are still a few people around today who do not understand the importance and necessity of biodiversity. Thankfully, the vast majority are well informed and keen to do what they can in their own place and their own way.

Some important reasons for maintaining biodiversity could include:

- 90% of modern medicines come from just 5% of the world's known plants. There are probably many thousands of plants yet to be discovered, particularly in tropical rainforests. At the frightening rate at which the Amazonian rainforest is being cleared, many of these plants will become extinct before they are discovered and their properties investigated. Many could well contain cures for cancers, AIDS and other serious diseases that afflict mankind, yet many will be lost before we find out.
- All species of plants and animals contain their own unique genetic blueprints. By maintaining genetic diversity, we have a 'Reserve Bank' to draw from in our quest to develop new and better varieties of plants and animals that may be resistant to pests, resistant to disease, grow faster and produce higher yields of grain, fruit, meat or milk. As we lose species, we also lose their genetic diversity and we will sorely regret that as our scientific knowledge and technology increases and we seek new solutions to problems.
- When a species becomes extinct, one link is lost from the interconnecting web of life. As each link is lost, the web is broken down, eventually to a point where it can no longer function. When this happens, ecological disaster follows. This could result in famine, pestilence, erosion, salinisation, desertification and a whole host of other problems which, if they could ever be fixed, would take enormous resources, time, effort and willpower. It would be far better to remember that *'Everything is connected to everything else'* and maintain what we have, rather than trying to fix it later.



In any functioning ecosystem, *Everything is connected to everything else.*

YOU TELL HIM, FABIAN!

The case for maintaining biodiversity was well summed up by one of Australia's foremost entomologists, Fabian Douglas, Nhill, after a rather belligerent businessman asked him: "So what if one of your precious little moths or butterflies becomes extinct?"

Fabian looked out the window and noticed the businessman's shiny new Mercedes Benz parked in the driveway.

"Put it this way", Fabian replied. "If I take a hammer and knock the hubcaps off your car, it won't look as good, but it will still run OK. Then, if I smash your windows, you will still be able to drive it, but it won't be very comfortable for you.

"After that, I damage you brakes – your car will still go, but you won't be able to stop it.

"Then I smash your radiator. Before long the engine will overheat and seize up. If I continue to wreck your car, it will get to the stage that it will no longer run.

"I hope that you can see from this analogy that every time we lose a species from the complex web of life, it contributes to the eventual breakdown of the whole ecosystem.

"It is far better to look after what we have got now, than it is to try to fix it up later".



Chapter 9. WELL, WHAT AM I SUPPOSED TO DO?

There are many things we can do as individuals to help maintain biodiversity while we strive to make a dollar. Some of us are already environmentally aware and contributing to 'restoring and maintaining the balance', while a few of us could do a bit more. Sadly, a few have yet to begin the journey.

It has been said that we should all 'think globally and act locally'. While no-one can individually solve the Greenhouse Effect or fix the hole in the ozone layer, we can all make some contribution to minimising and overcoming problems by working at the local level and doing what we can where we can.

Perhaps the first step in a long journey is to accept that we are 'stewards of the land', holding it in trust for all future generations who follow us. What will our great grandchildren think of us? Will they praise our wisdom and foresight? Or will they curse our greed, negligence and stupidity?

Will we pass onto them a world as good or better than it was when we inherited it, or will we leave them massive problems, many of which will be unsolvable?

Do we have to clear every tree from our property, shoot everything that moves and dig up everything from underground, in our relentless pursuit of wealth? Do we really need to take more than our share of the world's goods? The great Mahatma Ghandi summed it up pretty well, when he said: "The world can cater for man's need, but not for man's greed."

The concept of ecologically-sustainable land management is not new. This is what renowned economist John Stuart Mill, London, 1806-1873, had to say – in 1857!

"There is room in the world, no doubt, and even in old countries, for a great increase in population, supposing the arts and quality of life to go on improving, and capital to increase. But even if innocuous, I confess seeing very little reason for desiring it. The density of population necessary to enable mankind to obtain, in the greatest degree, all the advantages both of co-operation and of social intercourse, has, in all the most populous countries, been obtained. A population may be too crowded, though all be amply supplied with food and raiment. It is not good for man to be kept perforce at all times in the presence of his species ... Nor is there much satisfaction in contemplating the world with nothing left to the spontaneous activity of nature; with every rood of land brought into cultivation, which is capable of growing food for human beings; every flowery waste or natural pasture ploughed up; all quadrupeds or birds that are not domesticated for man's use exterminated as his rivals for food, every hedgerow or superfluous tree rooted out, and scarcely a place left where a wild shrub or flower could grow without being eradicated as a weed in the name of agriculture. If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not happier population, I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compels them to it." (Quoted in Birch, 1976, 31).

So, have we learned anything in the many long years that have passed since J. S. Mill provided his words of wisdom in 1857? It would seem not, as too many people are much more concerned about their own increase in wealth than about sustainability or needs of future generations.

Highly-regarded Australian science writer Graeme O'Neill, in his Science Watch article in the Sunday Herald Sun of May 5, 2002, had this to say:

"The autumn edition of Swinburne University of Technology's quarterly magazine, Swinburne News carries a brief but disquieting article on the future – or rather our disregard for it.

The author is Professor Richard A. Slaughter, Foundation Professor of Foresight at Swinburne's Australian Foresight Institute, who spends much of his working life thinking about tomorrow, and the longer-term future.

Professor Slaughter laments the short-term thinking that has become the norm in Western culture. We are so entranced by our wealth, success and technological prowess that we pay scant attention to the costs of spiralling demand or our consumption into an ever-receding future.

His unpopular message is that, if we are to live happily ever after, we must grip the painful nettle now. Unfettered vegetation clearance has left us with a catastrophic legacy of wind and water erosion, waterlogging and salinisation of our soils.

Australia was never over-endowed with prime agricultural soils, and merely stabilising these processes is a multi-billion dollar task. The cost of recovering lost agricultural lands is beyond any government, so we must abandon vast tracts of ruined land in south-eastern and western Australia.

Yet graziers in Queensland are frenetically clearing hundreds of thousands of hectares of native vegetation each year, fearing that legislation will soon prevent them doing so.

As fast as we replant native vegetation, and grow native tree plantations to help fulfil our commitment to the Kyoto Protocol on climate change, Queensland's graziers are undoing our efforts."

O'Neill goes on to write about our need to embrace existing technologies for production of 'clean' electricity to reduce greenhouse gases in the atmosphere and in doing so, help create a more sustainable environment for present and future generations.

To succeed in this noble goal of handing on the earth, and all its treasures, to future generations in as good or better condition than when we received it, we must embrace the concept of ecological sustainability and do all in our power to achieve it.

Sadly, in most developed countries, pursuit of an ever-increasing Gross Domestic Product has become the goal of most governments and ecological sustainability is overlooked. We, the people, have been dragged along by government policies and slick advertising campaigns, to the point where most of us believe that amassing material possessions leads to a higher quality of life when, in reality, nothing could be further from the truth.

It creates an unachievable goal for, as soon as we acquire some 'must have' item, it becomes obsolete and we are then convinced, by powerful advertising and peer

So what is 'quality of life', if it is not gained by acquisition of material possessions? Charles Birch suggests true quality of life is to be found in friendship, trust and love, augmented by one's perception of nature, beauty, art and music. If one already has these enduring qualities, it is hardly plausible to believe that a sustained attempt to amass even larger quantities of goods can add very much to one's happiness. (Birch, 1976:23).

Other writers have defined quality of life as loving and being loved, feeling safe and secure in one's home and community, being able to express one's self artistically, being able to express one's opinions freely without being ridiculed or jailed, feeling part of and being able to contribute to one's own community, having opportunities to be involved in physically and mentally challenging activities, having a sense of self-worth, and being recognised by others for one's efforts and successes.

Once we embrace concepts of true quality of life and our role as stewards of the land, we can then find it easier to embrace the concept of ecological sustainability and perhaps look for new and better ways of managing land and natural resources while still making a living.

Most farmers today are already making many changes to the way they run their farms and manage their land. Many contract an agronomist to help with yearly farming plans, many have developed 'whole farm plans' and are working on long-term projects to make their farming enterprises ecologically sustainable and more economically viable. Many have also joined Landcare groups to share knowledge and participate in projects for their, and the environment's, common good.

WHAT CAN WE DO?

- Fence areas of remnant native vegetation to help preserve biodiversity. This does not necessarily mean taking land out of production totally, as light grazing from time to time can benefit some native grasses and species that depend on them for survival.
- Where appropriate, plant shelterbelts along fence lines and on adjoining roadside reserves with local provenance plant species.

Roads exist primarily for movement of vehicles, machinery and stock. But bare roads like this provide no other function.
Photo: Clive Crouch



- Consider planting trees on low-yield sections of paddocks as habitat for wildlife or as woodlots to be harvested for firewood in future years.
- Maintain/reclaim/restore wetlands to provide habitat for beneficial birds and amphibians.



Maintaining, reclaiming or restoring wetlands can have many benefits including maintaining and restoring biodiversity, providing habitats for a wide variety of native fauna, and increasing landscape and aesthetic values in the local area.

Photo: Clive Crouch

- Prepare firebreaks around trees in paddocks before burning stubbles.
- Where trees with hollows are scarce, put up nest boxes for birds and roost boxes for bats.
- When undertaking rabbit control measures, use a backhoe to destroy warrens because it is much less damaging to native vegetation than ripping.
- Plough firebreaks on your side of the fence, instead of on the adjoining roadside, unless the road is a designated by Local Government Fire Prevention Committees as 'Strategic Fire Break'. Ploughing roadsides destroys native vegetation and promotes growth of fire-prone annual weeds such as barley grass and wild oats, leading to a greater fire hazard than that posed by remnant native vegetation.

Consider sowing some areas to native grasses. These are perennial; grow on poor soils without need for cultivation or fertiliser (which actually kill native grasses); retain green shoots even through long, hot summers; and are much less prone to support fire than introduced annual grasses.

Several perennial native grasses, such as Kangaroo Grass, still have green shoots, even at the end of a hot, dry summer. Apart from providing green pick for stock, they are much less fire prone than introduced annual grasses.

Photo: Clive Crouch



Tree-lined roads provide habitats for wildlife, act as shelterbelts for adjoining landholders and provide landscape and aesthetic values for travellers.

Photo: Clive Crouch



When repairing or replacing fences along roadsides, cause as little damage as possible to remnant roadside vegetation. Where good stands of native vegetation remain, consider leaving the old fence in place and running a new fence inside the line of trees. This would save the time and expense involved in clearing the fence line, would allow trees to continue to function as a shelterbelt and would help maintain biodiversity of the local area.



Where there is a shortage of mature trees with hollows, nest boxes can be a valuable aid to maintaining or restoring biodiversity to the local area. Conservation groups, such as the Nhill College Environment Cadets, are often happy to donate their time for worthwhile projects that benefit the environment.

Photo: Clive Crouch

CASE STUDY 12: 'SATISFICING AND MAXIMISING'

A study conducted by researchers in Sweden some 20 years ago, found that most farmers worked at only 40% of their farm's potential. They listed two strategies that most people choose between – 'satisficing' and 'maximising' - and suggested that farmers were 'satisficing'.

This means they were doing only what was needed to produce enough income to lead, what was for them, a satisfactory lifestyle, as opposed to getting maximum productivity from their farms.

When discussing this scenario with farmers in Victoria's Wimmera district, most 'pooh hoo'd' the idea that they were 'satisficing'. When asked what they were producing off their farms, most replied 'grain, wool and meat'.

It was then suggested to them that instead of buying most of their food from the supermarket, they could be producing most of their own food by milking a cow, running a few pigs from which to make bacon and ham, having a vegetable garden, an orchard, a few beehives, chooks, ducks, geese and so on.

Almost without exception, farmers threw their hands in the air in mock horror, saying 'blimey – that sounds like too much hard work for me!'

Yet, around many farms, there may be a hectare or two of old cars, trucks and machinery dumped 'out the back' and fences are just bare wire. If this were a densely-populated country, as in many parts of Asia and Europe, two or three families would live off the hectare or two where the old machinery is dumped and fences would have vines and fruit trees growing on them to provide food for the local inhabitants.

There is nothing wrong with 'satisficing' if it allows us to achieve the lifestyle that we want without 'busting a gut', and we must accept the fact that most of us are not 'maximising' potential of the land already cleared for agriculture. So, until we are all 'maximising', there is no valid reason why any more land should be cleared of its native vegetation.

Barry Commoner was a U.S. Senator who, in the 1970s, ran on an environmental platform. He was instrumental in developing environmental principles and had the unique ability to simplify complex principles into everyday language that could be easily understood by lay people.

Barry Commoner's 'Six Environmental Principles':

1. Everything has to go somewhere

If we clear an area of native bushland most, if not all, of the animals that lived there will die out. Even if there is an area of native bushland nearby, animals cannot move in because it will be already fully occupied – there are no unoccupied homes.

If we burn something, we may have got rid of it from our property, but smoke and other gases released into the atmosphere can add to the greenhouse effect, lead to acid rain or cause other damaging long-term effects.

The 'Law of Conservation of Matter' states that matter can be neither created nor destroyed – it can only be changed into another form of matter.

2. There is no such thing as a free feed

Everything we do has a cost. While an individual landholder may profit from clearing native bush and growing crops on the cleared area, there is always a cost to the environment through loss or reduction of biodiversity. It may also cost the area's hydrological system, the landscape and atmosphere systems and biogeochemical cycling.

There may also be a long-term cost to future generations, through resultant erosion and salinity. Before embarking on any activity that may impact on the environment (and therefore on future generations), we need to carefully consider benefits and costs associated with that activity.

3. If you think that things are bad now – just wait!

Even if we immediately stop all man's activities that are adversely affecting the global environment, it may be hundreds or thousands of years (if ever) before the earth can repair itself.

Consider the effect of rising salinity in many of Western Australia's wheat belt areas. Although large-scale clearing of WA Mallee country has now ceased, the legacy of rising saline groundwater will be with us for many, many more generations and perhaps forever. There is just not enough money or resources available to tackle this massive problem.

Even if we immediately stop all atmospheric pollution, it will be a long way down the track before the hole in the ozone layer repairs itself or before the greenhouse effect diminishes.

4. Everything is connected to everything else

In natural ecosystems everything is connected to everything else. Rocks determine what the soil will be like, soil determines what plants will grow there and plants determine what animals will be present.

Hills and trees help determine the amount of rain that falls and green plants produce food through photosynthesis, converting light energy into chemical energy which they use in their metabolic processes.

Animals that eat these plants gain energy from them. In the process of photosynthesis, plants take in carbon dioxide and give off oxygen. Animals take in oxygen and give off carbon dioxide as a waste product, and so a balance is struck.

If we alter one thing in a natural ecosystem, the delicate balance of the ecosystem suffers.

5. Diversity means stability

The more diverse a natural ecosystem, the more stable it will be over the long term. But once we start to simplify ecosystems, they become very unstable. We may think of this in terms of farm management – if we have several diverse income streams, our income will be more stable over time.

But if we limit income to just one type of crop and have a drought or a flood, our crop may fail to the point where we may not be able to cover the cost of production, let alone make a profit from our enterprise.

So it is in the natural ecosystem - once it loses its biodiversity, the ecosystem can no longer maintain itself and begins to break down.

6. Up to a point, bigger is better

In terms of national parks and reserves, the bigger they are, the more diverse the habitats they are likely to contain and the greater the interactions and interdependence of species found there.

But if they are so big that there is not enough money or human resources to manage them adequately, problems will arise such as raging wildfires, invasion by pest plants and animals and so on.

The same may be true in agricultural ecosystems – up to a point, the bigger our enterprise, the more profitable it should be. But once the enterprise becomes so big that it becomes impossible to properly manage, problems will arise.

(Source: Barry Commoner: 'Six Environmental Principles', quoted in Miller, 1979, p31).

Chapter 11. OK, SO WHO IS GOING TO HELP ME!

Most people these days are aware of the need to look after the environment in which we live and it is wonderful to see so many landholders doing what they can to protect, maintain and restore biodiversity, often at their own expense.

Because protecting the environment benefits all people, both those living now and generations to follow, the costs should be borne by the population as a whole and not just by the individual landholder who is trying to 'do the right thing'.

Funds derived from the partial sale of Telstra have helped communities, Landcare groups, and individual landholders carry out works that will benefit the environment and therefore the community too.

But there also needs to be financial rewards or compensation for landholders who take land out of production to establish shelterbelts and woodlots, or to fence areas of remnant vegetation. Under Federal legislation, tax rebates are now available to landholders who place new covenants on remnant native vegetation.

While more funds are needed to help landholders halt the decline of biodiversity, many individuals, groups and organisations are willing to provide assistance, advice and/or funding for projects to help maintain or restore biodiversity. Some of these include:

Bird Observers Club of Australia

183-185 Springvale Road (PO Box 185) Nunawading Vic 3131

Telephone: (03) 9877 5342 Fax: (03) 9894 4048

Email: information@birdobservers.org.au

Website: www.birdobservers.org.au

Advice on how to maintain or create habitat for birds. Some funding for worthwhile projects such as restoring wetlands, providing nest boxes, etc, may be available through their Australian Bird Environment Fund.

Greening Australia Victoria

Head Office - 10 Buckingham Drive (PO Box 525) Heidelberg Vic 3084

Telephone: (03) 9450 5300 Fax: (03) 9457 3687

Email: general@gavic.org.au

Website: www.greeningaustralia.org.au

Ron Dodds, Manager Southwest Region, RMB 3087 Horsham Vic 3401

Telephone (03) 5381 1010

Advice on suitable plants, site preparation, direct seeding, tree planting, obtaining grants and assistance with projects.

Hindmarsh Landcare Network

Project Manager, Hindmarsh Shire Office, Nelson Street Nhill Vic 3418

Telephone: (03) 5391 1811 Fax: (03) 5391 1376

Email: planting@hindmarsh.vic.gov.au

Advice and support for Landcare projects in Hindmarsh Shire.

Natural Heritage Trust

GPO Box 787 Canberra ACT 2601

Telephone: 1800 065 823 Fax: (02) 6272 3626

Email: nht@deh.gov.au

Website: www.nht.gov.au

Provide funding for a raft of worthwhile projects.

Natural Resources Conservation League

Head Office – 593 Springvale Road Springvale South Vic 3172

Telephone: (03) 9546 9744 Fax: (03) 9547 8791

Email: nrcl@nrcl.org.au

Website: www.nrcl.org.au

Department of Primary Industries**Department of Sustainability and Environment**

Regional Office – Grains Innovation Park 110 Natimuk Road Horsham Vic 3400

(Private Bag 260 Horsham Vic 3401)

Telephone: (03) 5362 2111/136 186 Fax: (03) 5362 2187

Email: customer.service@dpi.vic.gov.au

Website: www.dpi.vic.gov.au

Advice on pest plants and animals, 1080 rabbit poisoning campaigns, Rabbit Busters programs, Fox Off baiting programs, Good Neighbour programs, advice on resource management and habitat restoration and conservation of native flora and fauna.

Trust for Nature (Victoria)

Head Office – Level 2, 385 Little Lonsdale Street Melbourne Vic 3000

Telephone: (03) 9670 9933/1800 999 933 Fax: (03) 9670 9977

Email: trustfornature@tfn.org.au

Website: www.tfn.org.au

Wimmera Co-ordinator – Neil Marriott, Panrock Road Stawell Vic 3380

Telephone (03) 5356 2404

Advice on maintaining and protecting remnant native vegetation and assistance with arranging covenants on bushland blocks.

Wimmera Catchment Management Authority

26 Darlot Street Horsham Vic 3400 (PO Box 479 Horsham Vic 3402)

Telephone: (03) 5382 1544 Fax: (03) 5382 6076

Email: wca@wcma.vic.gov.au

Website: www.wcma.vic.gov.au

Advice on maintaining and restoring native vegetation, wetlands, erosion control, etc, and where to access grant monies for worthwhile projects.

INTEGRATED PEST MANAGEMENT

While biological control is the most desirable form of pest management, it has not yet been developed to the stage where it can be used as the sole means of pest control. So, in many cases, we have to use mechanical methods of control (ploughing, ripping, burning) or chemical control (herbicides, insecticides, fungicides) to allow crops, pastures and native vegetation to survive.

Usually, we need a combination of mechanical, chemical and biological control (integrated pest management) to keep pest species under control. But mechanical means involve use of expensive machinery and fuel and chemical companies rarely give products away, so there is often considerable cost to the landholder.

By saving and replacing some native vegetation, bringing back birds, mammals, reptiles, amphibians and even spiders, we can help restore biodiversity of the local area. If we can do that, beneficial species will, through natural biological control, help restore the balance of nature and may well help us to save a dollar or two.

NOW IT'S YOUR TURN

Give yourself a pat on the back if you've done any of these things and can tick the box:

- ☐ Fence areas of remnant native vegetation.
- ☐ Work with Trust for Nature to put a covenant on important areas of remnant native vegetation so that it will be protected for all time.
- ☐ Plant shelterbelts using local provenance plant species.
- ☐ Plant local provenance trees, shrubs and groundcovers on unproductive areas of land.
- ☐ Maintain and/or restore wetlands.
- ☐ Prepare firebreaks around trees in paddocks before burning stubbles.
- ☐ Plough firebreaks on your side of the fence, instead of on public roads.
- ☐ Keep old, hollow trees (dead or alive) as nesting or roosting sites for birds and bats.
- ☐ Put up nest boxes for birds and bats where there is a shortage of trees with hollows.
- ☐ Work with neighbours and Department of Sustainability and Environment/Department of Primary Industries to keep pest plants and animals under control.
- ☐ Where appropriate, sow areas to native grasses to help maintain/restore biodiversity.

- ☐ Where appropriate, sow areas to native grasses to help maintain/restore biodiversity.
- ☐ When replacing fences along roadsides, cause as little damage as possible to remnant native vegetation.
- ☐ Agree that I am a 'steward of the Earth', keeping it in good condition for many generations to come.

***If you ticked all the boxes, you deserve a medal,
because you are a wonderful person.
Now encourage your neighbours to become 'wonderful' too,
and the earth will be a better place for everyone!***

THE END

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