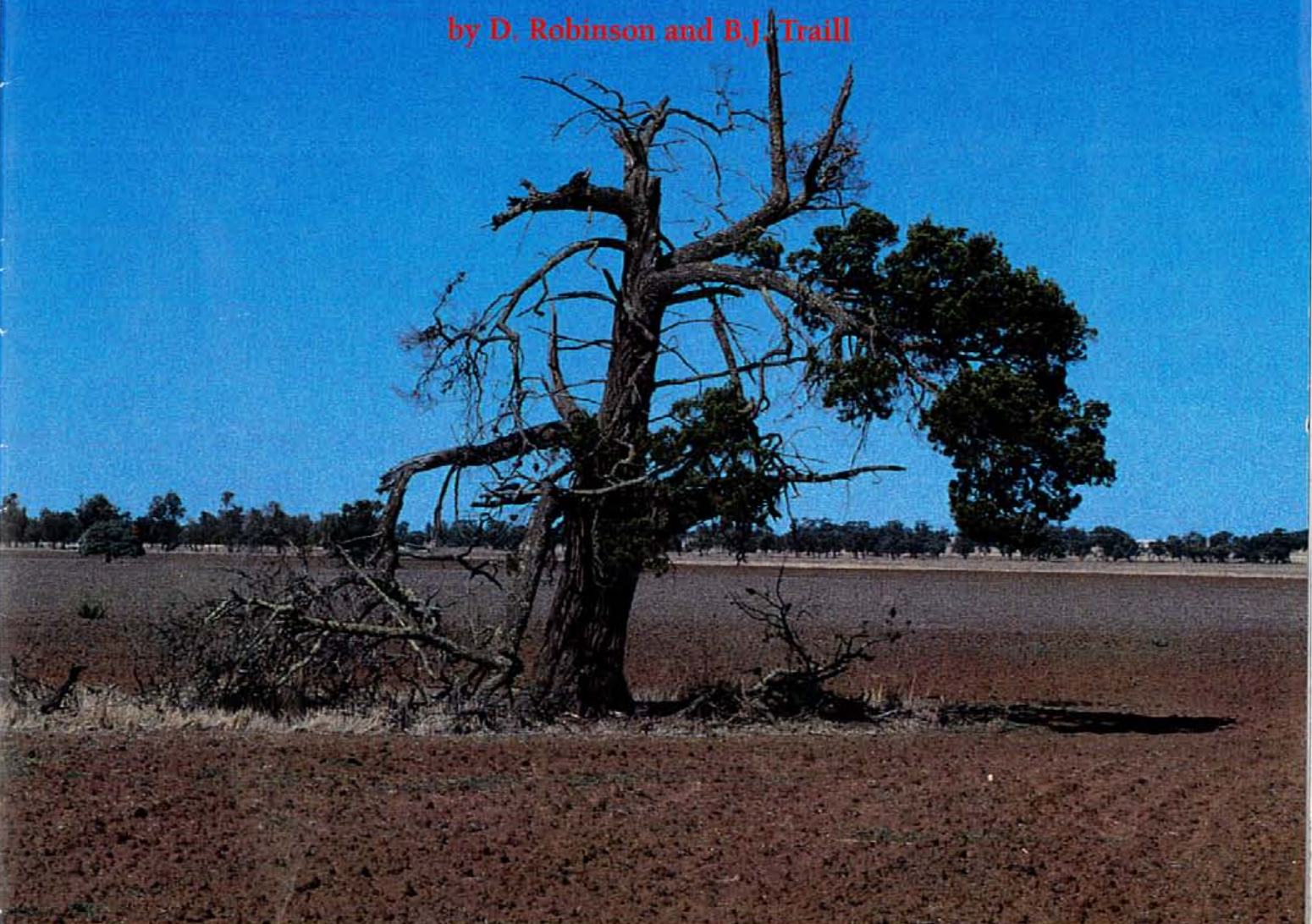


# CONSERVING WOODLAND BIRDS IN THE WHEAT AND SHEEP BELTS OF SOUTHERN AUSTRALIA

by D. Robinson and B.J. Traill



**SUMMARY:** The temperate woodlands are the most threatened type of wooded ecosystem in Australia. They once covered 10% of land in eastern and south-western mainland Australia. Since European settlement more than 80% of that area has been cleared of its former native vegetation for agriculture. In some districts, more than 95% has been cleared and much of what remains is grossly altered. Because of this destruction and alteration of most woodland habitat, the temperate woodlands now contain a very high number of threatened plants and animals, including many birds. One bird, the Paradise Parrot, is extinct. At least 25 other species are known to be threatened and, throughout the woodlands region, at least one quarter of woodland birds are in decline. This number of declining and threatened species will undoubtedly increase with the continuing loss of about 2% of the total area of remnant habitat every year and further degradation of the remaining habitat. Principal causes of degradation are habitat fragmentation, raised water tables, salinity, over-grazing, tree dieback, logging and predation by feral predators. Many of these threats also threaten the future viability of agricultural production in the wheat and sheep heartland. Conservation thus depends on an approach that involves the whole community and integrates nature conservation with conservation of the land.



The only species of bird to have become extinct on the Australian mainland, the Paradise Parrot was once fairly common in the more fertile woodlands of northern New South Wales and southern Queensland. Naturalists alive in the early 1900s could recall it as a once-plentiful bird. By 1900 it was rare. By 1930 it had disappeared. This same process of decline and extinction today affects more than one-quarter of all woodland birds.

PHOTO: A. D. & M. C. TROUNSON



## INTRODUCTION

The temperate woodlands once covered a vast tract of eastern and south-western Australia (Fig. 1). In the east there were approximately 65 million hectares of woodlands along the slopes and plains inland of the Great Dividing Range, from southern Queensland to the southern Flinders Ranges of South Australia. In Western Australia, temperate woodlands and other vegetation types covered 14 million hectares in the south-west of the State — an area now better known as the Western Australian wheatbelt (Fig. 1). Today, a mere 10-15% of that entire woodland system remains in any form and the heart of the woodland ecosystem has been replaced by Australia's agricultural heartland of wheat and sheep production.

Under the key criteria of what comprises ecologically sustainable development (48), this replacement of 85-90% of the temperate woodland ecosystem with a highly modified agricultural landscape in less than 150 years has clearly failed (34; 55; 56; 67;68). The maintenance of biodiversity and ecological integrity has not been achieved, nor has there been maintenance of the renewable natural-resource base of water and soil. Native vegetation has been cleared from an area three times as large as Victoria. Twelve to fifteen billion trees have been cleared from the Murray-Darling Basin alone (79). The Paradise Parrot is

<sup>1</sup> All bird names follow those in Christidis & Boles 1994 (11)

extinct. Regent Honeyeaters<sup>1</sup> are no longer recorded 'in immense numbers' or 'in thousands' as they once were (24) but are endangered, and more than one quarter of all land-bird species found in the woodlands are in decline or threatened (Table 1). Likewise with the land, nearly one million hectares of irrigated land is affected by unnaturally high water tables and eight million hectares by soil-structure decline (30; 41; 66). Throughout the temperate woodlands, the annual value of lost agricultural production because of soil degradation is more than \$400 million (30; 41), a figure expected to rise markedly as more than 60% of some districts become salt-affected in the next 20 years and the area of croplands and irrigated pastures increases (27; 41;48).

Conservation of the remaining fragments of the woodland ecosystem and of the broader woodland landscape is consequently one of the most urgent priorities for both nature conservation and for future agricultural production in this country (13; 55; 67; 76).

This conservation statement describes the causes of decline of temperate woodland birds, the actions needed to prevent further declines of woodland wildlife and the actions needed to enhance and integrate the ecological sustainability of the woodland environment and the agricultural land.

## ECOLOGY OF THE WOODLAND ENVIRONMENT

### The woodland environment

The temperate woodlands are described as 'savannah woodlands' and historically consisted of large, widely-spaced trees with a species-rich ground-layer of grasses and herbs and scattered shrubs (44). They include the Brigalow woodlands of Brigalow *Acacia harpophylla* and Poplar Box *E. populnea* in northern New South Wales and southern Queensland, woodlands of White Box *E. albens*, Yellow Box *E. melliodora*, Yellow Gum *E. leucocylon*, ironbarks and gums along the inland slopes of the Great Dividing Range, woodlands of Grey Box *E. microcarpa*, Black Box *E. largiflorens*, Buloke *Allocasuarina luehmannii* and White Cypress-pine *Callitris glaucophylla* on the plains inland of the Great Dividing Range, and woodlands of Salmon Gum *E. salmonophloia*, Wandoo *E. wandoo*, Gimlet *E. salubris* and York Gum *E. ixiphleba* in south-western Australia. Because of regional and local variations in landform, soil type and climate, the savannah woodlands are typically interspersed with other vegetation types, including foothill forests, mallee woodlands, wetlands, open forests of River Red Gum *E. camaldulensis*, heathlands, shrublands and native grasslands (34; 60; 68). Together, all of



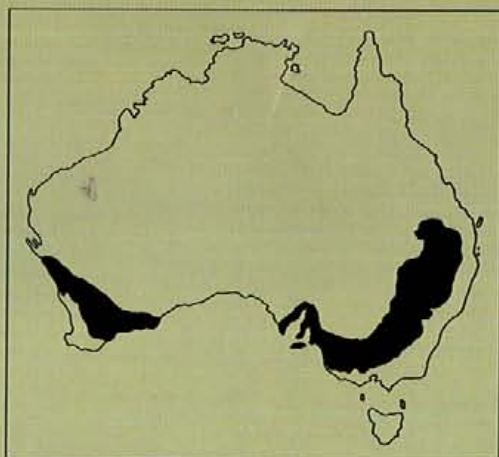
these vegetation types constitute the woodland region (60).

At the continental scale, the temperate woodlands occupy a distinctive climatic and geographic zone in the 300-700 mm annual rainfall range between the semi-arid lands of the inland and the moister forests near the coast (44; 45; 60). They are distinguished from these adjoining regions by less marked seasonal variations in temperature, lower extremes of rainfall and temperature respectively and a longer growing season (45).

#### Characteristics of the woodland birds

Because of the woodlands' unique environment, a distinctive group of woodland-dependent birds is found there. These species have evolved in response to the long growing season and year-round availability of food (45), the preponderance of eucalypts and associated habitat components such as abundant tree hollows, peeling bark, nectar and other carbohydrates (21; 54), the grassy ground-layer and the open structure of the vegetation (54). The bird fauna thus includes many species of nectar-feeder, ground-seed feeder, open-ground insect-eaters and hollow nesters. Woodland birds are also characterised by a high proportion (c. 32%) of species that nest co-operatively (22).

Because the woodlands are located between more arid, inland environments and the moister environments of the coast and ranges, their bird fauna also contains some inland species (e.g. Malleefowl, Budgerigar) as well as birds typical of wetter forests (e.g. Crimson Rosella, Eastern Yellow Robin, Western Spinebill). More significantly, their geographic position, and year-round supply of food, means that woodlands provide suitable, seasonal habitats for migratory birds dispersing from environments where food has become scarce (45; 46). They also provide refuge for inland birds in times of drought (58; 68).



Grey Box woodland as it should be in the southern Riverina. Woodlands were once rich and complex environments composed of hundreds of species of different plants, multiple layers of vegetation, and trees of different ages. Due to habitat alteration by grazing, cropping and timber cutting, few examples of such woodlands now exist.

PHOTO: SALLY MANN

Fig. 1. (Below left): The vast tract of eastern and south-western Australia which was once covered by temperate woodlands.

**TABLE 1. Threatened and extinct woodland birds in temperate Australia.** X = Extinct; T = Threatened or rare in temperate woodlands; S = Secure, population under no immediate threat. For SA, categories refer only to the south-east; for WA only to the south-west. Status categories taken from Garnett (1992b)

Species	Aust	Qld	NSW	Vic	SA	WA
<b>WOODLAND-DEPENDENT SPECIES</b>						
Bush Stone-curlew	S	S	T	T	T	T
Squatter Pigeon (southern subspecies)	T	T	T			
Carnaby's Black-Cockatoo	T					T
Red-tailed Black-Cockatoo (both southern sub-species)	T			T	T	T
Western Long-billed Corella (southern sub-species)	T					T
Paradise Parrot	X	X	X			
Superb Parrot	T		T	T		
Swift Parrot	T	T	T	T	T	
Turquoise Parrot	S	T	T	T		
Barking Owl	S	S	S	T	T	S
Crested Shrike-tit (western subspecies)	T					T
Grey-crowned Babbler	S	S	S	T	X	
Painted Honeyeater	T	T	T	T	T	
Regent Honeyeater	T	T	T	T	X?	
Star Finch (eastern subspecies)	X?	X?	X			
Black-throated Finch (southern subspecies)	T	T	T			
Apostlebird	S	S	S	T	X	
<b>WOODLAND-ASSOCIATED SPECIES</b>						
Square-tailed Kite	T	T	T	T	T	T
Grey Falcon	T	T	T	T	T	T
Malleefowl	T	T	T	T	T	T
Glossy Black-Cockatoo	T	T	T	T	T	
Pink Cockatoo	T	T	T	T	T	T
Regent Parrot (eastern subspecies)	T		T	T	T	
Powerful Owl	T	T	T	T	T	
Masked Owl	T	T	T	T	T	T



Woodlands of Salmon Gum, Wandoo, York Gum and Gimlet (pictured) once covered several million hectares of land in the wheatbelt of Western Australia. Because they were used by early surveyors as indicators of fertile soils, nearly all woodland areas were taken up and cleared for agriculture very early on. An estimated 3% of these woodlands now remains in any form.

PHOTO: DENIS SAUNDERS



Grass-seed eaters are quintessential birds of the temperate woodlands. With habitat clearing and alteration, some species such as the Diamond Firetail, pictured here, have become less common. Other species that prefer the mostly cleared woodlands have increased in range or abundance; for example the Galah, Crested Pigeon and Eastern Rosella. Increases in the numbers of some of these latter birds are posing new threats to some other species, most notably in the form of nest-hollow competition with woodland birds.

PHOTO: GRAEME CHAPMAN



In spring and summer, inland species such as the woodswallows and White-winged Triller migrate to the temperate woodlands to breed. In autumn and winter, many species of birds from the damper forests also migrate to these woodlands for autumn and winter to feed on winter-flowering eucalypts, winter-flowering mistletoes or the autumn flush of ground-dwelling insects (45; 46; 60; 68). Many summer residents in the south-eastern woodlands also migrate to the Brigalow woodlands of more northern Australia (45; 46), or to woodlands as little as 50 km north or west (e.g. Superb Parrot; 80) for the winter, a fact underlining the important links between birds and habitats in different parts of the woodlands region.

## CHANGES TO THE WOODLAND ENVIRONMENT

### European discovery of the woodlands

Early European descriptions of the woodlands landscape were lyrical. During his famous expedition through south-eastern Australia in 1836, Major Thomas Mitchell rhapsodised about the woodland region of Victoria, describing it as '... a country ready for the immediate reception of civilized man ... unencumbered by too much wood.' '... in returning over flowing plains and green hills fanned by the breezes of early spring, I named this region Australia Felix — the Pleasant Land.' (43). The squatter, Edward Curr, was similarly moved to classical allusion when he arrived at the banks of the Murray River near present-day Echuca in 1840. He wrote, 'Looking around, on one side of us, we saw extensive reed-beds intersected by the Murray ... The other half of the circle was occupied by open, grassy, forest land, which extended we did not know how far. The grass under foot, as yet undefiled by flock or herd, was as green and

fresh as Eden, and the landscape generally bathed in a soft, hazy, sunlight, such as Monsieur Buvelot would love to depict.' (14). As put so appositely by Curr in his very next sentence, however, '... we were just then intent on sheep-feed, and not in scenery; so, after a brief delay, we re-mounted...'

### Development history

Like many other European settlers, Curr was inspired by the descriptions of Mitchell and others as to the suitability of the temperate woodlands for agriculture. The pastoral industry expanded rapidly throughout the temperate woodlands of south-eastern Australia and by 1860 there were more than 10 million sheep and 2 million cattle grazing on native grasslands and temperate, grassy woodlands in south-eastern Australia (1; 48). Soon afterwards, broadscale clearing of the south-eastern woodland region began for cropping (31; 48) and, by 1940, more than 85% of the region had been cleared of native vegetation (Table 2), with as much as 98% of vegetation removed in some woodland districts.

In Queensland, Western Australia and parts of the northern and western portions of the New South Wales wheatbelt, European occupation similarly began in the mid-1800s but tended to be restricted to certain vegetation types or sites close to water because of the difficulties of clearing the native vegetation, the climate or the precarious economics of farming that land. The removal of woodland vegetation for agriculture in these regions began in earnest early this century and only accelerated after World War II with the introduction of heavy machinery, clearing rates reaching a peak in Western Australia during the 1960s (34; 63) and in New South Wales since 1970 (5; 75; 76).



Throughout the woodlands region, native vegetation has been removed from an area more than three times as large as Victoria and, up until 1995, has continued to be lost from Queensland and New South Wales at the rate of about 200,000 ha (or 2% of all woodland remnants) every year — that is, about 548 hectares of woodland cleared and about 8200 birds killed or displaced every day (3; 5; 75; 76). At these rates, Australia ranks as the eighth-highest clearer of native vegetation in the world (5).

**TABLE 2. Proportion of woodland districts in different states with remnant native vegetation.** Regions and boundaries from Moore 1970, MDBC 1987, Hobbs & Saunders 1993, Thackway & Cresswell 1995. Sources for proportions of districts cleared: (1) Saunders 1989; (2) Biodiversity Unit 1995; (3) Harris 1986 (4) MDBC 1987 (5) Shire-based data from DCNR (6) Davidson 1996; (7) Ford & Barrett 1995; (8) Sivertsen 1993; (9) Goldney & Bowie 1990; (10) data from Dept of Env't and Heritage; (11) Catterall & Kingston 1993; (12) Sivertsen 1994.

Locality	Total area (ha)	% area with native vegetation
<b>WESTERN AUSTRALIA</b>		
Wheatbelt	14,000,000	7 <sup>1</sup>
<b>SOUTH AUSTRALIA</b>		
Narracoorte Plains	1,579,200	22 <sup>3</sup>
Mt Lofty Ranges & Adelaide Plains	2,375,200	52 <sup>3</sup>
Eyre and Yorke Peninsulas	3,033,000	24 <sup>2,3</sup>
Murray-Darling	2,355,200	92 <sup>3,4</sup>
<b>VICTORIA</b>		
Box-ironbark region	3,702,500	19 <sup>5</sup>
Riverina	2,146,600	8 <sup>5</sup>
Murray-Darling	3,299,000	94 <sup>5</sup>
Western Slopes	340,400	15 <sup>5,6</sup>
Naracoorte Plains	260,800	40 <sup>5</sup>
<b>NEW SOUTH WALES</b>		
Darling Riverine Plain	9,257,800	9 <sup>4</sup>
New England Tablelands	931,000	25 <sup>2,7</sup>
Nandewar Bioregion	2,103,000	25 <sup>2,7</sup>
Cobar Peninsulas	2,450,000	15 <sup>8</sup>
Western Slopes	8,087,400	15 <sup>9</sup>
Riverina	3,453,400	9 <sup>4</sup>
Brigalow	5,245,800	9 <sup>4</sup>
<b>QUEENSLAND</b>		
Brigalow Belt (southern part)	5,639,000	14 <sup>2,10</sup>
South-east inland plains	2,106,000	16 <sup>11</sup>
Nandewar Bioregion	629,200	25 <sup>2,7,10</sup>
New England Tablelands	1,396,500	25 <sup>2,7,10</sup>
Darling Riverine Plain	1,293,300	19 <sup>12</sup>
<b>Total</b>	<b>75,684,300</b>	<b>12</b>

## EFFECTS OF VEGETATION CLEARANCE AND HABITAT MODIFICATION ON WOODLAND WILDLIFE

### Habitat loss

In every State with temperate woodlands, woodland communities have been identified as among the most endangered and most poorly conserved vegetation types (4; 60; 68). Thirteen of the fifteen woodland communities described for the Murray-Darling Basin are conserved poorly, or not at all (41), while 95% of the 41 woodland and box-ironbark vegetation associations found in New South Wales are, at best, poorly conserved and 46% are not conserved at all (4).

The decline of biodiversity has been exacerbated by the disproportionate loss of vegetation communities found on more fertile soils. Woodlands growing on fertile soils were the first to be cleared for crops and pastures and now scarcely remain (4; 34; 44; 52). For example, an estimated 0.01%, 0.03%, 0.5% and 3.0% survives intact of the once dominant White Box, Grey Box, Brigalow and Salmon Gum woodlands, respectively (4; 52; 63; D. Robinson unpubl. data). By contrast, woodlands growing on rocky hills, steep slopes or infertile soils were only cleared later, if cleared at all. These latter woodlands now constitute the bulk of our remaining habitat (34; 51).

The impacts of such extreme habitat loss on woodland birds have been severe. The woodlands now contain one of the highest concentrations of extinct and threatened birds of any region or habitat in Australia (25; 57). Twenty-five species are listed as extinct or threatened in at least part of the region (Table 1) and although only one, the Paradise Parrot, is evidently extinct throughout its range, an additional four species of woodland-dependent bird appear to be extinct in at least one State (Table 1). Furthermore, the popula-

*The gregarious Regent Honeyeater was once common in the woodlands of eastern Australia, particularly along the inland slopes of the Great Dividing Range where flocks of birds roamed seasonally in response to the flowering of different species of eucalypts and mistletoes. It is now endangered nationally, with as few as 2000 individual birds surviving within its known range.*

PHOTO: GRAEME CHAPMAN





*The Speckled Warbler typifies a large group of ground-feeding birds that search for insects among the grass clumps, low shrubs, and bark and leaf litter of woodlands and open forests. Where their feeding habitat has been too highly modified by over-grazing, timber-cutting or weed invasion, these birds disappear.*

PHOTO: GRAEME CHAPMAN

*An aerial panorama of the central wheatbelt district in Western Australia. Once a predominantly tree-covered landscape, the wheatbelt now contains a mere 7% of the former extent of its native vegetation. Those remnants that do survive (the dark green patches) are mostly small and isolated from one another, consequently increasing the risks of local extinction for their populations of native wildlife.*

PHOTO: DENIS SAUNDERS



tions of eight of eleven threatened species that have been studied are continuing to decline (25; 60) and as few as 1000 Red-tailed Black-Cockatoos of the south-eastern subspecies, 2000 Regent Honeyeaters and 5000 Swift Parrots survive in the wild (25; 60).

Perhaps more alarming is the exceptionally large number of woodland birds that are not yet listed as threatened but are in decline. In south-eastern Australia, 57 species of birds have been found to be declining in parts of their range, 80% of them woodland birds (60). In the Western Australian wheatbelt, nearly 50% of all birds and 88% of resident passerines have declined in range or abundance since European settlement, while only 17% of the birds have increased (68). On the New England Tablelands, 47% of landbird species found in dry forests and woodlands are in decline (23). Throughout the woodlands region, at least one quarter of the bird fauna has declined in abundance, a figure which is bound to increase as the impacts of recent clearing ensue (61; 63).

In Western Australia for example, in one wheatbelt district of 160,000 ha that had been mostly cleared by 1930 and has only 7% of its native vegetation left, 16 species (12%) have completely disappeared. In a second district, which began to be seriously cleared only after World War II and retains 12% of its former native vegetation, only four species (3%) have disappeared but others have begun to decline (63; 68). It seems inevitable, then, that more and more birds will continue to disappear from every woodland district as the length of time since their habitat was removed increases and the effects of that habitat loss follow (63; 76).

Throughout the woodlands, the



decline of woodland birds has been exacerbated by the disproportionate clearing and alteration of woodlands found on fertile soils or close to water (34; 46; 60). Over-grazing of grasses along water-courses, for instance, is considered to have caused the national or regional extinctions of the Paradise Parrot, Star Finch, and Black-throated Finch (25). For other species such as the Regent Honeyeater, Swift Parrot, Purple-crowned Lorikeet, Yellow-plumed Honeyeater and Grey-crowned Babbler, the clearing of fertile sites is thought to have contributed to their decline by the loss of productive habitats rich in insects and nectar (24; 61; 68; 78).

#### **Habitat fragmentation**

The clearing of most native vegetation has altered the once-extensive woodland landscape into a fractured one consisting of scattered woodland patches, isolated trees in paddocks and narrow, roadside or streamline strips of vegetation among a sea of wheat, sheep and stumps (Fig.2).

As a consequence of this process of habitat fragmentation, most remnants may become too small or isolated to support viable populations of many birds. At an 81 ha reserve in the Western Australian wheatbelt three species, Southern Scrub-robin, Western Yellow Robin and Golden Whistler, have disappeared over the last 16 years and a fourth, the Blue-breasted Fairy-wren, has been reduced to just ten birds (63; 65). On the New England Tablelands four species, Peaceful Dove, Red-browed Firetail, Double-barred Finch and Hooded Robin, have disappeared from a 240 ha reserve over the last 17 years, and Brown Treecreeper is just holding on (23; H. Ford, pers. comm.). Given that the average size of most existing remnants of native vegetation in the woodlands region is much less than 50 ha (5; 27; 60), however, most isolated remnants may be unable to support persisting populations of woodland wildlife in the



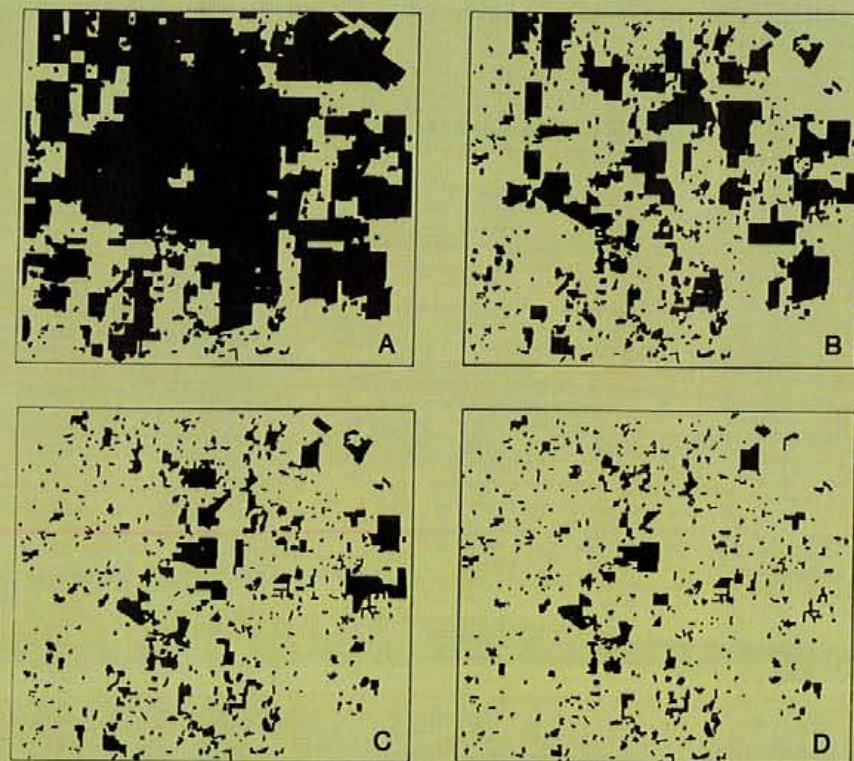
longer term. Re-establishment of vegetation links between remnants and increases in size of existing remnants are urgent priorities, therefore, for nature conservation in the woodlands region.

Even where the remnants of native vegetation are large, they may be too isolated to provide useful habitat for some species of wildlife. For example, the breeding distribution of the Superb Parrot and Regent Parrot along the Murray and Murrumbidgee Rivers, are restricted to patches of River Red Gum forest connected to and within about 10 km of the birds' prime feeding habitat in box woodlands or mallee respectively. Where that habitat connectivity has been lost, there are no breeding birds (80).

Although habitat fragmentation has generally caused a decline in the number of species present in each woodland remnant and in local population size (2; 38; 63), it conversely has benefited a few open-country birds such as the Noisy Miner, Galah, Australian Magpie and Australian Raven (2; 38; 68). The increased numbers of these species have had additional, adverse effects on woodland-dependent birds such as competition for nesting hollows by Galahs, destruction of Black-Cockatoo eggs by competing Galahs, higher rates of nest predation by currawongs, ravens and magpies in smaller remnants (2; R. Major, unpubl. data), and exclusion of insect-feeders and nectar-feeders from most small woodland remnants by aggressive Noisy Miners (12). In turn, increased numbers of miners and decreased numbers of other insectivores have been shown to cause outbreaks of insect populations, tree dieback and the death of trees (36; 39). Galahs also cause some tree death by ringbarking at nest sites (D. Saunders pers comm.). Hence, habitat fragmentation contributes ultimately to habitat degradation and to simplification of the bird community (20).

### Degradation

Nearly every surviving woodland remnant is being degraded because of over-grazing by rabbits and domestic stock, tree dieback, weed invasion, the use of inappropriate fire regimes, rising groundwater, salinity, nutrient inputs from fertiliser and stock, increased temperatures and increased wind speeds (23; 27; 34; 70; 73). Collectively, these processes modify and simplify the structure and composition of the vegetation, restrict tree regeneration and accelerate the rate of tree deaths (36; 73). As a consequence, the remaining habitat becomes unsuitable for many species of animal and plant and they disappear from degraded remnants. This has been true particu-

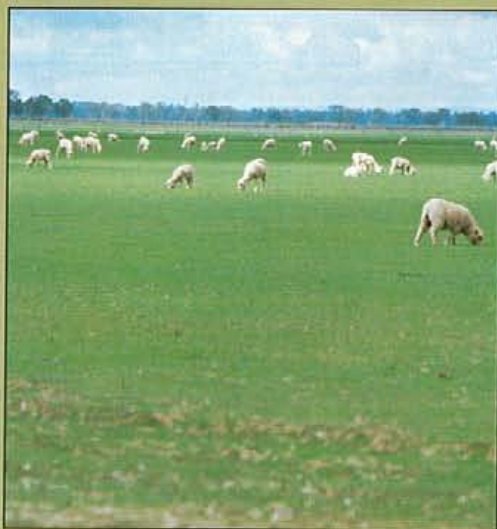


larly for ground-dwelling animals, including ground-feeding and ground-nesting birds because of the loss of litter, logs, tussock grasses and other specialised habitat elements from woodland remnants (19; 23; 35; 56; 58; 60).

The loss of individual plants, animals and habitats in turn threatens the viability of other components of the woodland ecosystem by causing the breakdown of fundamental biological activities such as pollination, seed dispersal, pest control or decomposition (34; 36; 58). Thus, even where woodlands remain, they often consist of the living dead because these essential, biological activities are no longer occurring and populations of plants and animals are dying out (27).

For example, loss of mature trees is now occurring rapidly in many woodland remnants. In south-western Victoria, the number

Fig. 2. The process of progressive habitat loss and habitat fragmentation with increasing time since European occupation. The example depicts a 160,000 ha district in the central wheatbelt of Western Australia. A represents pre-1920; B pre-1940; C pre-1960; and D 1984. Reproduced from Hobbs *et al.* (1993) and used with permission of the publisher.



Grey Box woodland as it now exists in much of the southern Riverina and one of the principal causes of habitat loss — the provision of grazing land for cattle and sheep.

PHOTO: SALLY MANN





The firewood industry in Australia is centred on the woodlands region. After woodchipping, it is Australia's second-largest timber industry. Furthermore, it probably has a disproportionately greater impact on native wildlife than woodchipping because most of the woodlands have already been cleared and most wildlife populations are consequently small. The woodpile shown here, for example, represents about 700 trees, once habitat for many woodland birds and other species of woodland wildlife.

PHOTO: B.J. TRAILL

of known Red-tailed Black-Cockatoo nest-trees decreased by 8% over a three year period (60), while the proportion of live trees at a Salmon Gum woodland in Western Australia decreased by 21% in just three years (69). This loss of old trees is a major threat to birds that are dependent on old-growth trees. About one third of woodland birds need mature trees for nest sites or feeding (68; 78). Most eucalypts do not form significant numbers of hollows or provide old-growth habitat until 140-400 years of age, however (40; 60; 69). The current rates of loss of older trees and poor regeneration of seedlings therefore mean that there may be periods of more than 100 years when there are few old trees available for these birds (60).

#### Intensification of land use

In the northern and western portions of the eastern Australian wheatbelt, habitat loss and degradation is being exacerbated by continued clearing and/or changes to more intensive land use, in response to economic pressures for more cropping land and more productive pasture lands (16; 41; 42; 50; 76). These changes will only hasten the decline and loss of native wildlife. In just eight years between 1977 and 1984, for example, approximately 14% (2.5 million ha) of the New South Wales wheatbelt was cleared for cropping, subsequently causing the loss of nearly 70% of remnant vegetation in some woodland districts (76). In the last 20 years, nearly one million hectares of native pasture in New South Wales' wheatbelt has been replaced by sown pasture (1), the change necessitating increased levels of soil disturbance, fertilisers and pesticides, and the destruction of native plants and associated wildlife.

Concurrently, the area of irrigated farmland in the New South Wales' wheatbelt has

increased by 157% and now totals nearly one million hectares (1) while, throughout the eastern woodlands, the amount of water being diverted for irrigation is increasing by an average of 8% every year (42). As a consequence, water tables are rising rapidly and causing extensive tree dieback, habitat alteration and habitat simplification. These changes in turn are threatening woodland wildlife. Two of the prime populations of the endangered Grey-crowned Babbler in Victoria occur on woodland remnants perched only two metres above the water table. Already, parts of their habitat are showing signs of tree dieback and death and other parts have been invaded by a dense understorey of weeds (61). Similar changes to woodland environments have been observed in the wheatbelt of Western Australia, and it is predicted that most remnants in the valleys of large catchments may be affected eventually by saline groundwater unless there is active intervention to halt the rising water (27).

#### Logging and firewood collection

Throughout the woodlands region of eastern Australia, almost five million hectares of production forests are logged commercially for timber (60). Particularly in Victoria, South Australia and New South Wales, these forests have been repeatedly cut over since European settlement and are now highly modified. It is well known that the largest timber industry in Australia is wood chips, which consumes about 6.4 million tonnes of wood per year. It is less widely known that firewood production is Australia's second largest timber industry, annually consuming 6.1 million tonnes of wood (53), more than 60% of that in Victoria and New South Wales coming from the woodlands and box-ironbark forests (60).

The extensive harvesting of timber for firewood and other products has caused many changes to the vegetation structure and composition (60). Most old trees, dead standing trees and fallen timber in woodlands and forests used for timber production have been removed. As a result, many hollow-nesting species have declined or disappeared from forests with few hollow-bearing trees and stumps (60; 78). Because older, larger trees also provide more plentiful supplies of food such as nectar and insects, or specialised sources of food such as peeling bark, rotten wood or grassy gaps between the trees, birds depending upon those resources (e.g. Regent Honeyeater, Crested Shrike-tit, Jacky Winter) also have become less common in, or disappeared from, woodland remnants of dense young regrowth (56; 60; 78; 81).



## Mining

In Victoria and New South Wales most of the main gold-bearing areas are in the ironbark forests and woodlands and most of those habitats have consequently been heavily disturbed by past mining operations. Recently, the number and scale of operations has increased in both States. Most of these new mining operations use open pits and are concentrated on alluvial deposits on more fertile soils. This continuing destruction of the most productive habitats in the woodland system compounds the problems caused by the already critical shortage of woodlands on fertile soils. An additional concern with gold mining is the leakage of cyanide (used in ore-processing at most mines) into tailings dams. These dams are often highly attractive water sources for birds. In one recent case in New South Wales, over 2000 birds were estimated to have been killed at a mine dam after drinking water contaminated with cyanide. In the mid-1980s, more than 60,000 Budgerigars died at a mine dam in the goldfields of Western Australia (7)

## Predation

Throughout Australia, ground-nesting and ground-feeding birds have been shown to be especially prone to decline and local extinction (25; 57; 58; 68). Although their decline is partly due to loss of habitat (35), predation by foxes is another significant cause of mortality among ground-dwelling birds and may be the principal cause of some species' continuing decline. Cats are also significant predators of birds, killing an average of 7% of nestling Red-tailed Black-Cockatoos every year in the wheatbelt of Western Australia (34) and about 11 million birds per annum in Victoria alone (74). Such impacts by feral predators undoubtedly contribute to the decline or extinction of populations of woodland birds stranded on small habitat islands in the rural landscape (70).

## EFFECTS OF VEGETATION CLEARANCE AND HABITAT MODIFICATION ON THE RURAL LANDSCAPE

### Impacts on agricultural land

In addition to the significant impacts habitat clearing and alteration has had on woodland wildlife, removal of most of the native vegetation in the woodland region has had marked impacts on the sustainability and productivity of rural land.

The temperate woodlands currently provide a substantial portion of Australia's agricultural produce. They support 70% (13 mil-

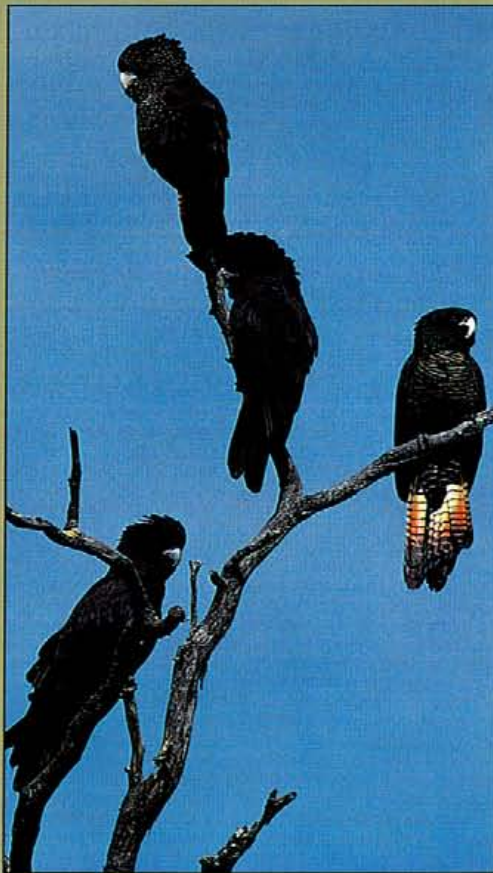


lion ha) of Australia's croplands and 80% (140 million) of its sheep. They produce 92% of Australia's irrigated cereals, 79% of its pasture and lucerne, 67% of its fruit and 25% of its vegetables (8; 41; 62; 82).

Annually, the total value of primary and secondary production in the Murray-Darling Basin is estimated to be about \$10,000 million, or some 30-40% of the total production from Australia's natural resource-based industries (41). The gross annual value of agricultural production in Western Australia's wheatbelt is about \$1,800 million (82). However, set against that value of annual production, the annual value of lost agricultural produc-

*About one-third of woodland birds nest in hollows. The continuing removal of hollow-bearing trees and stumps for firewood or timber is thus a serious threat to woodland wildlife. Birds such as the Rufous Treecreeper, pictured here, need trees to nest in and prefer to feed on fallen timber among the ground. Where these habitat elements have been removed, birds such as the Rufous Treecreeper, Brown Treecreeper and Scarlet Robin tend to disappear.*

PHOTO: BABS AND BERT WELLS



*The nationally endangered south-eastern subspecies of the Red-tailed Black-Cockatoo is confined to a small part of south-western Victoria and south-eastern South Australia. Like many other animals, it uses separate habitats for feeding and breeding and therefore requires an environment in which both are found. Although much of its feeding habitat is protected in State Forests, its nesting habitat on private land is disappearing rapidly as a consequence of tree dieback and deliberate felling of potential nest trees for firewood.*

PHOTO GEOFF LONGFORD/GEO



The effects of increased salinisation due to rising water tables on Salmon Gum woodland in the Western Australian wheatbelt. Eighteen percent of the entire wheatbelt region may eventually be affected by salinisation. In other parts of the woodlands region, where clearing of native vegetation is only occurring now, salt-affected landscapes may not begin to intrude for another 50-100 years. However, rapidly rising water tables in these newly cleared districts demonstrate that they, too, will become salt-affected, unless remedial actions are taken now.

PHOTO: DENIS SAUNDERS



tion as a result of land degradation in the wheat and sheep belt is \$400 million (30; 41). These losses are due mostly to the effects of rising groundwater and soil degradation.

#### **Rising groundwater and salinity**

Replacement of the deep-rooted, perennial woodland vegetation with shallow-rooted pastures and grasses has had significant impacts on the hydrological balance of the woodland environment (27). In south-western Australia alone, the area of land affected by human-induced salinity measures 440,000 ha and is predicted to increase to 2.5 million ha (18% of the wheatbelt). Already, 3% of cleared land has been rendered useless for cropping because of soil salinity and the figure is expected to increase to 15% in the next 30 years (47).

In the eastern woodlands, the rate of increase of salt-affected drylands is 2-5% per year (8; 41), and considerably more land is likely to be affected as these rising groundwaters reach the subsoil 30-100 years after initial clearance of native vegetation (18; 41). The area of irrigated land affected by high water tables currently spans 800,000 ha and is eventually expected to encompass more than 80% (1 million ha) of all irrigated lands (41), with accompanying losses in rural production of as much as 60% in the next 20 years (48).

Increasing salinity additionally affects the quality of surface waters and our drinking water. Every minute, six tonnes of salt from the Murray-Darling Basin pass into South Australia along the Murray River (55). In south-western Australia, 40% of surface freshwater supplies are affected by salt (55). These figures will only increase as water tables continue to rise (27).

#### **Soil degradation**

Because of repeated cropping and ploughing, the temperate woodlands contain the most extensive areas of degraded land of any region in Australia (8) and the extent of degradation is anticipated to halve production in some rural districts in the next 50 years. These changes to the environment have broader impacts for the rural community than just agriculture, and new cropping districts have noted increases in the occurrence of flooding, sedimentation of rivers and algal outbreaks in response to the decrease in tree and native grass cover, the increase in fertiliser inputs and more erosion (18).

#### **Impacts on climate**

In south-western Australia, average winter rainfall has decreased by 4-5% over the cleared portion of the wheatbelt in the last 70 years, and simultaneously increased by about 6% over the uncleared semi-arid woodlands

Found only in the south-west of Western Australia, Carnaby's Black-Cockatoo is a nationally threatened species that has disappeared from over one-third of its range in the past 25 years. One of the causes of its decline has been the loss of habitat links between feeding grounds and breeding grounds. Carnaby's Black-Cockatoos will not fly over large expanses of cleared land to feed in isolated patches of habitat. Lack of access to food has consequently caused low rates of breeding success and nestling survival among populations in highly fragmented landscapes, ultimately leading to those populations' demise.

PHOTO: MICHAEL MORCOMBE





to the east (68). Increases of 1-5° in average summer temperatures have also occurred as a result of over-clearing of the native vegetation (68). While the causes of the changed winter rainfall are not clear, it is certain that the removal of deep-rooted native vegetation exerts a significant effect on the regional climate (68).

A more far-reaching consequence of past and present vegetation clearance is the contribution made to greenhouse gases when dead vegetation is burned or rots. About 27% of Australia's net emissions of greenhouse gases is estimated to come from clearing for agriculture (5). Furthermore, the only significant reduction made to the emission of greenhouse gases in Australia occurred as a result of the cessation of vegetation clearance in Victoria in the late 1980s (6), thus emphasising the significance of native-vegetation retention in maintaining our climate.

## CONSERVATION MANAGEMENT FOR THE FUTURE

### Current conservation status of the woodlands

Of all major vegetation types in southern Australia, native grasslands and grassy woodlands are by far the most poorly represented in conservation reserves. As much as one-third of some wet forest types are now reserved (19). By contrast, less than 1% of the original extent of most woodland communities is reserved (4; 19; 41). In New South Wales, 95% of all ironbark and woodland communities are poorly reserved or not reserved at all (4).

### Future conservation in the woodlands

The future conservation of the woodland ecosystem is complicated because the woodlands no longer exist as a single, tree-covered landscape, stretching in the east from the Flinders Ranges to southern Queensland and in Western Australia throughout the southwest (Fig. 1). The woodlands instead consist of hundreds of thousands of small scattered remnants on public, private and leasehold land, within an agricultural landscape of predominantly freehold and leasehold land. In contrast to the possibilities for reserving wet forests, then, no large resource of public land exists in the wheat-sheep zone which may be used for reservation (51; 59) and the total area of public land reserved for conservation rarely exceeds 5% (60).

By comparison, private and leasehold lands comprise 80-98% of all land in the woodlands region and remnants on private land constitute 15 to 85% of all native vegetation in the woodlands region (49; 51; 60). These private land remnants provide the prin-

cipal habitat for many species of wildlife, especially species found on fertile soils. They represent an integral component of the regional landscape, providing particular nesting habitats (e.g. 98% of Red-tailed Black-Cockatoo nests in Victoria have been on private land), feeding habitats (e.g. box woodlands for Superb Parrots), habitat links between larger remnants, habitats for immature or non-territorial birds and habitats for dispersing birds (49; 60). Furthermore, the way in which private land is used and managed may threaten the survival of adjacent remnants on public land (e.g. through water runoff or nutrient runoff), or help to protect



them by acting as a buffer from degrading events (27; 32). The future for conserving woodland wildlife thus depends as much on the sustainable management and co-operative conservation of woodland remnants and agricultural land on private and leasehold land as on the appropriate management of remnants on public land. If we are to conserve native wildlife and rural land in the woodlands region, there must be co-operative efforts by conservation management agencies, landholders and the wider community to protect all native vegetation remnants throughout the wheat-sheep zone, regardless of the tenure of land on which remnants are found (29; 49; 59; 60; 71).

### Repair of the woodland environment

A more fundamental challenge for nature conservation in the woodlands region is that few remnants of native vegetation are large enough to persist in the long-term (27; 70). Most remnants therefore will continue to lose their local populations of plants and animals because of small population size, isolation, habitat alteration and degradation if nothing is done to redress the balance. Similarly, the

*Once widespread and common throughout the woodlands of eastern Australia, the communally breeding Grey-crowned Babbler has become extinct in southeastern South Australia and the ACT, is endangered in Victoria and is declining in New South Wales and southern Queensland. A ground-foraging, insectivorous bird, its loss has been attributed partly to the extensive modification of the ground layer, particularly to the loss of leaf and stick litter and associated, invertebrate wildlife.*

PHOTO: GRAEME CHAPMAN



The Hooded Robin is now a seriously threatened bird throughout much of its range in the woodlands region. It has become extinct in large parts of the Western Australian wheatbelt, parts of Victoria and parts of New South Wales. Despite its increasing rarity, it is not listed as a threatened bird in any State. If we wait until more and more populations of Hooded Robin become extinct before acting, however, the same fate will befall it as has happened with the Paradise Parrot, Swift Parrot and Regent Honeyeater. Extinction is an incremental process and we must take heed now of the one quarter of all woodland birds that have already begun to disappear.

PHOTO: G. STEPHINSON

The eastern subspecies of the Star Finch now appears to be extinct in the temperate woodlands. It was once found from northeastern New South Wales to northeastern Queensland. It has not been reliably reported from the woodlands region for one hundred years and probably disappeared very early on as a consequence of over-grazing of woodlands next to watercourses.

PHOTO: GRAEME CHAPMAN



past over-clearing and changed land use in the woodlands region have caused irrevocable changes to land-water resources and the climate which will continue to degrade the natural environment for the next 100 years, if management continues as it is today. In 100 years, for example, the area of land affected economically by soil acidification is expected to have increased by 65%, all irrigated land will be salt-affected and production in some districts is expected to halve (41; 66).

Thus, while it is imperative to protect and restore all existing remnants of native vegetation, it is not enough. If the spectre of declining land productivity, declining wildlife and increasing land degradation is not to haunt us, significant areas of the cleared, temperate woodlands urgently need to be revegetated.

#### Restoration of the woodland environment

Already in many woodland districts, landholders, local communities and landholder groups have begun this process of landscape repair and restoration (10; 17; 29; 59; 60). Indeed, many of the conservation programs undertaken to date in the woodlands region have been initiated by local communities taking on responsibility for threatened birds or other wildlife (10; 17; 72).

In northern Victoria, the Superb Parrot Action Group has begun an extensive revegetation program on roadsides and private land to link isolated feeding grounds to the birds' breeding grounds, and to increase the total area of feeding grounds. In north-eastern Victoria, the Molyullah-Tatong Tree and Land Protection Group has established corridors on private land to link remnants of Mugga Ironbark *E. sideroxylon* for the endangered Regent Honeyeater. In conjunction with the Department of Natural Resources and Environment and the RAOU, the landcare group also has helped to fence more than 50% of all ironbark remnants in the district. The Sheep Pen Creek Land Management Group and Molka Land for Wildlife Group have adopted Grey-crowned Babbler as a focal species for conservation work. More than 20 km of fencing have been erected and a planting program has begun to



revegetate gaps between remnants. Groups elsewhere in Victoria have also begun conservation programs to assist this species (62) and the endangered Red-tailed Black-Cockatoo.

In New South Wales, RAOU volunteers and those from other bird clubs have undertaken habitat protection and revegetation programs to assist the Regent Honeyeater near Armidale and at Capertee Valley. The National Parks & Wildlife Service has begun a project to protect Superb Parrot nest trees on the south-western slopes and a group is revegetating degraded areas of land in the southern Riverina to provide habitat for the Superb Parrot and to halt further land degradation resulting from salting. In South Australia, the Department of Environment and Natural Resources and the RAOU has begun a cooperative project to conserve the Red-tailed Black-Cockatoo, including the fencing of remnant patches of box-Buloke woodland, and the Department has begun a study of the endangered Glossy Black-Cockatoo population on Kangaroo Island. In Western Australia, more than 340 Land Care groups now operate, most of them in the wheatbelt (29) and groups have been established to help protect the Malleefowl and other threatened wildlife (72).

#### The future

Despite the community's best efforts, the repair and restoration of the land is not hap-



pening rapidly or appropriately enough to counter the effects of clearing and land degradation.

It has been calculated that between 500 million and one billion trees and shrubs need to be planted in the Western Australian wheatbelt to restore its hydrological balance, 100 million of which need to be planted in the first year and 30-60 million trees for the next nine years (37). In 1990, however, only nine million trees were planted throughout the wheatbelt (37). Concurrently, nearly three-quarters of a million hectares of native vegetation were cleared Australia-wide, mostly in the eastern woodlands (5), leading to the death of as many as ten million birds (from 3).

Even where community actions are taking place, they often are not obtaining sufficient support, either in the form of information on how to restore landscapes according to ecological principles, or in financial help. In northern Victoria, 20 km of fencing have been erected to restore habitat for the Grey-crowned Babbler at a cost of \$40,000 for materials and unpaid community labour. It is estimated that realistic conservation of the Babbler's habitat across the State will require a minimum of 600 km of fencing at a cost of about \$1.2 million and voluntary labour.

Clearly, therefore, more support is required from the whole community in order to protect the remaining woodlands and woodland wildlife. If the birds of Mitchell's "Australia Felix" are to be saved, we all need to recognise that the major causes of decline are similar for wildlife as for rural land, and that the solutions required are the same. To conserve the birds, we need to look after rural lands and waterways in a way which embraces nature conservation as an essential element of land management, land productivity and land sustainability.

We all are responsible for nature conservation in rural Australia and all need to be involved in the restoration of Mitchell's 'Pleasant Land'.

## ACTION PLAN

### Strategic actions

1. Clearance of native vegetation for alternative land uses should cease throughout the woodlands region. This will require:

- the introduction of strong controls on clearing in Queensland and the tightening of existing controls in Western Australia, Victoria and New South Wales to mirror those in South Australia.
- annual or biennial monitoring, to ensure that controls are being effectively implemented.



Many landholders in southern Australia can recall hearing Bush Stone-curlews calling at night. Today, these birds are rarely heard, their decline being attributed partly to habitat loss and modification and partly to predation by foxes.

PHOTO: KEITH IRELAND



The nectar-loving Swift Parrot only breeds in Tasmania. It migrates from there every autumn to winter in south-eastern Australia, where it lives mostly in the nectar-rich box-ironbark forests and woodlands of Victoria and New South Wales. Because of clearing of more than 85% of these preferred wintering habitats, and continuing clearing of 500-1000 ha of its breeding habitat for commercial woodchipping every year, the breeding population of the Swift Parrot has declined markedly in the last decade. It now consists of fewer than 1300 breeding pairs and is thought to be decreasing by more than 1% every year.

PHOTO: BOB SHEPHERD



Estimates of the conservation status of our temperate woodlands suggest that only c. 13% of the former tree cover is left. The reality is even more dire. Most remnants of woodland vegetation, of which this degraded woodlot in Western Australia is a prime example, do not have an understorey of shrubs or regeneration, have a highly modified flora and fauna and are subjected to many types of degradation. Unless we modify current land-management practices, most existing remnants consequently will perish over time.

PHOTO: DENIS SAUNDERS

- public reporting in the form of a statement to each relevant parliament detailing the extent and rate of clearing on a regional basis.
2. Major additions should be made to the reservation system in every State to make the reservation status of the woodland ecosystem comprehensive, adequate and representative. This will require reservation of a high proportion of threatened communities and at least 15% of the pre-1788 distribution of every community. Communities that need urgent attention are:
- all woodland communities for which less than 5% of their former extent remains;



- all woodland communities on fertile soils;
  - woodlands that provide critical habitat for wildlife during drought or when migrating;
  - woodlands in Queensland where bird species that have become extinct or endangered further south are still relatively common.
3. Action should be taken to strengthen the capacity for woodland conservation outside reserves through:
- listing of threatened woodland species and communities under Commonwealth and State endangered species legislation;
  - development of conservation plans for listed species and communities;
  - development and implementation of local conservation strategies;
  - identifying and modifying the management of areas of public land where nature conservation should be a priority (e.g. travelling stock reserves, Crown leasehold lands, State Forests, public water frontages and Crown land reserves).
  - increased funding from land management agencies and the wider community for on-ground works by landholders and government agencies to conserve water and the land/water resource base;
  - significantly more government support for conservation on private land in the form of rate relief or direct funding for conservation management (17; 82);
  - making land conservation grants by the Commonwealth to State or local government, and by any level of government to landholders, contingent on meeting guidelines for biodiversity conservation (e.g. width of plantings, retention of remnant native vegetation, selection of plant species, inclusion of understorey plants and agreement on regional priorities for nature conservation);
4. The firewood industry should be moved from State Forests on public land to plantations on private land. To facilitate this shift, there should be:
- phasing out of subsidies for logging on public land;
  - no issuing of new firewood licences and no licence transfers;
  - tax incentives or subsidies to landholders to establish plantations on private land in the woodlands region.
5. Further surveys and research should be undertaken to improve our knowledge of bird distributions and abundance in the woodlands region and to monitor the effectiveness of any actions taken to protect woodlands and their dependent wildlife. Priorities include:
- a second Atlas of Australian Birds to identify changes in bird distribution and abundance since the first Atlas ended in 1981 and to identify critical areas for conservation work;
  - establishment of long-term monitoring sites in the woodlands of Queensland and New South Wales to assess the effects of recent vegetation clearance on wildlife;
  - significantly increased funding for conservation of declining species, not just for already endangered taxa.
6. Government bodies should re-introduce incentives for fox control.

Volunteers from the RAOU, Kingstown Landcare Group and Kingstown Primary School in northern New South Wales planting ironbarks as habitat for the Regent Honeyeater.

PHOTO: BETH WILLIAMS





7. Gold mining should only be permitted by companies that use non-toxic methods of ore-processing.

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A fence erected by the Sheep Pen Creek Land Management Group in northern Victoria to protect and extend the area of available habitat for the endangered Grey-crowned Babbler. Projects such as this are occurring throughout the woodlands region. They need continuing financial support from land management agencies if there is to be long-term conservation of wildlife and the land in the temperate woodlands.

PHOTO: IAN DAVIDSON





**RAOU**

BIRDS • KNOWLEDGE • CONSERVATION

Founded in 1901, the RAOU is Australia's oldest national conservation organization. Members are dedicated to the study and conservation of native birdlife and the promotion of the same. Membership is open to anyone with a concern and fascination for birds and a desire to see them fully protected. The production of this Conservation Statement was funded by the NSW component of the National Estates Program, Australian Heritage Commission. The views are those expressed by the authors, not of the Australian Heritage Commission. RAOU Conservation Statements are produced by the RAOU Conservation Committee in order to provide information concerning current and future problems relating to the conservation of Australasian birds, and to suggest avenues for the solution of these problems. RAOU Head Office: 415 Riversdale Road, Hawthorn East, Vic. 3123. Tel: (03) 9882 2622. Fax: (03) 9882 2677. Production: Kate Gorrings-Smith and Andrew Pecze Printing: Tecprint Australia, 34 Radford Road, Reservoir, Vic. 3073.

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