

CHAPTER 4: CONSERVATION OF WOODLAND BIRDS IN A FRAGMENTED RURAL LANDSCAPE

4.1 INTRODUCTION

There is much concern about declining numbers of birds as a result of habitat clearing and fragmentation. The trend is global with bird species declining in North and Central America, Europe and Africa (Karr 1982; Lynch and Wigham 1984; McLellan *et al.* 1986; Askins and Philbrick 1987; Askins *et al.* 1987; Robbins *et al.* 1989; Newmark 1990; Bolger *et al.* 1991). Australia also faces widespread decline in bird species, particularly woodland birds in agricultural and pastoral land (Howe 1984; Saunders 1989, 1990, 1993; Robinson 1991; Garnett 1992).

There is general agreement that in areas where there is intensive land use, a system of reserves will, by itself, be inadequate to protect Australia's flora and fauna (Recher 1976, 1990; Benson 1989; Saunders 1989, 1990; Recher and Lim 1990; Saunders and Curry 1990; Woinarski and Tidemann 1991; Hobbs *et al.* 1993). To complement the reserves, management guidelines are required for areas outside national parks and nature reserves that advise land holders about how they can conserve local bird species (Laudenslayer 1986; Saunders 1990; Leach and Hines 1993). This represents a swing away from the view of the agricultural landscape being a predominantly hostile matrix in which remnants of native vegetation struggle to survive, to one in which the whole of the landscape is regarded as the important biological resource.

Studies have shown that many native species can occur in small remnants at densities comparable to those in large reserves (Higgs and Usher 1980; Loyn and Suckling 1984; Cieslak 1985; McLellan *et al.* 1985; Freemark and Merriam 1986; Ford 1987; Loyn 1987; Derleth *et al.* 1989). Clearly the composition, as well as number of species, is a

critical factor for conservation. However, as more studies point to the value of small remnants for conservation, we might expect, in rural landscapes, a shift in priorities away from the rarest, most sensitive species towards species that are tolerant of intermediate levels of disturbance, but which are declining in abundance. In this paper we present our assessment of the conservation status of 137 land bird species occurring on the Armidale Plateau, of the New England Tablelands, northeast New South Wales, Australia (co-authors for this publication were; H. A. Ford and H.F. Recher). We use these species to demonstrate that emphasis on the conservation of species that are regionally rare and highly sensitive to disturbance (and as a result dependent upon large areas of undisturbed woodland), may lead to management advice that is unrealistic and ultimately detrimental to the regional fauna. This may, in part, explain the failure of conservation efforts to prevent the continuing decline of bird species on the Tablelands. We also suggest that pastoral areas such as the New England Tablelands may be better defined as variegated landscapes (McIntyre and Barrett 1992) rather than fragmented landscapes.

4.2 STUDY AREA

The New England Tablelands were first settled by graziers in the 1830's and around this time the clearing of native vegetation commenced. By the 1930's extensive clearing of woodland had stopped (Davidson and Davidson 1992). Today about half of the area on the Tablelands is covered by dry sclerophyll, open forest (15%) and woodland (35%, Smith and Turvey 1977). The forest tends to occur along the eastern edge of the Tablelands, which is cooler and experiences higher rainfall than the western margin (Hobbs and Jackson 1977). Tree cover on private land is about 30% with about half of this affected by eucalypt dieback (Jones *et al.* 1990). Dieback, caused by leaf-eating insects, is the result of intensified grazing practices that have occurred since the 1950's (Lowman and Heatwole 1992). Most woodland birds are less common in areas of the Tablelands that are affected by dieback (Ford and Bell 1981; see also Chapters 2 and 3).

Trees in small isolated patches of woodland are more likely to be affected by dieback than those in large patches of woodland (Jones *et al.* 1990). The study site, which will be referred to as the Armidale Plateau, is the upland area within a 60 km radius of Armidale. It is intensively grazed and remaining tree cover is less than 20%, of which the majority (85%) is on private land. Eucalypt woodland is the dominant form of vegetation on the Armidale Plateau. The two most common types of woodland are the stringybark woodlands dominated by the New England stringybark *Eucalyptus caliginosa*, occurring on the poorer granite soils along ridges and hill-tops; and the Blakely's red gum *E. blakelyi* and yellow box *E. melliodora* association, restricted to the richer soils at lower altitudes. The understorey is sparse throughout the study region, either naturally or due to grazing and clearing. The common understorey species are the fern-leaf wattle *Acacia filicifolia*, blackthorn *Bursaria spinosa*, biddy bush *Cassinia quinquefaria* and regenerating eucalypts. Elevation of the study area ranges from 900 m to about 1300 m. The climate is temperate, with an average annual rainfall of 800 mm.

4.3 METHODS

4.3.1 Assessment of conservation status of woodland birds

The assessment included land birds known to occur or to have previously occurred (as breeding populations) on the Armidale Plateau. Changes in abundance, sensitivity to habitat degradation and habitat specificity of each species were assessed using the following sources of information:

- 1) Previous surveys in the study area (Ford and Bell 1981; Ford *et al.* 1985; Dunkerley 1989; Ford and McFarland 1991; Ford in press).
- 2) Unpublished records and observations of the authors (co-authors for this publication were; H. A. Ford and H.F. Recher), other local ornithologists, and land-holders.
- 3) Data from a single census in 294 woodland sites. Each site was visited once during spring 1990. Birds were recorded over a 20 minute period within a 200 m by 60 m strip transect (this same data is presented in Chapter 2).

4) Quantitative descriptions of habitat variables in each of the 294 censused sites. Correlations between these habitat variables and bird species were used to assist in identifying species that are habitat specialists, dependent on healthy woodland and/or dependent on large areas of woodland. The results from this fourth source of information are not presented in Chapter 2.

Land birds were classified into one of the following five groups (Table 4.1):-

Group 1: Species that are likely to have once been common and are now absent from the Armidale Plateau (6 species); based on historical records and current distribution, or known habitat requirements and availability of original habitat.

Group 2: Species that are likely to have once been common, but are now considered uncommon on the basis of known declines in specific remnants, or current distribution and availability of preferred habitat (18 species). Species such as the brown treecreeper and crested shrike-tit (see Table 4.1 for scientific names) are easily detectable and so despite being uncommon are relatively well represented in the transect counts.

Group 3: Species that are common, but are dependent upon healthy woodland (35 species). These species are absent from the smaller woodland patches that are affected by dieback, and more common at sites where grazing, logging, clearing of understorey vegetation and removal of fallen timber is limited (based on results presented in Chapter 2). In both groups 3 and 4, a number of species were recorded at few, if any of the 294 census sites. However, they are known from historical records and other surveys to be common to the Armidale Plateau. Common species may not have been detected during the census for the following reasons: Some are nocturnal such as the owl nightjar and boobook owl; cryptic species like the quail are often missed during a single 20 minute census; species like the fairy martin, nankeen kestrel and pallid

cuckoo are open-country species being more common outside the woodland patch; some migrants, like the dollarbird are more common after the census was done; and wide-ranging wary species like the brown goshawk, little eagle and Australian raven often stayed outside the census transect, away from the observer.

Group 4: Species that are common and tolerant of fragmentation and disturbance (33 species). A species was placed in this group if it was common in small, degraded patches of woodland (partly based on results in Chapter 2). This group is divided into two subgroups; i) Species that prefer open country (tend to occur outside transects), and ii) Species that were common in transects (including the degraded ones).

Group 5: Species that may never have been common, are known to occur (or to have occurred recently) on the Tablelands (Ford and McFarland 1991), but were not, or rarely, recorded on transects (35 species). This group is divided into two subgroups; i) Species that tend not to be habitat specialists on the Armidale Plateau (26 species), and ii) Species that tend to be habitat specialists (19 Species). The latter subgroup includes the glossy black-cockatoo, white-plumed honeyeater and striped honeyeater that occupy casuarinas; the red-browed finch and white-browed scrub-wren that live along creeklines; the regent honeyeater that is associated with ironbarks; the Australian king parrot, cicadabird and satin flycatcher that require forest rather than woodland; and the chestnut-rumped heathwren that requires heathy vegetation that occurs in low-nutrient sites such as granite outcrops.

Species whose distribution was considered to be marginal to the Armidale Plateau (Table 4.1, marked M) are either more abundant in drier habitats to the west of the Tablelands (Mw), for example, the inland thornbill and ground cuckoo-shrike, or are

more abundant in wetter, woodland/open-forest habitats to the east (Me), for example, the red-browed treecreeper and wonga pigeon (Blakers *et al.* 1984; Ford and McFarland 1991).

4.3.2 Effect of woodland area

The area of each patch of woodland was calculated for the same 294 woodland sites described in the previous section, using 1:25 000 topographic maps and aerial photos. The sites (at which a single 200 m by 60 m strip transect was placed) were randomly chosen but stratified to cover the full range of available patch sizes (2 ha to > 400 ha). Where more than one site was placed in the larger patches, they were at least 100 metres apart. A patch was considered to be a separate area, if, for the most part, it was greater than 50 m from an adjacent area of woodland. In many cases patches were connected by strips of woodland (< 100 m wide).

Woodland patches were divided into six size categories; greater than 400 ha (77 sites), 101-400 ha (79 sites), 51-100 ha (39 sites), 21-50 ha (43 sites), 6-20 ha (35 sites) and less than 6 ha (21 sites). The average number of species within each transect (including and excluding open-country species), was calculated for all sites in each of the six size categories. The means were compared using a Kruskal-Wallis test (Sokal and Rohlf 1981), *a posteriori* tests of mean ranks were carried out using Dunn's multiple comparison technique (Neave and Worthington 1988).

The proportion of sites at which a species was recorded (inside the transect only) was calculated for each size category. Species recorded in fewer than 10 sites (Table 4.1) were excluded. The response of each of these species to decreasing patch size was described as:

1) Increasing, if the proportion of sites occupied in small patches (< 6 ha) was more than twice the proportion of sites occupied in large patches (> 400 ha);

- 2) Decreasing, if the proportion of sites occupied in large patches (> 400 ha) was more than twice the proportion of sites occupied in small patches (< 6 ha);
- 3) Intermediate, if the proportion of sites occupied in medium sized patches (21-50 ha) was more than twice that for both small and large patches; and
- 4) No change (Table 4.1).

For comparison this analysis was repeated, defining small patches as being 6-20 ha instead of less than 6 ha, and these results are discussed.

Species that were observed mostly in large areas of continuous woodland (> 400 ha), particularly in the national parks and state forests along the eastern edge of the Armidale Plateau, are presented here as being dependent on large areas of relatively undisturbed woodland (Table 4.1, marked *). As these continuous areas of woodland tend to be less degraded (Chapter 2) it may be that these species are highly sensitive to disturbance rather than being dependent on large areas *per se*.

4.4 RESULTS

4.4.1 Assessment of conservation status of woodland birds (Table 4.1)

The conservation status of 137 land birds was assessed (Table 4.1). Six species are likely to have once been common but are now absent from the Armidale Plateau (Table 4.1, Group 1). A further 18 species are declining, having once been common, but are now uncommon (Group 2). Thirty-five species are common to varying degrees but are vulnerable due to their apparent dependence upon healthy woodland (Group 3). Only 33 species (24%) are abundant and widely distributed on the Tablelands. The majority of these are open-country species and/or common in degraded woodland (Group 4). The remaining 45 species may never have been common on the Tablelands and tend to be habitat specialists and/or tend to be marginal to the Armidale Plateau (Group 5). The number of sites (out of 294) at which each species was recorded, inside the transect, is given for each species (Table 4.1).

4.4.2 Effect of woodland area

A total of eighty-nine species was recorded in at least one of the 294 sites (Table 4.1). There was a significant difference between the number of species in different-sized woodland patches ($H = 11.61$, d.f. = 5, $p < 0.05$, Figure 4.1). Multiple comparison of mean ranks showed that the mean number of species was significantly higher in patches between 20 ha and 400 ha in size. Patches smaller or larger than this range had fewer species (Dunn's multiple comparison technique; $z = 2.94$, $p < 0.05$). If birds that are predominantly open-country species, such as the eastern rosella, willie wagtail, rufous song-lark, yellow-rumped thornbill and Australian magpie, are removed from the analysis (14 species, including those in Table 4.1, Group 4i) the difference is no longer significant ($H = 10.62$, d.f. = 5, $p = 0.06$), but the trend is the same (Figure 4.1).

Forty-nine species were recorded at ten or more sites (Table 4.1). The proportion of sites occupied by each of these species was compared in large (> 400 ha), medium (21-50 ha) and small (< 6 ha) patches. Sixteen species (33%, Table 4.1 ↓) were twice as common in large than small patches, nine (18%, ↑) were twice as common in small than large patches, ten (20%, ▣) were twice as abundant in medium sized patches (21-50 ha) as in either large or small patches, and fourteen (29%, ●) showed no difference. Although this analysis is biased towards the more common species (occurring in $\geq 10/294$ sites) that can be expected to be more tolerant of disturbance, the results suggest that 67% of the bird species are tolerant of moderate levels of woodland fragmentation.

Not all species that decreased in smaller patches are intolerant of disturbance. For example, the three species of treecreeper that occur on the Armidale Plateau are least common in the smallest patches (Figure 4.2, Table 4.1 ↓; Groups 2, 4 ii and 5 ii). However, only the red-browed treecreeper, which was not recorded in woodland patches smaller than 400 ha, could be described as highly sensitive to fragmentation. Both the white-throated treecreeper and the brown treecreeper were recorded in woodland patches as small as 6-20 ha (Figure 4.2). Woodland patches that are smaller than six

hectares are often heavily degraded and many bird species were, like the treecreepers, absent or rarely seen in these sites (Chapter 2). If the above analysis is repeated and small patches defined as being 6-20 ha instead of < 6 ha, only seven bird species (14%) show a decrease in small patches compared with very large patches (> 400 ha). They are the crimson rosella, scarlet robin, superb blue wren, olive-backed oriole, white-eared honeyeater, brown thornbill and white-browed scrub-wren. Again we caution that this analysis refers to the more common species (49 species occurring in at least 10 sites out of 294), that are more likely to be tolerant of woodland fragmentation and disturbance.

Seventeen species are considered to be dependent upon large areas (> 400 ha) of continuous woodland (Table 4.1 marked with *). Two species, the powerful owl and the masked owl, have disappeared from the Armidale Plateau (Group 1). Thirteen species may never have been common in the study area (Group 5). Of these, 12 tend to be habitat specialists on the Armidale Plateau (Group 5 ii): For example, the white-browed scrub-wren and red-browed finch are more common along creeklines, the spotted quail-thrush is an open-forest ground dweller that is more common along rocky ridges with grass clumps. Other species like the satin flycatcher, cicadabird and red-browed tree creeper are more common in forest rather than woodland habitats. Species that are dependent on large areas of woodland are more likely to be marginal to the study area. Of the 24 species considered to have always been marginal to the Armidale Plateau (Table 4.1, marked Me or Mw), three have disappeared (Group 1), 21 may have always been uncommon (Group 5) and, of these, nine are dependent on large areas of woodland (Table 4.1, *). Only two species, the peaceful dove and the fan-tailed cuckoo, are not marginal to the Tablelands, were once common and appear to be declining (Group 2). Both these species are, however, widespread and common elsewhere in their range.

4.5 DISCUSSION

We have been moderate in our views of the conservation status of woodland birds on the Armidale Plateau (Table 4.1). There are extensive areas of land degradation where over-clearing, intensive grazing and eucalypt dieback have severely reduced the woodland bird community (Ford and Bell 1981; see also Chapter 2). Woodland is still being cleared on the Northern Tablelands and grazing and dieback continue to degrade remaining wood lots. If current land management practices do not change, even the most hardy woodland birds (Group 4, Table 4.1) will decline. In Victoria, the brown falcon, grey butcherbird, tawny frogmouth, dollarbird and scarlet robin are declining or locally extinct (Robinson 1993). On the Armidale Plateau these five species are either common but dependent upon healthy woodland (Group 3), or common and tolerant of fragmentation and disturbance (Group 4). If the trends on the New England Tablelands are the same as those in rural Victoria, then even common robust species (Group 4) may decline, joining those species in group 2 (Table 4.1).

While it appears that a large proportion of the woodland birds on the New England Tablelands are under the threat of local extinction (Table 4.1, Groups 2, 3 and 5), there is also a positive message. That is, that the majority of local bird species are surprisingly resilient to disturbance under the present land management. The implication of this is that with sympathetic management, the majority of bird species can be conserved within a predominantly grazing landscape. Like Saunders *et al.* (1987), Hopkins and Saunders (1987) and Loman and Von Schantz (1991), we believe that there is a need to develop guidelines for management at a local scale that aim to conserve species richness. Our research indicates that for patches of woodland larger than 6 ha, habitat quality is at least as important as the area of a remnant for maintaining bird species richness. The severity of eucalypt dieback was one of the strongest predictors of number of bird species and individuals of most ecological groups (Ford and Bell 1981, Chapter 2). This result is similar to that of other workers (Lynch and

Wigham 1984; Dobkin and Wilcox 1986; Haila 1986; Freemark and Merriam 1986). Based on the analysis of habitat data from each of the 294 woodland sites in our study area (Chapter 2), management guidelines aimed at protecting and enhancing species richness have been produced for landowners who are interested in attracting woodland birds onto their properties (Barrett and Ford 1993). These are summarised as follows:

- 1) Maintain or replant understorey vegetation.
- 2) Maintain a mixture of local tree and shrub species.
- 3) Exclude grazing stock from some areas to allow native grasses and legumes to develop.
- 4) Tolerate moderate levels of mistletoe, as they attract many species, especially honeyeaters.
- 5) Maintain a range of tree age classes. If large, old trees are absent, provide nest boxes.
- 6) Leave fallen trees and large, woody debris to break down naturally.
- 7) Protect or establish vegetation beside creeks and rivers.
- 8) Link larger, healthy patches of woodland with strips of native vegetation that are as wide as possible.
- 9) Give management priority to remnants that are 20 hectares or larger and, where lacking, increase the size of smaller wood lots by encouraging regeneration or planting around their boundaries.

These recommendations are similar to those made by Recher (1993) for the restoration of degraded ecosystems. With minimal effort they are achievable within the current management regimes. They are also compatible with sustainable agriculture and there should be long-term economic benefits to the land-holder as well as environmental benefits to the community (Breckwoldt 1986; Davidson and Davidson 1992; Hobbs *et al.* 1993).

There is a danger that a species must become rare before it is considered to be at risk by land authorities. Substantial resources are then required to save it, for example, the

regent honeyeater recovery plan alone is costing over A\$400 000 (Ford *et al.* 1995). By putting less emphasis on rare, highly sensitive species that depend on large areas of undisturbed habitat, conservation resources can be channelled into simple, locally based management goals, such as those described above. In these goals it is suggested that priority should be given to patches of woodland as small as 20 hectares (point 9), so what of the seventeen species that depend on areas of undisturbed woodland that are greater than 400 hectares in size? Of the 77 sites in these large patches, 54% were on private land, 18% were crown reserve and 28% were either national park, state forest or nature reserve. The larger national parks, nature reserves and state forests are relatively safe areas for these rarer, sensitive species. Given that in total, national parks, nature reserves and state forests cover at most 10% of the Tablelands (Pigram and King 1977), the continued existence of these seventeen species on the Tablelands will depend on management on private land. Two things will be required: Firstly, private land owners will need to retain existing large patches of woodland. Secondly, the amount of woodland in large patches will need to be increased on some properties to compensate for the inevitable losses on others. Are either of these likely to occur on the Tablelands?

The Victorian Department of Food and Agriculture, recommends that land owners retain a minimum of 10% tree cover for sustainable land management (Bird *et al.* 1992). As the average size of a grazing property on the Armidale Plateau is 800-1000 ha on most properties, the maximum size of a wood lot following the Department's recommendation would be less than 100 ha. It is also unlikely that the 10% tree cover would all be in one block. Under the Victorian recommendations, retaining or creating larger sized areas requires the co-operation of adjoining land owners and integrated plans of management for the region. While programs, such as Landcare and integrated or total catchment management, are avenues by which the retention or restoration of large blocks of woodland can be achieved on the Armidale Plateau, it may be some time before this level of integrated regional management can be achieved. There is also the risk, that we continue to emphasise, that by focusing on rare and possibly marginal

species, a larger number of common species may decline, becoming rare in turn (McIntyre *et al.* 1992). Thus, we suggest the following approach:

In the medium to long-term, land owners and regional authorities should work toward the integration of management for nature conservation purposes between adjoining properties. As part of this program, a regional plan should include some areas in excess of 400 hectares and existing large blocks of woodland should be protected against further reduction in size, fragmentation or degradation. This should go some way towards protecting the seventeen species that are highly sensitive to habitat fragmentation and dependent upon large areas of undisturbed woodland. However, as has already been stated, with the exception of the peaceful dove and fan-tailed cuckoo (that are regionally rare, but common elsewhere in their distribution), these species tend to be atypical and marginal to the Tablelands. Given also the logistical problems of creating large reserves on private land, we suggest that in the short term, management strategies should emphasise the conservation of those species that show a capacity to survive moderate levels of fragmentation. In such a management plan the species in groups 2 and 3 (Table 4.1) would be given priority. That is, available resources would be expended primarily to ensure the survival of species that may be common, but which require healthy habitat (Group 3), or that were likely to have once been common, but are now uncommon (Group 2). This could be achieved with woodland patches of 20-100 ha in area.

There is still a place for the management of species on the Armidale Plateau that have specific habitat requirements other than a dependence on large areas of undisturbed woodland. For example, heathland vegetation occurring in nutrient-poor sites, such as granite outcrops, could be protected on specific properties as habitat for chestnut-rumped heathwrens. Casuarina stands could be protected for glossy-black cockatoos and heavily forested areas protected for the Australian king parrot and forest raven. It should, however, be considered that many of the species that are specialists on the

Armidale Plateau (Table 4.1, Group 5 ii) are also marginal species and may be less specialised elsewhere in their range where they are better suited to the habitat. This is also true for the seventeen species that depend on large areas of woodland, and the same rationale applies; that is, that unless these species are rare over their entire range (like the regent honeyeater), efforts to conserve these species should be secondary to the conservation of the majority of locally adapted species.

This project was set up using the fragmentation model as a theoretical framework. Areas of woodland were viewed as islands of habitat in a 'sea of grassland' which was considered hostile to most woodland bird species. This model arose from the theory of island biogeography that emphasises the importance of area and isolation, and predicts that fragments will have fewer species as they become smaller and more isolated (MacArthur and Wilson 1963; Diamond 1975). There are some areas, such as the semi-arid Western Australian wheatbelt, where there is a clear distinction between patches of original vegetation and the surrounding matrix of crops and pasture, which is totally unsuitable for virtually all bird species (Saunders 1989; Saunders and Curry 1990; Saunders *et al.* 1991). This is not the case on the New England Tablelands where it is often difficult to decide where a woodland patch ends and grassland begins. As previously mentioned, it is also evident that on 1.2 ha transects, within woodland patches greater in area than 6 ha, changes in the area of a patch are of limited importance to the majority of bird species (Chapter 2; see also Table 4.1, Figure 4.1). Census transects placed in grassland (between scattered trees) show that a number of woodland species are present in low numbers in this open country. These birds were almost always flying over the transect, presumably on their way to isolated trees or woodland patches (Chapter 3). For these reasons we feel that the variegation model, which describes the landscape as a 'diffuse mosaic of open forest and scattered trees' or more generally 'a constantly shifting mosaic of habitats of varying suitability', is more applicable to rural environments, such as the New England Tablelands, where grazing is the major activity (McIntyre and Barrett 1992).

In any region, a significant proportion of the bird species that are rare and sensitive to disturbance are likely to be on the edge of their distribution. Marginal species are more likely to have specific habitat requirements and so perceive even the unaltered landscape as fragmented. If conservation priorities are set using the fragmentation model, marginal species will generally be given higher priority than local species. It is the marginal species that will always seem to be in most need of assistance, being highly sensitive to disturbance and dependent on large habitat islands. In many circumstances it may be appropriate to give top priority to the rarest, most sensitive species (Soulé and Simberloff 1986; Robbins *et al.* 1989; Hobbs *et al.* 1992). Certainly we must consider the possibility that the disappearance of a species along the margin of its distribution may foretell a decline across the whole of its range. However, we must also ask how representative these species are of the community as a whole? As has been discussed, in this study fifteen of the seventeen species that require large areas of woodland are atypical. They tend to be marginal to the Tablelands, being more common in drier woodland to the west or wetter woodland/open-forest to the east of the region (Table 4.1, marked *) and most have narrow habitat requirements (Table 4.1, Group 5 ii).

Modelling studies have demonstrated that sub-optimal habitat containing sink populations may be important for the long-term survival of the larger metapopulation and should be part of a regional conservation program (Howe and Davis 1991). The variegation model recognises the value of the disturbed areas, that is the scattered trees and smaller habitat fragments. It predicts that rather than the largest, undisturbed woodland patches being the most important conservation resource, the whole of the landscape is important to varying degrees, at one time or another. This helps to avoid an over-emphasis on species that are highly sensitive to habitat fragmentation when producing regional management plans for conservation. For the reasons already discussed, it is unlikely that individual property owners or groups of neighbouring properties will be able to establish 400 hectares of continuous woodland for

conservation purposes. As a result, if the seventeen bird species that are regionally rare, highly sensitive to disturbance and dependent on large (>400 ha) areas of continuous woodland are given priority in a conservation management plan for the New England Tablelands, the rural community are likely to feel alienated from the conservation process. By contrast, recognising and promoting the conservation value of sub-optimal habitat, or disturbed areas between large areas of undisturbed habitat such as nature reserves, state forests and national parks, is a step closer to establishing community-based conservation. Rather than giving land-holders the impression that they have to leave their land and allow it to return to a natural state in order to make a contribution to regional biodiversity (a view that we fear is still common on the Tablelands), the message is that with sympathetic management, even relatively small properties have a role to play in maintaining local species diversity.

Figure 4.1: The effect of area of woodland patch on the mean number (\pm SE) of bird species (within 1.2 ha transects, 294 in total). Woodland patches were divided into six size categories; > 400 ha (n = 77), 101-400 ha (n = 79), 51-100 ha (n = 39), 21-50 ha (n = 43), 6-20 ha (n = 35) and < 6 ha (n = 21). There is a significant difference in the mean number of species in different sized patches (Kruskal-Wallis, $H = 11.61$, d.f. = 5, $p < 0.05$). This difference is not significant when open-country species are excluded ($H = 10.62$, d.f. = 5, $p = 0.06$).

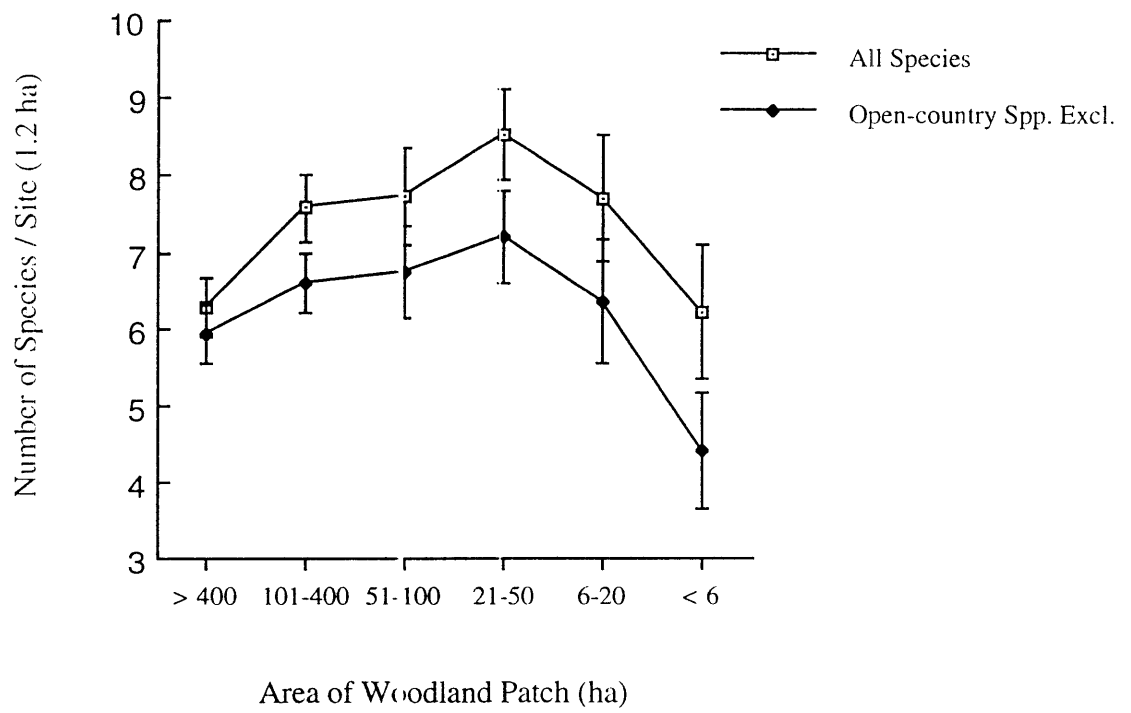


Figure 4.2: The mean number (\pm SE) of white-throated treecreepers *Climacteris leucophaea*, red-browed treecreepers *Climacteris erythroga* and brown treecreepers *Climacteris picumnus*, on 1.2 ha transects (294 in total), in different sized patches of woodland ; > 400 ha (n = 77), 101-400 ha (n = 79), 51-100 ha (n = 39), 21-50 ha (n = 43), 6-20 ha (n = 35) and < 6 ha (n = 21).

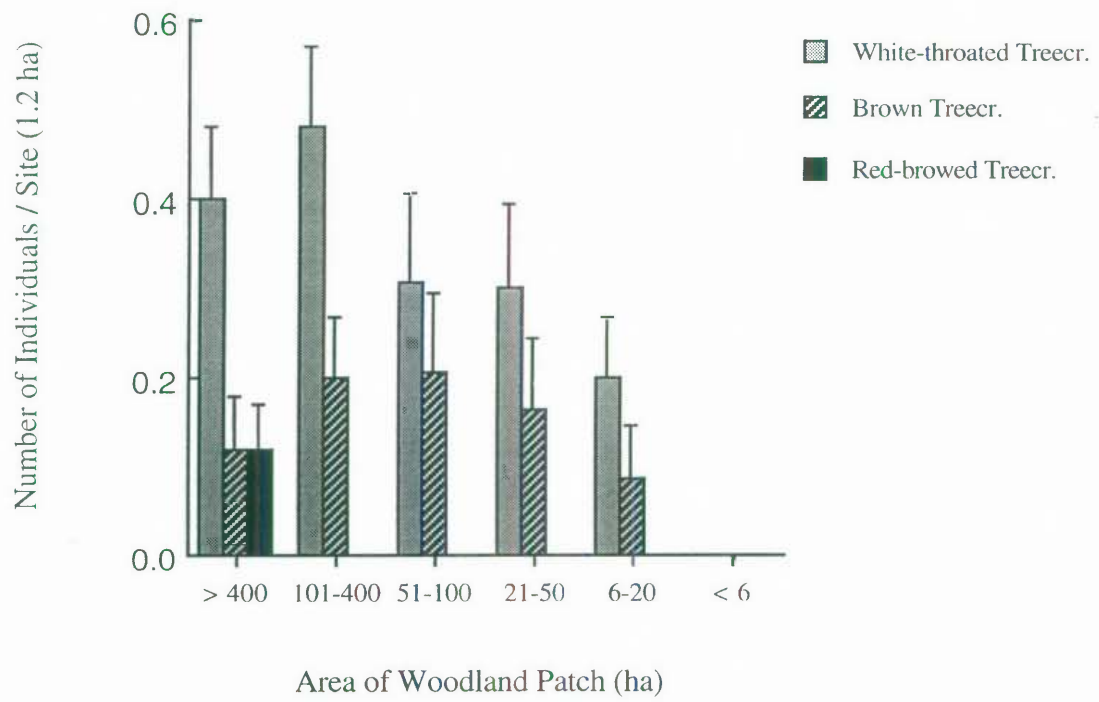


Table 4.1: The conservation status of 137 land birds on the Armidale Plateau. The number of sites, out of a total of 294, at which each species was recorded (inside the 200m strip transect) is given for each species. Bird species that are considered to be dependent to some extent on large areas of woodland (> 400 ha) are marked with an asterisk *. Species that are marginal and more common to the east of the Armidale Plateau are marked Me, marginal species that are more common to the west of the Tablelands are marked Mw. Species occurring in > 10 sites are identified as showing an increase ↑, decrease ↓, or no change in abundance with decreasing area of woodland •. Species that were more common in medium sized patches are marked ■.

Group 1: Species that are likely to have once been common and are now absent from the Armidale Plateau. Based on historical records and current distribution, or known habitat requirements and availability of original habitat (6 species).

Emu	<i>Dromaius novaehollandiae</i>	0	Mw
Bustard	<i>Ardeotis australis</i>	0	Mw
Bush Stone Curlew	<i>Burhinus magnirostris</i>	0	
*Powerful Owl	<i>Ninox strenua</i>	0	Me
*Masked Owl	<i>Tyto novaehollandiae</i>	0	
White-browed Babbler	<i>Poma. ostomus superciliosus</i>	0	

Group 2: Species that are likely to have once been common but are now uncommon on the basis of known declines in specific remnants¹, or current distribution and availability of preferred habitat (18 species).

Whistling Kite	<i>Haliaeetus sphenurus</i>	0	
Stubble Quail	<i>Coturnix pectoralis</i>	0	
Brown Quail	<i>Coturnix australis</i>	0	
Painted Button Quail ¹	<i>Turnix varia</i>	0	
*Peaceful Dove ¹	<i>Geopelia striata</i>	2	
Common Bronzewing	<i>Phaps chalcoptera</i>	1	
Musk Lorikeet ¹	<i>Glossopsitta concinna</i>	9	
Little Lorikeet ¹	<i>Glossopsitta pusilla</i>	6	
*Fan-tailed Cuckoo	<i>Cuculus pyrrhophanus</i>	2	
Tree Martin	<i>Cecropis nigricans</i>	0	
White-winged Triller	<i>Lalage sueurii</i>	3	
Hooded Robin ¹	<i>Melanodryas cucullata</i>	3	
Jacky Winter	<i>Microeca leucophaea</i>	14	■
Crested Shrike-tit	<i>Falculiculus frontatus</i>	16	●
Speckled Warbler	<i>Sericornis sagittatus</i>	13	↓
Brown Treecreeper ¹	<i>Climacteris picumnus</i>	27	↓
Diamond Firetail ¹	<i>Emblema guttata</i>	4	
Double-barred Finch ¹	<i>Poephila bichenovii</i>	3	

Group 3: Species that are common but dependent on healthy woodland (35 species). Species that are usually absent from small, degraded patches were considered to be dependent on healthy woodland (Barrett *et al.*, in prep.).

Brown Goshawk	<i>Accipiter fasciatus</i>	5	
Little Eagle	<i>Hieraaetus morphnoides</i>	2	
Crimson Rosella	<i>Platycercus elegans</i>	76	↓
Pallid Cuckoo	<i>Cuculus pallidus</i>	5	
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>	3	
Golden Bronze-Cuckoo	<i>Chrysococcyx lucidus lucidus</i>	11	↓
Boobook Owl	<i>Ninox novaeseelandiae</i>	0	
Tawny Frogmouth	<i>Podargus strigoides</i>	0	
Owlet Nightjar	<i>Aegothales cristatus</i>	1	
Sacred Kingfisher	<i>Halcyon sancta</i>	23	↓
Dollarbird	<i>Eurysiomus orientalis</i>	4	
Scarlet Robin	<i>Petroica multicolor</i>	22	•
Eastern Yellow Robin	<i>Eopsaltria australis</i>	24	↓
Golden Whistler	<i>Pachycephala pectoralis</i>	14	▪
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	46	•
Restless Flycatcher	<i>Myiagra inquieta</i>	10	▪
Leaden Flycatcher	<i>Myiagra rubecula</i>	38	↓
Grey Fantail	<i>Rhipidura fuliginosa</i>	76	▪
Rufous Song-lark	<i>Cincloramphus mathewsi</i>	12	↑
Superb Blue Wren	<i>Malurus cyaneus</i>	30	↓
Brown Thornbill	<i>Acantniza pusilla</i>	26	↓
Buff-rumped Thornbill	<i>Acantniza reguloides</i>	75	•
Weebill	<i>Smicrornis brevirostris</i>	9	
Orange-winged Sittella	<i>Daphoenositta chrysoptera</i>	48	•
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	55	•
White-eared Honeyeater	<i>Lichenostomus leucotis</i>	21	↓
Fuscous Honeyeater	<i>Lichenostomus fuscus</i>	83	▪
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	17	▪
White-naped Honeyeater	<i>Melithreptus lunatus</i>	71	•
Eastern Spinebill	<i>Acantnorhynchus tenuirostris</i>	22	↓
Spotted Pardalote	<i>Pardalotus punctatus</i>	29	↓
Silvereye	<i>Zosterops lateralis</i>	4	
Olive-backed Oriole	<i>Oriolus sagittatus</i>	10	↓
White-winged Chough	<i>Corcorax melanorhamphus</i>	30	↓
Dusky Woodswallow	<i>Artamus cyanopterus</i>	33	↑

Group 4: Species that are common and tolerant of fragmentation and disturbance (33 species). A species was placed in this group if it is common in small, degraded patches of woodland (Chapter 2). This group is divided into two subgroups; i) Species that prefer open country (tend to occur outside transects), and ii) Woodland and open-country species that were common on transects (including degraded ones).

i) Species that prefer open country (tend to occur outside transects):

Straw-necked Ibis	<i>Threskiornis spinicollis</i>	0	
Wood Duck	<i>Chenetta jubata</i>	0	
Brown Falcon	<i>Falco berigora</i>	0	
Nankeen Kestrel	<i>Falco cenchroides</i>	0	
Masked Lapwing	<i>Vanelus miles</i>	0	
Crested Pigeon	<i>Ocyrops lophotes</i>	1	
Galah	<i>Cacatua roseicapilla</i>	7	
Red-rumped Parrot	<i>Psephotus haematonotus</i>	1	
Welcome Swallow	<i>Hirundo neoxena</i>	4	
Fairy Martin	<i>Cecropis ariel</i>	0	
Richard's Pipit	<i>Anthus novaeseelandiae</i>	0	
European Goldfinch	<i>Carduelis carduelis</i>	1	
House Sparrow	<i>Passer domesticus</i>	1	
Common Starling	<i>Sturnus vulgaris</i>	21	↑
Australian Magpie-lark	<i>Grallina cyanoleuca</i>	9	
Australian Raven	<i>Corvus coronoides</i>	5	

ii) Woodland and open-country species that were common on transects (including degraded ones):

Eastern Rosella	<i>Platycercus eximius</i>	84	↑
Laughing Kookaburra	<i>Dacelo gigas</i>	12	▪
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	50	•
Rufous Whistler	<i>Pachycephala rufiventris</i>	102	•
Willie Wagtail	<i>Rhipidura leucophrys</i>	46	•
Striated Thornbill	<i>Acantiza lineata</i>	115	•
Yellow-rumped Thornbill	<i>Acantiza chrysorrhoa</i>	34	↑
White-throated Warbler	<i>Gerygone olivacea</i>	56	↑
White-throated Treecreeper	<i>Climacteris leucophaea</i>	77	↓

Red Wattlebird	<i>Anthochaera carunculata</i>	50	•
Noisy Friarbird	<i>Philemon corniculatus</i>	81	▪
Noisy Miner	<i>Manorina melanocephala</i>	62	↑
Mistletoebird	<i>Dicaeum hirundinaceum</i>	38	▪
Striated Pardalote	<i>Pardaliparus striatus</i>	68	•
Grey Butcherbird	<i>Cracticus torquatus</i>	37	↑
Australian Magpie	<i>Gymnorhina tibicen</i>	54	↑
Pied Currawong	<i>Strepera graculina</i>	35	•

Group 5: Species that may never have been common, are known to occur (or to have occurred recently) on the Tablelands (Ford and McFarland 1991), but were not, or rarely, recorded on transects (45 species). This group is divided into two subgroups; i) Species that tend not to be habitat specialists on the Armidale Plateau (26 species), and ii) Species that tend to be habitat specialists (19 Species).

i) Species that may never have been common on the Tablelands:

Square-tailed Kite	<i>Lophoictinia isura</i>	0	
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>	0	
Wedge-tailed Eagle	<i>Aquila audax</i>	0	
Little Falcon	<i>Falco longipennis</i>	0	
Little Button Quail	<i>Turnix velox</i>	0	Mw
Red-chested Button Quail	<i>Turnix pyrrhothorax</i>	0	M-
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	2	
*Brush Cuckoo	<i>Cuculus variolosus</i>	0	Me
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>	1	
Barn Owl	<i>Tyto alba</i>	0	
Barking Owl	<i>Ninox connivens</i>	0	
Rainbow Bee-eater	<i>Meropis ornatus</i>	2	
Ground Cuckoo-shrike	<i>Coracina maxima</i>	0	Mw
Little Cuckoo-shrike	<i>Coracina papuensis</i>	2	
Flame Robin	<i>Petroica phoenicea</i>	0	Me
Broad-tailed Thornbill	<i>Acanthiza apicalis</i>	1	Mw
Little Thornbill	<i>Acanthiza nana</i>	0	
Little Friarbird	<i>Philemon citreogularis</i>	0	Mw
Blue-faced Honeyeater	<i>Entonozon cyanotis</i>	0	Mw

Lewin's Honeyeater	<i>Meliphaga lewinii</i>	0	Me
Black-chinned Honeyeater	<i>Meliphaga gularis</i>	2	
Tawny-crowned Honeyeater	<i>Phylidonyris melanops</i>	1	Me
Zebra Finch	<i>Poephila guttata</i>	0	Mw
White-Browed Woodswallow	<i>Artamus leucorhynchus</i>	6	
Pied Butcherbird	<i>Cracticus nigrogularis</i>	1	
Torresian Crow	<i>Corvus orru</i>	0	Mw

ii) Species that may never have been common and tend to be habitat specialists on the Armidale Plateau (19 Species):

*Wonga Pigeon	<i>Leucosarcia melanoleuca</i>	0	Me
*Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	0	
*Yellow-tail. Black-cockatoo	<i>Calyptorhynchus funereus</i>	0	
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	0	
*Aust. King Parrot	<i>Alisterus scapularis</i>	1	Me
*Cicadabird	<i>Coracina tenuirostris</i>	0	Me
*Satin Flycatcher	<i>Myiagra cyanoleuca</i>	1	Me
*Spotted Quail-thrush	<i>Cinlosoma punctatum</i>	0	Me
*White-browed Scrub-wren	<i>Sericornis frontalis</i>	12	↓
Chestnut-rumped Heathwren	<i>Sericornis pyrrhopygius</i>	0	
*Red-browed Treecreeper	<i>Climacteris erythroga</i>	6	Me
Striped Honeyeater	<i>Plectrohynchus lanceolata</i>	0	
Regent Honeyeater	<i>Xanthomyza phrygia</i>	0	
Yellow-tufted Honeyeater	<i>Lichenostomus melanops</i>	1	
White-plumed Honeyeater	<i>Lichenostomus pencillatus</i>	10	▪
*Red-browed Finch	<i>Emblema temporalis</i>	5	
Plum-headed Finch	<i>Aidenosyne modesta</i>	0	Mw
*Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	2	Me
*Forest Raven	<i>Corvus tasmanicus</i>	0	Me