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Forum—

Size Isn't Everything: The Importance of Small Remnants to the Conservation of Woodland Birds in Australia

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Introduction

There is no doubt that the successful long-term conservation of Australian birds will depend substantially on our ability to conserve and manage large, contiguous areas of their habitat. However, the legacy of unplanned and extensive clearing in the temperate agricultural zones is that few such areas remain in much of eastern, southern and south-western Australia. In these regions in particular, there is a growing realisation that the protection of our remaining large areas of native vegetation will not alone be enough to ensure the long-term persistence of all the bird species which historically inhabited such regions. Remnants, large or small, are not closed systems, and bird populations do not respond to them as such. We must begin to view the conservation of our woodland birds from a landscape perspective, especially in agricultural landscapes where they are particularly threatened. This means broadening the conservation focus to include the agricultural matrix itself as well as the smaller patches of native vegetation—even scattered paddock trees—embedded within it.

Large versus small

It has long been established that larger patches of remnant vegetation tend to be home to more species, a fact which has contributed to their being a central focus in conservation efforts. However, it is not necessarily useful to state that a large patch contains more species than a smaller patch (Major *et al.* 2001). Larger patches of a given habitat type tend to contain more individuals, and therefore, through passive sampling alone, would be expected to have more species. Of more interest is whether a large patch supports more species per unit area and, most importantly, whether it supports particular species which small patches cannot, owing to factors such as minimum area requirements or edge effects. That is: are the bird assemblages of patches nested with respect to patch area (Patterson 1990)?

The evidence suggests that sometimes this is the case, and sometimes it is not. For example, Watson *et al.* (2001) found that several species of woodland bird were significantly less likely to occur in a similar-sized sample area in a small patch than in a larger patch, such as the Hooded Robin *Melanodryas cucullata*, which was recorded only in patches larger than 100 ha. Similarly, Barrett *et al.* (1994) identified 16 woodland species which were less likely to occur in survey sites located in small (< 6 ha) patches. Major *et al.* (2001) found that sites greater than 200 ha had a significantly different bird assemblage composition from those smaller than 100 ha, suggesting that some species in that landscape would not be conserved without maintenance of those large patches.

On the other hand, Fischer & Lindenmayer (2002a), working in New South Wales (NSW) landscapes, found that when comparing similar-sized samples of the bird communities of different-sized patches, no species–area relationship was apparent, and that adding small patches first to a species-accumulation curve resulted in a similar rate of increase to adding large patches first. Indeed, even after excluding open-country species, several small patches contributed more species than an equivalent area of habitat contained in a few large patches. This result suggested that there were in fact several species which preferentially occupied smaller patches (Fischer & Lindenmayer 2002a). Remnant patches of Victorian box–ironbark forests tend to contain similar numbers of species per unit area regardless of patch area (Mac Nally *et al.* 2000), and Maron *et al.* (2004), in the Victorian Wimmera, found no effect of patch area on numbers of woodland birds recorded in 2-ha transects, as well as no evidence that nestedness correlated with patch area. Even the Hooded Robin was commonly found in patches of just a few hectares, in contrast with the strong area sensitivity reported in the NSW study by Watson *et al.* (2001).

Native villains

So it is important not to write off small patches simply because they are small—there are often other, more important factors which determine the value of a given remnant patch for a particular bird species. These might include the degree of patch–matrix contrast (Watson 2002), the amount and quality of resources contained within the patch (Zanette *et al.* 2000), and interspecific interactions (Piper & Catterall 2003). One of the strongest and most consistently reported ecological patterns in the local distributions of small passerine birds in eastern Australia is the reduction in diversity and abundance associated with occurrence of the native Noisy Miner *Manorina melanocephala*. Several studies have found the Noisy Miner to be the single greatest driver of bird community patterns, more influential than patch area, degree of isolation, disturbance and habitat structure *per se*, although occurrence of this species tends to be related to several of these factors (Grey *et al.* 1998; Major *et al.* 2001; Piper & Catterall 2003; Maron 2007). The Noisy Miner has been reported to prefer edge habitat, making the bird assemblages of smaller remnants particularly susceptible (Piper & Catterall 2003). However, small patches with a relatively intact shrub layer may escape domination by Noisy Miners, and can retain high small passerine species richness. In south-eastern Queensland, small sites (<15 ha) with a dense understorey of the introduced weed Lantana *Lantana camara* supported high richness of small birds, in comparison with both small and large sites with an open understorey, which were inhabited by Noisy Miners (Kath 2007). Noisy Miners also seem to require broad-leaved trees such as eucalypts, and so small remnants of Buloke *Allocasuarina luehmannii* woodland with few eucalypts were Noisy Miner-free and far richer in small passerines than larger eucalypt woodland remnants, despite their lack of a shrub layer (Maron 2007).

Valuable relicts

Of course, in many landscapes, small patches are important simply because they make up such a large proportion of remaining vegetation. Throughout the temperate and subtropical agricultural regions of Australia, clearing of native vegetation has been catastrophic, often leaving no more than a few percent of original native vegetation in a region (Yates & Hobbs 1997). In the Holbrook region of NSW, more than half of the woody vegetation cover is made up of patches

<5 ha (Gibbons & Boak 2002). Recent work in Victoria has found that at a landscape scale, the total area of vegetation present in a landscape has far more influence on the landscape's bird community than whether it is configured as large or small patches (Radford *et al.* 2005; Radford & Bennett 2007).

Furthermore, in these highly fragmented landscapes that were cleared for agriculture, the vegetation was removed in a non-random fashion. The best soil was cleared first, and land left vegetated tended to be that which occurred on poorer, higher, rockier or sandier areas (Yates & Hobbs 1997; Major *et al.* 2001; Gibbons & Boak 2002). Where small woodland areas on the better soils were retained—for stock shelter, water reserves around dams, roadside strips, woodlots to provide firewood—they often represent some of the last relicts of that vegetation type.

Many of our forest and woodland birds depend on resources such as nectar which experience seasonal or even annual fluctuations in availability. Different woodland types provide nectar at different times of the year, and the preservation of this complementarity in resource production is of critical importance. The selective clearing of particular woodland types means that, in some areas, potentially important links in the temporal chain have been weakened, creating a potentially catastrophic bottleneck in resource availability at a regional level—one which may become more severe under climate change. In many cases, therefore, small remnants of those selectively cleared woodlands may have disproportionately high value. For example, the once-extensive White Box *Eucalyptus albens* woodlands are among those that have been preferentially cleared throughout the inland slopes of NSW, with most remaining as scattered trees and small patches, yet they provide important habitat for nectarivorous birds such as the Regent Honeyeater *Anthochaera phrygia*, which tends to prefer more fertile sites (Menkhorst *et al.* 1999). In particular years, smaller remnants dominated by Grey Box *E. microcarpa* are preferentially used by overwintering Swift Parrots *Lathamus discolor* in the Victorian box–ironbark forest landscapes (Mac Nally & Horrocks 2000). Although our large reserves typically preserve examples of fairly low-productivity forest and woodland, the last vestiges of the woodlands of the most highly productive soils are less well protected.

Landscape values

Several studies have suggested that rates of processes such as nest predation and parasitism tend to be increased near patch edges (Paton 1994). Since small patches may effectively be 'all edge', such patches might be more likely to act as 'sink' habitats. Yet although nest predation is often higher at habitat edges (Gardner 1998; Berry 2002), a review of rates of nest success found no difference between remnants and continuous habitat (Ford *et al.* 2001), and studies on artificial nests in urban areas have found that patch size had no effect on nest predation risk (Matthews *et al.* 1999; Piper & Catterall 2006).

The idea that patches of remnant vegetation in a landscape can be classified as either sources or sinks fails to account for another possibility. Many bird species probably do not perceive small patches as discrete units which end where the tree cover does. Rather, a suite of patches and the matrix surrounding them may form part of an extended territory, with spatial and temporal variations in habitat suitability (Fischer *et al.* 2004). A small patch may be an important augment to nearby larger patches, without necessarily acting as a population source in itself.

So the value of these small, scattered remnants is not restricted to the patch itself—their value extends to the broader landscape. Many species which rely on woodland still forage well out into paddocks from remnants, yet remain within retreating distance of woody vegetation. Thus, the effective area of a remnant from the perspective of a bird is often greater than the area that humans perceive and researchers typically measure. Furthermore, landscape connectivity is enhanced by small remnants which can act as stepping stones. Even scattered paddock trees can act effectively to soften the matrix, potentially facilitating the movement of birds through otherwise inhospitable areas of cleared land (Fischer & Lindenmayer 2002b) and providing habitat in their own right (Fischer & Lindenmayer 2002c; Manning *et al*. 2004; Maron 2005). In the Victorian Wimmera, it is not unusual to see birds such as Diamond Firetails *Stagonopleura guttata* and Hooded Robins breeding in isolated patches of just a few hectares (in some cases, even in single paddock trees).

Inadequate protection

Unfortunately, in most States these small remnants, potentially of critical importance in their own right and as part of the broader system of reserves, have inadequate legislative protection. Most Queensland remnant vegetation mapping, critical for the implementation of the native-vegetation clearing controls, has a minimum resolution of 5 ha (Neldner *et al.* 2005). In Victoria, applications to clear small areas of remnant vegetation are routinely granted.

As agriculture intensifies in many parts of Australia, there is increasing pressure for the removal of even the small amount of native vegetation that is left. Paddock trees and small patches are cleared or reduced in size to allow for the movement of ever-larger machinery (Maron & Fitzsimons 2007), and roadside strips are degraded through livestock grazing and the ploughing of firebreaks. In the longer term, few of these remnants are regenerating, and they will eventually drop out of our landscapes altogether without investment in their protection and enhancement.

There needs to be a greater focus on the important role played in the landscape by small patches and even paddock trees. In my experience, where landowners have become aware of the biodiversity significance of their small woodlots, many take a much greater interest in protecting what they have. Increasingly, much of the financial support for native-vegetation protection and enhancement on private land is provided through competitive schemes where landholders undertake to protect and manage a parcel of native vegetation on their property for a price they propose, and the funding body selects those bids deemed most competitive. Such programs tend to place relatively little value on smaller, more degraded remnants. However, such remnants are potentially where the greatest gains can be achieved through appropriate management agreements, as larger, more intact remnants tend to be so because they already are managed relatively sympathetically, and are also better protected under legislation.

Proper valuation of small remnants is especially important in heavily cleared landscapes which may be close to the threshold of 10% vegetation cover, below which landscape-level species richness declines sharply (Radford *et al.* 2005; Radford & Bennett 2007). A small remnant is disproportionately valuable to such landscapes compared with a similar-sized remnant in a well-vegetated landscape. Yet, typically, a small remnant in a heavily cleared landscape would be undervalued in most habitat assessments, which favourably weight less-isolated remnants (e.g. Habitat Hectares: Parkes *et al.* 2003). Although more isolated patches may support fewer species than if they were surrounded by more vegetation cover, their contribution to the species richness of the landscape as a whole may be greater.

Although there are many landholders in agricultural regions who voluntarily forego short-term production benefits to protect habitat on their properties, we cannot expect them to shoulder the entire burden. Ideally, we need a combination of improved legislation which closes vegetation-clearing loopholes that are currently exploited by an unscrupulous minority, along with broader opportunities for incentives to provide additional vegetation-management services. The move towards long-term environmental stewardship agreements by the previous Federal Government provides an opportunity for enhancing conservation outcomes on private land. Such schemes should allow for compensation of landholders for costs of maintaining small patches in good condition, and modifying land-management practices in production-dominated parts of their properties to protect elements of matrix habitat, such as paddock trees.

At a time when we should be planning for increasing the amount of native vegetation in our most severely fragmented regions (Vesk & Mac Nally 2006), our small remnants of native vegetation are a valuable framework on which such large-scale landscape-restoration programs can be built (Watson *et al.* 2001). Already we face potential extinction debts in many landscapes, and to reduce the severity of continuing population declines we must replace habitat. Instead we are on a trajectory of continuing net habitat loss. Should we lose our small remnants and paddock trees, the ecological dynamics of whole landscapes will be affected, potentially triggering a new wave of local extinctions of our woodland birds.

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