Science for Saving Species

Research findings factsheet

Project 3.2.6

Threatened Species Recovery Hub

National Environmental Science Programme

Effectiveness of conservation interventions for Australian woodland birds: A systematic review of "what works"

In brief

Woodland birds number almost 200 species across their range in temperate and subtropical Australia. As a community, they are in serious decline, due to many threats, chiefly habitat loss and fragmentation, livestock grazing, competitive exclusion by noisy miners, inappropriate fire regimes and loss of habitat features such as tree hollows and understorey. However, knowledge of threats does not necessarily tell us what conservation actions work to conserve woodland birds. We reviewed the scientific evidence evaluating the effectiveness of conservation interventions at improving the condition of Australian woodland bird communities. After screening over 5,500 potentially relevant studies, we compiled a database of the 141 studies that tested the effect of 26 different conservation management actions on one or more species of Australian woodland bird. We found only 37 studies fulfilled specific eligibility criteria, such as having an appropriate control. Very few interventions had enough evidence about how woodland birds respond to be able to draw firm conclusions. For the interventions with multiple sources of evidence, there was a mix of positive, negative and/or no effects reported. There are many good reasons why such inconsistent results might occur, but this makes it difficult to offer general advice about what works for woodland birds. We conclude that the need to evaluate most management actions for woodland birds remains urgent. To facilitate this, appropriate comparison sites are key; often, studies we reviewed lacked such sites. The comprehensive database that we have collated from our review allows managers to find and use relevant (though limited) scientific evidence to inform their conservation decisions. However, the future expansion and updating of this database with rigorous, well-designed studies and monitoring will be essential.

Noisy miner. Image: Paul McDonald

Scarlet robin. Image: Barry Baker

Rainbow bee-eater. Image: Paul McDonald

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Hooded robin. Image: Dean Ingwersen, OEH

Background

Australian woodland birds form a distinct ecological community distributed across one-third of the continent. While several of these birds are individually listed as threatened across part or all of their range in temperate and sub-tropical Australia, the overall community, comprising almost 200 species, is also experiencing widespread and, in some places, severe decline. Their habitats are some of the most heavily cleared and fragmented ecosystems in Australia, and woodland birds are important functional components of these landscapes.

Decades of research have enabled us to quantify the trends (often declines) in woodland bird populations, and understand their response to various threats and anthropogenic pressures. In addition to the key drivers of decline – habitat loss and fragmentation – other threats include grazing by livestock; feral and native herbivores; feral predators; inappropriate fire regimes; competitive exclusion by native noisy miners (*Manorina melanocephala*); and removal of specific habitat features, such as tree hollows, understorey and woody debris (Table 1). However, knowledge of the threats alone is insufficient to conserve woodland birds. It is vital for us to understand how these birds respond to management actions that are implemented to alleviate these threats. Currently, this knowledge is limited.

Some research exists into the effectiveness of management actions at abating threats and reversing woodland bird declines. These actions include tree planting, grazing management, noisy miner control, and adding or leaving woody debris in the landscape. However, despite decades of research and management, the knowledge gained from these studies has not yet been compiled in a systematic way, and it remains unclear which conservation actions are most reliably effective at improving the condition of the woodland bird community. In other words, we still have a limited understanding of "what works" for woodland birds.

Given the public's interest in conservation initiatives for woodland birds, and the importance of investing in interventions that have tangible benefits, synthesising and evaluating the effectiveness of these actions will help guide the future management of this ecological community.

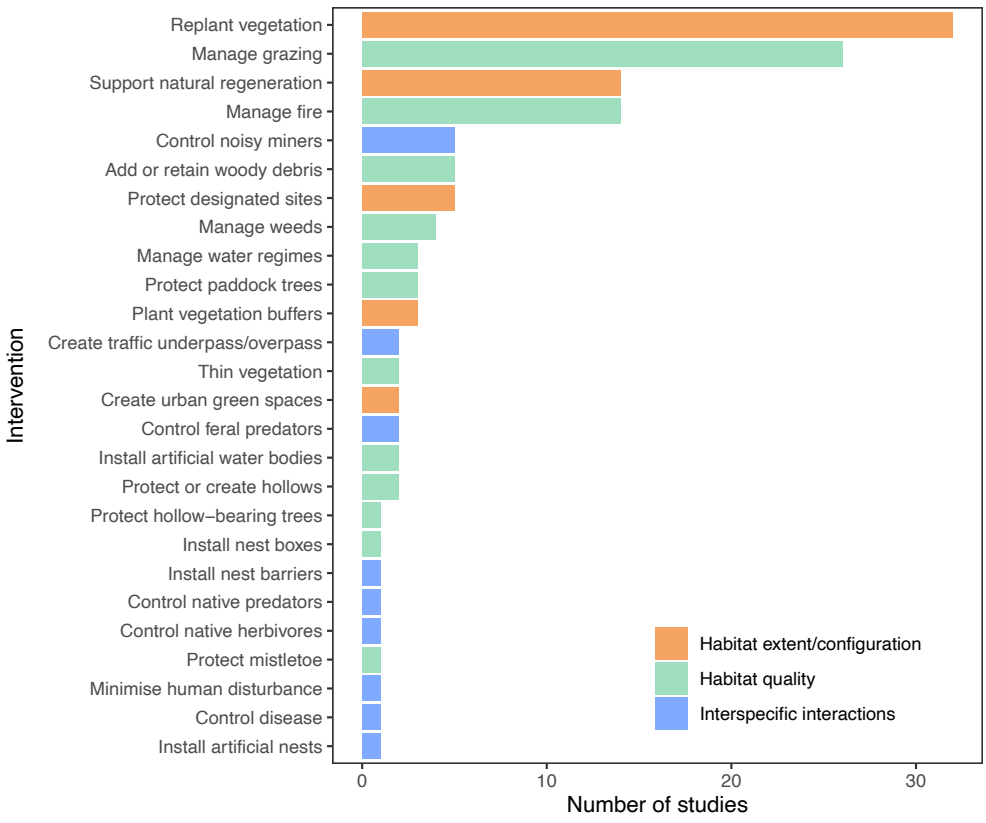

Figure 1: Number of studies testing the effectiveness of each intervention included in the database, coloured based on type of action (n = 141 studies; note some studies tested multiple interventions).

Regent honeyeater. Image: Mick Roderick

Table 1: Threats to Australian woodland birds and the relevant actions to mitigate them. We classified the threats and actions into factors affecting habitat extent and configuration, habitat quality, and interspecific interactions and disturbance.

Drivers of change	Threat	Action
Habitat extent and configuration	Vegetation removal (e.g., land clearing)	Protect designated sites
		Retain remnant habitat*
		Replant vegetation
		Support natural regeneration
		Plant vegetation buffers or shelterbelts
		Create urban green spaces
Habitat quality	Stock grazing	Manage grazing (stock exclusion, grazing reduction, rotational grazing or irregular grazing)
	Inappropriate fire regimes	Manage fire (prescribed burning, planning, fire suppression)
	Non-native trees, grasses and shrubs	Manage weeds
	Loss or degradation of key habitat resources	Add or retain coarse woody debris
		Protect or create hollows
		Install nest boxes
		Protect paddock trees
		Install artificial water bodies
		Protect mistletoe
	Overgrowth/loss of open spaces	Thin vegetation
	Feral herbivore grazing or browsing	Control feral herbivores (goats, pigs, deer, donkeys, rabbits)
	Native herbivore grazing	Control native herbivores (macropods)
	Loss of landscape hydrology or soil properties	Manage water regimes
		Reintroduce digging marsupials
	Agricultural chemical use and intensification	Change agricultural practices
Intraspecies interactions, disturbance and population dynamics	Noisy miner competition	Control noisy miners (removal, translocation)
	Feral animal predation	Control feral predators (foxes, cats, rodents)
		Install nest barriers (around tree or branch)
	Native animal predation (incl. sugar gliders)	Install sugar glider–proof nest boxes
		Control sugar gliders
		Remove berry-bearing bushes
	Human disturbance	Create traffic underpasses or overpasses
		Minimise disturbances to sites or establish buffers
	Egg collection	Legislate against egg collection
		Educate or engage with communities
	Small populations	Captive breed and release individuals
		Translocate individuals
		Provide supplementary food
	Disease (e.g., psittacine beak and feather disease)	Control disease
Overarching drivers	Climate change	Build climate-resilient habitats and populations
	Multiple and/or interacting threats	Combinations of actions

* Note: Retain remnant habitat was considered in a separate review and meta-analysis

Main aim of the research

The aim of this study was to review and synthesise the scientific evidence evaluating the effectiveness of conservation interventions at improving the condition of Australian woodland bird communities.

We conducted a systematic review of the published and unpublished literature to:

- create a database of research evaluating the response of woodland birds to any conservation intervention,
- synthesise the effectiveness of on-ground management activities for improving the species richness (i.e., the number of species present at a site) and the abundance of woodland birds (i.e., the number of individuals present at a site).

Woodland habitat. Image: Chris Jones, Arthur Rylah Institute

What we did

We searched for published and unpublished scientific studies using specific search terms about habitats, species of woodland birds, and locations. The titles and abstracts of 5,548 articles were screened and, from these, 705 articles were examined in detail to identify all studies that tested the effect of a conservation management action on one or more species of Australian woodland bird.

We found 141 studies that met these criteria. We compiled these into a database that outlines the habitat type, location, species of interest, interventions tested, the experimental design, comparators, and the response variables used for each study.

To evaluate management effectiveness, we extracted data from 37 studies that reported the number of bird species or total abundance of birds in response to any management intervention. Due to the small number of studies and diversity of statistical methods, we used vote counting to synthesise the overall outcomes rather than meta-analyses. This involved counting the number of relationships (and papers) that reported significant positive, significant negative, or no significant differences between control and treatment sites for each intervention-response combination. For the vote counting analysis, we only retained studies that used control sites that were otherwise similar to the treatment sites, but at which the management intervention was not done. This was to ensure that the effectiveness of the action was measured relative to the sites at which such actions would normally be done – for example, a suitable control site for tree planting would be a paddock without trees, not an area of remnant woodland.

Little lorikeet. Image: Paul McDonald

Key findings

Summary of relevant studies

The 141 relevant studies (published and unpublished) tested the effectiveness of 26 interventions (Figure 1). The interventions most frequently studied were replanting, managing grazing, managing fire and supporting natural regeneration. We found very few studies on the effect of installing nest boxes, controlling weeds, creating artificial tree hollows or controlling feral predators – despite all these actions being commonly implemented. Thirty-six studies evaluated combinations of actions, with the most common combination being grazing management combined with retaining remnant habitat.

Numbers of bird species and total abundance across all species were the two most common response variables (73% of studies recorded at least one of these). Other response measures included numbers of species and abundance of individuals within bird subgroups (e.g., insectivores or nectarivores), measures of how bird communities were composed of different species, and the occurrence or abundance of individual species. Very few studies assessed the effect of interventions on breeding, behaviour or survival.

Synthesis of management effectiveness

Just over a quarter of our 141 papers in the database (n = 37) had data eligible to be included in the vote counting synthesis of management effectiveness. These studies were distributed across temperate and subtropical Australia, with most in the far south-east of the mainland (Figure 2).

Figure 3 shows a tally of responses for 16 management interventions for numbers of bird species (i.e. species richness) and abundance of birds. Managing grazing, managing fire and controlling noisy miners had the most evidence available to evaluate general trends of effectiveness.

Managing grazing

Grazing management studies examined stock exclusion, irregular or rotational grazing or low-intensity grazing, and all interventions were compared with high-intensity or business-as-usual grazing – with mixed results for numbers of bird species and bird abundance. Four studies of grazing exclusion reported either no effect (n = 3) or a positive effect (n = 1) on the number of bird species.

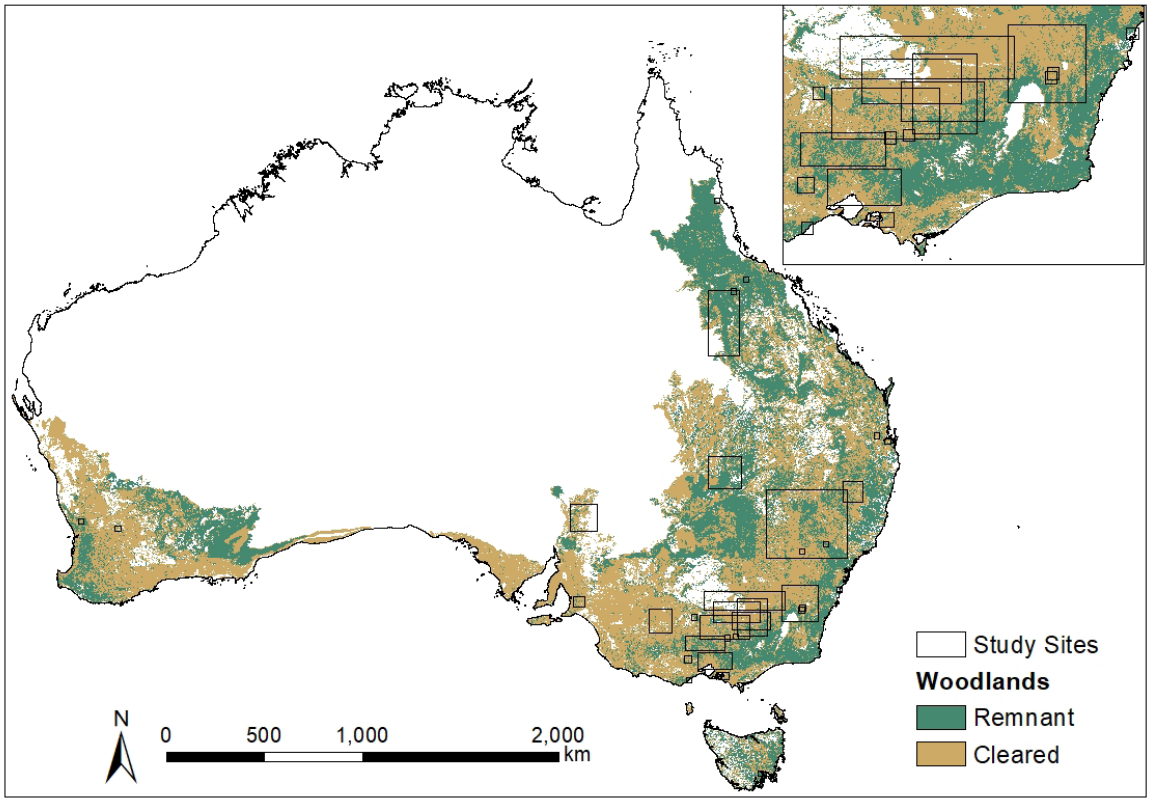

Figure 2: Location of studies that were included in the database that tested the effectiveness of conservation actions for woodland birds in Australia (n = 37).

Jacky Winter. Image: Paul McDonald

Key findings (continued)

Two negative responses were reported for irregular and rotational grazing, while five studies found these interventions to be positive or neutral. Effects on total bird abundance were similarly mixed, with positive or neutral responses.

Managing fire

Prescribed burning mostly had no effect on numbers of woodland bird species or bird abundance (n = 14 responses from five studies), though four negative responses from three studies were also reported. Across all seven studies, the nature of prescribed burning differed greatly, ranging from dry or wet season burns for weed control, spring or autumn planned burns, planned burns every three or 10 years, or other more generic descriptions of intensity (low-intensity) or frequency (twice burnt). Across all studies, the effects of prescribed burning were compared between recently burnt and not recently burnt sites, rather than considering effects of burning regimes across landscapes. These site-based comparisons do not, therefore, capture potential landscape-level benefits of prescribed burning via wildfire suppression, which may in turn help retain areas of long-unburnt habitat.

Other interventions

While two studies of noisy miner removal showed three positive responses for total bird abundance, most showed no significant effect on the number of species of woodland birds at a site (n = 2 responses from two papers) or bird abundance (n = 6 responses from four papers). Noisy miner control primarily involved lethal removal.

Replanting and adding or retaining large woody debris had consistently positive effects on the number of species of woodland birds and total bird abundance, although these results are from just three and two papers respectively. Most other interventions had too little evidence to draw reliable generalisations across all contexts.

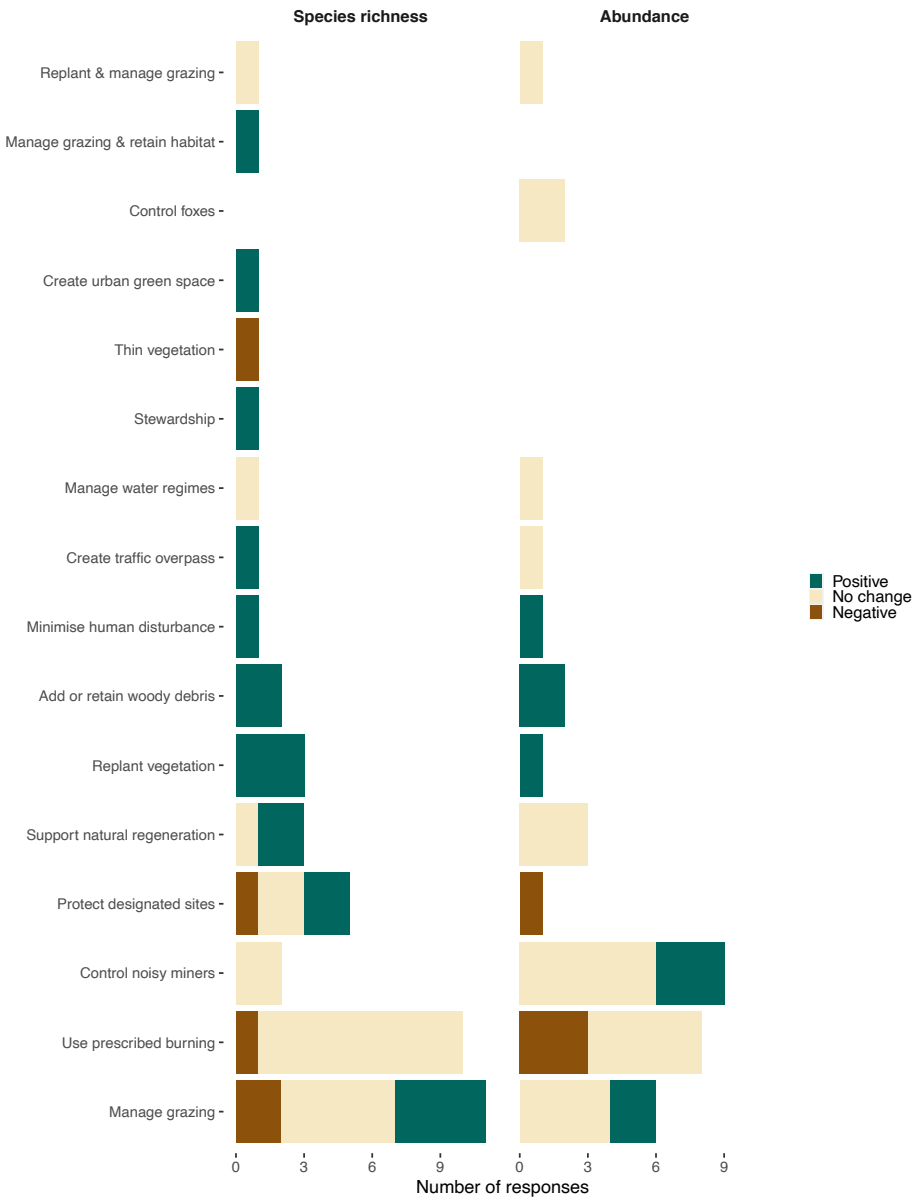

Figure 3: Number of positive, negative or "no change" responses per intervention for species richness (i.e., the number of bird species) and total abundance of woodland birds. Note: multiple responses could be extracted from a single paper.

Speckled warbler. Image: John Barkia

Implications and recommendations

We set out to identify which conservation interventions work for Australian woodland birds. A key product is a database that compiles the research evaluating 26 actions for conservation and recovery of almost 200 woodland species and the broader bird community. This is a comprehensive collection of existing research on the actions that have been implemented for woodland birds, which can be used to inform conservation management plans and projects across Australia.

While there were 141 studies describing the interventions and their effectiveness, all of which are included in the database, only 37 had study designs, and reported statistical analyses, that made them appropriate for inclusion in the subsequent "vote counting" synthesis. From these, only four interventions had more than four studies each that were designed in such a way that we could evaluate effectiveness. Overall, the data on management effectiveness for woodland birds is surprisingly thin.

Among eligible studies, we found inconsistent evidence about the effectiveness of most interventions. These varied results could be due to many reasons. The interventions could have differed in their intensity, method, or spatial characteristics such as area over which they were done. Measurements of bird response were also done at different times since intervention. And of course, the sites varied in their ecological context, such habitat type, extent, fragmentation and condition, or other interacting threats, such as presence of noisy miners. Thus, at this stage, it is difficult to make broad generalisations based on the available evidence for any intervention.

None of the interventions with four or more studies had consistently positive or negative effects on woodland birds. Managing grazing, controlling noisy miners and protecting designated sites had mixed responses. However, of 18 responses on prescribed burning, none found a positive result on the number of woodland bird species or bird abundance.

Replanting and adding or leaving woody debris consistently increased the number of species and bird abundance. However, the number of studies was small – two for woody debris and three for replanting – meaning we have low confidence about how these birds would respond in other contexts. Woodland bird species richness was also found to increase with five other management interventions, but these results are each based on a single study.

It was surprising that installing nest boxes, controlling weeds and controlling feral predators each had only one study with appropriate controls and statistical reporting, despite all these actions being commonly implemented for woodland birds. Even for those interventions more frequently evaluated (e.g., tree planting), we could only extract relevant data about their effectiveness from a small subset due to their experimental design, and their statistical analysis and reporting.

Knowledge gaps and management implications

This review has revealed that despite a lot of research on woodland birds, very few studies can be used to evaluate how effective management actions actually are at conserving them. Further, the number of species (species richness) and abundance of birds were the most common metrics reported, but only capture part of the story about the condition of woodland bird species and the overall community.

These results lead to two recommendations and future research needs:

1. There is an *urgent need to evaluate most management actions* for woodland birds. In particular, priority actions to evaluate include either ones that are (i) commonly implemented, but have few studies on effectiveness (such as installing nest boxes), or (ii) are relatively well-studied but show conflicting results (such as managing grazing, controlling noisy miners or formally protecting habitat). Adaptive management is a useful framework to implement and monitor conservation actions in a way that supports such evaluation. This can be enhanced by scientist–practitioner collaborations and longer-term studies. Well-established programs like the Conservation Standards can also help practitioners design management that is suitable for evaluation.
2. It is important to *use appropriate controls* (comparison sites) to determine true effects of interventions. Many studies compared the interventions with "reference" sites (e.g., remnant sites with intact woodland bird communities) rather than using "business as usual" sites for comparison. Using reference

Swift parrot. Image: John Barkia

Implications and recommendations (continued)

sites is useful to identify how close a manipulated site gets to a reference, desired state, but doesn't allow for evaluation of the difference made by the intervention itself. This instead requires comparison with, for example, a site where the action has not occurred, but was otherwise similar to the intervention site. Though we acknowledge that for some interventions, such as grazing management, finding appropriate controls and accounting for confounding factors is difficult.

There are considerable logistical and ecological constraints in evaluating management actions and setting up controlled studies in the field (e.g., a "BACI" Before, After, Control, Impact experimental design). However, the compilation of studies in this review demonstrates that it is possible, and valuable. Studies that are not designed to allow for the impact of an intervention to be explicitly measured (e.g., inappropriate or no controls; failure to account for confounding factors among sites) are less amenable to informing the adaptive management needed to continually refine and improve the way we "do things on the ground" for woodland birds.

The comprehensive database of published and unpublished studies we have collated in our review now makes it possible for managers to find and use the relevant scientific evidence to help inform their conservation decisions. However, it is essential that this small evidence base is strengthened and updated with more rigorous, well-designed studies and monitoring. To expand our knowledge about conservation effectiveness for woodland birds, it is critical that evaluation of actions such as managing grazing and fire takes place in parallel with current and future management.

Cited material

The database of studies collated during the review can be found here: https://espace.library.uq.edu.au/view/UQ:28ea8b7

Yellow box. Image: John Briggs

Further Information

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