

# Birds of the Great Western Woodlands



birds are in our nature

The Nature  
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AUSTRALIA



# Welcome to the Great Western Woodlands

“This is the last opportunity on Earth for anyone to look at the ecology of an intact temperate woodland” ~ Professor Harry Recher, FRZS, AM

SPANNING THE LANDSCAPE BETWEEN THE NULLARBOR PLAIN AND THE WESTERN AUSTRALIAN WHEATBELT IS THE LARGEST INTACT TEMPERATE WOODLAND ON THE PLANET.

Covering 16 million hectares, the Great Western Woodlands is enormous. It is 800 kilometres east to west as the crow flies, covering an area larger than England. Most miraculously of all, it is still virtually intact – a single, vast mosaic of natural ecosystems.

Viewed from space, the contrast between the Great Western Woodlands and the neighbouring agricultural landscape of the Western Australian wheatbelt is striking. It boggles the mind to think these woodlands, shrublands and mallee once extended all the way to the Darling Scarp, near the west coast of the continent.

Around the world, temperate woodlands and the soils beneath them are a valued commodity, and have been subject to human disturbance for millennia. As a result, in many parts of the world, woodlands and woodland birds are in decline.

Almost 90% of Australia’s temperate woodlands have been cleared for agricultural development. Remaining woodlands in Australia like the Great Western Woodlands make a significant contribution to the remaining extent of this biome both here and globally.

Less than 10% of the Western Australian wheatbelt retains native vegetation, and much of what remains is restricted to small isolated patches or roadside reserves. So much of Australia’s woodland habitat has been lost that the Great Western Woodlands represents perhaps our only opportunity to study a large intact bird community. How does such a large intact system function? This was one of the main questions the project set out to explore.



## Great Western Woodlands by numbers

Over 70% the size of Victoria	230% the size of Tasmania	Over 66% the size of the UK	Larger than 30 states of the USA
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## Collaboration for conservation

In 2011, BirdLife Australia and The Nature Conservancy embarked on a bird research and conservation project in the Great Western Woodlands. With input from a technical advisory group combining scientific expertise from universities, government and non-government organisations, this ambitious project proposed to provide reliable baseline information on the birdlife of this vast region by conducting systematic bird surveys at a network of fixed sites across the entirety of the Great Western Woodlands. Using a robust, scientific framework, the project aimed to assess species distribution, population status, movements and ecology of bird species in the area, to better inform conservation and management of this significant region.

This project was made possible through the generous support of The Nature Conservancy’s David Thomas Challenge and individual supporters from BirdLife Australia. Running from 2012 to 2014, these surveys also helped build a foundation for an ongoing, long-term bird monitoring project.

Satellite image with the boundary of the Great Western Woodlands marked in yellow. Native vegetation is darker green, with cleared land in light greens and browns.



Western Rosella



Major Mitchell's Cockatoos







“The project has fully immersed me in a wonderland and offered an opportunity to contribute to citizen science towards conservation that is as substantial as it gets.”  
~Volunteer feedback



## Surveying 16 million hectares

Across the Great Western Woodlands, nine broad survey areas were identified to best capture the diversity of the region. At each of these nine areas approximately 25 fixed survey points were selected, giving a total of 231 individual survey sites.



For such a vast area to be regularly surveyed, volunteer survey teams were enlisted, donating their time, expertise and enthusiasm to the project. Since autumn 2012, in all seasons, teams were out counting the birdlife of the Great Western Woodlands. At each of the 231 survey sites they conducted a 20 minute search of a two hectare area. They also conducted additional surveys as they stopped along the way, and recorded uncommon species when they saw them, chronicling the bird diversity of the Great Western Woodlands.

### Volunteer effort

152

Number of  
volunteers

4374

Number of  
survey forms  
submitted

over  
195 000

Number of  
kilometres  
travelled

\$500 000

Volunteers  
donated about  
\$500 000 in  
time, effort and  
resources



“The group was constantly struck by the contrasting vegetation at the different sites. The bird activity and the resulting species counts really related to the surrounding vegetation and what was flowering.”  
~Volunteer feedback

## Pulling it together

In just three years, 4,374 bird surveys were conducted, almost as many as were completed in the Great Western Woodlands in the previous 100 years combined. This enormous bird survey database was combined with other information, including flowering data and vegetation structure at each of the survey sites, fire history, landscape productivity, land tenure and disturbances such as mining activity. Drawing on the expertise of ecologists from across Australia, these data were analysed to measure how birds and bird communities change across space and time in the Great Western Woodlands.







### Species groups of particular interest

Seven groups of birds were studied in detail to elucidate general trends of habitat use and responses to disturbance that are occurring more widely across all bird species. Waterbirds and large raptors were not analysed as they are difficult to obtain sufficient data for from small area surveys, particularly over a brief, 3-year project.

Resource nomads travel large distances, crossing the landscape to follow eruptions of seasonal food resources, particularly nectar, fruit, seeds and water. Most honeyeaters are resource nomads, as are Zebra Finches and Emu.

Hollow nesters include parrots and lorikeets, as well as the Striated Pardalote and Rufous Treecreeper. In order to reproduce they need mature, hollow-forming trees to be present in their habitat.

Ground-foraging insectivores spend a lot of time on the ground, so are susceptible to predation from feral predators, and sensitive to understorey degradation and clearing. Small insectivorous passerines such as wrens and robins are part of this group.

### Community composition

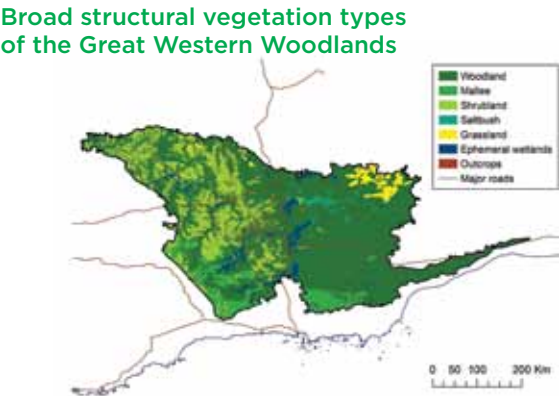
The Great Western Woodlands is not a continuous, uniform habitat, instead it is a matrix of woodland, mallee, shrubland, water bodies, rocky outcrops and other features. This diversity helps support an enormous variety of life. However, analysis of the bird community found that the species assemblage was generally uniform across much of the Great Western Woodlands. This is common in areas of low rainfall where most species are generalists. The major differences were the birds of the freshwater wetlands, and birds of the mallee and heath in the southwest of the Great Western Woodlands.

Raptors are at the top of the avian food chain. They generally require large areas to find food, and some species adapt well to modified landscapes. Small, predominantly sedentary raptors such as Brown Falcon and Nankeen Kestrel are included in this group.

Threatened birds that have declined in other parts of their range are of particular interest, to see how their populations are faring in the Great Western Woodlands. Threatened species include Malleefowl, Major Mitchell's Cockatoo and Shy Heathwren.

Wheatbelt decliners such as Gilbert's Whistler, Blue-breasted Fairy-wren and Rufous Fieldwren have declined in abundance and distribution in the neighbouring wheatbelt. Wheatbelt decliners are highly sensitive to human disturbance and habitat fragmentation.

Wheatbelt increasers do well in disturbed habitats, preferring cleared lands to forage in or making use of resources around human settlement. Wheatbelt increasers are species such as the Australian Raven, Crested Pigeon and Galah.



### What makes the Great Western Woodlands great?

214

How many bird species have ever been recorded historically?

182

How many species recorded in this project?

10

How many threatened species recorded during the project?

Weebill

Most commonly recorded species?

18.4

% of Australia's bird species found in the GWW?

32.9

% of Western Australia's bird species found there?



### resource nomad

### Woodland wanderers

White-fronted Honeyeaters are a resource nomad with a distribution within (and outside) the Great Western Woodlands that varies both spatially and temporally, driven by the availability of nectar. Their abundance within the Great Western Woodlands over the period of the current project was higher than for at least the previous 14 years (below).

Habitat modelling was used to identify which characteristics of the environment best predict the presence of White-fronted Honeyeaters, and how much of the Great Western Woodlands have these characteristics. During the current project their predicted area of suitable habitat ranged from 8.7 million hectares to 14.7 million hectares (54% to 92% of the Great Western Woodlands). They were least common in the dry spring of 2012 and most common in the wetter 2013 and 2014 springs (below). Not surprisingly for such a highly mobile species, their distribution was best modelled by recent rainfall in the month prior to the survey, and by the spring season, when flowering often peaks in a number of plant species.

These maps of the Great Western Woodland illustrate how the amount of suitable habitat for the White-fronted Honeyeater varies spatially and temporally, with the darker the colour, the more suitable the habitat. The maps compare October 2012 (above) and October 2013 (below).



### What did we find?

The results show that the Great Western Woodlands appears to be a stable, healthy ecosystem. Survey teams recorded a total of 182 bird species in the 3 years of the project. Birds such as the Weebill were recorded on almost every trip, but some, like the Banded Stilt, only made an appearance after heavy rains.

Only one species is known to have gone extinct in the Great Western Woodland. Western Grasswrens were recorded in the early 1900s near Kalgoorlie, but have since been lost from the Western Australian interior, now restricted to an isolated population near Shark Bay.





# The nectar story

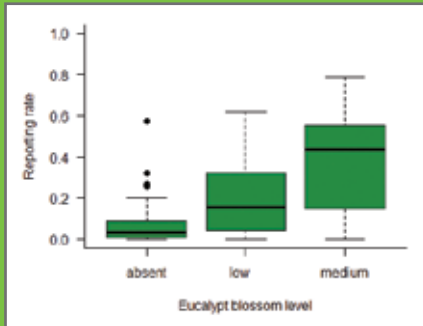
## resource nomad

### The nomadic life of the Purple-crowned Lorikeet

For the Purple-crowned Lorikeet, even 16 million hectares isn't large enough. These small, brightly-coloured parrots feed almost exclusively on eucalypt nectar, and move across the landscape to exploit flowering events.

In some seasons lorikeets were recorded in almost every survey across the Great Western Woodlands. At other times they were rarely seen, likely having moved to the forests and woodlands outside the Great Western Woodlands.

Habitat modelling was used here to identify which vegetation, flowering, climatic, land use and disturbance characteristics these nomadic species were responding to. Not surprisingly, like the other four nectar-feeding species analysed, Purple-crowned Lorikeets were more likely to be recorded at survey sites which had a higher level of blossoming.



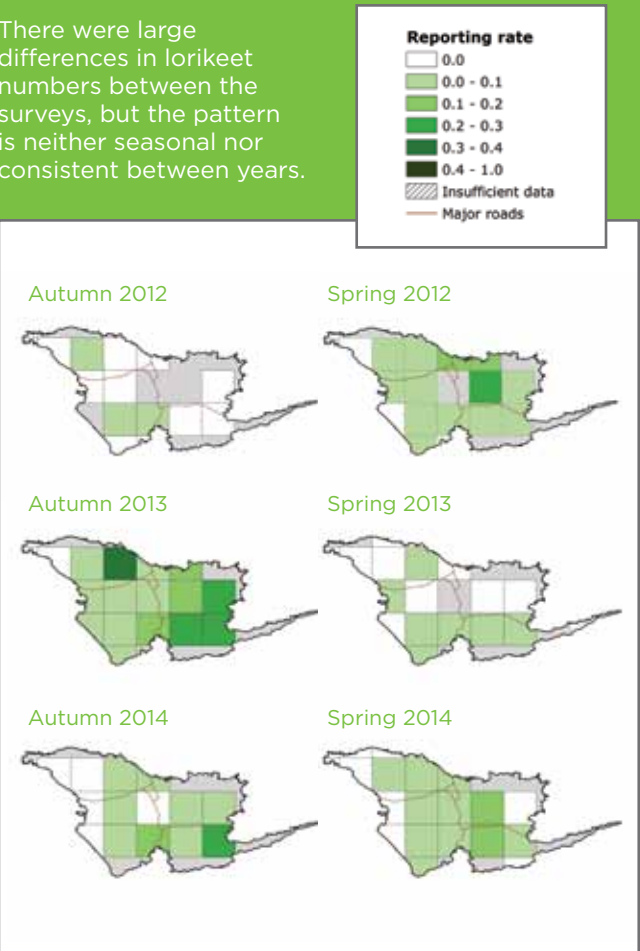
How Purple-crowned Lorikeets and other nomadic nectar-feeders locate their food in the landscape is unknown. What is known is that large patches of eucalypt spread over broad areas are vital for these birds' long-term survival. Eucalypt nectar is their main food source. While they are capable of covering large distances to find flowering eucalypts, the habitat has to be large enough, and varied enough that sufficient numbers of eucalypts will be flowering somewhere across the landscape at all times of year, regardless of seasonal variation.

Their occasional absences from the Great Western Woodlands show these birds are also reliant upon land outside this region.



Purple-crowned Lorikeet

The maps below show movements of Purple-crowned Lorikeets in autumn and spring surveys across the Great Western Woodlands in 2012-2014. The darker the colour, the more frequently lorikeets were recorded in surveys.



# Sentinels of stability

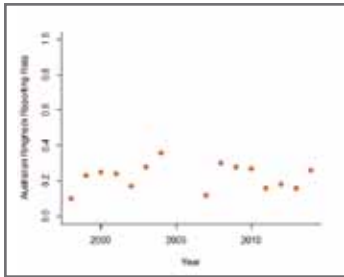
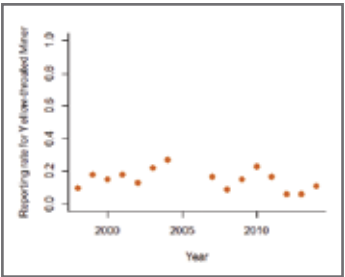
The number of species at a particular site can fluctuate between seasons and years, as birds move around and numbers fluctuate in response to environmental conditions. This is a natural cycle, and analysis of long-term data shows that despite sometimes large seasonal or annual fluctuations, bird numbers for most species throughout the Woodlands appear generally stable.



Yellow-throated Miner

Australian Ringneck

Annual reporting rates showing annual variation but long-term stability of Yellow-throated Miner (left) and Australian Ringneck (right) inside the Great Western Woodlands, 1998-2014.



## wheatbelt decliner

### Doing well in the woodland

A songster of inland woodlands, the Gilbert's Whistler requires large areas of habitat to survive. Once widespread throughout the wheatbelt and the Great Western Woodlands, they have now almost completely disappeared from the wheatbelt, and are considered locally extinct in many areas.

Over the past 16 years, 89% of records of the species have been made from within the Great Western Woodlands. This region remains their stronghold in Western Australia.



Gilbert's Whistler (male)

Gilbert's Whistler (female)

## A picture of health

Of the 76 species analysed in the Great Western Woodlands only nine species (12%) showed declines over 37 years of data. By comparison, comprehensive studies of woodland fragments in the neighbouring Western Australian wheatbelt and in eastern states woodlands have typically found that 20-50% of species have recorded declines. So what is it about the Great Western Woodlands that provides this greater stability for birds?

Is it the size and lack of disturbance? Is it the connectivity and intactness? Is it the habitat composition? It is likely to be all three.

A healthy woodland ecosystem allows natural ecosystem processes to occur and provides habitat connectivity enabling nomadic species to move around landscapes in response to changing resources. This connectivity also allows sedentary species to escape impacts of localised disturbances such as fire and climate change and then re-establish populations when conditions improve.





Size matters

In simple terms, the larger the area, the more birds can live there. But it is more than that. The bigger the bird population, the smaller overall impact a single disturbance event such as a fire will have on the bird population. In a small patch of habitat, a single fire could eradicate much of the population of a single species. It will take time for the remaining birds to breed up in numbers, or for birds from neighbouring patches to immigrate and for numbers to get back to their previous levels. In a large area, the overall effect of the same size fire would be smaller, and recovery of bird populations would be quicker. Birds in larger patches are better able to adapt to change and survive into the future.

ground-foraging insectivore

Staying connected

It is not enough that a patch of habitat is large. Organisms need to be able to move around in it. The fewer barriers there are for animals to move through a landscape, the more they are able to avoid unfavourable conditions and move back again when conditions improve. This is landscape connectivity.

What constitutes a ‘barrier’ differs between species. Grey Teal will travel thousands of kilometres over large areas of cleared agricultural land towards rainfall in the arid zone. Major Mitchell’s Cockatoos will travel tens of kilometres daily between feeding and roosting sites.

Ground-foraging insectivores are particularly sensitive to cleared ground, as they are generally weak fliers, and susceptible to predation, particularly from introduced feral cats and foxes. Studies on White-browed Babblers and Blue-breasted Fairy-wrens have found that they are unlikely to cross gaps larger than 170m and 60m respectively.

To maximise the number of species that persist in the landscape, we need to consider the manner in which we alter the environment.

White-browed Babbler



Blue-breasted Fairy-wren



wheatbelt decliner

The eastern subspecies of the Western Rosella is found in the Great Western Woodlands. In the neighbouring wheatbelt, Western Rosellas are considered rare and highly sensitive to disturbance. Habitat modelling showed they were rarely recorded around stock waterpoints, preferring instead to occur in close proximity to the water and denser vegetation occurring naturally around granite outcrops in the southwest of the Great Western Woodlands, as shown by this habitat suitability map (darker colours identify more suitable habitat).

Western Rosella



Chipping off the old block

One of the most valuable characteristics of the Great Western Woodlands is its enormous size. But this is also one of its greatest weaknesses. Opportunities for humans to use small portions of the Woodlands seem to have limited impact, because of the size of the remaining woodland. However habitat suitability modelling demonstrated many species were impacted by seemingly localised disturbances from artificial water points, towns, roads and historic timber collection.

Landscape connections

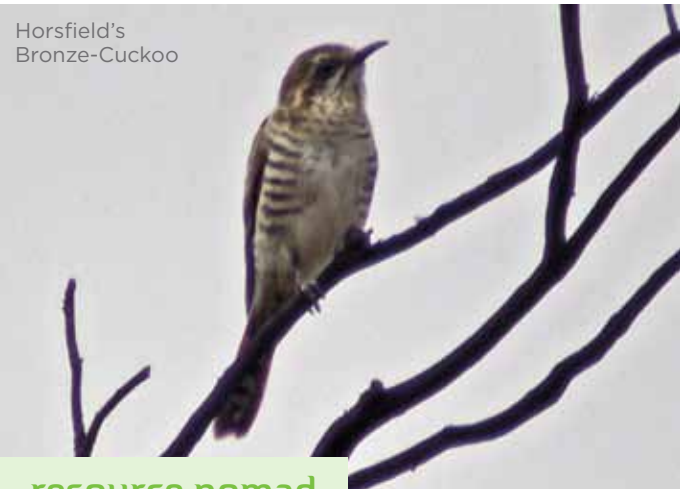
The Great Western Woodlands forms the eastern part of the Gondwana Link vegetation corridor, connecting the arid inland to the southwest coast. The experience in the Western Australian wheatbelt and elsewhere has taught us that many woodland birds struggle to survive in a fragmented landscape. We know some species will not cross areas of open land. While vegetation links are important in repairing damaged landscapes, connectivity must be maintained in intact ecosystems.

Almost all of the 95 species recorded as declining in the Western Australian wheatbelt are also found in the Great Western Woodlands. For some of these species, such as Blue-breasted Fairy-wrens, Shy Heathwrens and Southern Scrub-robins, the Great Western Woodlands remains their last stronghold. Maintaining a large, intact, and well-managed woodlands is vital to ensure the ongoing viability of these species in Western Australia.

Small changes, big impact

A comparison of the bird fauna with the adjacent Ravensthorpe region to the southwest found that although the majority of species were the same as in the Great Western Woodlands, abundances of some species were very different. Wheatbelt increaser species, that favour open modified habitat and are not perturbed by human activity, were present in significantly higher numbers in the Ravensthorpe region. These wheatbelt increasers act as indicators of disturbance, illustrating that even though the area still retains 62% native vegetation cover, this is still sufficient disturbance to allow these opportunists to thrive.

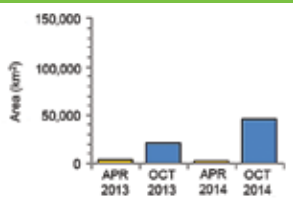
Maintaining native vegetation cover and minimising disturbances inside and outside the Great Western Woodlands is vital. Connectivity between areas is also important in the face of fire, climate change, and fragmentation of surrounding habitat.



resource nomad

Horsfield’s Bronze-Cuckoo is a seasonal migrant, most frequently recorded in the Great Western Woodlands in winter and spring, as depicted in the plot of predicted occupied area, right.

It is a brood parasite, laying eggs in the nests of small, sedentary passerines. Ideal bronze-cuckoo habitat is best predicted by good rainfalls in the previous month, the same rains that trigger breeding in their host species.



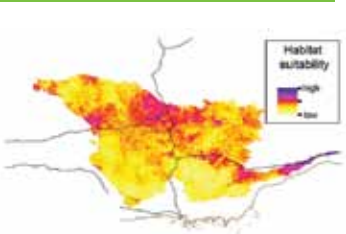
wheatbelt increaser

Opportunist

The Australian Raven, a wheatbelt increaser species, has benefited greatly from human disturbance. The darker colours on the habitat suitability map (below) illustrates their preferred habitat is centred around open areas, townships, roads, and other forms of human disturbance.

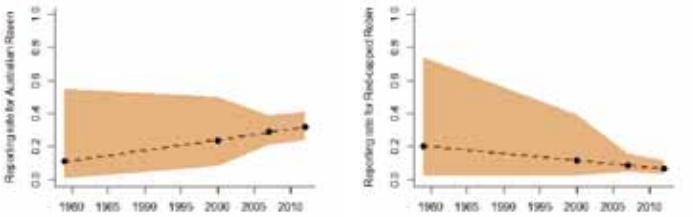


Australian Raven



Long term change

The figures below show the linear trend (dashed line) in reporting rate (dots), averaged over four 5-year periods (1977-1981, 1998-2002, 2005-2009, 2010-2014). Over this period, the Australian Raven has steadily increased (below left), while the Red-capped Robin has decreased (below right). This emphasises the importance of long-term monitoring in detecting gradual change.



Red-capped Robin





# Fire in the Great Western Woodlands



An extensive study in gimlet (*Eucalyptus salubris*) woodland on the western edge of the Great Western Woodlands has highlighted the complex responses birds have to fire.

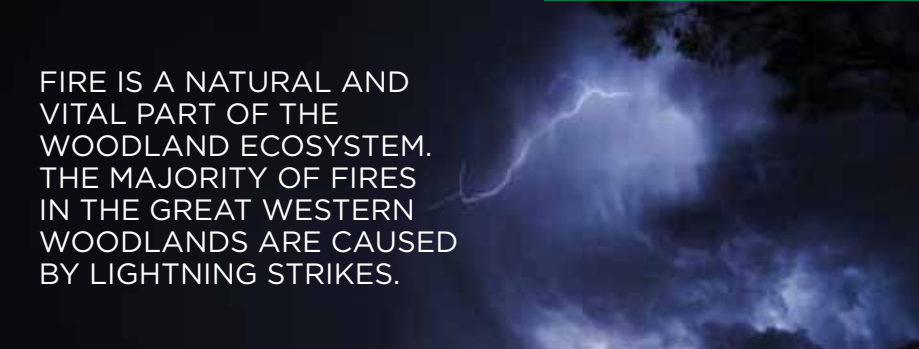
## Landscape mosaic

With fire as a natural process in the ecosystem, the landscape becomes a mosaic of vegetation of different times since fire. Although it can be difficult to accurately age some woodlands where rainfall is patchy, as the trees do not form annual rings, an exception is the Gimlet, discussed right.

Old growth habitat is one of the most important resources in vegetation communities as it takes the longest to be replaced. Some areas of Gimlet studied here have been aged at over 400 years since the last fire. What is considered ‘old growth’ changes with habitat type. Shrublands, for example, are considered mature after much shorter periods, less than 100 years since last fire.

## What happens in frequently-burned woodland?

Despite fire being a natural process, when land burns too frequently the structure of the vegetation changes, resulting in the loss of features of old-growth habitat such as tree hollows and coarse woody debris. Also, if plant species that are killed by fire cannot reach maturity and set seed before the next fire comes, they can potentially become locally extinct and are replaced by those that can set seed. In general, this could change woodlands into more fire-tolerant habitat types, such as mallee or grassland. Invasive grasses could also take advantage of these conditions. In turn the grass provides more fuel for fires: a vicious cycle of change. Inappropriate fire regimes have the potential to significantly alter the vegetation of the Great Western Woodlands.



Young Gimlet woodland



Intermediate Gimlet woodland



Mature Gimlet woodland

### Young Woodland

Depending on the intensity of the burn, some fire-killed stags remain standing, but the canopy vegetation is largely removed. Young trees germinate from seed, creating a low dense vegetation layer.

### Intermediate Woodland

As the regrowing trees develop, the canopy height increases, and understorey shrubs can be dense. The vegetation is generally uniform – lots of trees all of the same age, all with similar height and trunk width.

### Mature Woodland

The canopy of mature woodland starts to thin gradually, as subdominant trees die and others shed branches due to wind-throw, leaving gaps. Mature trees develop hollows for birds to roost and nest in. Leaf litter and logs support a diversity of invertebrate life and the ground layer becomes a patchy mosaic of leaf litter, biological soil crust (moss and lichens) and bare ground.

## How do birds respond to vegetation of different ages?

From research on 30 commonly-recorded bird species, 10 species had a significant response to fire in Gimlet woodland. Four main patterns emerged – incline (4 species), decline (1 species), bell-shaped (2 species) and delayed responses (3 species). The figures below illustrate how reporting rate for these species changes as time since fire increases, showing the trend line (orange) with 95% confidence intervals (light orange). The youngest vegetation studied here was 6 years since last fire, therefore the response of any irruptive species, that only occur, or occur in highest numbers, just after a fire, would not have been detected.

Striated Pardalote



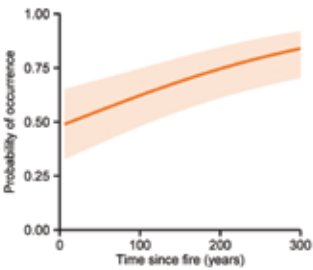
Western Yellow Robin



White-eared Honeyeater

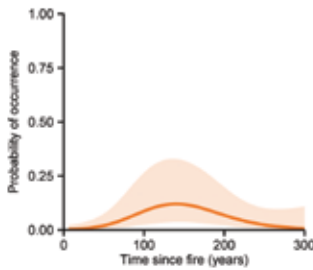


Rufous Treecreeper



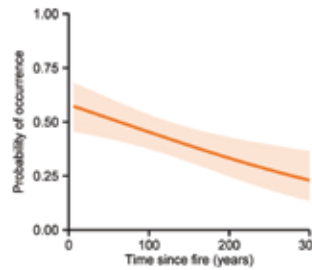
### Incline

Birds like Striated Pardalote will use recently burnt areas, but their numbers increase as the vegetation ages and hollows become available for breeding.



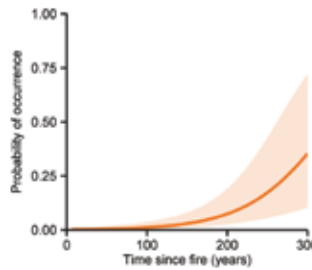
### Bell curve

Western Yellow Robin and Grey Fantail prefer intermediate age woodland, with thin stems, a more continuous canopy and an open understorey for hunting insects in.



### Decline

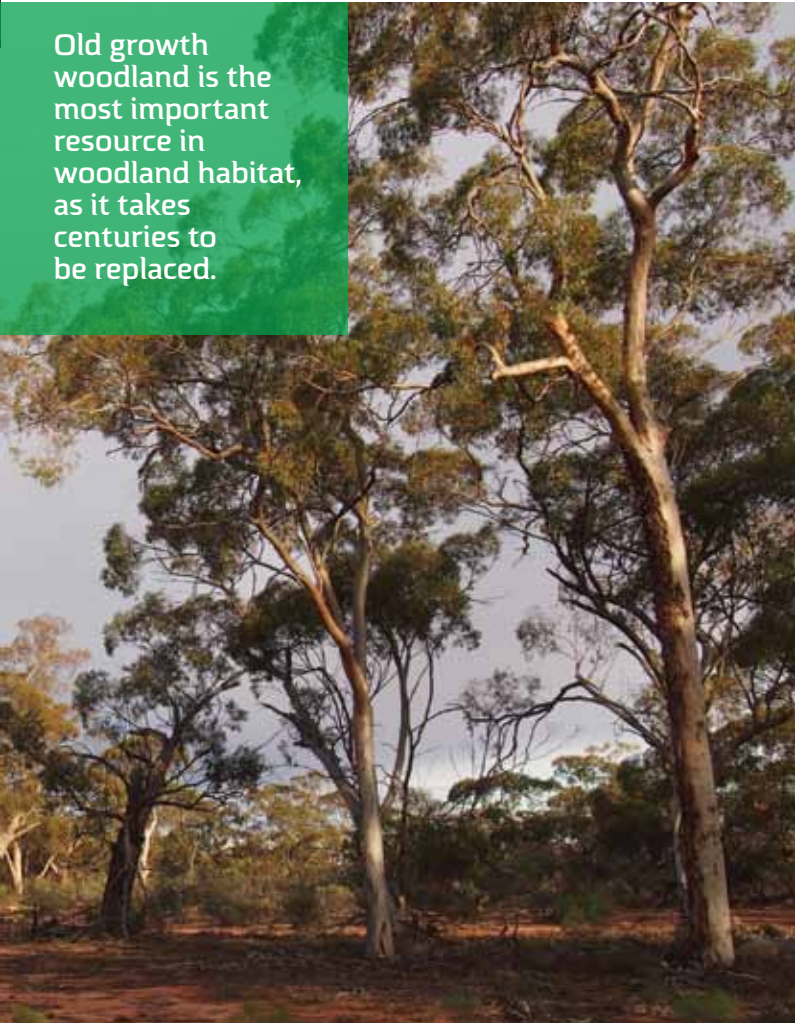
White-eared Honeyeater were more frequently recorded in recently burnt areas, feeding on honeydew and the insects in the tender regrowth.



### Delayed

Species like Rufous Treecreeper are largely absent from recently burnt areas, and take significant time to return.

Old growth woodland is the most important resource in woodland habitat, as it takes centuries to be replaced.



## hollow nester

## Guardians of old growth woodland

Rufous Treecreeper are an ideal indicator species for mature woodlands. They are a sedentary species, living in pairs and small family groups year round in the same site. Treecreepers both roost and nest in tree hollows, so are only found in habitats with hollow-forming trees. They forage on trees trunks, logs and in leaf litter and debris.

With these restrictions, they are found across southwestern Australia wherever there are large stands of mature woodlands, from the wet karri forest in the southwest coast, to salmon gum woodlands of the arid interior. In Gimlet, our data indicate they are rarely found in woodland younger than 150 years since fire.

Rufous Treecreeper



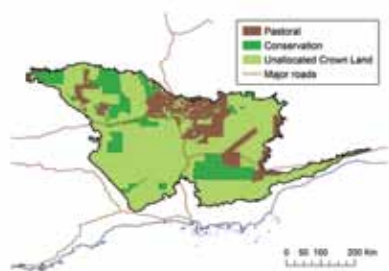
The piping call of the Rufous Treecreeper signals the presence of mature woodland.





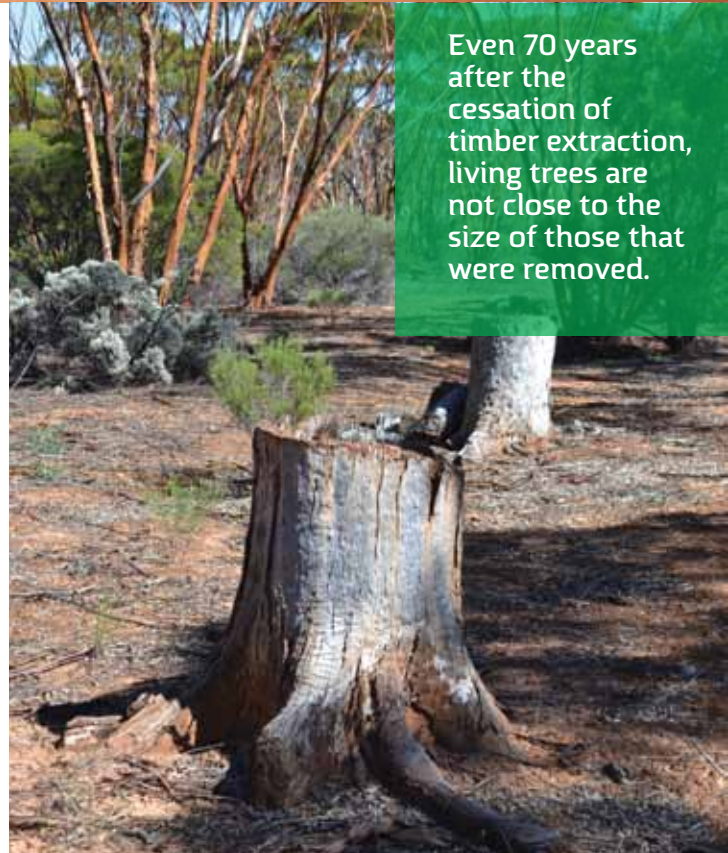
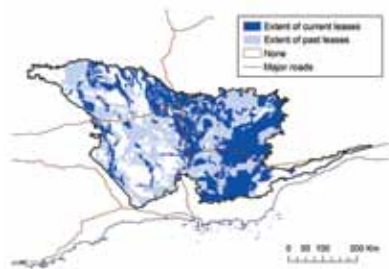
## Land tenure

At present, only a small proportion of the Great Western Woodlands are reserved for conservation. As seen in the map right, over 70% of the Woodlands are classified as Unallocated Crown Land. Unallocated Crown Land has no legal protection, and is also subject to no formal management.



## Golden legacy

Far beneath the roots of the woodland trees, rich underground mineral deposits gave rise to the region being known as the Goldfields. The extent of the Great Western Woodlands currently covered by active mining and exploration leases show the potential impact of mining and associated activities is enormous.



Even 70 years after the cessation of timber extraction, living trees are not close to the size of those that were removed.

## Timber

The second legacy of the glory days of the goldrush is timber extraction. Wood for smelting and to fuel railway boilers was collected from across the Goldfields.

The consequences of this timber extraction can still be seen today, reflected in modified woodland vegetation structure and lower abundance of resources provided by large, old trees, such as hollows. A current threat is also posed by illegal sandalwood harvesting.

## Greater than the sum of its parts

The Great Western Woodlands is the best example of an intact temperate woodlands left on Earth. Through strong science and hard work from project staff and dedicated volunteers, a snapshot has been taken of the bird life of this magnificent ecosystem. This provides the key baseline information required to monitor the health of the Great Western Woodlands into the future.

## We know what makes the Great Western Woodlands great and we need to keep it that way

The broadscale movements of resource nomads compared with the limited capacity for movement in ground-foraging insectivores highlight the importance of landscape connectivity, at both large and small scales

Research in Gimlet woodlands quantifies the importance of protecting old-growth woodlands, for the breeding and foraging habitat they provide for hollow-nesting birds and ground-foraging insectivores such as the Rufous Treecreeper.

Landscape features such as granite outcrops and their surrounding vegetation provide important refugia for birds during harsh conditions. Connectivity to these features must be maintained.

Mallee and heath in the southwest of the Great Western Woodlands provides vital habitat for wheatbelt decliner species. This vegetation connects the Great Western Woodlands to the southwest forests via the Gondwana Link.

Freshwater lakes support an additional suite of birds that are not generally permanent residents of the Great Western Woodlands. Longer-term research is necessary to better understand the role these sporadic events have upon nomadic waterbirds in Australia.

Major Mitchell's Cockatoos and Galahs



## a good news story

At present the news is good for the Great Western Woodlands. The range of native habitats is diverse, healthy and intact. Species that have declined elsewhere appear to be stable in the Great Western Woodlands. However, at present most of the Woodlands are on public land, and only small areas are reserved for conservation.

Limited fire management, feral animals, weed encroachment, and human activities including road construction and mining, threaten this vast, wild area. Yet the region also represents a part of the country where conservation opportunities still exist on an enormous scale.



Crimson Chat



Splendid Fairy-wren





More information about the project results and ongoing bird surveys can be found at <http://www.birdlife.org.au/projects/great-western-woodlands>

To take part in bird surveys in the Great Western Woodlands, email [gww@birdlife.org.au](mailto:gww@birdlife.org.au) or visit the website.

## Credits

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*Prepared by:* Tegan Douglas and Elizabeth Fox, June 2015

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With our specialised knowledge and the commitment of an Australia-wide network of volunteers and supporters, we are creating a bright future for Australia's birds.

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