Australian National University

Conserving woodland birds

the need for population data in evidence-based planning

Laura Rayner

Adrian Manning | **Philip Gibbons** | **David Lindenmayer**

with **the Canberra Ornithologists Group**

Laura Rayner is based at the Australian National University, Canberra, Australia, where she is a postdoctoral fellow at the Fenner School of Environment and Society.

Her research focuses on the population dynamics and conservation of bird communities in modified landscapes. *Conserving woodland birds: the need for population data in evidence-based planning.* The following text from her presentation will help illuminate her slides.

The title of my talk may look a bit scientific, but I hope you'll find it interesting. My message is simply to encourage you to collect long-term bird data. I finished my (PhD) thesis at the Australian National University last year, where my focus was on conserving woodland birds.

My research was based on long-term data collected by volunteers in the Canberra Ornithologists Group; a group just like yours. I'll present the findings of my research to you, and perhaps it will inspire you to tackle a long-term bird monitoring project. I believe the findings of my work are relevant to the conservation objectives of your group.

Population ecology *deals with the dynamics of species populations and how these populations interact with the environment.* → **demands** long-term data

Citizen science *is scientific research conducted, in whole or in part, by amateur or non-professional scientists.* → **supplies** long-term data

Population Ecology and Citizen Science.

I have a passion for Population Ecology and Citizen Science, and they are linked. Studies in population ecology cannot be undertaken without long-term data. Yet there is very little incentive for researchers to do this type of work, and it is difficult to secure funding over long time-frames.

By default, citizen science often collects such data, and when done in a structured way the benefits gained are enormous.

Why are long-term data important?

Populations fluctuate markedly through space and time,

especially…

- in Australia where weather is highly variable, and
- for species that are highly mobile (like birds).

In terms of conservation…

we want to ***identify concerning trend patterns and their drivers*** as distinct from natural variation in population size and extent.

Why are long-term data important?
As you would all know, sometimes you'll see a bird one year and perhaps it won't show up the next. We know that populations fluctuate through space and time, and particularly birds because they're highly mobile.

Especially in Australia where our weather is incredibly variable. In terms of conservation, we're primarily interested in identifying concerning trend patterns in the size and extent of bird populations (as distinct from natural variation in bird occurrence), and what might be driving these patterns.

Why are long-term data important?

Long-term, systematic data collection

allows us to…

- establish rate and magnitude of decline,
- investigate trend patterns under different climatic conditions (e.g. drought)
- evaluate the effectiveness of management interventions (e.g. reserves)
- determine the impact of threats that are spatially and temporally dynamic (e.g. urbanisation)

Long term, systematic data collection gives us the details we can't get from short-term studies, *e.g.* the rate and magnitude of population declines.

This helps us focus on the trends of concern, and what should we do about them. The processes presented on this slide were the focus of my PhD research, and the results I'm going to present.

Empirical research

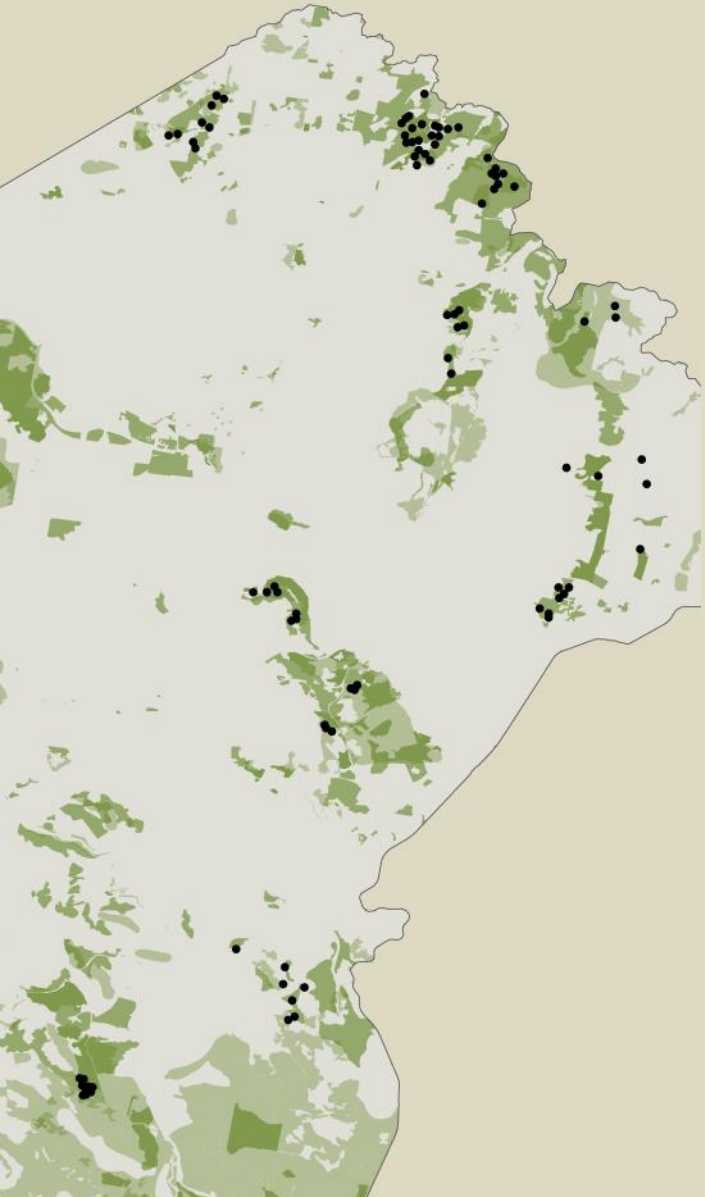
What is the conservation status of temperate woodland birds in the Australian Capital Territory?

and

What is driving change in their populations?

These were the central questions of my thesis.

Empirical research



Source: Canberra Ornithologists Group

Sites: 92

Years: 14

Period: 1999 – 2012

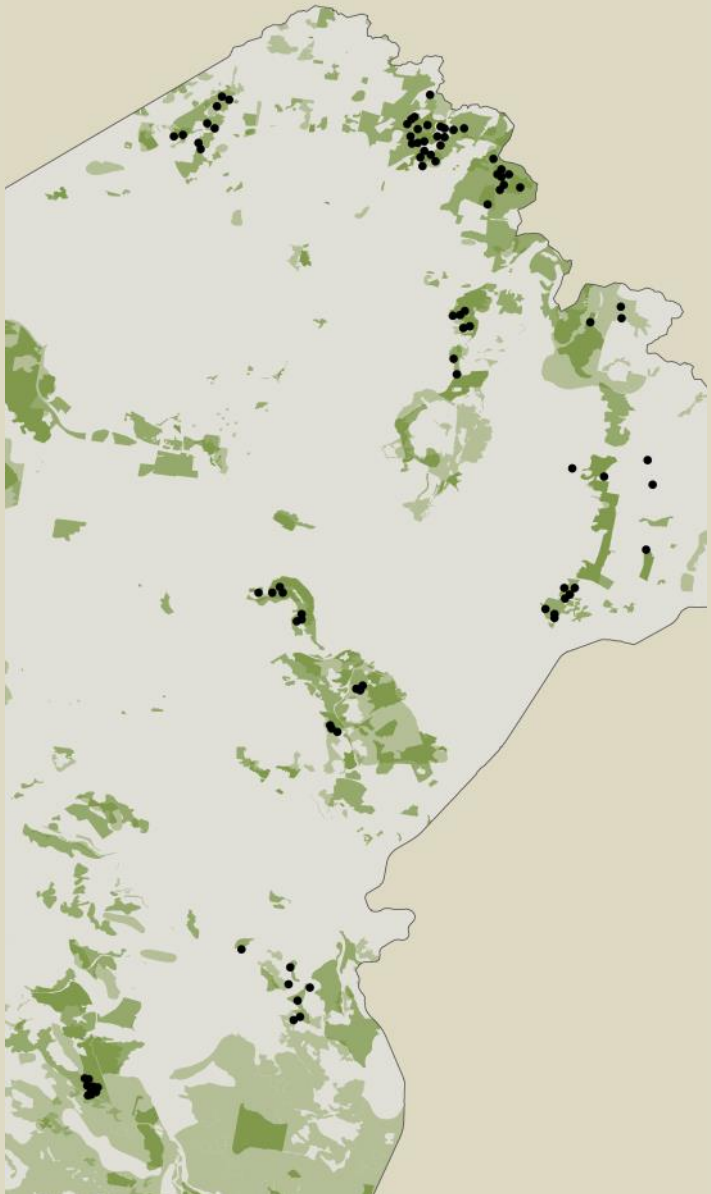
Sampling: Seasonal

Location: ACT woodlands

Empirical Research.
All of the data used in my research was provided by the CO-Group. Data were obtained from 92 sites in NE ACT, over 14 years from 1999-2012. Data was collected seasonally (*i.e.* four times each year).

The Three Regulatory Factors I examined were: (1) Weather - particularly drought, (2) Reservation - old and newly established, and (3) Urbanisation. The advantage of having long-term data was being able to look at the effects of these three factors over time, and the temporal effects of urban encroachment was one of the most important findings.

Empirical research



Three regulatory factors
discussed in the decline literature and relevant to ACT birds

WEATHER
including drought

RESERVATION (old and new)

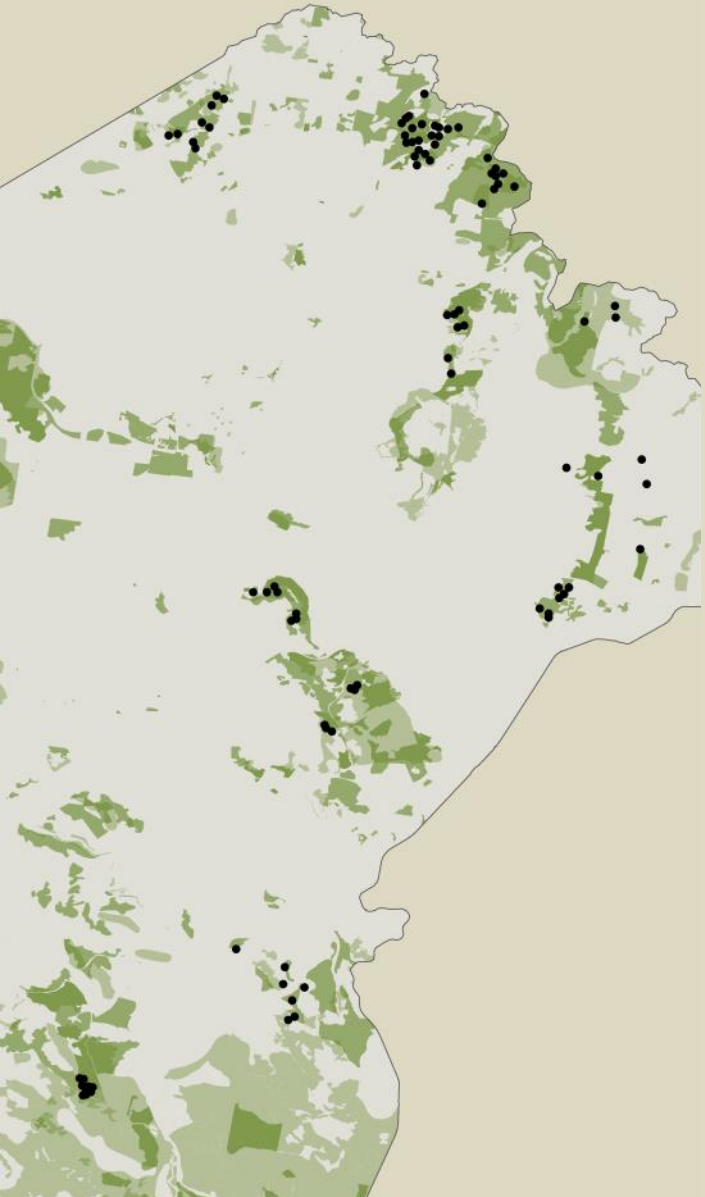
URBANISATION
in space and time

Weather. A lot of research suggests that birds are declining, and there is concern about the impact of drought on these populations.

The fear is that during drought abundances drop and then stabilise briefly in better conditions, then drop further in the next drought before populations have a chance to recover. However, there's not a lot of evidence of this.

Image: D. Gray

Weather



Weather drives population variability, but **does it drive declines?**

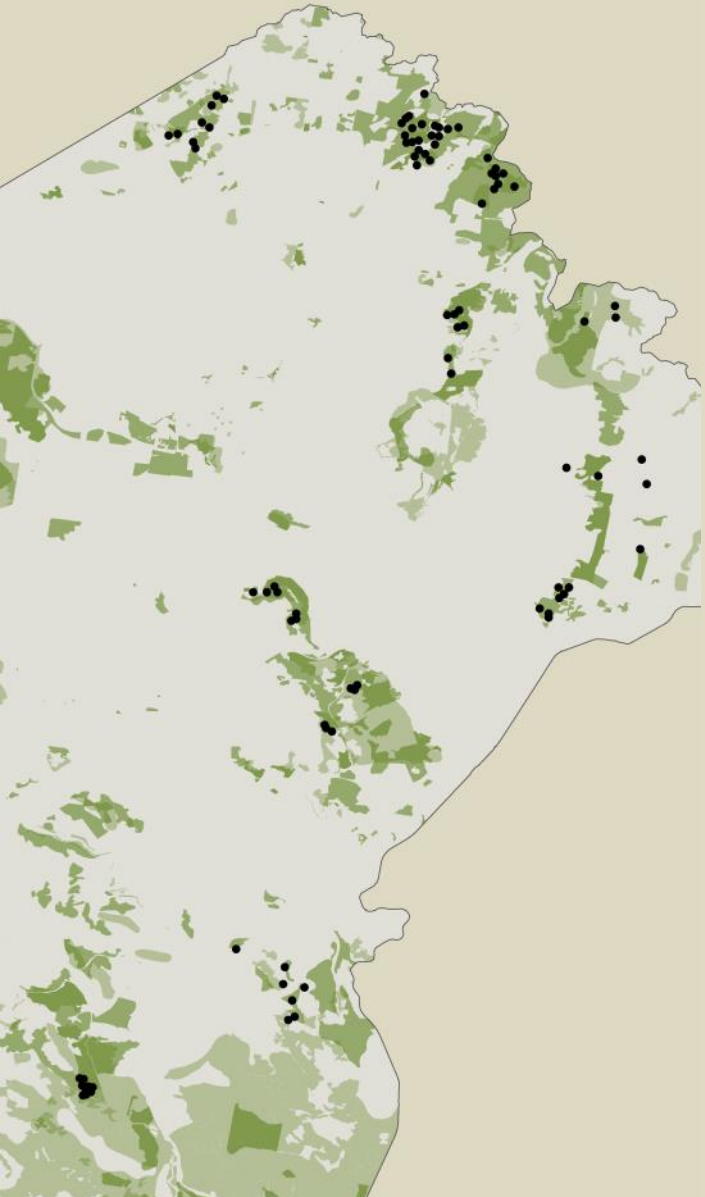
Studies during drought. These 7 studies were undertaken during what we call the 'Millennium Drought' (2001-2009). This column shows the proportion of species that decreased in an area. There's a lot of variation across studies from different states.

Generally if you average it across regions, you can expect that about a quarter of species in an area will drop in abundance during drought. But that doesn't really tell us whether drought is *causing* long-term population declines, or whether on the other side of drought they'll recover.

Weather

Location	Study period	Species	Decline	Reference
Northern VIC	1995 – 2008	159	~70%	Mac Nally *et al.* 2009
Cowra, NSW	2002 – 2008	62	~30%	Reid & Cunningham 2008
Mount Lofty, SA	1999 – 2007	59	~30%	Szabo *et al.* 2011
Temperate NSW	1999 – 2007	31	~25%	Cunningham & Olsen 2009
Warrumbungle, NSW	1990 – 2010	25	~24%	Stevens & Watson 2013
Canberra, ACT	1998 – 2008	62	~20%	Bounds *et al.* 2010
Southern NSW	1998 – 2009	76	~5%	Lindenmayer & Cunningham 2011

Weather



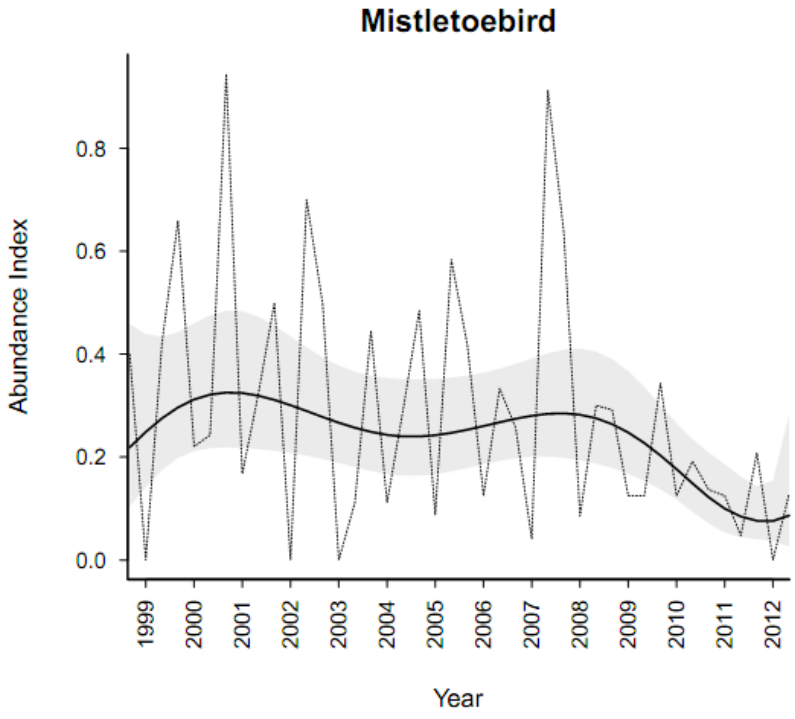
The effects of drought are of great interest.

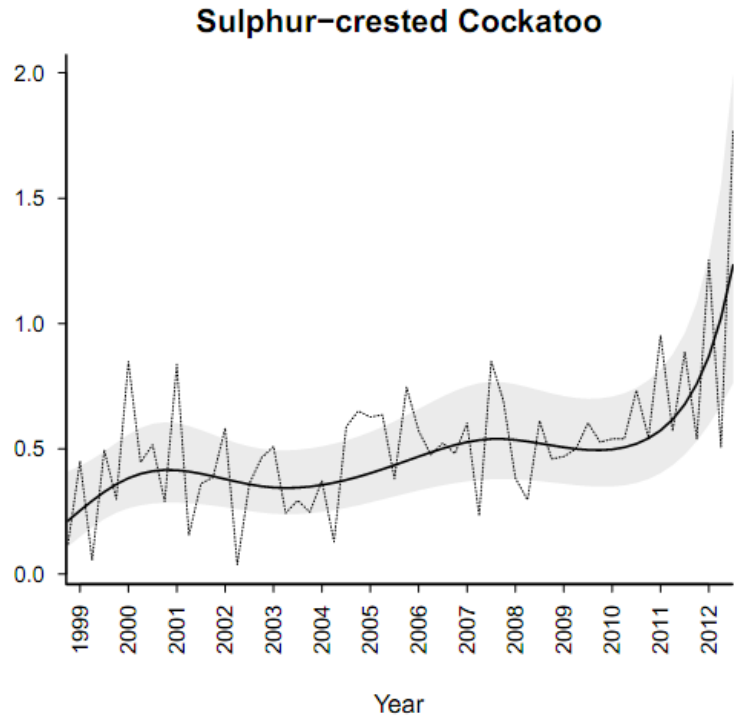
Only 4 studies have attempted to link weather data to long-term trends in bird populations.

These graphs show how two bird species are doing over the last decade or so. The models are adjusted for seasonal fluctuations in abundance, and cover pre- and post-drought periods.

Weather

Cubic regression splines and
Hierarchical Generalised Linear Modelling
adjusted for seasonality and random effects





Weather

Cubic regression splines and linear mixed modelling provide us with a smoothed trend line, which here shows us a steady and significant decline in the abundances of Mistletoebird, and an increase in abundances of the Sulphur-crested Cockatoo.

Of the 57 species I analysed from the ACT region, 39 species showed no significant population trend (*i.e.* populations were stable) during one of the most severe droughts in Australian history.

However, 18 species did show a significant temporal trend.

Weather

Increasers: **12**

Most of the significant trends were increases (12 species). This included the ‘usual suspects’ – big-bodied generalist species that have adapted well to agricultural and urban landscapes.

Some are great to see; others perhaps not-so.

Weather

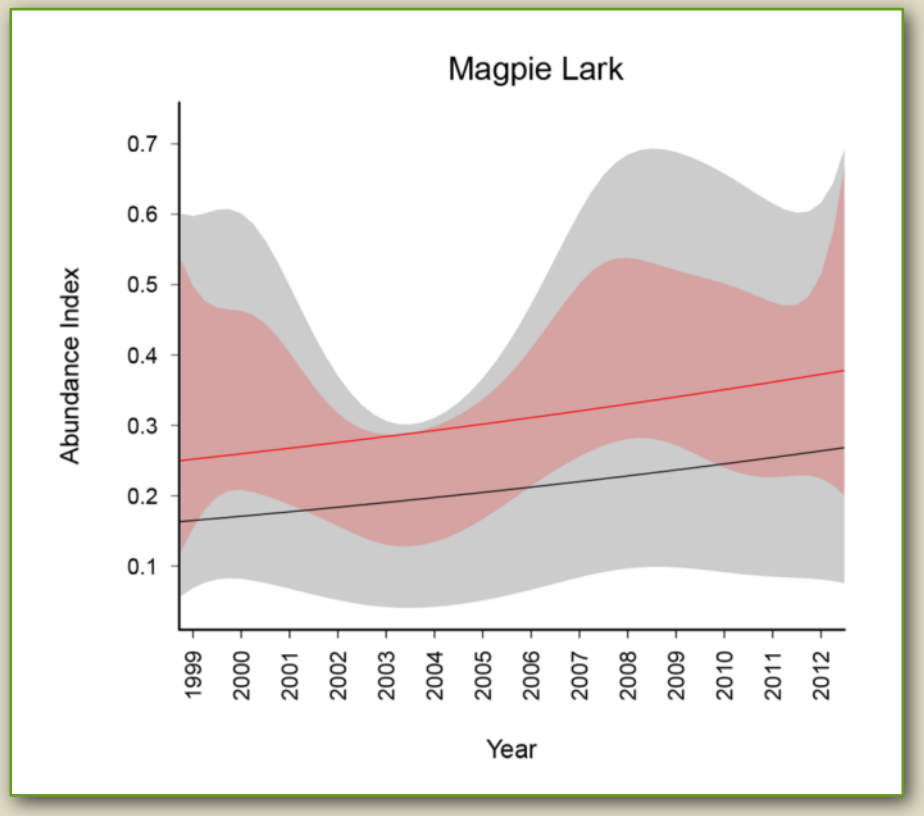
Decliners: 6

We found 5 native decliners: Grey Shrike-thrush, Striated Thornbill, Mistletoebird, Scarlet Robin, Tree Martin. I love all of those birds and don't want to lose them.

Then there's the Common Myna (she laughs; audience cheers). We do have a very active group that's trying to control numbers of this species, but we also think they're dropping down following a population boom in the ACT.

Weather

We explored **rainfall**, **temperature**, indices of **moisture** and **growth**, and the **Southern Oscillation Index** as a measure of drought.



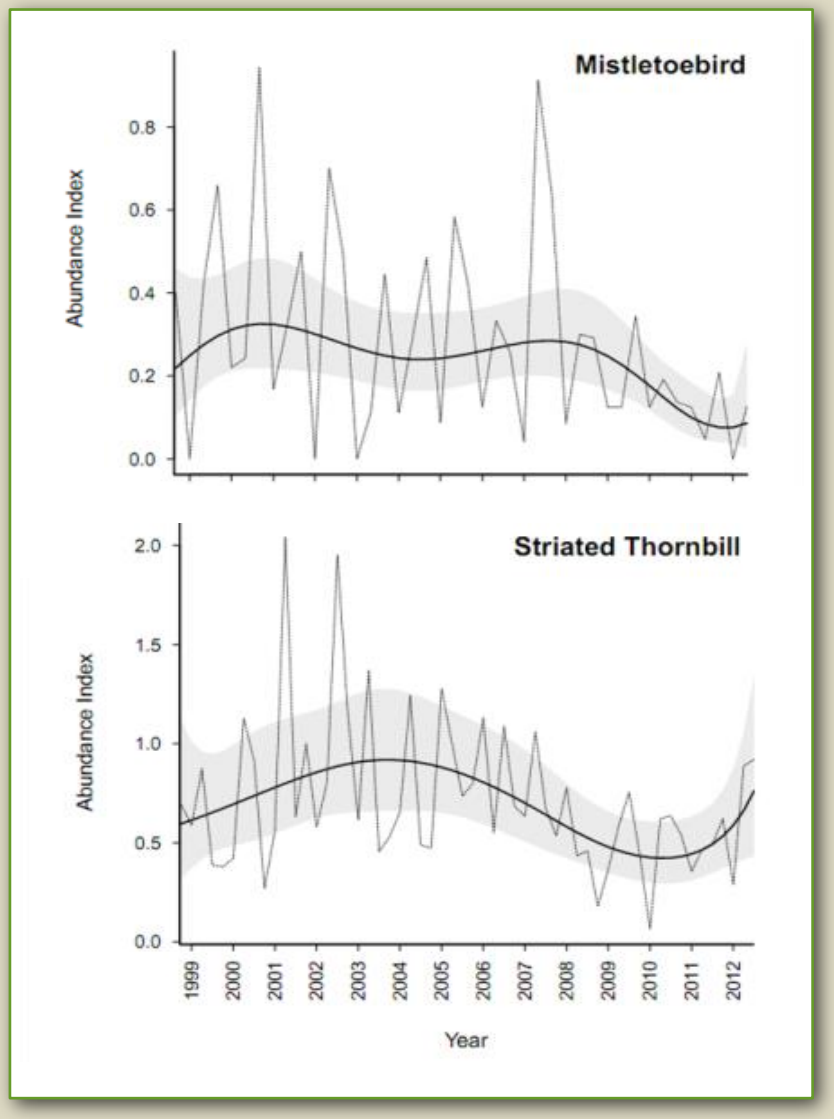
How much of the trend is being driven by weather?

I looked at these trend lines and out of all that variation in what they were doing, I wanted to know how much of it is due to rainfall, or temperature, etc. I also added the Southern Oscillation Index into our investigation; it's basically a measure of El Nino, which drove the drought conditions in eastern Australia.

Here's what I found.

The red line is the trend after you remove all of the variation that is attributable to weather. For most species, adding the weather data improved the accuracy of our trend estimates, but didn't alter the overall pattern. This means that short-term fluctuations in bird abundances *are* driven by weather, but long-term trend patterns aren't. At least, that is the case for these birds in the ACT.

Weather



Weather explained population variability for 21 species

effects were highly variable and species-specific

however

We found no evidence that declines were drought-related

In fact, the opposite.

Weather

Species are well adapted to survive highly variable weather in the ACT

including extreme weather events such as the Millennium Drought (2001-2009).

Ongoing monitoring is needed to determine how species will adapt to changing climate regimes.

The important finding from this study is that we found no evidence that drought is causing declines. It's good news really, because if it was, how hard would that be to manage?!

My study is suggesting that species are adapted to handle drought; it's part of their evolution. In fact, we found a number of species (e.g. Striated Pardalote, Mistletoebird) that were actually favoured by drought.

However, continued monitoring is needed to determine how species will adapt to our changing climate.

This was my first study, and one I was keen to do because we suspected that birds were declining in protected areas.

Image: D. Stojanovic

Protected areas have two objectives:
representativeness and persistence.
Representativeness means capturing as many species in a protected area portfolio as possible (akin to Important Bird Area).

Persistence means that, once we establish a reserve, do species persist there. I conducted a literature review and found that, of 539 papers assessing the effectiveness of reserves, less than 5% evaluated *ecological* effectiveness.

Reservation

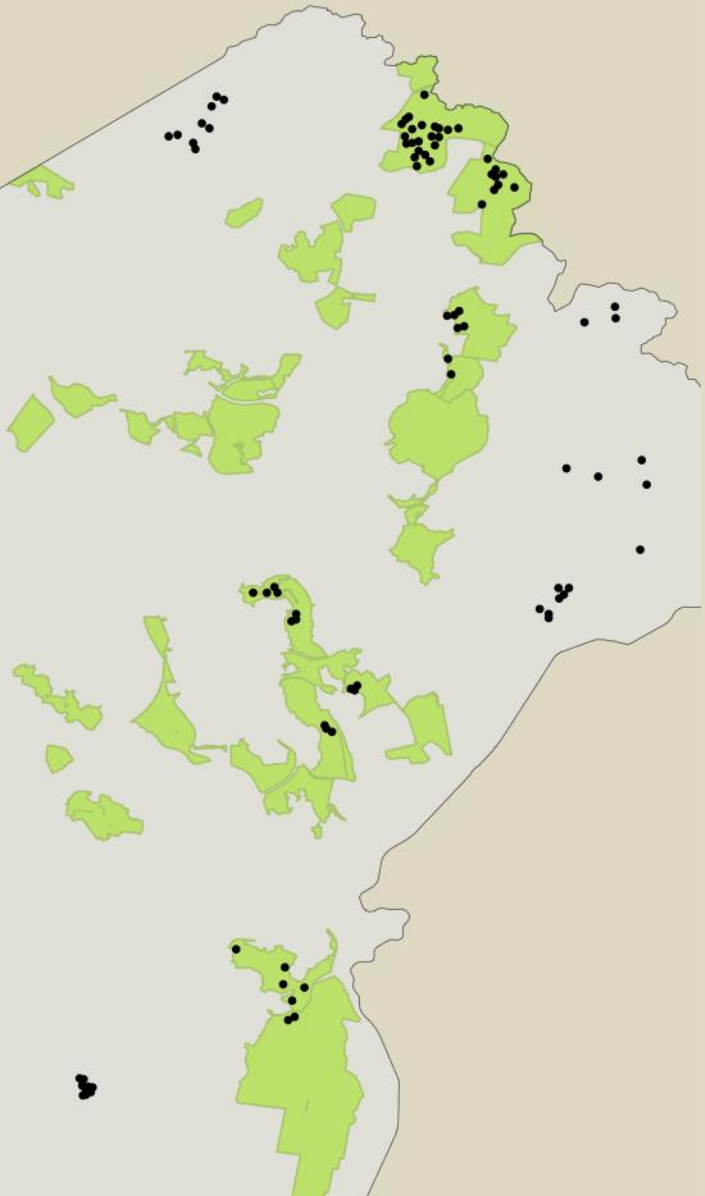
Protected areas have two fundamental objectives:

Representativeness & **Persistence**

From 539 papers,

<5% investigated ecological effectiveness

Reservation



Unreserved

vs.

Reserved

- **Old reserves**

  vs.

- **New reserves**

The long-term data collected in Canberra were really interesting. A similar number of sites were located outside and inside reserves; and there was even a mix of sites located in older and newer reserves.

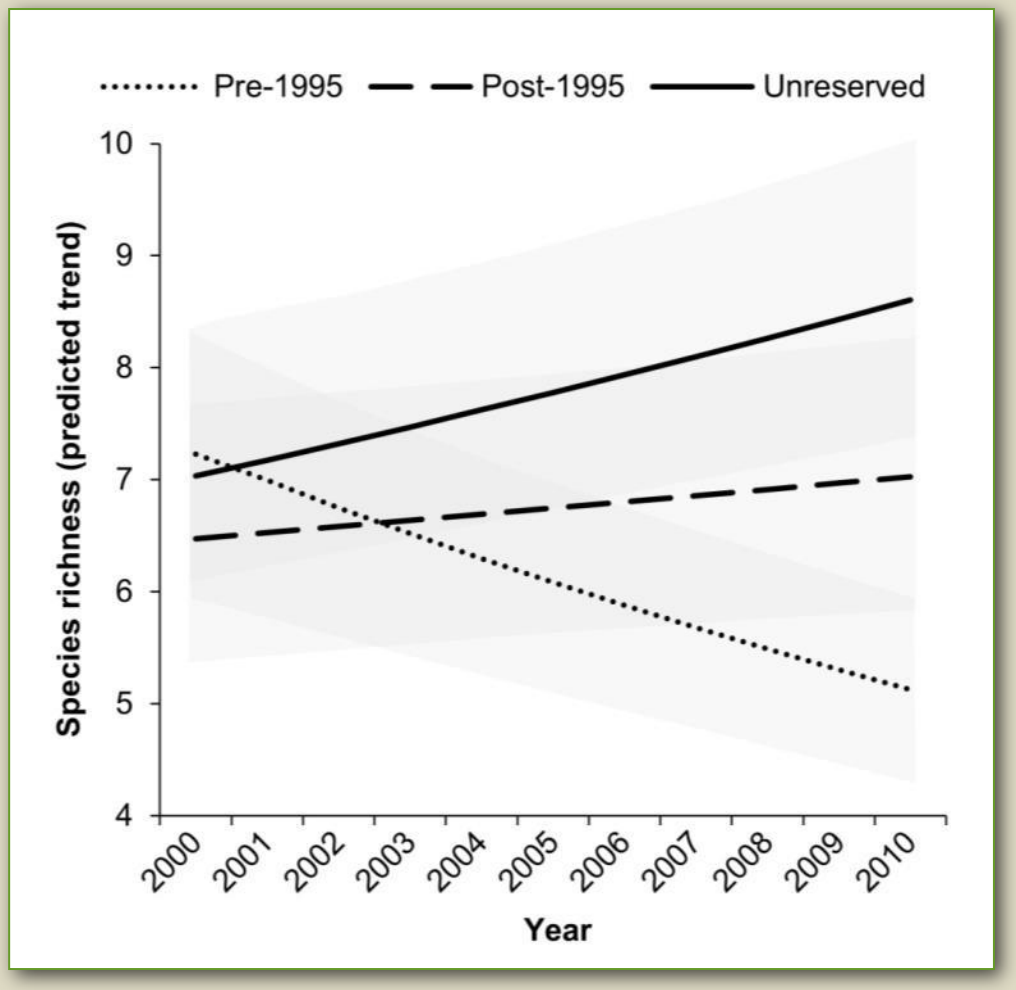
As I defined them, older reserves were those created before 1995, which coincides with a significant change in environmental protection legislation in the ACT.

Reservation

I considered the effects of reservation on:

- species richness
- richness of vulnerable species
- individual species trends
- functional groups

Reservation



Species richness

Difference across reservation categories

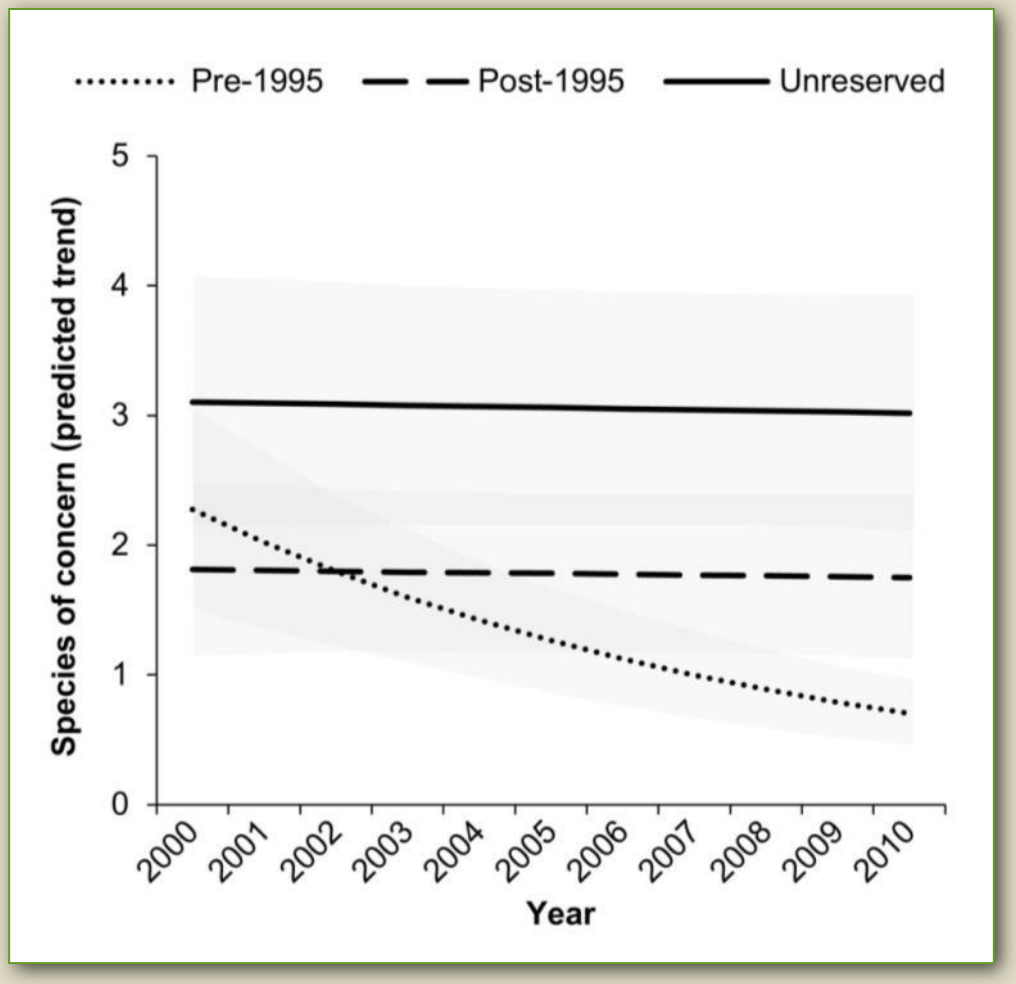
Gaining species off-reserve

Losing species on older reserves

The graph on Species Richness shows notable differences between reserve categories. On ‘non-reserves’ (solid line) we’re getting more species over time; on old reserves we’re losing them, and more quickly. This might only be a difference of four species in a decade – but in a couple of decades, how many species will we have left and what will they be?

What’s more concerning is the graph for Vulnerable species. Off-reserves have good numbers of these species and seem to be maintaining them. There are fewer of these species on reserves, old and new, and a significant loss of vulnerable species on older reserves.

Reservation



Vulnerable spp.

Fewer species on reserved sites, old and new

Significant loss of species on older reserves

Reservation

Individual species

	Old reserves	New reserves	Unreserved
Increasers	9	17	19
Decliners	26	9	7

This slide breaks these trends down to individual species seen at the different sites. With 26 decliners, our older reserves are clearly losing species. This may not be too surprising, however, given that they weren't established to protect birds (i.e. such reserves were located on ridge-tops and unproductive land).

However, the unreserved and newer reserves are performing similarly, with fewer declining species. This is a very positive outcome. It suggests that we're getting better at establishing reserves to benefit birds. But it doesn't change the result that unreserved (often private) land are doing at least as well, if not better, at protecting woodland birds than reserves.

Reservation

Individual species (across all sites)

12 species showed only increasing trends:

2 woodland-dependent:

Australian King-Parrot
Australian Magpie
Australian Raven
Crested Pigeon
Galah
Magpie Lark
Noisy Miner
Pied Currawong
Red Wattlebird
Sacred Kingfisher
Sulphur-crested Cockatoo
White-eared Honeyeater

Reservation

Individual species (across all sites)

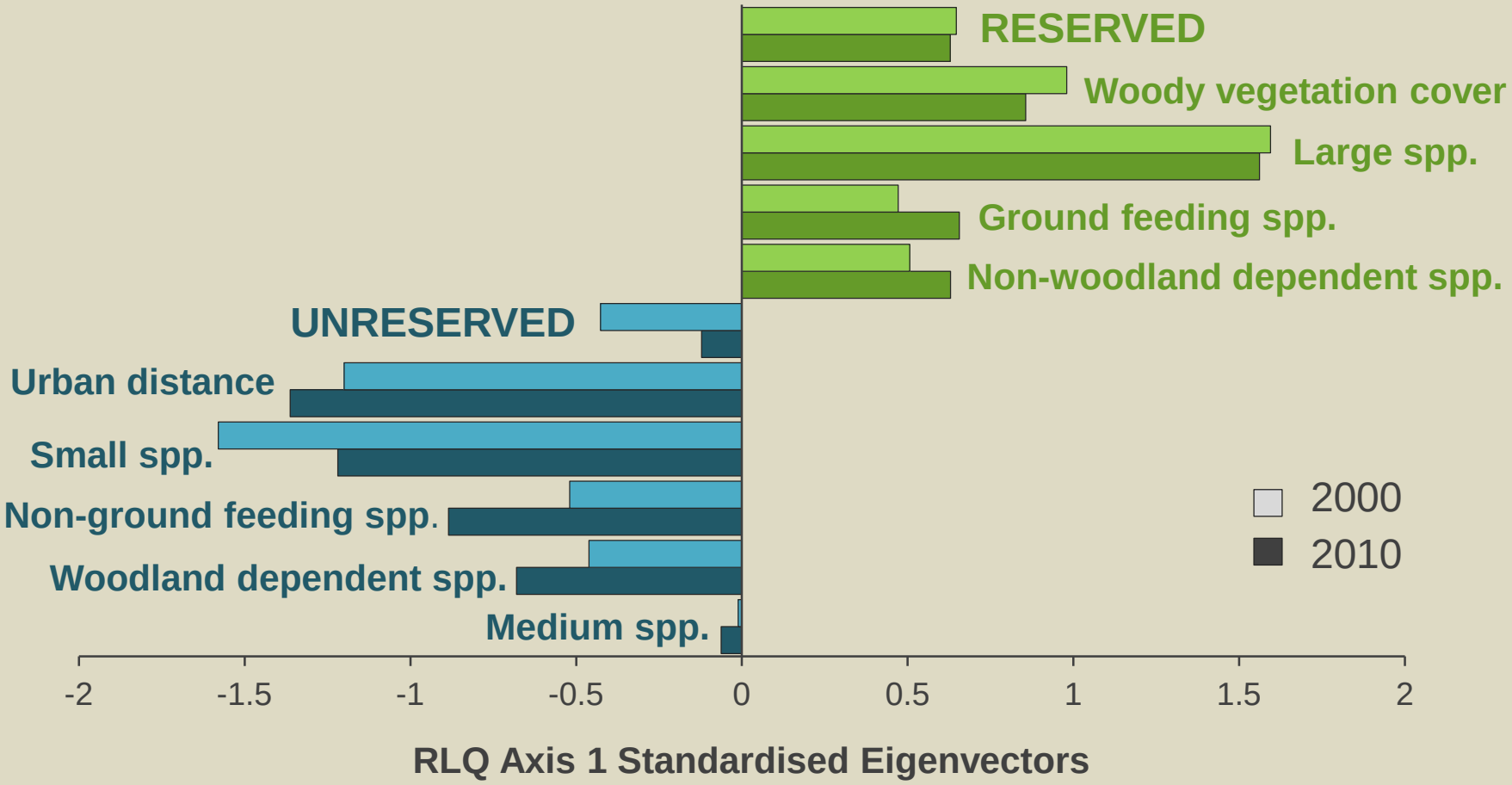
15 species showed only declining trends:

12 woodland-dependent:

Dusky Woodswallow
Golden Whistler
Grey Currawong
Grey Fantail
Grey Shrike-thrush
Rufous Whistler
Silvereye
Striated Thornbill
Superb Fairy-wren
Tree Martin
White-plumed Honeyeater
White-throated Gerygone
White-throated Treecreeper
Willie Wagtail
Common Starling

Reservation

Functional groups



The figure for *Functional Groups* illustrates the characteristics of reserved and unreserved areas. In reserves, we're seeing more of the larger, ground-feeding, non-woodland dependent species.

In unreserved areas, there's more of the smaller, non-ground-feeding species, which also tend to be woodland-dependent.

The figure also shows that our reserves are doing a fantastic job in protecting woody vegetation – perhaps too good for species that large sparse vegetation cover! The unreserved areas that tended to do well were the furthest from urbanisation.

In summary, reserves are not performing as well as we would like. However, we see encouraging signs of improvement in our newer reserves, particularly in maintaining vulnerable species.

Reserves and non-reserves furthest away from urban areas are doing best. This may suggest that urban encroachment is driving negative trends (declines) in species populations.

Reservation

Reserves are not performing as well as we would like:

Lower detection of vulnerable species
Declines of smaller, woodland species

however

We found improvements in recent reservation:

New reserves are maintaining vulnerable species

Reservation

Reserves are important for maintaining woody cover

Potentially important for connectivity

Urban encroachment is possibly driving negative trends

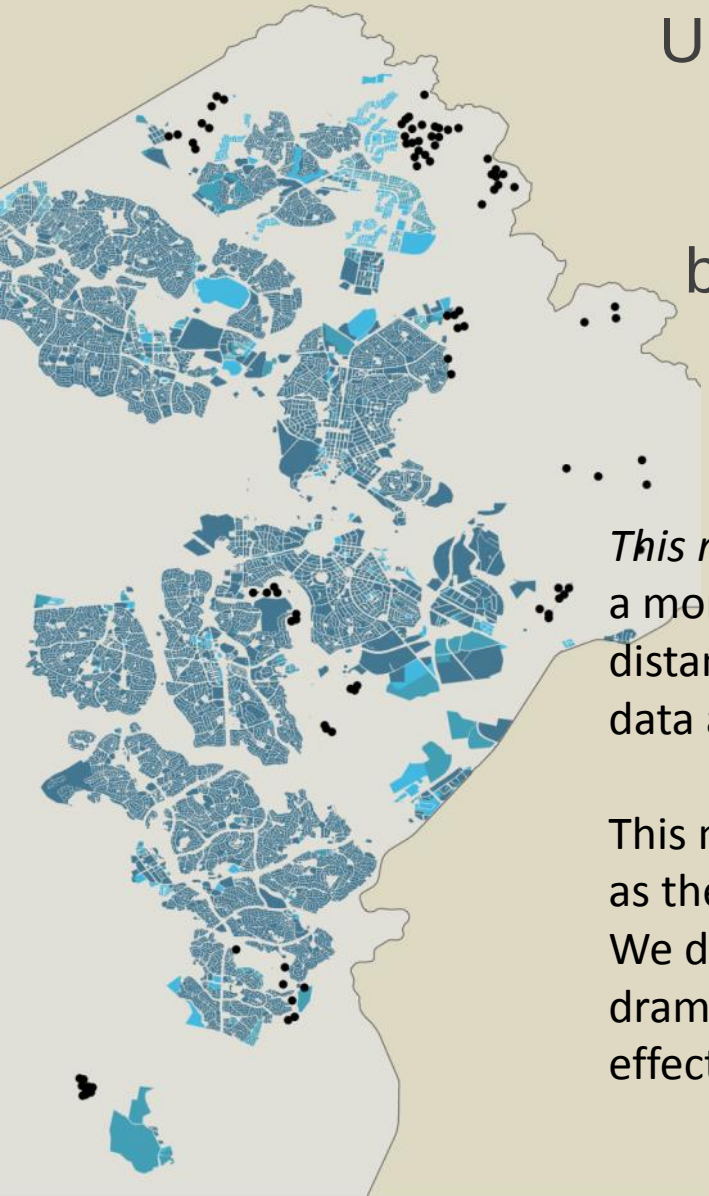
Sites furthest away are performing best

Urbanisation

This subject is so interesting to me. There's a lot we can do to make our urban areas more hospitable to birds. All around the world, bird responses to urban development tend to be mixed –some species benefit from urbanisation, others obviously avoid it.

What I could do with the COG data is look at effects of urbanisation on species through time.

Urbanisation



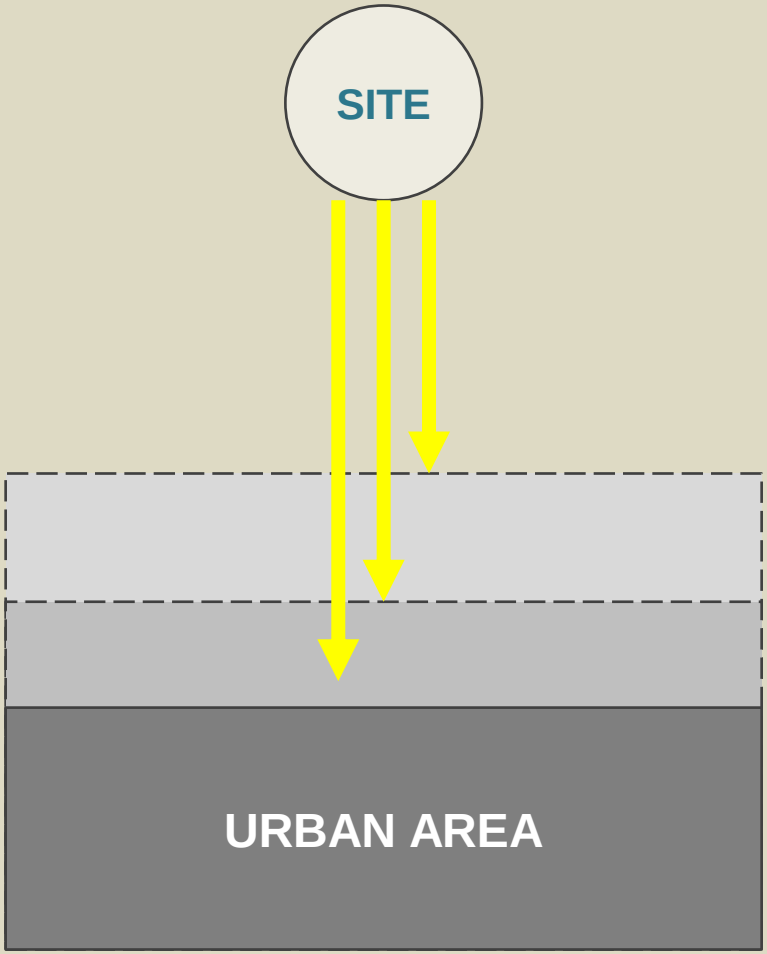
Urbanisation has been shown to have mixed effects on species,

but few have looked at these effects **through time**.

This next figure depicts an urban boundary moving closer to a monitoring site over time (i.e. yellow arrow indicating that distance between the two reduces). We've been collecting data at sites like this for over a decade.

This means we can measure species responses at that site as the distance to the urban boundary changes (reduces). We don't have to worry about site factors changing dramatically; we can focus on the distance-to-boundary effects.

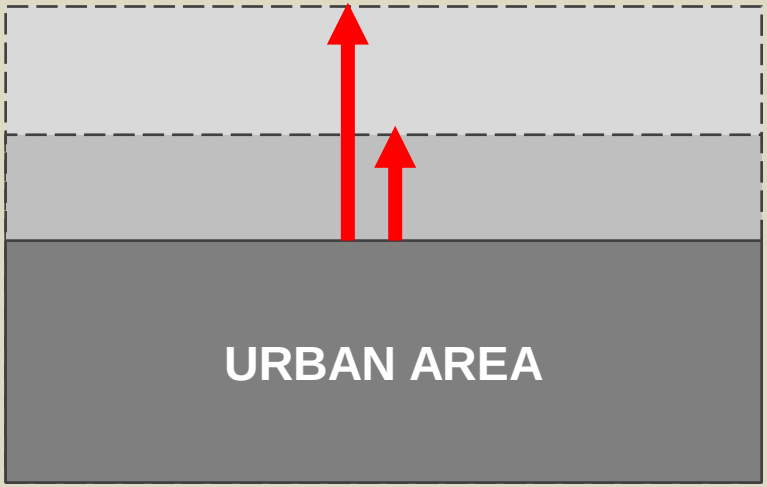
Urbanisation



We can also measure how the rate of change in this distance (red arrow) influences bird populations through time. Examining the *rate of change* in an urban boundary has not been done before. We can ask ‘does it matter how quickly we encroach on a site?

Urbanisation

SITE

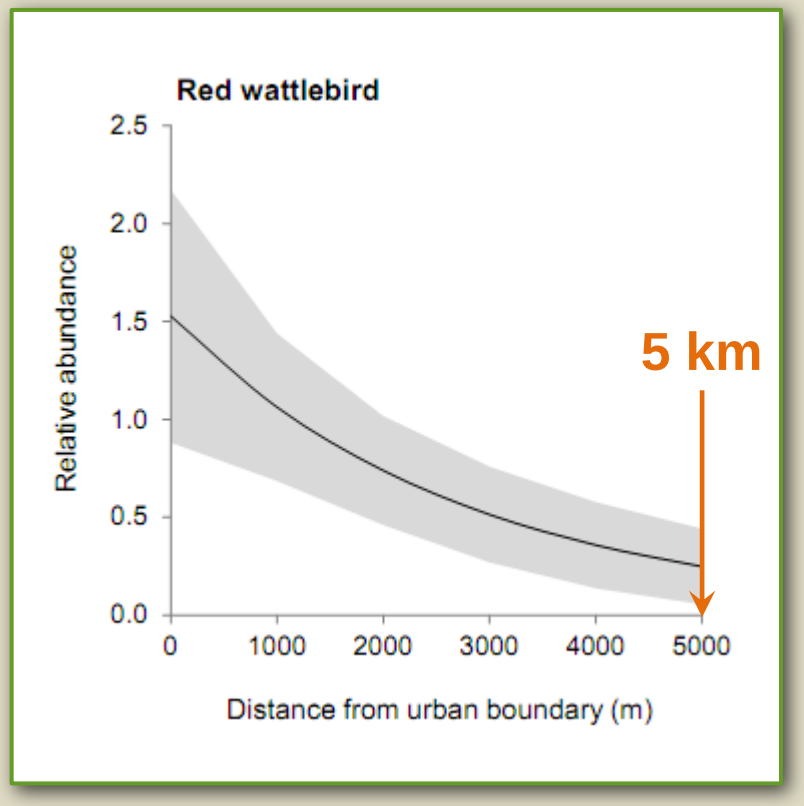


Urban adapters and urban avoiders.

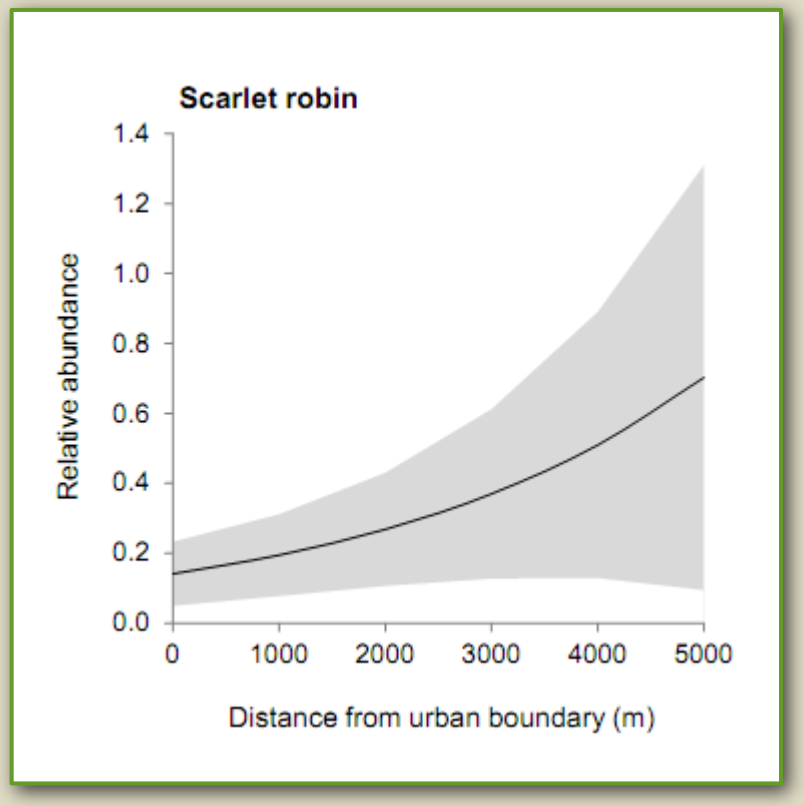
Our results supported the research literature. There's almost an even number of birds that are favoured (15 adapters) or disadvantaged (17 avoiders) by urban areas. You'll find the latter species further from urban areas.

Urbanisation

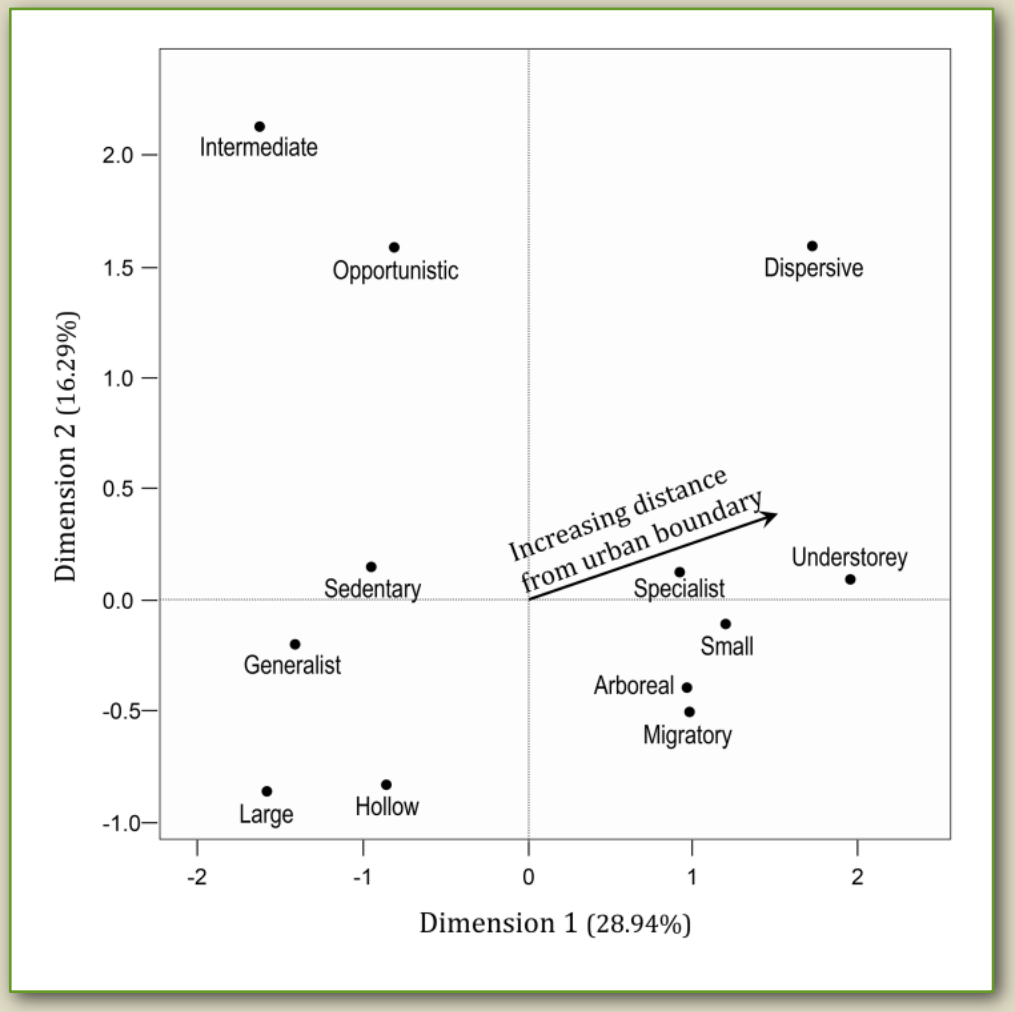
Urban adapters
15 species



Urban avoiders
17 species



Urbanisation



Trait associations

Urban adapters → larger, non woodland-dependent birds and opportunistic or hollow nesters.

Urban avoiders → smaller, woodland-dependent birds that rely on mid- and upper-canopy structure for nesting.

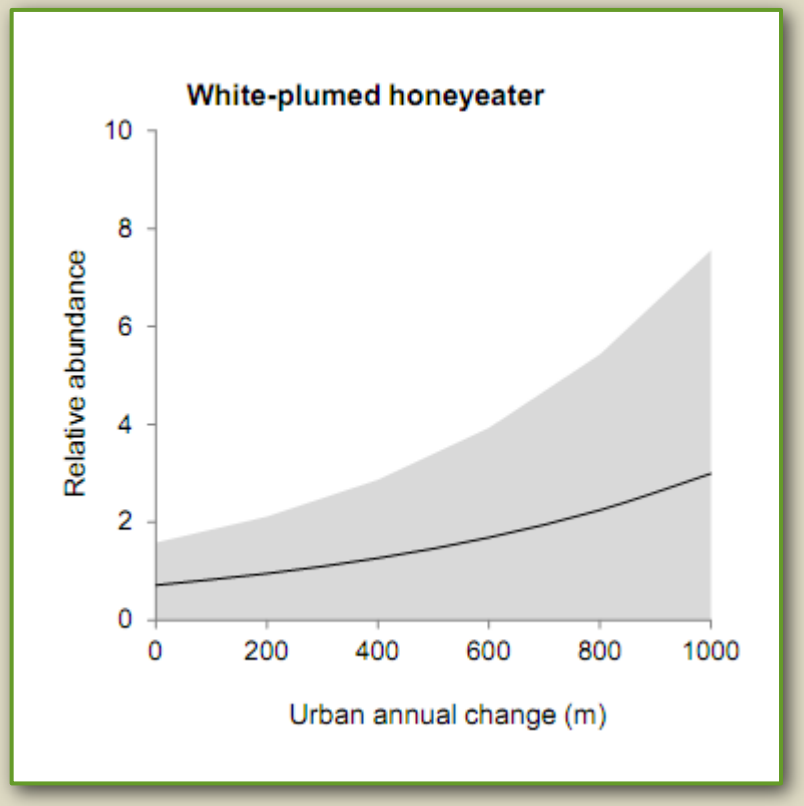
Trait associations.

What's cool and new, is this. Most research looks at traits associated with adapters and avoiders based on data from a transect line of maybe 200 or 300 metres, with data collected over a year or two.

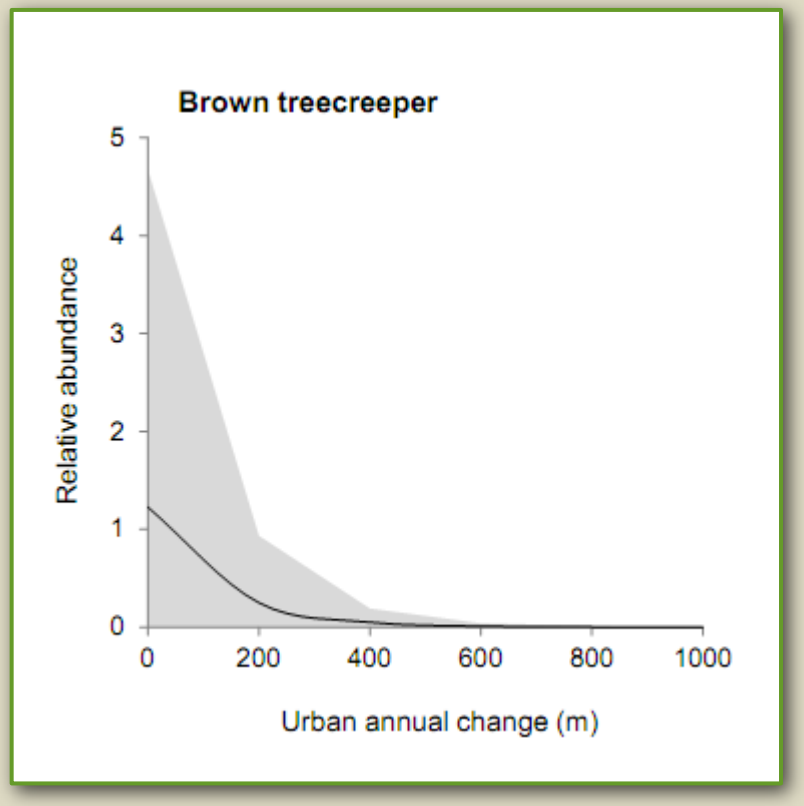
Our observation data comes from permanent sites, with over ten years of surveys, up to five kilometres from the original urban boundary. We identified some urban avoider species for which this distance is their limit. This slide summarises some typical features of urban avoiders and adaptors found in our research.

Urbanisation

Change tolerant
3 species



Change intolerant
12 species



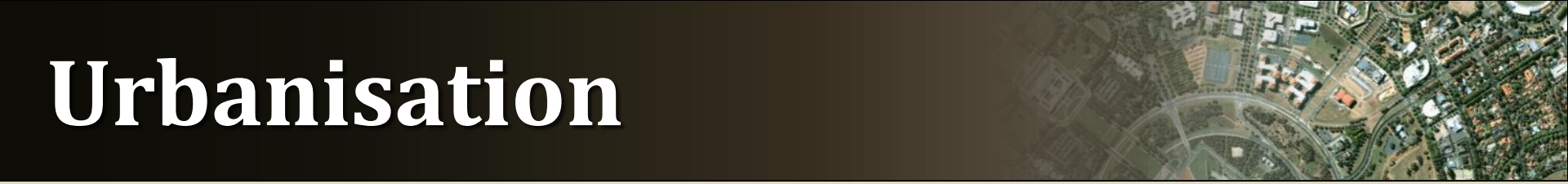
Change-tolerant and Change-intolerant species.

These are the results from our analyses of the *rates of change in encroachment* (decreasing distance between site and urban boundary for a given period).

We found only 3 species that are 'OK' with encroachment that happens quickly. For 12 species, the faster you change the urban boundary (reduce the distance to the site) the more likely these species are to abandon a site.

For example, the Brown Treecreeper, a species of national concern and an iconic 'decliner', cannot persist at sites were urban development has encroached by more than 100m/year. This encroachment effect is independent of the proximity to urbanisation.

Urbanisation



Occurrence/abundance of approximately half of the region's avifauna is strongly linked to urban proximity

however

Rate of urban fringe development is also important for some species

Species showing long-term declines are also more likely to be urban avoiders.

Summary on Urban encroachment and Rate of encroachment.

The occurrence and abundance of approximately half of the ACT avifauna is strongly linked to urban proximity. The rate of urban encroachment is also important (may have negative effects), particularly for vulnerable species.

It may require a range of appropriate urban development strategies to conserve threatened species in nearby woodland habitats.

Recommendations for Management

Management

Weather

- Quantify the influence of weather extremes on key resources for birds
- Collect movement data to enhance inference from regional population trends

Management

Reservation

- Reserve irreplaceable woodland habitats on the urban fringe
- Protect native vegetation located on productive land
- Increase conservation efforts in areas of low urban land cover

Management

Urbanisation

- Increase buffers between important woodland and urban development
- Investigate the benefits of sensitive urban design
- Stage large developments to reduce short-term impacts on avifauna

All of this work was made possible by people like you, doing what they love.

Since submitting my thesis in August last year,
this research is being used as key evidence for listing the

Scarlet Robin as threatened in the ACT.

Notes added to powerpoints from an audiotape of her presentation
to Hunter Bird Observers Club on 11 February 2015
(compiled by Grahame Feletti, edited by Laura Rayner)

Keywords: urban sprawl, temperate woodland, bird conservation, Canberra

THANK YOU!

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