

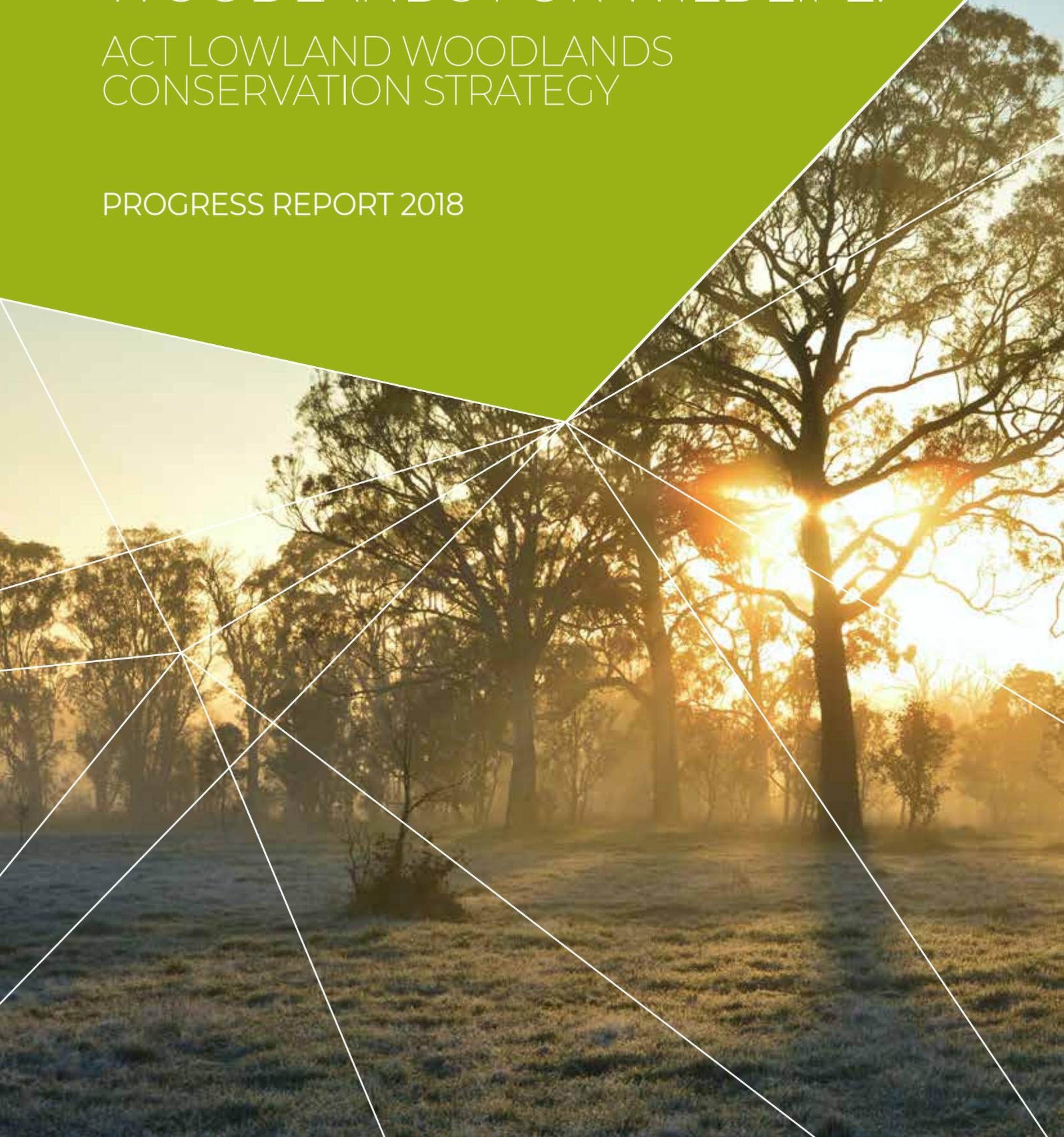


**ACT**  
Government

# WOODLANDS FOR WILDLIFE:

## ACT LOWLAND WOODLANDS CONSERVATION STRATEGY

PROGRESS REPORT 2018



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# BACKGROUND





## LOWLAND WOODLANDS

Lowland grassy woodlands include Yellow Box–Red Gum Grassy Woodland (hereafter referred to as Box Gum Woodland), an endangered ecological community under the ACT [Nature Conservation Act 2014](#) (NC Act) and White Box–Yellow Box–Blakely’s Red Gum Grassy Woodlands and Derived Native Grassland, a critically endangered community under the Commonwealth [Environment Protection Biodiversity Conservation Act 1999](#) (EPBC Act). Lowland Grassy Woodlands in the ACT include remnants of Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland, which is a listed threatened community in NSW.

The ACT has some of the biggest, best connected and most botanically diverse woodlands in Australia. Woodlands are home to a diversity of species, including several threatened plants and birds. The ACT retains more than a third of the original extent of its grassy woodlands, and benefits from characteristics such as:

- » large patches (typically greater than 100 hectares)
- » a high level of connectivity across the landscape
- » a high botanical diversity, including many rare and threatened species, and
- » generally good condition (vegetation structure/regeneration/weed invasion) (ACT Government, 2004).

Woodlands provide shelter for animals, store carbon, protect water quality, and provide recreation opportunities for the public (ACT Government, 2004).

Woodlands are vulnerable to threats, including:

- » climate change
- » land-use pressure
- » invasive plant species
- » fragmentation
- » feral and pest species
- » dieback
- » grazing
- » historical clearing
- » inappropriate fire regimes
- » urban development

## ACT LOWLAND WOODLAND CONSERVATION STRATEGY

The 2004 Woodlands for Wildlife: ACT Lowland Woodland Conservation Strategy—Action Plan 27 (the Strategy) aimed to reduce the impact of threats and improve the protection and management of lowland woodlands across the ACT.

The Strategy has resulted in significant improvements made to the protection, restoration and management of woodlands in the ACT. This progress report summarises implementation and reflects on key highlights of woodlands restoration and research projects against the three main goals and supporting actions. Progress against actions is summarised at Appendix A.

# THE ACT LOWLAND WOODLAND CONSERVATION STRATEGY

The Strategy is driven by an overarching vision, underpinned by protection and management goals. Specific actions are outlined in the strategy to meet these goals.

## VISION:

To make an outstanding contribution, regionally and nationally, to the conservation of lowland woodland.

## GOALS:

1. Conserve all types of lowland communities in the ACT as viable and well-represented ecological systems.
2. Conserve viable, wild populations of all lowland woodland flora and fauna species in the ACT and support regional and national efforts towards conservation of these species.
3. Manage and rehabilitate lowland woodlands across all tenures with appropriate regeneration, restoration and reinstatement practices.

## PURPOSE

The Strategy incorporates the action plan requirements for the following listed species:

- » Yellow Box–Red Gum Grassy Woodland
- » Tarengo Leek Orchid (*Prasophyllum petilum*)
- » Small Purple Pea (*Swainsona recta*)
- » Hooded Robin (*Melanodryas cucullata*)
- » Swift Parrot (*Lathamus discolor*)
- » Superb Parrot (*Polytelis swainsonii*)
- » Brown Treecreeper (*Climacteris picumnus*)
- » Painted Honeyeater (*Grantiella picta*)
- » Regent Honeyeater (*Anthochaera phrygia*)
- » Varied Sittella (*Daphoenositta chrysoptera*)
- » White-winged Triller (*Lalage sueurii*).

The Strategy and its associated action plans commenced in 2004. The NC Act requires action plans to be monitored for their effectiveness (see Part 4.5 of the NC Act on Action Plans). The Conservator of Flora and Fauna must report to the Minister for the Environment and Heritage at least every five years. The report must be made available to the public.

## FURTHER INFORMATION

The following links provide more information on various issues covered in this progress report:

[ACT Lowland Woodland Conservation Strategy](#)

[Threatened Species Action Plans](#)

[Woodlands Restoration in the ACT](#)

[ACTmapi](#)

[Canberra Nature Map](#)

[Mulligans Flat Woodland Sanctuary](#)

[Environmental Offsets](#)

[Dieback Information](#)

[Conservation Effectiveness Monitoring Program](#)





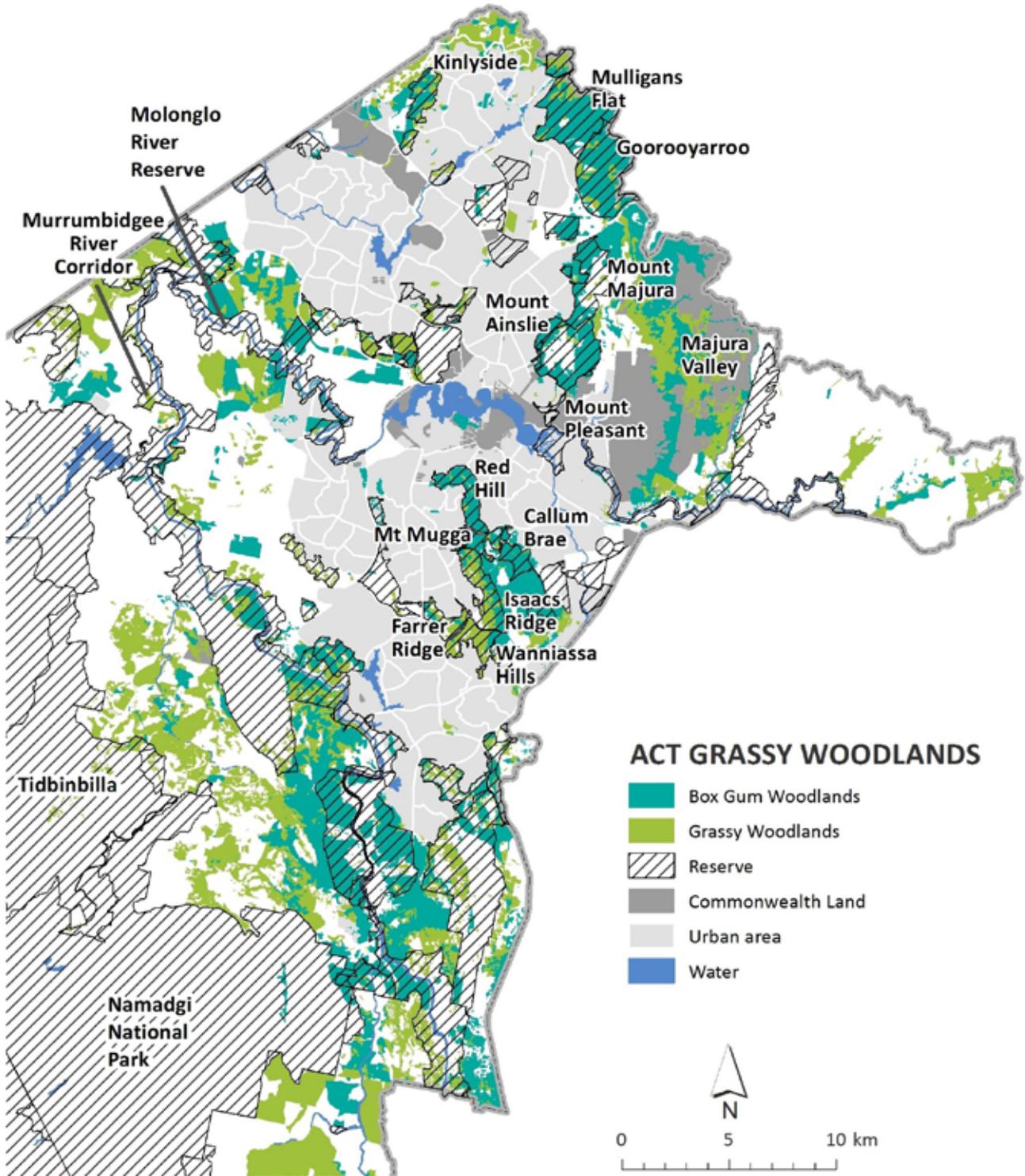
# PROGRESS AGAINST GOAL 1

Conserve all types of lowland woodland communities in the ACT as viable and well-represented ecological systems

## DISTRIBUTION OF GRASSY WOODLANDS

The distribution of lowland grassy woodlands in the ACT is shown in Figure 1.

**Figure 1:** Extent of Lowland Grassy Woodland and Box Gum Woodland in northern ACT.



Source: ACT Government, 2017e. *National Park Feasibility Reference Group Resource Paper*.

Approximately 10,824 hectares of lowland grassy woodland is protected within public land nature reserves or special purpose reserves (ACT Government, 2017e) (see Table 1). This is mainly within Canberra Nature Park and the Murrumbidgee River Corridor, with smaller amounts protected in the proposed Molonglo River Reserve and Namadgi National Park. These areas have a high level of protection.

Approximately 2,756 hectares of lowland grassy woodland vegetation community is on Commonwealth land (ACT Government, 2017e). The majority of this is in the Majura Valley and managed by the Department of Defence, with a smaller area managed by the Capital Airport Group Pty. The area known as Newline has 113 hectares on Commonwealth land and 98 on ACT land.

Commonwealth land is managed to meet the requirements of the EPBC Act, which provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places: White Box–Yellow Box–Blakely’s Red Gum Grassy Woodlands and Derived Native Grassland is listed under the EPBC Act as a threatened ecological community.

The remaining 21,281 hectares lowland grassy woodland areas are largely found within Paddys River and the Naas Valley with smaller areas in Kowen and northern Gungahlin.

Table 1 provides an assessment of the area of lowland woodland by tenure (ACT Government, 2017e).

**Table 1:** Lowland Grassy Woodland by land category in the ACT.

Location	Grassy Woodland (ha)
Canberra Nature Park	6,224.8
Molonglo River Reserve (Special Purpose Reserve)	255.2
Molonglo River Corridor (Special Purpose Reserve between Molonglo Gorge and Jerrabomberra Wetlands)	7.5
Murrumbidgee River Corridor	2,210.9
Lanyon Landscape (Special Purpose Reserve)	1,259.5
Tidbinbilla	223.2
Namadgi National Park	608.9
Harcourt Hill	34.1
<b>Total</b>	<b>10,824</b>
Majura Valley	2,414.3
Newline (Commonwealth)	113.8
CSIRO (Ginninderra)	22.2
National Capital Authority (mainly around Lake Burley Griffin)	48.3
Tidbinbilla Space Station	59.8
<b>Total</b>	<b>2,658</b>
Kowen Travelling Stock Route	336
Kowen Forest	434.9
Newline (ACT)	98.5
Other areas (Gungahlin, Kowen, Naas Valley, Paddys River)	20,510.5
<b>Total</b>	<b>21,380</b>
<b>TOTAL</b>	<b>34,862</b>

Note: the Figures sourced in this table were those used in the National Park Feasibility Reference Group Resource Paper (ACT Government 2017e). Figures are approximate and reflect mapping used to inform the National Park Feasibility Reference Group. The figures are indicative only: more recent mapping is likely to change these figures.

## RESERVATION AND ZONING CHANGES SINCE THE COMMENCEMENT OF THE STRATEGY

Since the commencement of the Strategy many woodland areas in the ACT have been added to the reserve network, managed as environmental offset areas, and/or rezoned to Hills, Ridges or Buffers on the Territory Plan. Offset areas are managed for conservation, often for a net gain in biodiversity outcomes. Objectives outlined in the Territory Plan for the Hills, Ridges and Buffer Zone aim to conserve environmental integrity, natural heritage resources, natural habitats and wildlife corridors.

Table 2 outlines the areas of woodland and associated species that have been protected since the implementation of the Strategy.

**Table 2:** Timeline of Reserves created since the implementation of the strategy

Year	Reserve/Area Protected	Comment	Hectares
2005	Mount Mugga Mugga Nature Reserve	66 hectares were added to the Mount Mugga Mugga Nature Reserve by rezoning the area from Residential and Major Roads to Hills, Ridges and Buffers with a nature reserve overlay applied.	66
2006	Goorooyaroo Nature Reserve	1,000 hectares of Yellow Box-Red Gum Woodlands were protected in Goorooyaroo Nature Reserve and Callum Brae through the amendment of the nature reserve overlay boundaries.	1,000
2012	Bonner	The Bonner 4 East offset area was incorporated within Mulligans Flat Nature Reserve and no longer zoned as a future urban area.	21
2012	Williamsdale	Two areas containing woodland on the Williamsdale Property of 110 hectares are currently managed as environmental offsets.	110
2014	Isaacs Ridge	36.9 hectares of Box Gum Grassy Woodland vegetation were incorporated into the existing Isaacs Ridge Nature Reserve, and is now managed as an environmental offset.	36.9
2016	Pinnacle Nature Reserve	19.5 hectares (including 5.1 hectares of woodland) were allocated as a Nature Reserve, and consists of adjacent blocks to extend the existing nature reserve. The Pinnacle Nature Reserve is managed as an environmental offset.	19.5
2016	Justice Robert Hope Park	18 hectares were rezoned from Urban Open Space to Hills, Ridges and Buffers, and joins to the Mount Majura Nature Reserve.	18
<b>MOLONGLO VALLEY STRATEGIC ASSESSMENT</b>			
The Molonglo Valley Plan for the Protection of Matters of National Environmental Significance identified the following conservation outcomes for Box Gum Woodland in the Molonglo Valley:			
2011	Kama, Molonglo River Park, Patch GG	Establishment of three environmental offset areas totalling the protection of 234 hectares of woodland (Kama Nature Reserve, Molonglo River Park, and Patch GG).	234
2016	Molonglo Valley	Adaptive management of 73 hectares of woodland within the strategic assessment area.	73
2016	West Molonglo	Maintenance and enhancement of woodland occurring within West Molonglo.	

Year	Reserve/Area Protected	Comment	Hectares
<b>GUNGAHLIN STRATEGIC ASSESSMENT</b>			
2013	Kinlyside	290 hectares (including 160 hectares of woodland) were rezoned from Residential to Hills, Ridges and Buffers. The Kinlyside Nature Reserve was created. Adjoining rural areas are managed as an environmental offset.	290
2013	Kenny Conservation Area	160 hectares (including 85 hectares of woodland) were rezoned from Residential to Hills, Ridges and Buffers and created the Kenny Nature Reserve.	160
2013	Kenny Broadacre	23 hectares (including 10 hectares of woodland) were rezoned from Broadacre to Hills, Ridges and Buffers with a Nature Reserve overlay. This area is managed as an environmental offset.	23
2013	Throsby east	105 hectares (including 80 hectares woodland) were rezoned from Residential to Hills, Ridges and Buffers with Nature Reserve overlay. This reserve became an addition to Mulligans Flat and Goorooyarroo Nature Reserve.	105
2013	Throsby north	172 hectares (including 85 hectares of woodland) were rezoned from Residential to Hills, Ridges and Buffers with a Nature Reserve overlay. This reserve became an addition to Mulligans Flat and Goorooyarroo Nature Reserve.	172
2013	Horsepark north	76 hectares (including 34 hectares of woodland) were rezoned from Broadacre to Hills, Ridges and Buffers.	76
2013	Taylor	21 hectares (including 8 hectares of woodland) were rezoned from Residential to Hills, Ridges and Buffers.	21
2013	Jacka	23 hectares (including 15 hectares of woodland) were rezoned from Residential to Hills, Ridges and Buffers.	23
<b>WEST BELCONNEN STRATEGIC ASSESSMENT</b>			
2017	West Belconnen Conservation corridor	Commitment to expand the Murrumbidgee River Corridor to avoid all impacts on woodland and habitat for other species. The areas has been rezoned to Hills Ridges and Buffers with a nature reserve overlay.	68.2

Note: the data in this table reflects information provided in Territory Plan variations, Strategic Assessment documentation and offset management plans. It is indicative only and may not reflect more recent and detailed mapping of vegetation communities.





## PROGRESS AGAINST GOAL 2

Conserve viable, wild populations of all lowland woodland flora and fauna species in the ACT and support regional and national efforts towards conservation of these species

Many threatened species<sup>1</sup> are found within woodlands.

Nationally threatened species include:

- » Golden Sun Moth (*Synemon plana*)
- » Pink-tailed Worm-lizard (*Aprasia parapulchella*)
- » Swift Parrot (*Lathamus discolor*)
- » Superb Parrot (*Polytelis swainsonii*)
- » Button Wrinklewort (*Rutidosis leptorrhynchoides*)
- » Austral toadflax (*Thesium austral*)
- » Small Purple Pea (*Swainsona recta*)
- » Hoary Sunray (*Leucochrysum albicans*)
- » Tarengo Leek Orchid (*Prasophyllum petilum*)
- » Canberra Spider Orchid (*Arachnorchis actensis*)

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1 Listed under the [Environment Protection and Biodiversity Conservation Act 1999](#) (Cth) (EPBC Act).

ACT listed threatened species<sup>2</sup> include:

- » Scarlet Robin (*Petroica boodang*)
- » Varied Sittella (*Daphoenositta chrysoptera*)
- » White-winged Triller (*Lalage sueruii*)
- » Hooded Robin (*Melanodryas cucullata*)
- » Perunga Grasshopper (*Perunga ochracea*)
- » Brown Treecreeper (*Climacteris picumnus*)
- » Little Eagle (*Hieraetus morphnoides*)

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2 The [Nature Conservation Act 2014](#) (ACT) (NC Act) provides for the listing of regionally threatened species. The species listed here are not listed under the EPBC Act but are listed under the NC Act. Processes are underway to align species listings which may change the status of ACT listed species



## MULLIGANS FLAT WOODLAND SANCTUARY

Eleven kilometres of rabbit, cat and fox proof fencing was erected in 2009 to form Mulligans Flat Woodland Sanctuary, encompassing 485 hectares of woodland (Woodlands and Wetlands Trust, 2015). The Sanctuary is managed by the Woodlands and Wetlands Trust in partnership with the ACT Parks and Conservation Service within the Environment, Planning and Sustainable Development Directorate.

The Sanctuary has a vision to support the natural, predator-free restoration and conservation of Box Gum Woodlands. The objectives of the Sanctuary are to:

- » restore ecological processes
- » maintain a feral predator-free Sanctuary
- » create nationally significant, community-lead conservation projects
- » support research, education and community participation
- » act as a catalyst for change around conservation and restoration of Box Gum Woodland. (Woodlands and Wetlands Trust, 2015).

Significant ecological restoration and conservation projects and research occur at this site, including:

- » biomass management
- » grazing impacts by Eastern Grey Kangaroos (*Macropus giganteus*)
- » feral species exclusion
- » species introductions and reintroductions within a predator-proof sanctuary
- » research around the benefits of adding coarse woody debris to woodlands
- » research around the effects of adding animal carcasses to woodlands
- » flora and fauna surveys (including invertebrates)
- » woodland restoration techniques.

Recent highlights include the successful reintroduction and breeding of the Eastern Bettong (*Bettongia gaimardi*), Bush-stone Curlew (*Birhinus gallarius*) and Eastern Quoll (*Dasyurus viverrinus*).

Findings from these research and restoration programs have been applied to other on-ground restoration activities in other woodland areas in the ACT.

## Mulligans Flat-Goorooyarroo Woodlands Experiment

The Mulligans Flat-Goorooyarroo Woodlands Experiment is a long-term project that aims to investigate restoration techniques in woodland. Beginning in 2004, research is aimed at a whole-of-ecosystem understanding of woodlands with a focus on restoring structure and function to increase biodiversity (ACT Government, 2017e). The project is implemented through a partnership between the ACT Government, Australian National University (ANU), CSIRO, James Cook University and other partners, funded by partners and successive Australian Research Council Linkage grants.

Projects to date include (Australian National University, 2018):

- » vegetation surveys to evaluate the effect of treatments on vegetation structure and composition
- » fauna surveys to determine the composition and biodiversity of different groups of fauna, including reptiles, birds, invertebrates, small mammals and the Eastern Bettong.
- » invertebrate research
- » kangaroo research
- » reintroduction of the Brown Treecreeper
- » reintroduction of the Eastern Bettong
- » coarse woody debris research
- » carrion research
- » bird banding.

There are plans to extend the Sanctuary area and to reintroduce the Yellow-Footed Antechinus (*Antechinus flavipes*) and Eastern Chestnut Mouse (*Pseudomys nanus*).

## Kangaroo management research

Research into the impact of kangaroo grazing have been published since 2010. Together, eight studies have provided evidence to indicate that high densities of kangaroos negatively impact other species that utilise the same habitat. These studies support and inform the Eastern Grey Kangaroo: Controlled Native Species Management Plan (Kangaroo Management Plan) (ACT Government, 2017d). Research includes:

- » research on vegetation at Goorooyaroo and Mulligans Flat nature reserves
- » the effect of reducing grazing on beetle diversity
- » the benefits of coarse woody debris in ecosystem recovery under different levels of grazing
- » impacts of grazing on ground-dwelling reptiles
- » restoration of grassy woodlands
- » habitat preferences of the threatened Striped Legless Lizard and
- » the effect of grazing on bird communities in grassy habitats.

More recently, the following reports have been published:

- » Fertility Control of Eastern Grey Kangaroos: Assessing efficacy of a dart-derived immune-contraceptive vaccine (Wimpenny & Hinds, 2018).
- » Kangaroos and Conservation: Assessing the Effects of Kangaroo Grazing in Lowland Grassy Ecosystems (Snape, et al., 2018)
- » Factors influencing Sub-adult Mortality Events in Eastern Grey Kangaroos (Portas & Snape, 2018).

Research continues to investigate the impacts of kangaroo grazing on ground layer vegetation structure and biodiversity through consideration of multiple factors including grazing pressure, pasture growth, vegetation species associates, reptile abundance and diversity, floristic richness and other habitat features. The impacts of grazing have shown that high levels of Eastern Grey Kangaroo grazing cause changes to grass structure that impact on reptile abundance and species diversity (Howland, et al., 2014). It has also found that native birds prefer a mosaic of grassland structures that will assist in maintaining native bird diversity (Howland, et al., 2016). Research also notes that heavy grazing caused by kangaroos reduces the complexity of the understory of woodlands, reducing its suitability for a variety of native birds.

Results contribute to the development of a model to predict appropriate kangaroo densities for specific sites.

## Kangaroo population management

The ACT Parks and Conservation Service (ACT PCS) undertakes conservation culling of Eastern Grey Kangaroos in some Canberra Nature Park nature reserves. Populations are managed in accordance with the Kangaroo Management Plan (ACT Government, 2017d), which sets out to maintain wild populations of kangaroos while also managing their environmental, economic and social impacts, and ensuring their welfare. Annual kangaroo culling for conservation purposes is important in protecting the natural environment and species that suffer from overpopulation of kangaroos. High numbers of kangaroos can graze the ground layer vegetation so it is no longer able to provide food and shelter for small animals such as reptiles, insects and ground-feeding birds.



# THREATENED WOODLAND BIRDS

Research carried out in Canberra Nature Park reserves continues to provide useful data on woodland birds. Key highlights are outlined below.

## Superb Parrot research and monitoring

The Superb Parrot is currently managed under Action Plan No. 17. Sightings of the nationally vulnerable Superb Parrot were relatively uncommon in Canberra prior to 2000, but have since increased, with breeding behaviour recorded annually in the Territory since 2003 (COG unpublished data). A significant breeding colony of superb parrots is located in the Throsby area of northern Canberra, where 8–10 pairs have displayed breeding behaviour between 2009 and 2014. The success or otherwise of these breeding events was unknown.

During the 2015 and 2016 Superb Parrot breeding seasons (September to December), the ACT Government supported research by the ANU's Fenner School into the breeding and foraging ecology of the Superb Parrot. The study has provided previously unknown information on nest tree selection, characteristics and dimensions of nesting hollows, breeding productivity, social and breeding behaviour, inter- and intra-species competition, hollow visitation rates, foraging movements and foraging site selection (Rayner, et al., 2016).

In 2015, 14 Superb Parrot nests were initiated in the Throsby area. These nests produced 38 fledglings, with a nest success rate of 71%. In 2016, there was a decrease in the number of Superb Parrot nests initiated at Throsby, with only five pairs attempting to breed. These breeding adults arrived two weeks later than in the previous season. Nest success was higher in 2016 (80%) than in 2015, but total reproductive output (13 fledglings) decreased by 66%.

Despite fewer nesting birds in 2016, nest-site fidelity was high, with four of the five nests occurring in trees occupied by Superb Parrots in the previous year. All nests previously used by Superb Parrots for breeding were either reused by Superb Parrots or occupied by known hollow competitors in 2016. The late arrival of the Superb Parrot appeared to intensify hollow competition, as by the time they arrived to Throsby many of the hollows previously used were already occupied, mainly by Crimson Rosellas and Eastern Rosellas.

It is unclear why fewer Superb Parrots were seen in Canberra in 2016. High temporal variability in local abundance is characteristic of this parrot's ecology, such that low numbers in Canberra for any given year does not necessarily constitute a worrying trend. However, reports from other breeding locations in NSW in 2016 suggest a more widespread decrease in numbers.

## Research on birds in urban areas

Research into bird richness in urban areas has developed evidence-based urban planning, policy and management strategies to improve conservation outcomes in urban landscapes (Ikin, et al., 2015).

According to research undertaken in the ACT, there is a difference in bird assemblages between suburbs and urban reserves (Ikin, et al., 2014), as would be expected. Woodland and river corridors support high bird species richness. Small woodland birds are more likely to be impacted by urban development (Stagoll, et al., 2015; Ikin, et al., 2012).

The research found that habitat structure and composition are important for sensitive woodland species. Suburbs with more native trees support higher bird species richness (Ikin, et al., 2013) and large trees and urban green spaces within the suburbs provide important habitat resources for birds (Stagoll, et al., 2015; Ikin, et al., 2013).

## THREATENED PLANTS

Research continues to provide useful data on threatened plants. Key highlights are outlined below.

### Tarengo Leek Orchid

Hall Cemetery contains the only known population of the Tarengo Leek Orchid in the ACT. The site is a grassy woodland dominated by Blakely's Red Gum and Yellow Box, part of an endangered ecological community listed under both the NC Act and the EPBC Act. Individual plants at Hall Cemetery are counted and permanently tagged. This level of monitoring allows for analysis of population trends (ACT Government, 2017b).

Over the 26 years of monitoring, the total number of flowering individuals tended to increase before stabilising in the late 1990s with minor fluctuations. At the sub-population level there were marked differences with the largest sub-populations remaining stable while others declined or increased at statistically significant levels. This indicates that unknown factors are driving abundance at the small spatial scale of the sub-population (ACT Government, 2017b).

Eighty-nine individuals were recorded in 2016, making it the second largest flowering event in the 26 years that surveys have been conducted (ACT Government, 2017b).

Following an analysis of 25 years of monitoring data, the role of frost has been identified as a factor in fluctuations of the Tarengo Leek Orchid population. The analysis indicates that Tarengo Leek Orchid flowers in greater abundance during years with fewer nights  $\leq 4^{\circ}\text{C}$ . Work is continuing on management techniques to conserve populations of the Tarengo Leek Orchid and to provide shelter from frost. This includes trialling regeneration of Blakely's Red Gum and alternate mowing regimes (Wilson, et al., 2016).

### Small Purple Pea

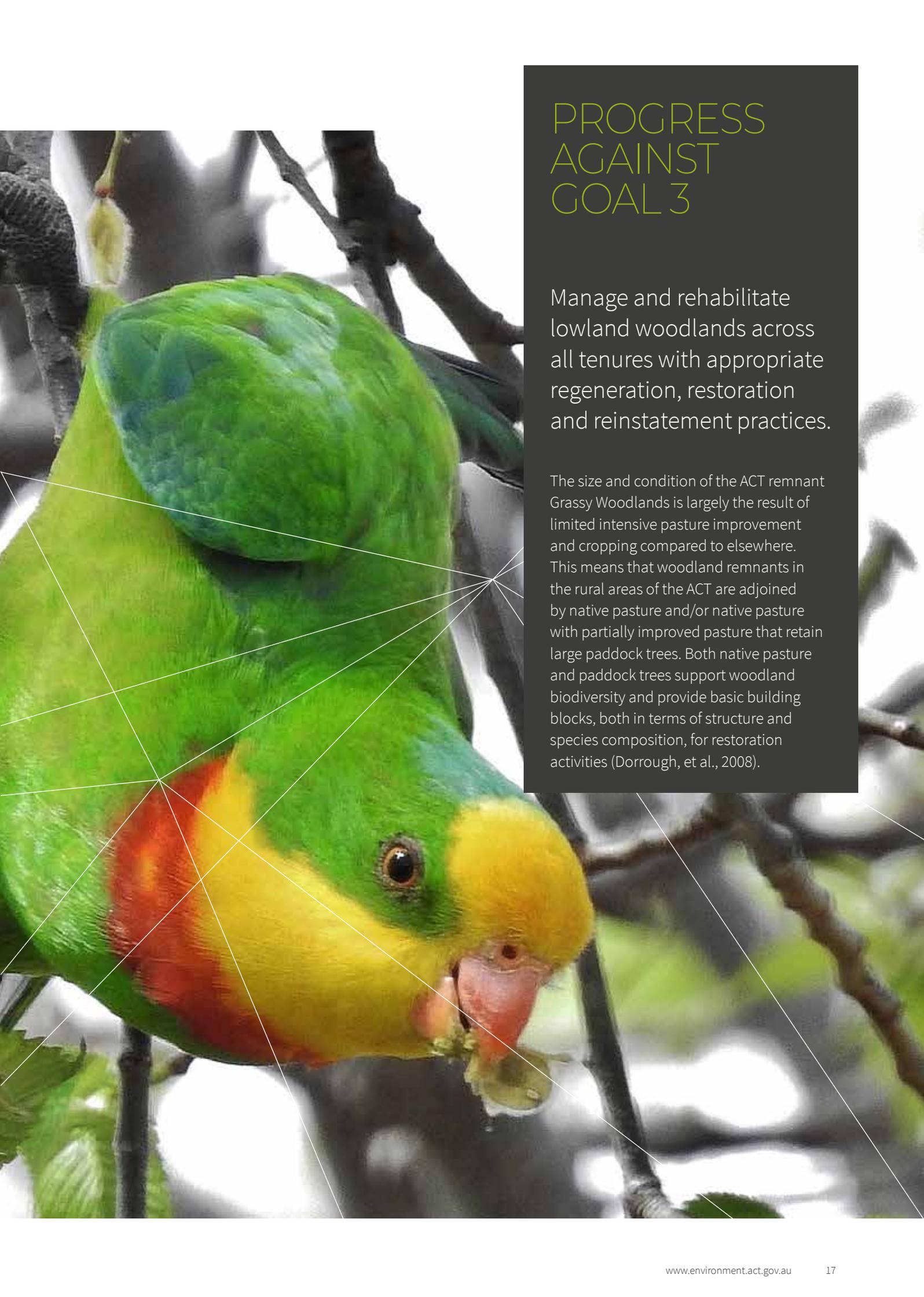
Five sites within the urban areas of Canberra have been known to support populations of the Small Purple Pea. Annual counts of individual plants are made at all sites, with individuals in the Mount Taylor and Kambah sites given tags. This level of monitoring allows population trends to be analysed and relationships with climate and management at the Mount Taylor population to be identified (population sizes are too small at the other locations) (ACT Government, 2017b).

One hundred and forty-nine individual plants were recorded at Mount Taylor over three surveys in 2016, showing a 40.6% increase on the 2015 survey. The relatively high number of individuals recorded in 2016 may be attributed to two interrelated events:

- » high rainfall in winter and early spring in 2016 and mild temperatures (particularly minimum temperatures); and
- » the proportion of plants affected by grazing or damage in 2016 (2.7%) was substantially lower than in 2015 (17%) (ACT Government, 2017b).

Fire has been considered as a way of expanding the distribution of the population at Mount Taylor. Given that the site is still recovering from severe fire in 2003, any prescribed burning at this site needs to be carefully considered because of the potential stimulation of regeneration (ACT Government, 2017b).

The Australian National Botanic Gardens (ANBG), in collaboration with the Environment, Planning and Sustainable Development Directorate (EPSDD), has established a genetically-diverse seed bank. These seeds will be used to increase population sizes that exist at Kambah and Aranda Nature Reserves, and to establish a new population in the Molonglo Nature Reserve.



## PROGRESS AGAINST GOAL 3

Manage and rehabilitate lowland woodlands across all tenures with appropriate regeneration, restoration and reinstatement practices.

The size and condition of the ACT remnant Grassy Woodlands is largely the result of limited intensive pasture improvement and cropping compared to elsewhere. This means that woodland remnants in the rural areas of the ACT are adjoined by native pasture and/or native pasture with partially improved pasture that retain large paddock trees. Both native pasture and paddock trees support woodland biodiversity and provide basic building blocks, both in terms of structure and species composition, for restoration activities (Dorrough, et al., 2008).

## PROGRAMS AND INVESTMENT

Following commencement of the Lowland Woodland Conservation Strategy, there has been significant investment in woodland restoration through the following initiatives:

### One Million Trees Program (2008–2018)

The ACT Government received \$3.29 million from the Australian Government to plant native trees over ten years in the Murrumbidgee River Corridor. By 2016, some 250,000 trees had been planted by the ACT Parks and Conservation Services using contractors and volunteers. Plantings in urban areas and in the Lower Cotter Catchment were also planted under the Million Trees Program.

### ACT Woodland Restoration (2011–2014)

From 2011 the ACT Government committed \$250,000 a year for four years towards woodland restoration of 450 hectares (4.5 square kilometres) of key landscape areas that will provide additional connectivity between woodland patches.

The project restored degraded areas of key habitat and connectivity value, assisting natural regeneration in existing woodland patches and replacing missing habitat elements such as logs or a shrub layer. The project was delivered by Greening Australia Capital Region in consultation with the ACT Government, catchment authorities and rural landholders (ACT Government, 2018b).

### Restore ACT and Greater Gorooyarroo Woodlands–Biodiversity Fund (2012–2017)

The Restore ACT and Greater Gorooyarroo Woodland project was funded by the Australian Government Clean Energy Future Biodiversity Fund (\$2.155 million) to restore woodland in ACT woodlands and the Greater Gorooyarroo area, which straddles the ACT and NSW border.

The project aimed to protect, consolidate and connect 60,000 hectares of the largest remaining Box Gum Woodland landscape in Australia through on-ground restoration and regeneration works. ACT NRM (ACT's Regional natural resource management body) contracted Greening Australia to facilitate education programs, and work with rural landholders in the ACT and NSW to encourage woodlands restoration. The project began in 2012 and, by the end of 2015, over 2,700 hectares had been revegetated and 6,982 hectares of invasive species control undertaken. Through the fund, extensive control activities for foxes in the Greater Gorooyarroo region was undertaken (ACT Government, 2016).

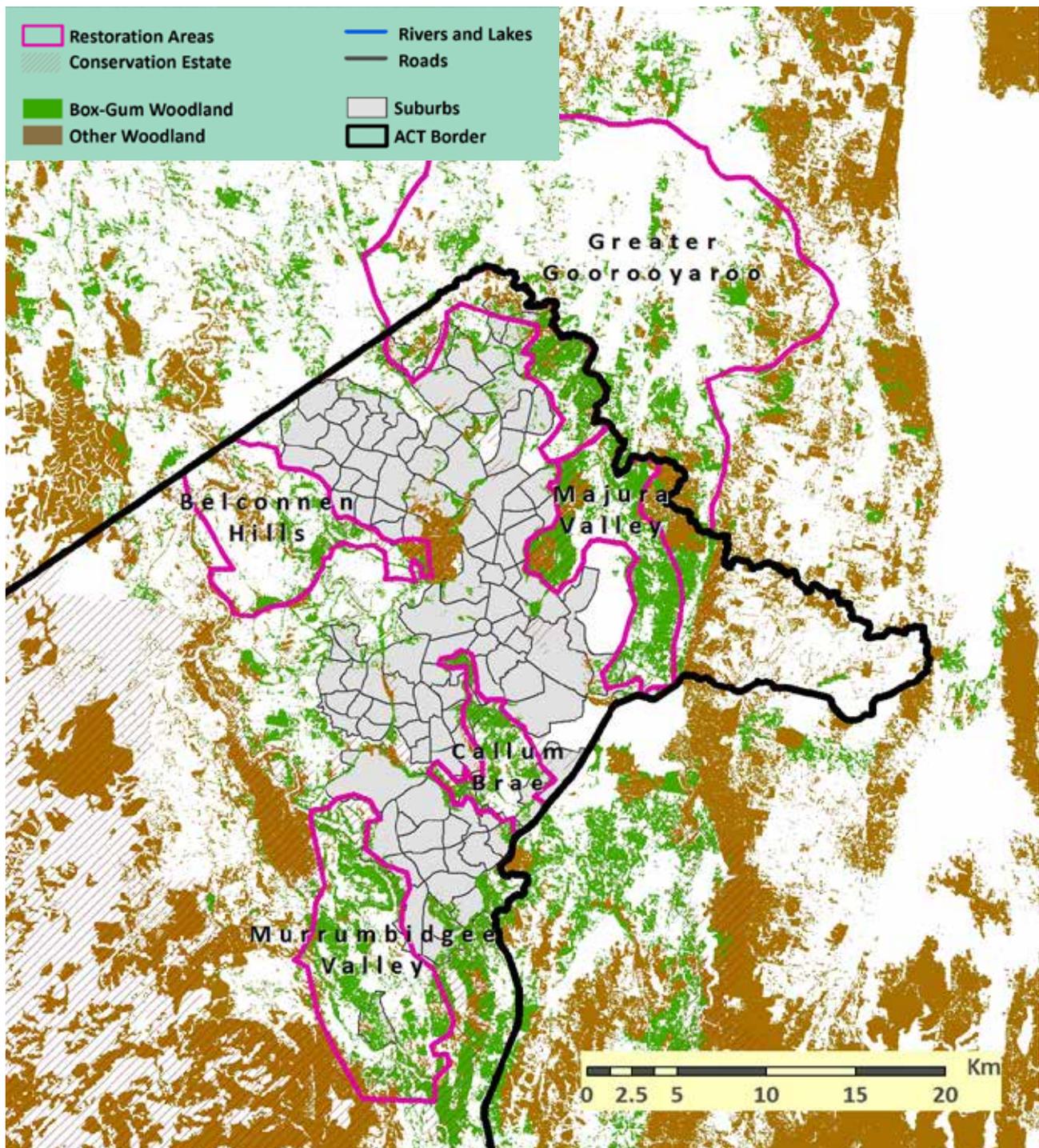
The program restored five distinct woodland blocks ('landscapes' – see the map in Figure 2):

- » Murrumbidgee River Corridor (2008 –present, funded through the One Million Trees program)
- » Greater Gorooyarroo (commenced 2012)
- » Majura Valley (commenced 2013)
- » Callum Brae (commenced 2014) and
- » the Belconnen Hills areas (commenced 2011) linking the Kama Nature Reserve with the Stony Creek tributary running into the Murrumbidgee River (2014).

Some highlights of the project included:

- » revegetation of 612.9 hectares
- » 28,548 seedlings planted
- » 101 kilometres of direct seeding
- » 786 hectares of woodland enhancement and protection
- » 4,415 tonnes of coarse woody debris distributed
- » 4,494 hectares of invasive species control
- » engagement with 18 rural landholders, and 43 schools, community groups and organisations
- » establishment of 12 monitoring sites (Greening Australia, 2016).

**Figure 2:** Map of the ACT illustrating the five woodland restoration areas targeted by the Restore ACT and Greater Goorooyaroo Woodlands. The five woodland areas includes the Murrumbidgee Valley, Callum Brae, Belconnen Hills, Majura Valley, and Greater Goorooyaroo.



## National Landcare Program (2014-2018)

ACT NRM received \$3,804,860 through the Australian Government National Landcare Program over five years (ACT Government, 2017f). Local Landcare groups contribute significant time and resources to help woodland restoration program efforts, including Ginninderra, Molonglo and Southern ACT Catchment Groups, ParkCare groups, Aboriginal people and rural landholders. The National Landcare Program delivered over 1,320 hectares of restoration to support the recovery of threatened Box Gum Woodland.

## Barrer Hill Restoration

The Barrer Hill Restoration Project within the Molonglo Valley was funded through an environmental offset. Restoration projects have been occurring at the site since 2014.

Highlights of this work include:

- » Revegetation: Tube stock planting has occurred within all management areas of the site. Translocation of the endangered Button Wrinklewort occurred in 2017 to support potentially suitable habitat. Seeds from the Small Purple Pea at the ANBG are currently being established to be translocated to Barrer Hill in 2018.
- » Rock and coarse woody debris placement: Rocks and native hardwood logs have been strategically introduced to grassland areas to promote reptile and invertebrate habitat.
- » Scraping: Removal of around 0.3 hectares of topsoil with excessive nutrients has seen positive responses from reseeded native grassland and forbs to replace exotic species.
- » Direct seeding: A direct seeding trial was initiated in 2017 of native grasses and forbs. Responses have been positive.
- » Vertical habitat structures: As part of a research project to understanding how modified areas can be restored with vertical habitat structures, five man-made utility poles and five dead trees were translocated to the Barrer Hill site. The structures contain carved hollows and artificial bark to provide habitat for wildlife.

New interpretive signage has been erected at the site, illustrating the innovative restoration techniques, history of the site and Aboriginal connections to the landscape.



# WOODLANDS RESTORATION RESEARCH

Ongoing research into woodland restoration helps improve conservation outcomes.

## Provenance and soil condition

CSIRO has been leading research on the impact of climate change on restoration, including research on provenance and soil condition. A study on Yellow Box genetic diversity in scattered remnant trees and mature restoration sites found that the restoration sites are genetically poorer, and are unlikely to add value to the landscape, particularly once the older remnant trees die out (Broadhurst, 2013). Recommendations include enhancing the existing restoration sites with seed from a more genetically diverse source (genetic rescue). The genetic diversity of two Yellow Box seed production areas were evaluated to determine if the seed harvested would contain sufficient genetic diversity to supply appropriate adaptive potential to future restoration projects (Broadhurst, et al., 2015).

The Australian Government and CSIRO are working to develop climate resilient revegetation approaches, focusing on climate adjusted provenancing (Prober, et al., 2015). Currently, local provenances are typically used in revegetation projects because they are thought to be best adapted to current local environments. However, with a changing climate this approach may no longer be the best for future persistence. Instead, the potential for adaptation to a changing climate might be increased by incorporating a broader gene pool, adapted to different climatic conditions. This strategy increases the adaptive potential of a population, and addresses the risk of inbreeding where seed is collected from local, but small populations.

Current provenance trials are being used to identify genetic differences in climate-related traits such as leaf thickness, growth rate and survival among provenances. Trees and shrubs from a range of provenances have been direct seeded in restoration sites to monitor the success over the long term in a real life situation. Forb species from across 15 provenances are also being trialed in controlled glasshouse experiments at CSIRO, which will provide short-term results due to their shorter life span.

Box Gum Woodland soil condition response to a drier climate has been investigated by CSIRO (Prober, et al., 2014a), and methods trialed to improve soil condition in restoration projects (Prober, et al., 2014b), suggesting that in the short term, addition of biochar and mulch can improve restoration outcomes, however longer term monitoring of treatments is required.

## Benefits of coarse woody debris

Several studies on the impact of additional coarse woody debris have informed woodland restoration areas. One study found that the application of coarse woody debris to areas of sapling growth can reduce mammalian browsing damage at low to moderate kangaroo browsing pressure (Stapleton, et al., 2017). Other research looks at the impacts of coarse woody debris on reptiles (Manning, et al., 2013), beetles (Barton, et al., 2011; Barton, et al., 2009) and soil (Goldin & Hutchinson, 2014).

## Native forb restoration

Forb enhancement techniques are being trialed in Kama Nature Reserve. The research has revealed that forb enhancement via direct seeding is a viable technique in conditions where sufficient seeds are used, excess leaf litter is removed, soil fertility is low, and competition is reduced.



# SUPPORTING ACTIONS



## WOODLAND RESEARCH AND INFORMATION PROJECTS

A number of ongoing projects continue to contribute to the understandings of effective woodland restoration.

### Vegetation mapping

Vegetation community mapping in the ACT is complete. The mapping classification describes the woodlands of the ACT (see Table 3) in finer detail than any previous classification system and includes five lowland/foothill woodland communities and seven subalpine woodland communities.

There are also six dry sclerophyll open forest communities, two forested wetlands and six sub-alpine woodland communities that adjoin lowland woodland communities and in some cases, such as when considering habitat of threatened woodland species, are best considered along with the seven lowland woodland communities.

Mapping the ACT's woodlands using detailed community descriptions provides important information on community traits such as distribution, extent and species composition of woodland areas. It can also assist in determining areas of woodland that may require further protection.

Vegetation mapping is now being used to inform conservation and management priorities, including the development of the ACT Native Woodland Conservation Strategy.

**Table 3:** Woodland Communities

Dominant species / structural characteristics	Community code
<b>Subalpine</b>	
Mountain Gum – Snow Gum ± Robertson's Peppermint grass-forb very tall woodland to open forest	U22
Snow Gum – Epacris breviflora – Leptospermum myrtifolium tall woodland to open forest of drainage depressions	U23
Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies	U27
Snow Gum – Mountain Gum – Daviesia mimosoides tall dry grass-shrub subalpine open forest	U28
Black Sallee grass-herb woodland in drainage depressions and moist valley flats	U118
Alpine Sallee shrub-grass subalpine mid-high woodland	U158
Jounama Snow Gum – Snow Gum shrubby mid-high woodland on granitoids	U207
Blakely's Red Gum – Yellow Box (± White Box) tall grassy woodland	U19
<b>Tableland</b>	
Yellow Box – Apple Box tall grassy woodland	U178
Ribbon Gum very tall woodland on alluvial soils along drainage lines	p520
Snow Gum grassy mid-high woodland	U78
Red box tall grass-shrub woodland	Q6



## Monitoring

The ACT Government has established a Conservation Effectiveness Monitoring Program (CEMP), which provides a framework for monitoring and evaluating the condition of nature reserves, pressures impacting on them and the effectiveness of management in mitigating threats.

The CEMP will gather monitoring data collected across government and non-government sectors and report in a coordinated format that supports adaptive, evidence-based decision making. The CEMP has identified eight ecosystems for which individual monitoring programs will be designed, including lowland upland woodlands (ACT Government, 2017a).

Monitoring programs that contribute to adaptive management of lowland grassy woodlands include:

- » surveying and monitoring woodland species such as Striped Legless Lizard, Superb Parrot, Button Wrinklewort, Canberra Spider Orchid and Small Purple Pea. Conservation Research also conduct longitudinal studies of groundcover flora condition in grassy ecosystem sites
- » citizen science activities undertaken by groups such as the Canberra Ornithologists Group, Frogwatch and ParkCare, and research under the Mulligans Flat–Goorooyarroo Woodland Experiment.
- » the long-term Canberra Ornithologists Group Woodland Bird Monitoring program, which is undertaken across ten Canberra Nature Park reserves.

## Connectivity research

Fragmentation of woodland areas caused by clearing has meant that many areas of habitat are reduced to small, isolated patches. Without corridors to connect patches of habitat, native wildlife populations are less likely to survive. The EPSDD has worked towards developing large networks that connect patches of high-quality vegetation.

To support this work, CSIRO published *Flyways and Byways: Guiding restoration of wildlife corridors* in 2014 (Doerr, et al., 2014), which followed earlier work by Barrett and Love (2012). This research highlights the importance of scattered trees to improving woodland connectivity. The CSIRO research found that gaps between trees of less than 150 metres provided connectivity for movement-limited species that occupy woodland habitat. It also found that keeping inter-patch distances between 1 and 1.3 kilometres would benefit woodland specialist species while also inhibiting the abundance of exotic invasive species. The research recommended that these findings inform the planning of restoration efforts. This information, used in combination with connectivity mapping tools available through ACTmapi, is important for woodland management.

## CLIMATE CHANGE RESEARCH

Understanding the impacts of climate and potential future scenarios are important considerations when it comes to protecting, managing and conserving woodland ecosystems.

### Biodiversity adaptation pathways

Biodiversity Adaptation Pathways are an approach to help decision makers plan for and respond to a changing climate.

The Biodiversity Adaptation Pathways Project ran a series of workshops with the natural resource management community in 2015 and 2016 to consider future climate impacts and social drivers of change for the ACT and region, with a focus on lowland grasslands, lowland woodlands and aquatic ecosystems.

These workshops identified four areas of priority work:

- » Strengthening climate ready objectives of policies, strategies and plans in order to support the implementation of adaptive management principles
- » Identifying climate refugia for key species
- » Monitoring for biodiversity climate adaptation
- » Managing data and information to strengthen decision-making and collaboration (ACT Government, 2018a)

### Eucalypt dieback

Dieback refers to the gradual deterioration of health in trees, sometimes leading to tree death. Dieback is usually caused by a combination of factors, such as disease and pathogens, insect attack and/or stressful climate conditions.

While dieback affects many species in the ACT and NSW regions (including *Eucalyptus viminalis*, *E. bridgesiana* and *E. melliodora*), recent observations supported by satellite imagery have recognised a significant increase in the incidence of dieback in Blakely's Red Gum. Dieback of Blakely's Red Gum appears to affect any age class and is occurring across rural landscapes, urban environments and reserves within the ACT.

High rates of mortality among younger trees have resulted in a lack of successful maturation across the ACT landscape. If younger trees are unable to replace the older, dying trees, the population will slowly thin out.

A great deal of uncertainty surrounds the cause of Blakely's Red Gum dieback in the ACT, which is thought to be the result of a number of stress-inducing factors, impacts associated with climate change and reduced resilience within the landscape.

Future research into the long-term, broader landscape process that might be causing dieback is being progressed. Research can provide a greater understanding surrounding:

- » the impact of different 'times since fire' on the intensity of dieback in Blakely's Red Gum
- » the interaction between Noisy Miners (*Manorina melanocephala*), psyllids, loss of understory vegetation and loss of small woodland birds
- » the effect of climate change and drought events on Blakely's Red Gum and associated ecological community
- » soil condition and its correlation with Blakely's Red Gum health
- » how conditions are changing spatially and temporally, and how they are affected by different treatments, through the establishment of long-term monitoring sites of Blakely's Red Gum
- » genetic and greenhouse trials of local provenance and provenance from other regions
- » which other species may be affected by dieback now and into the future.

A spatial and temporal analysis of the distribution and health of Blakely's Red Gum has been undertaken to determine the rate and extent of dieback across the ACT over time (ACT Government, 2017c).

## CLIMATE READY REVEGETATION

Modelling future climate change conditions provides important information to guide woodland restoration across the Territory.

### Biodiversity refugia

The ACT Government is conducting a biodiversity refugia investigation to determine which species and areas will be suitable for restoration projects under predicted climate change scenarios. This works with the recommendations provided in Climate Ready Revegetation. Distributions of local species are being modelled with predicted future climate conditions to determine where they might best survive. Native species outside the ACT that are likely to expand their range are being included in the investigation (ACT Government, 2018a).

The model-predicted future distribution of vegetation is informing current management activities undertaken by the ACT Government (e.g. such as fire management and restoration activities).

### Climate change and restoration projects

A guide has been published to assist land managers in preparing Climate Ready Revegetation (Hancock, et al., 2016) and advises using climate modelling to determine the most appropriate species and provenance for revegetation projects.

Analysis of genetic variability in Yellow Box remnant and restoration sites (including sites in northern ACT and north of the ACT border) has been undertaken to investigate the relationship between the genetic variability of vegetation at these sites and the likelihood they will successfully adapt to the impacts of climate change (Broadhurst 2013).

Research illustrating the importance of several factors for successful ecological restoration in a changing climate has been undertaken, including soil condition (Prober et al. 2014a, Prober et al. 2014b) and exploitation of genetic variability and provenancing in plant species (Prober, et al., 2015).

Research and modeling has also been carried out to consider the likely impacts of climate change on structure, processes and biodiversity of temperate grasslands and grassy woodland communities across southeast Australia (Prober, et al., 2012).



## COMMUNITY ENGAGEMENT

Awareness and education about the value and importance of woodlands has become significant in the ACT. The following initiatives are some examples that encourage awareness and involvement from the broader community towards restoring and protecting woodlands. The list is not exhaustive.

### Canberra Nature Map

The Canberra Nature Map website was launched in 2014 and provides a user-friendly platform for members of the public to upload geotagged photos of flora and fauna and have them verified by the website's expert moderators. Canberra Nature Map continues to grow, and is an important community-generated dataset.

### Woodland Flora Field Guide

The *Woodland Flora: a Field Guide for the Southern Tablelands* (Sharp, et al., 2015) is a woodland flora field guide published in 2015. It provides user-friendly information on 440 woodland flora species that occur in the Southern Tablelands.

### Vegwatch

Vegwatch is a community science monitoring program designed around the ACT Vegetation Survey and Monitoring Manual (Sharp & Gould, 2014). The Molonglo Catchment Group have tested the repeatability and robustness of volunteer data gathered using the manual against data gathered by professionals using the same process. The project found that the manual was a suitable tool for a community-based biodiversity survey.

### ParkCare and Landcare Groups

ParkCare and Landcare groups continue to undertake restoration projects across the ACT. Some important activities involve erosion control, weed treatment and tree planting. Interpretative walks are facilitated by ParkCare groups throughout the year. Three new ParkCare groups have been established since 2013: Friends of Black Mountain, Friends of Mt Pleasant, and Urambi Hills ParkCare Group.

### Southern Tablelands Ecosystem Park

The Southern Tablelands Ecosystem Park at the National Arboretum is an education forest that allows visitors to learn about and identify trees and plants of the Southern Tablelands, in particular trees and plants of the Yellow-Box Red-Gum Grassy Woodland ecosystem.

### Friends of Grasslands Forum

In 2014, Friends of Grasslands held the *Grass half full grass half empty? Valuing native grassy landscapes*, which facilitated the meeting of scientists, land managers, conservationists and volunteers. The forum covered topics such as weed management, fire, fauna and grazing.

### Caring for Ngunnawal Pathways

Funded through an ACT Government 2016–17 Environment Grants program, the Molonglo Catchment Group founded the *Caring for Ngunnawal Pathways* project. The purpose of the program is to facilitate the sharing, application and integration of Ngunnawal cultural knowledge and traditional land management practices.

### Grassy Woodlands Stakeholder Group

The Grassy Woodlands Stakeholder Group is a consultative committee comprised of representatives from several community groups and experts engaged in conservation and land management. The group discusses issues and exchanges information with the ACT Government to support conservation outcomes for lowland woodlands in the ACT. This includes providing input into the development of ACT Native Woodland Conservation Strategy.

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# APPENDIX 1: PROGRESS AGAINST ACTIONS



Information		
Objectives	Actions	Progress
<p>A. The location, type and ecological condition of all Lowland Woodland in the ACT are described.</p> <p>B. A comprehensive database of Lowland Woodland and component species in the ACT is maintained.</p> <p>C. ACT data is included in national, state and community databases*</p> <p>*In particular the bird database developed and maintained by the Canberra Ornithologists Group</p>	A. Locate, classify, and assess the ecological condition of all remaining Lowland Woodland in the ACT.	<p>Community-scale vegetation mapping and classification is complete.</p> <p>Seven Lowland Woodland vegetation communities have been identified for the ACT. Community descriptions provide important information on community traits (e.g. distribution, extent, condition, and species composition).</p>
	B. Continue to develop and maintain the database of Lowland Woodland to support planning, management and research.	<p>ACTmapi (<a href="http://www.actmapi.act.gov.au">www.actmapi.act.gov.au</a>) is the current publicly accessible database that is able show the distribution of woodland communities and related threatened species across the region. It is an important tool for planning decisions.</p>
	C. Address those woodland elements where there is a lack of information.	<p>The community-scale vegetation mapping that has been carried out for the ACT region will provide detailed community descriptions and will provide further detail on woodlands within the ACT by describing traits such as species composition.</p>
	D. Link data collection to national, state and community databases.	<p>Community-scale vegetation mapping has been carried out to National Vegetation Information System (NVIS) standards, and will be uploaded onto the NVIS site.</p> <p>Canberra Nature Map (<a href="http://www.canberranaturemap.org">www.canberranaturemap.org</a>) is a website that allows citizens to upload images of individual species and their locations, providing data on distribution of various species across the ACT. Moderators ensure that data is accurate. Presence data is incorporated into ACTmapi and the CSIRO Atlas of Living Australia.</p> <p>The ACT Government has a Memorandum of Understanding (MOU) with the Canberra Ornithologists Group (COG) to provide bird survey data.</p>

Protection		
Objectives	Actions	Progress
<p>A. A comprehensive, adequate and representative system of Lowland Woodland areas in the ACT is protected by reservation, or other measures where reservation is not practical or desirable.</p> <p>B. Land development proposals affecting Lowland Woodland are assessed for their ecological impact</p> <p>C. The ACT Heritage Places Register includes lowland woodland.</p>	<p>A. Undertake evaluations of the extent to which protected and other areas managed for conservation contribute to a CAR system.</p>	<p>The Comprehensive, Adequate and Representative (CAR) system requires that the full range of vegetation communities are protected, that the protected area is large enough to maintain ecological viability and the diversity (including genetic diversity) within each community is protected. The required target is 15% of the pre-1750 distribution of each vegetation type.</p> <p>The lowland woodland in the ACT is mostly well preserved to the CAR level, however, vegetation mapping will determine whether any rare woodland communities do not have adequate protection. Snow-gum woodland is not adequately represented in reserves the ACT.</p>
	<p>B. Develop and support appropriate reservation proposals for areas identified for reservation representing:</p> <ul style="list-style-type: none"> <li>• The geographic and ecological extent of the Lowland Woodland communities</li> <li>• Key habitat for threatened and declining species and</li> <li>• Elements that will achieve a CAR system.</li> </ul>	<p>Since 2004 there has been considerable expansion of reserved lowland woodland in the ACT by approximately 2,500 hectares.</p> <p>The introduction of the <a href="#">Environment Protection and Biodiversity Conservation Act 1999</a> (EPBC Act), Environmental Offsets Policy 2012 (EPBC Offsets Policy) and the ACT Environmental Offsets Policy 2015 (ACT Offsets Policy) has resulted in important areas, either threatened ecological communities or threatened species habitat, being identified and conserved as offset areas.</p> <p>Table 1 (page 8) outlines the areas added to conservation reserves over the life of the Strategy.</p>
	<p>C. Identify ecologically important off-reserve areas and determine the most appropriate form of protection (e.g. through LMAs, MOUs, voluntary agreements). Ensure that protection requirements are included in such agreements.</p>	<p>Off-reserve woodlands are located predominantly on rural leases and Commonwealth land.</p> <p>Land Management Agreements (LMAs) are required for rural leases.</p> <p>Offsets on leasehold land are able to be established under the ACT Offsets Policy.</p> <p>Threatened species and communities on Commonwealth Land are protected and managed under the EPBC Act.</p>
	<p>D. Ensure land development proposals are under relevant environmental impact, nature conservation and tree protection legislation.</p>	<p>Potential impacts to threatened species and communities are required to be assessed under the <a href="#">Planning and Development Act 2007</a> (PD Act) and the EPBC Act.</p> <p>The ACT Offsets Policy and EPBC Offsets Policy require that threatened species and communities are assessed under the ‘avoid, minimise, mitigate’ approach. Offsets are required where impacts to a protected matter are unavoidable and offsets are appropriate.</p> <p>The <a href="#">Tree Protection Act 2005</a> (TP Act) ensures that registered or regulated trees (within a tree management precinct) are flagged in a development proposal. Trees outside the tree management precincts are protected under the Nature <a href="#">Conservation Act 2014</a> (NC Act).</p>
	<p>E. Work with the ACT Heritage Council to identify Lowland Woodland suitable for nomination to the ACT Heritage Places Register. Prepare nominations.</p>	<p>The <a href="#">Heritage Act 2004</a> section 42A (2) limits the ACT Heritage Council’s ability to register a place or object if it is already protected under the NC Act. The Council may register a place protected by the NC Act only if that place also has cultural heritage significance, or natural heritage significance of a kind not protected by the NC Act (such as a geological formation).</p>

Threats		
Objectives	Actions	Progress
Threats to Lowland Woodland and component species have been identified and prioritised. Appropriate planning and management actions have been taken to substantially reduce or eliminate threats.	A. Identify and monitor threats (including urban expansion, fragmentation, overgrazing, weed and pest invasion, firewood collection, dieback and fire) to Lowland Woodland and component species.	<p>The Conservation Research Branch in EPSDD has undertaken annual condition monitoring in woodland reserves since 2009 so that emerging threats can be addressed before they become more widespread.</p> <p>The main threats to woodland areas have been identified as:</p> <ol style="list-style-type: none"> <li><b>Urban expansion</b> <ul style="list-style-type: none"> <li>Urban expansion remains a threat to ACT woodlands but is mitigated through the ACT Offsets Policy and the EPBC Offsets Policy which manage the impacts to threatened species that cannot be avoided or mitigated. Under these policies, suitable offsets for impacts are identified and allow areas to be protected in perpetuity.</li> <li>Strategic assessments are used in the ACT to identify potential environmental impacts and appropriate offsets over a larger area, allowing for more of a landscape-scale approach to avoiding, mitigating and offsetting (as opposed to site-by-site). For proposed development areas, strategic assessments need to include a description of the proposed avoidance, mitigation, and offset activities. Offset sites must be monitored.</li> <li>Strategic assessments have been undertaken for the Molonglo Valley, Gungahlin, West Belconnen and the Eastern Broadacre areas.</li> <li>Almost \$120,000 was allocated for restoration and regeneration works over 50 hectares of woodland in ACT nature reserves. This funding is part of an offsets package designed to compensate for loss of Box Gum Woodland from works to the Kings Highway.</li> <li>Agreements under the Gungahlin and Molonglo Strategic Assessments include commitments to enhance around 500 hectares of woodland in ACT reserves. Refer to Table 2 for environmental offsets that protect and enhance lowland grassy woodland.</li> </ul> </li> <li><b>Fragmentation and loss of keystone trees</b> <ul style="list-style-type: none"> <li>Fragmentation and loss of keystone trees may be due to urban expansion, chronic dieback, or issues with recruitment and regeneration meaning that some are not being adequately replaced. In response to fragmentation and funded by the ACT Government, the CSIRO published a report on woodland connectivity in 2014: Flyways and Byways: Guiding restoration of wildlife corridors (Doerr, et al., 2014).</li> <li>This research provides an approach to addressing connectivity for woodland birds, and has been adopted by the ACT Government in restoration activities where needed. Long-term monitoring is underway to determine if habitat connectivity is improved, particularly for birds.</li> <li>The TP Act provides processes to assess the loss of mature trees, however, lag times for recruitment means that there is an ongoing impact.</li> </ul> </li> <li><b>Overgrazing</b> <p>The ACT has some of the highest density populations of Eastern Grey Kangaroos recorded in Australia. Impacts to grassy ecosystems and woodland fauna (particularly to reptiles and invertebrates) have been observed as a result of overgrazing.</p> <p>Kangaroo population and grassland biomass monitoring continues to occur across Canberra Nature Park. Conservation culls are conducted annually in areas that are being negatively impacted. Ongoing research into fertility control continues, and when completed offers another potential tool for effective kangaroo population management.</p> </li> </ol>

Threats		
Objectives	Actions	Progress
<p>Threats to Lowland Woodland and component species have been identified and prioritised. Appropriate planning and management actions have been taken to substantially reduce or eliminate threats. (continued)</p>	<p>(continued)</p>	<p><b>4. Weeds and Pests</b></p> <p>Good quality Box Gum Woodland within the reserve network is a priority area for weed and invasive animal control. Woodland areas within Canberra Nature Park have generally seen a reduction in weed cover and improved native understory condition. Canberra Nature Map has been instrumental in identifying outbreaks of new invasive weeds, including Spanish Heath, Moth Vine and Marsh Marigold. These have been promptly treated and monitored.</p> <p>An overall reduction in weeds has been carried out in woodland areas. In 2015–2016, a targeted search-and-destroy program resulted in 3,600 hectares of weed control, including African Love Grass, Serrated Tussock, and St Johns Wort.</p> <p>The ACT Government is developing the Groundstorey Mapping Project, using LiDAR to map weeds remotely. Mapping is being trialled at 7.5cm and 30cm resolutions, and can remotely estimate the abundance of weeds. Whilst the program is most successful with grasslands, it is proving to work well in open woodlands also.</p> <p>Rabbit control is an area of ongoing work within Canberra Nature Park. Rabbit control work is carried out in Mulligans Flat to eradicate the pest within the Sanctuary's predator proof fence area. The Rabbit Haemorrhagic Disease Virus has been released within the reserve, and has proven successful. This method is now being applied across Canberra Nature Park. Rabbit warrens are recorded by ParkCare groups using the Collector app, and warrens are treated by Parks and Conservation Service staff.</p> <p>Pigs are present in low densities in the Molonglo River Reserve and Rob Roy Reserve, with occasional sightings in other reserves. Control occurs via trapping or baiting.</p> <p>Deer populations are increasing in Canberra and present an emerging threat to native ecosystems including Box Gum Woodland. Further research and potential action is required. Indian Myna is a common and aggressive species which competes with other hollow nesting birds, often displacing them. An Indian Myna community trapping program was implemented in 2005 and continues to significantly reduce the abundance of the birds in urban areas. Further management may be required to reduce competition with hollow nesting birds such as the Superb Parrot.</p> <p>The Spotted Dove is another exotic species which occurs in the ACT and has the potential to impact on native woodland birds.</p> <hr/> <p><b>5. Coarse Woody Debris</b></p> <p>As an outcome of research carried out in Mulligans Flat, installation of coarse woody debris is now implemented across Canberra Nature Park in an attempt to replace this missing structural element from woodland ecosystems.</p> <hr/> <p><b>6. Dieback and Climate Change</b></p> <p>Dieback among eucalypts is observable in varying intensities across the region. The ACT Government has funded the University of Canberra to conduct a multi-criteria analysis of factors contributing to dieback to determine the cause, and direct planning and management efforts. Climate change is considered to be an underlying factor.</p> <p>Biodiversity Refugia modelling has been carried out within the Conservation Research branch, and is able to predict potential areas for loss or optimal areas for growth for various species under potential future climate scenarios.</p>

Threats		
Objectives	Actions	Progress
Threats to Lowland Woodland and component species have been identified and prioritised. Appropriate planning and management actions have been taken to substantially reduce or eliminate threats. (continued)	(continued)	<p><b>7. Fire</b></p> <p>When planning fuel reduction burns, ecological thresholds for woodland communities are applied as outlined in the ACT Strategic Bushfire Management Plan Version 3. Known environmentally sensitive areas and mature, hollow-bearing trees are protected to the greatest possible extent when burns are conducted in close proximity. However, loss of large trees still occurs and further education and training is required.</p> <p><b>8. Native Species Impacts</b></p> <p>The Noisy Miner is being observed within woodland areas; research indicates it poses a threat to smaller woodland birds, and can contribute to tree dieback.</p> <p>Rainbow Lorikeets occur in the ACT (possibly escaped aviary birds) and have the potential to impact on native woodland birds.</p>
	B. Prepare and implement threat abatement responses.	<p>In response to this issue of fragmentation, two nominations for key threatening processes are underway. The ACT Conservation Council has nominated the 'Loss of Hollow-bearing trees as a Key Threatening Process' and has been under review by the ACT Scientific Committee.</p> <p>The Scientific Committee has nominated 'Unnatural Fragmentation of Habitat as a Key Threatening Process'.</p> <p>If listed, these trigger the development and implementation of Threat Abatement Plans.</p>
	C. Monitor effect of threat abatement measures.	<p>Conservation monitoring is carried out under the Conservation Effectiveness Monitoring Program (CEMP). It provides a framework for monitoring the condition and long-term changes across ACT ecosystems, and creates a standard monitoring program to observe the effect of management actions and support land management decisions.</p> <p>VegWatch, run by the Molonglo Catchment Group, is a community science monitoring program that has run since 2012. It allows citizens to take part in monitoring the effects of management actions such as weed control, burns or other restoration activities. Six woodland sites are monitored under this program.</p>

Planning		
Objectives	Actions	Progress
<p>A. The Lowland Woodland Conservation Strategy and up-to-date ecological information is the major basis for assessing planning decisions impacting on conservation of Lowland Woodland and component species.</p> <p>B. Government and non-government organisations recognise the values of Lowland Woodland and component species and incorporate their conservation requirements in planning, development and land management activities.</p> <p>C. Woodlands and woodland remnants are assessed for their contribution to supporting protected areas and maintaining ecological connectivity across the ACT.</p> <p>D. Lowland Woodland Conservation contributes to targets established in the Murrumbidgee Catchment Blueprint through meeting targets in the ACT Natural Resource Management Plan.</p> <p>E. Co-ordinated arrangements for the protection of Lowland Woodlands are established across the region.</p>	<p>A. Consult with all government and non-government parties participating in ACT and regional planning processes to ensure that information on the conservation significance of lowland woodland and component species is incorporated:</p> <ul style="list-style-type: none"> <li>• into strategic planning for the ACT and region, and</li> <li>• at an early stage, into planning for urban and other development in the ACT, and</li> <li>• into development control and management plans.</li> </ul>	<p>In 2012, the ACT Government published its Nature Conservation Strategy 2012-2023. The Strategy acts as a guide for a coordinated and integrated approach to nature conservation across a range of sectors, including land management, planning, business and community. According to the Implementation Plan 1 (2013-2018), by December 2015, 28 out of 68 milestones were on track, while 8 were behind schedule. A second Implementation Plan is due by the end of 2018.</p> <p>The NC Act provides for listing of threatened ecological communities, threatened native species and protected native species and for the preparation of action plans. It includes a range of offences and penalties.</p> <p>Strategic assessments administered under the EPBC Act for large scale development proposals in Gungahlin and Molonglo areas has resulted in the mapping of all threatened species and communities within the proposed development areas, as well as the identification of possible environmental impacts, mitigation measures, and potential offset areas. Strategic assessments provide the ability to assess cumulative impacts associated with proposed developments over a broad area, and potentially achieve conservation outcomes at the landscape level, helping to avoid gradual loss and inefficient use of offsets. Strategic assessments require consultation with external stakeholders.</p> <p>Offsets and their associated Offset Management Plans have resulted in the protection of woodland areas through rezoning and conservation management actions.</p>
	<p>B. Proposals assessed under the <a href="#">Land (Planning and Environment) Act 1991</a> include information on woodlands and their component species.</p>	<p>The PD Act and Territory Plan determine the assessment track required for development approval (Code, Merit, or Impact).</p> <p>Proposals under the Impact Assessment track require an Environmental Impact Statement (EIS); these are required for developments that intend to clear more than 0.5 hectares of native vegetation (or 5 hectares if the land is zoned as a Future Urban Area). The EISs needs to detail the environmental values of the proposed development site and the potential impacts. Threatened woodland communities and their component species must be included.</p> <p>The Conservator of Flora and Fauna may determine that the development will not have a significant adverse impact. Combined with EPBC Act and ACT offset requirements, urban expansion generally occurs away from good quality Box Gum Woodland areas.</p>

Planning		
Objectives	Actions	Progress
<p>A. The Lowland Woodland Conservation Strategy and up-to-date ecological information is the major basis for assessing planning decisions impacting on conservation of Lowland Woodland and component species.</p> <p>B. Government and non-government organisations recognise the values of Lowland Woodland and component species and incorporate their conservation requirements in planning, development and land management activities.</p> <p>C. Woodlands and woodland remnants are assessed for their contribution to supporting protected areas and maintaining ecological connectivity across the ACT.</p> <p>D. Lowland Woodland Conservation contributes to targets established in the Murrumbidgee Catchment Blueprint through meeting targets in the ACT Natural Resource Management Plan.</p> <p>E. Co-ordinated arrangements for the protection of Lowland Woodlands are established across the region.</p>	<p>C. Work with other agencies (development and infrastructure) and landholders (especially rural lessees and Commonwealth agencies) to prevent minimise further fragmentation and maximise connectivity of Lowland Woodland and encourage activities aimed at improving viability of Lowland Woodland remnants.</p> <hr/> <p>D. Work with NSW agencies to develop, implement and promote measures of protection of Lowland Woodland communities in the region.</p>	<p>Funded woodland restorations projects in the ACT and greater Goorooyarroo areas involves collaboration with other agencies to achieve restoration outcomes.</p> <p>The ACT Government works in partnership with agencies including Greening Australia, the Australian National University (ANU), the University of Canberra, rural landholders, ParkCare groups, and Landcare groups.</p> <p>The Mulligans Flat Woodland experiment has encouraged interest from rural landholders, particularly those near the reserve.</p> <hr/> <p>The ACT Government has contributed to the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland National Recovery Plan. The ACT is also part of the national recovery teams for the Superb Parrot and the Regent Honeyeater.</p> <p>The Mulligans Flat Woodland Sanctuary collaborates with NSW agencies, particularly with regard to translocations: the Brown Treecreeper, New Holland Mouse and Bush Stone Curlew were sourced from NSW populations.</p> <p>Kosciusko to Coast (K2C) operates with South East NSW landholders, but regularly meets with ACT representatives to align policies.</p> <p>The ACT and Region Catchment Management Coordination Group was developed in 2015 to address the impacts of land development and urbanisation on the catchment at a regional level.</p> <p>The Ginninderry development crosses the ACT/NSW border. The environmental offset for this development, the Ginninderry Conservation Corridor, will be managed as a single unit by a conservation management trust to ensure consistency in management across the border.</p> <p>The ACT Government provided comments on the NSW Draft South East and Tablelands Regional Plan, particularly in regards to the potential of development along the border in areas with high conservation values.</p> <p>Coordination between NSW and ACT remains important where reserves cross the border (Goorooyarroo Nature Reserve) and where rural land across the border is adjacent to ACT reserves.</p>

Management		
Objectives	Actions	Progress
<p>A. Best practice management is applied to all Lowland Woodland in the ACT with particular attention to habitat of threatened, uncommon and declining species.</p> <p>B. The ecological condition and habitat quality of the remaining Lowland Woodland communities in the ACT is maintained or improved.</p>	<p>A. Have in place management plans (Public Land) or similar arrangements (other tenures) that reflect commitment to active and effective conservation of woodland remnants.</p>	<p>Reserve Operational Plans are being developed for Canberra Nature Parks, which will identify woodland communities as areas of importance and detail management actions to be undertaken within these areas. A draft Canberra Nature Park Reserve Management Plan is proposed to be released for public consultation.</p> <p>The Draft Molonglo River Reserve Management Plan has recently undergone public consultation. Feedback is currently being processed.</p> <p>A review of the Murrumbidgee River Corridor Reserve Management Plan is due to commence.</p> <p>The revised Lower Cotter Catchment Reserve Management Plan was released in February 2018.</p> <p>Land Management Agreements with rural landholders are in place.</p> <p>Woodland areas on National Capital Authority owned land is strategically managed under management and operational plans that include provisions relating to ecological burning, weeding, and other on-ground works.</p>
	<p>B. Continue to develop and promote ‘best practice’ management of Lowland Woodland and its component species with particular attention to declining and threatened species in the ACT by:</p> <p>(i) Promoting research into conservation management of Lowland Woodland.</p>	<p>Partnerships between ACT Government and research institutions such as the ANU and CSIRO have resulted in ongoing research on woodland restoration and threatened species. Some example include:</p> <p>The Mulligans Flat Woodland experiment, a flagship project leading woodland restoration research, including reintroductions, pest management and woodland restoration.</p> <p>Forb enhancement in Kama Nature Reserve (David Johnson, Fenner School of Environment and Society, ANU)</p> <p>Impacts of urbanisation on woodland birds (Dr Karen Ikin, Fenner School of Environment and Society, ANU)</p> <p>Causes of decline in woodland birds and superb parrot research (Dr Laura Rayner, Fenner School of Environment and Society, ANU; ACT Government Woodland Ecologist)</p> <p>Availability and use of tree hollows and nest boxes (Dr Darren Le Roux, Fenner School of Environment and Society, ACT Government Environment Project Officer)</p> <p>Impacts of kangaroo grazing on birds and reptiles (Dr Brett Howland, Fenner School of Environment and Society, ACT Government Ecologist)</p> <p>Connectivity research (CSIRO).</p>
	<p>(ii) Identifying and prioritising activities for regeneration and restoration of Lowland Woodland.</p>	<p>As part of the Molonglo development offset, Barrer Hill, Kama Nature Reserve and the Arboretum Woodland are currently undergoing restoration activities, aiming to restore sites of varying condition to high quality woodland.</p> <p>The Molonglo Adaptive Management Strategy provides guidelines for restoration of suitable sites.</p> <p>Active research, such as the Mulligans Flat Sanctuary project, guided and identified priorities for restoration activities.</p>

Management		
Objectives	Actions	Progress
<p>A. Best practice' management is applied to all Lowland Woodland in the ACT with particular attention to habitat of threatened, uncommon and declining species.</p> <p>B. The ecological condition and habitat quality of the remaining Lowland Woodland communities in the ACT is maintained or improved. (continued)</p>	(iii) Develop and apply an 'adaptive management' approach linking research and monitoring to management.	<p>Publication and reporting of research results ensures that recommended management guidelines as a result of research finds are taken into consideration in policy and management guidelines. For example, following the results of the coarse woody debris experiments in Mulligans Flat, the recommended treatments are now being applied across Canberra Nature Park woodlands and offset areas.</p> <p>Implementation of the CEMP will provide an adaptive management approach for linking research and monitoring to management actions through the detection of changes in ecosystem condition.</p>
	(iv) Developing 'best practice' management guidelines for managers of all land tenures and community groups to apply when undertaking woodland restoration activities.	<p>Restoration research at Mulligans Flat is ongoing and regularly published.</p> <p>A woodland restoration plan to guide restoration activities was prepared in 2014 for the Barrer Box-Gum Woodland in the Molonglo River Park (SMEC, 2014).</p> <p>Management guidelines were prepared in 2015 to guide restoration and management in the Molonglo River Reserve (ACT Government, 2015).</p> <p>CSIRO prepared a report for guiding restoration of wildlife corridors and how to improve woodland connectivity (Doerr, et al., 2014).</p> <p>Guidelines have been published on how to plan revegetation projects for the changing climate (Hancock, et al., 2016).</p>
	C. Reviewing management of Lowland Woodland areas in government horse paddocks and agisted land to ensure ecological condition is enhanced	<p>The Hall, Hackett and Rose Cottage Horse Holding Paddocks contain woodland areas.</p> <p>Management of the horse paddock complexes is through a Service Level Agreement between the ACT Government and Territory Agistment. The Agreement includes the following requirement "manage areas identified with high environmental significance such as yellow box and red gum woodlands in accordance with Action Plan 27".</p>
	D. Taking into account the known conservation requirements of component flora and fauna species (in particular, declining and threatened species) in management of Lowland Woodland.	<p>Threatened Species and Threatened Ecological Community Action Plans include requirements for threatened species. It is assumed that other native fauna and flora will benefit from management actions in woodland managed for threatened species.</p> <p>Lowland woodland within Canberra Nature Park is addressed in Reserve Management Plans.</p>
	E. Liaise with Commonwealth agencies responsible for managing National Land containing Lowland Woodland and habitat for threatened species, and keep the MOUs with those agencies under review.	<p>Threatened species and communities on Commonwealth Land are protected and managed under the EPBC Act.</p> <p>Following a change in policy, ACT Government has pulled away from joint agreements/MOU on Commonwealth land containing threatened species and communities because they are protected under the EPBC Act.</p>

Community/landholder involvement		
Objectives	Actions	Progress
<p>A. Landholders, community groups and others are actively involved in Lowland Woodland Conservation.</p> <p>B. Lowland woodland sites, their managers and the community are linked together in a Conservation Management Network.</p>	<p>A. Encourage the involvement of landholders, community groups and others in the protection and management of Lowland Woodland.</p>	<p>Canberra Nature Map allows the public to report flora and fauna sightings in the ACT, which are then confirmed by local experts. The website encourages community awareness of biodiversity and conservation.</p> <p>The ParkCare Facilitator and ParkCare Support Officer assists volunteers and ensures best management practices takes place. Three new ParkCare groups have established since 2013: Friends of Black Mountain, Friends of Mt Pleasant and Urambi Hills ParkCare Group.</p> <p>The Southern Tablelands Ecosystem Park (STEP) located at the National Arboretum encourages community participation, education and awareness of woodland diversity and conservation.</p> <p>Three community catchment groups (Southern ACT Catchment Group, Ginninderra Catchment Group, and Molonglo Catchment Group) are heavily involved in woodland protection and management in the ACT.</p> <p>ParkCare groups need resources to restore highly degraded areas within parks. Providing resources for proposed work in degraded areas could utilise this valuable work force while improving sites that are often most visible and well used.</p> <p>Working with rural landholders on conservation and restoration projects remains a priority. Further support is required to accommodate land management interest from schools and community groups such as the scouts, to educate and engage younger generations on environmental values.</p>
	<p>B. Facilitate information and skills exchange between stakeholders aimed at achieving best practice management of Lowland Woodland.</p>	<p>ParkCare forums enable ParkCare volunteers to communicate successes and challenges. Ten of the ParkCare groups perform interpretive walks at least annually for the public to attend.</p> <p>The ACT Government Conservation Research branch runs an annual conference called EcoFocus, attended by staff, scientists, conservationists, ecologists, and more from institutions such as ACT Government, the ANU, the University of Canberra, and Greening Australia to communicate projects and results.</p> <p>A grass identification course is run every two years for staff, contractors and volunteers to assist in weed identification.</p> <p>The catchment groups run workshops and information sessions for landholders and the general public.</p> <p>A woodland flora field guide has been published for the southern tablelands region (Sharp, et al., 2015).</p>

Community/landholder involvement		
Objectives	Actions	Progress
<p>A. Landholders, community groups and others are actively involved in Lowland Woodland Conservation.</p> <p>B. Lowland woodland sites, their managers and the community are linked together in a Conservation Management Network. (continued)</p>	<p>C. Encourage the formation of an ACT and NSW regional Conservation Management Network (CMN) for Lowland Woodland building upon the existing NSW CMNs.</p>	<p>The local NSW CMN is no longer active. Other groups including Kosciuszko 2 Coast, Landcare and Land for Wildlife currently fill this role.</p> <p>Community groups including Friends of Grasslands, the Molonglo Catchment Group, Ginninderra Catchment Group and Southern ACT Catchment Group all cross the border into NSW.</p> <p>The ACT Region Catchment and Landcare Association is based on the three catchment groups in the ACT region</p> <p>The Mulligans-Goorooyaroo Woodlands Experiment is a cross-jurisdiction collaborative project achieving successful conservation and restoration outcomes in woodlands and woodland connectivity.</p>
	<p>D. Investigate opportunities for voluntary agreements and incentives for land managers to conserve Lowland Woodland and component species.</p>	<p>Incentives and grants are available for landholders, however take up of these is generally low. Encouragement is required for landholders to participate in conservation activities. Those that do participate should also be acknowledged.</p> <p>The Environmental Stewardship Program provides experience on working with private landholders to conserve box-gum woodland and could be drawn on for guidance.</p>

Threatened or uncommon plants	
Key Action	Progress
<p><b>A Leek Orchid (Tarengo Leek Orchid)</b> (<i>Prasophyllum petilum</i>)</p> <p>Seek an alternative location for a future cemetery and minimise future burials within the Hall Cemetery.</p> <p>Prepare a new management plan based on accurate mapping of the location of the graves and plants.</p>	<p>Annual site inspections are performed with Cemeteries ACT to provide management advice. Conservation Research is working with ACT Cemeteries to relieve pressure on the woodland areas.</p> <p>Conservation Research has prepared a Management Plan for the Cemetery to ensure best practices applied. A number of new grave sites have been allocated to areas of lower ecological value because the moratorium on new burials was lifted.</p> <p>The location of all plants have been marked since 1995; the population appears to have increased slightly before stabilising over the 25 years of monitoring (Wilson, et al., 2016).</p>
<p><b>Small Purple Pea</b> (<i>Swainsona recta</i>)</p> <p>Investigate reintroduction of plants into the Kambah site from other populations within the region (EACT).</p>	<p>The Kambah population was burnt in June 2011. The burn was patchy and of low intensity. A total of 7-10 plants have been recorded at Kambah since 2002, but only 1 plant was recorded in 2012. The previously unburnt sections of habitat were burnt in autumn 2013. No new recruitment has been observed since 2013, despite other disturbance sensitive forbs responding well.</p> <p>Translocations are planned to increase the genetic diversity and improve seed viability.</p> <p>A seed orchard is currently being established at the ANBG. Once these are established, translocations to Molonglo and Kambah will take place.</p> <p>Translocation to Williamsdale has taken place.</p> <p>Canberra Nature Map includes additional records of occurrence and abundance, including the identification of a new population.</p> <p>Monitoring is ongoing; during the 2016 surveys the Mt Taylor population had a 41% increase, with 149 individuals counted. Only two plants were recorded in Kambah, one of the lowest counts on record. Four plants were counted in the Caswell Drive population (Wilson, 2017).</p>
<p><b>Austral Toadflax</b> (<i>Thesium australe</i>) and <b>Hoary Sunray</b> (<i>Leucochrysum albicans</i> var. <i>tricolor</i>) and rare species.</p> <ul style="list-style-type: none"> <li>Maintain a database of known occurrences and abundance to enable analysis of changes in distribution and abundance.</li> <li>Consider listing if any of the species are declining in extent and abundance.</li> </ul>	<p>The Hoary Sunray and Austral Toadflax are listed under the EPBC Act and will be included on the NC Act lists under processes to align ACT listings and those of the Commonwealth.</p> <p>Submissions to Canberra Nature Map have expanded records of occurrence and abundance of a number of rare species in the ACT. As a result of the number of these additional sightings, 25% of species on the non-statutory rare plants list have been removed.</p>
<p><b>Eucalypt outliers</b></p> <p>Maintain a register of plants and encourage regeneration through fencing and weeding.</p>	<p>Spatial data is maintained by the ACT Government for all known occurrences of eucalypt outlier species. Protection measures are instigated as needed during development activities (e.g. fencing).</p> <p>In 2015, fifteen Black Gums (<i>Eucalyptus aggregata</i>) in Kowen were inspected. While the trees were healthy, regeneration was being impacted by sheep grazing. Sheep camping in summer combined with high levels of Serrated Tussock may impact long-term survival. In 2016 surveys, no seeds were observed. Seed collection and fencing was planned to take place in 2017.</p> <p>White Box (<i>Eucalyptus albens</i>) remains on site and regeneration is occurring.</p> <p>River Red Gum (<i>Eucalyptus camaldulensis</i>) remains on site, regeneration is taking place.</p>
<p><b>Snow Gum Woodland</b></p> <p>Priorities for management and protection of all remaining Snow Gum woodland areas that are partially modified or moderately modified, where these are ecotonal between woodland and grassland.</p>	<p>Spatial data is maintained by the ACT Government for all known locations, including condition assessments. Areas within nature reserves are subject to appropriate management.</p> <p>Vegetation mapping across the ACT has enabled extent, condition and prioritisation of lowland Snow Gum Woodland in the ACT. Rob Roy nature Reserve is now protected (which includes a Snow Gum population). Snow Gum Woodland in the ACT, however, is still not adequately protected in reserves.</p>

Threatened or uncommon animals	
Key Action	Progress
<b>INFORMATION</b>	
Identify key habitats and potential habitats for threatened, declining and rare woodland species, and areas of high biodiversity, based on database records held by Environment ACT and other organisations such as COG.	<p>Spatial data has been collected and maintained by the ACT Government for all species.</p> <p>Targeted surveys of the Superb Parrot breeding areas are ongoing.</p> <p>An agreement between the ACT Government and COG allowing access to their comprehensive bird records is ongoing.</p>
<b>PROTECTION AND MANAGEMENT</b>	
<p>Protection of habitat: Give priority for habitat protection and conservation management to woodland patches, particularly threatened species habitat, or those that are large or have complex habitat structure.</p> <p>Evaluate and implement the most appropriate form of habitat protection (Reservation, Memorandums of Understanding, Land Management Agreements, Directions by the Conservator of Flora and Fauna).</p>	<p>Key habitat areas are identified in all assessable developments, and continue to be identified during strategic assessments. For example, the Little Eagle nesting sites have been precluded from proposed urban developments; additionally, monitoring by the developer has provided important information about the abundance and movements of the Little Eagle in the ACT.</p> <p>Woodland bird habitat information has been collected as part of the Gungahlin Strategic Assessment. Key woodland habitat at Throsby has been added to the reserve network.</p> <p>A range of mechanisms are used to secure woodland outcomes across tenure.</p>
<p><b>Maintenance and enhancement of connectivity:</b> Give priority for habitat protection and restoration (re-creation of connections) to connections between woodland patches, particularly between large patches or between threatened species habitat and other woodland patches. Connections include corridors (which should be &gt;25 m wide) and ‘stepping stones’ (woodland patches within 1 km of other patches) (Hooded Robin, Brown Treecreeper).</p>	<p>Connectivity analysis has identified woodland bird habitat quality, and determined how connectivity between habitats can best be enhanced through restoration efforts. The Restore ACT and Greater Gorooyaroo Woodland project was funded by the Australian Government Clean Energy Future Biodiversity Fund and the ACT Government. It aimed to protect and enhance the Box Gum woodlands across ACT nature parks and the Greater Gorooyaroo area. The program restored five distinct woodland blocks: the Murrumbidgee River Corridor, Greater Gorooyaroo, Majura Valley, Callum Brae, and Belconnen Hills.</p> <p>On behalf of the ACT Government, the NSW National Parks and Wildlife Service identified woodland and forest habitat values and key linkages. This analysis is guiding 1,500 hectares of restoration within woodland restoration projects totalling \$6 million across the ACT and neighbouring NSW. Monitoring of the effectiveness of improved connections is undertaken. The connectivity mapping is publicly available (through ACTmapi) and is being utilised in ACT planning and development decisions. For example, it influenced the location and type of faunal crossing points along the Majura Parkway and was utilised in the Gungahlin Strategic Assessment. The data can be rerun in the future to determine how connectivity value has been impacted by development and restoration.</p> <p>The Flyways and Byways: Guiding restoration of wildlife corridors report (Doerr, et al., 2014); funded by the ACT Government, highlights the importance of scattered trees to improving woodland connectivity. The research found that gaps between trees of less than 150 metres provided connectivity for movement-limited species that occupy woodland habitat. It also found that by keeping inter-patch distances between 1 and 1.3 km would benefit woodland specialist species, while also inhibiting the abundance of exotic invasive species.</p>

Threatened or uncommon animals	
Key Action	Progress
<p><b>Maintenance of woodland remnants and isolated paddock trees:</b> Measures should be taken to protect woodland remnants (small isolated patches and tree clusters, road verges) and paddock trees, particularly large mature trees on fertile soils or trees known to be used by threatened species. Measures such as encouraging efforts by landholders and conservation groups should also be taken to ensure replacement of paddock trees, particularly species with potential to develop nest hollows and winter flowering eucalypts. (Painted Honeyeater, Regent Honeyeater, Superb Parrot, Swift Parrot).</p>	<p>Research has found that large, hollow-bearing trees in the urban environment are important in maintaining local biodiversity. Individual paddock trees and isolated remnants have been mapped and included in connectivity analyses. Trees and isolated remnants of high connectivity value or potential are the focus for restoration and protection. Retention of trees is encouraged.</p> <p>A nomination for the ‘Loss of Hollow-bearing Trees as a Key Threatening Process’ has been submitted to the ACT Scientific Committee by the ACT Conservation Council. Criteria used to justify the nomination are impacts to the threatened species including the Superb Parrot, Brown Treecreeper and Glossy Black Cockatoo.</p>
<p><b>Limitation on removal of live and dead timber:</b> Maintain or enhance habitat complexity and protect large, mature eucalypts (a key resource) by limiting the removal of standing living and dead timber, particularly where other land uses, such as rural activities, road and service easements, and public land that is managed for recreation or other intensive uses. This management action should be given priority in habitat for threatened species that require structural complexity or large mature eucalypts. (Hooded Robin, Brown Treecreeper, Painted Honeyeater, Regent Honeyeater, Superb Parrot, Swift Parrot, Varied Sittella, White-winged Triller).</p>	<p>Maintaining dead timber is a management objective for many of the ACT’s nature reserves.</p> <p>Under the NC Act it is an offence to damage native timber on leased and unleased land, and to damage or take native fallen timber. Activities Declarations for the ACT’s nature reserves prohibit the collection of firewood.</p> <p>Some Land Management Agreements within habitat areas have clauses that restrict clearing of dead standing timber and collection of firewood.</p> <p>Research into the importance of coarse woody debris has demonstrated that preventing timber loss alone may not be enough to support the structure and function of woodland ecosystems. To assist the accumulation of coarse woody debris, the deliberate addition of timber has been trialled in Mulligans Flat Woodland Experiment. Results were able to estimate that the addition of woody debris may be able to fast track ecosystem restoration process between 100 and 200 years. Woody debris is now reintroduced across the ACT’s nature reserves (Manning, et al., 2013).</p> <p>The Barrer Hill Restoration Project within the Molonglo Valley is part of a research project on how modified areas can be restored with vertical habitat structures. Five utility poles and five dead trees were translocated to the Barrer Hill site. The structures contain carved hollows and artificial bark to provide habitat for wildlife (ACT Government, 2017).</p>
<p><b>Prevention of intensive grazing:</b> Measures should be taken to prevent intensive grazing pressure so that habitat complexity is maintained or enhanced. This management action should be given priority in habitat for threatened species requiring structural complexity. On rural leases in the ACT, appropriate levels of stock grazing in Yellow Box – Red Gum woodland will be encouraged through LMAs. (Hooded Robin, Brown Treecreeper, White-winged Triller, Superb Parrot).</p>	<p>Land Management Agreements set grazing rates to support healthy woodland structure and function in areas of higher biodiversity values.</p> <p>The ACT’s high density populations of the Eastern Grey Kangaroo are managed for conservation purposes. The ACT Kangaroo Management Plan and the Eastern Grey Kangaroo: Controlled Native Species Management Plan set out the policy and management directions. Three recent studies are guiding kangaroo management in the ACT:</p> <ul style="list-style-type: none"> <li>• Fertility Control of Eastern Grey Kangaroos: Assessing efficacy of a dart-derived immune-contraceptive vaccine (Wimpenny &amp; Hinds, 2018).</li> <li>• Kangaroos and Conservation: Assessing the Effects of Kangaroo Grazing in Lowland Grassy Ecosystems (Snape, et al., 2018)</li> <li>• Factors influencing Sub-adult Mortality Events in Eastern Grey Kangaroos (Portas &amp; Snape, 2018)</li> </ul>

Threatened or uncommon animals	
Key Action	Progress
<p><b>Maintenance of patches of shrubs or eucalypt regrowth:</b> measures should be taken to maintain or enhance habitat complexity by maintaining patches of shrubs and/or eucalypt regrowth. Priority should be given to habitats for threatened species requiring these features for nesting and shelter purposes. (Hooded Robin, Varied Sittella).</p>	<p>Woodland restoration projects aim to restore shrubby patches, dependent on fire safety guidelines. Restoration and habitat regeneration activities continue to focus on connectivity requirements, wherever possible.</p>
<p><b>Regeneration of habitat:</b> include identified habitat requirements into programs of woodland regeneration and restoration (e.g. regenerating or planting trees with potential to develop nest hollows and food trees such as winter-flowering eucalypts, planting shrub patches). Undertaking regeneration or restoration activities that enhance connectivity between woodland areas. (Hooded Robin, Brown Treecreeper, Painted Honeyeater, Regent Honeyeater, Superb Parrot, Swift Parrot, Varied Sittella, White-winged Triller).</p>	<p>Habitat regeneration is incorporated in Reserve Management Plans and woodland restoration programs. Enhancing bird habitat is a key objective for several reserves.</p> <p>Restoration activities, including the completed ACT Woodlands Program and Restore ACT and Greater Goorooyaroo Woodlands project, identify connectivity requirements whenever possible, according to published CSIRO recommendations (Doerr, et al., 2014).</p> <p>The Barrer Hill restoration project has trialled the translocation of stags with enhanced habitat features. Monitoring has demonstrated success with birds utilising the stags and bats taking up residence.</p>
<p><b>Minimisation of adverse effects of fire:</b> ensure planned burns are carefully managed, particularly those in or near identified areas of faunal significance. The timing and intensity of planned burns should take into account adverse effects on fauna, particularly threatened and declining species, such as disruption of breeding. Areas identified as threatened species habitat should receive the same protective measures against unplanned fire as for other identified areas of fauna significance. (Hooded Robin, Brown Treecreeper, Painted Honeyeater, Regent Honeyeater, Superb Parrot, Swift Parrot, Varied Sittella, White-winged Triller).</p>	<p>Bushfire operations plans are developed annually to manage bushfire, and include consideration of the impact to threatened species. Prescribed, ecological and cultural burns are planned and implemented for selected threatened species. The ACT Strategic Bushfire Management Plan recognises the importance of ecological communities and biodiversity values; fire management plans implement strategies to maintain threatened species and communities. Burns are conducted according to the ecological guidelines published in the Strategic Bushfire Management Plan for the ACT.</p>
<p><b>Minimise nest hollow competition:</b> Discourage use of nesting sites by introduced species such as the Common Starling (<i>Sternus vulgaris</i>), Common Myna (<i>Acridotheres tristis</i>) European Honey Bee (<i>Apis mellifera</i>) through research and, where practical, pest control techniques. The scope for placement of nest boxes should be evaluated. (Brown Treecreeper, Superb Parrot).</p>	<p>A study of the effectiveness of nest boxes in Victoria demonstrated that a large portion of nest-boxes were never used. Nest boxes in younger forests were occupied more frequently but were prone to infestations by introduced insects. It was suggested that an assessment of the ecological and economic benefit of nest boxes in comparison to other strategies for creating and retaining hollow-bearing trees be undertaken (Lindenmayer, et al., 2009).</p> <p>Nest-box occupancy at the Barrer Hill restoration site found that 89% of the nest boxes were occupied by exotic or common native species; however, no rare or threatened species were found to be utilising them (Le Roux, et al., 2015).</p> <p>Research on the Indian Myna has found that habitat fragmentation and urbanisation that are the main drivers behind native bird decline, which simultaneously benefits the Indian Myna (Garrock, et al., 2014a). Community-led culling has resulted in an overall decrease in Indian Myna populations at a local level, though a higher culling rate is required to impact population size (Garrock, et al., 2014b).</p>

Threatened or uncommon animals	
Key Action	Progress
<b>MONITORING AND RESEARCH</b>	
Monitor fauna, particularly threatened, declining and rare species, to determine their long-term trend and status in the ACT and region through compilation of observations and in some cases systematic surveys.	<p>Canberra Ornithologists Group continue to monitor woodland birds at 15 locations (142 monitoring sites) in the key woodland corridors around Canberra, including reserve and leasehold areas. Surveys of birds are done seasonally (four times a year) and some sites have been monitored for 8 to 10 years. The most recent analysis of survey data was in 2011 (Taws, et al., 2011).</p> <p>The Scarlet Robin has been listed as vulnerable, based on long term COG monitoring data and PhD analysis (Dr Laura Rayner).</p> <p>Superb Parrot surveys have been conducted in Throsby and Molonglo to monitor the impacts of development in these areas. Monitoring will be ongoing as per offset commitments.</p>
Encourage and support the continuation of the Canberra Ornithologists Group's monitoring programs, particularly with regard to threatened and declining species.	The ACT Government continues to encourage COG with its bird conservation work.

Threatened or uncommon animals	
Key Action	Progress
<p>Encourage and support research into the ecology and conservation requirements of threatened species, and facilitate the incorporation of research results into Lowland Woodland management. Research priorities for threatened species include:</p> <ul style="list-style-type: none"> <li>• specific habitat requirements and key resources (such as Mistletoe or nesting hollows), including distribution of key habitats</li> <li>• effects of habitat modification, fragmentation and land use practices such as grazing</li> <li>• investigation of movement patterns, particularly in relation to flowering patterns and nectar productivity of key eucalypts and other key resources such as nesting sites ('landscape' species)</li> <li>• breeding success, survival and recruitment rates of breeding populations</li> <li>• dispersal of young birds (particularly in fragmented environments)</li> <li>• nest predators and rates of predation</li> <li>• competition with introduced pests for nest hollows</li> <li>• evaluation of threats to important sites</li> <li>• assessment of potential for augmenting local populations through reintroductions, which could accelerate the extension of the range of the species and increase the probability of long-term viability of local populations</li> <li>• interactions with the other species (such as Mistletoebird and Painted Honeyeater)</li> <li>• distribution and ecology of mistletoes.</li> </ul>	<p>Research as part of the Mulligans Flat Woodland Experiment continues. Outcomes of species reintroductions and restoration research, include:</p> <ul style="list-style-type: none"> <li>• the health response of Bettongs following successful reintroduction (Portas, et al., 2016)</li> <li>• the successful Quoll reintroduction</li> <li>• the successful New Holland Mouse reintroduction</li> <li>• the Bush Stone Curlew introduction</li> <li>• the failed Brown Treecreeper reintroduction – which resulted in increased understanding of reintroduction procedures and habitat preferences (Bennett et al. 2013a)</li> <li>• impacts of land use changes, such as grazing and fire (McIntyre, et al., 2014)</li> </ul> <p>Superb Parrot research has included preferred nest hollow characteristics and dimensions. Further support of this research would further the understanding of Superb Parrot habitat requirements.</p> <p>Regent Honeyeater research (ANU) has resulted in short term data on nomadic Australian nectarivores, a suite of threatened woodland birds, and the flowering phenology of key woodland eucalypt species. Support of further research would result in a comprehensive data set on 'landscape species'.</p> <p>NSW Government has funded habitat restoration and conservation research for the Swift Parrot in the Riverina and Central Coast.</p> <p>Multiple research papers have been published showing the importance of Mistletoe for woodland birds and invertebrates (Watson, 2015). Mistletoe removal needs to be discouraged to retain this resource.</p> <p>Brett Howland's PhD investigated the impact of native grazers on birds and reptiles.</p> <p>Geoff Kay's PhD investigated box-gum woodland conservation in agricultural areas, specifically the impacts on herpetofauna (reptiles and amphibians), and management strategies to improve habitat. This included monitoring the impact of grazing in box-gum woodland (Kay, 2017; Kay, 2016a; Kay, et al., 2016a; Kay, et al., 2017).</p> <p>Karen Ikin's PhD investigated the impact of urban spread on woodland birds, and recommends management strategies to guide future urban planning.</p> <p>Laura Rayner's PhD investigated population dynamics of woodland birds, and recommends management strategies on ecologically sensitive urban design.</p> <p>ACT Government in partnership with ANU have successfully restored Pink-tailed Worm-lizard habitat in the Molonglo Valley.</p> <p>Active research shows that the Noisy Miner (<i>Manorina melanocephala</i>) excludes smaller woodland birds (Bennett, et al., 2015a; Bennett, et al., 2014) and contributes to insect related dieback (Howes, et al., 2014). The species responds well to fragmentation (Berati, et al., 2016; Hall, et al., 2016) and will expand with climate change (Bennett, et al., 2015b). Analysis of complementary threat mitigation strategies suggests that Noisy Miner control is most successful when implemented along with treatment for other threatening processes such as tree cover loss or ground story degradation (Tulloch, et al., 2016).</p>

Threatened or uncommon animals	
Key Action	Progress
<b>NATIONAL AND REGIONAL COOPERATION</b>	
Maintain links with, and participate in national recovery efforts for threatened woodland species to ensure that ACT conservation actions are coordinated with national programs.	The ACT has provided extensive data and input into the development of National Recovery Plans, and is a contributor to the Superb Parrot and Regent Honeyeater recovery teams.
Liaise with the NSW Department of Environment and Conservation with the aim of achieving a coordinated, regional approach to the conservation of threatened bird species, especially in relation to cross-border planning issues.	<p>The ACT Woodland Restoration Project works on rural lands in the ACT and in NSW. Funding from the Commonwealth's Biodiversity Fund was obtained to improve regional woodland, habitat and connectivity in the ACT and cross border.</p> <p>The ACT appears to be a regional stronghold for many woodland birds listed as threatened in NSW such as the Speckled Warbler, Flame Robin, Scarlet Robin and Gang Gang.</p> <p>The ACT Government provided comments on the Draft South East and Tablelands Regional Plan, particularly in relation to woodland connectivity and increased risk of fragmentation with recent changes to Yass Council subdivision rules.</p>
<b>EDUCATION</b>	
Raise community awareness through community liaison and public education, with the aim of fostering protection of threatened woodland species and their habitats.	<p>The Mulligans Flat Woodland Sanctuary is a flagship program of international importance that has attracted media attention and provides a strong education resource for the public.</p> <p>The Southern Tablelands Ecosystem Park at the National Arboretum is an education forest that allows visitors to learn about and identify trees and plants of the Southern Tablelands, in particular trees and plants of the Yellow-Box Red-Gum Grassy Woodland ecosystem.</p> <p>In 2014 the Canberra Nature Map website was launched and provides a user-friendly platform for members of the public to upload geotagged photos of flora and fauna and have them verified by the website's expert moderators. Canberra Nature Map continues to grow, and is an important community-generated dataset.</p> <p>The ACT Government in collaboration with the Grassy Woodlands Stakeholder Group is hosting a Grassy Woodlands Forum in June 2018. The Forum is an opportunity to bring together scientists, researchers, practitioners and community groups to share knowledge and learnings about woodlands and woodland species in our region and inform woodlands management.</p> <p>Funded by the ACT Government 2016-17 Environment Grants program, the Molonglo Catchment Group founded the Caring for Ngunnawal pathways project. The purpose of the program is to facilitate the sharing, application and integration of Ngunnawal cultural knowledge and traditional land management practices.</p>

