

# Bushcare Boosters Module 3

## *The Birds and the Bees of Bushcare*



Participant's Workbook

## Acknowledgements

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Thanks to Waverley Council and Hornsby Shire Council for hosting the pilot workshops for this module.

Front cover photo: Blackbutt Creek in Gordon (Sydney Metropolitan Catchment Management Authority)

Other Photos: Thomas Morgan, Bev Debrincat, Bryan Wyer, Sophie Constable, Bev Debrincat, Joel Winter, Lee Parker, Akos Lumnitzer, David Jenkins, NSW National Trust of Australia, NSW Office of Environment and Heritage.

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Published by Sydney Metropolitan Catchment Management Authority, PO Box 3720, Parramatta NSW 2124. (02) 9895 6207 [www.sydney.cma.nsw.gov.au](http://www.sydney.cma.nsw.gov.au)

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Thanks to the New South Wales Office of Environment and Heritage for permission to reproduce the Fauna Profile Sheets from their publication (2008) Rapid Fauna Habitat Assessment of the Sydney Metropolitan Catchment Management Authority, Department of Environment and Climate Change, Hurstville, and to Martin Shultz for use of his photos.

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This project has been assisted by the New South Wales Government through its Environmental Trust.



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# Contents

<b>About the Bushcare Boosters training modules.....</b>	<b>1</b>
<b>About Module 3.....</b>	<b>1</b>
<b>Learning outcomes for this workshop (Module 3).....</b>	<b>2</b>
<b>1. Introduction.....</b>	<b>3</b>
<b>2. Understanding ecosystems and Fauna relationships.....</b>	<b>4</b>
2.1 Natural change in ecosystems.....	6
<b>3. Elements of habitat.....</b>	<b>8</b>
3.1. Plants.....	9
3.2. Caves, Rocks and Crevices.....	12
3.3. Hollows.....	13
3.4. Leaf litter and debris.....	14
3.5. Soil.....	15
3.6. Water.....	16
3.7. Man-made objects.....	17
<b>4. Animal interactions.....</b>	<b>19</b>
4.1 Territorial behaviour.....	19
4.2. Predation and introduced species.....	20
<b>5. Specific Fauna Requirements.....</b>	<b>21</b>
<b>6. Steps to create a fauna friendly Bushcare site.....</b>	<b>23</b>
6.1. Step 1 – Observe your site.....	23
6.2. Step 2 – Understanding change at your site.....	23
6.3. Step 3 – Fauna habitat management.....	24
6.4. Step 6 – Monitoring.....	25
<b>7. Limitations of urban fauna.....</b>	<b>27</b>
<b>8. Work site exercise.....</b>	<b>28</b>
<b>9. Resources: Publications and websites.....</b>	<b>29</b>
<b>10. Glossary.....</b>	<b>31</b>
<b>Appendix: Fauna in the SMCMA Landscape – Profile Sheets.....</b>	<b>33</b>



# About the Bushcare Boosters training modules

This module is part of the **Bushcare Boosters** workshop program developed by the Sydney Metropolitan Catchment Management Authority as support training material for Bushcare volunteers. Boosters workshops aim to help volunteers value and understand their Bushcare and other on-ground work as part of the big picture of biodiversity restoration across Australia. The program encourages recognition of the interconnectedness of work across all sites, big or small and the contribution it makes to habitat health and landscape change.

The series includes:

- Module 1 – Working safely and weed control techniques
- Module 2 – Bushcare and the Big Picture
- Module 3 – The Birds and the Bees of bushcare

The modules do not need to be completed in numerical order or in their totality. The series has been designed to support a flexible delivery approach that can be tailored to meet the individual needs of each training group. Each workshop in the Bushcare Boosters program can be delivered as a stand alone training event or combined with other modules and field sessions. The modules provide base information which can be altered, added to and tailored to suit the needs of participating volunteers. There are specific learning outcomes for each workshop.

## About Module 3

Module 3 looks at the sometimes forgotten side of the Bushcare equation, the fauna. While it will not give you detailed solutions for every situation, we aim to provide some tips for making your Bushcare project as fauna friendly as possible.

The content of Module 3 is of a general level and is most suitable for volunteers who have some practical experience in the field but who wish to participate in a short refresher course to develop a better understanding of the importance of fauna and the Bushcare techniques that can enhance fauna habitat. It is not aimed at volunteers who have obtained accredited training in environmental restoration. However Module 3 does require some experience in Bushcare to be of most benefit to participants.

# Learning outcomes for this workshop (Module 3)

This workshop has been designed to help you:

- improve your knowledge and understanding of the intrinsic importance of fauna and habitat in Bushcare work
- increase your confidence to manage for fauna habitat on work sites
- take the right steps when planning a 'whole of environment' Bushcare project

## **ACTIVITY 1: GETTING TO KNOW THE GROUP**

**To get to know your fellow Bushcarers in the group, please introduce yourself and tell them the following information:**

- **Your name and the site(s) where you volunteer**
- **What you would like to get out of today's session**

# 1. Introduction

The pressures on our natural environment are many. One of the consequences is the continuing loss of our plant and animal species across the globe. Despite the seriousness of the threats, there are hundreds of success stories across Australia where plants and/or animals have been saved and restored by the timely action of the community.

Your Bushcare site, and the network of Bushcare sites across the landscape, can be the difference between local extinction and survival for some species of native fauna.

## TIP:

In urban areas, both bushland and non-bushland sites (e.g. weedy 'wild' areas, parks, built structures and man-made objects) can provide essential refuge and connections that help support healthy viable populations of many fauna species.

Although much of what Bushcarers do is about plants, to be truly successful at Bushcare we need to look after the whole environment of our site and promote the diversity of life that is possible there.

## ACTIVITY 2: YOUR FAUNA FEELINGS

**Give an outline of what native fauna fascinates you the most and /or what fauna you would like to see on your Bushcare site. Do you have a favourite fauna experience from your Bushcare work?**



*Eastern water dragon*

Photo by: Thomas Morgan



*Silveryeye*

Photo by: Bev Debrincat



*Echidna*

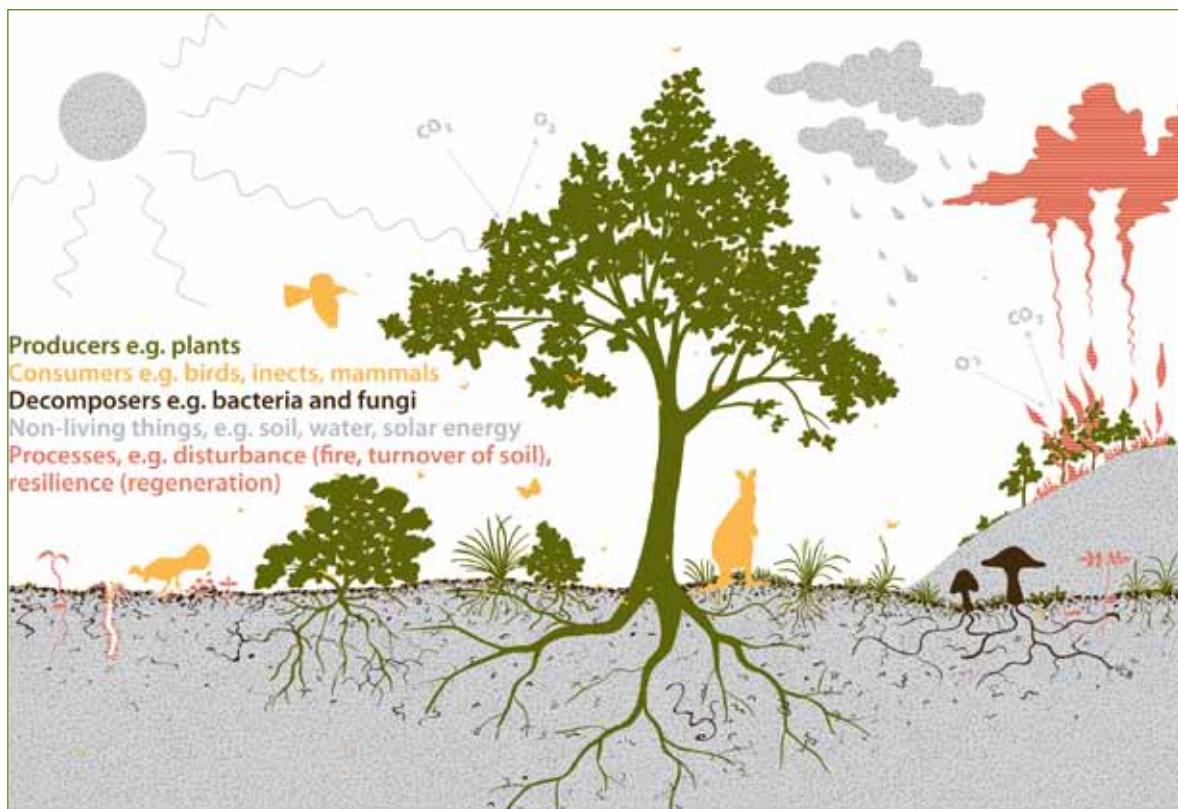
Source: OEH

## 2. Understanding ecosystems and faunal relationships

An ecosystem is made up of the interactions between living things and between living and non-living things. Ecosystems may be considered at different geographical scales, from a grain of sand with its rich microfauna, to a whole beach, to an estuary, to a semi-enclosed sea and, eventually, the whole Earth. At a global level it can include things such as climate change, which evidence shows will change temperature patterns and increase sea level. The way that plants and animals interact with the environment can be very complex and has evolved over many, many thousands of years.

Ecosystems provide services, including:

- provision of clean air
- water filtration
- organic waste recycling
- reducing the impact of flood and drought
- physical and mental benefits.



*A simple ecosystem interaction model*

Source: Virginia Bear

The key to maintaining ecosystem services is maintaining diversity of species (biodiversity). Our focus is on fauna, which interacts with plants, other animals, and physical aspects of the site such as soils, geology, and climate. Our fauna carry out many important roles that help ecosystems survive and thrive. Fauna provide ecosystem services such as:

- pollination of flowers
- spreading seeds and propagules
- grazing on plants
- digging and aerating soil
- create hollows in trees
- pest and insect control

Every landscape element in a given environment may provide habitat for fauna. Before any work is carried out at your site, such as plant and tree removal or the movement of soil or rock, you need to observe (either by formal survey or informally) the fauna relationships at your site.

### ACTIVITY 3: THE FAUNA RELATIONSHIPS AT YOUR BUSHCARE SITE

Our native Australian fauna includes:

- Invertebrates – more than 275,000 species including more than 220,000 insect species
- Fish - more than 4,400 species including 300 freshwater species
- Amphibians – more than 200 species
- Reptiles – around 850 species
- Birds – around 850 species
- Monotremes and marsupials – 2 and 140 species respectively
- Mammals – 270 land-dwelling species

**Of the fauna that you have seen on your site:**

- **What are the features of the site that they are using?**
- **How does your fauna interact with each other?**

**Don't forget what's happening at your feet in the soil! Share the information in small groups.**



*'Green grocer' cicada*

Photo by: Brian Wyer



*'Graphic flutter' dragonfly*

Photo by: Sophie Constable



*Striped marsh frog*

Photo by: Brian Wyer

## 2.1. Natural change in ecosystems

### Succession

The natural environment does not stay still. As plants grow, they in turn influence other plants and may influence the local environment. For example, the environment of a sandstone ridgeline immediately after the passage of a fire is a very different one, from 5, 10, and 20 years later.

A tall Eucalypt forest community in the long term absence of fire may become a rainforest community. Both magnificent in their own right, but quite different in their potential for fauna.

Each stage has its advantages and disadvantages for fauna, with sometimes very noticeable changes occurring to fauna at different stages of the cycle. This means that understanding change at your site, and the likely implications for fauna is important, although sometimes very challenging even for specialist scientists working in this field.

### Disturbance

There are many aspects of the environment that cause major change to habitat. Bushfires, flooding, heavy storms, etc can cause major changes to the makeup of a bushland system. In large reserves the impacts are spread across systems with lots of buffers to change. The result is a “mosaic” of varied habitat features across the landscape that suit a range of fauna species. In smaller urban remnants, disturbance is still essential for many natural processes to occur. But the small and isolated nature of many urban remnants means that large scale disturbance can have damaging effects. Getting the “natural” disturbance balance right is a huge challenge.

Human society can have many impacts on the natural environment. This can include:

- pollution
- changes to bushfire patterns
- changes to water flows
- altering landform features
- clearing vegetation
- introducing weeds and predators
- and many more.



*Little penguin rescue*

Photo by: David Jenkins [www.nomadphoto.com.au](http://www.nomadphoto.com.au)

## ACTIVITY 4: DESCRIBE THE PROBLEMS AT YOUR SITE THAT IMPACT ON LOCAL FAUNA

Most importantly, identify some possible solutions to address the problems.

Problem	Explanation	Is this happening on your site, if so how much of a problem is it?	What can you do about it?
		(yes / no) Minor / Major	
<b>Clearing</b>	Loss of old trees means the loss of shelter, and less connections across the landscape.		
<b>Dumping</b>	May leach contaminants and lead to feral animals and rats taking refuge.		
<b>Runoff and changes to moisture</b>	More water might change local vegetation and therefore change habitat for fauna.		
<b>Weed invasion</b>	Weeds displacing local native bushland can reduce the diversity of food sources for fauna.		
<b>Changed fire patterns</b>	Changes to bushfire patterns can change the structure of native plants at your site, changing habitat type.		
<b>Feral animals</b>	Feral predators can eat local fauna, and grazing animals such as rabbits can compete for food.		
<b>Fragmentation</b>	Most of our bush remnants are now small & isolated. Connecting to other patches allows fauna to move, and also repopulate after a disturbance.		

### 3. Elements of habitat

'Habitat' is all the physical and biological things which collectively make up 'the place' where a plant or animal lives, and the elements of the landscape that it uses to survive and breed.

Important features of the landscape include:

- Plants – types of plants and the stage they are in, in their dynamic life cycles
- Landform features – e.g. slope, aspect, topography
- Geology – the influence of rock material on the shape and surface covering of the land
- Climate – variations of temperature, rainfall, and local influences and micro-climates
- Connectedness – links to other natural areas, populations of fauna, and escape routes
- Land use – human uses of the surrounding landscape

The increasing Australian population and expanding land development has left an increasingly isolated set of natural areas, both large and small. Connectivity is a measure of how well-linked any one natural area is with others.

Connections between natural areas are extremely important for the movement of fauna to:

- repopulate after natural disturbance such as fire
- exchange genetic information (both plants and animals)
- allow movement to areas of more suitable habitat as communities change in structure and dynamics.

As a general rule, the more isolated an area, the less species of plant and animal will be able to be maintained in the long term and the more vulnerable the population will be to extreme events such as drought or fire.

### 3.1. Plants

#### Structure and age of plants at your site

Plants are a fundamental building block for fauna habitat. They provide food, shelter, breeding places and help to define the possibilities for many fauna to occur.

Research has shown that in many instances, the structure of the plants (the height, density, and diversity) is just as important for some species of fauna as the type of plants themselves.

#### TIP:

We often place our own values on vegetation without thinking of how local fauna values and uses aspects of the flora. We might not like long, “untidy” grasses and dead timber and leaves in our garden, but for animals in the bush these might be essential parts of their habitat. When it comes to fauna, we often need to think messy is good, and chaotic is fine. The complete opposite of what we sometimes tell our children!!

This challenges the assumption that in nature (in terms of habitat at least), one type of plant is always better than another. As a general rule, diverse native plant communities make the best habitat, but it is an overgeneralisation to say that, for fauna, non-native vegetation can't play an important role.

In urban situations this means bushland weeds, and also non-native amenity plantings in parks gardens, rail corridors etc. can be habitat for native fauna. For example, lantana can sometimes provide excellent habitat for small birds, reptiles and insects in the absence of suitable native cover. Important habitat can be found in some of the most unusual places. For example a small population of long-nosed bandicoots was found using built structures for shelter in inner-city Dulwich Hill. Investigations showed that weedy refuges may also have helped to protect them from domestic and feral animals. This population is now protected and part of a long term program to expand their numbers.

So before controlling or removing any plants, even noxious weeds, ask yourself: “Whose home could that be?” Remember to consider what is happening underground.

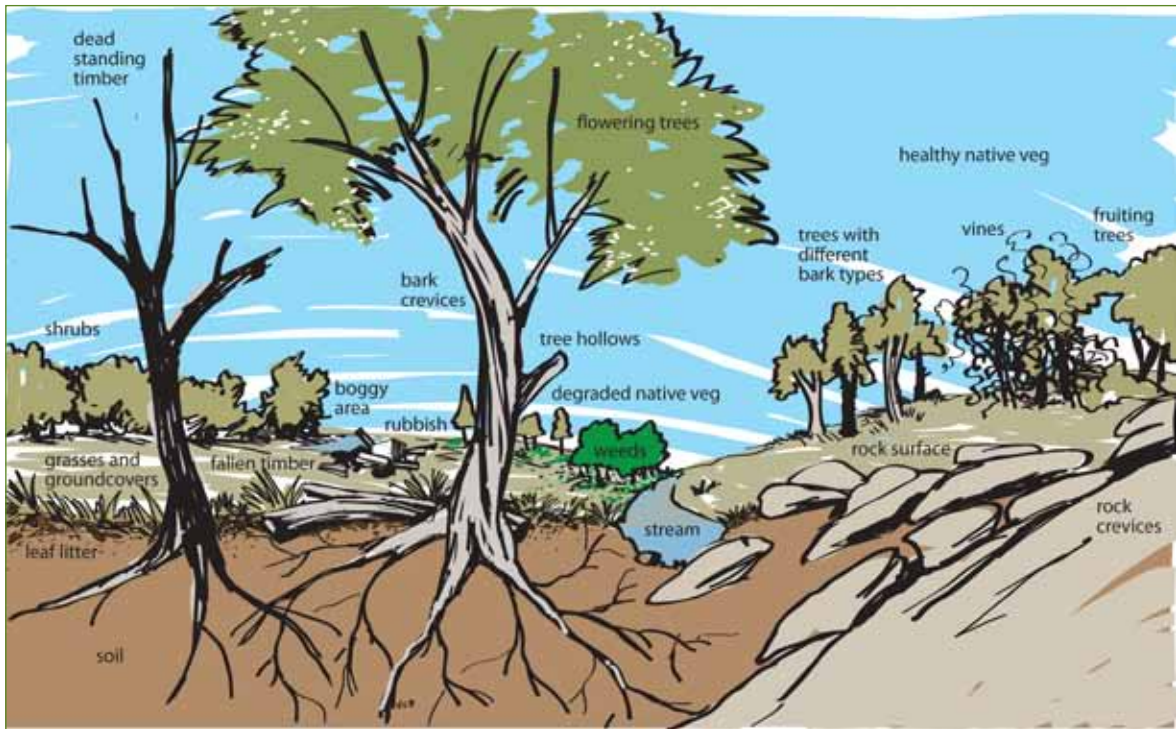


Source: National Trust of Australia (NSW)

The structural elements of the vegetation that need to be considered are the

- Mulch layer
- Ground layer
- Mid storey
- Canopy

Each layer may offer different features to fauna, with some using different layers for different purposes. e.g. nesting in the canopy or grass; feeding in open ground.



*Elements of habitat*

Source: Virginia Bear

### Plant Community Type

A plant community is an assemblage of plants and animals that exist together to make up a particular type of ecosystem. There are quite distinct fauna associations with different plant communities. See Appendix 1 for profiles sheets showing the broad vegetation types in the Sydney region and their importance to fauna.

## ACTIVITY 5: NOMINATE THE PLANT COMMUNITIES OCCURRING AT YOUR SITE.

Type of Bush (Remnant or reconstruction)	Description	What is on your site?  Is there any plant missing on your site that you would like to return? (Note: a site might include a number of different types of vegetation – what is there and where is it?)
<b>Rainforest</b>	Dense at the top with very little light penetrating through to the bottom layers.	
<b>Wet Eucalypt Forest</b>	Tall Eucalypts and similar hard leaved trees (e.g. Turpentines) dominate the top layer of plants. Fairly green and lush in the lower levels.	
<b>Dry Eucalypt Forest</b>	Tall Eucalypts and similar hard leaved trees (e.g. Angophoras) dominate the top layer of plants, with hard dry types of shrubs and ground layer plants below.	
<b>Grassy Woodlands</b>	Scattered medium sized trees with a grassy or scattered shrubby understorey.	
<b>Grasslands</b>	Heavily dominated by grasses and low herb type plants.	
<b>Heathlands</b>	Hard, low and leathery shrubs dominate.	
<b>Wetlands</b>	Areas where water either permanently or temporarily inundates the bush, usually have sedges and rushes as a part of the flora.	
<b>Other features</b>	Fungi, rocks, fallen timber	
<b>Reconstructed area</b>	Areas planted with native species. Even some introduced plantings can have biodiversity value.	
<b>Your own patch</b>	Describe...	

### 3.2. Caves, Rocks and Crevices

Caves, rocks and crevices are essential elements of the landscape for many species. Not only are they useful for protection but many food sources that are important for fauna may be found in these elements of the landscape. Many animals use rocks and rock environments for shelter, modify body temperature, to hide from predators, find food, avoid extreme weather conditions and escape bushfires.

Bush rock is also known to provide egg-laying sites for reptiles. It provides habitat for a number of threatened plant species and a diversity of bryophytes (mosses and liverworts) and lichens. Bush rock also serves a broader function of helping to maintain the macro and micro environment by inhibiting soil erosion, retaining slope stability, reducing the scope and intensity of fires and assisting in preserving soil moisture.

The loss of bush rock can have a dramatic impact on the ability of fauna to survive. This process has been listed as a "Key Threatening Process" under NSW Threatened Species Legislation.

Crevice between rocks can sometimes be filled by dumped sediment and vegetation, or weed growth. These crevices can be important refuges for ground dwelling fauna from temperature extremes, predators, and the weather.

#### Case Study: Broad-headed snake

Relationships in the environment can be very specific - for example the broad headed snake needs a particular flat type of sandstone rock that distributes and retains heat well. The theft of bush rock combined with the increasing density of the canopy in some areas of its range, have made the snake a threatened species. Experimental studies where the canopy was thinned and the rock returned have shown improvements in local populations. For more information visit the Threatened Species home page of the NSW Office of Environment and Heritage.



*Broad headed snake  
threatened by  
bush rock removal*

Source: SMCMA

### 3.3. Hollows

Tree hollows are an essential feature of a mature habitat for fauna. One of the biggest challenges in urban areas is that trees with hollows often carry risk issues, especially those in mixed use parks. Protecting hollows, and making sure that other trees live long enough to generate hollows, is a critical part of protecting urban fauna.

But remember, hollows on the ground are just as important, but for a range of different fauna. Cleaning up ground timber is probably the number one mistake by Bushcarers when it comes to fauna.

#### TIP:

If a tree has to come down because of its risk to people, think about turning the former possum, bird or bat roost, into a snake, lizard, ant and worm home. Nest boxes can provide important temporary nesting sites for birds and tree dwelling mammals, but choose your design carefully, and monitor them for the presence of European bees or Common Mynahs, which will sometimes take over an artificial nest box.

#### Case study: Powerful owls

Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large trees that are at least 150 years old. During the breeding season, the male powerful owl roosts in a "grove" of up to 20-30 trees, situated within 100-200 metres of the nest tree where the female shelters. They can range over many hundreds of hectares including using heavily urbanised areas. A Marrickville Bushcarer reported a pair sighted in her backyard, which was confirmed by the museum on photo evidence. Despite their ability to use the urban landscape, without suitable hollows they cannot persist. This is why they are listed as a Threatened Species. Will the tree that you save from weedy vines be powerful owl habitat in a few decades time? Quite possibly.



*Powerful Owl*

Photo by: Akos Lumnitzer

### 3.4. Leaf litter and debris

Humans have a tendency to like “neat and tidy” environments. Leaf litter gets raked up, and grass gets neatly mown. Our fauna are a little bit like teenagers, they prefer multiple layers of litter and debris, albeit for different reasons. Having said that, for some invertebrates, their preferred environment is the ash bed after a fire, where they thrive. So there are no absolutes when it comes to fauna needs.

Generally speaking a diversity of structural elements is a good thing for our fauna. This means different layers. The ground layer can be critical for lots of ground dwelling fauna, in particular the invertebrates, frogs, reptiles, and non-tree dwelling mammals and marsupials.

Next time you take a walk through the bush, examine how spiders in particular like to spin their webs between bits of timber debris, dead branches, and over hanging vegetation.

Worms and a pile of leaf litter go hand in hand, with worms helping to aerate soil, bind soil, and break down organic matter to make it available for other plants.

#### Case study: Green and golden bell frogs

Green and golden bell frogs will occupy ponds, bare ground, turf, long grass, weeds, deep mud cracks, reeds, rubble piles, rocks and logs at some stage in their life cycle.

Bell frogs prefer unshaded ponds. So the ground layer including long grass, debris and humus is essential for their local survival. They also thrive in opportunistic standing water that lasts long enough for them to breed in. So an area that has been “tidied up” is of limited value.



*Green and golden bell frog making use of reeds*

*Source: NSW National Trust of Australia*

### 3.5. Soil

Soil is a key part of the landscape. As well as being one of the key influences on vegetation type, it can be an important influence on distribution for burrowing animals, and not just the big cuddly kind but also the millions of invertebrates that are the basis of the food chain for many higher order species.

Scientific studies have shown that soil compaction can be a major limit to the suitability of an area for habitat, in particular for burrowing animals and soil microfauna. So keeping our soil healthy is one of the hidden needs of our fauna. Without the millions of soil borne organisms beavering away, and providing food for the layers up the food chain, our fauna might be limited but for no obvious visible reason. Healthy soils make for healthy bush.

#### Case study: Spotted pardalote

Even some bird species take advantage of different soil characteristics, like the pardalote that makes nests in the exposed banks of loamy soil, sometimes on eroding upper banks near waterways. The spotted pardalote forages on the foliage of trees for insects, especially psyllids, and sugary exudates from leaves and psyllids. When small insect eating birds are not provided with enough breeding places or shelter, outbreaks of lerps can occur on nearby eucalypt trees. This is currently occurring in plague proportions in western Sydney.



*Spotted pardalote pair  
nesting in soil*

*Photo by: Bev Debrincat*

### 3.6. Water

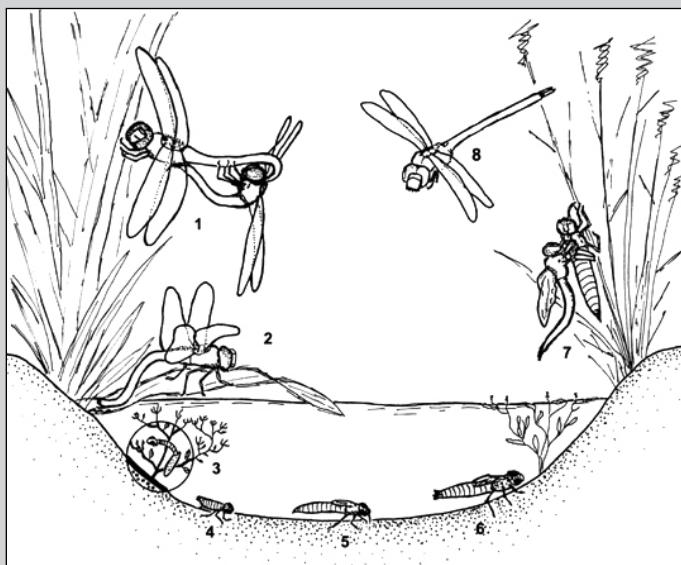
Water is an essential part of any ecosystem. Water is one of the key influences on vegetation type. The abundance of water determines the very existence of invertebrates, fish, amphibians, birds and mammals that depend on water for all or part of their life cycle, whether it be for resting, feeding, breeding, or nesting purposes. Even intermittent puddles can provide important habitat.

It's also important to recognise that Australia has an environment that is adapted to wetting and drying cycles due to our changing weather patterns. Think about the needs of local plants and animals, a good dry cycle might be just as important in some contexts as enough water to follow natural patterns.

Urban bushland areas tend to have more water after development than they do pre-development, with runoff from the surrounding area channelling water away from properties. This might favour some animals, and disadvantage others.

#### Case study: Dragonfly life cycle

The life cycle of a dragonfly is dependant upon water, which can include rivers, streams, marshes, pools and lakes almost year round. They spend most of their lives hidden from human eyes as larvae in the water. Female adults lay eggs in plant tissue or directly into the water. Larvae hatch from the eggs and progress through several moults, becoming larger each time. When the wings of the larva are ready to emerge, it climbs out of the water and emerges from the tight larval case. Both larvae and adults are predatory carnivores. Male dragonflies are usually found near aquatic surroundings. Female are found on the water when they mate or lay eggs, otherwise they prefer to live away from the water to avoid contact with the males.



- (1) Mating
- (2) Egg-laying
- (3-6) Larval development
- (7) Last moulting – emergence
- (8) Adult insect

*Dragonfly life cycle*  
Source: M. Bedjani

### 3.7. Man made objects

Shelter, or micro-habitat, is essential to the survival of animals. Shelter protects them from bad weather, human intervention and predators while they reproduce, and raise their young. The same shelter is often sought out by a range of different fauna, and therefore plays an important role in the food chain. In a natural habitat, shelter comes in the form of caves, rocks, crevices, leaf litter, soil, debris, trees, hollows, foliage and fallen logs.

Man-made objects found in our local bushland are often considered to be ugly rubbish that must be removed from a site. However, although they do not occur naturally in the environment, fauna have adapted to and found uses for these artificial items. Man-made objects such as:

- pavers and bricks
- pots
- roof and wall tiles
- pipes
- tyres
- sheets of corrugated iron
- concrete
- dumped cars
- railway sleepers
- fence posts

can provide important shelter, for reptiles, snakes, amphibians and insects. These materials often retain heat long after the sun goes down, and create safe hidey-holes where other habitat elements may be missing from a site.

Remember to consider the habitat role that artificial objects may play in providing habitat before removing them from your site. Look under artificial structures very carefully and monitor other species that are on site as well. You may even consider introducing suitable artificial materials, such as sandstone rocks, logs and debris, nesting boxes etc to your site to help bridge the gap and help restore balance to the ecosystem, because microhabitat can take decades to be naturally replaced. With an increase in the number of small fauna an increase the number of larger fauna will follow!

#### Case study: Artificial microhabitat on the far south coast

The Far South Coast Conservation Management Network have demonstrated the effectiveness of installing artificial microhabitat as a potential restoration technique where these features have been removed, or in new areas of native vegetation such as tree planting. Eastern pygmy-possums, southern water skinks, white-footed dunnarts, eastern blue-tongue lizards, giant burrowing frogs and jacky dragons have all been found to use the replica habitat.

## 4. Animal interactions

Our fauna doesn't just interact with the physical parts of the environment. It's important to look at how animals interact with each other - for example, predator/prey relationships in urban bushland, and relationships between animals competing for the same resource. This can include animals of the same species.

### 4.1. Territorial behaviour

In some instances territorial behaviour might limit the number of animals that live in a given area, in other instances it might simply be competition for a limited food resource. Again, each site might be different, and the needs of each species or group of species might vary at different sites. The size and connectedness of bushland reserves will be an important factor in how animals interact, and their effects on each other and their ability to survive.

#### Case study: Yellow-bellied glider

The yellow-bellied glider is a large, active, sociable and vocal glider. Adults weigh 450 - 700 grams, have a head and body length of about 30 cm and a large bushy tail that is about 45 cm long. They are very mobile and occupy large home ranges between 20 to 85 hectares to encompass dispersed and seasonally variable food resources.

It has a loud, distinctive call, beginning with a high-pitched shriek and subsiding into a throaty rattle. They use their calls to help define territorial boundaries.

So for this species, large well connected systems of bushland are needed to provide adequate territory.



*The territorial  
yellow-bellied glider*

*Photo by: Joel Winter.*

*Source: Office of Environment and Heritage*

## 4.2. Predation and introduced species

Predation by a range of feral animals is listed under NSW legislation as a Key Threatening Process to Biodiversity. This includes foxes, feral dogs, and feral cats. Ground dwelling native fauna, such as bandicoots, are particularly vulnerable, especially in smaller and isolated reserves. Fox control programs in Sydney's northwest have shown excellent results in reducing local populations, with a corresponding increase in local native fauna being seen. However, urban councils can be quite limited in regard to feral animal management, especially where land ownership and boundary issues are complex. Current control techniques are controversial given that baiting attracts pet dogs and other non-target species.

Other introduced species such as rabbits, goats, pigs, deer, and even bees and some species of ant cause major problems. In the case of the herbivores it is competition for food, space and shelter that cause the damage.

The gambusia fish is also listed as a threatening process to biodiversity and is one of the most significant threats to all of our aquatic ecosystems as mature fish eat the juveniles of natives.



*Red fox on farm land*

*Photos by: Lee Parker*

## 5. Requirements for Specific Fauna

Fauna Type	Type	Food source	Habitat Preference
<b>Birds</b>	<b>Large nectarivores</b> (nectar feeders) e.g. little wattlebirds, scaly-breasted lorikeets	Banksia, hakea, melaleuca, grevillea, eucalyptus, callistemon	Shrubs and trees for foraging, perching and nesting. Some require hollows for nesting.
	<b>Small nectarivores</b> e.g. eastern spinebill, brown honeyeater	Melaleuca, epacris, correa, eucalyptus, callistemon, hakea, banksia	Spend most time foraging and perching in shrubs but also use trees.
	<b>Granivores</b> (seed eaters) e.g. eastern rosella, common bronzewing, red-browed finch	Acacia, casuarina, leptospermum, lomandra, poa, themeda	Utilise shrubs and trees for perching, nesting and foraging but also forage on mature grasses.
	<b>Frugivores</b> (fruit eaters) e.g. common koel, silvereye, satin bowerbird, wonga pigeon	Ficus, eleocarpus, syzygium	Shrubs and trees are important habitat.
	<b>Insectivores</b> e.g. superb fairy –wren, eastern yellow robin, spotted pardalote	Insects and other invertebrates that inhabit either the bark and foliage of trees and shrubs or on the ground	Dense shrubs important for protection and nest sites as well as some open areas for foraging.
	<b>Carnivores</b> (meat eaters) e.g. currawongs, pied butcherbirds, kites, falcons, laughing kookaburra.	Other birds, insects, reptiles, frogs, mammals, marsupials	Tall trees for perching, roosting and nesting. Some require hollows for nesting.
	<b>Waders and water birds</b> e.g. great egret, grey-faced heron, spoonbill, mangrove heron.	Wetland plant seeds. Fish, aquatic and terrestrial invertebrates, amphibians, reptiles, crustaceans, small mammals, and occasionally other birds	Shallow water less than 12 inches deep for standing in or perching over. Trees and shrubs and emergent marshes are particularly important as nest sites.

Adapted from the Best Practice Guidelines for Enhancing Bird Habitat produced by Birdlife Australia's Birds in Backyards Program.

Fauna Type	Type	Food source	Habitat Preference
<b>Amphibians</b>	<b>Juvenile</b> (tadpoles)	Plants, algae and detritus until the legs develop and then insects, larvae, microbes or other small animals.	Lakes, ponds, creeks, streams and small water pools that have developed due to rainfall, residing in nutrient-rich, murky brown or greenish-colored water
	<b>Adult</b> e.g. striped marsh frog, dusky toadlet, little john's frog.	Insects and bugs, worms, spiders, other frogs, small lizards and mammals.	Dense foliage in understorey and canopy layers. Rocks, logs, leaf litter, shallow pools.
<b>Insects</b>	e.g. robber fly, biting midge, balsam beast, wanderer butterfly, pumpkin beetle, reed bee, cuckoo wasp.	Leaves, nectar, pollen, sap, fruit, other insects, dead animals, blood of larger animals, roots, seeds, stems and wood.	Everything everywhere!
<b>Invertebrates</b>	e.g. freshwater shrimp, trapdoor spider, purple stone centipede, earthworm.	Fungi, leaves, other animals, dead animals, carnivores, blood and tissues of larger animals, detritus,	Soil for burrows; leaves, trees and mulch for web-building mulch and leaf litter, trees and shrubs,
<b>Reptiles</b>	e.g. eastern long-necked tortoise, southern leaf-tailed gecko, eastern water skink.	Smaller invertebrates, amphibians, crustaceans, fish, birds, insects, mammals and reptiles. Eggs. Grasses, leaves, fruits, shrubs and marine plants such as algae and kelp.	Logs, bare rock, bare earth, termite mounds, sand, fallen timber, drain pipes, animal burrows, hollows, under brickwork and stonework.
<b>Fish</b>	e.g. long-finned eel, cox's gudgeon, mountain jollytail, glass perchlet.	Aquatic insects, shrimps and other freshwater crustacea, worms, tadpoles and small fish.	In-stream debris, sedges and rushes, fallen timber or rocky outcrops.

Fauna Type	Type	Food source	Habitat Preference
<b>Mammals, marsupials and monotremes</b>	e.g. echidnas, bats, bush rats, possums, bandicoots, wallabies.	Nectar, succulent shoots, buds, bark, fungi, grasses, native and orchard fruits, eggs and nestlings, seeds, spiders and insects.	Forest and woodland, open grassy areas, mature trees with hollows, dense shrubs, holes in stream banks, under ground, rocky outcrops, buildings, roofs and stormwater culverts, dense vines.

## 6. Steps to achieve a fauna friendly Bushcare site

Making your site as fauna friendly as can be requires long term focus and a staged work plan, otherwise the transition period can be devastating, if not fatal, for the wildlife that are dependent upon the site. Patience is the name of the game.

### 6.1. Step 1 – Observe your site

Before any work is commenced at your site it's important to observe or survey what's there. This will also help you to monitor the site effectively. Give yourself at least a year to try and work out what wildlife is using your site.

- Get familiar with the physical habitat elements of your site
- Classify the living and non-living parts of your site
- Identify the key threats to flora and fauna at your site
- Determine what's 'missing' from your site.

#### TIP:

Have a look at a less disturbed patch of bush, with similar plants and natural features as a "reference" site to understand your own Bushcare site.

### 6.2. Step 2 – Understand change at your site

- Ascertain what was there previously
- Describe what is there now
- Envisage what will be there in the future without any intervention.

Find out about locally endemic native fauna by comparing similar local sites, asking long-term local residents what used to be there, consulting members of the scientific community or by reading about the distribution and habitat requirements of different species in Sydney. The NPWS Wildlife Atlas is a good starting place for your research (see Website Resources on Page 30).

### ACTIVITY 6: IMPACTS AT YOUR SITE

**What changes, if any, either positive or negative, have had an impact on fauna at your Bushcare site? What could you do to support fauna habitat at your site?**

### 6.3. Step 3 – Manage the habitat for fauna

Once you know what fauna is or should be at your site, you can assess whether your site has all of the landscape elements (discussed in Section 3) that are needed to support that fauna. You will find some general tips that will help you manage your site for fauna below. Please note that because there are no universal prescriptions that apply to all fauna, the following tips are very general in nature, and apply to the average range of more common species. For many rare or threatened species, or species that find urban environments hostile, more tailored actions may be needed. A Threatened Species Management Plan may exist for that species and these plans (available on the internet) should be used to guide the restoration process. Be aware that the management actions in the plans may be different or even contrary to those listed below<sup>1</sup>:

#### **Maintain diversity**

- Maintain a diversity of plant species, including grasses, groundcovers, herbs and vines.
- Maintain “structural” diversity – have some areas of low ground cover, some areas of dense shrubbery, and some areas of dense canopy.
- Maintain a variety of age classes of plant growth –for example some bird and insect species that thrive in open low vegetated areas may move on when the vegetation becomes higher and more dense, and vice versa.
- Consider availability of food resources including seed, fruit, nectar, a range of prey such as insects, snails, worms, reptiles, frogs, fish, small mammals, etc. and the supporting habitats that attract these species.
- Include fallen woody material, bush rocks and scattered open grasses and groundcovers with exposure to full sun for sunbaking.
- Maintain a dense moist understorey and groundcover near clean water sources.
- Remember - although nectar-producing native plants such as grevilleas are beautiful, and hardy, in some instances too many might further favour successful urban territorial birds such as wattle birds and noisy miners, which can exclude smaller, less aggressive birds with their size and belligerence.
- Try to provide year round flowering and fruiting with the locally native plants you select.

<sup>1</sup> The following sections are based on many of the concepts and ideas communicated by Danie Ondinea through articles, workshops and walks and talks she delivered in Sydney.

### Managing existing habitat

- Keep old trees and trees with hollows as a priority, as shelter and rest sites. If they are a safety risk, try to move the risk by keeping people away. If that is not a safe enough option, see if your council or an arborist can remove the fragile limbs and keep the solid trunk standing.
- Carry out major weed removal works outside of the site-fauna breeding seasons.
- If a tree with hollows has to go, give the lizards, frogs, insects and worms a home on the ground, instead of removing it from site completely.
- Maintain bird 'display' sites e.g. dead branches, tree trunks etc.
- When weeding around the base of boulders and rock walls, previously secure wildlife shelters may be exposed, leaving wildlife vulnerable to predation. Carry out the work over a number of weeks in a mosaic pattern and replant as you go.
- Assess dense vines for nests and possum dreys before removing them. Ensure replacement habitat is available. Poison the vines rather than pull them down so that the animal has warning and time to move.
- Avoid tidying up the ground layer - ground debris and leaf litter can provide very important cover and a range of food sources as they decompose. Note, always avoid leaving weed material on site that might regrow, or create other site problems.
- Protect clean water on site such as ponds, creeks and waterways from pollution and sedimentation e.g. that comes through a stormwater outlet
- Minimise the amount of pesticide that is used
- Report feral animal problems to local control authorities.

### Consider connectivity

- Target your planting activities to provide buffers to good quality bushland, and connections with other high value areas.
- Where possible make connections across the landscape to other natural areas such as waterway corridors, parks and bushland reserves. Attempt to reduce the distance between dense thick shrubbery, as many small and shy bird species cannot traverse wide open spaces.
- Create safe travel routes such as connecting canopy. Research on roadways has shown that even aerial ropes strung across large trees can allow movement of some arboreal mammal species, keeping them away from the risk of traffic.
- Install weed mats correctly so that the mats are securely pinned down across the entirety of the material. They may create a barrier to wildlife.

## 6.4. Step 4 - Monitoring

It is important to set up an assessment and monitoring program at your site that can be quantitative, repeatable, quick and simple to do. There are various different methods of survey and monitoring depending on what your species focus is, e.g. plants, birds, reptiles, invertebrates etc. and what resources you have available.=

Monitoring your site allows you to:

- compare biodiversity over time
- assess and improve management actions
- prioritise and target management actions
- determine what factors are contributing to sites improving or remaining the same over time.

### Tips for monitoring

#### Informal monitoring

Keep a site notebook. Write down any interesting fauna observations. Keep it simple but record the important details:

- name of person making the entry
- date and time
- description of the observation - e.g. saw powerful owl sitting in pittosporum
- any additional items of interest - e.g. powerful owl had small rodent in talons
- other evidence of fauna - e.g. scat, scratching, nest, dead animals

These might be very useful over time as evidence of changes in population, either positive or negative, and many other research purposes.

#### Formal monitoring

Take periodic photographic records of your site. Photo records can help to show the type and structure of vegetation over time, other physical features such as landform. Actual photographs of fauna can be a fantastic resource to confirm your identification. Photos have many limitations, but are the easiest form of monitoring.

Tips for setting up photo points:

Incorporate features that don't change, e.g. a large tree trunk, a rock, a watercourse. This will allow future photographers to take photos from the same point. Some cameras now have ability to GPS record the location of photographs.

For more enthusiastic Bushcarers, the NSW National Parks and Wildlife Services have a program that records the locations of plant and animal sightings in the "Wildlife Atlas". For information about getting involved in this process, visit the Office of Environment and Heritage home page. See page 30 for links.

Other interest groups such as the Frog and Tadpole Study Group and Birdlife Australia (previously Birds Australia) have excellent monitoring programs that you or your group might take part in.

The Best Practice Guidelines for Enhancing Urban Bird Habitat produced by Birds in Backyards Program <http://www.csu.edu/cerc/researchreports/documents/BestPracticeGuidelinesforEnhancingUrbanBirdHabitat.pdf> (or search the website [www.birdsinbackyards.net](http://www.birdsinbackyards.net)) provides advice for developing a bird habitat restoration plan for bushcare sites. The guidelines recommend doing an initial site assessment, for example doing a simple 20 minute bird survey at least a month before any work commences, ideally in spring to assess breeding use and then to continue to regularly monitor with similar surveys to compare over time the outcomes of your project. The Birds in Backyards survey forms provide a useful template for urban sites. You can register to contribute your surveys at [www.birdsinbackyards.net/surveys](http://www.birdsinbackyards.net/surveys)

The NSW Government also supports the Biannual Water Bug Survey. This program monitors macro invertebrates in waterways and helps to identify and classify them to assess stream health. If you haven't done it before, do it once, it's a must do fun activity, especially for kids (big and small!)

## 7. Limitations of urban fauna

An important point to remember about fauna at Bushcare sites is that not all fauna will be able to survive at all sites. Set realistic targets based on the fauna you hope to protect or return to your site.

Species categories	Comment	Examples
<b>Common urban species</b>	Able to tolerate and sometimes thrive in the urban environment and bushland surrounds – sometimes to the exclusion of other native species.	<ul style="list-style-type: none"> <li>• noisy miner</li> <li>• rainbow lorikeets</li> <li>• wattle bird</li> <li>• monarch and blue triangle</li> <li>• butterfly</li> <li>• red bellied black snake</li> <li>• striped marsh frog</li> <li>• water dragon</li> </ul>
<b>Fragile urban species</b>	Find the urban environment hostile without the right sort of refuges, habitat and connections in the landscape. The birds are often small-bodied, insectivorous and nectarivorous species.	<ul style="list-style-type: none"> <li>• powerful owl</li> <li>• sugar glider</li> <li>• brown snake</li> <li>• orange ringlet butterfly</li> </ul>
<b>Rarely found urban species</b>	Require very large refuges and good quality landscape connections to survive in urban areas. e.g. Ku-ring-gai Chase NP	<ul style="list-style-type: none"> <li>• platypus</li> <li>• antechinus</li> <li>• sugar glider</li> <li>• broad headed snake</li> </ul>

## 8. Work site exercise (Activity 7)

Fauna possibilities	Prompting questions	Possible actions?
What animals are occurring on your site now?	Are these common, fragile, or rare urban species?	
What animals have been recorded but are no longer present, or evident?	Is this a recent disappearance, or a long term progressive disappearance?  Has something changed on site that may have links to this disappearance?  Is this a reversible, natural, or otherwise identifiable event or change?	
What animals might be found in a site with your characteristics, but are not currently present?	Sites with similar characteristics retain these species in urban areas.  Sites with similar characteristics have also lost these species in urban areas.	
Are the current characteristics of your site able to support a population of your species of interest? (either present or absent)	Is the size, configuration, landform, plant structure or composition of your site compatible with the needs of your species of interest?  E.g. – territory, range, diversity of habitat etc	
If not, are the characteristics of the site able to be enhanced to bring back the fauna or make them more viable?	Can you restore, introduce, or enhance essential environmental features to enable a population to survive in the long term?	
Are there local pressures on fauna that can be managed?	E.g. Feral animal control, managing visitors, pollution control, etc	

Are there Government regulations that need to be considered?	E.g. Threatened Species Recovery Plans or Priority Action Statements, Best Practice Guidelines, other research or strategies.	
Can action at your site fit into a larger scale action plan or strategy?	Are there corridor enhancement projects, feral animal control, replanting, or other large scale strategies occurring?	
Do you have the time, support, and resources to achieve your goal?	Is your group able to achieve your goals alone, or are partners required?	

## 9. Resources – Publications

### TIP:

Your Council Bushcare Officer or supervisor may know of other publications with more local information. Make use of your local support staff, they are there to help and can often pass on valuable gems of information.

#### **Australian Bats**

S. Churchill, 1998, Reed New Holland, Sydney.

#### **A complete guide to reptiles of Australia**

S. Wilson and G. Swan, 2003, Reed New Holland, Sydney.

#### **Best Practice Guidelines for Enhancing Urban Bird Habitat: Scientific Report**

Birds in Backyards Program, 2008, NSW.

#### **Biodiversity Strategy**

Ku-ring-gai Council, 2006, Gordon.

#### **Bushland fauna assessment guidelines**

G.M. McKay, B. Wilson and M. Couston for Ku-ring-gai Council, 1999, Key Centre for Bioresources, Macquarie University.

#### **Ecological Management and Restoration – Volume 12 No 2 August 2011**

Includes article “Chainsawing for conservation: Ecological tree removal for habitat management” by David A. Pike, Jonathon K. Webb and Richard Shine

#### **Kurnell Peninsula: a guide to the plants, animals, ecology and landscapes**

Virginia Bear, 2010, Sydney Metropolitan Catchment Management Authority.

#### **Rapid Fauna Habitat Assessment of the Sydney Metropolitan Catchment Management Authority area**

Department of Environment and Climate and Climate Change, 2008, NSW.

#### **Tracks, scats and other traces: A field guide to Australian mammals**

B. Triggs, 1996, Oxford University Press, Melbourne.

#### **Urban wildlife more than meets the eye**

D. Lunney and S. Burgin, 2004, Royal Zoological Society of New South Wales, NSW.

#### **West Sydney Wild: Exploring Nature in Sydney's Western Suburbs**

A. Fairley and D. Waterhouse, 2005, Rosenberg, Sydney.

# Websites and Links

## **Atlas of Living Australia**

[www.ala.org.au](http://www.ala.org.au)

The **Atlas of Living Australia** provides tools to enable users of biodiversity information to find, access, combine and visualise data on Australian flora and fauna.

## **Australian insects**

<http://australian-insects.com/>

## **Birds in Backyards**

[www.birdsinbackyards.net](http://www.birdsinbackyards.net)

## **Dragonfly life cycle**

<http://iogya.blogspot.com.au>

## **Ecological Consultants Association**

[www.eca.nsw.org.au](http://www.eca.nsw.org.au)

## **Frog & Tadpole Study Group of NSW**

[www.fats.org.au](http://www.fats.org.au)

## **Eremaea birds**

<http://www.ereamaea.com/>

A bird-spotting atlas to which anyone can contribute.

## **Habitat Network**

[www.habitatnetwork.org](http://www.habitatnetwork.org)

## **NSW Biodiversity Strategy**

<http://www.environment.nsw.gov.au/biodiversity/nswbiostrategy.htm>

## **NSW BioNet**

<http://www.bionet.nsw.gov.au/>

Submit, search and map records of flora and fauna sightings across NSW to the Wildlife Atlas.

## **Sydney Basin Bioregion**

<http://www.environment.nsw.gov.au/resources/nature/sydneyBasin.pdf>

## **Sydney Bats**

<http://www.sydneybats.org.au/cms/>

## **Sydney Metropolitan Catchment Management Authority**

[www.sydney.cma.nsw.gov.au](http://www.sydney.cma.nsw.gov.au)

For information or to order a publication email [sydney@cma.nsw.gov.au](mailto:sydney@cma.nsw.gov.au)

## **Urban Habitat Guidelines for the ACT**

[http://www.anu.edu.au/anugreen/files/1852\\_3.%20Urban\\_Habitat\\_Guidelines\\_for\\_the\\_ACT.pdf](http://www.anu.edu.au/anugreen/files/1852_3.%20Urban_Habitat_Guidelines_for_the_ACT.pdf)

## 10. Glossary

Adapted from Biodiversity Information Resources and Data <http://bird.net.au/>

<b>Arboreal fauna</b>	a term used to describe tree dwelling fauna (also see terrestrial fauna)
<b>Biota</b>	the total assemblage of plants and animals in an area.
<b>Biodiversity</b>	the variety of all life forms, the different plants, animals and micro-organisms, the genes they contain and the ecosystem of which they form a part.
<b>Bioregion</b>	biogeographic areas that capture the patterns of ecological characteristics in the landscape or seascape and form part of the Interim Biogeographic Regionalisation for Australia.
<b>Buffer Zone</b>	a designated area which is used to reduce impact on a core area or biodiversity value to be protected.
<b>Community</b>	an assemblage of plants and animals that exist together to make up a particular type of ecosystem.
<b>Connectivity</b>	the capacity for biodiversity to move between disjunct landscape elements such as habitat patches, lakes and streams (also see corridors and links).
<b>Conservation status</b>	a systems of rating the level of threat for a species, some variations exist according to jurisdiction eg. ICUN (world), EPBC (Australia), TSC (NSW),
<b>Corridor</b>	a linear strip of habitat that facilitates the movement of biodiversity between separated habitats, thereby increasing 'connectivity.'
<b>Distribution</b>	the known limits or geographic extent of an area where a species is known to occur (this does not imply the species occurs in all parts of its distribution but rather it may occur at suitable habitats within its distribution).
<b>Ecosystem</b>	the organisms of a community, together with the atmosphere, soil, water and light which form a functioning system.
<b>Ecotone</b>	transitional zone or area between ecological communities.
<b>Endemic</b>	having a natural occurrence to a specified area.
<b>Environment</b>	incorporates all living and non-living surroundings of a plant or animal.

<b>EPBC Act</b>	Environment Protection Biodiversity Conservation Act 1999, Commonwealth of Australia.
<b>Exotic species</b>	a species not native to Australia.
<b>Habitat</b>	all the physical and biological things which collectively make up 'the place' where a plant or animal lives, and the elements of the landscape that it uses to survive and breed.
<b>Home range</b>	the area utilised by an individual animal to facilitate its normal life functions such as feeding and breeding.
<b>Indigenous species</b>	belonging to, or found naturally in a particular environment and forms part of the natural biodiversity of a place.
<b>Old growth forest</b>	an ecologically mature forest that contains significant amounts of vegetation in its oldest growth stage, including senescent trees and where the effects of disturbances are now negligible.
<b>Rare</b>	used where there are relatively few known populations or the taxon is restricted to a relatively small area (see conservation status, threatened species).
<b>Remnant vegetation</b>	the remains of native vegetation uncleared since European settlement. (for planning purposes it can include areas of native revegetation/regeneration greater than 10 years old.
<b>Species</b>	individuals of the same type which are able to interbreed to produce fertile offspring under natural conditions contributing to a common gene pool.
<b>Subspecies</b>	a discrete geographical or independent breeding group of a species which can be consistently characterised by given features.
<b>Terrestrial fauna</b>	fauna that is ground dwelling (also see arboreal fauna).
<b>Threatened species</b>	a species that is assigned a conservation status of vulnerable, endangered, critically endangered or extinct in the wild.
<b>TSC Act</b>	Threatened Species Conservation Act 1995, New South Wales.

# Appendix

## Fauna in the SMCMA Landscape – Profile Sheets

Reproduced with permission from the NSW Office of Environment and Heritage from: DECC (2008) *Rapid Fauna Assessment of the Sydney Metropolitan Catchment Management Authority Area*. Department of Environment and Climate Change, Hurstville (pages 8-19).

### 2.3 Fauna in the CMA landscape

A *fauna habitat* is a broad environment utilised by a suite of fauna with similar environmental requirements. Eleven broad vegetation types have been identified occurring within the CMA (adapted from Keith 2004; DECC 2007a) and these vegetation types have been used to broadly define 'fauna habitats' in this study. The distribution of these habitats is shown in Map 2, excluding marine habitats. Each of the identified habitats supports varying fauna assemblages, thereby contributing to the high fauna biodiversity value of the region. This section outlines for each identified habitat: a) the importance to fauna in a regional context; b) distribution within the CMA; c) reservation status within the region; and d) whether a habitat has been listed as a priority habitat. A *priority fauna habitat* is identified as a fauna habitat that is of exceptional importance for the conservation of vertebrate fauna, particularly threatened and regionally significant species and has restricted occurrence within the CMA. A more detail description of what constitutes a priority fauna habitat and a brief description of these habitats is provided in Appendix 1. The broad distribution of priority fauna habitats with the CMA area is shown in Map 3. Given limited resources, protection and enhancement of priority fauna habitat will generate the maximum benefit to threatened species conservation and to vertebrate diversity in the region.

#### 1) Rainforest (RF)



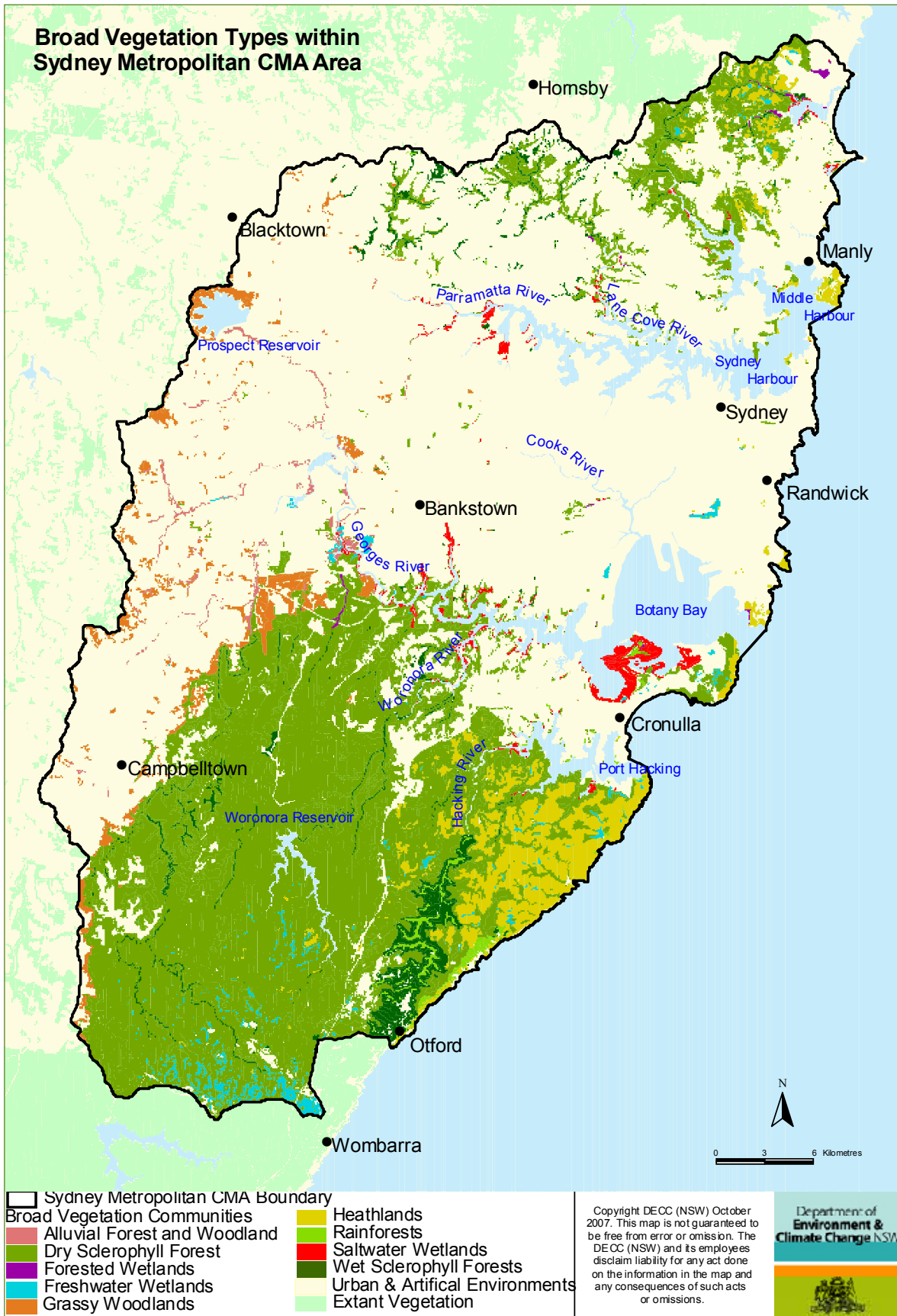
##### Importance to Fauna:

- Supports a number of subtropical species at their southern range limit, such as the Logrunner and Green Catbird.
- Supports species that are rare in other vegetation communities within the CMA, such as the Mountain Brushtail Possum (*Trichosurus caninus*) and Sooty Owl (*Tyto tenebricosa*).
- In the past supported a number of threatened frugivorous pigeons listed under the TSC Act 1995, such as the Wompoo Fruit-Dove (*Ptilinopus magnificus*), Superb Fruit-Dove (*P. superbus*) and Rose-crowned Fruit-Dove (*P. regina*). Today these species are only vagrants to the region.
- In the past supported the Stuttering Frog (*Mixophyes balbus*), a species listed under the TSC Act 1995 that appears no longer to be present within the CMA.
- Provides potential habitat for some species that have not yet been recorded within the CMA but may occur e.g. Golden-tipped Bat (*Kerivoula papuensis*).

*Distribution in CMA:* Highly Restricted

*Reservation Status:* Some of the best patches are situated on unreserved land, such as in the Upper Hacking River catchment linking Royal NP to the Illawarra Escarpment rainforests. Endangered Ecological Communities (under TSC Act 1995) include Littoral Rainforest, Western Sydney Dry Rainforest and Sydney Blue Gum High Forest (with a rainforest subcanopy).

*Priority Fauna Habitat:* Yes



The distribution of broad vegetation types (adapted from Keith 2004) within the Sydney Metropolitan CMA are (excluding some coastal and all subtidal habitats) boundary (taken from Tozer et al. 2006)

## 2) Wet Sclerophyll Forest (WSF)



### *Importance to Fauna:*

- Supports a wide range of wet forest species that are patchily distributed across the CMA.
- Supports a number of species that are uncommon in other vegetation communities, such as the Pilotbird, Superb Lyrebird (*Menura novaehollandiae*) and the Greater Glider (*Petauroides volans*).
- Typically supports important hollow-bearing trees that provide roosting and nesting habitat for a variety of species that range into adjacent vegetation communities to feed. This group includes tree-hole roosting bats and a number of bird species.

*Distribution in CMA:* Patchily Distributed

*Reservation Status:* Relatively well protected in DECC, DPI (Forests) and local government reserves. Endangered Ecological Communities (under TSC Act 1995) include Blue Gum High Forest (Critically Endangered Community), Sydney Turpentine Ironbark Forest (wetter parts) and Moist Shale Woodland.

*Priority Fauna Habitat:* No

### 3) Dry Sclerophyll Forest and Woodland (DSF)



**Importance to Fauna:**

- The primary habitat that supports the Sydney Basin Bioregion's endemic fauna: the Red-crowned Toadlet, Broad-headed Snake and Rockwarbler. Habitat supporting these species are well reserved in expansive national parks ringing the Sydney Basin.
- Important habitat for a number of threatened species, including the Giant Burrowing Frog (*Heleioporus australiacus*), Rosenberg's Goanna (*Varanus rosenbergi*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*) and Gang-gang Cockatoo (*Callocephalon fimbriatum*).
- Important habitat for a number of regionally significant species, such as the Chestnut-rumped Heathwren (*Calamanthus pyrrhopygius*) and Lace Monitor (*Varanus varius*).
- Overhangs in some localities provide important roosting habitat for a number of threatened species, including the Eastern Bentwing-bat (*Miniopterus schreibersii*) and Large-eared Pied Bat (*Chalinolobus dwyeri*).
- Cracks and crevices provide important habitat for a variety of reptiles, such as the Broad-tailed Gecko (*Phyllurus platurus*) and Cunningham's Skink (*Egernia cunninghami*).

**Distribution in CMA:** Widespread.

**Reservation Status:** Well protected in DECC, military and local government reserves. Endangered Ecological Communities (under TSC Act 1995) include Duffys Forest and Sydney Turpentine Ironbark Forest (drier sections).

**Priority Fauna Habitat:** No

#### 4) Grassy Woodland (GW)



**Importance to Fauna:**

- This vegetation type was formerly widespread in the western parts of the CMA but today remnants are predominantly small, isolated, weed infested and disturbed. Consequently, the fauna occurring within this habitat has either disappeared, is in the process of disappearing or is rare and restricted in distribution within the CMA.
- Species that have recently disappeared include the endangered Bush Stone-curlew (*Burhinus grallarius*) and vulnerable Speckled Warbler (*Pyrrholaemus sagittatus*).
- Species that are in the process of disappearing include a range of threatened species such as the Squirrel Glider (*Petaurus norfolcensis*), Brown Treecreeper (*Climacteris picumnus*) and Diamond Firetail (*Stagonopleura guttata*).
- Species that are rare and restricted include the Brown Toadlet (*Pseudophryne bibronii*), Tree-base Litter-skink (*Carlia foliorum*), Jacky Winter (*Microeca fascinans*) and White-winged Chough (*Corcorax melanorhamphos*).
- This habitat is important for nectarivorous species, such as the threatened Swift Parrot, Grey-headed Flying-fox (*Pteropus poliocephalus*) and Black-chinned Honeyeater (*Melithreptus gularis*).
- Most remnant patches have few tree hollows present resulting in a depauperate hollow fauna. Patches that support tree hollows are of critical importance.

**Distribution in CMA:** Very Patchily Distributed with few relatively undisturbed patches remaining.

**Reservation Status:** Poorly protected and most reserved patches are isolated from adjacent patches. Endangered Ecological Communities (under TSC Act 1995) include Castlereagh Swamp Woodland, Cooks River/Castlereagh Ironbark Forest, Cumberland Plain Woodland and Shale Gravel Transition Forest.

**Priority Fauna Habitat:** Yes

## 5) Alluvial Forest and Woodland (AW)



### Importance to Fauna:

- Similar to the grassy woodlands this vegetation type was formerly widespread along watercourses and low-lying swampy ground predominantly in the western parts of the CMA. But today much of this habitat has been reclaimed into playing fields, urban areas and industrial estates. Therefore similar to the grassy woodlands much of the fauna is now restricted to narrow bands with a high edge effect resulting in a number of species that have disappeared, are in the process of disappearing or are rare and restricted in distribution within the CMA.
- Species that have recently disappeared include the endangered Bush Stone-curlew and vulnerable Speckled Warbler.
- Species that are in the process of disappearing include a range of threatened species such as the Squirrel Glider, Brown Treecreeper and Diamond Firetail.
- Species that are rare and restricted include the Brown Toadlet, Tree-base Litter-skink, Jacky Winter and White-winged Chough.
- This habitat is important for nectarivorous species, such as the threatened Swift Parrot, Grey-headed Flying-fox and Black-chinned Honeyeater.
- Important habitat for a variety of bats including the Greater Broad-nosed Bat (*Scoteanax rueppellii*).
- Associated temporary wetlands are important for a variety of declining waterbird species such as Latham's Snipe (*Gallinago hardwickii*) and frogs such as Tyler's Tree Frog (*Litoria tyleri*).

*Distribution in CMA:* Patchily Distributed with most remaining vegetation present as narrow bands with a high 'edge effect' and heavily disturbed by surrounding land uses.

*Reservation Status:* Poorly protected and most reserved patches are isolated from adjacent patches and still impacted by adverse management from adjacent lands or upstream pollution sources. Endangered Ecological Communities (under TSC Act 1995) includes River-Flat Eucalypt Forest on Coastal Floodplains.

*Priority Fauna Habitat:* Yes

## 6) Heathland (HE)



### Importance to Fauna:

- Much of this habitat has been subject to an increased level of disturbance such as the increased incidence of wildfire, often a result of arson. This increased fire frequency and intensity has resulted in the loss of several threatened species in the last few decades, including the Eastern Bristlebird (*Dasyornis brachypterus*) and Ground Parrot (*Pezoporus wallicus*).
- Much of the fauna present within this habitat is uncommon in other vegetation communities.
- Threatened species present include the Giant Burrowing Frog, Red-crowned Toadlet, Littlejohn's Tree Frog (*Litoria littlejohni*), Rosenberg's Goanna, Southern Brown Bandicoot (*Isodon obesulus*) and Eastern Pygmy-possum (*Cercartetus nanus*).
- Regionally significant species present include Freycinet's Frog (*Litoria freycineti*), Bold-striped Cool-skink (*Acritoscincus duperreyi*), Southern Emu-wren (*Stipiturus malachurus*), Chestnut-rumped Heathwren, Beautiful Firetail (*Stagonopleura bella*) and New Holland Mouse (*Pseudomys novaehollandiae*).
- This habitat is important for nectarivorous species, such as the threatened Grey-headed Flying-fox and regionally significant Tawny-crowned Honeyeater (*Gliciphila melanops*).

*Distribution in CMA:* Patchily Distributed.

*Reservation Status:* Moderately protected. However some heathlands display disturbance features attributable to poorly managed longwall mining operations. Impacts include ground subsistence, streambed cracking, wetland loss and the input of pollutants into headwater streams. Endangered Ecological Communities (under TSC Act 1995) include Eastern Suburbs Banksia Scrub and Kurnell Dune Forest (heathier components) and Themeda Grassland on Seacliffs and Coastal Headlands

*Priority Fauna Habitat:* Yes

## 7) Forested Wetland (FOW)



### Importance to Fauna:

- Similar to alluvial woodland much of this habitat has been lost or substantially modified in the past due to land reclamation activities. Much of the remaining patches are either regenerating after past clearing and/or have a high 'edge effect'.
- This habitat represents an intergrade between treeless wetlands (freshwater and saltwater) and backing dryland vegetation. Therefore it provides an important buffer to fauna using either adjacent wetlands or forested habitats.
- Stands that include scattered Swamp Mahogany (*Eucalyptus robusta*) provide important feeding habitat for the endangered Swift Parrot and occasionally the endangered Regent Honeyeater (*Xanthomyza phrygia*).
- Other threatened species that utilise this vegetation type include the Black Bittern (*Ixobrychus flavicollis*).
- Regionally significant species present include Tyler's Tree Frog and a range of waterbirds, such as the Nankeen Night Heron (*Nycticorax caledonicus*). A variety of insectivorous bats occur including the Eastern Bentwing-bat and East-coast Freetail-bat (*Mormopterus norfolcensis*).
- Forested wetlands provide important winter habitat for a number of bird species e.g. Rose Robin (*Petroica rosea*) and Brown Gerygone (*Gerygone mouki*).

**Distribution in CMA:** Patchily Distributed with most remaining vegetation present as narrow bands with a high 'edge effect' and heavily disturbed by surrounding land uses.

**Reservation Status:** Poorly protected and most reserved patches are still impacted by adverse management from adjacent lands or upstream/coastal pollution sources. Endangered Ecological Communities (under TSC Act 1995) include Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest.

**Priority Fauna Habitat:** Yes

## 8) Freshwater Wetland (FRW)



### Importance to Fauna:

- Similar to alluvial woodland and forested wetlands, much of this habitat has been lost or substantially modified in the past due to land reclamation activities. Much of the remaining patches are either heavily modified or artificially created. Few untouched natural wetlands remain in the CMA
- Freshwater wetlands encompass a number of types with associated distinctive fauna.
- Hanging swamps associated with open treeless plains, particularly on the Woronora Plateau provide important habitat for a number of threatened frogs, such as the Littlejohn's Tree Frog which is only known from a small number of locations within the region. Other threatened frogs include the Giant Burrowing Frog and Red-crowned Toadlet.
- Freshwater wetlands elsewhere range in size and type from extensive reedbeds to open expanses of water. A range of threatened species occur such as the Australasian Bittern (*Botaurus poiciloptilus*) and Green and Golden Bell Frog (*Litoria aurea*).
- These wetlands support an extensive range of species that are considered regionally significant, such as various crane and rail species.
- These wetlands are important as drought refuges for a variety of waterbirds, including the threatened Freckled Duck (*Stictonetta naevosa*) and regionally significant Australasian Shoveler (*Anas rhynchotis*) and Red-kneed Dotterel (*Erythronyctes alba*).
- Some wetlands support colonial waterbird nesting sites, particularly of the Australian White Ibis (*Threskiornis molucca*). Although deemed as a pest by many during times of drought Sydney's wetlands support some of the only active colonies in the state.
- Many wetlands are important as nesting sites for non-colonial waterbirds but their importance on a state-wide scale is poorly understood e.g. crakes.
- Coastal wetlands are frequently important to species utilising adjacent saltwater wetlands. For example, Dee Why Lagoon is used as an alternative shelter site to Long Reef by migratory shorebirds during strong onshore winds.
- Freshwater wetlands provide important habitat for a number of species listed under international migratory bird agreements e.g. Latham's Snipe.
- A number of declining and regionally significant passerine bird species occur, such as the Little Grassbird (*Megalurus gramineus*).

*Distribution in CMA:* Patchily Distributed.

*Reservation Status:* Poorly protected and most reserved patches are still impacted by adverse management from adjacent lands or upstream/coastal pollution sources. Endangered Ecological Communities (under TSC Act 1995) include Freshwater Wetlands on Coastal Floodplains and Sydney Freshwater Wetlands.

*Priority Fauna Habitat:* Yes

## 9) Saltwater Wetland and Coastal Shoreline (SW)



### Importance to Fauna:

- Similar to freshwater wetlands, much of this habitat has been lost or substantially modified in the past due to land reclamation activities, in particular areas of saltmarsh and intertidal flats used by a wide variety of shorebirds. Few untouched natural saltwater wetlands remain in the CMA.
- Saltwater wetlands encompass a number of types with associated distinctive fauna ranging from saltmarsh to mangrove forest, intertidal flats to rocky coastline and islets.
- Extensive areas of saltmarsh are now rare in the region. This habitat supports the only two remaining populations of the regionally significant White-fronted Chat (*Epthianura albigrons*). Extensive saltmarsh and adjacent sedgeland at Towra Point also provide important habitat for a number of other regionally significant species, such as the Southern Emu-wren and Lewin's Rail.
- The expanses of mangroves present have increased often at the expense of saltmarsh and intertidal flats. Mangroves support the regionally rare Mangrove Gerygone (*Gerygone levigaster*) and a wide range of waterbirds. Some migratory shorebirds, particularly the Whimbrel (*Numenius phaeopus*) roost in mangroves at high tide.
- Intertidal flats, particularly in parts of Botany Bay support a number of threatened (such as the Great Knot (*Calidris tenuirostris*) and Terek Sandpiper (*Xenus cinereus*) and regionally significant migratory shorebirds, many of which are listed under international migratory bird agreements.
- Recognition of the importance of migratory shorebirds within Botany Bay is demonstrated by the listing of 'The Endangered Shorebird Community occurring on the Relict Tidal Delta Sands at Taren Point'.
- Intertidal flats are also important for a range of other waterbirds, such as waterfowl and egrets.
- Migratory shorebird roosts occur at a number of localities in Botany Bay and at Long Reef. These important areas provide resting habitat for these species during high tide.
- Predominantly secluded sections of shoreline provide important nesting habitat for the endangered Little Tern (*Sterna albigrons*), vulnerable Pied Oystercatcher (*Haematopus longirostris*) and the regionally significant Red-capped Plover (*Charadrius ruficapillus*).
- Reef platforms provide foraging habitat for the threatened Sooty Oystercatcher (*Haematopus fuliginosus*) and regionally significant Eastern Reef Egret (*Egretta sacra*).

*Distribution in CMA:* Patchily Distributed.

*Reservation Status:* Poorly protected and most reserved patches are still impacted by adverse management from adjacent lands, disturbance or coastal pollution sources. Endangered Ecological Communities (under TSC Act 1995) includes Coastal Saltmarsh.

*Prioritv Fauna Habitat:* Yes

## 10) Coastal Waters (CW)



### Importance to Fauna:

- A wide range of birds and marine mammals occur in subtidal waters ranging from waters in protected bays to exposed continental shelf waters.
- Marine mammals are characterised by the Common Dolphin (*Delphinus delphis*) and Bottlenose Dolphin in protected waters and the Humpback Whale and Minke Whale (*Balaenoptera acutorostrata*) in more pelagic waters. Seals are occasional visitors with the most common species being the Australian Fur Seal (*Arctocephalus pusillus*).
- A variety of seabirds occur ranging from tiny storm-petrels to the majestic Wandering Albatross (*Diomedea exulans*).
- Marine reptiles are infrequent; the most frequently recorded being the Green Turtle (*Chelonia mydas*), Leatherback Turtle (*Dermochelys coriacea*) and Yellow-bellied Sea Snake (*Pelamis platurus*).
- Most threatened species occurring within these habitats are non-breeding visitors, such as the Humpback Whale, Gibson's Albatross (*Diomedea gibsoni*) and the Southern Giant-petrel (*Macronectes giganteus*).
- An exception is the Little Penguin (*Eudyptula minor*), with an endangered population nesting on the shoreline of North Head. Other colonies formerly occurred elsewhere, such as at Cape Banks.
- Inshore waters also provide important feeding habitat for the endangered Little Tern and regionally significant species such as the White-fronted Tern (*Sterna striata*).

*Note: This group of fauna was beyond the scope of the current study.*

*Distribution in CMA:* Extensive

*Reservation Status:* Poorly protected.

*Priority Fauna Habitat:* No

## 11) Urban, Rural and Artificial Environments (UE)



### Importance to Fauna:

- Urban, rural and artificial environments include residential and industrial lands, urban-rural landscapes, playing fields and ornamental parks, cleared ground with rank grassland, and extensive artificial environments such as Sydney Airport.
- Although alienated environments, many areas retain a scattering of original trees or plantings of a variety of native species. The greater the representation of these in an area, in addition to proximity to remnant habitat, the higher the species diversity present.
- Not surprisingly these environments are the home of a range of feral species, such as the House Mouse (*Mus musculus*), Black Rat (*Rattus rattus*), House Sparrow (*Passer domesticus*), Common Mynah (*Acridotheres tristis*) and Common Starling (*Sturnus vulgaris*).
- More surprisingly is the diversity of threatened and regionally significant species that also occur. The Swift Parrot is sometimes recorded foraging in flowering streetscape and parkland trees. Both original and some planted trees are an important food source for the threatened Grey-headed Flying-fox. The Eastern Bentwing-bat, Little Bentwing-bat and Southern Myotis roost in a variety of artificial structures such as under bridges, in stormwater drains and disused gunnery emplacements.
- In artificial environments such as Sydney Airport other threatened and regionally significant species occur, such as the Pied Oystercatcher, Double-banded Plover (*Charadrius bicinctus*) and Australian Pipit (*Anthus australis*).
- In disused plots of cleared land or rural pastures typified by long grass and weeds species such as the regionally significant Brown Quail (*Coturnix ypilophora*), King Quail (*C. chinensis*), Brown Songlark (*Cinclorhamphus cruralis*) and Golden-headed Cisticola (*Cisticola exilis*) may occur.
- Perhaps it is not surprising that a range of birds and bats occur in these alienated landscapes. Of greater surprise is the range of non-flying mammals and even reptiles. For example, recently a population of Long-nosed Bandicoots (*Perameles nasuta*) was discovered in Dulwich Hill, hardly pristine bushland. Similarly the Water-rat (*Hydromys chrysogaster*) occurs around the built-up shoreline of Sydney Harbour.
- Reptiles present range from the Broad-tailed Gecko that not only has adapted to living in some people's letterboxes but also ventures indoors to the ubiquitous Cream-striped Shinning Skink (*Cryptoblepharus virgatus*). Snakes also occur in some areas, particularly the Red-bellied Black Snake (*Pseudechis porphyriacus*).
- Houses and other buildings are not only utilised by some geckoes but also as roosts by some insectivorous bats, such as the Gould's Wattled Bat (*Chalinolobus gouldii*) and White-striped Mastiff-bat (*Tadarida australis*).

Distribution in CMA: Extensive

Reservation Status: Not Applicable