

the MammalBook

Mammals of the
Grey Box Grassy
Woodlands in the
Goulburn Broken
catchment



Goulburn Broken Catchment Management Authority, Victoria, Australia.

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Front cover: Yellow-footed Antechinus. Photo: C. Tzaros

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Iconic throughout the world, our native mammals are fascinating and precious, and well worth taking the time to learn about. Koala. Photo: R. Jones

INTRODUCTION

Our mammals are marvellous! They are found nowhere else in the world and it's important we take the time to learn about, appreciate and conserve them.

From the largest kangaroo to the tiniest microbat, we are lucky to share our home with such amazing wildlife. The evolution of Australia's mammals has been influenced across millennia by unique circumstances of isolation, geology and climate. Consequently, these unique species have adapted in ways unlike most mammals from other continents.

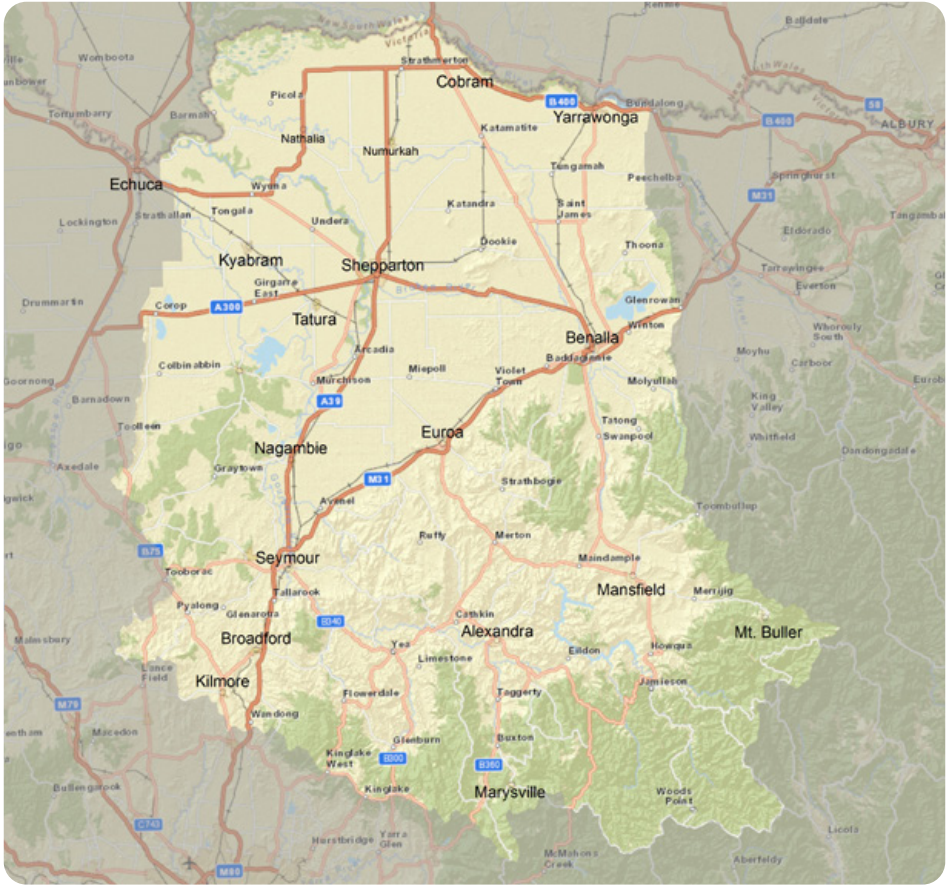
This booklet provides a window into the world of mammals in the Goulburn Broken catchment, specifically the 30 native species found predominantly in the Grey Box Grassy Woodland community.

(Source: Flora and Fauna Guarantee Act 1988 – Threatened List. October 2021. Department of Land, Water and Planning).

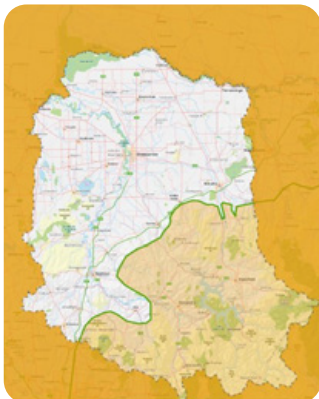
Since European settlement, a total of 357 native mammal species have been recorded in Australia. The Goulburn Broken catchment's Grey Box Grassy Woodlands are home to some 30 mammal species including the platypus and echidna, which are members of the Order Monotremata, Subclass Prototheria, Class Mammalia.



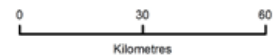
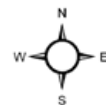
Grey Box Grassy Woodland. Photo: J. Mentiplay-Smith



This booklet highlights the 30 native mammal species predominantly found in the Goulburn Broken catchment's Grey Box Grassy Woodlands ecological community.



The white area denotes the Grey Box Grassy Woodland region of the Goulburn Broken catchment.



Native fauna and cultural meaning.

Traditional Owners have lived alongside Australia's native fauna for many tens of thousands of years. Various species of mammal – from the extinct diprotodon to the kangaroo, wallaby and possum, have supplied Traditional Owners with food, materials and clothing as well as spiritual and cultural expression through stories, song, dance and art for millennia. Such connection indicates a deep understanding between people and the environment.

Since European settlement, Australia's native fauna has become embedded in a type of 'collective cultural consciousness'. Through the unique species with which we share our home, a national identity that contributes towards how we see and represent ourselves as a nation has emerged. The kangaroo and emu appear on the Commonwealth Coat of Arms, numerous native animals are Olympic Games mascots and names of sporting teams. Native animals appear on postage stamps and coins and are strongly represented in the film and literary world: Think of Blinky Bill, Snugglepot and Cuddlepie, Skippy the Bush Kangaroo, Crocodile Dundee and Dot and the Kangaroo, to name just a few.



Brush-tailed Phascogale. Photo: C. Tzaros



In 1918 May Gibbs published the iconic *The Complete Adventures of Snugglepot and Cuddlepig*, the first story of its kind to champion native Australian fauna.

Acknowledgement: The 'Snugglepot and Cuddlepig' images by May Gibbs are from the collections of the State Library of New South Wales.



1

MAMMAL MEGAFAUNA

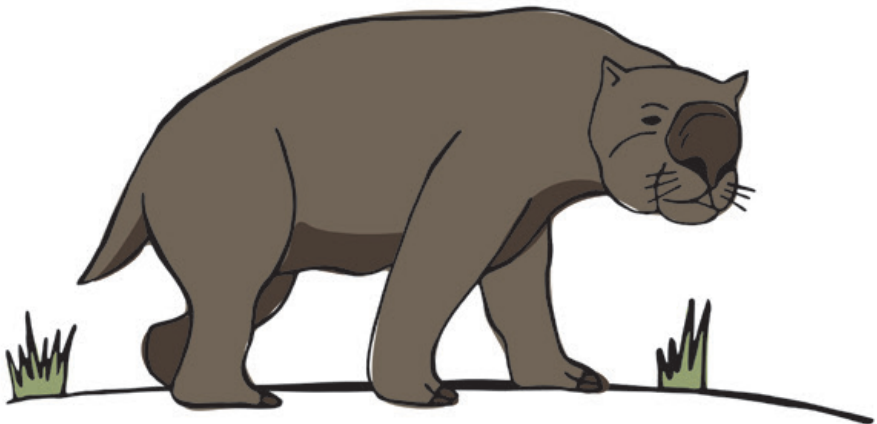
After the reign of the dinosaurs, it is believed around 90 species of megafauna (including mammals, reptiles and birds) evolved in Australia, some of which roamed the Goulburn Broken catchment. Eventually these giants either disappeared or evolved and adapted into species we recognise and share our home with today.

DIPROTODON (*Diprotodon optatum*)

Also known as the 'Giant Wombat', the Diprotodon roamed the open grassy plains of the Goulburn Broken catchment. In 2013 Diprotodon remains were found in the Koondrook Forest near Barham, approximately 90 kilometres from the western boundary of the catchment boundary.

- Traditional Owners and the Diprotodon co-existed for many thousands of years prior to its extinction around 25,000 years ago.
- It is possible that the story of the mythological Bunyip, a ferocious creature of Traditional Owner storytelling, originated from the Diprotodon.
- The limbs of Diprotodon were stout and sturdy. Its feet were small and turned-in and like the modern-day wombat the female had a backwards-facing pouch in which she carried a single joey.
- The Diprotodon is often compared to a modern-day hippopotamus in height and size, however fossil records indicate it was slightly smaller.
- 'Diprotodon' means 'two forward teeth'. This marvellous marsupial had continuously growing front teeth it used to root out and shred vegetation, woody stems and leaves. It is estimated the Diprotodon consumed approximately 100-150 kilograms of vegetation each day.
- Diprotodon fossils have been found across most of Australia, although no remains have been found in Tasmania (it was present on King Island).
- Want to know more? Visit Diprotodon optatum - The Australian Museum <https://australian.museum/learn/australia-over-time/extinct-animals/diprotodon-optatum>

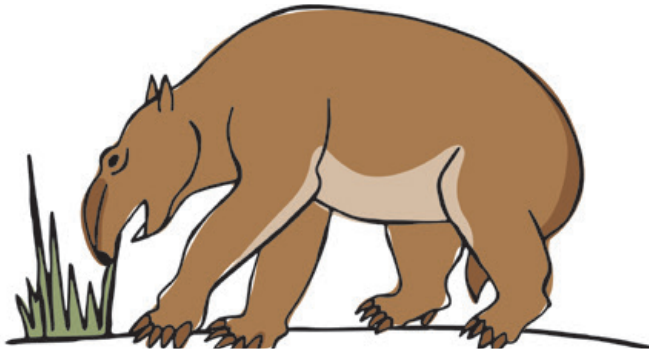
Around 130 million years ago the land mass of Gondwana began to separate and continents drifted apart. Around 65 million years ago the last dinosaurs became extinct. Larger animals known as the *megafauna* species began to evolve.



MARSUPIAL TAPIR (*Palorchestes azeal*)

Not a great deal is known about the Marsupial Tapir! It was an unusual marsupial herbivore with retracted nasal bones, which researchers believe supported a small trunk similar to that of the modern-day tapir.

- The Marsupial Tapir is comparatively rare in the fossil record, however enough fossils have been collected for the Australian Museum to construct a full scale model.
- It is feasible that it lived in the Goulburn Broken catchment region due to the vegetation and climate at the time. It was thought to be a solitary animal, and did not congregate in herds.
- Similar to its relative the modern-day wombat the female Marsupial Tapir most likely had a backwards-facing pouch in which her joey developed.
- Want to know more? Visit *Palorchestes azeal* - The Australian Museum <https://australian.museum/learn/animals/mammals/palorchestes-azeal>



GIANT KANGAROO (*Procoptodon goliah*)

Also known as the 'Pleistocene Kangaroo', the Giant Kangaroo bore a similar – but somewhat strangely altered – resemblance to a modern-day kangaroo. Giant Kangaroo fossils have been found at Tocomwal in New South Wales, adjacent to the Goulburn Broken catchment.

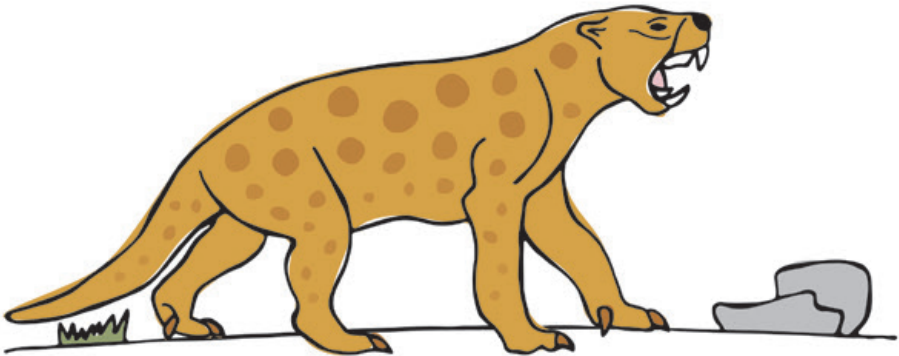


- The Giant Kangaroo stood at approximately two metres tall and weighed around 200 kilograms.
- A flat-faced species, it had forward-facing eyes and a single large toe on each foot.
- Each 'hand' consisted of two long fingers adept at grabbing vegetation.
- As with the Diprotodon, the Giant Kangaroo co-existed with humans for many thousands of years.
- The fossil record suggests it became extinct around 15,000 years ago.
- Want to know more? Visit *Procoptodon goliah* - The Australian Museum <https://australian.museum/learn/australia-over-time/extinct-animals/procoptodon-goliah>

MARSUPIAL LION (*Thylacoleo carnifex*)

The Marsupial Lion holds the honour of being the largest true carnivorous Australian mammal known, and based on its fossil record, was a formidable predator. It likely hunted the young slow-moving Diprotodon, and as it dominated the Australian continent, it would have roamed and reigned across the Goulburn Broken catchment.

- The Marsupial Lion was a fierce member of the megafauna family. It had a cat-like skull with enlarged premolars that acted like long blades, serrated canine-like upper incisors and horizontal lower incisors. Adding to this arsenal was an enlarged retractable thumb claw it used to tear apart prey and a pseudo-opposable thumb most likely used for climbing.
- As it had no grinding teeth, the Marsupial Lion would not have consumed much plant matter. This animal was a confirmed carnivore!
- Studies conducted on the Marsupial Lion's 'bite strength' indicate it had the most powerful bite of any mammalian predator living or extinct.
- The Marsupial Lion was specialised for big game - it was probably inefficient at catching smaller 'fast food'. As the size of prey began to decline 40,000 to 50,000 years ago, this may have contributed to its extinction.
- Want to know more? Visit *Thylacoleo carnifex* - The Australian Museum <https://australian.museum/learn/animals/mammals/thylacoleo-carnifex>



Although many thousands of years have passed since megafauna roamed, their story is far from over, with new fossils always being discovered such as the Diprotodon remains unearthed at Koondrook in Victoria. Conversely, fossils discovered in the past can be re-examined to reveal new information. In 1997 a fossil found at Queensland's Riversleigh World Heritage Area was originally thought to be part of a different genus of Marsupial Lion that existed 23-34 million years ago. Upon discovering variations in its teeth, it was found to be a separate genus altogether, demonstrating that although these animals are long extinct, for us their history is always evolving.



This 'messy' section of roadside, blooming with Gold-dust Wattle and surrounded by fallen logs, branches, standing dead stumps, sticks and leaf litter, provides the perfect home for a variety of spiders and insects which becomes sustenance for mammals such as the antechinus, dunnart, bat and brush-tailed phascogale. Without this habitat, none of these mammals could live here. Photo: J. Mentiplay-Smith



2

DIVERSE, HEALTHY WOODLANDS - AND WHY MAMMALS NEED THEM

If you live on the land, any positive change to the way you manage your property can have immense benefits for all animals. Diversity is key! By allowing the different layers such as logs, leaf litter, mid-storey shrubs and tall trees to exist, grow, thrive, die and rot on your property, you are welcoming all varieties of wildlife – not just native mammals but small and large birds, insects and reptiles.

Mammals play an important role in maintaining ecosystem health. They provide essential 'ecosystem services' such as seed dispersal and pollination. They are food for other animals, and as they travel across the ground, they scatter fungi, which in turn nourishes the soil and contributes to plant growth and development.

A 'messy' patch of bush on your property, a vegetated corridor, or a piece of understorey scrub in the corner paddock – or even in the back yard – is valuable real estate and a plentiful supermarket to native fauna. By leaving fallen logs and branches and leaf litter in situ, or by relocating it to a more suitable location, you are allowing for the natural processes on your property to unfold. By enabling a diverse range of native species the opportunity to survive, feed and breed, they will provide you with all the enjoyment and satisfaction a healthy, functioning and sustainable 'living' property with its varied layers of habitat, can provide.

Roadsides are important in helping maintain our mammal populations. Healthy roadsides with a diverse range of vegetation species and an intact ground storey serve to connect habitats and are places of refuge. It is incredibly important that these narrow strips of vegetation are as healthy, diverse and connected as they can be.

Roadside vegetation is often the only way mammals such as koalas, brush-tailed phascogales, possums and gliders can travel through the landscape. If roadsides are not connected by vegetation or by a ground layer, native animals cannot travel, so suffer from a lack of food and shelter. They also experience a lack of genetic diversity and robustness due to the inability to travel for 'out-breeding' opportunities.

If your property abuts a vegetated roadside, help maintain its diversity and health by not 'cleaning up' to allow plants to flourish amidst an intact ground layer.



To us, this is a termite mound nestled amongst a Grey Box Woodland. For an echidna, it represents a fully stocked supermarket. Retaining and encouraging a diversity of 'natural structures' such as a termite mound in your patch of bushland makes all the difference as to who can live there. Photo: J. Mentiplay-Smith



3

POUCHED MAMMALS OF THE GREY BOX GRASSY WOODLANDS

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Mammals that have a pouch – whether it be a fully formed pouch or a simple fold in the skin – are called marsupials. All marsupial young are born after just weeks or days of gestation and complete their development outside the mother’s body within the security of the pouch.

COMMON DUNNART (*Sminthopsis murina*) and FAT-TAILED DUNNART (*Sminthopsis crassicaudata*)

Sometimes called 'native mice', these fierce little Dunnarts share their family tree with other members of the carnivorous marsupial *Dasyuridae* family such as Tasmanian devils, quolls, phascogales and antechinus. They are generally nocturnal and are found only in Australia.

The Common Dunnart and the Fat-tailed Dunnart live life in the fast lane. They breed in spring-summer with gestation taking around 12-13 days. Up to 10 joeys are born 'grain-of-rice' size however not all will survive. They initially suckle within the pouch and wean at around 70 days. Once they become too big to remain 'indoors' they are cared for by their mother in their above-ground nest. Female Dunnarts have an average life span of 18 months; males live for around 15 months and die after mating.

The Dunnart diet consists mainly of spiders, beetles, cockroaches, grasshoppers and termites. Small mammals, reptiles and frogs are occasionally on the menu. Dunnarts do not need access to water as their food contains all the moisture they need. In times of plenty, Dunnarts can store excess fat in their tails to draw upon when cooler temperatures and lack of food necessitates accessing this storehouse of energy. Dunnarts can enter a state of torpor (a form of short-term 'hibernation') whereupon they conserve energy by lowering their body temperature and metabolic rate.

Dunnart diet and nesting requirements mean they depend upon a healthy 'messy' ground layer consisting of hollow logs, branches, sticks and understorey plants. Along with predation by foxes and cats, the most significant threat to the Common Dunnart and Fat-tailed Dunnart is the loss of this precious ground cover that provides homes for the food they eat as well as safe havens and nesting habitat.



Common Dunnart. Photo: S. Mahony



Fat-tailed Dunnart. Photo: W. Terry



Grey Box Grassy Woodlands are a nationally threatened ecological community.

Underpinning the survival of any species is a healthy, resilient environment. The Goulburn Broken catchment's Grey Box Grassy Woodlands are a distinct ecological community, meaning they are a naturally occurring group of plants, animals and other organisms that live and interact together. The Grey Box Grassy Woodland habitat structure and composition is determined by soil type, position in the landscape, climate and water availability. Photo: J. Mentiplay-Smith

YELLOW-FOOTED ANTECHINUS (*Antechinus flavipes*)

The Yellow-footed Antechinus is a carnivorous marsupial that relies on tree hollows, fallen timber, branches and logs in which to hide and forage. Not only is this feisty little critter a joy to watch dart about the logs and trees, it is an important link in the food chain, as it is food for larger predators such as goannas and birds of prey.

The Yellow-footed Antechinus may look very much like a non-native house-mouse, but this is where the similarities stop. Antechinus have many sharp teeth, whilst house-mice have chisel-shaped front teeth. Antechinus have five clawed toes on their front feet and four clawed toes on their back feet. House-mice have four clawed toes and a clawless 'thumb' on their front feet, and five clawed toes on their back feet. Antechinus have a furred tail and 'layered' round crinkly ears, whilst house-mice have a bald tail and 'single layered' ears.

Unlike many marsupials, the Yellow-footed Antechinus forages during the day. It feasts upon eggs, flowers, small reptiles, insects, nectar, small birds and even house-mice. Male Antechinus die soon after mating due to stress and lack of nutrients. This is thought to be nature's way of ensuring sufficient resources for the next generation as there are no males left to compete with the females and their young.



Yellow-footed Antechinus. Photo: C. Tzaros



A hollow-dependant species, the Yellow-footed Antechinus will seek refuge in nest boxes where natural tree hollows or hollow logs are in short supply. Photo: J. Mentiplay-Smith



Brush-tailed Phascogale. Photo: R. Jones

BRUSH-TAILED PHASCOGALE (*Phascogale tapoatafa*)

The Brush-tailed Phascogale shares its family tree with other members of the carnivorous marsupial *Dasyuridae* family such as Tasmanian devils, dunnarts, antechinus and quolls. It is nocturnal and primarily arboreal meaning it relies on healthy, connected woodlands so it may travel through the treetops to search for nectar, insects, spiders, centipedes and bird eggs.

As a hollow dependant species, the Brush-tailed Phascogale will use several tree hollows in which to nest and shelter during the day. This is possibly a predator evasion tactic but means that the demand for nest hollows is further exacerbated. Where natural hollows no longer exist, it readily uses artificial nest boxes. It is easy to determine if a nest box is used by either a glider or a phascogale: Gliders build their nest out of fresh leaves and keep their nest box clean, whilst a Brush-tailed Phascogale constructs its nest out of a variety of materials – mainly stringybark, but also animal hair, feathers, snakeskin and even the desiccated bodies of dead animals. Their habit of using the corner of their nest box as a toilet also gives the nest box a unique ‘phascogale’ odour! Nest boxes are readily sought out and used by a variety of native animals. If you live in a woodland or forested area, installing nest boxes on your property is one of the most immediate ways you can benefit wildlife.

As with dunnarts and antechinus, the Brush-tailed Phascogale leads a short, fast life. After mating in late autumn to early winter, the male perishes. As he is around just one-year-old, this makes the Brush-tailed Phascogale the largest known mammal to die after its first – and last – breeding season. The female raises her 5-8 young from mid-June to early August, firstly within her pouch (a fold of skin on her belly rather than a true pouch) for seven weeks and then in the nest until the joeys are five months old. A female will sometimes raise two litters in her lifetime. She typically dies before her second birthday.

Along with habitat destruction and predation by foxes and cats, the loss of hollow-bearing trees poses the greatest threat to the Brush-tailed Phascogale. The loss of hollow bearing trees has been listed as a potentially threatening process in the *Flora and Fauna Guarantee Act 1988* due to the dependence on this habitat by so many native species.



The Brush-tailed Phascogale feathers its nest with – literally – feathers... and anything else found in the forest such as fibrous stringybark, animal hair, snakeskin and even scraps of newspaper. Photo: O. Talamo



NARROW-TOED FEATHER-TAILED GLIDER (*Acrobates pygmaeus*)

The Narrow-toed Feather-tailed Glider is the world's smallest gliding mammal, weighing in at an average of just 12 grams. It is distinguishable from other small marsupial species by its 7-8 centimetre-long feathery tail, which acts as a steering and braking mechanism.

The Narrow-toed Feather-tailed Glider uses its long, brush-like tongue to feed upon grains of pollen, small insects and drops of nectar. As a nocturnal marsupial, it spends its nights busily searching for food, gliding 20 or more metres between trees. Curiously, its toes feature 'suction cups' that enable it to climb almost any surface (including vertical panes of glass).

This tiny marsupial can enter a state of torpor (a form of short-term 'hibernation') when the temperature cools or when food becomes scarce, by slowing its breathing and heartrate to conserve precious energy. Unlike a true hibernation, torpor only lasts for short periods. However, there is a downside: as this little glider is unresponsive during torpor, it is at greater risk of predation.

The Narrow-toed Feather-tailed Glider lives in communal nests of up to 30 individuals for warmth, safety and probably convenience. Females typically give birth to two litters of up to four young in a season.

SUGAR GLIDER (*Petaurus breviceps*)

Named for its fondness for sugary sap and nectar, the nocturnal Sugar Glider spends much of its arboreal nightlife leaping and gliding in search of food and nesting hollows. The Sugar Glider is one of three species of glider found in the Goulburn Broken catchment's Grey Box Grassy Woodlands (the other two being the Squirrel Glider and the Narrow-toed Feather-tailed Glider) and is one of seven species of glider native to Australia.

The Sugar Glider – as with all gliders – has a membrane extending between its ankles and wrists. Upon leaping from a branch, it extends its limbs to open this 'parachute'. It may glide for 50 metres or further, depending on the height of the tree from which it alights and the surrounding topography. Unlike a bat or bird, the Sugar Glider is not capable of sustained flight, however its ability to glide is a unique adaptation to a life lived amongst the treetops.

Females give birth in winter and spring after just 15-17 days gestation when one or two joeys weighing an incredible 0.2 grams, are born. With only their sense of smell fully developed, the tiny joeys crawl towards the scent gland in their mother's pouch. Here they remain safely cocooned, consuming milk for 60 days. They will leave the nest at around 110 days. During the colder months, the Sugar Glider may enter a state of torpor (a form of short-term 'hibernation') whereupon it minimises energy consumption by curling into a tiny ball and reducing breathing and body temperature.



Sugar Glider. Photo: R. Jones

Sugar Glider survival depends upon the presence of large, mature trees with hollows. The loss of large old hollow-bearing trees, habitat decline and fragmentation means this and many other native animals cannot traverse the landscape in search of food and mates. As the incremental loss of large old trees continues, the Sugar Glider is forced to occupy dangerous roadsides where large old trees remain, increasing the risk of vehicle collision. As well as loss of natural hollows, other threats include the loss of understorey food plants, inappropriate fire regimes, cats, foxes and barbed wire fences that snag the delicate gliding membrane (see page 52 Case study 2: Fences and wildlife).

Nest boxes are essentially artificial tree hollows and are readily used by gliders when installed in suitable habitat. They are a useful short-term solution to the native animal 'tree hollow housing crisis' currently experienced by many species.



With fewer natural tree hollows remaining in the landscape, Sugar Glider families cram into nest boxes for warmth and security demonstrating they are efficient users of artificial real estate. Photo: O. Talamo



SQUIRREL GLIDER (*Petaurus norfolcensis*)

Sharing the same environment and similar features and habits to the Sugar Glider, the larger Squirrel Glider is a gliding marsupial living a nocturnal life amongst the treetops. It too has adapted to utilising nest boxes where natural tree hollows are lacking. If you live in a woodland or forested area, installing nest boxes is one of the most immediate ways you can benefit hollow dependent wildlife such as the Squirrel Glider.

The Squirrel Glider covets the sugary nectar and sap that packs a carbohydrate punch, and readily uses its sharp teeth to pierce tree trunks to cause the sap to ooze. Insects, bird eggs and small nestlings are also on the menu. Natural predators of the Squirrel Glider in the Grey Box Grassy Woodland environment include goannas, carpet pythons, owls and kookaburras, demonstrating their importance in the natural food chain.

The Squirrel Glider produces one or two joeys after just 18 days gestation. The young remain in their mother's pouch for around three months and wean at four months to become independent at around 10 months of age.

The Squirrel Glider faces the same threats as its Sugary cousins - cats, foxes and barbed wire fences that snag their delicate gliding membrane (see page 52 Case study 2: Fences and wildlife), as well as habitat loss and degradation, loss of hollow-bearing trees and understorey food plants, inappropriate fire regimes and the occupation of existing tree hollows by aggressive species. As the incremental loss of large old trees containing hollows continues across the landscape, the Squirrel Glider is forced to occupy dangerous roadsides where large old trees remain, increasing the risk of vehicle collision.

EASTERN RING-TAILED POSSUM (*Pseudocheirus peregrinus*)

Sporting a distinctive curl to its white tipped prehensile (grasping) tail, the Eastern Ring-tailed Possum is well adapted to the urban environment. It does not rely exclusively on tree hollows for nesting; therefore, its accommodation options are broader. It constructs a nest called a drey using sticks, grass and shredded bark that it grasps in its agile tail. A hideaway in the corner of a shed, the convenient crook of a tree branch, a patch of mistletoe or similar dense vegetation are all viable locations for this possum's drey.

The Eastern Ring-tailed Possum is nocturnal and mostly arboreal. It eats a wide variety of native and introduced vegetation and employs the unusual trait of eating its own dung that it produces during the day whilst sleeping and resting in its drey. This adaptation is also utilised by other mammals around the world to ensure food is digested twice so the maximum amount of nutrient from an otherwise nutrient-poor food is extracted.

Eastern Ring-tailed Possum parents construct their drey together. After just 20-26 days gestation one, two (sometimes three) jellybean sized joeys are born and stay in their mother's pouch for seven weeks. As they grow, they move onto their mother's back. Interestingly, the male will carry his offspring on his back whilst the female is away feeding.



Eastern Ring-tailed Possum. Source: Museums Victoria. Photographer: D. Paul <https://collections.museumsvictoria.com.au/species/8447>

COMMON BRUSH-TAILED POSSUM (*Trichosurus vulpecula*)

The Common Brush-tailed Possum – sometimes known as a 'Brushy' – is a nocturnal, semi-arboreal marsupial and is generally herbivorous, however it will also consume small mammals and nestlings, insects and eggs. The Common Brush-tailed Possum has transitioned into the urban environment in part due to its fondness for fruit trees and vegetable gardens, but also due to its adaptation to 'human habitat' as large old trees and their associated tree hollows become increasingly scarce across the landscape.

The Common Brush-tailed Possum is culturally significant to Traditional Owners. The possum skin cloak was an everyday item for Aboriginal people in the cooler parts of Australia. They were worn for warmth, used for blankets and baby carriers, functioned as drum skin, and used at burial. At birth, a baby was given a small cloak made of Brush-tailed Possum skin and as the child grew, their cloak was added to. By the end of the person's life, their cloak served as their burial wrapping.

Except at breeding time, the Common Brush-tailed Possum leads a mostly solitary life. After a gestation of only 17 days, the newborn possum joey wriggles its way to its mother's pouch whereupon it attaches itself to a teat for the next five months. At around 10 months of age the joey reaches maturity.

The Common Brush-tailed Possum was introduced to New Zealand in the mid-1800s with the intent of creating a fur industry. With no natural predators it subsequently thrived with numbers currently estimated at 30 million animals. It is considered a major pest as it heavily predated upon native flora and fauna that has not evolved to contend with possums.

In Australia, the Brush-tailed Possum is sometimes also regarded as a pest - especially if it is occupying your house wall or ceiling cavity! As the Brush-tailed Possum depends upon safe, secluded tree hollows in which to sleep during the day, it may 'move in' to human habitat as a last resort, perceiving the ceiling or walls of your home a satisfactory substitute.

The best course of action may be to work with the possum rather than against it. If a possum stays around your home it will assert territorial rights and discourage other possums. Installing a possum nest box in a tree or in an elevated location in your yard is a way of relocating without displacing your resident 'Brushy'. If it takes up residence in your nest box, be sure to block up any entrances into your roof to prevent future incursions.



Common Brush-tailed Possum. Photo: R. Jones

KOALA (*Phascolarctos cinereus*)

The Koala is iconic and instantly recognisable. Weighing anywhere up to 15 kilograms, it is the largest tree-dwelling marsupial in the Goulburn Broken catchment, with males being half as big again as females. The Koala is mostly active at night and only comes to ground to move between trees. Access to water is not necessary – the Koala receives all its moisture from the leaves it eats.

With its cuddly body, snub nose and fluffy soft toy like ears, the Koala is an endearing ambassador for Australia. These days it is hard to believe that their population was severely reduced for the fur trade, with Australia's Marsupial Destruction Act (1877) openly sanctioning their slaughter. During the life of the fur trade the total number of Koalas killed was at least eight million. Although now no longer threatened by the fur industry, the Koala still walks a precarious line of survival. In February 2022, the Koala was officially listed as endangered in the Australian Capital Territory, New South Wales and Queensland. It is not classified in Victoria. The sobering reality is that despite its legal protection, a large proportion of the Koala's habitat and food is located on private land which is largely unprotected.

The Koala is a solitary, territorial animal, with each individual requiring around 100 trees for its nutritional needs. A Koala's diet depends upon where it lives – and not all eucalyptus leaves are created equal! Of Australia's 700 or so eucalyptus species, only around 50 are palatable to the Koala and only around 12 or so make up its staple diet. The Koala is a very particular diner, it selects only the choicest leaves – preferably new, soft and juicy growth – before moving on to the next, meaning large tracts of habitat is required.

Eucalyptus leaves are toxic, tough, and difficult to digest. To manage this the Koala has evolved a slow metabolism and long digestive system to break down the leaves. However even this effort yields just 25% of the nutrients ingested – and requires a 20 hour sleep. The other four hours are spent eating up to one kilogram of eucalyptus leaves each night!

Koalas are seasonal breeders, mating in spring through to early autumn. After 35 days gestation a jellybean-sized joey weighing 0.5 grams is born (twins occur occasionally). The joey crawls into its mother's pouch and attaches to one of two teats, where it grows and develops. It stays in the pouch for 13 weeks, opens its eyes at around 22 weeks and at around seven months of age it will climb aboard its mothers' back. By its first birthday the joey is independent.

However, there is something the joey needs to do: Before it can eat toxic eucalyptus leaves, it must 'inoculate' its digestive system with its mother's intestinal microorganisms by ingesting her dung, thus enabling it to process and digest the only food in the world a Koala can eat.



Koala. Photo: S. Drysdale



Bare-nosed Wombat. Photo: R. Jones

BARE-NOSED WOMBAT (*Vombatus ursinus*)

Considerably smaller than its *Diprotodon* megafauna ancestor, the stout Bare-nosed Wombat is often thought to 'lumber', however it can sprint at an amazing 40 kilometres per hour! Another surprising attribute is its cube-shaped dung, unique to the animal kingdom. There is a logical reason for this shape: Each night the Bare-nosed Wombat deposits its cubed droppings atop prominent rocks and logs to serve as territorial markers advising other wombats of its presence. By having flat sides, these 'dung messages' stay perfectly in place.

The Bare-nosed Wombat prefers to live in the well-drained creeks and gullies where excavating a burrow is easier. It may construct up to 12 burrows in its home range, with three to four main tunnels with multiple entrances and sleeping quarters. Because of all this digging the pouch faces backwards; a clever design that protects the joey from scattered rocks and debris generated whilst its mother works. As well as using its stout body to excavate burrows and compress the soil along the walls, the Wombat can also use its 30–40-kilogram body mass to trap and crush a predator between itself and the burrow roof.

At birth the Bare-nosed Wombat joey weighs just one gram and leaves the pouch at around five months of age. At seven months of age it is fully independent.

As with its close relative the Koala, the Wombat needs to sleep away a large portion of the day so it can process a coarse diet of grass, shrubs, bark, roots and moss. Full digestion normally takes 14–18 days so it may extract the most nutrients and water possible. Mostly nocturnal, the Wombat will travel around three kilometres in a night to search for food. Unusual for a marsupial, its teeth constantly grow, therefore it needs to gnaw upon coarse material to keep the growth in check.

Sometimes regarded as an agricultural pest, the Wombat can be subject to culling. Habitat loss and competition for food with livestock and rabbits is also a significant threat, along with vehicle strike and sarcoptic mange which is spread by foxes and dogs, and can kill entire colonies of Wombats.

BLACK-TAILED WALLABY (*Wallabia bicolor*)

The Black-tailed Wallaby – and all wallabies – are marsupials belonging to the macropod group (meaning ‘large footed’). Australia has around 30 species of wallaby of which the Grey Box Grassy Woodlands of the Goulburn Broken catchment is home to one – the Black-tailed Wallaby. It possesses specific genetic, reproductive, dental and behavioural characteristics that make it different to other wallabies and is the only living member of the genus *Wallabia*.

The solitary Black-tailed Wallaby is often heard before seen. The fat *slap* of its bounce amongst the shrubbery compared to the staccato spring of the Eastern Grey Kangaroo is an audible indicator that this shy little marsupial is not far away, albeit keeping a low profile.

The female Black-tailed Wallaby is *polyoestrous*, meaning she can overlap two pregnancies by gestating both an embryo and a foetus in a second uterus at the same time. This means she can be continuously pregnant throughout her reproductive life and give birth approximately every eight months.

The Black-tailed Wallaby joey weighs just one gram at birth after a 33–38-day gestation and spends the next eight to nine months in its mother’s pouch. The suckling of the newborn temporarily halts the development of the newly conceived embryo.



Black-tailed Wallaby. Photo: D. Pendavingh

EASTERN GREY KANGAROO (*Macropus giganteus*)

A large herbivorous marsupial, the Eastern Grey Kangaroo is a common sight in the Grey Box Grassy Woodland ecological community. This grassland specialist can cover an impressive six metres in one bound and maintain a speed of around 20 kilometres per hour. It moves its back legs only at the same time, and only forwards. For this reason it is depicted on the Commonwealth Coat of Arms as a metaphor for a country moving ahead.

A most iconic marsupial, the Eastern Grey Kangaroo is instantly recognisable, especially as the unforgettable – and remarkably capable – ‘Skippy the Bush Kangaroo’. The Male Eastern Grey Kangaroo can weigh more than 70 kilograms and will ‘box’ or exhibit other aggressive behaviour to achieve dominance in a family group. The male will also exhibit ‘high standing’ whereupon he extends another 30 centimetres by standing up on his toes to appear more threatening to a rival.

The Eastern Grey Kangaroo generally breeds when conditions are favourable. After a 36-day gestation the tiny joey is born and crawls to its mother’s pouch where it suckles for around nine months. The joey is heavily reliant on its mother until weaning at around 18 months.

Currently the Goulburn Broken catchment’s Grey Box Grassy Woodlands Eastern Grey Kangaroo population is plentiful due in no small part to the introduction of permanent water, crops and pasture that was not present prior to European settlement. When Eastern Grey Kangaroo populations increase to unsustainable levels, damage to farmland, native habitat and property can occur and they can experience malnutrition and starvation from over grazing. Availability of resources, physical superiority and a great deal of luck will determine the lifespan of an Eastern Grey Kangaroo, however the average is around six to eight years.



Eastern Grey Kangaroo. Source: Museums Victoria. Photographer: R. Start <https://collections.museumsvictoria.com.au/species/8419>



4 NON-POUCHED MAMMALS OF THE GREY BOX GRASSY WOODLANDS

Non-pouched terrestrial native mammals in the Goulburn Broken catchment's Grey Box Grassy Woodlands are represented by rodents and bats. All other placental mammal species present are non-native (e.g., horses, pigs, cats, deer, goats, rabbits, foxes). The dingo is thought to be the first introduced placental mammal to Australia around 4,000 – 5,000 years ago.

RAKALI (*Hydromys chrysogaster*)

The native rodent representative of the Goulburn Broken catchment's Grey Box Grassy Woodlands is the Rakali, once known as the Water Rat. To alter perceptions and the negative connotation associated with the word 'rat' the Australian Nature Conservation Agency recommended the name be changed to that used by the Ngarrindjeri Aboriginal people in the Lower Murray River and Coorong region of South Australia - 'Rakali'.

The Rakali is a busy, semi-aquatic rodent. Weighing up to one kilogram, it is the largest native rodent in Australia. It is mostly nocturnal and lives in burrows along the banks of water bodies. At first glance the Rakali may be mistaken for a European rat, however its distinctive white-tipped tail and ease of moving around its aquatic environment declares its 'true identity'.

Dining on a variety of insects, fish, yabbies, mussels, snails, frogs, eggs and small birds mean the Rakali depends upon healthy waterways. Once hunted for its soft fur, the Rakali was also considered a pest due to its alleged damage to irrigation channels and fishing nets. Due to targeted destruction populations plummeted, with destruction permits still issued during the 1960s.

Unhindered, the Rakali lives for two to three years and has a low reproduction rate, with just two to four pups born between spring and summer. Drought, floods and habitat degradation can be catastrophic for the Rakali population, therefore it is vital we maintain or increase the health of our waterways.



Rakali. Photo: R. Peachey

MAMMALS OF THE AIR: MICROBATS AND MEGABATS

Tiny microbats and large megabats (also known as flying foxes) are the only mammals capable of sustained flight. Microbats feed exclusively upon insects, whilst flying-foxes feed upon fruit and nectar.

There is so much to learn about micro and mega bats! The best place to begin is the Australasian Bat Society <https://www.ausbats.org.au>

MICROBATS – FAST AND FURIOUS

Darting through the night sky, microbats leave their roosting sites at dusk to spend the night pursuing their insect-based dinner. In a single night microbats can eat at least one third of their body weight. Multiply this by many, many thousands of microbats, it is not difficult to see how these tiny flying mammals provide a valuable 'pest control' service.

There are 12 species of microbat that call the Goulburn Broken catchment's Grey Box Grassy Woodlands home:

1. White-striped Free-tailed Bat (*Austronomus australis*)
2. Gould's Long-eared Bat (*Nyctophilus gouldi*)
3. Lesser Long-eared Bat (*Nyctophilus geoffroyi*)
4. Gould's Wattled Bat (*Chalinolobus gouldii*)
5. Chocolate Wattled bat (*Chalinolobus morio*)
6. Southern Myotis (*Myotis macropus*)
7. Inland Broad-nosed Bat (*Scotorepens balstoni*)
8. Southern Forest Bat (*Vespadelus regulus*)
9. Little Forest Bat (*Vespadelus vulturnus*)
10. Large Forest Bat (*Vespadelus darlingtoni*)
11. Southern Free-tailed Bat (*Ozimops planiceps*)
12. Ride's Free-tailed Bat (*Ozimops ridei*)

Microbat Fast Facts:

- Microbats are placental mammals, not marsupials (they do not have a pouch). Like all bats they are the only mammals capable of sustained flight.
- Including those inhabiting the Goulburn Broken catchment's Grey Box Grassy Woodlands, there are more than 60 species of microbat in Australia.
- Microbats are tiny, weighing between 3 - 150 grams, depending on the species.
- Microbats use echolocation 'pulses' to locate and gauge the distance between themselves and other objects, including prey. They emit a sound and 'listen' for it as it bounces back. The time taken for the pulse to return indicates the location of the object. Normally a microbat emits about 10 pulses per second. When an insect is detected, this increases to 100 pulses per second.
- During summer and autumn when insects are plentiful, microbats fatten up in readiness for winter.

- Once the nights become cooler and insects disappear, microbats lower their body temperature and enter torpor (a form of short-term 'hibernation') and survive on their stored fat until spring. If you know the location of microbats that have settled into torpor, be careful not to disturb them. Emerging from torpor too soon subjects them to predation and forces them to draw upon valuable fat reserves. If disturbed too many times they will deplete their stored energy and will not survive until spring,
- Microbats roost in tree hollows, behind pieces of bark and in caves. Dead trees are vitally important for microbats, as they contain plenty of roosting places. Even small dead trees of just 20 centimetres in diameter are extremely valuable. Do all you can to keep this precious resource on your property!
- The lack of tree hollows in the landscape mean microbats need to roost in cracks in fenceposts, storm water pipes, culverts and within house and shed roofs and walls. Microbats will also roost in nest boxes. Visit ausbats.org.au for information on how to build and install a bat box.
- Called pups, microbat babies are born in late spring and are dependent upon their mothers until mid-summer. At birth, pups are approximately one-third the size of their mother. This is the equivalent of a human giving birth to (approximately) a 20-kilogram baby!
- As they are a mammal, microbat pups feed on their mother's milk.



Gould's Wattled Bat. Photo: W. Terry



Gould's Long-eared Bat. Photo: W. Terry

FLYING FOXES – OUR MEGABAT MAMMALS

Flying foxes (megabats) first appeared in the fossil record about 50 million years ago. It is assumed they evolved as night-active to take advantage of the 'empty airspace' left by the day-active birds. Although called 'flying foxes', other than being a mammal, megabats are not related to foxes - their name comes from their 'foxy' facial features. Unlike microbats that use echolocation to seek out their insect prey, as fruit and nectar feeders megabats rely upon their large eyes and keen nose to seek food at night.

Two species of flying fox call the Grey Box Grassy Woodlands home:

1. Little Red Flying-fox (*Pteropus scapulatus*)
2. Grey-headed Flying-fox (*Pteropus poliocephalus*)

Megabat Fast Facts:

- We usually think of 'birds and bees' pollinating our plants however flying foxes are major pollinators of eucalypts; without them the composition of Australia's forests would be very different. Flying foxes will travel up to 80 kilometres a night to feed, and in the process of feeding they transfer pollen, thus expanding the tree's gene pool and capability to survive.
- Because they are integral to seed dispersal and pollination, the rapid decline in flying fox populations is very concerning. It means the long-term survival of our unique eucalypt and rainforest ecosystems is under threat.
- The Grey-headed Flying-fox is one of the largest bats in the world, weighing up to 1 kilogram and sporting an impressive wingspan of up to 1 metre. In contrast the Little Red Flying-fox is the smallest flying fox in mainland Australia. As with the Grey-headed Flying-fox, the Little Red Flying-fox is important for pollination and seed dispersal.
- Both species give birth to a single pup. When small, the pup feeds on milk and clings to its mother's fur whilst she forages at night. Upon becoming too large to remain a passenger, the pup stays at the roost to await its mother's dawn return. It is cared for by its mother until it can fly and forage independently.
- Roosting above a water body helps flying foxes remain cool in summer. Grey-headed Flying-foxes and Little Red Flying-foxes roost in camps around swamps, woodlands, patches of rainforest and along creeks.
- Flying foxes do not generally have a 'fixed address', rather the availability of food influences where they live and move.
- Loss of habitat is a major threat to flying foxes. When their natural habitat is destroyed they are forced to seek refuge where they can. This means they may crowd into confined urban areas and gardens, which can be unpopular with the human residents.
- Threats to Grey-headed Flying-foxes and Little Red Flying-foxes include habitat destruction, disturbance by people and pets at roost sites, barbed wire, fruit tree netting and heat stress.



Grey-headed Flying-fox. Photo: S. Wilson



5 MONOTREMES - IN A CLASS OF THEIR OWN

Compared to other mammals, the Platypus and the Short-beaked Echidna have structural differences in their brains, jaws, digestive systems and reproductive tracts. The female produces leathery-shelled eggs instead of giving birth to live young, however like all mammals, the female feeds her young milk. Both animals held a strong place in Traditional Owner culture with the Platypus supplying soft fur, and the Echidna bearing a fatty, reputedly tasty meat.

PLATYPUS (*Ornithorhynchus anatinus*)

Sometimes referred to as the 'Duck-billed Platypus', early European scientists considered this remarkable monotreme an elaborate hoax constructed from pieces of other animals, so unusual was its physiology. Today the Platypus is an iconic Australian species and still the subject of well-deserved curiosity. It holds a strong place in modern Australian culture, being the animal emblem of New South Wales and a mascot for the 2000 Sydney Olympic Games.

The Platypus feeds mainly at night upon a varied menu of tadpoles, water bugs, worms, yabbies and insects. The Platypus does not have teeth; instead it has grinding plates located at the back of its jaws made of keratin, the same protein found in hair, claws, horns and hooves. The grinding plates mash food into a paste that travels directly to the intestines, negating the need of a larger stomach.

The Platypus breeds at four years of age. Deep within her burrow, the pregnant female lays one or two eggs and nurtures them between her tail and rump. Jellybean sized babies emerge after just 10 days incubation and for the next four months feed on fatty milk that seeps from pores in the mother's skin.

Male Platypuses have a venomous spur on each hind foot which is most likely used in battle with other males. Although causing swelling and pain, the venom is not life threatening to humans.

There is so much to learn about the Platypus! The Australian Platypus Conservancy is the place to keep up to date with information: <https://platypus.asn.au>



Platypus. Photo: K. Jones



Short-beaked Echidna. Photo: S. Drysdale

SHORT-BEAKED ECHIDNA (*Tachyglossus aculeatus*)

The Short-beaked Echidna is a monotreme - an egg-laying mammal. This unique style of reproduction means the female lays a single egg incubated in her pouch. After just 10 days the small leathery egg hatches to reveal a jellybean sized baby called a puggle. Clinging to hairs inside its mother's pouch, the puggle feeds on fatty milk for two or three months until its spines become too sharp to remain welcome. The mother then expels the puggle into a purpose-built burrow where it lives until weaning at around six months of age.

The Echidna is a solitary creature that roams across large, overlapping home ranges of up to 50 hectares. Only when the female is rearing her puggle in a burrow does the Echidna remain in one place.

The Echidna feeds upon termites, ants and other insects. It uses its sticky 17-centimetre-long tongue to scoop up the scurrying 'moving feasts' - along with a good measure of gravel and soil. Its strong, rigid snout is adept at breaking open rotting logs and termite mounds, and its short limbs and shovel-like claws are purpose built for digging and burrowing. Like the platypus, the male Short-beaked Echidna has a spur on each hind leg. Unlike the platypus, it is non-venomous.

Thanks to its body armour, the Echidna has few natural predators. When threatened it will curl into a ball and wedge into a crevice to expose its threatening spines.

The Echidna is a competent swimmer and will traverse bodies of water using its little snout as a snorkel. Keeping shallow bowls of water in your garden can help these spikey visitors cool off during times of extreme heat.



6 MISSING MAMMALS

The Grey Box Grassy Woodlands of the Goulburn Broken catchment was once home to a variety of native mammals that are now either extinct, locally extinct or missing. Not all species were recorded or described by European settlers, therefore some we know about, and some are lost to history.

WHITE-FOOTED RABBIT-RAT (*Conilurus albipes*)

Extinct

The White-footed Rabbit-rat was barely known to Europeans before its swift decline and ultimate extinction. Its range was once vast and included the temperate and semi-arid woodlands and grassy woodlands throughout Victoria, extending across south-eastern South Australia, eastern New South Wales and southern Queensland.

According to records from 1846, the White-footed Rabbit-rat was known and commonly seen in Victoria. It has not been sighted since 1860-1862 and is considered extinct. After millennia of evolution and adaptation this animal now exists only in museum exhibits and sketches; such a high price to pay for 'progress'.

The White-footed Rabbit-rat was Australia's largest native rodent. Its body measured around 23–26 centimetres and its brown and white tail around 22–24 centimetres. It had broad rabbit-like ears and weighed around 200 grams.

This native rodent nested in hollow logs amongst grassy tussocks and gave birth to several young. As a ground dweller, the White-footed Rabbit-rat immediately suffered from the effects of European colonisation which included the introduction of livestock, rabbits, foxes, cats, the clearing of woodlands and the cleaning up of fallen timber.



Illustration of the White-footed Rabbit-rat (2001) reproduced from A Field Guide to the Mammals of Australia by Peter Menkhurst and Frank Knight



RUFIOUS BETTONG (*Aepyprymnus rufescens*)

Extinct in Victoria

Prior to European settlement the Rufous Bettong lived amongst the Goulburn Broken catchment's Grey Box Grassy Woodlands and further afield across the Murray Valley. Now it is found only in Queensland and New South Wales, however even within these states its range has contracted significantly.

At 70-80 centimetres long from nose to tail, the Rufous Bettong is a small nocturnal marsupial, grey and reddish-brown in colour. Like the kangaroo, the Rufous Bettong can walk forwards by placing its forelegs on the ground and bringing its hind legs forward together, as well as hop. Unlike the kangaroo, the Rufous Bettong can gather and carry grass and leafy material with its tail, which it uses to build a daytime nest. Once darkness falls it emerges to forage for herbs, roots, tubers and fungi, travelling up to four kilometres each night. Females breed continuously, raising a single joey with each pregnancy.

The Rufous Bettong is an important 'bio-engineer'. Its digging and scratching helps to aerate the soil and decompose leaf litter, speed up nutrient recycling and reduce biomass. Its local extinction means this valuable 'ecosystem service' no longer occurs. The Rufous Bettong also has an important role in dispersing fungal spores and plant seeds, which it transports through the bush on its snout, paws and small body.

Land clearing, agricultural expansion, fragmentation of forests, changing fire regimes, predation by foxes and cats and competition for food by rabbits and hares are all factors influencing the disappearance of the Rufous Bettong from the Goulburn Broken catchment's Grey Box Grassy Woodlands – and Victoria.

SPOT-TAILED QUOLL (*Dasyurus maculatus maculatus*)

Endangered in Victoria, not presumed present in the Goulburn Broken catchment.

The Spot-tailed Quoll has suffered a 50% reduction in its known range within Victoria since European settlement.

Where it remains, the Spot-tailed Quoll occupies a large home range up to 2200 hectares depending upon the quality of habitat and availability of den sites such as hollow logs, hollow trees, rock crevices and caves. The female gives birth after just three weeks gestation and may carry and feed up to six young which become independent after 18 weeks.

As the largest marsupial carnivore on mainland Australia, the Spot-tailed Quoll is slightly larger than a domestic cat. It is a proficient climber and will feed upon terrestrial and arboreal prey such as antechinus, possums, gliders, rabbits, birds and insects.

In a forest setting where vehicular and walking tracks are present, foxes and cats gain easy access to Spot-tailed Quoll habitat. Other impediments to Spot-tailed Quoll survival include vehicle strike, trapping, shooting, poisoning, disease and too frequent burning regimes which results in the loss of fallen timber and hollow logs needed for foraging and denning opportunities.



Spot-tailed Quoll. Source Museums Victoria. Photographer D. Paul <https://collections.museumsvictoria.com.au/species/8451>



SOUTHERN LONG-NOSED BANDICOOT (*Perameles nasuta*)

Present in the Goulburn Broken catchment. Not presumed present in the Grey Box Grassy Woodlands of the Goulburn Broken catchment.

The presumed loss of the Southern Long-nosed Bandicoot to the Goulburn Broken catchment's Grey Box Grassy Woodlands to land clearing, 'cleaning up' of fallen timber, cat and fox predation, competition for food from rabbits and hares and vehicle strike means our region has lost a vital piece of the ecosystem.

The Southern Long-nosed Bandicoot is small solitary animal, foraging at night using its sensitive snout to detect fungi, insects, mice, snails, grass seeds and lizards. In the process of turning over the soil in search of food, this little 'bio-engineer' performs an important ecological service by aerating the soil. This increases the rate of debris decomposition, enhances soil production and nutrient recycling, and disperses seed and fungi spores which contributes to healthier forests and increased plant diversity and woodland structure.

The Southern Long-nosed Bandicoot is highly active and has a distinctive galloping gait as it traverses its territory (up to 40 hectares for males). Its presence can be observed by the small round holes it leaves in the ground from where it sinks its snout to seek food.

The Southern Long-nosed Bandicoot has a short gestation period of around 11-12 days and can breed up to four times a year with litters containing up to five joeys. Therefore, the decline of this endearing little marsupial seems to be due to the enormity of navigating the many threatening processes that are proving too great to overcome.

Mammal extinctions in Australia: An unenviable achievement.

Australia's unique native wildlife contributes to and enhances the nation's cultural identity; it endears distinction and provides a sense of national pride and profile. However the survival of many of the very animals we champion is at real risk – these animals are in trouble. Australia has the worst record of mammal extinctions in the world, with 34 native mammal species now lost forever since European colonisation.

Extinction of Australian land mammal fauna has occurred at a rate of about one to two species per decade since the first post-1788 Australian mammal extinction. Unfortunately, the losses are consistent. A species of bat, the Christmas Island Pipistrelle was listed as extinct in 2021, and a native rodent, the Bramble Cay Melomys became extinct during 2006–2014.

Take some time in your day to observe, learn about, read about, talk about, watch and listen for our amazing wildlife. Appreciate them and be an advocate for their preservation, not only for those in your own back yard, but across the country. They are amazing and unique and have a significant place in our national identity, but once they are gone they are gone forever.



- All mammals are either monotremes (such as the echidna and platypus), marsupials (pouched animals such as the kangaroo and koala), or placentals (such as the rakali and bats).
- Australia is the only continent to have the largest populations of all three of the major groups of mammals (monotremes, marsupials and placentals). Papua New Guinea has one species of monotreme (echidna), several species of marsupial (terrestrial and arboreal kangaroo species) and placental native bats and rodents.

- Native rodents are placental mammals, not marsupials. They do not have a pouch and they give birth to fully developed young. Rodent species from other continents include chipmunks, squirrels, hamsters, porcupines and guinea pigs, none of which are native to Australia.
- Bats are native placental mammals. Like native rodents, they do not have pouches and give birth to developed young.
- According to the Journal of Mammalogy (2018) there are currently 6,495 species of recognized mammals worldwide. Of these 96 are recently extinct and 6,399 are still in existence.
- All marsupials are mammals that develop and protect their young in a pouch, however the design of the pouch varies. In some species it is a deep opening; in others it is a simple fold of skin on or near the stomach. As they are mammals, all marsupials feed their young milk.
- The time a joey spends in the pouch depends on the species. Red Kangaroo joeys leave the pouch at eight months of age but will continue to suckle until around 18 months of age. Dunnart joeys may only spend a matter of weeks in the pouch but will continue to suckle externally whilst in the nest.
- Australia does not have the monopoly on marsupials! There are more than 330 species of marsupial worldwide. Around two thirds (approximately 220 – 250) live in Australia and Papua New Guinea and surrounding islands whilst the other third are found in South America. North America has one marsupial species, the Opossum.
- Marsupials are born in a very incomplete state. They are very small - often the size of a jellybean or a grain of rice - and are hairless. At birth their hindlimbs are partially formed and their forelimbs are fully formed. Their tiny toes have sharp, curved claws so they can crawl along the mother's fur into the safety of the pouch.
- Australian marsupials are categorised into three groups:
 - Dasyurids: Carnivorous marsupials such as quolls, antechinus, Tasmanian devils, numbats, dunnarts and phascogales.
 - Peramelemorphs: Omnivorous marsupials such as bilbies and bandicoots.
 - Diprotodonts: Herbivorous marsupials such as kangaroos, wombats, koalas, possums, wallabies and the extinct diprotodon.
- Some of Australia's oldest marsupial fossils are from Tingamarra, a 55-million-year-old site in Queensland. Some of these fossils are species similar to ones discovered in South America.
- The largest existing marsupial is the Red Kangaroo weighing around 90 kilograms and standing at 2.1 metres tall. The smallest existing marsupial is northern Australia's long-tailed planigale; a carnivorous marsupial resembling a house-mouse. It weighs an incredible 4.2-4.3 grams and measures just 55-65 millimetres. This tiny marsupial also holds the honour of being one of the world's smallest mammals; the largest was the extinct Diprotodon.

Source: The Australian Museum. What is a marsupial? - The Australian Museum and CSIRO Quick facts about marsupials – CSIROscope.

How many species of mammals are there? | Journal of Mammalogy | Oxford Academic (oup.com)
(Vol 1 Issue 99, Feb 2018).

Case study 1: Marsupial mansions

Tree hollows are valuable real estate for our native animals – and are even more precious considering they can take 100–200 years to develop. Australia lacks animals and birds that excavate hollows in tree trunks (such as the woodpecker). Consequently, the formation of tree hollows depends upon the slow work of fungi, rot, termites and lightning strikes. Small hollows suitable for wildlife such as the tiny feather-tailed glider will take about one hundred years to form. As a guide, between three to 10 hollow-bearing trees will provide around 30 hollows which is required per hectare to support a diverse wildlife population.

Species that rely wholly or partly on hollows for breeding and shelter in the Grey Box Grassy Woodlands in the Goulburn Broken catchment are:

- Brush-tailed Phascogale
- Sugar Glider
- Squirrel Glider
- Narrow-toed Feather-tailed Glider
- Common Brush-tailed Possum
- Eastern Ring-tailed Possum
- Yellow-footed Antechinus
- All Microbats

Artificial tree hollows – otherwise known as nest boxes – are a good ‘band-aid’ solution to address the lack of natural tree hollows in our landscape. Installing some ‘marsupial mansions’ on your property is a practical way to immediately increase habitat for our arboreal mammals.

What can you do?

1. Install your own nest boxes! If you build your own, make sure they are made from solid 20-millimetre-thick timber, not plywood. The thickness of the timber ensures thermal insulation for the animal inside and the solid, non-ply material ensures the nest box will not swell and deteriorate in wet weather. Visit <https://www.latrobe.edu.au/wildlife/nesting-boxes> for more information.
2. Discourage introduced or pest species from using nest boxes (noisy miners, feral bees, starlings and sparrows). If you see a non-target species using the nest box, block up the entrance with a piece of cloth and leave it in place for several months.
3. Plant locally indigenous understorey species. These plants provide the food for the animals that will use your nest boxes.
4. Plant locally indigenous tree species that will one day produce hollow habitat.

**Above all else, retain hollow-bearing trees, whether dead or alive.
All tree hollows are important!**



Dead or alive – trees are important! Removal of dead old trees (either standing or lying on the ground) results in the loss of habitat for many animals. Photo: J. Mentiplay-Smith

Case study 2: Fences and wildlife

Fences are vital but it is important to recognise they create significant and sometimes deadly barriers for our wildlife. Fences reduce the movement of animals across the landscape resulting in genetic 'bottlenecks' and smaller, fractured populations. Barbed wire poses a serious risk to wildlife and should be avoided. The fluffy tails and fragile membranes of gliders are easily snagged on barbed wire whereupon they suffer a protracted and painful death. Animals that sustain injuries from barbed wire often succumb to infection or predation.

Living in a rural area means we share our home with wildlife, which adds to the enjoyment of living where we do. It pays to be aware of the needs of wildlife when designing and constructing fencing.

What can you do?

1. Leave a gap between the ground and the bottom wire to enable wildlife to move beneath.
2. Use a plain high-tensile fencing wire to reduce the chance of entanglement by kangaroos.
3. Remove all barbed wire and use an electric offset wire ('hot wire') instead, to contain domestic stock. Wildlife and barbed wire are a cruel combination and barbed wire is dangerous and damaging to domestic stock.
4. If it is not possible to remove all barbed wire, place a length of split poly pipe (or a length of old garden hose that has been split) along the barbed wire. This will stop a glider or bat from becoming caught. You can do this at places along the fence line that are known bat or glider 'thoroughfares', often near places of high-quality vegetation or near water.
5. Build your fence at a maximum height of 1.2 metres to allow kangaroos to safely jump over. Add a white 'sighter wire' to the top of the fence to enable kangaroos to see the top more clearly.
6. If you are installing new fencing, take time to ascertain if you are fencing across an established wildlife thoroughfare and where possible, adapt the layout to accommodate this. It is easier and cheaper in the long run to build fences that avoid the path of wildlife, than it is to constantly repair damaged fences and deal with dead or suffering wildlife.





This Grey-headed Flying-fox became entangled and died on a barbed wire fence.
Photo: J. Mentiplay-Smith

Case study 3: At the ground level

The ground storey is vital for our mammals. A healthy, intact ground layer enables ground-dwelling native species to feed, hunt and rest through the day and avoid predators. A healthy ground storey is fundamental to the 'natural maintenance' of our rural ecosystems and is a vital component for overall healthy, functioning ecological processes.

Cleaning up fallen timber immediately reduces the diversity of native species. Once homes and food sources are destroyed, they are very slow to return. Cleaning up is fast-acting and long-lasting.

What can you do?

- Look upon fallen logs, branches, sticks and leaves as a valuable resource produced by your property. If it is in the 'wrong spot' relocate this material where possible, to a safe area on the property. It is amazing what animals will turn up when a supermarket and real estate is available.
- Don't stack it – spread it! All fallen timber is important. Relocate large logs around the 'drip line' vicinity of paddock trees. This will improve the health of the tree which provides shade and shelter for stock and limits the impact of concentrated stock camping, therefore reducing soil compaction, excess manure and nutrient build up, soil erosion and changes in soil biology.
- Do not pile up logs directly beneath trees as this will create a concentrated source of 'hot' fuel should fire occur.
- Leave some large logs scattered around the paddock. This provides habitat for native species, provides protection for the soil and any newly emerging seedlings (which are the next generation of paddock trees) and are useful scratching stations for stock. Echidnas and dunnarts can move more effectively across open paddocks where there are safe 'stepping stones' in the form of scattered logs to shelter behind and beneath.
- Fallen logs and branches can become a fox and rabbit harbour if they are piled up in a stack. Leave the logs scattered on the ground and the only animals that will use this habitat as a hiding spot are the small native ones such as antechinus, frogs, lizards and dunnarts.
- Leave fallen logs, sticks and leaves and start a new neighbourhood trend. By not 'cleaning up' you are conveying the message that the ground storey is important and a valuable resource.



Grey Box Woodland with a healthy ground layer. Photo: C. Tzaros

Stumps and fallen timber means food and safety for this Yellow-footed Antechinus. Photo: C. Tzaros



Appendix 1. Species list and Victorian listing

(Flora and Fauna Guarantee Act 1988 – Threatened List, October 2021. Department of Land, Water and Planning)

MARSUPIAL MAMMALS

DUNNART

Common Dunnart	(<i>Sminthopsis murina</i>)	listed as vulnerable
Fat-tailed Dunnart	(<i>Sminthopsis crassicaudata</i>)	Not listed

ANTECHINUS

Yellow-footed Antechinus	(<i>Antechinus flavipes</i>)	Not listed
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PHASCOGALE

Brush-tailed Phascogale	(<i>Phascogale tapoatafa</i>)	Listed as vulnerable
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GLIDER

Narrow-toed Feather-tailed Glider	(<i>Acrobates pygmaeus</i>)	Not listed
Sugar Glider	(<i>Petaurus breviceps</i>)	Not listed
Squirrel Glider	(<i>Petaurus norfolcensis</i>)	Listed as vulnerable

POSSUM

Common Brush-tailed Possum	(<i>Trichosurus vulpecula</i>)	Not listed
Eastern Ring-tailed Possum	(<i>Pseudocheirus peregrinus</i>)	Not listed

KOALA

Koala	(<i>Phascolarctos cinereus</i>)	Not listed
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WOMBAT

Bare-nosed Wombat	(<i>Vombatus ursinus</i>)	Not listed
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KANGAROO AND WALLABY

Black-tailed Wallaby	(<i>Wallabia bicolor</i>)	Not listed
Eastern Grey Kangaroo	(<i>Macropus giganteus</i>)	Not listed

PLACENTAL MAMMALS

RODENT

Rakali (Water Rat)	(<i>Hydromys chrysogaster</i>)	Not listed
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MEGA BAT

Grey-headed Flying Fox	(<i>Pteropus poliocephalus</i>)	Listed as vulnerable
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Little Red Flying Fox	(<i>Pteropus scapulatus</i>)	Not listed
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MICRO BAT

White-striped Free-tailed Bat	(<i>Austronomus australis</i>)	Not listed
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Gould's Long-eared Bat	(<i>Nyctophilus gouldi</i>)	Not listed
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Lesser Long-eared Bat	(<i>Nyctophilus geoffroyi</i>)	Not listed
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Gould's Wattled Bat	(<i>Chalinolobus gouldii</i>)	Not listed
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Chocolate Wattled Bat	(<i>Chalinolobus morio</i>)	Not listed
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Southern Myotis	(<i>Myotis macropus</i>)	Not listed
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Inland Broad-nosed Bat	(<i>Scotorepens balstoni</i>)	Not listed
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Southern Forest Bat	(<i>Vespadelus regulus</i>)	Not listed
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Little Forest Bat	(<i>Vespadelus vulturinus</i>)	Not listed
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Large Forest Bat	(<i>Vespadelus darlingtoni</i>)	Not listed
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Southern Free-tailed Bat	(<i>Ozimops planiceps</i>)	Not listed
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Ride's Free-tailed Bat	(<i>Ozimops ridei</i>)	Not listed
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MONOTREMES

MONOTREME

Platypus	(<i>Ornithorhynchus anatinus</i>)	Listed as vulnerable
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Short-beaked Echidna	(<i>Tachyglossus aculeatus</i>)	Not listed
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IF YOU FIND SICK OR INJURED WILDLIFE

Australian Platypus Conservancy (5416 1478/0419 595 939, usually 24 hours).

Healesville Sanctuary Australian Wildlife Hospital (5957 2829, 8.00 am to 5.00 pm daily; animals needing care can be dropped off between 9.00 am and 4.00 pm daily).

Wildlife Victoria (8400 7300, 6.40 am to 8.30 pm daily).

WEBSITE REFERENCES

Atlas of Living Australia – find wildlife recorded in your area - <http://biocache.ala.org.au/explore/your-area>
Australasian Bat Society <https://www.ausbats.org.au>
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Australian Platypus Conservancy – <https://platypus.asn.au/rakali>
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