Wildlife Friendly Gardening in Southwestern Australia

Guide 3
Garden Structure Installation Manual

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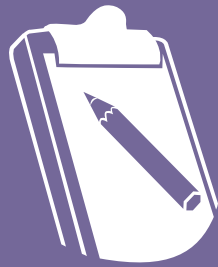Hannah F. Gulliver[b], Paul G. Close[a]*
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Acknowledgements

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Any participants taking part in the installation activities described in this manual does so at their own risk. All structure installations for this project have been approved by the University of Western Australia's Animal Ethics Committee, application number: 2021/ET000799.

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Table of Contents

Purpose of This Guide

This document provides a guide for residents in southwestern Australia (Figure 1) to install wildlife friendly structures in their own garden. These structures aim to provide shelter or water to wildlife to help them persist in urban areas. Residents can choose one or more of the following structures to install:

1. Bat box

2. Bird bath

3. Bird box for pardalotes

4. Bird box for parrots (only for residents located in or south of Bunbury)

5. Frog hotel

6. Pond

7. Possum box

8. Reptile shelter
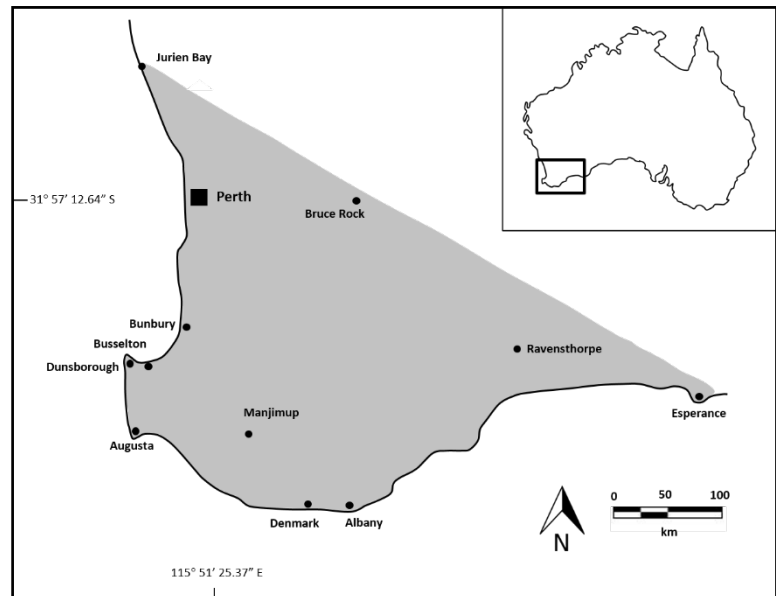
Figure 1: Map defining the region covered by this installation guide: southwestern Australia, from Jurien Bay to Esperance.

The structure designs and installation methods recommended in this manual have been selected to:

- Ensure the structures are safe to use by wildlife
- Maximise the attractiveness and usefulness of the structures to wildlife
- Minimise any potential benefit to unwanted pests or introduced species

This guide does not:

- Provide all possible ways of assembling or installing the above garden structures
- Provide installation instructions for all possible garden structures or all wildlife-friendly gardening techniques
- Provide a list of all possible suppliers of each garden structure

This resource has been produced as part of a citizen science research project; 'Turning Gardeners into Conservationists: Using Gardens to Conserve Wildlife' led in partnership by the University of Western Australia and Perth NRM. This project is funded by the Australian Government's Inspiring Australia Science Engagement Programme. This guide only covers certain wildlife friendly structures that are the focus of the research project.

It is worth noting that research on the biodiversity benefits of wildlife friendly structures and the best design of these structures is still in its infancy. The recommendations in this manual are based on the information that was available at the time of publication. The 'Turning Gardeners into Conservationist' project aims to improve our understanding of the value of wildlife friendly structures, and the designs that best benefit wildlife.

Wildlife Friendly Gardening

Wildlife friendly gardening is the manipulation of gardens by residents with the goal of providing habitat for wildlife. This can include providing:

Water Sources

Food Resources

Shelter for Wildlife

Common wildlife friendly gardening activities include planting native plants to provide habitat and food, and providing water and shelter through the installation of wildlife friendly structures like ponds, bird baths, nest boxes, frog hotels, and reptile shelters. This guide provides instructions of how to install an assortment of these wildlife friendly structures.

How to Use This Manual

This manual provides step-by-step instructions detailing how to install wildlife friendly structures in your garden. There are eight structure options to choose from including a:

1. Bat box
2. Bird bath
3. Bird box for pardalotes
4. Bird box for parrots
5. Frog hotel
6. Pond
7. Possum box
8. Reptile shelter

Whether you choose to install just one or multiple of these structures in your garden is up to you! Some structures will be easier to install and monitor than others, so you might like to take this into account when making your choice.

If you are installing these structures as part of the 'Turning Gardeners into Conservationists' project, we encourage you to monitor these newly installed structures as outlined in *Guide 2: Wildlife Monitoring Manual* to help build our knowledge of the biodiversity benefits of wildlife friendly gardening. *Guide 1: Vertebrate Species Identification Guide* provides helpful photographs and information to assist you in identifying wildlife using your garden and structures.

For each of the wildlife friendly structures, we have provided the following information to help you install them:

Purpose:	The benefit that the structure provides to wildlife.
Animals:	The animals that the structure is designed to support.
Difficulty:	A ranking of how easy or challenging the structure is to assemble and install in your garden. We have ranked each as either 'Easy', 'Medium' or 'Challenging'.
Cost:	The approximate cost (AUD$) to purchase and install the structure. *Please note: Citizen Scientists involved in the project will receive a discount on most structures.*
Purchase:	Our recommended supplier where you can purchase the structure. Each of the listed suppliers deliver and provide what we consider to be one of the safest and best designs for wildlife.
Equipment:	Everyday household items needed to install the structure.
Positioning:	Where to place the structure in your garden to maximise its use.
Installation:	Step-by-step instructions to install the structure.
Tips:	Some hints to help you install and maintain the structure.
Why This Design?:	A summary of why we consider this structure design to be the best option for wildlife!

General Installation Guidelines

- **Before starting, consider carefully which structure/s you would like to install in your garden.** You may want to consider your budget, garden space, which structure is suitable for your surroundings, and what you will have time to install, monitor and maintain. Our guide provides a 'difficulty' ranking for each structure to help guide your decision making:

    o *Easy:* requires minimal effort or materials to get started and little to no maintenance.

    o *Medium:* requires some installation effort and/or maintenance.

    o *Challenging:* is more difficult to install and/or monitor (e.g. involves ladder climbing or digging) and may need regular maintenance.

- **Safety first!** Please don't attempt to install any structures if you are uncertain about the safety or health of yourself or others (e.g. climbing ladders without help). Only do what you feel comfortable with.

- **Be mindful of any council regulations** in your area regarding structures. For example, some ponds may need fencing if they are over a certain depth or size.

- **Be considerate to neighbours** when installing structures. For example, ponds may attract frogs that are noisy at night, and bat or bird boxes may collect droppings underneath.

- **Be mindful of your pets.** If you have an outdoor dog or cat, it's best to install structures where wildlife will not be disturbed by your pets. For example, a nest box installed out of reach may be a safer choice than a pond.

- **Don't worry if you get an unexpected animal using your structure!** We are interested in any animal that uses your structure, even if it wasn't the intended one, so be sure to tell us everything you see using your structure.

- **We are equally as interested if <u>no</u> animals use the structure during the study!** Even if you saw nothing, please submit your 'zero' survey as outlined in *Guide 2: Wildlife Monitoring Manual.*

Wildlife Friendly Garden Structures

Bat Box

Purpose
To provide a safe place for microbats to roost.

Animals
Microbats, particularly Gould's wattled bat.

Difficulty
Challenging.

Cost
$95.00.
Note: Citizen Scientists involved in the project will receive a discount on this item!

Purchase
'Microbat (bottom entry) box' from The Re-cyc-ology Project.
http://www.re-cyc-ology.com.au/p/nest-box-orders.html

Equipment
3m high ladder, white sand or similar.

Positioning

- ✓ Place on a sturdy tree trunk or branch capable of supporting the box's weight (at least 20cm in diameter).

- ✓ Place about 3m off the ground to protect the nest from ground predators.

- ✓ Where possible, place the box on the eastern side of a tree to keep the temperature of the box suitable for bats.

- ✓ Install on a vertically straight part of the tree to ensure the box is not tipping upwards or downwards.

- ✓ Choose a location that you can access safely with a ladder.

- ✘ Do not place the box near branches which would block the landing pad and entrance at the base of the box. Bats prefer an unobstructed flight path in and out of the box.

- ✘ Avoid placing in noisy locations such as near busy roads, your driveway or locations that are often disturbed by people.

Bat Box

Trunk is facing down; box is not vertical.

Correct! Place on a vertical section of tree.

Trunk is facing upwards; box is not vertical.
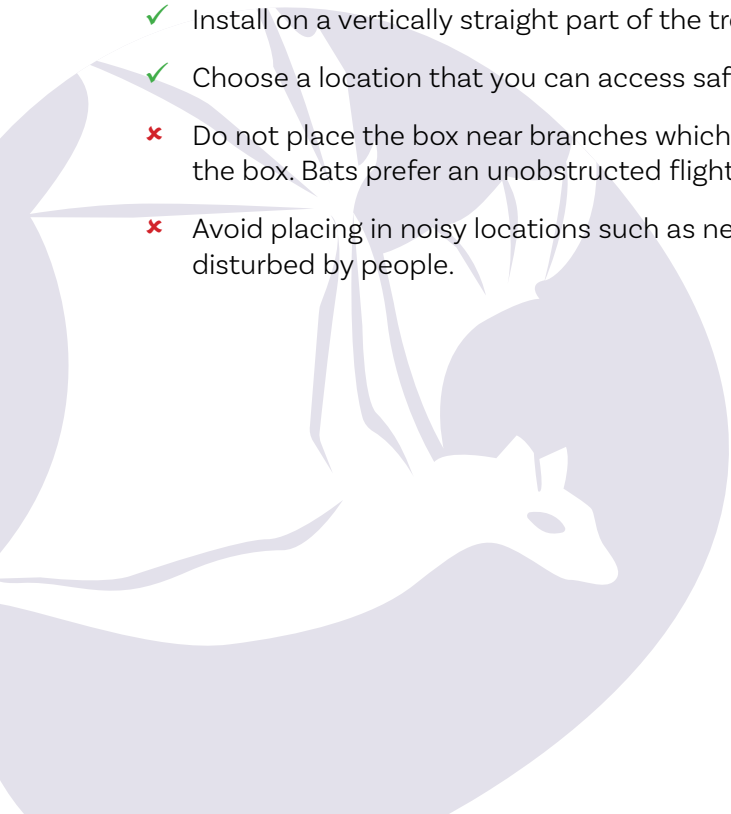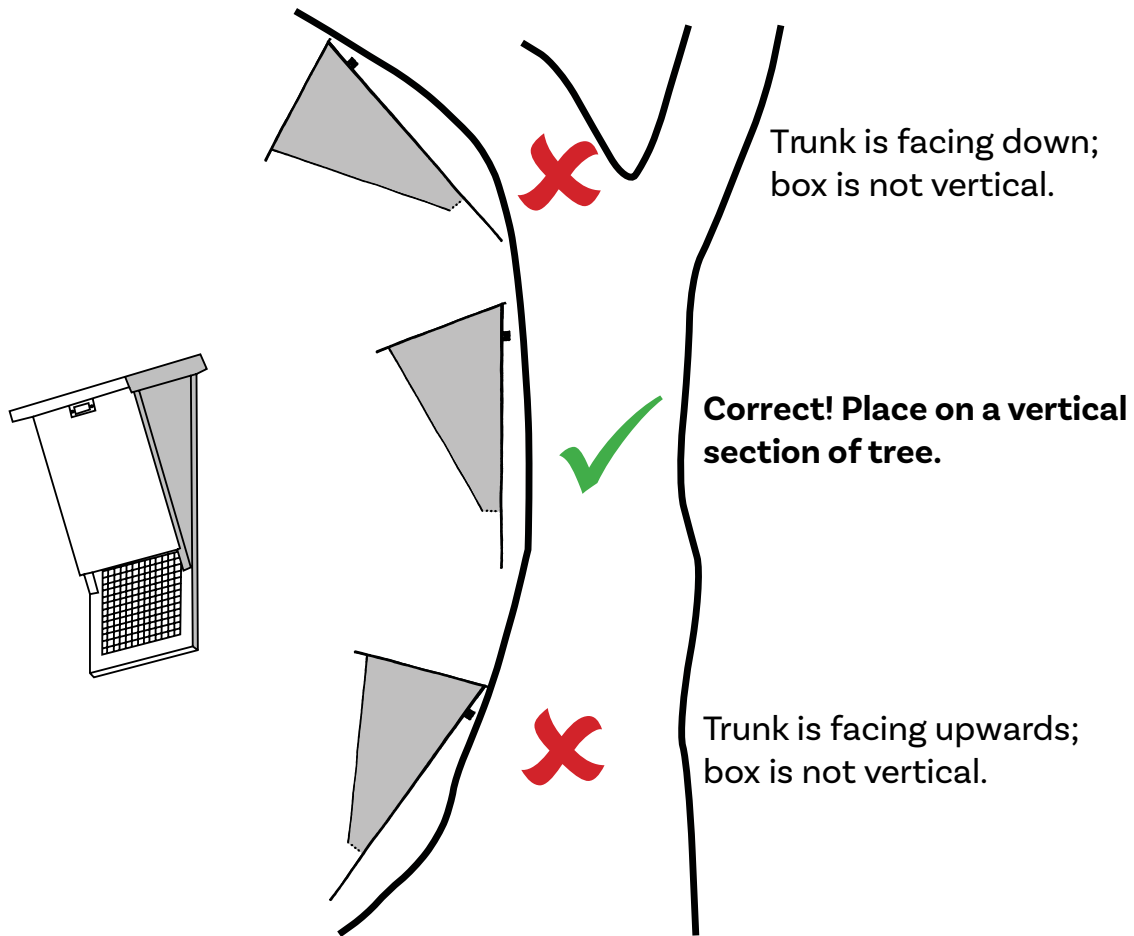
Figure 2: Ensure you install your bat box on a vertical section of the tree.

Installation

1. Use a ladder to reach the location where you will secure the bat box to the tree. You may like to ask another person to steady the ladder for safety.
2. Following the instructions of the box supplier, attach the box to the tree so that it is vertical, steady and securely fastened to the tree.
3. Lay some white sand or other light material on the ground directly below the box so that any guano (bat poo) is easy to see and you'll know bats are in residence!

Tips

- Do not clean your bat box (even if there are bat poo stains!) as this may disturb any bats that are using the shelter.
- Avoid contact with the box or droppings if there are bats in residence, and never handle a bat.
- Bats may take longer than other animals to start using the box so don't be too discouraged if some months (or even years) go by without a resident!

Why This Design?

The small **bottom-entry with a 'landing pad'** allows the bats to climb into the box as they would any natural shelter. Droppings fall out the down-ward facing entry so the boxes are self-cleaning and bat presence can be easily detected from below.

Bats like a warmer box than birds or possums. For this reason, positioning the box on the **eastern side of the tree** provides suitable temperatures.

The box has **thick walls (around 20mm)** to protect it from becoming too hot or cold for bats.

The box has a **weatherproof** design to maintain a safe, dry and warm environment.

The box uses **water-based exterior paint** which is less likely to be toxic to animals than oil-based paints or varnish and will extend the box's life.

Native bats are known to occupy both single-chambered and multi-chambered bat boxes. While multi-chambered boxes may support a greater variety of bat species, we have selected a **single-chambered box** for this project as they are a more affordable option.

Bird Bath

Purpose
To provide animals, especially birds, with a safe watering point for drinking and bathing.

Animals
Birds, potentially frogs and some mammals.

Difficulty
Medium.

Cost
$55.00.
Note: Citizen Scientists involved in the project will receive a discount on this item!

Purchase
The materials you need are available from Bunnings. You can search the product code on their website: https://www.bunnings.com.au/.

To install your bird bath, you will need to purchase:

- Northcote Pottery 47 x 57cm Terracotta Cottaseal Bird Bath
    o Search product code (I/N): 2800745

Equipment
Hose or watering can, water, one fist-sized rock.

Positioning

✓ Ensure bird bath is placed on firm, level ground.

✓ Place bird bath under dappled shade to prevent algal growth in warm water.

✓ Place bird bath close to medium shrubs (within 2-3m from plants approximately 1-1.5m high). This will encourage birds to use the bath as they can view it from safety first. Additionally, planting or placing the bath near a 'prickly' plant species will provide protection for smaller birds.

✗ Avoid putting the bath within 3m of structures that a cat can reach and stalk birds (e.g. avoid placement next to large tree branches and solid fences).

✗ Avoid placing directly under trees that drop leaves regularly (e.g. deciduous trees) to prevent the bath filling with leaves.
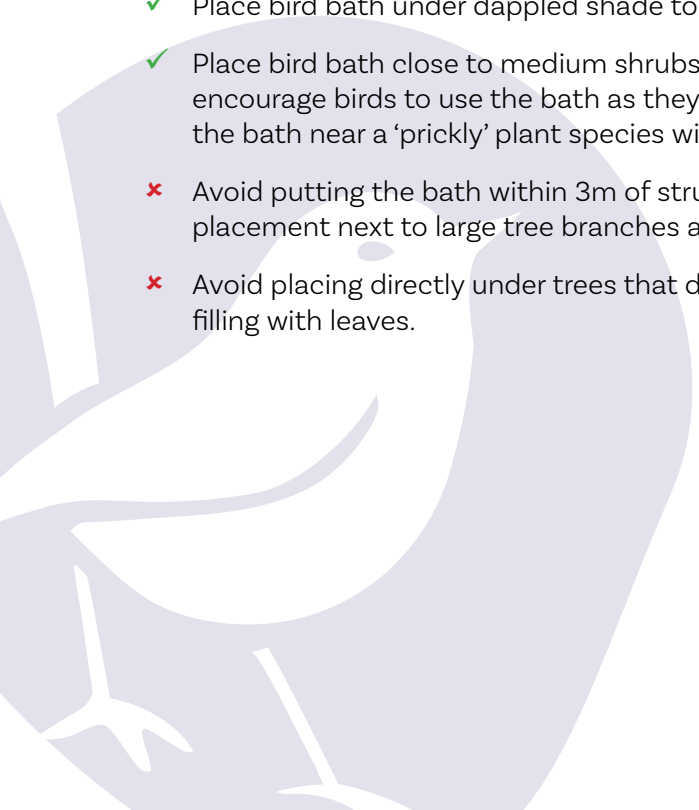
Bird Bath

Figure 4: Tips for positioning your bird bath.

Installation

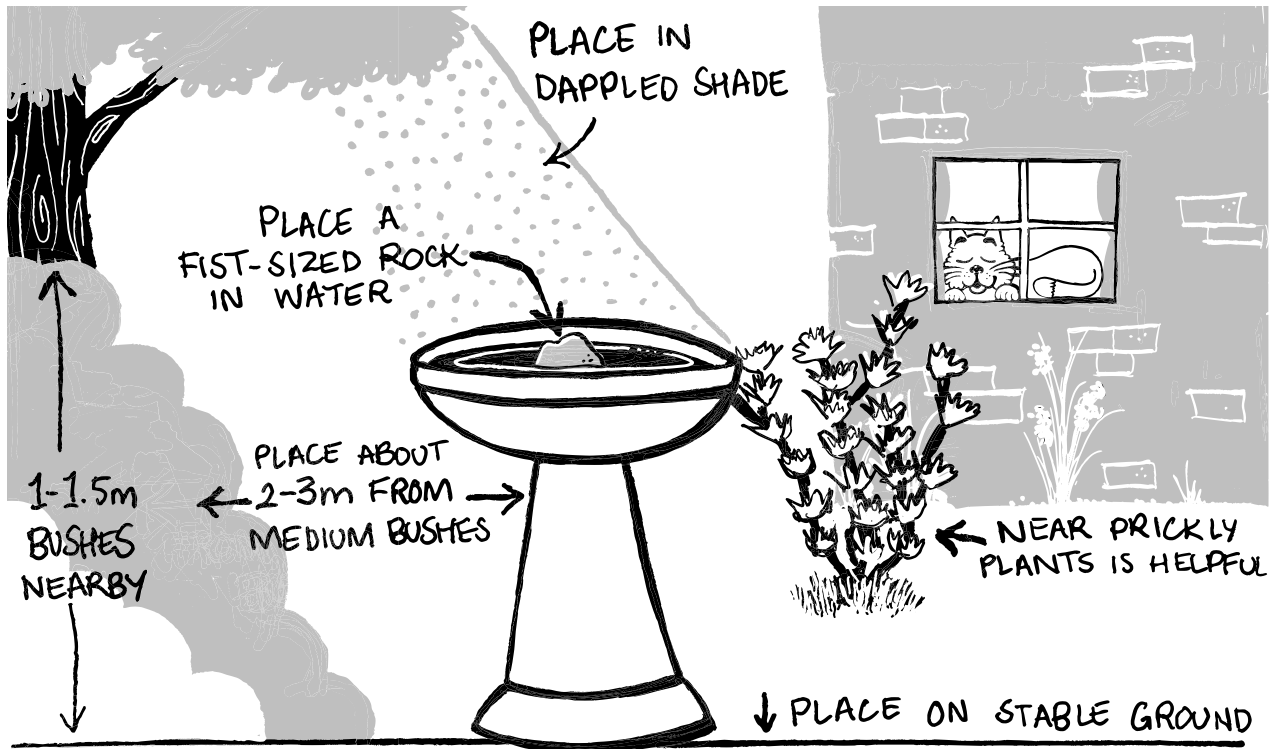1. Once you've picked the location for your bird bath, push the pedestal base of the bath into the earth and check it is level and not wobbling. If you are concerned about the bath tipping, you can secure it further by hammering a short star picket into the ground and then placing the pedestal over it.

2. Fit the bowl onto the pedestal.

3. Fill the bath with water.

4. Place one fist-sized rock in the middle of the bird bath to provide an additional perching spot and exit location for animals using your bird bath.

Tips

- Ensure that the bird bath is regularly topped up with fresh water. Depending on the season and rainfall, this is normally 2 to 3 times a week. However, in summer this may be as frequently as every day.

- Keep the bath clean. Clean the bath approximately once a week with a scrubbing brush and clean water (no soap). Cleaning the bath each week will also help prevent the spread of bird diseases, breeding of mosquitoes, or algae growth.

- Do not use household cleaners to clean your bird bath as this may be toxic to animals that come to drink. Calcium build-up can be removed by soaking with dilute vinegar for a few hours and then rinsing thoroughly.

Why This Design?

Pedestal-style bird baths are **elevated** and provide good predator protection while being easy to set up.

Shallow bowls are preferred by birds for bathing and will allow birds and other animals to enter and exit the bath easily. This also minimises the risk of drownings.

Terra cotta provides some grip which can help birds enter and exit the bath compared to more slippery plastic or ceramic styles.

Terra cotta is **heavier** than plastics so is less likely to fall over in strong winds.

Bird Box for Pardalotes

Purpose
To provide a safe nesting site for pardalotes and other small birds.

Animals
Striated pardalote and occasionally spotted pardalote, tree martins and some other small animals.

Difficulty
Challenging.

Cost
$95.00.
Note: Citizen Scientists involved in the project will receive a discount on this item!

Purchase
'Very small vertical (front entry) box' from The Re-cyc-ology Project.
http://www.re-cyc-ology.com.au/p/nest-box-orders.html

Equipment
3m high ladder, couple of handfuls of dry wood chips (enough to create a 10cm depth of wood chips at the base of your box).

Positioning

- ✓ Place on a sturdy tree trunk or branch capable of supporting the box's weight (at least 20cm in diameter).

- ✓ Place about 3m off the ground to protect the nest from ground predators.

- ✓ Where possible, place the box on the south-eastern side of a tree to keep the box as cool as possible on hot days.

- ✓ Place near to branches around the entrance as birds like to land on these before entering the box.

- ✓ Place the box on a tree with canopy overhead to help shade the box and stop it from overheating in summer.

- ✓ Install on a vertically straight part of the tree to ensure the box is not tipping upwards or downwards.

- ✓ Choose a location that you can access safely with a ladder.

- ✗ Avoid placing in noisy locations such as near busy roads, your driveway or locations that are often disturbed by people.

Bird Box for Pardalotes

Trunk is facing down; box is not vertical.

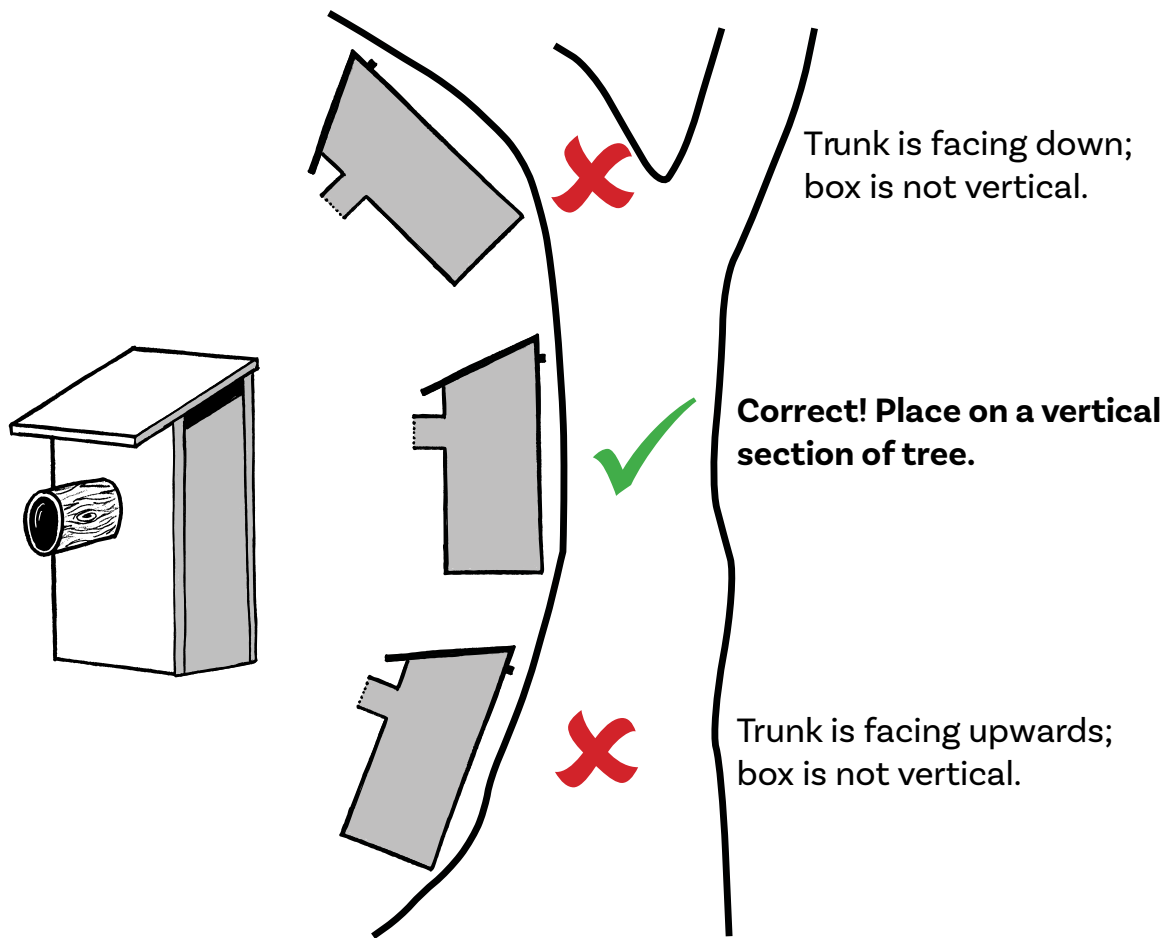**Correct! Place on a vertical section of tree.**

Trunk is facing upwards; box is not vertical.

Figure 6: Ensure you install your bird box on a vertical section of the tree.

Installation

1. Use a ladder to reach the location where you will secure the bird box to the tree. You may like to ask another person to steady the ladder for safety.

2. Following the instructions of the box supplier, attach the box to the tree so that it is vertical, steady and securely fastened to the tree. Ensure the entry to the box faces outward, away from the trunk.

3. Ensure the box is secure and will not fall if a bird uses it.

4. Fill the box with 10cm of dry wood chips at the base. This provides a starting point for birds to create nests. These can be gathered from your garden, however, be sure not to use straw/hay or damp mulch as this can go mouldy.

Tips

- A small telescopic mirror (available for $6 at Bunnings: Craftright Inspection Telescopic Mirror; Product Code (I/N): 5810236) may help you check your box during monitoring.

- Following heavy rain or a storm it is a good idea to check the box hasn't shifted position or collected water inside. If you notice any water inside, you may need to reposition the box.

- Please don't remove any nests from the box, even if you think they have been abandoned.

Why This Design?

Pardalote boxes have **small tube entrances** which allows entry to pardalotes and other small birds, while preventing larger and more 'pushy' animals (such as feral rainbow lorikeets) from entering.

The box has **thick walls (around 20mm)** to protect it from becoming too hot or cold for birds.

The **entry is made from natural tree-hollows** which increases the chance of native species using the box.

The box uses **water-based exterior paint** which is less likely to be toxic to animals than oil-based paints or varnish and will extend the box's life.

The box has a **weatherproof** design to maintain a safe, dry and warm environment.

The box has **drainage holes** to prevent any moisture build-up inside the box.

The box **contains a ladder** inside which allows both target and non-target species to safely exit the box at any time.

The box has **air-slots** under the lid to provide ventilation and reduce the chance of feral bees invading.

Bird Box for Parrots

> **WARNING: Do not install this type of bird box if you live north of Bunbury, WA.**
>
> Parrot boxes are easily invaded by rainbow lorikeets, which are declared pests in Western Australia. This pest species, which occurs in and around Perth, is quite aggressive and will harass and compete with native birds. If you want to install a bird box and live north of Bunbury, install a pardalote box which is too small for the rainbow lorikeets to use. Rainbow lorikeets do not occur in or south of Bunbury, so parrot boxes are safe to install for residents in these regions.

Purpose
To provide a safe nesting site for small parrots and other birds.

Animals
Western rosella, elegant parrot, red-capped parrot, other small animals.

Difficulty
Challenging.

Cost
$120.00.
Note: Citizen Scientists involved in the project will receive a discount on this item!

Purchase
'Small vertical (front entry) box' from The Re-cyc-ology Project.
http://www.re-cyc-ology.com.au/p/nest-box-orders.html

Equipment
3m high ladder, couple of handfuls of dry wood chips (enough to create a 10cm depth of wood chips at the base of your box).

Positioning

- ✔ Place on a sturdy tree trunk or branch capable of supporting the box's weight (at least 20cm in diameter).

- ✔ Place about 3m off the ground to protect the nest from ground predators.

- ✔ Where possible, place the box on the south-eastern side of a tree to keep the box as cool as possible on hot days.

- ✔ Place near to branches around the entrance as birds like to land on these before entering the box.

- ✔ Place the box on a tree with canopy overhead to help shade the box and stop it from overheating in summer.

- ✔ Install on a vertically straight part of the tree to ensure the box is not tipping upwards or downwards.

- ✔ Choose a location that you can access safely with a ladder.

- ✘ Avoid placing in noisy locations such as near busy roads, your driveway or locations that are often disturbed by people.
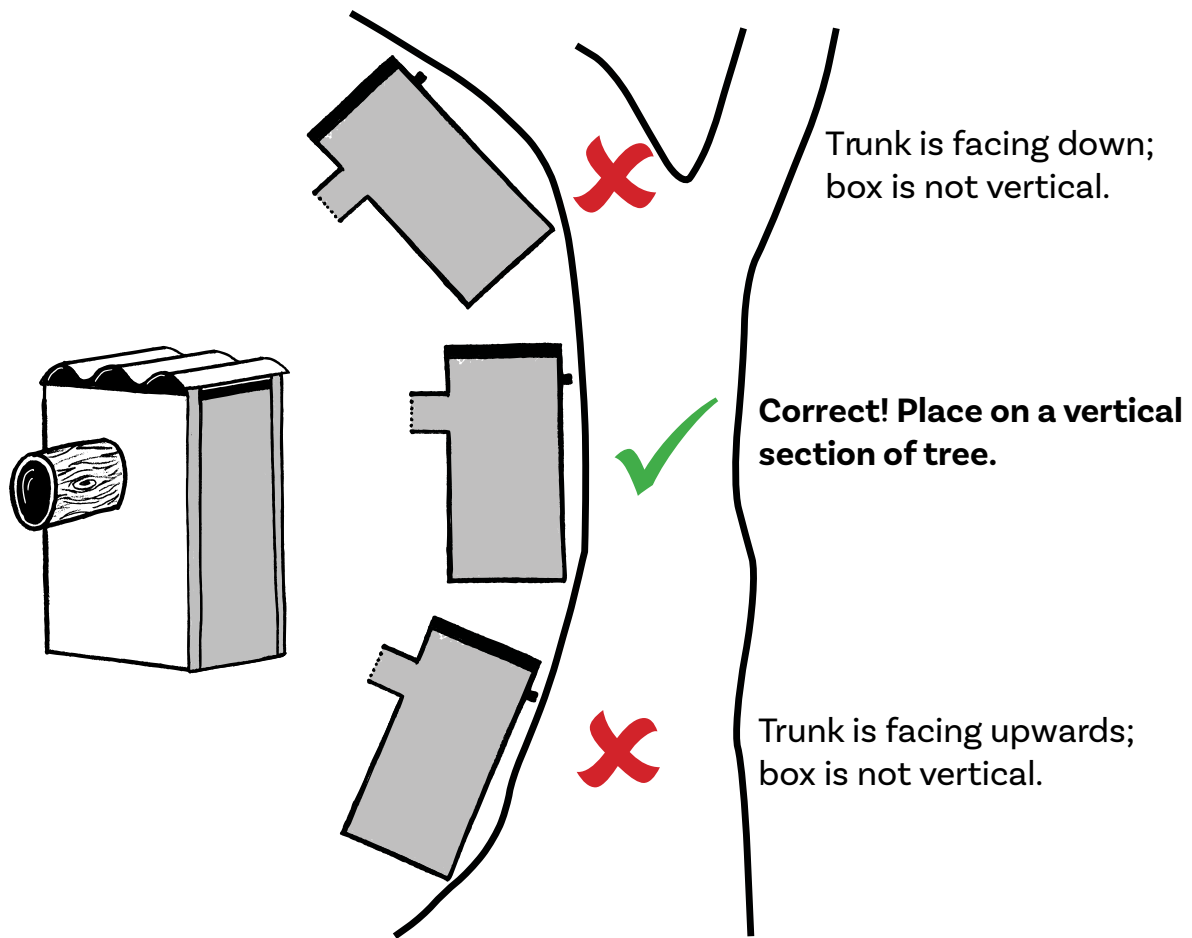
Bird Box for Parrots

Trunk is facing down; box is not vertical.

Correct! Place on a vertical section of tree.

Trunk is facing upwards; box is not vertical.

Figure 8: Ensure you install your bird box on a vertical section of the tree.

Installation

1. Use a ladder to reach the location where you will secure the bird box to the tree. You may like to ask another person to steady the ladder for safety.

2. Following the instructions of the box supplier, attached the box to the tree so that it is vertical, steady and securely fastened to the tree. Ensure the entry to the box faces outward, away from the trunk.

3. Ensure the box is secure and will not fall if a bird uses it.

4. Fill the box with 10cm of dry wood chips at the base. This provides a starting point for birds to create nests. These can be gathered from your garden, however, be sure not to use straw/hay or damp mulch as this can go mouldy.

Tips

- A small telescopic mirror (available for $6 at Bunnings: Craftright Inspection Telescopic Mirror; Product Code (I/N): 5810236) may help you check your box during monitoring.

- Following heavy rain or a storm it is a good idea to check the box hasn't shifted position or collected water inside. If you notice any water inside you may need to reposition the box.

- Please don't remove any nests from the box, even if you think they have been abandoned.

Why This Design?

This nest box has a **larger entrance** than the pardalote box design, allowing entry to a broader size-range of bird species (only excluding very large birds like galahs and kookaburras). Remember, do not install this type of bird box if you live north of Bunbury, WA (see 'Warning' section on page 18 for more information).

The box has **thick walls (around 20mm)** to protect it from becoming too hot or cold for birds.

The **entry is made from natural tree-hollows** which increases the chance of native species using the box. The **hollows are also non-toxic** which allows parrots to chip or chew at the hollow entry with no risk.

The box uses **water-based exterior paint** which is less likely to be toxic to animals than oil-based paints or varnish and will extend the box's life.

The box has a **weatherproof** design to maintain a safe, dry and warm environment.

The box has **drainage holes** to prevent any moisture build-up inside the box.

The box **contains a ladder** inside which allows both target and non-target species to safely exit the box at any time.

The box has **air-slots** under the lid to to provide ventilation and reduce the chance of feral bees invading.

Frog Hotel

Purpose
To provide a safe place for frogs to rest, and escape predators and the dry heat of the day.

Animals
Tree frogs such as the motorbike frog, slender tree frog and spotted-thighed frog.

Difficulty
Medium.

Cost
$55.00.
Note: Citizen Scientists involved in the project will receive a discount on this item!

Purchase
The materials you need are available from Bunnings. You can search the product code on their website: https://www.bunnings.com.au/.

To install your frog hotel, you will need to purchase:

- 1x 1m length of Holman 40mm x 1m Class 9 Press PVC Pipe
    - Search product code (I/N): 4750049
- 1x 1m length of Holman 75mm x 1m PVC Stormwater Pipe
    - Search product code (I/N): 4770101
- 1x 1m length of Holman 90mm x 1m Stormwater Pipe
    - Search product code (I/N): 4770093
- 1x Holman 40mm 90° White PVC Elbow
    - Search product code (I/N): 3141346
- 1x Holman 75mm 90° Female and Female PVC Stormwater Plain Elbow
    - Search product code (I/N): 4770308
- 1x Holman 90mm 90° Female and Female PVC Stormwater Elbow
    - Search product code (I/N): 4770310

Please note: Bunnings stocks various pipes and elbows so be sure to check the product code matches what's listed above and check that the elbows fit securely onto the respective pipes before purchasing. Depending on your local Bunnings store layout, the 40mm pipe and elbow may be in a different section to the 75mm and 90mm pipes and elbows.

Equipment
Large cable ties or weatherproof tape, fine-tooth handsaw (e.g. a hacksaw), piece of sanding paper, shovel, measuring tape, water, hose.

Positioning

- ✓ Place in a moist, shady, quiet spot in the garden away from pets and neighbours.
- ✓ Place in a location that has soil or earth to dig the hotel into.
- ✓ Where possible, place the hotel near some low, shade-loving plants and leaf litter as this will enhance the habitat for frogs.

Frog Hotel

Positioning

✓ You can bury the frog hotel in a pot if you do not have an appropriate space in the garden, or only have a courtyard. The pot needs to be at least 20cm deep and 40cm wide. You can use a larger pot and plant appropriate plant species around it.

✗ Avoid placing in areas where you use pesticides, herbicides or fertilisers.

Installation

1. Cut each of the three 1m lengths of PVC pipes with a saw so that each length is split into one 40cm length and one 60cm length. In total, you will now have three 40cm lengths and three 60cm lengths.

2. Lightly sand all the cut edges of the pipes to ensure there are no sharp edges that may cut or harm wildlife.

3. Group the six pipes and cable tie or tape them together so they are secure and don't wobble. If you are using cable ties, you may need to thread a couple together to make them long enough to reach around all the pipes. You can use weatherproof tape as well as cable ties to ensure the pipes are securely fastened together. The arrangement of these pipes within the bundle does not matter.

4. Once you have grouped the pipes, measure the total diameter of the frog hotel.

5. In the location you want to install your hotel, dig a shallow hole (approximately 15cm deep) that is slightly larger than the diameter of the hotel.

6. Place the hotel in the hole, making sure that the base is level.

7. Fill in the hole around the sides of your frog hotel with soil and compact until it is level with the surrounding ground. Then add a little soil inside the interior of the pipes to help stabilise it. You may like to use a stick to compact the soil inside the pipes.

8. Check that the hotel is secure and not wobbling. If it is still wobbling, you will need to dig the hole deeper or secure it further with cable ties/tape.

9. Attach the PVC elbows onto the matching sized PVC pipes. It doesn't matter if you fix them to the 40cm or 60cm lengths (or a mix of both!). When you are finished you will have three pipes with elbows and three pipes without elbows.

10. Lightly water around where you installed the frog hotel to help create a moist environment that will attract frogs!

Tips

• Once you have installed your hotel, try not to bump, knock or move it as frogs may take a while to repopulate a moved hotel.

• In summer, it's a good idea to occasionally dampen the soil around the hotel to keep the habitat moist.

• If you wish, pipes can be painted with a non-toxic exterior paint to match your garden (green/brown is best, avoid bright colours!).

Why This Design?

Figure 10: Frog hotel installed in the ground with elbows attached.

The pipes provide a **moist, cool environment for tree frogs** to hide in. Tree frogs can climb the slippery pipe surfaces using their suctioning toe pads.

This design does **not require a water-filled bowl** which needs maintenance and regular topping-up to prevent mosquito infestation.

The **different sized pipes** provide spaces to accommodate different size frogs.

Using **non-toxic paint** to decorate is safest for frogs, as they have permeable skin and can absorb toxins.

This design is **cheap and easy** to make with a few items from your local hardware store but can be enhanced according to your preference.

This design is easy to **fit into small gardens** and is suitable for most garden types.

Pond

Purpose
To provide a source of water for animals and a habitat for frogs to live and breed in.

Animals
Frogs and potentially birds, mammals and reptiles.

Difficulty
Challenging.

Cost
$200.00.
Note: Citizen Scientists involved in the project will receive a discount on this item!

Purchase
Most of the materials you will need to install a pond are available from Bunnings. You can search the product code on their website: https://www.bunnings.com.au/.

To install your pond you will need to purchase:

- 1x Pond shell: AQUAPRO 113L Coquetdale Preformed Poly Pond
    - Search product code (I/N): 2921052
- 1x Bag of builder's sand: Westbuild 20kg White Washed Sand
    - Search product code (I/N): 0760103
- 1x Bag of pebbles: Tuscan Path 20-80mm 15kg Natural Stone Mix
    - Search product code (I/N): 3451809
- 2x Clay bricks: Brighton Masonry 230 x 110 x 76mm Standard Common Clay Brick
    - Search product code (I/N): 1180261
- One aquatic or emergent plant.
    - We recommend choosing a native twigrush (e.g. *Machaerina* species, formerly known as *Baumea*), water ribbons (e.g. *Cycnogeton huegelii*, formerly known as *Triglochin*), or the Native Waterlily (*Ottelia ovalifolia*).

Equipment
Shovel, builder's level, water, hose.

Positioning

✓ Find a flat surface away from underground pipes, conduits or tree roots that will fit the area of the pond (about 1 x 1.3m).

✓ Place in dappled shade where the pond will get some partial sunlight. Too little sun may stop frogs from breeding, and too much may overheat the water, causing deoxygenation and excessive algal growth.

✗ Avoid placing underneath trees that regularly drop leaves (e.g. deciduous plants) to reduce algae/nutrient build-up.

✗ Avoid placing in areas that are noisy or frequently disturbed by humans or pets.

✗ Avoid placing in areas where you use pesticides, herbicides or fertilisers.

✗ Avoid placing the pond near pine trees or oleander as their resin/sap is toxic to wildlife.
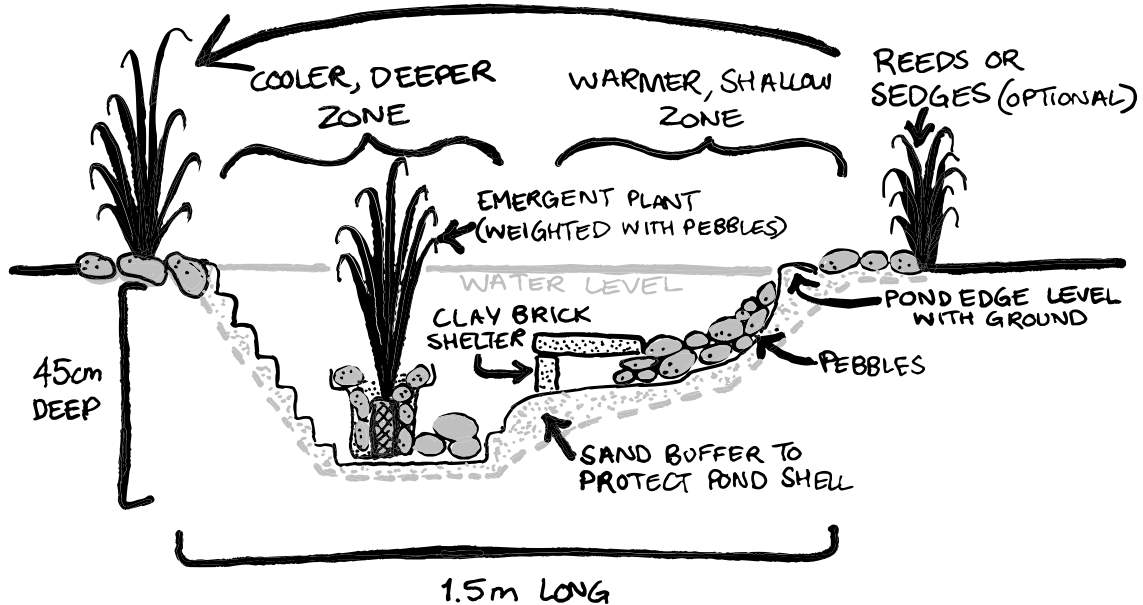
Pond

Figure 11: A diagram showing the best way to arrange and assemble your pond. Ensure your pond is flush with the ground, your aquatic plant is positioned in the deeper section of the pond and some shelter items are available in the shallower sections. If you would like to, you can also plant some native reeds or sedges around the edge of the pond to increase habitat.

Installation

1. Turn your pond shell upside down and press into soil where you plan to install your pond to get a rough outline of the pond shape to guide your digging.

2. Dig a hole that is 5cm larger than the imprint to allow for fitting, and is at least 50cm deep.

3. During digging, it is handy to regularly check the hole is big enough and the correct shape by loosely fitting the pond inside the hole - there should be some clearance all around, particularly at the base. If it doesn't quite fit, continue digging until it does.

4. Remove any gravel or sharp rocks in the hole that could puncture the lining of the pond base.

5. Place some builder's sand at the base of the hole to provide some protection for the pond shell.

6. Place the pond shell into the hole, ensuring the pond edges are flush with ground level, and fill the sides of the hole compactly with builder's sand. Ensure the pond is level with a builder's level otherwise water may overflow on one side during rainfall events.

7. Keeping the plant in its pot, place your aquatic or emergent plant in the deep end of the pond. Weigh your plant down with some pebbles to stop it floating or tipping over. The water plant will help provide habitat and remove excess nitrogen from the water.

8. Rinse the pebbles and bricks with water before installing in the pond.

9. Place a handful of pebbles both inside the pond and around the edges of the pond to provide cover and habitat for frogs and tadpoles.

10. Using two clay house bricks, create an underwater shelter as shown in the above diagram. Avoid limestone rocks or concrete blocks as these can dissolve in water.

11. Gently fill your pond with water.

12. OPTIONAL: Once you have completed your pond you can plant some native reeds or sedges around the edge of your pond to provide additional habitat for wildlife.

Pond

Tips

- One plant and a few shelter items will be enough habitat for this pond. Be careful not to overcrowd the pond as this will reduce the water volume.

- Don't be tempted to install a fountain! Strong fountains may discourage frogs.

- Maintain your aquatic plant so that it covers no more than a quarter of the pond surface.

- Avoid putting Arum Lily or Water Hyacinth in or near the water as they are invasive weeds.

- For this project we recommend you do not put any other plants or fish in the water. Fish may eat frog eggs and tadpoles, especially exotic fish like mosquitofish.

- A few leaves on the pond base provides some good habitat, but if too much builds up try to remove some of the excess. Too much leaf litter will deoxygenate the water.

- Unless algae growth is prolific, you won't need to scrub out your pond. Some algal growth on the sides provides food for tadpoles and aquatic invertebrates, which in turn provide food for larger animals.

- Keep in mind the safety of children and council regulations on ponds when installing.

Why This Design?

The pond shell provides both a **shallow zone** for frogs to lay eggs, and a **deep zone** (~35cm) allowing tadpoles to move up or down to adjust to temperature changes in the water.

The **large surface-area-to-volume ratio** of the pond will help diffusion of oxygen into the water and reduces the need for a pump.

The **clay brick shelter** inside the pond and pebbles around the edge will help provide shelter and a range of habitats for tadpoles and frogs while making it easy for other animals to escape the pond if they fall in. Clay bricks are better than limestone or concrete as they will not break down in the water.

The **natural stone mix** we recommend is a good choice of pebble for ponds as other pebbles such as limestone can break down and pollute the water.

The **water plant** will help provide habitat and help filter the water.

A **solid pond shell** is much easier to install than pond liner and is less likely to leak.

Possum Box
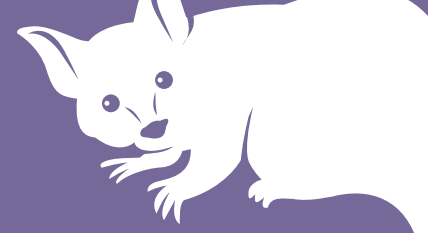
Purpose
To provide a safe nesting site for possums to sleep in.

Animals
Possums such as the brushtail possum and western ringtail possum.

Difficulty
Challenging.

Cost
$150.00.
Note: Citizen Scientists involved in the project will receive a discount on this item!

Purchase
'Medium mammal (rear entry)' box from The Re-cyc-ology Project.
http://www.re-cyc-ology.com.au/p/nest-box-orders.html

Equipment
3m high ladder.

Positioning

- ✓ Place on a sturdy tree trunk or branch capable of supporting the box's weight (at least 20cm in diameter).

- ✓ Place about 3m off the ground to protect the nest from ground predators.

- ✓ Where possible, place the box on the south-eastern side of a tree to keep the box as cool as possible on hot days.

- ✓ Place near to branch forks to encourage possum use of the box.

- ✓ Place the box on a tree with canopy overhead to help shade the box and stop it from overheating in summer.

- ✓ Install on a vertically straight part of the tree to ensure the box is not tipping upwards or downwards.

- ✓ Choose a location that you can access safely with a ladder.

- ✗ Avoid placing in noisy locations such as near busy roads, your driveway or locations that are often disturbed by people.
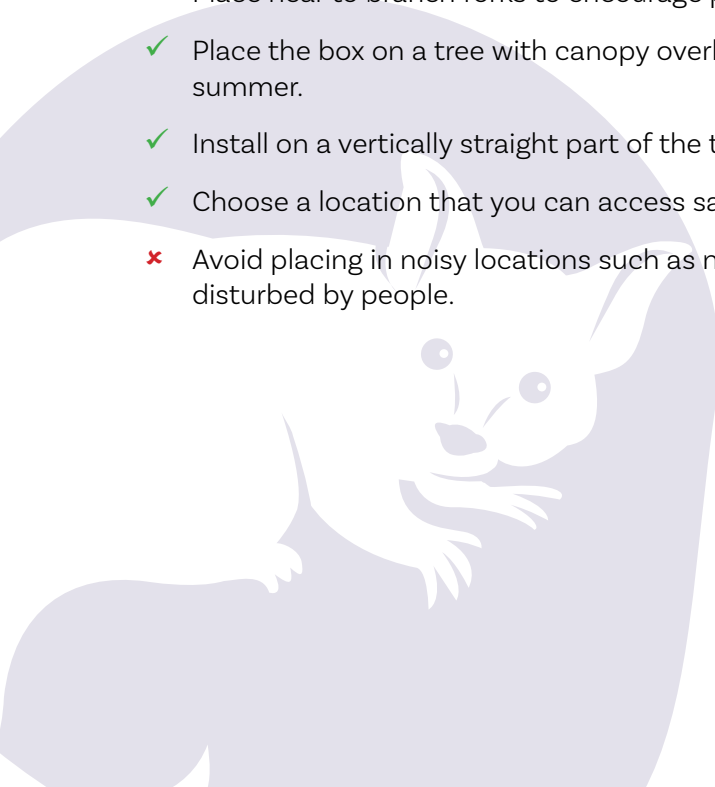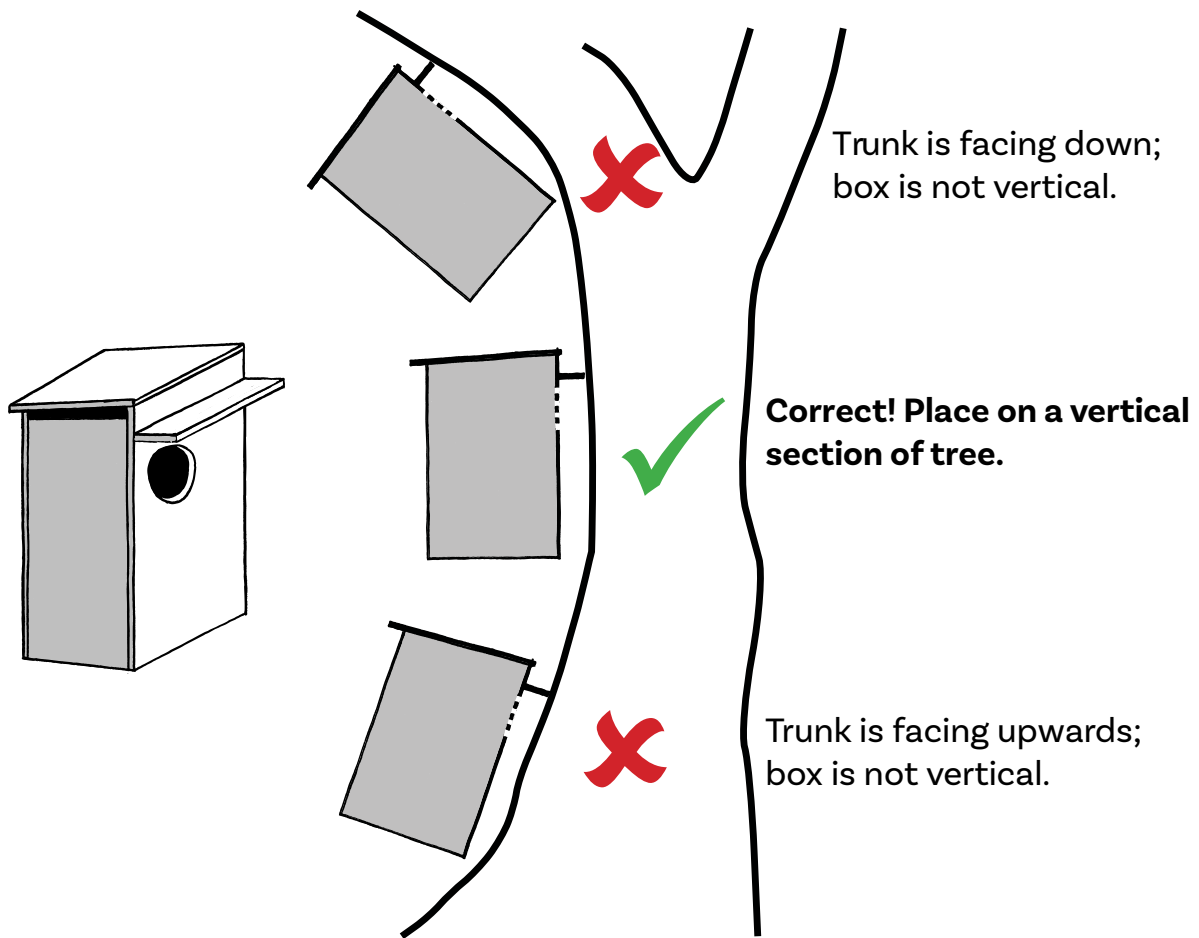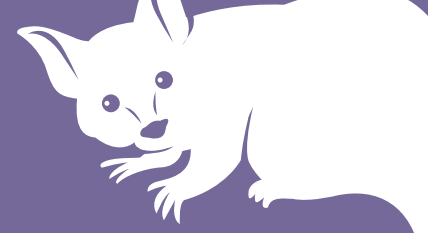
Possum Box

Figure 13: Ensure you install your possum box on a vertical section of the tree.

Trunk is facing down; box is not vertical.

Correct! Place on a vertical section of tree.

Trunk is facing upwards; box is not vertical.

Installation

1. Use a ladder to reach the location where you will secure the possum box to the tree. You may like to ask another person to steady the ladder for safety.

2. Following the instructions of the box supplier, attach the box to the tree so that it is vertical, steady and securely fastened to the tree. Ensure the entry to the box faces the tree.

3. Ensure the box is secure and will not fall if a possum uses it.

Tips

- A small telescopic mirror (available for $6 at Bunnings: Craftright Inspection Telescopic Mirror; Product Code (I/N): 5810236) may help you check your box during monitoring.

- Following heavy rain or a storm it is a good idea to check the box hasn't shifted position or collected water inside. If you notice any water inside, you may need to reposition the box.

- Please don't remove any nests from the box, even if you think they have been abandoned.
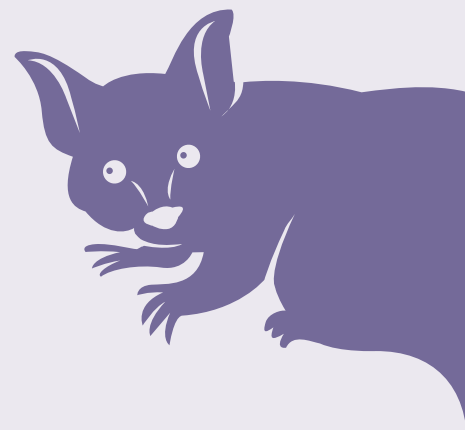
Why This Design?

This nest box will **fit both of the large possum species** found in southwestern Australia.

The box has **thick walls (around 20mm)** to protect it from becoming too hot or cold for possums.

The box uses **water-based exterior paint** which is less likely to be toxic to animals than oil-based paints or varnish and will extend the box's life.

The box has a **weatherproof** design to maintain a safe, dry and warm environment.

The box has **drainage holes** to prevent any moisture build-up inside the box.

The box **contains a ladder** inside which allows both target and non-target species to safely exit the box at any time.

The box has **air-slots** under the lid to provide ventilation and reduce the chance of feral bees invading.

Reptile Shelter

Purpose
To provide a safe environment for reptiles to bask in the sun and shelter.

Animals
Skinks, geckos, legless lizards, other small reptiles.

Difficulty
Easy.

Cost
$5.00.

Purchase
The materials you need are available from Bunnings. You can search the product code on their website: https://www.bunnings.com.au/.

To install your reptile shelter, you will need to purchase:

- Brighton Masonry 300 x 300 x 40mm Charcoal Mypave Paver
    o   Search product code (I/N): 3451637

Equipment
A small rock or piece of wood (no larger than 3cm wide, 3cm long and 2cm high) from your garden to act as a prop for the paver.

Positioning

✓   Place in a flat area of your garden.

✓   Place in full sun to allow shelter to warm.

✓   Place in a spot near undergrowth or thick leaf litter as this will allow reptiles to move to and from the shelter safely.

✗   Avoid placing in noisy locations such as near busy roads, your driveway or locations that are often disturbed by people.
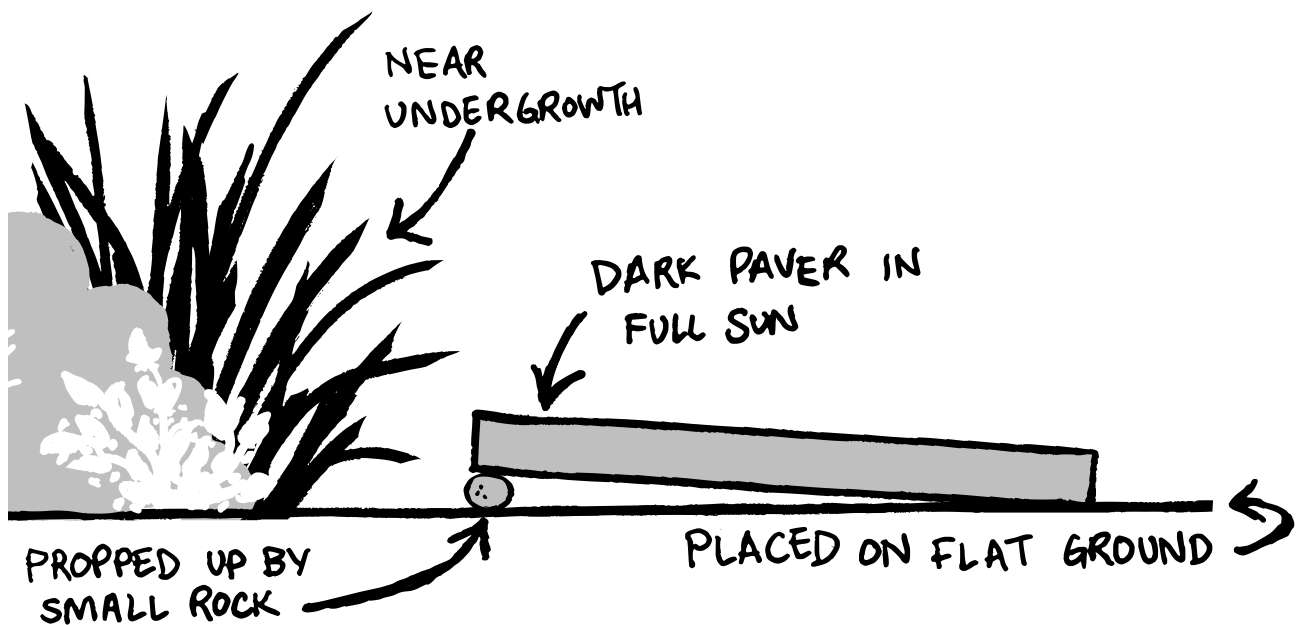
Reptile Shelter

NEAR UNDERGROWTH

DARK PAVER IN FULL SUN

PROPPED UP BY SMALL ROCK

PLACED ON FLAT GROUND

Figure 15: Tips for installing your reptile shelter.

Installation

1. Once you have found a location for your reptile shelter, find a small piece of rock or wood (~3cm wide, 3cm long and 2cm high) from your garden.

2. Lay the paver on the ground and prop up one edge with the small rock/piece of wood so there is a very small gap between the ground and paver.

3. Ensure that the paver is secure on the prop rock/piece of wood and won't slip off.

Tips

- Any paver that is similar in dimensions to what we suggest will work as a reptile shelter. If you can't get the exact paver we suggest, choose a similar sized one that is dark in colour.

- This garden structure has no maintenance, so is one of the easiest structures to install!

- Be mindful that small snakes may try to use this structure! If you are monitoring this structure as part of the 'Turning Gardeners into Conservationists' project, be sure to follow the instructions and safety considerations outlined in *Guide 2: Wildlife Monitoring Manual.*
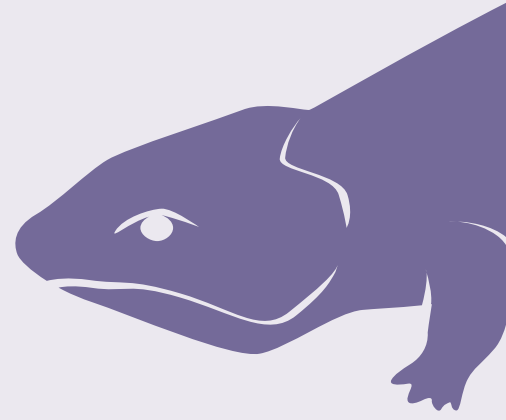
Why This Design?

The **area of the paver is large enough** to act as a hiding and basking spot for most common garden lizards. The thickness should provide warmth for reptiles in sunny weather while not allowing scorching summer heat through.

The **small gap underneath the paver** provides a safe refuge for small reptiles as larger predators cannot enter. This is why a small rock or piece of wood no larger than 3cm wide and 2cm high is used to prop up the paver.

The **dark paver colour** increases heat absorption from the sun which makes it more attractive for ectothermic (cold-blooded) reptiles.

This is the **cheapest, easiest and smallest** garden structure, and will only take a few minutes to set up!

Additional Resources
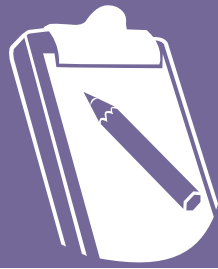
The following resources have been invaluable in informing the structures and installation methods detailed in this guide:

- Aplin K, Paino A & Sleep L (2000) '*Building Frog Friendly Gardens: A Practical Guide to Encouraging Frogs to Visit and Breed in Gardens of Southwest Western Australia*' Western Australian Museum, Perth.

- Australasian Bat Society '*Attract Microbats*' resources: https://www.ausbats.org.au/install-a-microbat-house.html

- BirdLife Australia '*Birds in Backyards*' resources: https://www.birdsinbackyards.net/

- Bishop AB (2018) '*Habitat: a practical guide to creating a wildlife-friendly Australian garden*' Murdoch Books.

- Cherriman S (2022) '*Hollowed Out*' Available at: http://www.re-cyc-ology.com.au/p/the-book.html

- Goldingay RL, Rueegger NN, Grimson MJ & Taylor BD (2015) '*Specific Nest Box Designs Can Improve Habitat Restoration for Cavity-Dependent Arboreal Mammals*' Restoration Ecology 23(4): 482-490. https://onlinelibrary.wiley.com/doi/full/10.1111/rec.12208

- McGlashan A (2021) '*Hollow Using Wildlife*' and '*Nest Box Designs*' resources: https://nestboxtales.com/

- Perth NRM '*ReWild Perth*' resources: https://rewildperth.com.au/resources/

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12	New Holland honeyeaters in bird bath	Earth Guardians, ala.org.au
14	Terracotta bird bath	Thomas Baskerville
15	Striated pardalote	Aaron Stevenson, ala.org.au
17	Striated pardalote on bird box	Simon Cherriman, iNSiGHT ORNITHOLOGY 2016
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20	Parrot box	Simon Cherriman, iNSiGHT ORNITHOLOGY 2020
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27	Pond	Thomas Baskerville
28	Common brushtail possum	2015 David Cook Wildlife Photography, ala.org.au
30	Possum box	Simon Cherriman, iNSiGHT ORNITHOLOGY 2016
31	South-western orange-tailed slider	Robert Browne-Cooper, ala.org.au
33	Reptile shelter	Dr Laura Skates
10	3D bat box illustration	Thomas Baskerville
10, 13, 16, 19, 25, 29, 32	Habitat structure illustrations	Hannah Gulliver