

Quality and longevity in artificial hollows – how to design and install long-lasting boxes

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There has been concern over the longevity and quality of nest boxes that are being installed especially where there is no long-term monitoring and maintenance inspections set in place. Average life of nest boxes can range from 2 to 15 years depending on multiple factors such as material used, construction design and how the box is attached onto the tree. There are also uncontrollable factors which can affect nest box longevity such as weather conditions, termite infestation and chewing of the box by species such as Cockatoos.

The aim of any nest box installation is to provide habitat refuge for hollow-using fauna species, so it is important that we use nest boxes that are high quality, of suitable design and will stay in position on the tree. A good quality box will often cost more to purchase however if it lasts 5 times longer with no maintenance required then there is cost benefit to the manager and to the fauna that use them.

Identifying weak points in the structural design of a nest box and improving those features will make a difference to box longevity. Important features include: a good durable protective lid, suitably positioned hinge, durable material with minimum thickness of 18mm, sealed cut edges, non-rusting screws and a zig zag wire expandable attachment to allow for tree growth. Annual maintenance inspections are useful in identifying attachment failures or box condition decline, and allow for timely repairs.

Introduction

There may be a misperception that making a nest box is easy and cheap. It can be if you don't want your nest box to last very long. There are a number of factors that have to be considered.

I have been making, installing and inspecting artificial hollows including nest boxes, capped hollows and augmented chainsaw hollows for over 18 years. These have been targeting mostly a diverse range of nocturnal mammals including microbats along with both diurnal and nocturnal bird species in a variety of habitats. In most part artificial habitat has been installed as replacement for lost hollows, to provide temporary fauna refuge directly after clearing works, and for habitat improvement in hollow depauperate sites such as Council reserves and offset sites.

Early on in my career I was installing form ply nest boxes with metal strapping and roofing screws. I was not satisfied with this method of attachment and was disappointed with the limited life span of many plywood boxes, especially when they were meant to be replacing lost natural hollows. Nest box structural designs had not changed much over the years and plywood was one of the most commonly used materials. I started to observe what were the common features that were failing and causing the box to deteriorate or to fall off the tree. The two most common factors of nest box failure were the lid falling off, and using a non-expanding attachment method. I then looked at ways to alter the design to increase longevity of the box; and rather than using plywood I made boxes from seasoned hardwood timber. My first hardwood box has been up for almost 15 years without requiring any repairs and has a family of sugar gliders regularly observed using it. The wire zig zags on the attachment are still expanding. None

of the hardwood boxes have failed structurally apart from one incidence which required a lid replacement. As most people make nest boxes out of plywood, I also looked specifically at how a plywood box could be constructed to last longer. Some of the important factors are the type of plywood used, minimum thickness, cut edges in particular have to be sealed well, and the hinge positioned appropriately or sealed strongly so the lid does not fall off due to decay.

Key to long-lasting artificial hollows

Experience has shown that box material type, attachment method, structural and species-specific design and placement are important for box uptake and longevity. Observations have shown:

- thin plywood boxes fail faster than thicker well sealed plywood or hardwood
- long-lasting screws hold boxes better than staples or nails (Figure 1)



Figure 1. A staple (shown here) and nails do not hold as well as good quality screws

- it is essential to account for tree growth or both the box and the tree will be impacted. Hardwood boxes have been in place for 10 to 15 years without requiring maintenance or replacement with

the zig zag Habisure attachment method continuing to expand out. In contrast, tree growth can push boxes with non-expanding attachment off the tree, or start crushing the back plate, and/or push the lid off (Figure 2)

- one of the most important parts of the box is the lid as this helps protect the rest of the box from decaying and makes a dark and safer cavity for the species that rely on the box
- lids that are not much wider than the top of the box allows water to more easily reach the end grain of the plywood walls or enter inside the box
- metal edging on the lid and around the entry hole can protect plywood from being chewed by animals, maintaining the entry hole size for target species
- hinges screwed into the cut end grain of the lid without being very well sealed is a common failure and will result in decay around the screws, followed by lid falling off (Figure 3). Brushtail possums, Ringtail possums, Rosellas and other species will use boxes without lids however the box will decay faster, and the young may drown in heavy rain
- nest boxes will often be used by non-target species with entry-hole size being the factor to exclude larger non-target species
- when targeting specific species, having an understanding of the species' breeding or shelter requirements can assist. E.g. Red-rumped Parrots were regularly observed feeding in an area that lacked nesting hollows. However, exposed wooden posts were available to install boxes on. As



Figure 2. A box with a crushed back plate and lid pushed off by tree



Figure 3. Decay around hinge screws will result in the lid falling off



Figure 4. Successful hardwood Red-rumped Parrot box

the species nest in spring and summer, hardwood boxes were placed on the south-east side of posts to give some protection from the hottest parts of the day. The entry hole size was made just adequate for this species to enter, excluding larger species. This has been successful with Red-rumped Parrots raising young in the boxes (Figure 4).

There are many hollow-dwelling species we have not been able to provide habitat for and this is something that needs to be acknowledged when installing nest boxes as a mitigation measure. More trials are required to create appropriate habitat for a greater number of species, including targeted habitat for amphibians and reptiles, which on occasion will use standard nest boxes to shelter in.

Design recommendations

I have tended to preference using 20 to 25mm thick hardwood timber to make nest boxes (Figure 5) for many reasons, such as:

- good durability
- very little chemical product required (e.g. coating lid with timber seal oil or end grain with long lasting paint)
- better insulation properties
- easier to cut climbing ladders into the inside and outside of the box
- more natural in appearance.

The few downsides are that it is heavier than other materials and may not be able to be sourced as easily or sustainably. However, there are plenty of trees being cut down for other reasons that could be salvaged to make nest boxes.

For a lighter weight design, a combination of hardwood and durable ply with minimum thickness of 18mm can be used, however consideration needs to be taken to get the longest life out of it.

Some suggestions of how to do this from my experimenting are:

- a good durable protective lid
- suitably positioned hinge under lid edge rather than into end grain of ply (Figure 6)
- durable ply with cut edges sealed well using oil based outdoor paint or other long lasting oil based product
- durable non-rusting screws to hold the box together
- base plate inset within side walls (Figure 7)
- a good zig zag wire expandable attachment to allow for tree growth (Figure 8)
- use wire knots inside box to stop the wire from pulling out. When the box eventually falls apart the wire will not be left sitting all the way around the tree thereby reducing risk of harm to tree. Check no sharp edges of wire are protruding (Figure 9)
- avoid using metal mesh ladder as these often have lots of sharp edges when cut. Hardwood timber ladders allow for some chewing by parrots however is not harmful to the bill
- a strip of hose makes a good latch to hold the lid in place and stops larger animals lifting it (Figure 10).



Figure 5. A durable hardwood box with 20-25mm thick timber



Figure 8. Expanding zig zag Habisure attachment



Figure 6. Hinge screwed into side and up under lid using good quality screws



Figure 9. Wire knots inside box stops the wire from pulling out



Figure 7. Inset base plate and include some drainage holes or small gaps



Figure 10. A strip of hose makes a good latch

The attachment is a key feature that can determine the useful life of a nest box. Expanding zig zag Habisure attachments are proving to be successful along with large galvanised nails to hang box onto (Figure 11). Another method is the use of long galvanised coach screws with metal spacers, allowing the tree to grow over the spacer rather than pushing directly against the box (Figure 12).



Figure 11. The zig zag Habisure attachment method used in conjunction with a wire loop over long galvanised nail



Figure 12. The spacer attachment method

Having a combination of two attachments for a box allows for one attachment failure. The box remains in the tree until the failed attachment can be rectified or remains until the box falls apart. Annual maintenance inspections from the ground can identify attachment failures or box structure condition decline.

What to consider before you install

If you wish to purchase or make your own nest box, first consider the benefit of installing it. How will it help the species you are considering providing habitat for?

There are nest box designs on the internet however are they built for longevity, with good structural design and an appropriate expanding attachment, along with meeting the needs of your target species? Don't be afraid to contact the supplier/designer and ask questions.

If you are not sure of where or how to position your box you could do your own search on the target species to find out information, such as do they breed in summer or winter or anytime of the year, is there abundant food sources available nearby or linking vegetation corridor which allows your target species to travel into the installation area. There are many factors to consider with box placement however generally avoid the entry hole facing coldest winds (south, south west) and avoid hottest side of tree (often hottest on north round to west depending on canopy cover). Alternatively employ an experienced person to install it for you. Contact local Environmental Consultants, Local Land Services and Council Environmental Officers to recommend quality nest box suppliers and installers.

References

Narawan Williams (2019). Box structure and longevity: Failings in nest box structure. Consulting Ecology. Vol 43, August 2019. Journal of the Ecological Consultants Association of NSW
<https://www.ecansw.org.au/wp-content/uploads/2019/12/Consulting-Ecology-Volume-43-August-2019.pdf>

About the author

Narawan has had the pleasure of being involved with native wildlife all his life. He has been a Fauna Ecologist for over 20 years. Part of his work and passion has been creating fauna habitat which has included installation, monitoring, and construction of nest boxes, capping salvaged hollows to reinstall, monitoring and advising on augmented hollow designs and educating community on the importance of habitat for wildlife. Concerns over the short life span of many nest boxes led him to look at different ways to increase longevity, with the long-term aim to share and discuss designs with others to encourage longer-lasting nest boxes.

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Nest box failure: most common reasons

1. Poor quality materials and construction

- Inappropriate ply or timber
- Plywood/timber too thin, i.e. under 18mm
- Cut edges not sealed adequately, particularly for ply
- Poor quality screws and staples, i.e. rust and too short
- Lid with inadequate overhang

2. Lid failure

- Hinge not protected from weather: ply/timber deterioration around screws causing them to loosen
- Tree pushing lid off box
- Lid hinge screws often fail due to being screwed into cut edge of ply and not sealed well. See below.



3. Failure of hanging attachment

- Attachment does not allow for tree growth and forces failure of box or strapping
- Sap of tree corrodes screws and metal strapping. Some species more corrosive than others. E.g. *Corymbia gummifera* and *Angophora costata*

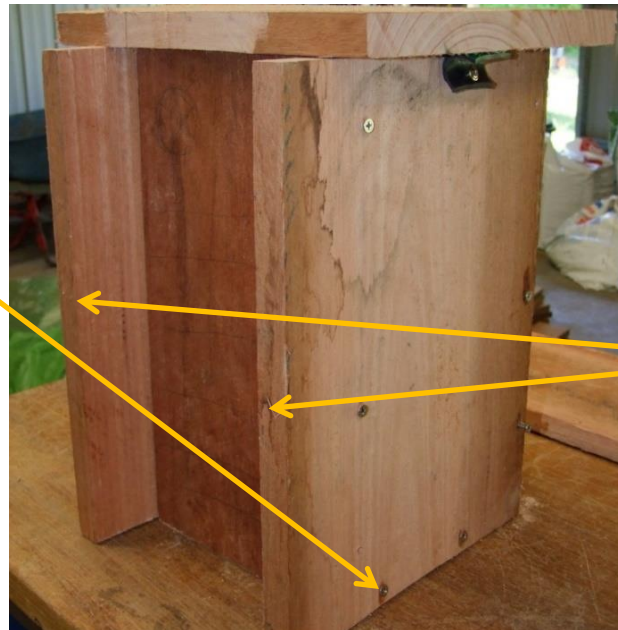
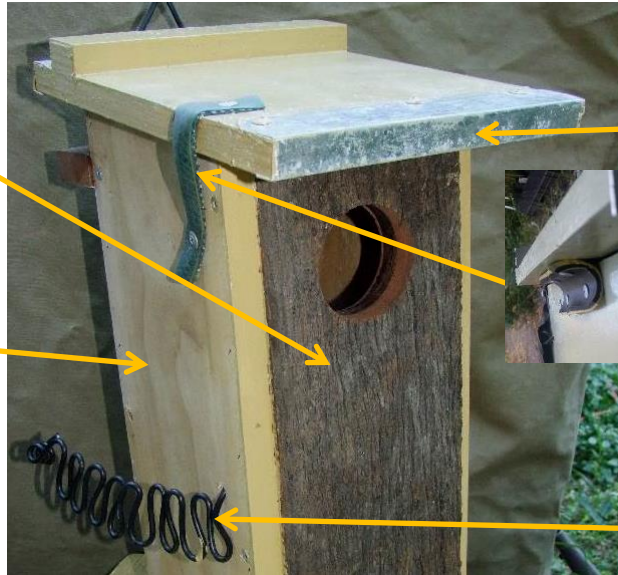
4. Base plate falls out

- Moisture entering box causes rot in base
- Inadequate drainage holes or gaps in base plate
- Base plate not inset into base of box

Recommendations to increase nest box life

1. Good quality materials and construction

- Made of seasoned hardwood timber or a combination of hardwood timber and ply. Suggest entry panel made of hardwood with climbing grooves. 3 sides plywood (well sealed ply lid or double layer of ply for extra life)
- Seasoned hardwood 20 to 25mm thick.
- For lighter weight box make 3 sides and lid from birch, marine or another external outdoor ply
- No ply thinner than 18mm
- Seal cut end grains and lid surface
- Use appropriate sealer to stop ply splitting in weather e.g. exterior oil based paint or marine based treatments
- For hardwood and ply surface you can use oil-based product such as Cutek (organic vegetable oil based product)
- Use stainless steel or outdoor decking screws 40 to 50mm long
- Pre-drill to avoid splitting timber
- Hinges can be made from thick rubber hose attached with galvanised flat head screws or non-rusting metal hinges
- Base plate inset into side panels with 4 to 5 drainage holes (5 to 6mm wide) or gaps (no more than 4mm wide)



2. Lid

- Lid overhang minimum 20–30mm
- Use metal plate on front and back edge of lid to prevent animals chewing. Fix with screws and sealant
- Fit hinges under edge of lid to protect from weather
- Two layers of ply will further increase longevity
- Secure lid in place with a latch to maintain alignment and closure

3. Attachment

- Use zig zagged wire for attachment to allow tree growth. Make spring form if heavier box
- Use 3.15mm wire, PVC coated
- Knot wire inside box wall to secure. Avoid sharp points
- Use 3 to 5mm wire rope threaded through rubber hose to install larger/heavier boxes

4. Design

- Include side flanges to stabilise box against tree
- Entry hole can go on front, back or side of box depending on target species
- Cut climbing grooves on inside of hardwood entry plate. A couple of grooves on front below entry hole