Boosting Biodiversity In the 'burbs

Second Edition

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Sustainable Living in the Suburbs

By Nev Sweeney

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1.0 Introduction: Why Supporting Suburban Biodiversity is Important

'Biodiversity' is a wide ranging word and in its broadest sense means the variability of life. As it is put by the Australian Museum "Biodiversity is the variety of all living things; the different plants, animals and microorganisms, the genetic information they contain and the ecosystems they form". Biodiversity is considered as three levels –

Genetic diversity – is the variety of genes within a species

Species diversity – is the variety of species within a habitat

Microbats eat lots of mosquitos

Ecosystem diversity – is the variety of ecosystems within a given area, large or small.

So in terms of my area of interest and the areas I write about, this article mainly comes under the heading of species diversity as it applies to the urban and suburban habitat although there may also be some small-scale impact ecosystem diversity.

Importance of Backyard biodiversity

Working to improve biodiversity on a small scale in our back and front yards can have benefits for us as well as the larger ecology and, of course, if enough of us urban and suburban dwellers work on improving biodiversity in our areas it can impact on a larger scale!

Nature does the work – By carrying out work to improve our 'backyard biodiversity' we can make growing productive species easier for ourselves by working with, rather than against nature. By planting appropriate species and installing garden features, we can attract beneficial bird and insect species which will help us by providing pest control and pollination services, so we don't have to. By developing a backyard ecosystem and holding off chemical sprays, over time those chemical sprays can become redundant.

Improved Resilience – Rather than planting a lawn monoculture with a few common decorative plant species, if we provide plantings of natives and insectary plants and even vary the varieties and types of vegetables grown, our system is more resilient. A variety of plants means that any pest of disease is less likely to overwhelm our efforts. Most pests are specialists, and only attack one species of plant, by growing different species and varieties, it reduces our vulnerability to pest attack. Also, growing conditions will vary from year to year, with this variability increasing due to climate change. By varying the species and varieties we grow it becomes more likely that regardless of the weather conditions, some will do well and ensure a harvest even if others falter.

Intrinsic value – while there are productive plant species and beneficial insect and bird species, ALL species have intrinsic value in and of themselves, even if they are not directly of value to humans. The loss of habitat and resultant loss of species in urban and suburban areas is something we can impact directly by supporting the return of biodiversity in the areas for which we are responsible. We all have an opportunity to be conservationists, by working to reduce habitat and species loss.

Grow biodiverse and save water – biodiverse plantings generate their own ecosystem and together they can act like a sponge, absorbing water in a downpour and reducing runoff considerably. Again, by working with nature we can make life easier for ourselves in the long run.

Save money – in these days of record temperatures in summer, we can use trees to cool the environment around out houses. This not only makes the outdoor environment more comfortable but reduces the amount of energy consumed to keep the indoor environment more comfortable. Reducing energy = reduced cost and reduced greenhouse gas emissions. It is win, win, win! Also, by including productive fruit, vegetables and herbs integrated into our plantings, allowing us to eat directly from our gardens, we again save money and reduce carbon emissions.

Birds are great concentrators of fertility

Amenity – I guess it does depend on what you find to be beautiful in the landscape but a biodiverse area tends to more attractive. A biodiverse planting of trees and bushes can produce flowers for longer and provide different types, shapes and colours of foliage, adding to the palette of beauty in your yard. As well as that, a beautiful and biodiverse garden can provide kerb appeal and increase the value of the property.

The diversity of life on Earth is essential to the health of our planet and to our wellbeing as humans. But nature is under pressure as never before. Our needs for food, water and land, and our demands for energy and more and more stuff are destroying habitats, polluting our air and water, and driving species of animals and plants to extinction. We are now losing biodiversity up to ten thousand times faster than it was disappearing 100 years ago. It is worth a bit of work in our home space to help bring our urban and suburban areas back into the realm of beautiful productivity that they once were, and even enhance it.

2.0 Providing Food for Beneficial Insects

There are two main requirements for attracting beneficial insects (pollinators and predators) to your garden and they are the same for attracting any guest – food and accommodation. Yes, there are a few other little management issues, but food and accommodation are the biggies. While accommodation is addressed later in this eBook, this article mainly looks at the food angle – providing an insectary (insect attracting) flower bed.

A great many beneficial insects make use of flowers and the nectar they provide as a food source. Some have long mouthparts for extracting it from deep flowers while others have short mouthparts and need more accessible nectar supplies. To provide the variety of species required, some planning needs to be done. The planning needs to take into account when the plants can be sown and when they will flower so you can be sure you have the right species.

2.1 Developing and implementing an insectary plant area - The plan

Species Selection

When working out which species of flowering plants you want to build into your insectary beds, there are some questions that are worth thinking about –

Do they do well in my area/climate? – OK this is an obvious one but making sure at the outset that all flowering plants you put in are adaptable to your area and growing conditions will save lots of frustration in the long run.

How long with they take to flower and how long will they flower for? The quicker the plants get to flowering stage the quicker they can start attracting those helpful little insects! Also, the longer the flowering period the less hassle you will have setting up your beds so that they will be providing blossom year round.

What colour blossom will they produce? A variety of colours is good, not just from an aesthetic point of view but different colours attract different species, for example wasps prefer yellow and white flowers while the pollinators prefer blue flowers but a variety ensures there is something there for all of the beneficial insects.

Will they self-seed and naturalise and do they have potential to become a weed? Having species which will naturalise in your garden is good, it means that they will require less care and attention to keep them going. A species which is too freely seeding or where the seed can easily be dispersed by birds or the wind can cause problems, however. If you live near a national park this can be of particular concern so that garden escapes into the bush can be prevented.

How hardy are they? Again, a plant which is hardy will prove to be a lot less work and will have a better chance of establishment than plants which are drought or frost sensitive.

Do they fit in with existing plantings? If you are not starting your garden from scratch but are looking to integrate the new species into existing plantings, they will need to fit in with what you are already growing. A bed of colourful annuals may look out of place in a native garden, dryland garden or a garden consisting mostly of trees. On the other hand if you are like me and don't really care, it won't be an issue.

Can they perform multiple roles? There is no reason why plants put into your garden to attract beneficial insects can't perform other roles as well.

- Flowers which attract insects can also be edible (eg nasturtiums or calendulas) and
- Flowering herbs such as borage, lavender and lemon balm can add delightful fragrances and be used in cooking or medicinally as well.
- Leaving vegetable to flower such as umbellifers (carrots, parsnips) or brassicas (broccoli or kale) provides you with a feed from the original plantings and then attracts beneficial insects as well.
- Nitrogen fixers such as Lucerne, white clover or red clover improve the fertility of your plantings as well as attracting beneficial insects.
- Dynamic accumulators are plants which delve down deep into the soil to bring up nutrients which are out of reach of most plants, their leaves then being used as mulch. Comfrey and dandelion are both plants which have this action but also attract beneficial insects with their flowers.
- Fruiting plants such as apples, avocadoes, olives and passionfruit attract beneficial insects with their flowers and give you a harvest of fruit as a bonus.
- Windbreak plants are planted on the side of your property which is subject to the prevailing winds to protect more sensitive plants form the strong winds coming from that direction. Natives such as bottlebrush (callistemon) and acacias can do double duty as windbreaks and insect attractors.
- Ground covers are used to act as a living mulch and to turn bare areas of bed into productive areas, but they can also attract beneficial insects. Such groundcovers include vetch and sweet alyssum.
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Indeed some plants can do triple duty – vetch is a nitrogen fixer as well as ground cover and insect attractant, nasturtium is a ground cover as well as having edible flowers and attracting insects and so forth. A little research before you select your species and you can get the most out of your productive insectary garden.

Other Management Issues

I mentioned earlier that there are a number of other management issues to be considered when designing the insectary area, and these are much easier to deal with at the planning stage.

Clumps rather than single plantings – insects are attracted to clumps of flowering insectary plants rather than single specimen plants, so planning to plant in clumps makes sense.

Don't use pesticides – This goes without saying! Any broad spectrum pesticide, even those organic ones like chilli and garlic spray can have a bad impact on non-target organisms. The organic ones will not persist in the environment but while they are active it will be bad news for pollinators and predator insects alike. Spraying with any kind of pesticide should be the action of last resort to treat an infestation when all else fails.

Reduce digging – There are a number of bad things which come from digging in the soil including damaging the soil structure and allowing organic matter to be oxidised out, but it can also be devastating for the life in the soil – the soil biota. In this case not digging in the soil prevents damage to predator eggs and nymphs living in the soil, which will then emerge and come to your aid later in the year.

Provide water – All living organisms need water at some stage in their life cycle and some predators such as dragonflies reproduce in it so it is worth having some source of water in or near your insectary area. It is also worth having a piece of wood or some other material so that insects can is it as a platform to drink from and climb out of the water container so they don't drown. A pile of gravel extending above the water line will also help to prevent insects drowning while trying to get a drink.

Developing a Blossom Calendar

To ensure that you have year 'round blossom to feed your beneficial insects it is worth drawing up a flower or blossom calendar. The idea is, as you research the plants you want to use, find out when they flower and plot it on a month-by-month 12 month calendar. Then it becomes a simple matter to work out if you have the whole year covered or not.

To develop my insectary blossom calendar I searched around for existing "beneficial insect" attracting seed mixes for sale on the net and consulted books like Penny Woodward's Pest Repellent Plants. I used this information to develop a list of species which would not only attract beneficial insects and be able to provide other functions as well, but also fit into my climate and garden. Once I had worked out a list of plants which looked promising I then researched their other properties, when they bloomed, when to sow them and whether they were annuals or perennials and put it all down on the blossom calendar.

While I recommend developing a blossom calendar for you unique situation, you can use the one I put together as a starting point. It and a blank calendar form are in the appendices (page 49).

Using the Calendar

I used the calendar to develop up a list of plants with which to start my insectary bed. For a start they needed to be able to be sown in autumn, because that's where we are now and I didn't want to put this off until spring so that limited the number of species I could use. I also wanted at least one ground cover, a nitrogen fixer and a collection of

different edible and cut flowers which would bloom the year round. After much deliberation, I came up with the following list –
Alyssum – scented, edible flowers and a long blooming period
Coreopsis – scented edible flowers which will start blooming in spring
Dill – edible herb
Gypsophila – edible and cut flower, ready to bloom in spring
Lupins – nitrogen fixer, edible blooms and seed,
Marguerite Daisy – winter flowering cut flower
Mustard – dynamic accumulator, edible plant and seeds
Queen Anne's Lace – edible root and flower
White clover – ground cover, nitrogen fixer

I should also include the choko and orange tree as these are already in the area and growing. Together these will form the basis of my multifunctional insectary bed. Using all of this information I then drew up a plan as to how things will go together. Of course the plan may need to be changed if unexpected issues crop up during the implementation phase.

And so the next part will be putting it all into practice!

2.2 Implementing the plan

The first thing I needed to do to get our insectary area happening was work out where it was going to go. I had originally put the bug hotel behind our composter to keep it sheltered but there was no room there for anything else and it really was a bit far away from the main growing area. After a quick look around it seemed fairly obvious that the place to put both the insectary bed and the bug hotel was on the eastern side of the wicking beds and west of the choko tree. That is to say, right in the middle of the largest veggie growing area. With this major decision sorted I could start!

The area allocated for insectary beds

I wanted to maintain access to all sides of the wicking beds so I needed to keep a small area clear for walking on the eastern side of the wicking beds. I had some steps I had picked up while working in the precast concrete industry out the front which are about 300mm x 1200mm. I decided to move them into place first, then place the bug hotel on top as a solid footing.

My original design was to have a rectangular bed with the long axis running north south and rows of the insectary plants and some water over to one side. I had three of the precast concrete steps but only two were needed to cover the area alongside the wicking beds so the obvious solution for the third was to place it at 90^{o} to the other two, dividing up the single rectangular bed into two smaller square(ish) ones.

Slabs and bug hotel in place

So much for the original design, but the new one gave better access into the beds for harvest and replacement of plants as well as providing a “landing strip” in front of the bug hotel so the insectary plants couldn’t grow up and obstruct access. Although it did require somewhat of a rethink of where the plants were going to go. The new design is also available here.

With the concrete strips down and the bug hotel in position the bones of the new design were now in place. Rather than long rows of flowers then new set up lent itself to a central feature, in this case the daisies, surrounded by clumps of the other flowers, so this is what I designed.

Sheet mulching completed

I needed to get hold of the seeds for my insectary plants (see previous article). Most were available but I found out that the marguerite daisy was not available from seed and I would have to get hold of it as a mature plant. I got hold of a good sized pot of marguerite daisy and another one of Shasta daisy, each would be a centrepiece for one of the beds.

One thing I have learned, it is best to plan your insectary beds for not for the next season, but rather the one after. I was planning in autumn for winter, but to give the plants a change to grow to flowering stage and start to do their thing, I should really have been planning for spring. It will still be OK but I just thought I'd mention it!

Seeds planted into punnets

With the seeds obtained,

planted into punnets and in the greenhouse it was time to get the beds ready.
The area was just grass and weeds so to render it ready for making into an insectary bed I sheet mulched the area. This process involves laying down a barrier first to prevent weeds poking through (usually cardboard or newspaper) and then placing a series of layers of organic materials down on top which rot down to a rich organic growing medium.

Six weeks later the insectary beds are looking good

Once the sheet mulch was down and the final layer of mulch applied, I was able to put the daisies in the centre of each bed and then arrange the other seedlings in clumps around them. I wanted to include a source of water as well so I got hold of an old terracotta pot which I had plugged up the drain hole of for use in another project. I sited it at the eastern end of the “landing strip” near the tree so it would be mostly in the shade and provide a water source for the beneficial insects.

The water supply for the bugs!

2.3 An Easy Insectary Bed

Insectary beds like the ones described above are beds of nectar and pollen producing flowering plants which attract beneficial insects, both pest predators and pollinators to help you make your food production efforts more effective. I specifically designed my first insectary area in the back yard near the veggie patches and it required some work and research on plant species, flowering times and other plant requirements. But what if you don't want to go through that crap? I wanted an insectary bed in the front yard as well and this time I did it the easy way!

The frame in place

First off I got hold of some timbers to make a 30cm high raised bed. It was a commercially available veggie bed "kit" based on timber preserved with Alkaline copper quaternary (not CCA – copper, chrome, arsenic) which is safe to grow food in. I put it together and placed it on the grass where I wanted it to go. To prevent the grass growing through I put a thick layer of newspaper underneath and placed bed so that the newspaper projected under the timber frame.

On top of the newspaper I laid down some "biscuits" of Lucerne hay. When hay or straw is harvested the machine makes the bales by compressing the plant material into sections. When the restraining blue string is cut the plant materials comes away from the rest of the bale and are generally called (around here at least) biscuits. I placed two layers of Lucerne hay biscuits over the paper on the inside of the assembled bed, so in other words I did not pull the hay apart of fluff it up, I left it densely packed. I gave both layers a good watering to make sure that they were thoroughly wet. This speeds decomposition which makes the nutrients in the hay available to the insectary plants.

Putting the Lucerne in place

Lucerne in place

With the Lucerne in place I did a similar thing with some straw bales which had been given to me by a friend. That almost filled up the bed and I gave the straw a thorough watering as well. The remaining 25 – 50mm between the top of the straw and the top of the bed I filled with compost and then gave it one more good watering. After the bed was finished I left it for a few weeks for decomposition to commence. It was winter so it would take a while to break down in the cooler weather as well as the fact that the seeds for the insectary plants could not be planted until spring.

Hay on top

To make things easy for myself I got hold of a packet of Good Bug seed mix from Green Harvest and broadcast most of it on the top of the 1.2 metre x 1.2 metre bed as evenly as I could, then covered it with some cocopeat. After that it was just a case of keeping it moist until the seeds germinated. By summer I will have a lovely insectary bed, full of nectar-containing flowers helping me to pull in those pollinators and predators.

The job of growing food is much easier when nature is doing some of the work!

The finished article

2.4 A DIY Insectary Seed Mix

This idea was stolen (with thanks) from Michael Wardle of Savour Soil Permaculture

There are articles on attracting good bugs to your garden above but I found this to be an idea that is elegant in its simplicity and wonderful in its effectiveness. The idea is that you have a mix of seeds for plants which attract good bugs, an inert carrier (sand) to make even dispersal of the seeds easier and a fertiliser (kelp powder) to give the plants a leg-up once the seeds are germinated. All of these components are kept as a dry mix in a glass jar, ready for broadcast dispersal in the area you want to grow them.

There is a very wide choice of flower seeds you can pick to go in your mix, and while this has been covered on page 7 in more detail some things to think about when deciding what your mix should include –

1. Does a flower chosen do well in your area?
2. How long do they flower for?
3. What colour flower do they produce?
4. How hardy are they?
5. Do they have a potential to become a weed?
6. Can they perform other functions? (eg nitrogen fixer, edible flowers or ground covers)

As an example, I made a mix up of Alyssum (mixed), cosmos, calendula, echinacea, gypsophila, heartsease, lupin (mixed), marigold (mixed), phlox and poached egg plant. To make the mix, I placed the seeds I had into a small glass jar, then added about four to one ratio as much sand as the seeds, by volume on top. I only use coarse sand here but figured I should remove some of the boulders so I ran the sand through a small kitchen sieve first, giving me a sand particle size similar to most of the seeds. I then added another 0.5 part of dry seaweed powder on top. I then mixed everything by rotating the jar for a few minutes, with a bit of end-over-end mixing thrown in. I don't think the ratios are critical, but that's how I did it and it seemed to work for me.

As always, unless you are going to use all of the mix straight away, it should be stored in a cool, dark, dry place, labelled as good bug mix (especially if you memory is anything like mine) and some indication of a 'sow by' date if you have one.

A bit of research and you can develop a mix that will attract all sorts of good bugs to your place, increasing biodiversity, improving your yields and reducing your pests. Putting you seed mix into a glass jar along with some sand and kelp powder will give you a powerful tool you can start using right away. In Michael's words it is 'easy to make, easy to store and easy to use'!

3.0 Providing Water to Improve Biodiversity

Having a source of water open for the use of wild creatures can benefit the whole ecosystem which is your yard. It may be utilised by bees and other insects, microbats or the birds for which it is named (hence the inverted commas around the word ‘bird’ in the title). We have a number of water sources around the back yard but nothing permanent in the front, so it was time for a bird bath. As usual I wanted to see if I could put something together from stuff I had floating around the house, I also wanted it to have a reservoir of some description to help it stay fuller for longer and hence be ‘self-watering.

3.1 Making a Self-watering ‘Bird’ Bath

The bowl to hold the water for the birdbath came in the form of a wide but not too deep terracotta plant pot that was not currently in use, apart from being full of slowly decomposing chokoes (don’t ask). The first task was to block the drain hole, easily done by some white silicon. All I did was place a plastic bag under the pot then sploodge (technical term) in the silicon until the hole was filled to the brim. I then left it for 24 hours so the silicon could cure.

To add the reservoir my original thought was to set it up so that a 1.25 litre or 2 litre PET bottle would do the trick. To put it into place I used some more silicon to attach a 50mm floor flange upside down to the bottom of the pot in the centre. Then I would put some 50mm pipe with holes in it into the upside down flange and stick the PET bottle on top of that. The problem was that it was for the front yard and the PET bottle would look like crap! So I decided to use a spare 750ml glass (ex cordial) bottle with a longer neck which would be much more stable and have a better ambience (for the birds I mean).

I cut the length of pipe such that the lip of the bottle was about 12mm below the rim of the dish, so that when the water level dropped below that point water would flow from the upturned bottle into the birdbath, refilling it. To facilitate this water flow I drilled a series of 3mm holes around the pipe about 25 – 30mm below the rim of the dish. I had sanded the rim of the pipe in contact with the shoulder of the bottle to make it a bit more stable but it still moved about a bit because the neck of the bottle was so much narrower than the 50mm pipe. I was concerned that if the bottle was moving about it might put the birds off. So (strangely enough) I had a spare rubber 25mm cuff used to connect 25mm flexible greywater tubes to outlets left over from the constructed wetland. By

pushing it onto the neck of the bottle and folding it over (with some effort) on itself twice it gave me a very snug fit, with no movement of the bottle at all.

Folded once

Folded twice

The final touch for the bath itself was a sandstone rock in one side so that any insects wanting a drink wouldn't fall in and be unable to get out. Already a cicada and a couple of beetles have used it!

With the birdbath itself completed I needed to set up a stand for it, high enough so that the local cats would not be a problem (you want a bird bath…… not a blood bath!) although it seems that the birds are always hassling the cats not vice versa! To make the pedestal I used a recycled 110mm x 110mm x 800mm post. I dug a hole using my earth auger and set it into the earth by about 200mm, then put the spoil back into the hole down the sides of the post. I then tamped down the soil on each side after checking to make sure it was upright with a spirit level. I screwed a 180mm x 180mm bit of pine into the top to support the bath and that was about it.

I did toss up where to site the bath but in the end I put it in the woodchip covered “park” area of our front yard so I wouldn’t have to mow around it, and under the mulberry tree to keep it cool and out of the sun. It is also visible from out bedroom window so I can keep an eye on it without having to go outside and cause mass panic in the customers.

The weather has been hot here lately (Jan 2020) and we have been getting customers!

3.2 Making a Beneficial Insect Watering Station

Ready for Guests!

When I looked again at the bug hotel which I made a couple of years back, with a view to improving it, I also looked at the provision I had made for supplying water to the beneficial insects which I hoped to attract. I had put in a 200mm terracotta pot which I intermittently filled with water and this was clearly not good enough. If the sides are steep the insects can have difficulty accessing the water in the first place and there is always a chance they can fall in and drown. Fortunately there is always something new to learn so I did some research and realised what I needed to make so they could have a safer and more accessible water supply.

The base

To provide water for insects the idea is that the water should be shallow and full of objects which the insects can land on then move down and get to the water without danger of falling in and then fly off again when they are ready. One of the downsides of shallow water with lots of landing spots for insects, though, is that the water can evaporate quite quickly and they are left with no water source at all, so I decided to add in a "self-waterer" like I did with the self-watering bird bath (as covered in 3.1 above) .

The self-watering bit consists of a 750ml glass bottle, kept full of water and upturned so that the water flows out once the water level in the dish falls below a certain point. I had an old terracotta pot saucer which is 32cm across and about 3cm deep, which made an ideal base.

To put the waterer into place I used some silicon to attach a 50mm floor flange onto a length of 50mm tube, then drilled some 2mm holes through the flange and pipe to let water out. I drilled the holes so that when the assembly was in place they would be about 10mm below the rim of the dish, this would give a corresponding depth of water of about 20mm.

Tube and flange, with holes drilled

This assembly was then attached to the bottom of the pot saucer, in the centre, with more silicon. I cut the length of pipe such that the lip of the bottle was about 10mm below the rim of the dish, so that when the water level dropped below that point more water would flow from the upturned bottle into the insect waterer, refilling it.

Flange and tube installed

As with the bird bath, the upside down bottle placed in the 50mm tubing moved around quite a bit, so to make it more steady I used a rubber 25mm cuff used to connect 25mm flexible greywater tubes to 34mm outlets. I installed it by pushing it onto the neck of the bottle and folding it over (with some effort) on itself twice, it gave me a very snug fit, with no movement of the bottle at all.

With the watering bit in place I now needed to put some material in which the insects could walk on to get at the water. I have seen some pretty ones that had coloured gravel, glass beads or even marbles, but when I looked into the costs I decided to see what I had hanging around. Years ago I had covered an area between the garage and the fence with roughly 12mm rounded pebbles, so I just scraped up a few handfuls, washed them off and placed them in the pot waterer.

Gravel in place

To make sure the water is at just the right height I filled the bottle up with water and then placed it into the waterer, letting it dribble out so I could see what the final water level was like. I seemed to hit it spot on; the water was about half way up some of the gravel so access was good without the water being too deep. If it hadn't been right I would have adjusted the height of the gravel by putting more in or taking some out so that the water level was right.

Ready to go!

I installed it on a small pedestal 3 bricks high, to get it up off the ground and in front of the newly raised bug hotel. So now all of the beneficial insects can check into the bug hotel, then have a drink at the bar afterwards!

Ready for Guests!

4.0 Accommodation

As mentioned above, there are two main requirements for attracting beneficial insects (pollinators and predators) to your garden and they are the same for attracting any guest – food and accommodation. Yes, there are a few other little management issues, but food and accommodation are the biggies. While food (and water) are addressed above, we will now look at the issue of accommodation.

4.1 Making a DIY Bug (Beneficial Insect) Hotel

The Finished Product

Called variously bee walls, insect hotels or bug B & Bs these collections of stuff with holes in them can look artistic or just messy, but they perform a valuable service for those of us who grow our own. They provide a habitat for beneficial insects, providing them with places to live and reproduce so that if they turn up, they will stay where we want them; in our gardens.

There are two broad classes of insect we want inhabit our hotel, the first are solitary bees such as the blue banded bee, teddy bear bee, the leaf cutter bee or other native bee. These bees, while they do not live in a hive and produce honey, do carry out pollination services for us, ensuring a bountiful harvest from our fruit and vegetables which require pollination to produce.

The second class provide us with protective services for our produce. There are a range of beneficial insects which act as predators on the pest which attack our crops, these include lacewings, ladybirds and predatory wasps. The bug hotel gives them a place to

set up home and breed so that we always have these willing workers in our garden to help us keep the bad bugs under control.

Structure

You need something to fit all the other elements in and it can be as big or as small as you want, so long as it fits the elements you want it to contain. I had an old pine packing case I had cleaned out of the shed, waiting to be disposed of, but as soon as I knew I wanted to make a bug hotel I grabbed it and cleaned it up. It is 630mm wide x 500mm high x 360mm deep and seemed large enough and solid enough to put up with the weight.

The top of the box was nowhere near waterproof and nobody likes to live in a damp house so I needed to put together a roof somehow. I had some colourbond miniorb corrugated steel which I had picked up from a construction site rubbish heap years ago and I figured it would do the trick. It was wide enough but too deep, I wanted 100mm overhang all around so I used the nibbler to remove the unwanted metal from one end of the sheet.

In place - Before the Roof

I wanted a pitched roof to shed the water better so I put the cut sheet on the floor of the garage and placed a broom handle in the central groove. By gripping a free end and pulling it up and over I was able to form a vee, which I would invert and place on the roof. I also had a length of terra cotta sewer pipe which had been stored underneath the tanks for 30 odd years, it went onto the top of the box in the centre and was fixed in place with some wedges. The miniorb was then put into place over the top of the terra cotta pipe and screwed down onto the box, forming a weatherproof roof.

Roof Installed

Between the compost bin and the fence there is a small protected area near the greenhouse which is where I set the hotel up. To get it off the ground I put it up on some bricks, which were made with holes piercing through them, my thinking being that they may provide a habitat for something as well, even if it was only redbacks! I know the other elements would add considerable weight to the box so I made sure it was on a solid foundation and well located before I started putting in anything else.

Elements

Once your outside structure is completed, the next job is to decide what elements you want to put in you hotel, to attract which insects. Following are some of your options, put a few of each in, or concentrate on a particular insect, the choice is yours.

1. Wood with Pre-drilled Holes – These are used by solitary bees. They will cater for a number of different bee species so they should offer a variety of hole sizes. Almost any type of timber will work provided it is the correct size, 200mm of depth is good and I used 50mm+ diameter branches. Hardwood works best and of course treated timber of any description should be avoided. The best hole sizes are as follows –

- 1/8” (3mm) wide by 70mm deep
- 13/64” (5mm) wide by 120mm deep
- 1/4” (6.5mm) wide by 150mm deep
- 3/8” (9.5mm) wide by 150mm deep
- 1/2" (13mm) wide by 150mm deep

(Yes, I know I’m and old fossil but all of my drills are in fractions of an inch and I can’t get used to millimetre sizing for drills!)

I found that it is easier to drill the large holes first, for two reasons – one – it is easier to clean the spoil from the smaller drill holes out of the larger drill holes than vice versa, and – two – it is easier to fit the smaller holes in and around the larger ones, once the larger ones are drilled. Anyway, that has been my experience.

I collected the size of drills I wanted then went to the woodpile and extracted some of the firewood which I had cut from fallen branches. After cutting it to length with my drop saw it was just a case of securing each piece in the woodworking vice, end up and

the drilling the required sizes and numbers of holes. If you are doing this for more than a couple of bits of wood it will take a while so be prepared for that, there will also be a remarkable amount of sawdust! Once the holes are drilled the timber can be stacked into the structure you have made with the holes facing out.

2. Sticks with pithy centres - Reed bees are common in this area and they like to nest in (wait for it!) sticks with pithy centres. The white and very friable pithy centre is easy to tunnel into and in the wild there are a number of species available for the bees. In your garden plants to look for could be lantana, hydrangea, tibouchina or even a grape vine. Hack around a bit and see what you can find, I found offcuts from our mulberry tree and the pithy centre is there so we will see how well it works.

On end

Cut your chosen sticks to about 200mm long and in various thicknesses (whatever you have available) then slide them into your bug hotel with the cut side out. To make them easier to handle you can pack them into a PET bottle and then locate the bottle where you want it, slip the sticks into gaps between other elements or hang up a collection of sticks tied together with wire in a tree.

From the side

3. Pine Cones - Pine cones are in there to provide a habitat for beneficial ladybirds. To keep the pine cones all together and stop them falling out of the hotel, but still make them accessible to the ladybirds, I put them into a box. I made the box out of offcuts so that it was big enough to take 5 pine cones. I cut a backboard to size and then screwed on the sides while holding everything at right angles with a couple of framing clamps. To finish it all off, once the pine cones were in place I stapled some chook wire on the front to keep them there and screwed the box onto the inside of the hotel – job done!

Making the box

Box completed with pine cones in place

4. Corrugated Cardboard - Lacewings are a predatory insect which are handy to have around and they like to nest in the small spaces inside corrugated cardboard. To make their accommodation I got hold of a PET drink bottle and cut the lid end off at the shoulder, so that the sides of the bottle were more or less parallel. I got hold of a cardboard box due for recycling and cut it up into 200mm widths then rolled it up until it was the same diameter as the inside of the bottle and the ends of the corrugations all pointed out. I then stuffed the roll into the bottle, which keeps the cardboard dry and stops in unrolling. I then slid it into the hotel, ready for its first client.

On End

From the Side

5. Clay Filled Pipes or Mud Bricks - Some bees and in particular blue banded bees, like to nest in sandy clay soils and this can be reproduced in the hotel by including mud bricks or packing the soil into plastic or terracotta pipes. If you are 'rolling your own' a mix of one part clay to three parts clay seems to work well, or use what you have access to and see how it works.

I had some 110mm diameter plastic pipe so I cut some 200mm lengths and grabbed some sandy clay left over from making a cob pizza oven. I sat the pipe upright in a cat litter tray (without cat litter of course!) and then packed the sand clay mix into the pipe. By picking the whole assembly up and dropping it a short distance several times it compacted the clay sufficiently that it all didn't all fall out when I lifted the pipe up. I filled the pipe up completely, compacting after each top up then using the flat end of a ¼"drill I poked in some starter holes 60mm deep into the clay soil mix. With that done I placed the filled tubes on their side, starter holes facing out of the hotel.

Siting your bug hotel

Ideally your bug hotel should face north, get at least some sun on it and not face the direction that your prevailing wind and rain comes from. After considerable looking around our place I decided on a protected area between the fence and the compost bin facing east. It is facing away from where most of or weather comes from (south and west) and I'm hoping it will prove attractive to those insect we want to attract. Time will tell.

Don't be Impatient

Speaking of time, it can take some time for your hotel to become tenanted. It can take several seasons for your local bugs to find and occupy your hotel, so check often, but don't panic if it takes a while to see any changes.

4.2 Renovating the Bug Hotel

As it was

As described in the previous section, I made a bug hotel a few years ago as part of a process to attract beneficial insects (predators and pollinators) to come and stay in our backyard. A short time after putting it together I moved it from the North western

corner of the yard to a place much more central, next to the choko tree. It has sat there, in front of the wicking beds for quite a while and has shown evidence of use by a number of insects.

However, every so often you get a kernel of information that changes how you look at things. A local program on our ABC – Gardening Australia – featured bug hotels and mentioned something that had not been discussed in any of my previous researches. A bug hotel should be set up between one and two metres off the ground! Considering that mine was not even 10cm off the ground let alone a metre, I needed to do something.

To start with I pulled out all of the different bug habitats and inspected them. Some were tenanted, but the rolled up corrugated cardboard was somewhat squashed and had suffered from the depredations of snails and so would require replacement. Everything else looked pretty much OK, but when I had removed everything to inspect the recycled wooden packing case which I had used as the outer casing I got two unwelcome surprises.

Snail Central

Some of their work!

The first was a crop of rather fat and smug looking red back spiders! Seeing as this was supposed to be a haven for my six legged friends I dispossessed them of their hiding places rapidly and none too gently. The other thing I found was that the bug hotel had become Snail Central! Clearly they were using the protection of the bug hotel as a place to over-winter in (it is still about 2 weeks off the end of winter here at the moment). They too were dispossessed in short order.

Now to elevate the hotel!

My original thought was to apply a couple of brackets onto the side of the wicking beds which the hotel backs up to, but when I felt the weight of the hotel and realised the wicking beds were only 600mm high anyway I realised that was not the way to do it. After considerable rumination I decided the most secure way was to build up a base from besser blocks.

Under construction

Compressed fibreboard

The first thing to do was to set up the bottom row of blocks so they were level using some compressed fibreboard offcuts as shims to level them up and ensure they had as steady footing. The surface of besser blocks tends to be a bit uneven and without the buffering effect of mortar, the block on block construction can be a bit unsteady as they get higher. I wanted things to be moveable if required, hence no mortar. To get around this I cut some compressed fibreboard to the size of my tower, ie a rectangle formed by two blocks sitting inside the two end blocks. This tied the blocks together so they did not get progressively more unsteady as the tower goes up.

With the tower complete, the bottom of the insect hotel is just on the one metre mark above the ground so it seems to have done the job. After going through and re-doing some of the accommodation and adding in some more pithy stems (why do I always say that with a lisp?) the hotel is now ready to be pressed back into service.

4.3 Making a Frog Hotel

We regularly get visited by frogs in our garden, I can tell by the different calls they produce. The trouble is that they tend to visit, then continue their wanderings, whereas I would like them to stay, for a while at least. When they come to see us they usually take up residence in the 50mm pipe which is the entrance for waste water into the constructed wetland. This is inconvenient for both parties, because once I know they are there I have to pump the washing machine effluent onto the surface of the wetland, rather than the way I designed it, and it can't be a huge amount of fun for the frogs either.

The answer to my conundrum is, of course, to build a specific place for the froggies to live, where the water is fresh and they are not cramping my water treating style. Thus the work recorded here. The frogs we tended to get were tree frogs (as I understand it) who had the ability to climb up and into the constructed wetland entrance, so they are my target (to use a poor expression) frog for this project.

The Frog Hotel

The raw materials!

The base container

The first thing I needed to get hold of was a large container to put the hotel together in. After a quick search I found a large unglazed terracotta pot that was 370mm wide at the top by 160mm high. It was designed to be a plant pot so there was a decent sized drainage hole in the bottom, which I needed to block, so I placed a bit of plastic underneath the hole and filled it in with 'wet area' silicone sealant.

The water reservoir

The froggies like a damp environment so I wanted to make sure that the bowl in which the tubes would be sitting would always have a reasonable level of water in it, so I decided to use the same approach as I had previously for the bird waterer/bath and the beneficial insect waterer. This involved setting up a tube with an upturned bottle in it, which acted as water reservoir.

The first action was to (using more silicon sealant) affix a 50mm floor flange turned upside down on the bottom of the pot. To allow it to get a bit closer to the edge of the pot I cut a small curve around one side with my band saw first, then applied plenty of silicone to the flange and put it in place. I then left the set up for 24 hours so the silicone in the hole in the bottom of the pot and securing the flange could cure.
This time I did not have a spare glass cordial bottle to hold the water so I had to get a bottle from the local 'El Cheapo' shop, which had a similar profile. The upside was that it was a one litre bottle, rather than a 750ml bottle like the other cordial bottles. It was then a case of measuring up how far the bottle neck goes down into the 50mm tube (incorrectly as it turns out), so that the mouth of the bottle is positioned a 20mm or so below the rim of the pot when the tube has been cut to length. I then drilled some holes in the side of the tube for the water to flow out from the bottle into the pot and siliconed (is that a word?) it into the upturned flange, to make it steady.

The only thing left to do was, as I had done with the other designs, was fit a rubber 25mm cuff (used to connect 25mm flexible greywater tubes to 34mm outlets) to the mouth of the bottle. Being a different bottle it did not fit perfectly at first, but I found if I folded the cuff over on itself, wet the bottle neck and then slid the cuff on, it fitted pretty well. The bottle would now fit securely in the tube.

Frog Hotel 'Rooms'

The rooms are in the form of vertical PVC pipes of various diameters and lengths, some fitted with 90^{o} elbows, some without. Just reading around, pipes of 90mm, 40mm and 25mm are recommended but I suspect the diameters are not critical in themselves, it being more important to have a variety. As previously mentioned we have had frogs take up residence in your 50mm constructed wetland inlet pipe. I looked at what I had floating around and seeing as I had lengths of 90mm, 50mm, 40mm and 25mm I decided to use lengths of all four.

Regarding the length of each hotel 'room', this was pretty much up for grabs as different sources recommended either figures that differed between sources or not figure at all. I took this to mean that the lengths of the pipe were not critical. Bearing in mind that the 50mm entry tube into the constructed wetland, which has proved popular, is 350mm long. I collected what tubes I had and constructed the following –

- I length of 90mm diameter tube at 500mm long (with 90^{o} elbow)
- 2 lengths of 50mm tube at 500mm long (1 with 90^{o} elbow, 1 without)
- 1 length of 50mm tube at 300mm long (with 90^{o} elbow)
- 1 length of 50mm tube at 200mm long
- 1 length of 40mm tube at 400mm long
- 1 length of 40mm tube at 300mm long (with 90^{o} elbow)
- 1 length of 25mm tube at 330mm long

So you can see from the above there are a mix of diameters and lengths of pipe with half having a 90^{o} elbow fitted. From what I have read the tubes with 90^{o} elbows fitted on the end seem popular with frogs. Maybe they provide extra protection? I don't know!

It will be most interesting to see which style of frog hotel 'room' they prefer when they turn up!

Filling

With all of the tubes ready, I needed some gravel to fill the pot and give some stability to the tubes when upright. Fortunately my daughter was getting rid of some reasonably

sized white gravel. I don't know how gravel is measured but at a quick took it seems to me to be 25mm – 30mm sized gravel. I was a bit concerned about herbicide residues (particularly Glyphosate) from the previous owners so I did a bioassay test (described here) and it was clear. I gave the gravel a wash in clean water anyway and I was ready to assemble the frog hotel.

Assembly

This was a remarkably simple and quick operation. With the pot ready to go and the water reservoir fittings in place, it was just a case of putting the tube rooms together, facing the 90^{o} elbows in different directions (to give the froggies a choice of aspect) and then setting them up in the pot. The pot was sitting on a bench in the greenhouse, which has a slight lean, so of course they all immediately fell over.

To recover from this embarrassment I borrowed some 25mm wide elastic (blue, if you must know!) from Linda, and then tied all of the tubes together securely upright in the pot. It was then just a case of trickling in the gravel in by hand and making sure it was evenly distributed and with no open spaces. Once the gravel was in and levelled, I removed the elastic and everything stood up fine, we were right to go!

Siting

I wanted to put the hotel in a place where it was likely to come to the attention of any frogs passing through, so I picked a place between the back wall of the house and the constructed wetland. The frogs had already colonised the constructed wetland previously so I figured the hotel would be easier to get to. It was also in a very protected area which is covered by the foliage of the constructed wetland and the mandarine tree, so that it was in full shade or dappled shade during the day.

I dug out a small depression and made sure the bottom was mostly level, then went to grab the hotel from the greenhouse. It was pretty heavy, so I wanted to get it in final position before I filled it with water. After some mucking around and testing with my spirit level I got it to where I wanted it to be, and even built a small ramp of dirt up one side to improve access.

Now I was ready to fill it with water! I filled the pot until it was about 10mm below the top edge of the pot and then placed the filled water bottle into the tube. The water came gushing down into the pot as it was designed to do, but unfortunately it kept going and overflowed the side of the pot. *sigh* I had set the bottle up too high so the water didn't stop before it hit the rim of the pot. I used a tenon saw to remove 25mm from the end of the tube and while it was a bit clumsy, it certainly did the job. It could probably stand the removal of another 3mm-5mm but I will see how it goes.

It has been in place for a week or so and so far no froggies, although those that know suggest that the frog hotel comes into its own in autumn when the frogs are looking for winter accommodation. A full bottle of water will keep it topped up for a couple of days, although it is mid-summer and pretty hot. I expect it will require less top-ups in the cooler weather. We shall see!

Check out our YouTube video on **making a Frog Hotel**

4.4 Gabions for Biodiversity

What is a gabion I hear you ask? It is not a term I was familiar with until comparatively recently, and my answer would be: ‘a wire cage full of rocks’. According to the all-knowing Wikipedia –

“A gabion (from Italian gabbione meaning "big cage"; from Italian gabbia and Latin cavea meaning "cage") is a cage, cylinder or box filled with rocks, concrete, or sometimes sand and soil for use in civil engineering, road building, military applications and landscaping.”

So you can see that I was not far off!

They are a thing in suburban gardens as well, sometimes as retaining walls, sometimes as supports for a garden bench, quite often filled with white, waterworn stones of various sizes. They have a number of things in their favour if you are looking at these structures –

- They are comparatively quick and cost efficient to put together, particularly when compared to earthworks, and traditional brick walls
- They are permeable to water, so don’t act like a dam if you use them as retaining walls,
- They can protect slopes from erosion,
- They are durable and low maintenance, they just sit there looking great!
- They can be filled with local materials (more on this later).

And, these are the bits that interested me –

- They provide a habitat/shelter area in their interstices for a wide range of small wildlife,
- They provide basking areas with greater heat storage (due to thermal mass) for reptiles and invertebrates.

The start of the story

Years ago I built a besser block base for a wood fired pizza oven in the back yard. For various reasons it never really worked out and I wanted that space for a three bay composting system so decided to demolish it. Unfortunately I had constructed it much more strongly than I remembered, with steel reinforcing, concrete and it was filled with concrete rubble. It took a LOT of work to remove.

What it looked like when I removed the concrete cover

I wanted to recycle the resulting rubble, but when I contacted concrete recyclers I got no answer, I figured I had about a cubic metre of the stuff so it must have been too small for them to be interested. So relented and figured a skip was the way forward……..until I costed one! The minimum was two cubic metres and it was $400 (cough! cough!). Now I know why they don't put costs on their websites, you have to ring them.

It was after that that I decided to retain and use the rubble, or 'urbanite' as it is often referred to, as a resource, rather than dispose of it as recycling (or worse) as a waste product. Thus killing the proverbial two birds with one stone: utilising a material which could have been waste onsite, and improving our biodiversity by providing habitat for small invertebrates and reptiles.

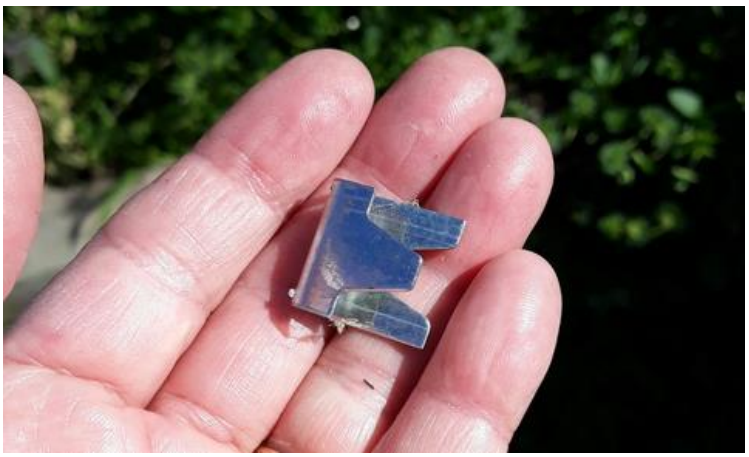
Some of the larger urbanite lumps

The Gabions

The first materials I needed to 'gabionise' were irregular shaped lumps of concrete that I discovered filled the inner part of the structure, along with a whole stack of gravel, which would be used elsewhere, not in the gabions. I was hoping to get some wire mesh discards, but that fell through and I wound up buying some 40cm wire mesh cubes from a certain hardware store, because I was impatient.

Flat pack gabion!

The instructions on how to put the gabions together by the manufacturer was pretty sparse and amounted to – 'put 'em together; put 'em in place; fill 'em with rocks'. The sides are essentially composed of 2.5mm wire configured into 50mm x 50mm squares, and the sides are held together with these weird looking clips (see pic). After some trial and error (they give you plenty of clips) I found that a pair of long nose pliers and a pair of combination pliers allow the clip to be held in place by one, and the tabs bent over to secure it by the other. Roles of the pliers vary depending on access. I put two or three clips on each side and the bottom, but I have not yet secured any of the tops.



Hold with one, twist with the other!

voila!

I set up two gabions in the front yard, then began the process of removing the concrete and gravel from inside the structure. The lumps of concrete (larger than 50mm so they don't fall out) I removed by clearing away the gravel from in between them, placed them into a steel bucket, then transported them to the gabions and placed the concrete lumps inside. There is an art to arranging rocks in a gabion, an art I don't have! But I got there eventually. The concrete lumps pretty much filled one of the gabions, with a few leftovers.

I had hoped to separate the besser blocks and re-use them, but it didn't take me long to work out that the only way to get things apart was a sledgehammer and then a 3 pound hammer (sorry about the lack of metrication). So I followed the same process basically, beat the living daylights out of the besser blocks until they came apart, and then put the fragments into the bucket, transport and stack into a gabion.

In the end I got a total of four gabions, all filled with what could have been waste, but was in fact a resource once I had thought enough about it. They are now in the front yard, providing the seats, and home for tiny critters, a win-win situation!

4.5 Going Microbatty

In 2016 I arranged for a gentleman from the NSW Department of Primary Industries, Dr Leroy Gonsalves, to come and talk to us at Permaculture Sydney West about microbats. Biodiversity is always a great subject for a PSW meeting, plus I personally knew nothing about microbats and wanted to learn.

As I expected the talk was fascinating. One of the points Dr Gonsalves made was that with land clearing and urbanisation of the Sydney basin, microbat habitat was declining at a serious rate. As a direct result of his comments I went out and bought a bat roosting box, closely followed by a second, and just recently I made and installed a third.

At this point in my article I would normally go through what microbats do for us (they eat insects, including mosquitoes) and how they fit into the local environment. However, rather than regurgitating somebody else's research, the site Backyard Buddies provides lots of information on these creatures - **Microbat - Backyard Buddies.** Also, details (including photos) of the almost 20 microbat species that make the Sydney basin their home can be found here - **meet sydney's microbats** (ausbats.org.au).

The Two Commercial Bat Boxes

The first one I bought was as a kit (the second was too) that I was able to put together and then paint up so that it didn't stand out quite so much (I used a nice British Racing Green colour). As usual for me, I can't remember where I actually bought the kits from, but when I looked on the 'net, the only place that was selling bat boxes that looked like mine was FauNature - **Bat Box - fauNature**

The measurements of the boxes are –

- the back board is 500mm x 190mm
- The bat box itself is 310mm long x 190mm wide by 100mm deep
- They are constructed from 18mm plwood
- The access is through a 15mm gap in the bottom of the box.

There is also a divider that goes up the inside middle of the box that has a coarse hessian glued to each side to help the bats get access. The inside of the front and back of the box also have coarse hessian glued to them. The bottom part of the backing board directly under the access gap has some grooves cut in it longitudinally to also help the microbats get into the box. To affix them to our front trees I put some coach bolts into the trees through the holes provided.

To site the boxes, the literature seems to recommend that you have a number of boxes facing different directions so that the bats can choose which one suits their needs for

that time of year. Consequently the first bat box was mounted facing north, while the second on was facing east. Both boxes are mounted 2.5m to 3m off the ground on the melaleuca alternifolia tree at the front of our property. Also, within about 5m to 10m of the boxes is a self-watering birdbath and a self-watering insect watering station if they need a drink of water.

One of the questions I get asked is, “do you get microbats in your bat boxes?” and the honest answer is – “I don’t know”! They are small and nocturnal so I don’t see them flitting around. There are certainly marks on the grooved access area that lead me to believe they have been tenanted, but it is difficult to know at any particular time if bat(s) are in residence.

I have been reluctant to unscrew the front hinged door (secured by two screws) to find out one way or the other. Until recently. I climbed up a ladder, unscrewed and opened the door, and found that they were indeed tenanted, just not by what I was expecting (see photo below!). I have asked for advice from experts as to whether they are a problem for the microbats or not, and it turns out that while these spiders will not predate the microbats, they are likely to put them off roosting in the bat boxes! I know they certainly would put me off, so I need to evict them.

The third Bat Box

I decided I wanted to build my own this time, so I could have a west facing bat box as well as the other two. My source of information was the wonderful book 'Nest Boxes for Wildlife' by Alan and Stacey Franks. There are two bat box designs and the first one I settled on was on pages 44 and 45 of the book. It states that it should be constructed of 'rough sawn hardwood' and this proved to be difficult to get hold of. Hardware stores and even timber merchants in my area seemed to only have DAR timber and when I asked about rough sawn they just gave me a strange look. I was able to find some in the delivery of fire wood we had delivered, but the dimensions of the pieces would not give me enough timber to build what I wanted.

Raw materials!

Fortunately, on page 46 was a different design where it stated that “the dimensions may be varied to almost any size” so that sounded good to me! It was basically a bottomless box with the cut-off leg of a pair of jeans attached inside. This would allow the microbats to climb up inside and find shelter. The idea was also to chain it below a limb of a tree rather than screw it into the tree itself.

Backing board completed

I was able to souvenir some rough sawn hardwood timber from the wood heap and by putting two pieces together was able to construct a backing board that was 590mm long x 220mm wide x 35mm thick. It was a bit heavier than I intended, but you work with what you have! I also used sides and the top from the wood heap, the sides being 460mm long x 100mm wide x 20mm thick and the top is 190mm wide x 140mm deep x 12mm thick. I also cannibalised a tomato stake to use as reinforcing to help with attaching the sides to the back board. The front of the box was a bit more difficult because I had no firewood the right size, so I found an old piece of pine and cut it to size – 500mm long x 140mm wide x 20mm thick. All the parts were fastened together with screws. It was the just a case of removing the leg from an old pair of jeans and screwing it in to one side of the top of the box.

Walls up and secured

Fabric installed

Close up of fabric attachment

With the box finished I was able to hang it from one of the melaleuca alternifolia trees in the front yard that faced roughly west. I found a couple of cup hooks and screwed them into the sides of the backing board, then cut some old chain to length and looped it over the branch, where it hangs about 2.5 metres above the ground. Now it is just a case of waiting to see if I can find any evidence of use by my microbatty friends!

5.0 Installing Our Native Garden

When considering plants for our garden, for me it used to be a simple process, can you eat it? Yes or no. If yes, plant it, if no ……..well, not so much. It took me a long while to understand that we can reduce the amount of work we have to do to maintain our garden by working with nature rather than against it and improving biodiversity can help that. For example by attracting insect predators rather than using sprays, and using native and introduced flowering plants to do this. I wanted to attract birds, and the birds I wanted to attract to the garden were the smaller insect eating birds to help out, and as with anyone you want to come and stay with you, you need to provide –

- food
- water
- refuge, and in the case of birds -
- nesting

We already have a self-refilling birdbath to provide water, but the rest was missing. After a bit of research, however, it turns out that by putting in some Australian native bushes and shrubs, they can provide nectar for birds and other pollinators, a place for the birds to retire to if they are being hassled by bigger birds and a place where they can nest!

The best natives to put in are grevilleas, melaleucas and banskias (although callistemons help too) and to have different plant sizes from trees down to small bushes and shrubs so the birds can access different levels. We already have three large *melaleuca alternifolia* trees in the front yard so I wanted to get some different size plants in there.

T*he bed widened and the ditch for buried pipe irrigation dug*

We have recently expanded the size of the planting bed in front of the house from 700mm to 1100mm and ripped out a couple of pointless ornamentals. The area gets good morning sun, particularly in the warmer parts of the year, but it gets very little afternoon sun due to the orientation of the house.
To expand the bed we lifted the concrete edging, removed the grass, dug up the soil under the grass and then dug the concrete edging into its new position. This gave us more growing space and reduced the amount of mowing required in a single action!

Buried pipe irrigation installed

While preparing the bed and prior to planting any natives, I also installed buried pipe irrigation. Some of the bed is under the eaves and it can get pretty dry here, particularly during the heat of summer. Once the natives are established they should be able to cope but the trick is to provide an environment that will allow them to become established easily so I needed a way to keep the water up to them efficiently, hence – buried pipe! Once they become established I will leave it in place for the other shallow rooted ground covers etc. but will probably install deep pipe waterers for the larger natives in the future.

I wanted a mix of heights and species, which would be able to cope with a partially shaded environment and for better or worse, this is what I got –

- 3 x banksias of various heights,
- 1 x grevillea
- 1 x callistemon (bottlebrush)
- 1 x syzygium (lilly pilly)

I also got some native violets (edible flowers) as a ground cover and there will no doubt be other bits and pieces go in as well as time goes by, I already have my eye on some native wildflowers.

Natives Installed

All of the main natives, being woody rather than herbaceous, do better with a wood chip style mulch. A woody mulch encourages beneficial fungi in the soil rather than say, using sugar can mulch which encourages bacteria and is better for annual veggies and the like. So I decided that a wood chip mulch is what I needed to get hold of.

Mulch installed

I have noticed not far from our place that someone is dumping tree shreddings on vacant land rather than paying a fee to dump them at the tip. To take advantage of this I lined the back of the car with a tarp and went over there with the mulch fork which Linda had gotten me for my last birthday and wow! After 10 minute of work I had enough wood chip mulch to cover what turned out to be two thirds of the bed, a second trip netting the last third. The mulch fork worked so well it was a case of "where have you been all my life!"

Native violet, ground cover to be

So the bed is now expanded, irrigated, mulched and planted. If I really want to kid myself I can call it a tiny bit of Zone 4 or 5 on our permaculture design, but regardless of that it should provide a nice environment for native birds and some insect predators as well. We'll see how it goes!

6.0 Resources – Books about Biodiversity

Habitat – A.B. Bishop – Murdoch Books Australia (AUS) 2018 ISBN 978 1 76052 347 3 – The book has ten chapters in two parts, each chapter has a case study at the end illustrating how the chapter can be used in practice. Part one (Biodiversity for Life) has three chapters, chapter one details what a habitat garden is and why it is beneficial; Chapter two covers ecology and food chains/webs; chapter three discusses how food webs work in the backyard. Part Two (Backyard Habitat) starts with chapter four which talks about plants for your backyard habitat, including classes of plants such as those for food, shelter and socialising and plants for pollinators. At the end of chapter four is an extensive plant directory with photos giving data on what layer and (Aust) zone they are for, flower colour, what they contribute and how high they grow. Chapter five covers earthworms and insects and how to put in habitat to support them; chapter six does a similar thing for frogs and reptiles; with a section at the end covering pests and other undesirable visitors. Chapter seven talks about habitat to support bird life; chapter eight does a similar thing for animals such as bats, possums and gliders; Chapter nine covers hints and principles for designing habitat garden and chapter ten gives details for projects to improve the biodiversity in your area such as constructing bee/bug hotels, bat and other animal boxes and a frog pond. This is a wonderful book, with lots of colour photos!

Habitat Garden – Peter Grant – ABC Books (AUS) 2008 ISBN 978 0 7333 1279 3 – This is a great book, lots of info! Chapter one covers the what and why habitat gardening chapter two talks about planning the habitat gardening, why do it, the planning process and includes some garden scenarios. Chapter three talks about propagating plants for the habitat garden; chapter four covers the activities associated with maintaining it including watering, mulching, pruning and managing weeds and pests. Chapter five covers attracting birds, insects and animals to the habitat garden, chapter six covers putting in a habitat garden in difficult areas such as coastal, rainforest and arid gardens. Chapter seven provides details on groups, nurseries and environmental care groups from plants and information can be available. Lots of colour photos.

The Australian Bird Garden – Graham Pizzey – Angus & Robertson (AUS) 2000 ISBN 978 0 207 19675 3 – The book is written in four parts. Part one covers experiences from the author's garden and travels. Part two covers the practicalities of setting up a bird-garden including what native birds need, soil, water and feeding birds, when birds fight their own reflections and nesting boxes. Part three discusses a few bird species and their behaviour, then more general information about birds as pollinators. Part four talks about plants and how they grow and interface with insects and birds. There is an appendix of plant lists by capital city with some smaller cities included. The book has lots of colour photos.

Nest Boxes for Wildlife – Alan and Stacey Franks – Blooming Books (AUS) 2006 ISBN 978 1 87647 20 7 – This small book starts by explaining why providing wildlife nest boxes is important in chapter one. Chapter two talks about the animals covered in the book and some of their habits. The main part of the book provides detailed plans, material and tool lists and instructions on how to build and mount animal nest boxes. The plans cover boxes for 17 bird species and 11 mammals. Chapter five covers providing food and water as an attractant to use the nesting boxes. The book features line drawings and lots of colour photos.

Attracting Frogs to Your Garden – Kevin Casey – Kimberley Publications (AUS) 1996 ISBN 978 0 9587628 0 5 – Again, this is a small book. But with lots of info. Chapter one talks about why there has been a decline in frog numbers and provides some hints for attracting frogs to your garden. Chapter two gives a general review of our unique amphibians, chapter three suggests some

resources to assist with frog identification and details simple steps to be taken that improve frog identification. Chapter four talks about how to look for frogs and chapter five talks about frogs as pest controllers. Chapter six covers cane toad identification and eradication. Chapter seven talks about frog calls and mating while chapter eight talks about doing the right things to keep frogs happy and healthy and chapter nine talks about raising tadpoles. Chapter ten details hot to set up a backyard frog pond and chapter eleven goes through 'frogsaping' your backyard with the appropriate frog-friendly plants. Chapter twelve covers attracting other animals (native birds, mammals, insects etc) and chapter thirteen covers frog photography. The book has line drawings, lots of B&W photos and a couple of colour photos on the covers.

7.0 Appendices

Appendix 1 Plants Which Attract Beneficial Insects (Insectary Plants) Blossom calendar

Name	Scientific Name	Uses	Time of Year sown	Annual/ Perennial	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Alyssum	Lobularia maritima	Scented, edible flowers	All year	A												
Bergamot	Monarda didyma	Herb, edible flowers, tea	Spring	P												
Birdsfoot trefoil	Lotus corniculatus	Nitrogen fixer, dye	Spring to autumn	P												
Borage	Borago officinalis	Edible flowers and leaves, dynamic accumulator, herb	late spring to early summer	A												
Buckwheat	Fagopyrum esculentum	Edible leaves and grain, dynamic accumulator	summer	A												
Calendula	Calendula Officinalis	Medicinal herb, repels pests, edible flower,	Spring & autumn	A												
Californian Poppy	Eschscholzia californica	Cut flower, ground cover	Spring & summer	A												
Candytuft	Iberis umbellata	Cut flower, edible but bitter	Spring & autumn	A												

Name	Scientific Name	Uses	Time of Year sown	Annual/ Perennial	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Chicory	Cichorium intybus	Edible root, dynamic accumulator	Spring	P												
Choko	Sechium Edule	Edible Fruit, leaves, climber	Spring (plant fruit)	P												
Coriander	Coriandrum sativum	Herb, edible leaves, seeds	Spring	A												
Coreopsis	Coreopsis	Cut flower, edible flower	Spring and autumn	P												
Cosmos (caudatus)	Cosmos caudatus	Cut flower, edible flower	Spring after frost to late summer	A												
Dill	Anethum graveolens	Herb, edible leaf and seed	Autumn & winter	A												
Flax	Linum Ultimatissimum	Fibre, edible seeds, oil	Spring & autumn	A												
Gerbera	Gerbera species.	Cut flower	Spring & autumn	P												
Globe Gilia (blue thimble flower)	Gilia capitata	Wildflower, cut flower	Spring	A												

Name	Scientific Name	Uses	Time of Year sown	Annual/ Perennial	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gypsophila (Baby's Breath)	Gypsophila Paniculata	Cut flower, edible flower	All year round except mid-winter or mid summer	P												
Hearts Ease (wild pansy)	Viola Tricolour	Cut flower, edible flower	Spring	A												
Lavender	Lavandula	Edible flowers, herb	Spring to early autumn	P												
Lucerne	Medicago sativa	Mulch, feed, nitrogen fixer, dynamic accumulator	Autumn or late winter/early spring	P												
Lupins	Lupin Lupinus	Edible flower, edible seeds, nitrogen fixer	Late summer & autumn	A or P												
Marguerite Daisy	Argyranthemum frutescens	Cut flower	Propagated by cuttings	P												

Name	Scientific Name	Uses	Time of Year sown	Annual/ Perennial	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marigold	Tagetes species	Cut flower, repel pests, edible flowers, yellow dye	Autumn and spring to early summer	P or A												
Mustard	Brassica nigra (black) sinapis arvensis (white)	Edible leaves, dynamic accumulator, edible oil, spice	All year	A												
Nasturtium	tropaeolum Majus	Edible leaves & seeds, ground cover,	Spring	P												
Orange	citrus x sinensis	Edible Fruit, windbreak, orange oil	Propagated by grafting	P												
Phacelia	Phacelia tanacetifolia	Cut flower, ground cover	Spring	P												
Queen Anne's lace	Daucus carota	Edible flower and root,	Spring & autumn	P												
Shasta Daisy	Leucanthemum × superbum	Cut flower	spring	P												

Name	Scientific Name	Uses	Time of Year sown	Annual/ Perennial	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
White Clover	Trifolium repens	Ground cover & nitrogen fixer, edible leaves	Autumn	P												
Yarrow	Achillea millefolium	Herb, dynamic accumulator, tea	Spring	P												
Zinnia	Zinnia species	Cut flower, edible flower, cut-and-come-again flowers, tea	Spring	A												

Appendix 2 – Blossom calendar blank

Name	Scientific Name	Uses	Time of Year sown	Annual/ Perennial	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec