Choko Tree Permaculture



Permaculture in the 'Burbs

By Nev Sweeney

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1.0 Introduction

1.1 My Permaculture Journey

I was a child of the 70s, the time of hippies, the back-to-the-land movement and all the other counterculture stuff. I really didn't give it much thought until I bought a book entitled 'The Survival Handbook - Self Sufficiency for Everyone' by Michael Allaby and others, including John Seymour. It was written in the UK and my copy was published in 1977, the year I bought it. Being a UK book, it did not reflect the Aussie experience but contained a lot of ideas that were brand new, to me at least. It talked about farming, building, land, communities, making textiles and clothes and growing, cooking and processing your own food. It set the (non-working) course of my life for pretty much the next 25 years.



Me, standing on where our house would be built

Shortly after this I got married to the love of my life and moved into our house in the wild western suburbs of Sydney. This gave me the base to start doing a few of the things that I had read about, like growing food. It was just the start, and I continued accumulating more second hand books on alternative energy, alternative technology, organic food growing, and also giving the ideas a go. By trial and error, making lots of mistakes that I could learn from.

The journey continued.

During the early 80s I accumulated a couple of books (second hand from the Sallies of course) called 'Permaculture One' and 'Permaculture Two' by two gentlemen; Mollison and Holmgren. I had a cruise through them but did not really have the background knowledge to make use of them at that time.

Things moved on and with all the worries in the world I was moving towards the dark side, considering myself a survivalist or what we would call today a prepper. I was interested in being self-sufficient and by that time I had a wife and two kids to support so I continued to learn how to provide for us, just in case things fell apart.



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In the mid-80s I started an external studies TAFE course in Agriculture, and in 1987 I was awarded a certificate in Agriculture. That same year I started the Farm Technology course at the local TAFE, which I completed in 1990. I had ideas of going bush to create a self-sufficient lifestyle, but life got in the way and it never eventuated. Over time, what this forced me to do was to look at how self-sufficient we could be on out 600m2 homestead in St Clair.

In the ‘80s and ‘90s as well as working for a living and helping to raise my family, I was able to work on my skills and practice them, things like growing vegetables and fruit and preserving them, managing chooks, setting up water tanks and water gardens, making and using alternative technology like a 12volt power system, solar cookers, stored heat cooker, and blacksmith forge; growing and spinning cotton, food storage plus lots of other fun stuff.



Meeting David Holmgren!

All that I was doing was predicated on a prepper mindset of being able to keep my family going in the event that TEOTWAWKI (The End of The World as we Know it) turned up. The downside of this mindset, of course, is that it tends to focus on the individual rather than community.

Things carried on in this vein until I changed jobs in 2000, and went from being an OHS Manager to being an OHS&E Manager, and I realised that I had no idea about the 'E' – which stood for 'Environment'. I enrolled in the Master of OHS & Environmental Management course with Western Sydney University, so I could bone up on what I would need to do.

As a byproduct this course of study turned out to be an eye opener for me into the environmental issues and problems that we were facing. The impact of what I learned was that we still did a lot of the same stuff (generating our own power, growing fruit and veg, storing and using rainwater), but for different reasons ie to reduce our environmental impact and be more sustainable rather than just be more self-sufficient per se. It also meant that some stuff we looked at differently, like the amount and types of waste we generated and the environmental impact of our purchases.

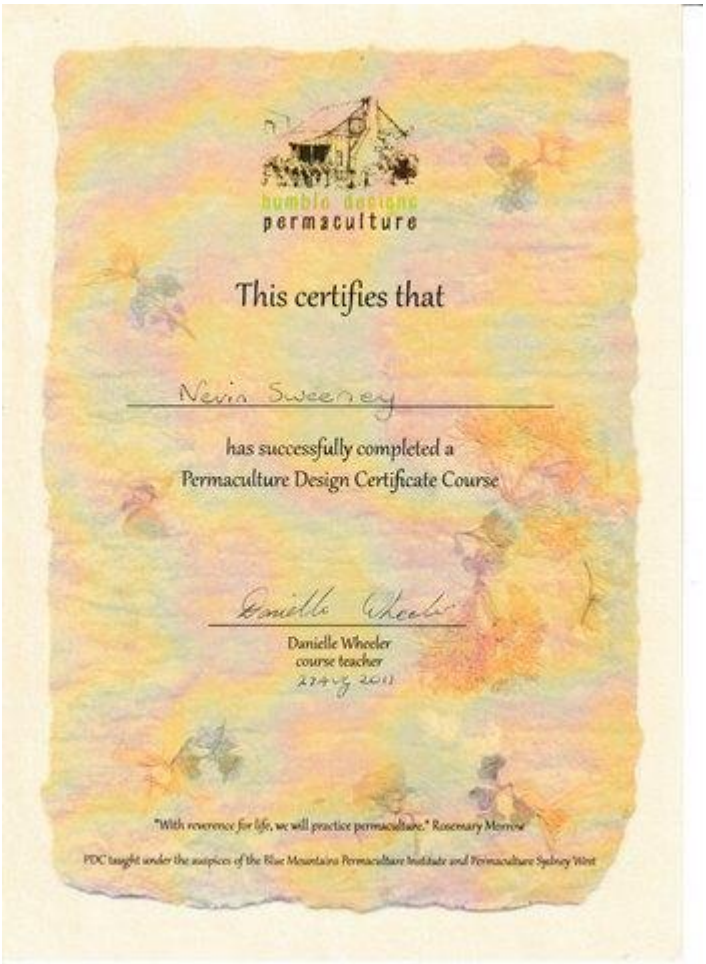


Costa (the Garden Gnome) and I at a PSW meeting

Also, as part of this course I learned about the concept of 'carbon footprint', which I learned much later was put together by BP to transfer responsibility for environmental degradation away from the petroleum industry and onto members of the public. While I thought it was an interesting idea, I found it to be not useful as a tool for planning a more sustainable lifestyle. As a result, the thesis which I developed for my Masters was based around the Sustainable Lifestyle Assessment Matrix (SLAM – yeah, I know, corny name!). It can be used by an individual or family as a planning tool for developing a more sustainable lifestyle.

Thus, for some considerable number of years I had been developing and practising what was almost a permaculture lifestyle, at least as far as was possible in the 'burbs.
For obvious reasons I had an interest in what was termed 'alternative technology', collected books on the subject and practiced what I could so that we could be more sustainable. That is probably why I was attracted to a stall run by the Alternative Technology Association (ATA who have since rebranded as ReNew) at a sustainability fair in Darling Harbour (Sydney) somewhere around 2008. After discussing what I had been up to with one of the gentlemen on the stall (Andrew Leahy) he suggested I come along to another group he was associated with – Permaculture Sydney West.

I attended the meeting as he suggested and did an impromptu talk on what we had been doing. I have been a member there ever since and after a couple of years I joined the committee, filling several posts over the years including Treasurer, vice President, President and Education officer.



In 2011, a good friend of mine, who was also a part of PSW, Danielle Wheeler, asked me to co-teach a PDC (Permaculture Design Certificate) with her. I had not attended a PDC so I did not feel that I was qualified teach it, so I had to decline her kind offer, but instead said that I would attend her course as a student. I found it to be a wonderful experience. While I had accumulated permaculture skills and experience in varying degrees in different subjects, I found that the PDC pulled everything together and increased my understanding considerably. The following year Danielle and I did co-teach a PDC together.

In 2013, working with others in the PSW group such as Greg and Vera Meyer, I started conducting workshops for councils around Sydney. Over the years the councils we worked with including Penrith, Blacktown, Hawkesbury, Cumberland, Paramatta and Sutherland.



Running a workshop for Blacktown Council

I also became involved with management of the Permaculture Australia Facebook group some years ago, as well as managing my own website called 'Under the Choko Tree' where I have been putting up the articles I write on living sustainably in the suburbs and Permaculture related subjects for almost 15 years. Some of these articles were originally published in Grass Roots or Earth Garden Magazines. I have also given talks over the years to permaculture groups such as Permaculture Sydney West, Permaculture Sydney North, Permaculture Northern Beaches, Permaculture Sydney South and at the Narara ecovillage.



Doing a presentation for Permaculture Central Coast

In 2023 I was given the surprise of my life when I was honoured with a Permaculture Elder Award at the Permaculture Convergence in South Australia in that year. Other recipients of the award included David Holmgren, Rowe Morrow, Robyn Francis, Robyn Clayfield and John Champagne, so I was in remarkable company.



I don't know where my Permaculture journey will lead me, although I do know that it will include interesting and productive experiences, allowing me to discover new and fascinating ideas and meet wonderful new people. The journey continues!

1.2 Some Benefits, and Challenges of Suburban Permaculture

A decent sized, greenfield bush block that we can place a dwelling on and design ourselves using permaculture principles seems to the ideal situation for many permies. Certainly, my idea was to learn as much as I could while living on our 600m2 suburban block before 'heading bush' back in the '80s. But the long and the short of it is, we are still here.

David Holmgren makes the point that "even in Permaculture Design Courses there tends to be a focus on 'clean slate' design.." (RetroSuburbia pg. 24). Yet the most

sustainable house/block is the one we are living in/on now. That coupled with the fact that Australia has a very urbanised population (around 90%), maybe we should be concentrating on 'permaculturing' our urban and suburban spaces rather than planning to 'head bush'.

That was the conclusion that I came to over 20 years ago that it was more important for us, and made more sense to remain in the 'burbs and see what we could do there rather than bolt for the back-blocks.

From my experience there are some distinct advantages (benefits) and disadvantages (challenges) to taking this approach, and this is what I have found –

Suburban Permaculture – Five Benefits and Four Challenges

Five benefits

People – with a higher population density people might be part of the problem but they are also part of the solution. Friends, neighbours, family and local permaculture groups provide more opportunities to work together with others to help develop your permaculture front (and back) yard, build community and culture, and generally get stuff done. There are also people who will walk past your productive property who you can share produce and information with, and invite them to your permaculture group. (Don't have a local permaculture group? Why not start one! (Check **here**).



Permaculture Sydney West blitz at our place

organic matter – The local environment can produce lots of organic matter for you to compost, use as mulch or feed to your worms. Leaves, grass clippings, veg waste, wood chips are available in your local area from your friends and neighbours and by working with them you can help return all this organic matter to the soil thereby increasing its fertility and productivity. A few years ago, there was a local tree lopper who would drop loads of wood chips on some unused land near our place, and I would regularly harvest this tree waste and use it in our garden. You can contact local arborists and get wood chips delivered free, you get a resource and the wood chips stay out of land fill, everybody wins!



Variety of microclimates – There are lots of variations available in terms of microclimates in the built environment. Buildings provide microclimates that are shaded, warmed by their thermal mass or dampened by runoff from their rooves. Thermal mass can also be provided by pools, ponds and water tanks. These same houses, sheds and fences will also modify the effect of winds, reducing or increasing air movements depending on how they interact with other aspects of microclimates.



The mulberry tree - summer and winter

Water - Rainwater and greywater – With the runoff from houses and shed rooves, rainwater tanks and other options like raingardens, drain chimneys or soakwells can store, or make direct use of rainwater to help it slow, spread and sink. Rainwater from

tanks can also take the place or reticulated water for keeping crops and ornamentals watered as well as being used inside the suburban house. Greywater is also an abundant suburban resource that can be put to use rather than removed from site for treatment, either directly or through a small constructed wetland for greywater treatment.



One of our water tanks

Proximity to services – For the most part, whatever you want, be it groceries, tools, plants, building materials, power or expertise, whatever you need it will be easier to access in the urban and suburban landscape. All of the permaculture projects designed to help you live a more sustainable life will require inputs and they will be more easily accessible in the 'burbs.



Living near a packaging free store can be very handy

Four Challenges

Rules – Like it or not, we are subject to three levels of government (local, state and federal) but the local council is the level most likely to have an impact on how we live our permaculture life, and they are most likely to become involved as a result of a neighbour complaining about your activities. This is where the 'social license' comes in and how actively developing community in your area and working positively with your neighbours can pay off by allowing you to fly under the radar.



Twenty years ago, I wanted to install a wind generator on the roof of the garage, but it was somewhat large and heavy and would have required serious engineering. Proactively I contacted the council, but just to inspect things would cost me almost as much as the wind generator itself. I refigured things and got a much smaller and more efficient unit, okayed it with the neighbour on that side and installed it. There were no problems with the neighbour or the council for the entire time it was in and running, and I decommissioned the unit in 2019.

Land size – We live on a 600m2 block which, when we bought it over 45 years ago, was a small block. Now it is a large one! I have driven through some of the new subdivisions where the block sizes are half ours or less and the houses are monstrous. This does reduce the amount of land available for growing and other activities, but it does encourage creativity in the use of space and technology.

Shade – While this can be a positive in small areas and can increase the variety of microclimates available, it can also be a challenge where the shade finds you from a source which you have no control over. This may be large trees on a neighbour's property, especially to the north or west of your block, reducing sun access and thereby limiting your growing potential, or a neighbour redeveloping their house from a single storey into a two-storey house and shading out your solar panels or solar hot water. This is also a case where working with your neighbours may gain a positive outcome. Sometimes, though, for example where large trees that have been there a long time and are protected by council, it will require creativity to make the best use of what sun access you do have, including perhaps delawning your front yard.



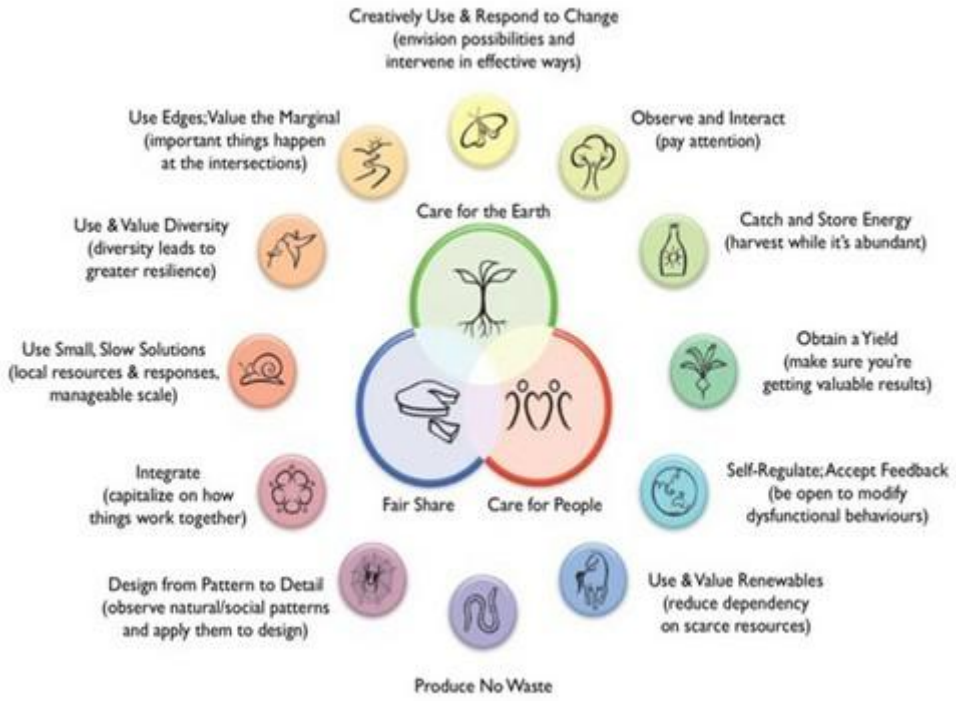
Delawning the front yard can open up options

Pollution – This can be a difficult problem depending on where it is that you are located. It may be an old house that has been on a main road, with possibilities for lead

from petrol or old paint and/or asbestos. It may be a new development which is being built on what was an old industrial area. This should have been remediated, but it is best to check yourself (not that I don't trust developers…… I just don't trust developers!). There may be ongoing pollution from currently operating mining or manufacturing facilities close by. In all cases it is best to arrange for soil testing to understand if there is a problem and if so, what it is and what the options are. If it is not practical to remove or remediate contaminated soil, growing in raised or wicking beds can be a way of producing food independent of the contaminated soil.

It is important to look at all aspects of a site when undertaking the zone and sector analysis for a project, but when the project is a suburban based one it is vital to include both the benefits and challenges of suburban living in the analysis.

2.0 Ethics, Principles and the Choko Tree



2.1 Permaculture Ethics and the Choko Tree

In the words of David Holmgren in his book 'Permaculture Principles and Pathways Beyond Sustainability': "Ethics are the moral principles that are used to guide action toward good and right outcomes and away from bad and wrong outcomes". In other words, permaculture ethics are the foundational moral compass or the 'why' we carry out permaculture related actions, as opposed to the permaculture principles which are the underpinning of practical, actionable techniques used to achieve permaculture outcomes, or the 'how' of what we do.

Again, drawing from 'Permaculture Principles and Pathways', the three permaculture ethics are:

- Care for the earth,
- Care for people, and
- Set limits to consumption and reproduction and redistribute surplus.

These ethics have been summarised by people with greater expertise than my own into the following six words:

- Earth Care (EC)
- People Care (PC)
- Fair Share (FS)

Earth Care: We support living systems where we can, allowing them to continue and multiply. We work with nature rather than against it—rebuilding soil health, harvesting rainwater, reducing energy usage and waste production, supporting biodiversity, and opposing habitat destruction.

People Care: We support systems that allow people access to the resources necessary them to live well, beginning with our own self-reliance and personal well-being, expanding outward to build strong, resilient and sustainable families, neighbourhoods, and local communities.

Fair Share: We share our surplus time, information, and resources freely with those in our communities: local, regional and online.

Over the years the plans we have put together and implemented in an attempt to put into practice the thoughts behind these ethics have shaped our lifestyle in ways we could not have predicted. Listed below are some of the aspects of our lives that been influenced by the ethics alone and in combination. This is not the end of the road; it is a continuing journey which I expect to go on for the rest of our lives.

Food (EC, PC, FS)

We grow a variable percentage of fruit, vegetables, herbs and eggs all year round using organic techniques and permaculture principles and are starting research into regenerative methods that are suitable for small scale/backyard growing. We manage the soil we use to grow our food by fertilising using the chook tractor, compost and other amendments such as rock dust and wood ash where required. We do some food

preserving, usually dehydrating with a solar dehydrator or canning. Excess produce is shared with friends and family as well as being provided for anybody who wants it through a street pantry at the front of our property.







Energy (EC, PC)

We have worked on reducing our energy consumption with the consequent reduction in GHG production on our behalf by the companies that retail energy and we produce as much renewable energy as we can, keeping us off grid much of the time.. We monitor our energy use, have conducted energy audits and put in processes and procedures to support our reduction in energy usage. This includes efficient cooking methods like cooking with stored heat, solar cooking and using a wok with our rocket stove. Water is heated using a solar water heater with reticulated electricity as backup when needed. Warmth is provided in winter using layered clothing, upgraded insulation and a wood heater which also allows us to cook and provides ash to maintain soil fertility. We keep cool in summer by surrounding the house with trees and structures to reduce the impact of heat on the house, and us.









Water (EC, FS)

While we are connected to the reticulated water supply, we use it efficiently with our current usage rate per person being 30% to 50% less than the standard household water consumption for our area. We store 18,000 litres of rainwater which is mainly

used for food growing but also has some use inside the house. We are set up for water efficient irrigation including techniques such as ollas and deep pipe watering. Greywater is reused to water perennial food plants either directly or through a constructed wetland to provide a level of purification. Rather than being sent through the wastewater system, water from tank overflows and roof catchment is returned to ground water via rain gardens, permeable path and drainage chimney.







Waste (EC, PC, FS)

All food and other organic waste is composted, given to worms or fed to the chooks. Any items found to be excess to our needs is donated to charity shops or provided as part of the 'recycle roundabout at PSW meetings. Recyclables such as glass, metal, paper or plastics are collected via the council recycle bit, provided to specific recycling services such as soft plastics, mattresses and building materials or taken to our local community recycling centre (CRC). We do have a small (140 litre) general waste bin provided by the council which is rarely more than half full.







Community (PC, FS)

We provide a community bench at the front of our property for those walking past to sit on and in the same area we provide a street pantry which we refill with pantry staples twice a week, a fruit and vegetable pantry where we provide excess fruit, vegetables, herbs and eggs and a street library that we top up with new books when required. We are members of our local permaculture group, and I did run a St Clair sustainability group for some years, but it did not survive Covid. I am a member of a number of online permaculture related groups and our website provides information on living sustainably in the suburbs including many eBooks, all free of charge.




Have a Seat
On Me!

Biodiversity (EC, PC)

We encourage local biodiversity by such techniques as allowing vegetables to flower (which also provides more vegetable by self-sowing and seed saving), planting areas with insectary flowers as well as growing flowering native trees and shrubs. We have designed and built insect and bird watering stations that refill themselves from a glass bottles included in the design. We also provide accommodation for beneficial insects such as predators and pollinators and other species using structures such as bug and frog hotels, microbat boxes and gabions for lizards. We also have two productive water gardens that provide habitat for dragon flies and other insects.



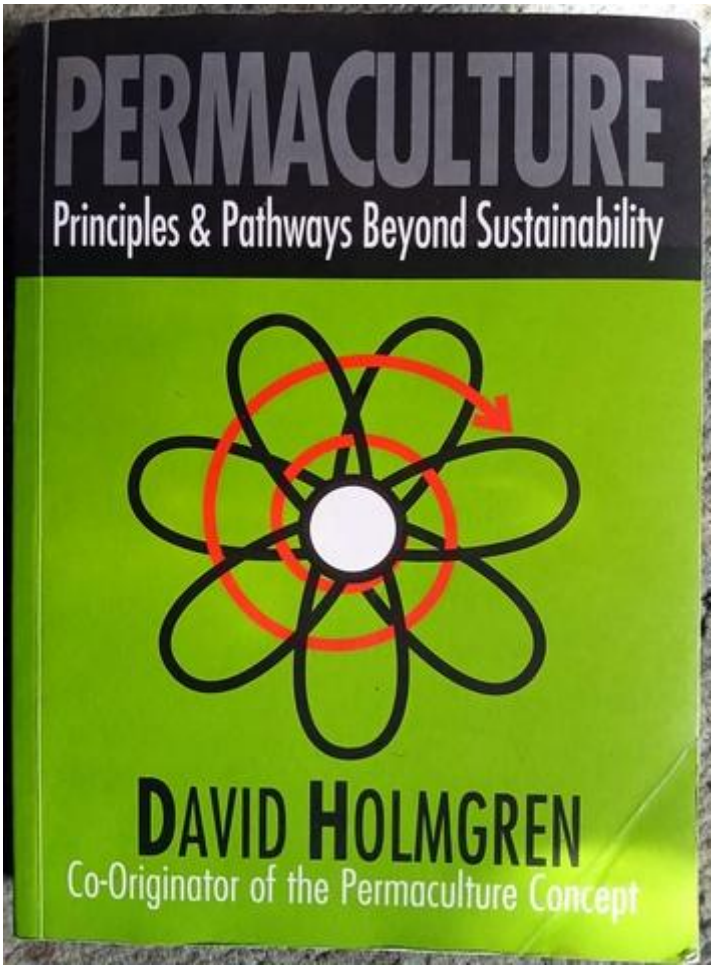


Obviously, there is considerable overlap between the ethics that underpin these and other actions we carry out to allow ourselves and others to live more sustainably and resiliently.

2.2 Permaculture Principles and the Choko Tree

2.2.1 Introduction

Permaculture principles provide a framework and tools for developing sustainable designs that emphasize working with nature rather than against it. They are a series of principles that were developed by the co-originators of Permaculture: Bill Mollison and David Holmgren. Their principles were enumerated in their books, ‘Permaculture: A Designer's Manual’ and ‘Permaculture Principles & Pathways Beyond Sustainability’ respectively.



Since then many Permaculture leaders have developed their own sets of principles including Rosemary Morrow in 'Earth Users Guide to Permaculture'; Jenny Allen in 'Smart Permaculture Design'; Jessi Bloom & Dave Boehnlein in 'Practical Permaculture'; Toby Hemenway in 'City Permaculture' and 'Gaia's Garden'; Aranya in 'Permaculture Design'; Jono Neiger in 'The Permaculture Promise' and Robert Kourick in 'Sustainable Food Gardens'.

Some of these principles have been a reframing or restatement of principles developed by Bill or David, whereas others are new ideas. Some permaculture writers, rather than develop their own, choose to refer to the twelve principles developed by David Holmgren in his book mentioned above, when the subject of permaculture principles comes up in their writings.

While reading his book, I found a quote by Aranya that seems applicable: “You’ll find many different versions of the principles on your travels. It’s not a matter of which ones are ‘right’, but rather which ones you’re finding useful in your life.”

When I was involved with teaching permaculture, either in the form of a Permaculture Design Course with my friend Danielle Wheeler, or in workshops conducted at the request of a number of local councils, the principles developed by David Holmgren were the ones we taught.

That is what this series of articles will be about, the twelve permaculture principles of David Holmgren because those have been the ones we at the Choko Tree found useful in our lives. The articles in the series will not be scholarly treatises about the subtle nuances of how the principles may be used in various circumstance, others far more skilled and experienced than I have already done that. These articles will be a record of how we have interpreted and implemented them here at the Choko Tree.

To be clear, the principles to which I am referring are reproduced below –

1. Observe and Interact
2. Catch and Store Energy
3. Obtain a Yield
4. Apply Self-Regulation and Accept Feedback
5. Use and Value Renewable Resources and Services
6. Produce No Waste
7. Design from Patterns to Details
8. Integrate Rather Than Segregate
9. Use Small and Slow Solutions
10. Use and Value Diversity
11. Use Edges and Value the Marginal
12. Creatively Use and Respond to Change

Thus the intention in writing this part of the eBook about the principles is to provide clarification, example and encouragement for those who are also walking the permaculture path, particularly in the suburban environment.

2.2.2 Observe and Interact

"Beauty is in the eye of the beholder". Engage with your environment, learn from it, and make informed decisions based on your observations.

This is not only a vital principle for permaculture design but also for everyday life at the Choko Tree. Our use of both deep pipe waterers and ollas for watering perennials and annuals respectively rather than an automated watering system requires that we spend time observing and interacting with our growing space. Thus we can check out when watering which plants need more water, what is ready to be harvested and if there are any incursions of pests or diseases that we need to deal with.



Another opportunity for me to implement principle one was after I learned about the concept of microclimates. One of the best ways I found to discover existing microclimates in our yard was to get out there and observe. For me this meant walking around during the year to see where the sun hits and doesn't hit in during the seasons, and the areas impacted by cold southerly or warm northerly and westerly winds. I loved wandering about while it was raining so I could see where the water ran in heavy rain, and areas that were well drained and not so well drained. These observations helped

me identify microclimates in our yard so I could make use of them or try and modify them to help us grow what we wanted.





Tomato plant, growing and fruiting in winter, frosty morning, in microclimate provided by 5500 litre water tank, gabion and possibly some influence from the mulberry tree

I have also observed the increase in biodiversity when we let our veggies like lettuce and bok choi go up to seed. Watching native bees, European bees, hoverfly and other insects come into our garden and interact with the plants and flowers is fascinating. (More detail on this is provided in Principle 10 – Use and Value Diversity)



Bee on brassica flower

Unfortunately, there have been times when I failed to observe and interact as Principle One would suggest. I had a Permaculture Sydney West blitz at our place many years ago, they were going to make a banana circle for me and asked where I wanted it. I pointed out an area in the front yard that made sense at the time (it was clear and not in the way). The banana plants sat there for years, they did not grow well getting to about 150mm in height maximum and did not produce any bananas. There was not

enough sun, or water (also due to the dryness of the soil the organic matter in the centre did not break down very well) and the soil was not the best. Over time, I was able to observe where they should have gone in the first place. I relocated the bananas to the back yard where they were in full sun, got lots of greywater from the bathroom and the soil was fertile. In a very short time, they were higher than the house and very productive.





The original banana circle after 10 years or so



Directly after transplant



After three Months



After six months

Always observe and interact!

2.2.3 Catch and Store Energy

"Make hay while the sun shines". Design systems that capture and store resources when they are abundant, like rainwater harvesting.



We have rainwater storage on all drainage from our roof into rainwater tanks of various sizes from 500 litres to 5,500 litres or into the soil through raingardens and other structures or into a pond. We also save our own seeds, transferring energy from one season to the next. How we generate and store electrical energy will be discussed under principle five.



We purchase and store some foods in bulk such as wheat grains, oats and rice, which are capable of providing metabolic energy in the event of supply chain interruptions thus increasing our resilience and also reducing waste. Metabolic energy is also provided by home grown fruit, vegetables and eggs. While our food growing system is set up to provide regular output rather than large gluts, some foods (eg mushrooms, leafy greens and onions) and have been preserved by drying using a home built solar dehydrator.



We also use solar power directly for cooking with our solar oven which has just been refurbished, and have a reflecting panel solar cooker, although the oven gets more use.



We have a number of trees on the property that produce food or fuel or both, allowing us to use rocket stoves to cook food, and that store both carbon and nutrients. We also have native trees that produce biomass for fuel which also provide, and encourage, local biodiversity.





Our water is heated using an evacuated tube solar water heater with an electric back up. Our house is a mid-seventies brick veneer home that is not energy efficient but has roof insulation and retrofitted wall insulation is being investigated. Trees and shrubs have been planted around the house to reduce heat gain in summer and required use of air conditioning for cooling. A back deck has been installed to reduce heat gain in summer, but with a clear roof and removable covering to encourage afternoon light and heat gain in winter.



2.2.4 Obtain a Yield

"You can't work on an empty stomach" Ensure that systems provide useful and tangible benefits.

We obtain our food yields from perennials in the form of fruit trees, herbs and perennial vegetables as well as annual vegetables.

Our annual vegetables are sown twice a month and through succession planting provide a mostly continuous harvest, although there are times of the year when harvests can be reduced. An example of this is in autumn when the warm season vegetable harvests are

coming to an end and cool season crops have not yet ramped up. During this 'hungry gap' some perennial vegetable species such as chokoes and Jerusalem artichokes provide a yield.



A similar gap can occur for some vegetable species in the early to mid-summer when the first high temperatures occur. This results in some vegetables, like lettuce and bok choi, that are providing a yield at that time to bolt to seed, and the growth of plants in the ground but not yet yielding to slow down, reducing yields again. One way around this being experimented with at the moment is to grow these vegetables indoors under lights, making use of solar generated electricity. Vegetables grown this way are less affected by external temperature fluctuations.



In general terms our system is set up to provide an ongoing harvest of vegetables rather than gluts which are then stored or preserved. There are some exceptions to this rule such as production of corn (preserved by freezing), onions (stored for later use) and carrots, (stored in the soil).



Our annual vegetable system makes use of a chook tractor which not only provides eggs but also maintains fertility in the soil by incorporation of their manure and removes weeds and vegetable residues.



Hardy and self-reliant weed species (perennial and annual) such as sow thistle, wild lettuce, dandelion and mallow, are harvested from areas of the yard that are not used for intensive production. They do not require cultivation and provide a yield with little to no input and are consumed in dishes along with cultivated vegetables, increasing yields with little effort. These areas also provide space for recreation and play, as well as providing green material for composting.



Prickly Lettuce (lactuca serriola), one of our favourites!

To maximise the yield of fruit through the year, a fruit harvest calendar has been developed to identify times when no fruits are available and fill them where space allows. We tend to get the most fruit in our area from citrus, bananas and mulberries with contribution from feijoa and nectarine.



In previous years we have obtained a yield from hard rubbish collections that have provided things like containers, furniture and construction raw materials. However, in recent times we have had to scale back due to space restrictions and only pick up such yields to raw materials for existing projects.

2.2.5 Apply Regulation and Accept Feedback

"The sins of the fathers are visited on the children unto the seventh generation" Monitor systems and make adjustments based on their performance and feedback.

Back when I was putting together the plan for year-round food production at the Choko Tree, I developed a seed sowing plan that worked out how I could sow seeds twice a month, based on our tastes, what grows well here and when it grows best. Over the years our tastes have changed and so has our climate, where originally, I could grow broccoli year-round, but now we can only grow it a month or two either side of winter. The sowing guide needs to be revised and updated regularly, so our food production efforts are responding to observed feedback from a changing climate.

Vegetable	Variety	July		August		September		October		November		December	
		Week 1	Week 3	Week 1	Week 3	Week 1	Week 3	Week 1	Week 3	Week 1	Week 3	Week 1	Week 3
Basil	Sweet	4 plants		4 plants		4 plants		4 plants		4 plants		4 plants	
Beans					1 row	1 row	1 row	1 row	1 row	1 row	1 row	1 row	1 row
Beetroot	Crimson Globe						1 row		1 row		1 row		1 row
Bok Choi					4 plants	4 plants	4 plants	4 plants	4 plants	4 plants	4 plants	4 plants	4 plants
Broccoli	Green sprouting	4 plants	4 plants	4 plants	4 plants	4 plants							
Broad beans	Coles Dwarf	1 Row											
Black Turtle beans								Full bed					
Cabbage	Sugarloaf	1 plant	1 plant	1 plant	1 plant	1 plant	1 plant	1 plant	1 plant	1 plant	1 plant	1 plant	1 plant
Capsicum	California Wonder	4 plants			4 plants			4 plants					
Chilli	Cayenne	2 plants			2 plants			2 plants					
Carrots	All year round				Half Bed								
Carrots	Chantenay				Half Bed								
Cauliflower		2 plants											
Celery	Golden Self Blanching				2 plants		2 plants		2 plants				2 plants
Cucamelon													
Cucumber	Lebanese			1 plant		1 plant		1 plant		1 plant		1 plant	
Garlic													
Kale	Scottish												
Leek							12 plants			12 plants			12 plants
Lettuce	Mignonette - green	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants
Lettuce	Oakleaf	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants	2 plants
Luffa						3 plants							
Malabar spinach						3 plants							
Onions	Gladalan white or brown												

Also, we have been moving away from species and varieties that are subject to attack by intractable pests like fruit fly, such as growing cherry and roma tomato varieties rather than larger varieties such as grosse lisse and moneymaker as we used to do previously. Also growing citrus fruit trees rather than stone fruit. The western Sydney climate also does not seem to favour pome fruits, but the citrus does well and is productive.



While our food production process is designed to provide a steady supply of fruit and vegetables there are times of the year when various gluts do occur. When these gluts happen, the resulting produce can be passed on to friends and relatives as well as to strangers bypassing the Choko Tree via a street pantry at the front of our block.



Also in the garden, we make use of vegetables that can self-sow by allowing them to flower and set seed, so that food production from that source needs less input from us.

It is more productive overall, particularly for vegetables like lettuce, bok choi and cherry tomatoes. As mentioned in Principle 3 edible 'weed' species are also allowed to grow and are harvested, requiring no management by us.



Sometimes they don't self-sow into the best areas for growing!



All of these tomatoes were self-sown and transplanted into this bed

I write articles for our website on how we do things (like this one!) and while there are technical issues preventing us including a section on each article to provide feedback, I

do publish the articles on Permaculture related Facebook groups both within Australia and overseas. These groups allow people to provide feedback, support, criticism and new ideas on how we can improve our permaculture design and lifestyle.





A couple of the Facebook groups we posted on

Many years ago, I developed a matrix to help us measure and then plan how we could become more sustainable plus a series of more detailed audit tools, and we have used

these, along with our permaculture plan, to help us set up systems so we could be more sustainable and resilient.


Sustainability Lifestyle Assessment Matrix

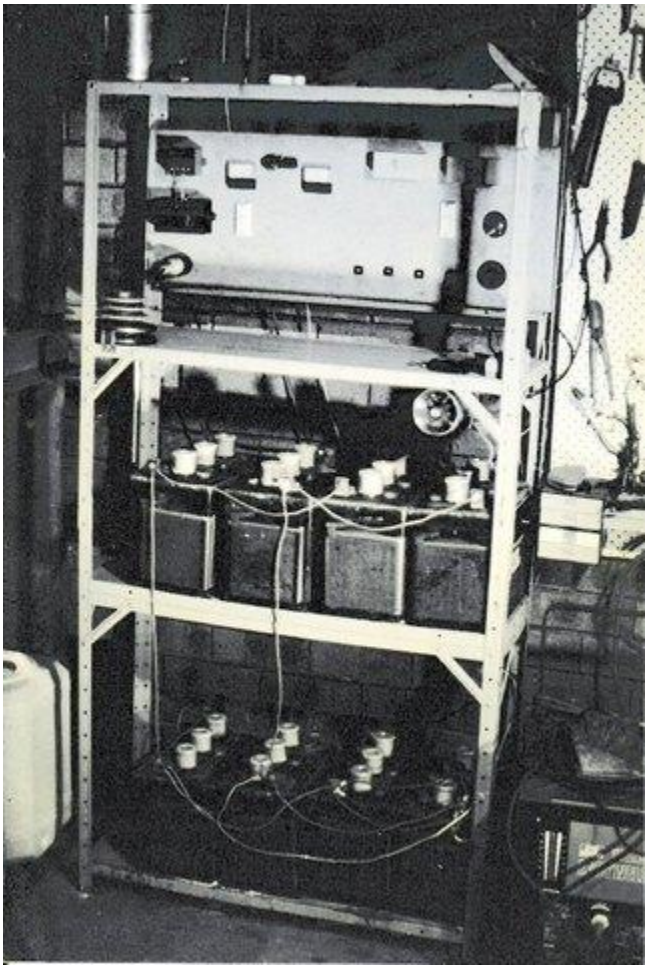
*The matrix is downloadable **here*** (Also see Appendix 1)

Something which has not happened but is planned is to conduct a WHIM blitz with permaculture practitioners form Permaculture Sydney West. A WHIM blitz (**W**hat **H**ave **I M**issed) means inviting PSW members onto our 'Choko Tree Farm', providing them with a tour so they can see what is in place, then sitting down with them and having a brainstorming session on that is missing or could be done differently or improved. Afterwards the ideas would be reviewed and researched and appropriate ones implemented.

2.2.6 Use and Value Renewable Resources and Services

"Let nature take its course" Utilize natural processes and resources to minimize reliance on non-renewables.

While we do maintain a connection to the electricity grid, it acts as a backup for when our photovoltaic panels are not able to provide sufficient energy due to reduced hours of sunlight near the shortest day of the year, inclement weather or times of high usage (or all three together).



The original 1980's setup

We have had an alternative energy system in place in various forms for over forty years, with various batteries to store energy for use. Our current system is 24 volt DC, 2.5kw with an MPPT, inverter and 24v to 12v converter to allow us to use our pre-wired 12 volt lights and nickel Iron batteries. The majority of the panels are on the western side of the roof where they reduce the impact of western Sydney sun on the roof and thus keeping the house cooler in summer.



MPPT, Inverter and 24v to 12v converter



The nickel iron batteries

As mentioned previously we have an evacuated tube solar water heater, which replaced a flat panel solar water heater some 15 years ago. The flat panel solar water heater had been in service for 25 years before needing replacement.



We also have several home-made solar cookers and a solar food dehydrator for preserving as well as an induction cooker for use with the solar power, and rockets stoves. The rocket stoves are powered by sticks falling form the various trees in the front yard. The wood heater used during the winter has a built-in oven and cooking surfaces so that we can cook on it as well as heating the house.



Rocket stove in use, fuelled by twigs from front yard trees

We also have a solar clothes drier which we got second hand from friends not long after we moved in, it has done continuous service for us for the last 50 years.



Where possible we use natures services for pollination and predators by encouraging local biodiversity. More detail on this is provided in Principle 10 – Use and Value Diversity.

We use grass hay or straw, produced locally where possible, to provide mulch. It is first broken down and any seeds removed by the chooks in the retirement village, keeping them entertained and giving them something to dig through. It is then applied to the veggie garden beds by wheelbarrow and then at the end of its life, is dug into the garden beds as organic matter by chooks in the chook tractor. The chooks cultivate the top of the soil (rather than by a petrol-powered rotary hoe) as well as foraging insects and snails etc and providing fertiliser (manure).



While we do have a small electric air conditioner that does get used as a backup when the heat gets too oppressive, mostly we keep the house cool by growing deciduous and evergreen trees that shade the house, a western facing back deck with shades and a cover, and window covers including re-use of waste polystyrene foam sheets.

2.2.7 Produce No Waste

“A stitch in time saves nine, waste not want not”. Minimize waste and maximize the use of all resources within the system. While I would love to detail how our systems produce no waste, we have not found that to be possible. Yet!



Accessing the bulk supply

We have conducted general waste and plastic specific waste audits and introduced changes as a result, such as the bulk buying of food and cleaning materials to reduce packaging waste. We apply the waste hierarchy (refuse, reduce, replace, reuse, recycle) and have implemented some zero waste principles (taking food containers to restaurants, fabric bags and containers when buying fruit, veg, meat and deli foods). We take our own containers to packaging free stores for food and cleaning agents we don't use enough of to make it worth bulk buying.



Some containers and bags we take shopping to avoid single use containers.

We plan meals and monitor leftovers and the contents of fridge and freezer to reduce food waste. Organic waste is fed to the worms or chooks or composted. Articles in reasonable condition but no longer needed are passed on to friends or relatives, donated to opportunity shops or included on the Permaculture Sydney West 'Recycle Roundabout' at the monthly meeting.

Black water goes directly to sewer, but grey water from the bathroom is sent to the middle of the banana circle and laundry greywater (washing machine and dishwasher) is used to water fruit trees via a constructed wetland. Diluted urine is used fertilise fruit trees, generally in spring. We considered a composting toilet but were told in discussions with the local council that the output from the composing toilet would have to go to a waste processing facility, work is ongoing.



The constructed wetland

We do have a small (80 litre) general waste bin provided by the council which is rarely more than half full as well as a recycle bin for glass, metal and some plastics. We also have a separate collection service that takes harder to recycle items like soft plastic and medication blister packs.

I have a reasonably well-appointed garage with hand and power tools, vices and other work areas along with some metal and woodworking skills picked up at TAFE many years ago that allows me to conduct repairs and maintenance required. I do not have skills with 240volt electricity and so hire work requiring repairs and maintenance in this area out to experts where needed.





2.2.8 Design from Patterns to Details

“Can’t see the wood for the trees”. Start with observing natural patterns and then apply those patterns to your design.

In the words of David Holmgren in Permaculture Principles and Pathways Beyond Sustainability: “The first six principles tend to consider systems from the bottom-up perspective of elements, organisms and individuals. The second six principles tend to emphasise the top-down perspectives of the patterns and relationships that tend to emerge by system self-organisation and co-evolution.”

One of the classic illustrations of this principle is the spiral shape used when constructing a herb spiral. On the day that PSW were doing a blitz at our place many years ago, the main thing that I wanted was a herb spiral. While we were standing around discussing the design, a friend of mine who was a roofer, turned up with some waste rooftiles that we could use to construct it. Initially this was a great thing and I was grateful, but as we moved forward in the construction it became apparent that the tiles did not work well to make a spiral. So, rather than go back to scratch and ditch the tiles, we came up with a design of several concentric circles, and thus our 'herb spiral' became a herb wedding cake!



The herb wedding cake



We have also used concentric circles in other areas such as the productive tree circle in the front yard that combines apples, citrus, nuts and a curry leaf tree and is set around a worm tower in the centre with an insect watering station on the top of the worm tower.

Another pattern generally portrayed as a series of concentric circles is the permaculture zone tool, which allows areas of similar use, activities and frequency of visitation to be grouped together when developing a permaculture design. The zone tool consists of five concentric circles moving out from the home or dwelling place, referred to as zone zero. The content of each of the permaculture zones can be describe as –

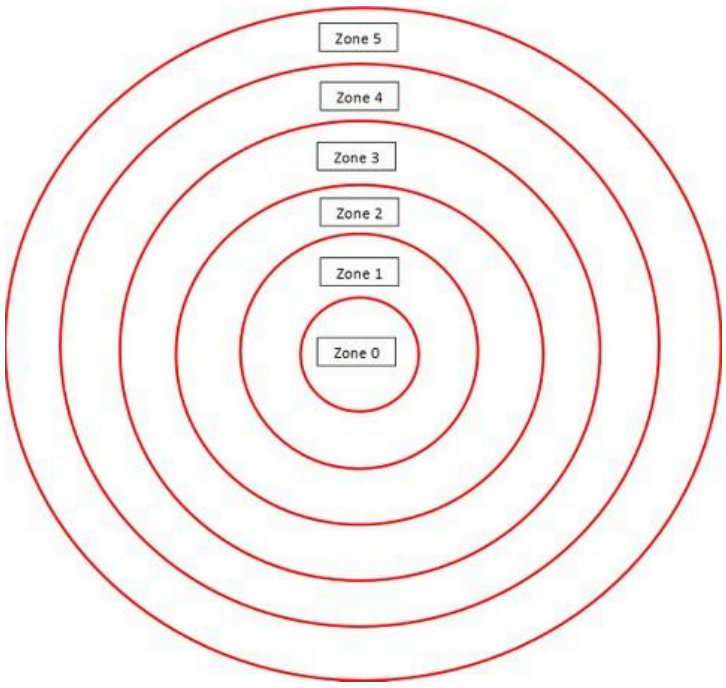
Zone 1: Nearest to the house, for elements that require frequent attention, or be visited often, e.g., salad crops, herbs , soft fruit like strawberries or raspberries, greenhouse and cold frames, propagation area, worm compost bin for kitchen waste, etc.

Zone 2: Farther from house the place for perennial plants or self-maintaining plants and elements needing infrequent work: mulching, pruning bushes, orchards, compost area, animals eg. poultry, rabbits, worm farm, bees

Zone 3: Occasionally visited areas where main crops are grown, for domestic and for trade use. After establishment, care and maintenance is fairly minimal e.g., watering or mulching once a week or so. Self-fed animals (stock), seasonal crops e.g. corn, wheat, rice, pumpkin, bamboo.

Zone 4: Semi - Wild food gathering (e.g. nuts, native fruits, mushrooms) wood for Fuel, Self-seeding trees, soil microbes semi-wild. This zone is mainly used for forage and collecting wild food as well as timber production.

Zone 5: Wilderness area: a rarely visited area often linked with neighbouring wildlife corridors. Sometimes managed to reduce risk of catastrophes i.e. fire/pollution/drought/hurricane. There is no human intervention in Zone 5 apart from the observation and enjoyment of natural eco-systems and cycles. Here is where we learn the most important lessons of the first permaculture principle of working with nature, not against.



The Choko Tree Zone Zero has been described exhaustively in a later chapter of this eBook, but in terms of the remaining zones it is my contention that our back yard area is mostly Zone One and front yard area mostly Zone Two. The backyard is mainly annual vegetables including salad crops, the chooks, compost area and greenhouse, while the front yard is perennial vegetables, fruit trees and other productive trees and perennial herbs.

I have also developed a zone-based tool I call 'Zones of Resilience' which is designed to be used in urban and suburban areas to help plan accessing needs both within and beyond the boundary of our permaculture property. For example, Food –

Zone 0 – Preserves and other stored food/ seeds
Zone 1 – Home garden/chook run/fruit trees/herb spiral
Zone 2 – Friends/neighbours garden, community garden/ school, church, business gardens/ community orchard
Zone 3 – Farmers market, community supported agriculture/foraged foods/food coop
Zone 4 – Independent groceries with regional focus/ IGA
Zone 5 – National chain supermarkets – Woollies/Coles

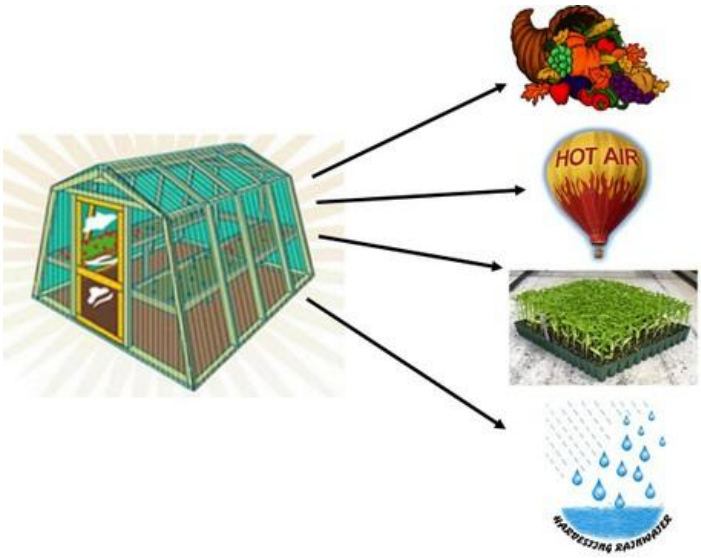
The tool has been developed to cover food, water, waste, energy, economic/financial aspects, consumption, shelter and access to service. The tool allows you to plan to access needs in multiple areas/zones, thus improving your resilience. The original article can be found later in this eBook.

By watching the pattern of the suns' movement across the sky, we have designed and planted perennials such as trees and shrubs as well as structures to reduce the impact of the suns heat on our zone zero, develop microclimates to maximise growth and allow plantings and structures to support biodiversity. This includes the siting of larger perennials such as the banana circle in the back tard, mulberry tree towards the north of the house and the melaleuca trees on the front (eastern) boundary to provide heat relief in summer.

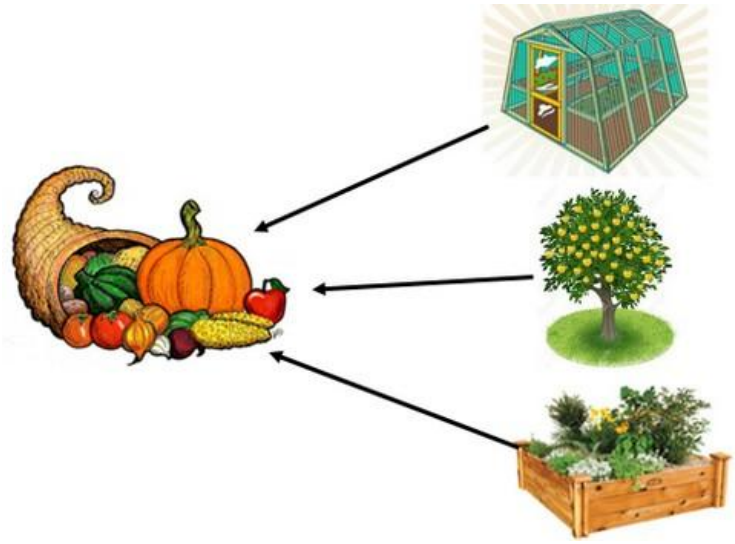
2.2.9 Integrate Rather Than Segregate

*"Many hands make light work"***.** Create relationships between different elements in a system to support each other. Another way to express this this is: every element has more than one function and every function is covered by more than one element where –

- A function is what you want to achieve from your design such as food production, water capture and storage or energy conservation.
- An element is what you put in place to achieve the functions you plan for in your design.



Every element has more than one function.....



.....and every function is covered by more than one element

Functions

Following are examples of some of the functions our system delivers –

For the function of **food production**, we have put in place the following elements: annual vegetable beds, perennial vegetable beds, fruit and nut trees, herb wedding cake, greenhouse, chook tractor, banana circle, trellises, hanging baskets, berry areas, mushroom containers, microgreens, sprouts and shoots, productive water garden. some have been very successful, other less so, but it is a journey, and we are still learning.





Annual veg in the backyard



Oyster mushrooms indoors

For the function of **energy capture, storage and use**, as well as access to reticulated electrical power, we general power using solar panels and, until recently wind generation. Electricity is stored in nickel iron batteries and used as 12VDC directly from the batteries and 240VAC via an inverter to provide energy for cooking, lighting, refrigeration and miscellaneous other appliances. Energy is also stored in wood on the property bought in, from waste and grown on the property. As an example of energy use, cooking food may be carried out using the suns energy directly using a solar oven or reflecting solar cooker or indirectly by solar generation of electricity via the solar system, converted to 240v and used to power an induction cooker. Food can also be cooked on the wood fired heater in winter or using the rocket stove fired with sticks gathered on site of in the local area. Stored heat cookers are also used to make more efficient use of energy consumed in cooking.



Cooking directly with heat from the sun





Cooking with the rocket stove using locally gathered twigs and sticks



Cooking with the sun indirectly using and induction cooker powered by solar electricity

Regarding **water capture, storage and use,** we have access to the reticulated system but also have 18,000 litres of water storage in rainwater tanks and rainwater in excess of our tank storage capacity is stored in the ground using elements like our raingardens and permeable paths. While black water is, for the most part, returned to the reticulated water treatment/sewage system, greywater from the bathroom is diverted directly to the banana circle in the backyard and the greywater from the laundry (washing machine and dishwasher) is diverted to be used for irrigation of fruit trees via the constructed wetland.

A selection of our rainwater tanks







Backup systems

The reality is that where every important function is covered by more than one element, there is redundancy built into the system. This means that if an element is no

longer able to provide a function, such as the reticulated power fails, preventing us from cooking a meal, another element can step in such as burning sticks in a rocket stove, or using the sun to power a solar oven, or electrical power from the batteries to cook that same food. By growing a variety of crops, a bad year for one does not mean our entire food supply is at risk. If an element fails, for whatever reason, our system is set up so that other elements can take over, even if only temporarily, to deliver that same function. This allows our system to be more resilient and keeps us supplied with food, water, energy or whatever in uncertain times.

Elements

Following are some examples of elements we have developed and the functions they provide -

Front Yard



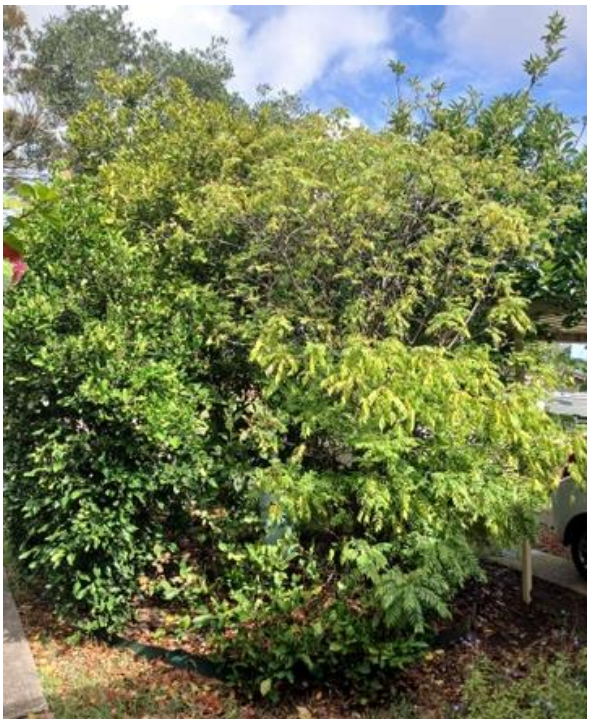
Front yard (looking north)

The front yard, rather than being mostly lawn with perhaps flower beds and a small tree or two has a number of functions integrated within it. Functions include food growing, mostly perennials providing fruit and nuts as well as perennial vegetables and perennial herbs in the herb 'wedding cake' in the centre of the front yard. Habitat is

provided by some large native trees, particularly three melaleuca alternifolia at the front of the property, a large fruit tree (mulberry – see below for details) smaller productive trees such as citrus, fig and olive and structures to improve biodiversity such as bird and insect waterers, bat nest boxes and gabions as homes for insects and lizards. Other functions integrated into the front yard include water storage, with a 5500 litre and 5000 litre tanks, rain gardens for storing excess water in the ground and amenity in the form of a shady and cool seating area under the mulberry tree with gabions as seats and a table and benches.

Details of two elements in the front yard and the functions they provide –

Fruit Tree Circle: Primarily this provides food in the way of fruit and nuts as well as providing flavour from edible tree leaves such as the makrut lime and curry leaf tree. But it also provides microclimate by slowing down cold southerly winds, privacy by blocking view of the house from the street, reducing the sun impact on the loungeroom in summer. As well, it also supports biodiversity with habitat for birds and insects and provides fertility in the form of leaf litter and shreddings of pruned branches. It also provides amenity; it is very pleasant to look out our front windows onto green space rather than just other houses.



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Mulberry tree : The primary products of the mulberry tree are the mulberries themselves, and the amount of produce is considerable, not only for consumption by ourselves and passers-by from our street pantry, but they also contribute to local biodiversity by feeding numerous birds, insects and fruit bats. As well as a bountiful harvest in mulberries, the tree provides considerable numbers of twigs and small branches used to start the main fire in winter or power the rocket stove year-round. It also provides fertility in the form of leaf litter, bird guano and bat excreta as well as protecting the northeastern side of the house from the summer sun. It is also a nice place to sit in the cool shade in summer (as mentioned above) and provides microclimates allowing us to grow crops like tomatoes well into winter.



Backyard

The backyard is the main productive area for annual vegetables but also has some perennial vegetables and fruit trees as well as chooks, water gardens, composting, worms, greenhouse, constructed wetlands and more water storage. Details of three of these elements and the functions they support are recorded below –

Banana circle: bananas are, obviously enough, the primary product of this element, however the banana circle also provides waste water treatment for greywater from the bathroom, organic matter for use as mulch and for composting, wildlife habitat for birds and wasps, shade on the back of the house from the hot western sun in summer, young banana trees, fresh banana leaves for cooking with or eating off, edible banana blossoms and amenity: they lend a tropical vibe to the backyard and make me feel happy, which I did not expect before I planted them!



Chook tractor: Here again, eggs the obvious are a primary product but just as importantly the chook tractor provides veggie patch cultivation, removal of weeds and pests from the annual veggie beds, application of manure for soil fertilisation, provision of feathers as long term nitrogen fertiliser sources. The chooks also provide companionship which I did not appreciate until they were boarded at a friend's place while we went on holidays, while I was in the house before leaving the backyard felt dead! Meat can be another product of chooks in the tractor, we do not eat our chooks, but we compost their remains.



Constructed wetland: The main product of this element is treated greywater so that it can be used to irrigate fruit trees, and while we cannot harvest food from the constructed wetland, it does produce organic matter for composting. It also provides some shade for the house against the afternoon sun in summer and improves biodiversity by providing habitat, attracting frogs and insects as well as supplying a warmer microclimate in winter due to its thermal mass. Plus, dare I say it, it looks nice, adding more green space to the garden.



Conclusion

We have been developing our system for over 45 years, with the benefits of permaculture insights for over 25 years. While there is no doubt that the system is still developing, what we have now has enabled us to produce our own food and energy and store available water, providing backup in the event of a failure of external systems. This has allowed us to improve our resilience and have some peace of mind in a changing world.

2.2.10 Use Small and Slow Solutions

"The bigger they are the harder they fall; slow and steady wins the race" Opt for manageable, incremental changes that allow for observation and adaptation.

Some examples from my experiences at the Choko Tree –

Veggie Growing: When I first came across the idea of growing vegetables in the back yard many, many years ago I had much enthusiasm but little skill or knowledge, and this was before discovering permaculture. My first venture into backyard growing I hired a rotary how and proceeded to cultivate an area approximately 5 metres long by 5 metres wide, bought a stack of seedlings and planted them in rows. After that life happened and it was a few weeks before I could get back to it. By the time I did the patch was hopelessly mired in weeds and was irrecoverable. That put me off growing for several years and ever since if anyone asks me advice when starting to grow their own food I always recommend they use small and slow solutions and start small.



Alternative Energy Systems: Also, quite a long time ago I became interested in alternative energy in the form of solar and wind power as stored in 12 volt lead acid batteries. I got hold of a second hand 12v car battery and some wire from 'Tandy' (remember them?) and proceeded to wire up a couple of festoon lights inside the house, keeping the battery charged from the mains with a small battery charger. I was super pleased when I was able to replace the battery charger with a 1.8 amp solar panel but it was really a backup in case of power failure. The system evolved over the next 40 years with more and better deep cycle batteries, lights from incandescent through fluorescent to LED with the system eventually powering the lights in the house and the fridge full time. That system developed over time allowing me to research and learn by

experience the pros and cons of alternative energy. The 12volt system has been replaced by a modern 24volt system that powers the entire house, but by using small and slow solutions I was able to put an alternative energy system through the house before they became mainstream.



The Earlier System





The Later System

Food Purchases: we prefer to deal with small independent suppliers, getting veggies and meat when we need them from a local greengrocer and butcher respectively, and using the local IGA and small-scale Asian grocers where possible. This is becoming more

difficult as small local suppliers are being replaced by national chains. We also patronise a local packaging free store that can provide bulk and organic foods and ingredients. Unfortunately, there are no nearby farmers markets, although we do make the trek out occasionally.



Food Growing: We use organic/permaculture techniques to grow our vegetables that rely on natural nutrient cycling, which is generally slower than the quick nutrient delivery from synthetic fertilizers, leading to potentially longer maturation times, though healthy organic soil with compost can support vigorous growth and produce nutrient-rich, flavourful food. Slower growth can also stem from using older, open-pollinated seeds and natural pest control that we use. This is taken into account by our sowing plan, providing us with regular harvests of tasty, chemical free food.



House Size: At the time our house was built in the mid 1970s, the average home was 130m2 to 140m2, and at 120m2 ours is a bit smaller, but compared with a newbuild today at 235m2 to 240m2 our house is around half that size. This has mean that less material was used in its construction and it requires less energy and materials to heat, clean and maintain. There is also less space to accumulate stuff in!

Delawning Our front yard: Where I live here in St Clair, 90% of dwellings have a front lawn, with the odd bit of shrubbery to break up the monotony but lawn is the front yard ground cover of choice. Lawn requires investment in the form of water, chemicals (fertiliser and pesticides) and energy for mowing to maintain, with mostly no return. We decided many years ago to reduce the size of our lawn, in favour of productive space, to a minimum and harvest what we could from the that area. This has been a slow process, with one step at a time for 45 years or more.

The front yard area occupies a space of 250m2, which was originally 100% lawn, but that has now been cut down by 80% to 50m2 of lawn space, the rest now being occupied by productive areas supporting productive trees and bushes, native trees and bushes, perennial vegetables, herbs, insectary and edible flowers as well as other useful

plants. This process started with three Melaleuca Alternifolias at the very front of the yard as obtained as tubestock from the Easter show (they are now over 10m in height) and has progressed in stages as I have learned more over the years. The latest additions are rain gardens to accept overflow from our front yard water tanks, but the process continues to this day.



Then





Now

It pays to remember Aesop's fable of the tortoise and the hare and its moral: 'Slow and steady wins the race' or the words of the Roman poet Claudian "Men are raised on high in order that they may fall more heavily" (The bigger they are, the harder they fall).

2.2.11 Use and Value Diversity

"Don't put all your eggs in one basket". Incorporate a variety of elements to increase resilience and productivity.

There are two aspects of diversity that have impacted the Choko Tree and certainly impacted our resilience and productivity: Crop diversity and biodiversity.

Crop biodiversity: When looking at crop diversity, this not only refers to the different crops grown and different varieties of those crops, but also how they are grown

together. If you are growing a monoculture, apart from all the other issues, and you have bad year for that crop, it can mean that there are lean times ahead.



Over the last forty years or so we have experimented with many vegetable crops (and a few staples, but we lack the land to grow them seriously) and in general terms the criteria we have used to decide on which ones to keep growing are that –

- They do well in our soil, climate and cultural practices,
- They produce well, and
- We find them palatable.



The last one is particularly important. Many years ago I grew a variety of climbing bean as well as our usual dwarf beans, in the hope of increasing our crop yield and diversity and to be fair, we did pretty well that year. Unfortunately, when I tried to feed the kids on the new climbing bean variety, they expressed the opinion (quite strongly!) that they didn't find it palatable. So much for that idea.

Another thing is that tastes change over time so that crops and varieties may need to be experimented with and cycled in the long term. We have experimented with a number of Asian greens, but in the long run, bok choi turned out to be the one that suited us the best.



Bok choi also self-seeds in our system

We also find that the occurrence of pests and diseases, particularly pests, will vary over time and this can impact on a particular crop or variety. We have tried probably a dozen tomato varieties over the years but have moved towards varieties that show a greater resistance to fruit fly, particularly varieties of Roma and cherry tomatoes. Cherry tomatoes also have the most endearing quality of self-sowing all over the place and being resistant to the cold weather that we get here.



Cherry tomatoes grown, in cold weather

Along with the different types and varieties of annual vegetables we grow here, we grow them in interplanted beds (with some notable exceptions) rather than in neat long rows. We find growing that way suits our system of growing small amounts of vegetables, planted twice a month and harvested as they are needed. The exceptions to this rule are sweet corn, which needs to be grown in a block to ensure the cobs are fertilised, carrots which we plant a bed out to in early spring and then harvest throughout the rest of the year and onions (several varieties together) which are harvested when ripe and then stored and used as required.

The other crops we grow are planted into a grid in our 1200mm wide beds with four seedlings crossways in the bed, followed by three seedlings, then four seedlings and so on until the bed is full. The idea being that not two plants from the same variety are

planted next to each other where possible. This is so that we have diversity in the beds as well as with the type and variety of vegetables that we are growing.



One raised bed of carrots does us all year!

Biodiversity – We encourage local biodiversity by such techniques as allowing vegetables to flower (which also provides more vegetable by self-sowing and seed saving), planting areas with insectary flowers as well as growing flowering native trees and shrubs. We have designed and built insect and bird watering stations that refill themselves from a glass bottles included in the design. We also provide accommodation for beneficial insects such as predators and pollinators and other species using structures such as bug and frog hotels, microbat boxes and gabions for lizards. We also have two productive water gardens that provide habitat for dragon flies and other insects.



Bird Bath



Bat box



Frog hotel



Complete with Peron's tree frog



And the frogs also show up in the most surprising places!

2.2.12 Use Edges and Value the Marginal

"Don't think you are on the right track, just because it is a well beaten path". Pay attention to the edges and interfaces between different elements, as they are often the most productive areas.

The main use of edge in the Choko Tree is the edge between the private space of our front yard property, the private spaces of our neighbours and the public space of our verge and road area at the front of our yard.



The front of the property including street pantry, street library and community bench

The northern edge of our yard is shaded in summer by the mulberry tree, which also allows the neighbour to harvest mulberries if they want. There are also a series of lavender bushes which allow harvesting of flower and fragrant foliage by the neighbours. Mixed in with the lavender bushes are four gabions that provide space for biodiversity, make use of material that would have otherwise been dumped and outline the edge of our property boundary. At the corner of the northern and eastern edges is a large bay tree, which provides us, the neighbours and passers-by with bay leaves for cooking.



The northern boundary giving neighbours access to mulberries in season, lavender, capsicums and tomatoes when available as well as bay leaves

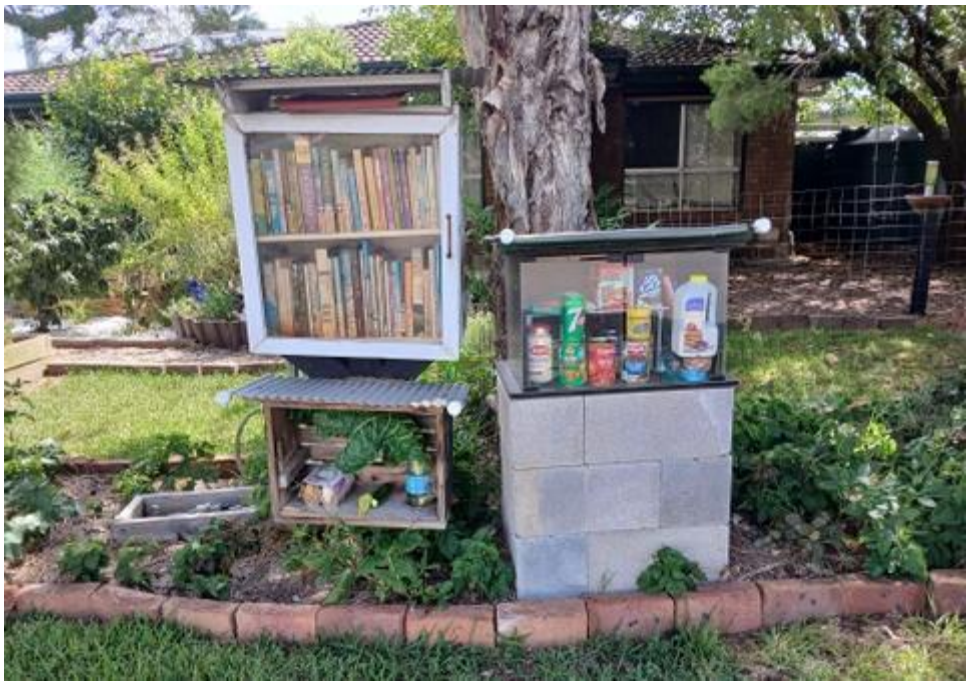


The bay tree on the northeastern corner of the front yard

The eastern edge of our yard provides a number of edible and useful plants that can be harvested from the verge. These include the bay tree, a midyim berry, lilly pilly, Feijoa, thornless blackberry, coffee bush, olive tree and rosemary plant. There also three tea trees (melaleuca alternifolia) that encourage biodiversity but can also be used to produce tea tree oil and some sweet potato growing between the trees. It is also worth noting that visitors to our street tend to park out the front of our house because the, now large, melaleuca trees provide the only afternoon shade from the sun.



Rosemary bush near the letter box, is easily harvestable from the street



The street library, street pantry and area for excess fruit, veg and eggs to be housed

There are a number of community related items that we have installed in the eastern edge of our property. These include a community bench that by passers can sit on, a street library where books can be taken or exchanged, a fresh fruit, vegetables and eggs street pantry where excess produce that we have grown can be shared. There is also a free grocery street pantry that we keep stocked with commercial groceries and where we get occasional donations of groceries, such as when Permaculture Sydney North members came to visit us.



Bed with blood orange, fig and dwarf lemon

The southern boundary with our next-door neighbour was a number of fruit trees in a bed on the boundary including a blood orange which can be harvested from the street, a fig and a dwarf lemon tree. Also, on the boundary west of the fruit trees is a rain garden, growing Dianella Caerulia, which produces blue berries and Lomandra Longifolia, also known as ‘basket grass’ and next to the rain garden is a large pot where we grow pumpkins, which we share with the neighbour. There is a 3000 litre rainwater tank on the western side of the rain garden and excess water from the tanks is directed into the raingarden. The rainwater tank also provides privacy for our neighbour when she is out on the deck in the front of her house.



Rain garden and pumpkin vine



...and lots of happy pumpkins!



3000 litre rainwater tank

The edges of our front boundary are very productive and allow us to chat with neighbours and by-passers as well.

2.2.13 Creatively Use and Respond to Change

"*Vision is not seeing things as they are, but as they will be".* Embrace change as an opportunity for innovation and adaptation.

One thing that has changed with our vegetable growing occurred a few years back and was a direct reaction to increasing temperatures in summer due to climate change. We found that in high summer the high temperatures and strong sunlight would burn young vegetables and reduce or stop growth of maturing vegetables. As a response to this we put frames up over the majority of our patches using star pickets and irrigation pipe and covered them with 50% shade cloth. Installation and removal dates of the shade cloth vary from year to year depending on the conditions, but generally the shade cloth is put on in mid spring and taken off and stored in mid autumn.



The reality is, however, that many of the changes we have made to our property and our lifestyle have not only been done to reduce out impact on the environment but also to increase our resilience in the face of future challenges as well as to demonstrate to others what is possible in the suburban landscape. These challenges include: rising temperatures including hotter summers, energy descent, environmental degradation, reduction in local biodiversity, threats to food supplies from a number of areas, pandemics and economic hardships.



To help us meet these challenges we have implemented the actions governed by many of the previously note principles, actions that include: producing our own fruit vegetables herbs and eggs, storing rainwater for us and the garden, being more energy efficient to reduce out energy needs and producing a proportion of our own energy, encourage local community (with varying degrees of success) and managing our own waste, reusing waste streams where we can and supporting local biodiversity.



We have been doing these things for many years, improving what we do as more information becomes available, and we learn more. What we are on is a journey with no end point.

3.0 Choko Tree Zone Zero

3.1 Introduction



Zone Zero before it was Zone Zero!

The concept of Zones in permaculture was developed by Bill Mollison and David Holmgren as a tool to allow areas of similar use, activities and frequency of visitation to be grouped together when developing a permaculture design. The idea for permaculture zones was laid out in the original book about permaculture - 'Permaculture One' and was conceived as a series of concentric circles (Zones 1 to 5) starting at the area around the house (zone 1) and moving towards untouched wilderness areas (Zone 5). Each zone may be described as below –

Zone 1: Nearest to the house, for elements that require frequent attention, or be visited often, e.g., salad crops, herbs , soft fruit like strawberries or raspberries,

greenhouse and cold frames, propagation area, worm compost bin for kitchen waste, etc.

Zone 2: Farther from house the place for perennial plants or self-maintaining plants and elements needing infrequent work: mulching, pruning bushes, orchards, compost area, animals eg. poultry, rabbits, worm farm, bees

Zone 3: Occasionally visited areas where main crops are grown, for domestic and for trade use. After establishment, care and maintenance is fairly minimal e.g., watering or mulching once a week or so. Self-fed animals (stock), seasonal crops e.g. corn, wheat, rice, pumpkin, bamboo.

Zone 4: Semi - Wild food gathering (e.g. nuts, native fruits, mushrooms) wood for Fuel, Self-seeding trees, soil microbes semi-wild. This zone is mainly used for forage and collecting wild food as well as timber production.

Zone 5: Wilderness area: a rarely visited area often linked with neighbouring wildlife corridors. Sometimes managed to reduce risk of catastrophes i.e. fire/pollution/drought/hurricane. There is no human intervention in Zone 5 apart from the observation and enjoyment of natural eco-systems and cycles. Here is where we learn the most important lessons of the first permaculture principle of working with nature, not against.

In the original “Permaculture one” and “Permaculture Two” there was no mention of a Zone 0, this came later and is referred to in Bill’s seminal work “Permaculture: A Designers’ Manual”. Zone 0 may be described as –

Zone 0: Home: indoor production (sprouts/ferments), processing food, waste, water & energy collection, repairs and education, relax, work and where you practise reduced consumption and re-cycling. This eBook focusses on our Zone 0.



Back in the day

We have been in our zone zero for over 40 years, and it is a child of its time, ie the ‘70s. It is a brick veneer and concrete tile roof home, with a floor area (house only) of 110m2 and relatively large aluminium windows (see above). There is some asbestos in the bathroom (since removed), the laundry and under the eaves of the house as well. Fairly early on we had a garage installed directly beside and sharing a wall with the house adding another 24m2 under roof.

It is a fairly basic house with a Lounge room, kitchen/dining room, laundry, bathroom with separate toilet and three bedrooms. The front of the house faces a little south of east, and thus the back faces a little north of west, which means the whole back of the house has always been exposed to the full fury of the western Sydney sun in summer. This is one reason I would like to have a discussion with the designers, the other is that while there are large windows at the front and rear of the house, there are no windows in the north wall to admit winter light or in the south wall to admit cool southerly breezes in summer. Still, you have to make do with what you have!

The house had no insulation when we bought it and for a while we thought we had bought ourselves a solar oven! This was remedied within two years by the installation of glasswool insulation in the ceiling. The brick and tiles are both dark in colour, increasing the summer heat gain as well.

Over the years we have laboured to make the house into a comfortable, energy efficient and productive space, with varying degrees of success. This eBook outlines some of the features we have installed to support our journey towards a more sustainable lifestyle.

3.2 The Kitchen

Why should the kitchen be first?

- The kitchen is a high energy use area (cooking, fridge & freezer, hot water, heating & cooling etc.)
- Up to 18% of water is consumed/turned into grey or black water in the kitchen
- Almost all the material we compost comes from the kitchen
- Much of the material we recycle comes from the kitchen
- The kitchen is the heart of the home.

But what does the term 'sustainable kitchen' mean? To me it is a kitchen that encourages an environmentally friendly lifestyle by -

- Making it easy to compost
- Making it easy to recycle
- Having space for bulk food containers
- Being equipped with energy saving appliances and lighting
- Being set up to save water
- Being productive in and of itself and,
- Inviting you to cook!

If you are starting from scratch you can design and build your own version of the perfect (sustainable) kitchen, but we (like the majority of people) have to make the best of what we already have and optimise it by retrofitting. That will be the focus of this article.

So let's look at each of the aspects which are set out above –

Making it easy to compost

This is essentially providing a container where organic materials can be stockpiled before being taken out to the composter/worm farm/chooks or wherever without chasing you out of the house due to the smell. The issue is how big the container needs to be and that will be governed by how much organic waste the kitchen produces and how often you want to head for the composter! One of the side effects we found when we started eating more out of the back yard was that the amount of rubbish we produced decreased considerably, but the amount of compostables we produced increased considerably.

There are a number of ways we have done this over the years, the lowest tech one being the old 2 or 4 litre plastic ice cream container with lid, and we have used that approach on and off. We have also tried purpose built bins of varying sizes and materials. Recently we have come across what I believe to be THE answer, or at least the answer for us – a Bain Marie tray with a lid. I got the idea by accident, we had bought several to use making biochar but I had one too many and it was a bit small, so I pressed it into service as a compost container and it has turned out to be perfect, for a number of reasons –

- They are readily available from catering suppliers, ridiculously cheaply for what they are (the one I am using cost us about $20) and available in a multitude of sizes.
- They are made from stainless steel so they are easy to clean, easy to disinfect and they last forever! (unlike any of the plastic containers we have used)
- The rounded sides mean that there are no edges or seams to accumulate yuck and cause rust like happens with the more conventional cylindrical mild steel bins.
- Being rectangular they make it easy to scrape vegetable matter directly off the cutting board into it.
- They would also be available second hand from restaurants/eateries closing down.

It would also be possible to set one up in a drawer (assuming you have a spare drawer) if you got the right size. The only downside so far has been the dish in the lid so you can get your hand under the handle to lift it up, which takes a bit of space from inside the container, but all up it has been a winner for us so far!

Making it easy to recycle

The way we have found works best for us is pretty simple. Years ago I put up some hooks to hold hats and brooms and stuff near the kitchen/laundry doorway, and we have a capacious (AKA big) bag hanging on the hook closest to the kitchen door. All recycling gets cleaned out (if appropriate) and then tossed into this bag. Approximately once a week we drag the recycling bin over near the front door, drag the recycling bag onto the front landing, then toss from one to the other, making sure that any recycling with our names and/or addresses has been removed as a precaution against identity theft.
Bingo! Works for us.

Having space for bulk food containers



One aspect of trying to live more sustainably is to reduce the amount of packaging we bring home and then have to either dispose of or recycle. One way we did this was to look at the sorts of foodstuffs we were buying and then identify and pursue packaging free alternatives. Buying in bulk can not only reduce food packaging we dispose of but can also save us money and increase our resilience, so it is a winner on all fronts. But we do have to be able to manage the supplies so we don't inadvertently run out or have them become unusable due to age or infestation.

We have been working over time to reduce the packaging we throw away by buying in bulk, buying packaging free, and growing/ producing our own. For the big stuff that we go

through quickly or has a long shelf life such as whole wheat, bakers flour, powdered milk, rolled oats, white rice etc have 20 litre polypropylene buckets with an airtight lid. These are generally stored in the laundry or the garage or a shed. For the day-to-day usage of the bulk stuff, we have large glass jars in the kitchen cupboards. We also have various sizes of glass jars from large ones we keep a good supply of things like red kidney or black beans, going on down though medium jars for things like nutritional yeast, dried onion and dried garlic to small jars for homemade curry and spice mixes, Italian herb mix and mixed herbs.



Some of the jars are recycled, particularly ones 500grams or less, but the larger ones (up to 3 kilos capacity) had to be bought in specifically, but they should be in use for a long time, seeing me out at least! We store them in and on various cupboards around the kitchen and dining room and I must admit I like seeing them there, for me they give the place a homey feel. But, it is a journey not a destination and we will continue to investigate sustainable food storage options into the future.

In terms of cleaning products we try to use materials like bicarb and vinegar, bought in bulk, for cleaning purposes with one glaring exception. Years ago we tried using a soap saver for washing the cutlery, plates and glasses etc. but found that the soap had a nasty habit of making the things we were washing up very slippery, and after we lost a couple of plates through being smashed on the floor, we went back to dish washing liquid. We do buy a 25 litre drum from a local supplier and refill squeeze bottles we have under the sink, which cuts down on cost and packaging considerably.

Being equipped with energy saving appliances and lighting

Generally speaking the appliances in our kitchen are designed to cook or to cool.

We have the usual stuff for cooking, a microwave and a gas range, but cooking for us can happen in a number of rooms of the house, or even out in zone 1.

Generally the way we work our cooking is that in summer we use our solar power system to power an induction hotplate and in winter we use the cooktop or oven in our wood heater to cook. If it works out that neither of those will do the job, the gas stove gets pushed into service, especially if it is late or I'm tired. Otherwise we do have other low/no energy appliances to help us cook including a couple of rocket stoves, a solar oven and a stored heat cooker (ie haybox cooker). The microwave is usually pressed into service to thaw or reheat previously cooked food again, using power from the solar panel/battery system. Also with the advent of our solar electricity system, appliances we got rid of years ago, have come back into use, particularly the slow cooker (crockpot) and rice cooker are very versatile and see frequent use in our place.

All in all the systems we have in place give us flexibility in how we cook to make the most of the energy source available at the time. This also increases our resilience, because if one system is offline, we can substitute it with another.

In terms of cooling, I would love a cool cupboard where cool air is pulled up from underneath the house, through a series of screened or perforated shelves and expelled through a solar chimney on the roof. Unfortunately we are not there yet. Prior to our present solar electric system, we had a 12 volt fridge which operated from the previous solar system (one half the system ran the lights, the other half ran the fridge). The fridge was a commercial fridge modified with a 12 volt Danfoss compressor by a friend of mine. Our current fridge is an efficient, but conventional fridge (no freezer section), backed up by a chest freezer in the laundry.

The lighting has evolved over the years as our solar electric system has evolved. Starting out with a conventional caravan style festoon light which was very inefficient and really only provided enough light to move around, great for power outages but no so much for everyday use. This was superseded by caravan (el cheapo) fluorescent lights which provided more light but tended to burn out the poor quality tubes quickly. They were in turn superseded by (expensive) high efficiency fluorescent lighting which were great for everyday

use, but still expensive, through to the LEDs we use today. All our lighting is still 12 volt, but fed by the new system direct from the 24 volt batteries through a 24v to 12v converter. We have an LED downlight over the stove and one over the sink, with two more over the dining room table next to the kitchen, to provide extra light on that side if required.

Being set up to save water

The water used in the kitchen is mainly from the kitchen sink, although we do have a dishwasher it is in the laundry. With there being only the two of us, it takes time to make up a load for the dishwasher, but it is much more water efficient to do that rather than do a series of small hand washes every day. The dishwasher (a Bosch) uses about 10 litres per load on our usual setting, which equates to 3 – 4 hand washes whereas each hand washed load we do would probably consume 15 litres by itself. The extra energy consumed is not an issue due to the solar energy/battery system providing the electricity for free.



To make the best use of water coming out of the kitchen tap we capture it for applying to the garden outside and to accomplish this we have gone super low tech, ie we use a bucket. The bucket sits in the sink and any water used for rinsing dishes, when peeling veg or waiting for the hot water to show up etc goes into the bucket and is then transferred to the garden. It is an el cheapo rectangular mop bucket but does a wonderful job.

When we first started out on this part of the journey I got hold of a sort of sink-within-a-sink that sat inside our kitchen sink and could be filled up, then removed to transfer the water for use elsewhere. Unfortunately it had a couple of shortcomings – it had a plughole/plug in the bottom, which leaked, and because it was so wide but shallow, when you lifted it out of the sink with more than a bit of water inside it became quite unstable and had a tendency to slosh the water out everywhere while it was being transported outside. This resulted in water all over the floor, the carpet, the cat, me…. You get the picture. So for a quarter the cost we picked up the bucket, and haven't looked back.

Being productive in and of itself

The kitchen is where we cook up our food but that doesn't mean it can't be productive in its own right. Our kitchen faces west, but is covered by the back deck, which provides lots of shade, so we don't get a lot of direct sunlight to grow even herbs on the windowsill. What we do use the kitchen space for is growing sprouts, particularly mung bean sprouts in a lunchbox, which needs no direct light. We also use the windowsill to green up soil sprouts which don't require direct sunlight either.

Inviting you to cook

This one is a bit more difficult because it depends so much on personal preference, but obviously two metres of kitchen bench space and a microwave is not exactly inviting to cook up that seven course banquet! Our kitchen is not big at 2.7m x 2.9m, which is why the dishwasher and freezer reside in the laundry. In that kitchen we have 2 square metres of bench space, about 0.6 square metres of sink/drainage (plus associated under storage), a fridge and a stove, plus one half size and one full size pantry style cupboards . Needless to say there is not much room for 2 people to cook but it is quite well put together for one person and I find that it is, for me, a very inviting space to cook in.

The advantages of the smaller kitchen are that it is not big enough to contain much extraneous rubbish, and everything is near to hand. There is a world of kitchen gadgets out there but we confine our purchases to multipurpose kitchen gear, it is surprising how many

of those kitchen gadgets they advertise are easily replaced with a sharp knife! It is also much quicker and easier to clean.

3.3 The Dining Room

I must admit that when I started this series I figured I would probably not do the Dining room as a separate section, but when I thought about it and considered some of the activities that have taken place in this room over the years, I realised it really is a multipurpose space.

The room is not huge at 3.0 metres by 2.6 metres and it shares the output of our one small aircon with the kitchen. It has one 240v pendant light in the middle of the room, and the more often used two 12v downlights over the dining room table. The large dining room window faces (like the house) a bit north of west and has a bamboo blind covering it outside to prevent the sun shining in as it sets in summer.

Some of the purposes it has fulfilled over the years include –

Eating Place/Meeting Place

First and foremost I guess, the dining room is a place to eat. We started out with the archetypal Laminex dining room table and four tubular steel and padding chairs donated by a relative, so common in the ‘70s and earlier. But before long we were able to get a solid wooden table and bench seats which easily seat six, made by a local craftsman in St Mary’s. The original design was for an outdoor table but we requested some changes, which he was happy to do, mainly around the table top being one piece rather than three boards with a gap between. It was pretty big and it was only after we got it home that I realised I would have to take the front door off to be able to get it inside!



A Bygone Birthday!

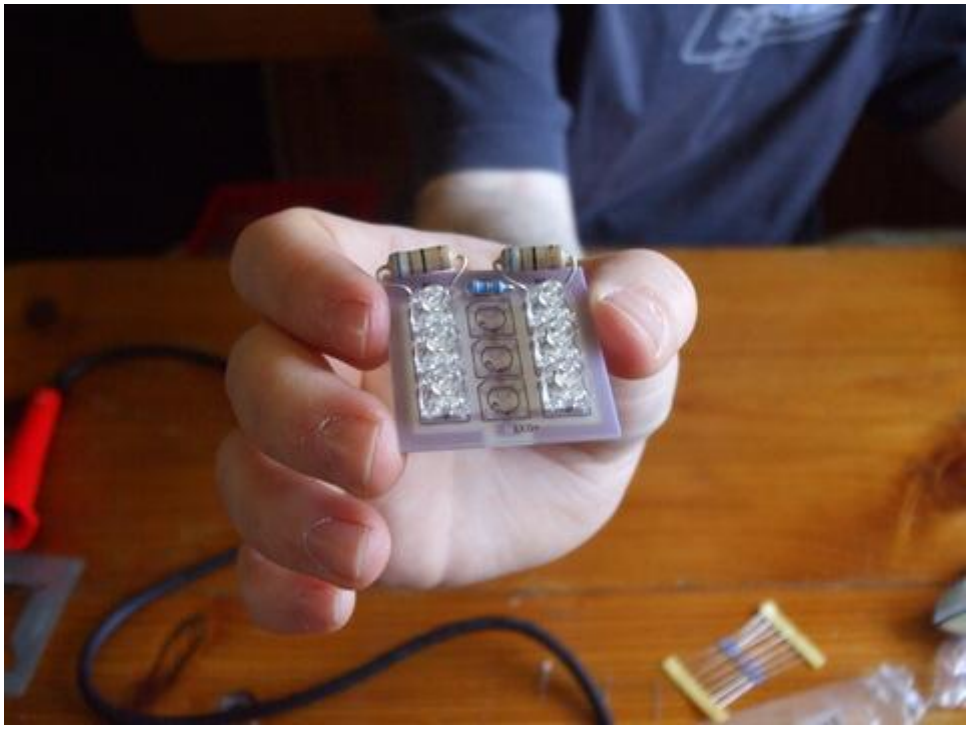
That table has been sitting where it is now in the dining room for over 40 years. It has been the setting for endless family meals, celebrations and general get- togethers over that time. It has been where we have crafted, played games, studied, had meetings, both family and otherwise. All manner of things have been consumed off it, and discussed around it. It has been the centre of much of our family life and when we pass on and leave it to somebody else they will be getting a table with history!

Kitchen Work Overflow Area



Being close to the kitchen area but not actually in it means that it can be used as a work area/set up area when making food. This particularly so when attempting some of the more space intensive (for us) activities such as pasta making, preserving, and some baking. I used to cook on the dining room table with a kero primus so I could use a traditional mild steel wok before we got the stove with a wok ring. Even now we have a small electric oven sitting on the table which we power with the off grid system for smaller dishes so we don't need to fire up the gas stove.

Workshop/Work area



I am lucky in that we have a garage and a spacious area to work in, but when I lived at home we did not have the luxury of a garage, or even a shed and so the dining room table became the main work area. Tools and materials could be laid out, repair work and small construction projects carried out. I have even seen a set up for a demountable vise, which would improve the ease of working considerably. Even with the garage I will still carry out light repairs to household stuff on the kitchen table because it is more convenient, such as fixing the TV when it went kaboom.

Storage



There are some kitchen bits and pieces like our pasta making equipment, preserving gear and fancy plates etc for which we don't have space for in our small kitchen. There are also some bulk food items stored in the dining room as well, that way they don't clutter the kitchen but are in reasonably easy reach when cooking. The kitchen dresser also was an early purchase which over the years has proved valuable in containing kitchen overflow.

Music room

I am not musical (just putting that out there)! However, Linda is, and years ago I was able to get her an upright piano. She practices regularly when she has time and is getting quite good at it. Unfortunately, while the piano had a place for candle sconces to go on the front to allow playing by candlelight, it was not fitted with them when we bought it. A few years

later I was able to find a pair which fit in an antique place in Windsor so it is now complete. The only place where the piano would fit, of course, was the dining room so it also doubles as our music room!



Garden Work



Yup, even with a garage and greenhouse, I find it easier to sow the seeds into punnets and pot the seedling on into newspaper pots, which I do every two weeks, on the dining room

table. It is more comfortable and certainly warmer/cooler than working outside, depending on the time of year. I bring the seed raising mix and some 8-cell punnets in from the greenhouse and the seeds down from my office and sow them all according to my sowing plan. After that I lay out and cut the paper and then form the strips into newspaper pots for potting on. I then fill them with seed raising mix and pot last fortnight's seedlings on into them at the dining room table. It is then a simple matter to take the filled punnets and newspaper pots back out to the greenhouse to continue growing.

Extra-curricular Activities

We live a hands-on life, doing stuff that I don't think was envisioned by the original designers of the house. Over the years the dining room has provided space that was not in the direct living area but is close enough so that anything needing it can be kept an eye on. Also, it was kept warmer/cooler than the outside environment and has allowed me to do some comparatively strange things including brooding chicks, fruiting mushrooms and raising crickets, all in a suburban dining room!

The dining room is a part of our zone zero, a multipurpose and very useful room which should not be neglected when reviewing what we do in our house.

3.4 The Laundry

As mentioned in the section on the kitchen, the laundry does take some overflow from the kitchen in terms of functionality. It is not a big room but currently stores our bulk food in 20 litre buckets, has the bag our recyclables go in hanging from the wall and it is also where the dishwasher is located. But we have also managed to fit in some other stuff too into its 1800mm x 3000mm innards!

The Freezer – while this was originally bought in to preserve the meat supply, these days we use it to hold other stuff. It is a chest freezer, and while it is not as easy to keep track of what is in a chest freezer they are more efficient because you don't get all the cold air falling out like you do as soon as you open the door of an upright freezer.

We find it very handy for holding stuff like bulk rolled oats, it not only keeps them fresh and extends their shelf life so we can buy a 25kg bag and work off that but it also prevents the whole bag going solid with pantry moth webs and grubs during the warmer months. I hate pantry moth! We also cook up several kilos at a time of legumes like red kidney beans, black turtle beans and chickpeas, then freeze them in 250gm to 300gm portions which is roughly equivalent to a drained can. We can then just thaw and use them without having a stack of cans to recycle!



Washing machine, dish washer and freezer, all in a row!

We also use it for bread, rolls etc, whether we make them or buy them. If left in the bread keeper until we use them, they will inevitably just go fungus, especially in the warmer months and I hate the taste of penicillin! Freezing the bread means we eat it all, but the composter and the chooks miss out.

The dishwasher – this obviously is a carryover from the kitchen, but it resides in the laundry room and as I mentioned in the kitchen article “With there being only the two of us, it takes time to make up a load for the dishwasher, but it is much more water efficient to do that rather than do a series of small hand washes every day. The dishwasher (a Bosch) uses about 10 litres per load on our usual setting, which equates to 3 – 4 hand washes whereas each hand-washed load we do would probably consume 15 litres by itself. The extra energy

consumed is not an issue due to the solar energy/battery system providing the electricity for free."



Output from both the washing machine and dishwasher into the sink

While it wouldn't fit in the kitchen anyway, one plus of having it in the laundry is that it can be included in the laundry greywater system which I will cover in the discussion about the washing machine. While it is possible to treat the greywater coming out of the dishwasher through the system, it currently isn't because I am concerned that the alkalinity of the dishwasher greywater may be a bit high for it to cope with. I am researching homemade alternatives under the caveats from my sweetie that anything I come up with –

a. must effectively clean the dishes etc, and

b. must not bugger the dishwasher!

The search continues!

Washing machine – We used to have a top loading washing machine, and I just used a hose of the required diameter connected to the end of the washing machine waste water outlet to run the greywater out onto the lawn. However, as we all know, front loaders are more water efficient, so that when it came time for the top loader to meet its maker (or the metal recycler) we bought a front loader. This was not without its own issues, however, as we

were putting in the same clothes and washing detergent, but it was using less water – therefore the concentration of pollutants would be higher! QED!



Valve to run laundry effluent to constructed wetland or waste

So, rather than run the greywater from the new machine out onto the lawn directly, I built a constructed wetland to treat it first. The water exits the hose from the machine into the laundry tub as a holding tank, and from there is moves slowly via a flexible hose into the constructed wetland. It has certainly cleaned up the greywater from the washing machine, even dropping the pH down from 9.6 to 7.4, so it was able to be run onto the ground under some citrus trees. This proved to be very handy during our recent drought.



The constructed wetland

The Other stuff - There is not much else in the laundry (there is not much room) but there is a cupboard which holds laundry stuff, soapmaking stuff, cat food stocks, some of our preserves empty preserving jars as well as other miscellaneous bits and pieces.

The Room Itself – Along with the rest of the house, the electricity supply for the laundry is generated by our collection of solar panels and stored in batteries and supplied though the inverter and the lighting is 12 volt, supplied directly from the batteries. When the weather gets hot, a door snake goes to block off the area under the door to keep the western sun out, the polystyrene foam window shield is installed, and we shut off the laundry from the rest of the house with a blanket across the doorway. We used to have a door there but it kept getting in the way so I took it off.

One thing I want to investigate in the future, in the roof above the laundry is the old unused 300 litre hot water tank and I want to talk to a plumber about running a pipe to the laundry

sink from it, and having some way of filling it with tank water. I could then use rainwater for some laundry operations. I suspect it might be expensive though.

3.5 Bathroom/toilet

In many cases the toilet and bathroom are one unit, but in our house they are actually two rooms, and having grown up in a house where they were both in the one room, I found this to be much more suitable arrangement! We also had the bathroom and toilet remodelled about 10 years ago which gave us some options around water saving and re-use.

The Bathroom

Our bathroom is not a huge room at 1750mm x 2400mm or equivalent to 4.2 square metres in area. In it there is a bathroom cabinet with a sink, and a corner spa with the shower over it, and not much else! According to Sydney water, 24% of water is used in the shower, so this was something we wanted to address and when we had the bathroom remodelled and the old bathtub removed (and turned into a water garden where we grow our water chestnuts) I asked for a specific modification.

That modification was to include a valve in the drain from the bottom of the spa which would allow me direct wastewater from the spa into the centre of the banana circle we had constructed in the back yard or to waste as required.



A bit convoluted, but that's how the shower water gets to the banana circle!



The shower nozzle which was installed with the spa turned out to supply 19 litres per minute, which I was not aware of at the time. After some years it started to fall apart and I needed to replace it. In my researches I was able to find a low water use (9 litres per minute) shower head which I duly bought and installed. The change was immediately obvious. When I did the original install on the waste water line out into the back yard, for good or ill, I used 25mm hose as the conduit for the water and while showering there was a tendency for water to build up in the bottom of the spa. I really didn't think too much about it, it was just a bit of an inconvenience that's all. When I installed the new low water use shower head, that build-up of water stopped and the existing drain was able to easily cope with the shower greywater removal. This was a very visual demonstration that even though the water flow didn't seem much different than the original it had been measurably reduced!

The low flow shower head

Yes, I know you are going to moan at me "a spa? Really?". Yes they do use considerably more water than a standard bath if you want to fill them up, but our reality is that it usually only gets used on the hottest days of the year when we are sheltering in place. The spa in that case forms a comparatively cheap swimming pool which we can use and then give the waste water to the bananas! They are always grateful.



The in-line valve

Another (minor) water saving fitting we have installed on the shower is an easily operated on/off inline valve between where the water supply comes out of the wall and where the shower hose connects to it. The idea is that once you get your hot/cold water mix right, if you want to shut the water off for any reason, say to apply shampoo, massage in conditioner or whatever you just shut it off with this valve. When you turn the valve back on your water mix is maintained and you don't need to waste water rebalancing the hot and cold before you can use it.

We have also installed lever style taps on the bathroom sink. We find they give us better water flow control and are easier to turn on and off, particularly when washing our hands, which we seem to be doing quite a bit of lately.

The energy to the bathroom is primarily solar, with hot water coming form an evacuated tube solar hot water system, and the main light being an LED downlight supplied from the remnants of the old 12 volt system, now integrated into the new 24 volt system. There is a

fan/heater/light installed which the new system runs through the inverter without difficulty although mostly it is the LED which we use for lighting.



While we have done pretty well growing vegetation along this part of the back of the house to protect it from the harsh western sun on those hot western Sydney afternoons, there are times of the day when the bathroom and toilet windows are quite exposed. For these times we have polystyrene sheeting which is cut to fit the inside of the window surround that fits in and reduces the problems considerably. We applied some contact to dress it up a bit!

We do make some of the products which we use in the bathroom including **deodorant** and **shampoo soap**. I have not found a home made toothpaste I am really happy with, the usual go-to sodium bicarbonate results in a (for me) unpleasant saline taste. I did come up with a **toothpaste** built around a calcium salt like calcium carbonate but I feel it could be better. Most cleaning and disinfection is done with vinegar, bicarb and metho.

The Toilet

The toilet is also quite small at 1500mm deep by 900mm wide, and it has……. The toilet! Prior to the remodelling the toilet had a single flush 10 litre cistern. We had installed a 2 litre drink bottle filled with water to reduce the flush volume but it still used more water than we wanted. During the remodelling we had the old toilet replaced with a new ceramic

3 litre half flush/6 litre full flush cistern. We have always practiced the “if it’s yellow, let it mellow……” thing and still do today.

The only other feature which sets the toilet apart is for entertainment more that anything else and it was one of the first modifications I made to the house after we moved in. I painted the inside of the toilet door with blackboard paint! With a selection of chalks placed on the cistern, it is endless fun for all the family!

3.6 The Lounge Room

The lounge room is where we spend a fair amount of time in the evening, particularly seeing as this is where (or near where) the primary source of heating and cooling for the house is, and as such it is part of our **cool refuge** and (if there is such a thing), warm refuge.

Heating and Cooling

Our main heating is provided by the Nectre bakers oven which is very efficient, especially after having an open fireplace as a source of heat for many years, although the open fire place was augmented by a since passed on kerosene heater. The baker’s oven also allows us to cook on and in it, so that the energy from the wood we burn does double duty. The oven is also used for dehydrating food for storage and we are currently working on a system to transfer heat produced in the oven into the bed to provide warmth in that area when we leave the warmth of the fire to head up to the cooler bedrooms.

The lounge area, as part of the whole house, has fibreglass batts as insulation, but in winter we apply bubble wrap to the very large lounge room windows. This acts as a type of insulation (sort of like double glazing) but at the same time it lets in plenty of light during the winter day which we find very useful from a psychological as well as environmental point of view (we don’t need to use extra lighting during the day. We also have roll down shutters fitted on the outside of the front windows (including the lounge) which cuts down on the heat getting in and we don’t miss the light so much in summer because we get plenty at other times!



In terms of cooling, there is an overhead fan in the lounge room, but the main cooling (when it is required) comes from the small air conditioner in the Kitchen/Dining area, which is positioned so that the output can be directed into the lounge area as well. We have a fan which we use in the large doorway between the lounge and kitchen/dining area which picks up the cool air and directs it into the lounge.

The lounge room can be segregated from the rest of the house by a concertina door at the arch between the hall/entryway and the lounge room, which facilitates keeping the room comfortable in both hot and cold weather. There is also a folding door between the kitchen and the hall/entryway and we use a blanket curtain to isolate the kitchen/dining are from the laundry, shutting off the whole south end of the house to keep it warmer/cooler as required.



Electricals

The main lights in the lounge room are two 12 volt high efficiency fluorescent lights, which are connected directly to the 24 volt batteries through the 24 volt to 12 volt converter, which means that even if the inverter shuts down due to low voltage, we still have the lights. The 240v ceiling fan is connected in where the old 240 volt light was placed. We also have a portable, stand mounted 240 volt fluorescent lamp connected to the off grid system through the inverter for task lighting.

We have the TV in the lounge room, we use it to watch YouTube videos on stuff we are interested in as well as my old 50s/60s sci fi and monster movies on DVD or on the net or other entertaining stuff. What can I say? We have optimised the TV power consumption to the point where it only uses 10 watts to run, so power usage is minimal. If you type 'optimise' and your TV brand and model into the net, you would be surprised at the information available on how anybody can set up their TV to consume less power.

Accommodation

The 4 person custom built lounge which we have is also a remarkably comfortable fold out double bed. We also have two reclining chairs which can also be used for sleeping in, and both of us have, at separate times, slept in them when uncomfortable or unwell. This means that when required we could easily and reasonably comfortably sleep four people in our cool/warm retreat, and that doesn't account for floor space!



Three bookshelves full of books, a small CD player and collection of CDs and a solar/wind up radio rounds out the entertainment section of the room.

When we first moved in, I had the lounge room floor sanded and coated, and for many years we had a variety of floor coverings but the past few years we have gone with just the polished boards for the ease of cleaning. I was initially concerned that it would make the room colder in winter, and even had plans to insulate under the floor for a while, but it doesn't seem to have made a difference to the feel of the room so I have decided to leave it as it is.



3.7 The Bedrooms

When the kids were living with us, the bedrooms were…… bedrooms! But since they have moved out, as tends to happen, the rooms pick up other purposes.

Common factors

All three bedrooms have a number of similarities; they are not particularly large with the master being 4 metres square and the two kids bedrooms being 3 metres squared. Each bedroom has its own aluminium window with the two front bedrooms having larger multi-pane windows (1800 x 1700mm) and the rear bedroom having a smaller window (1800 x 1200mm). The two front bedroom windows have roller shutters on them, but no windows on the back have a roller shutter so the back bedroom window is fitted 15mm thick

polystyrene sheets which can be installed on very hot days to help maintain the room temperature.

For cooling, each room has a three-speed fan in the centre of the ceiling (240v) and lighting was previously provided by one 12v high efficiency fluorescent light. These seem to have a limited lifespan, although it may be in excess of 10 years, but when they fail it is the whole light which blows rather than just the bulb, so they are being replaced by 12v LED downlights as they fail. There have been two 12 LED reading lights over the head of the bed in the master bedroom for many years.



Individual Rooms

Master bedroom

This is pretty much a standard bedroom with mostly just a bed and clothing accommodation. For winter heating there is a small 'Godin' slow combustion stove, which

we had fitted when our eldest daughter was born. The flue was installed such that it went through the wall into her bedroom, thus heating two rooms with the one appliance. We don't seem to use it these days.

We don't use electric blankets in winter, more detail on that can be found **here**.

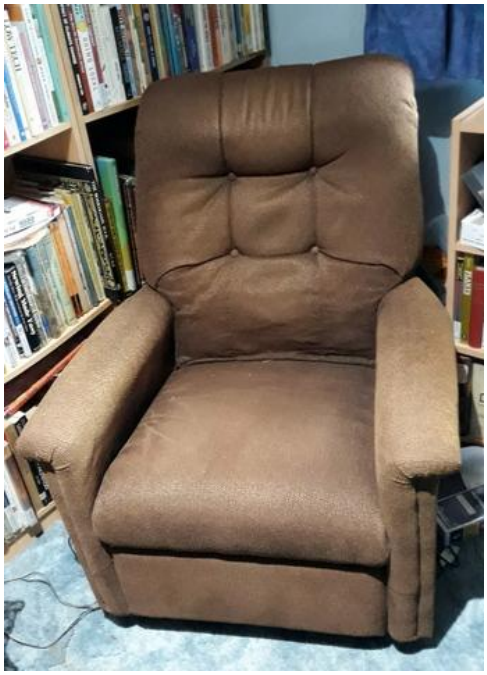
Second Bedroom

This has been taken over by Linda as her office/sewing room/ library. Over the area which she uses as her office and where the computer is located is a bunk bed. The bunk bed can be used by visitors or if one of us is sick and doesn't want to infect the other, or if one of us is sleeping restlessly. Plans are also in the wind to make and install a fold down bed under the bunk to provide extra sleeping accommodation for visitors if required.

The northern side of this room is covered pretty well by the large mulberry tree in the front yard, this has two effects, the first one being that it keeps this end of the house and this room in particular quite cool in hot weather. It also provides a nice outlook, the window facing out onto the 'park' area and providing a good view of the self-watering bird bath. Due to this and other foliage in the front yard, you are not looking directly out onto the neighbours which is nice.

Third bedroom

This is my office/library area and has bookshelves on all four walls. There is also a recliner in the corner as a reading chair, although it is very comfortable and has been christened the 'sleepy chair', which I have been known to retire to if I am having trouble sleeping. It could also be pressed into service as sleeping accommodation in the event it was needed.



The Sleepy Chair

The window is protected from the afternoon sun by a passionfruit vine, mandarin tree and, as the sun swings around, the banana circle. The outlook is mostly foliage and quite pleasant!

3.8 The Back Deck

The back of our house faces west (or at least slightly north of west) and when we first moved in it had no insulation. When I thought we had bought a house what we had in fact bought was a solar oven!

First on the agenda was insulation, then I needed to put up a deck to act as a barrier between the kitchen and dining room space and the hot western Sydney sun. The first one I built many years ago and with somewhat less knowledge and skill it turned out to be not so ideal. I took it to the width of the back landing and it should have been wider, some of the timber used, while being recycled, was not up to the task and it did not cover the back door very well.

It eventually got to the point where all of the superstructure was gone, leaving just the deck itself, which if nothing else, supported the outdoor section of the split system aircon. I set up a tarp on occasion to cover that area but I really needed a new, proper deck.
Some four or five years ago after much encouragement and motivation from my sweetie I designed and built the new deck and since it has been built we have found to be a great multipurpose space. It fills for us the following needs –



Sun Protection - The original idea was to protect the back of the house and it does that admirably. The roofing is clear polycarbonate, but that is covered with 2 layers of 90% shade cloth so that the deck is protected from the summer sun, but the covering can be removed to give us access to the warmth of the winter sun. There are bamboo blinds along the outside edge of the deck which prevent the sun from hitting the deck directly when rolled down. The sun does sneak past the southern end of the deck but I have installed another bamboo blind hanging from the eaves, which covers this tiny chink in our armour.

Amenity – The deck is also a nice place to sit if the weather is a bit cooler. It is a great place to read a book, have a cup of coffee or just look out over our wonderfully productive back

yard. It is a wonderful space to let us get out of the house and relax, but still be protected from the sun and rain.





Especially for the cat!

Growing space – I installed a set of hooks outboard of the deck frame and another set inboard of the frame, the idea being that I would install hanging pots for food growing outside during cooler weather and then transfer them to the inside hooks during the peak

summer heat and burning sun. In reality I haven't used the inboard ones yet. I also have a grape vine which I intend to grow up under the roof to provide a bit move cover, as well as grapes! A couple of blueberry bushes on the southern part of the deck rounds out the growing area.



Outdoor Cooking – the southern end of the deck is at a good height for cooking using our rocket stoves, and I regularly set up and use that area to make stir fries and noodle dishes in one of my woks, which work very well with our rocket stoves. I also have a square cast iron pan that I use for cooking barbecues with the rocket stove. I have also used this area to boil water and pasteurise the substrate when preparing for mushroom growing. Not exactly cooking, but still using the rocket stoves in that area.



Workshop space – as mentioned above, the southern part of the deck is at a great height for working, so it acts as an overflow for some of the work of cutting, drilling etc. that I would classically carry out in the garage. The space is airy, light and well-ventilated and is generally a pleasant place to work, plus it is a flat area I can set out a project on.



Water Catchment – While it is not water catchment in the classic sense ie rain going from roof, to gutter, to tank, I have constructed a permeable path outside the perimeter of the deck and any rain is conducted from the roof down into the path and from there into the ground. Previously in times of heavy rain, runoff from this area would find its way through to the neighbours, but with the current system all rain which falls on the deck area winds up in our soil, keeping plants alive in drier times.

No water lost, even in a storm



Storage – I do use a small part of the area for storage, I built a small table over the outdoor part of the aircon and we use it to sit our drinks etc on, but I also use it to store some of our home grown onions out there. The area is dry, has good ventilation and is easily accessible from the kitchen so I can whip out and grab an onion or two without cluttering up the kitchen.

Drying washing – It is an undercover area which we use to dry washing in times of inclement weather. The inboard row of hooks I was going to use for the hanging baskets has been strung with washing line and pressed into service to dry washing. We also have a couple of portable aluminium fold up washing lines which we can also set up on the deck as needed to provide more drying space.



Show Case – I use it to display things like our rocket stoves, stored heat cookers, solar food driers, pot in pot coolers and whatever else I can think of when we have open days like Permaculture Day and sustainable House Day. They are at the perfect height to be inspected by visitors walking in through the garage as part of our yard tours.



All weather access to the garage – I can whip out onto the back deck and walk along it in pouring rain and then drop down the stairs on the southern end and into the garage more-or-less without getting a drop of rain on me. This can be very handy if the off-grid system requires an adjustment during a storm or whatever. I have installed a 12vDC light under the eaves in the middle of the deck which provides an admirable degree of lighting if required.

While I must admit that Linda deserves the credit for motivating me to build the new deck after putting up with the remnants of old one for many years (you gotta sneak up on these things) I am very happy with how it turned out and with what a useful space it has become.

3.9 The Genkan



A Genkan is part of a Japanese house, it is the entryway, and traditionally the place where the outside shoes are removed and the inside shoes are put on. Being the voyeurs that we are, we watch some youtubers especially **Tokidoki Traveller**, an Australian girl living in Japan, and it appears that everyone there, has a genkan, even in an apartment. While I considered this an interesting fact I didn't really see the bigger picture on the how and why

of the genkan until I read David Holmgrens' book RetroSuburbia where on page 185 he talks about the 'No Shoes House'.

The idea is that cleaning (particularly of carpets) can be reduced if there is a system in place to prevent the dirt outside being tracked inside, especially when you are outside working and growing your own food etc. I have also read where this system also shows respect for the people (person?) who cleans the house by preventing the entry of grunge, which will then require extra cleaning. Thus time, energy (human and electrical) and resources are saved.

Unfortunately, this is Australia not Japan and such concepts can sometimes be at odds with what we are used to. My eldest daughter tried to implement a 'no shoes' approach for their place, but found that she got considerable pushback from visitors. I remember as a kid being required to take my shoes off before going into friends' houses, but clearly the world has changed. Thankfully (or not) we rarely get visitors so this has not been an issue for us!

It also appears that, at the front door at any rate, we have an area that is deal for use as a genkan. A few years ago I pulled up the carpet in front of the front door and put down some ceramic tiles. The area is just right for removing shoes and leaving them on the tiled part, which is easily cleaned. We also have a covered area outside the back door, when I put the back deck up I extended the cover so the concrete top step is now under cover too. We were kind of 'pre-adapted' to make use of this idea!

We now have places to take off the dirty shoes and generally have 'inside' shoes for cooler weather (I have a pair of 'Slumbies') and Linda has slipons that she uses outside the house. One issues that has cropped up is when we are moving from the backyard to front yard through the house, and to prevent the need for fancy footwork we have installed a runner that goes from the front tiles, across the area of carpet to the kitchen lino, and from there we have ceramic tiles in the laundry. We can make it from the front door to the back door without touching the carpet.

So far it is working for us!

3.10 The Garage

The garage was our first major addition to the house (after the open fireplace) and I needed it to be able to do STUFF.

Our garage is a multipurpose building that is much more than just a place to keep the car, in fact a car has not seen the inside of it since the early days. It is a simple rectangular building roughly 8 metres by three metres, with the front (eastern end) enclosed in brick the same pattern as the house and bearing the roller door, the south and west walls are constructed of a hardwood frame and enclosed with Hardieplank, (and yes, Hardieplank of this vintage contains asbestos, so no cutting or drilling). The north wall is common with the south wall of the house. The roof is rib and pan galvanised sheeting over hardwood joists, sloping down towards the back of the building.



There is no direct access from the house into the garage, but there is a door in the northern wall of the garage which extends past the back of the house, allowing me to get into the garage from the end of the back deck.

The garage has acted as, and enabled me to do a whole stack of things –

Workshop – It has been my workshop first and foremost, it gives me a place out of the weather to do work. This may be conducting repairs or building new stuff from scratch. Building things like ollas or deep pipe waters for irrigation, the solar oven or solar food dehydrator to make direct use of the sun's rays, or to make any number of gardening bits and pieces.

WE have a number of work benches set up with different types of vises that make working by myself easier, that way I don't need to hassle Linda (or anyone else) to hold stuff for me. One of the things my old mate Bill Tarplee taught be was that to be able to do stuff by myself I needed to have vises so I could secure the material being worked on safely. Among other things, we have 2 woodworking vises, 2 engineers vises, a blacksmiths leg vise, a pipe vise, a compound vise and a drill press vise.

We have five benches, two 1800mm x 600mm, two 900mm x 60mm, plus the original 'folding' one, 100mm x 550mm, secured to the wall at the back of the garage under the one and only widow. Of course some of this area is used to support fixed power tools so not all of the area is available for construction work.

Tool storage - . It has allowed me to store and use my considerable collection of hand tools as well as a place to use them. It is also a place to set up and use larger power tools such as the wood lathe, bench drill, table saw, router, small band saw, drop saw, grinder and electric welder. I also had a (large) homemade press and a pipe bender but I needed room and realised I hadn't used either for over 30 years so I donated them to a high school my mate John was teaching at.



Spares/Consumable Storage – This was probably more important when I used to do my own car servicing and we had a pretty comprehensive set of spares for many of the cars we owned. We still have bike spares and spare blades etc for our tools. It can also be irritating to have to whip out at a critical juncture of a build to pick up a screw, nut, bolt or whatever so we have a good collection of consumables to support what we are doing. I am not saying I have never had to whip out to pick something up from the hardware, but many is the time I've been able to find exactly what I needed in my stock of spare nuts, screws and bolts etc.

Bike garage – We have a trike, owned by Linda, which we do use for local transport around St Clair and it not only needs a place to reside, but a place for us to maintain it. The garage suits both of these purposes.

Runoff to tanks – When the garage was originally built the council inspector who checked it agreed I could put some water tanks on the back (western end) rather than wrecking my existing veggie patch by installing a rubble drain. This allowed me to put two galvanised 500 gallon (2250 litre) water tanks on the back of the garage and for 20 years that was the only water storage we had. They are still in regular use too.

The gutter of the southern face of the house runs over the garage roof for most of its length, because the garage abuts the house on that side, so some years after the garage went in I installed an offtake and valve from the guttering over the garage. This allowed me to take

water from the house roof which up until that time, had just gone straight into the stormwater system, and direct it into the tanks.

This modification effectively increased the catchment area of the garage roof by about double, ensuring that empty tanks refilled more quickly when we got rain.

Alternative energy set up – The garage facilitated our 12 volt alternative energy set up in a number of ways. Firstly, right from the start, because the long axis of the garage is east-west, it provides an excellent place to mount solar panels. The first solar panel I ever bought over 35 years ago was mounted on the garage because it faced the right direction, was flat and easy to walk (and work) on and the steel roof made it easy to secure the panel mountings to. In fact it remained the only place photovoltaic solar panels were mounted until we got the back-to-the-grid system installed on the back of the house roof about 10 years ago.

A good proportion of our solar array is still on the garage roof, but we also have panels on the east and western faces of the house too, but the garage roof has been the mainstay of our solar production for over 35 years, and will continue to be into the future.



But there's more! When I became interested in setting up the alternative energy system I needed a place with plenty of ventilation (off-gassing batteries!) and outside the main house to set up the batteries and switchboard etc. With the northern wall of the garage being common with the house it made it an ideal place to set everything up. I could then run the circuits up into the roof of the house through a hole in the brick wall so all the wiring was out of the weather. This also reduced the length of the wiring runs to get the power to where I needed it, thus reducing line losses.



Consequently, when it came time to replace the 12 volt system with the 24/240 volt system, the garage was the ideal place to set things up.

Another thing the garage allowed me to do is to set up a couple of wind generators to contribute power the 12vdc system. Wind generators can be noisy and if installed directly on the house they would transmit vibrations back to the house during times of heavy wind. By mounting them on the garage that prevented the vibrations being a problem.
In general terms, I don't know how far I would have gotten on the alternative energy system without having the garage. For more details on the old 12 volt system click here, and for more details on our new 24volt/240 volt solar system click **here**.

Blacksmith forge – Many years ago I put together a blacksmiths forge which I was going to mount in the garage. I chickened out and set it up outside (not ideal) and then eventually moved it into one of the sheds, but no ventilation installed this was also less than ideal. After many years I got around to setting it up in the garage, and this I am very happy with.



Cover southern end of the house - The garage effectively shields the southern end of the house from the hot summer sun, because while I use the term 'southern' it is in fact facing slightly west of south, allowing the hot summer sun to hat it up at the end of the day. The garage shades it and keeps it cool reducing solar input to the lounge/dining area on hot summer days.

Trialling Miscellaneous Fun Stuff - like building in this **drink bottle light**, which worked out to be surprisingly effective! (to find out how I made the drink bottle skylight, check out appendix 1)



Garages are different things to different people, but having a garage to work and store stuff in has been immensely valuable in our efforts to live a more sustainable life.

4.0 Chooks at the Choko Tree

4.1 Chooks and Suburban Permaculture



Chooks are a cornerstone of permaculture design, acting as self-propelled workers that cycle nutrients. For example, the "chook tractor" (a movable, bottomless coop) allows the chooks to systematically clear weeds, eat pests, till soil, and spread fertilizer across specific garden beds or orchards before planting. Integrating chooks into your setup can dramatically reduce your workload while building healthy, resilient soil. Ways of integrating chooks into your suburban permaculture design can be either by working with their accommodation, or in accordance with their primary function in the design.

Living circumstances

The "Chook Tractor"

Rather than keeping the chooks in a static run, mobile coops or ‘tractors’ allow chooks access to new (or previously covered) areas on a regular basis, depending on the system. To operate this system a tractor is placed on a veg patch that has completed its yield. The chooks will devour remaining greens, scratch up weed roots, eat insect larvae, and leave behind nitrogen-rich manure. Also, their constant scratching turns the soil and vegetation into loose, mulched earth, perfectly primed for your next planting.



Deep Litter Composting

An alternative to a traditional bare-earth or concrete coop floor, is the deep litter method. Carbon-heavy materials (like woodchips, straw, and dry leaves) are layered on the coop floor, preferably 200mm or thicker. As the chooks scratch, they mix their high-nitrogen manure with the carbon-rich litter material. Once or twice a year, the aged, nutrient-dense compost is dug out and applied directly to the gardens or orchard.



Chook Tunnels

Chook tunnels are narrow, wire-mesh pathways that allow chickens to travel through specific areas of the garden without damaging crops, for example travelling from their coop to a food forest. They can also be used to form a perimeter around the yard to restrict entry to weeds and/or pests from adjacent properties.



Suburban Food Forest

Chooks can be kept on deep litter within a dense suburban food forest system, the chooks will happily scratch around the base of trees, eating fallen, pest-ridden fruit (like codling moth larvae) and scratching up weeds that compete with the tree. Also, their manure drops directly into the root zone, acting as a natural fertilizer.



Miscellaneous

Chooks and the Greenhouse - Another permaculture technique is placing the chicken run against the wall of a greenhouse and with some access inside. The body heat and carbon dioxide generated by the flock naturally help warm the greenhouse and stimulate plant growth inside and the heat of the greenhouse can provide a pleasant area for the chooks to hang out in cold weather.

Bushfire Reduction – Chooks can, to a small extent, reduce bushfire risk by reducing fuel load by free ranging under hedges and within food forests to help break down leaf litter through scratching and manure thus reducing fire risk by reducing fuel load.

Primary Function

Another technique to use to integrate chooks into a permaculture design is to look at them from the point of view of their primary function in that design:

Soil Preparation

Chooks scratch up and eat unwanted weeds and invasive grasses their constant scratching breaks up compacted surface soil naturally and confining them to a specific bed by use of a structure such as a chook tractor prepares it for planting.

Nutrient Cycling

Chook droppings provide highly concentrated plant nutrients and are especially high in nitrogen. By allowing chooks access to compost in a confined area (so they don't spread it all over the yard!) their scratching turns over compost heaps, speeding up decomposition. In a deep litter system chook manure mix with high carbon straw or wood shavings to create rich, ready-to-use mulch. Chooks can also assist us with reducing organic waste, they convert kitchen scraps and fallen orchard fruit into high-value manure.

Integrated Pest Management

Foraging under fruit trees and cleaning up veggie patches as part of an annual crop rotation breaks the life cycles of destructive pest such as fruit flies. They also hunt down pests such as slugs, snails, wireworms and other grubs. They can also assist in disease control by eating fallen, rotting fruit removes fungal spores from the orchard floor.





The difference a day makes!

The Chook Zone

Generally, in suburbia we do not get enough land to look seriously at anything other than zone one or two, which limits where you would put your chooks. While councils can have an

impact on how close to the dwelling a chook area can be placed, if you plan for a chook tractor it could effectively be anywhere in the yard where vegetables are grown. A more permanent set up with need to be well thought out and may be more around zone two than zone one, but chooks will require checking on almost a daily basis so closer can be more convenient than farther away.



However, David Holmgren does make the point that 'social license' ie trust and mutual agreement with your neighbours can be more effective in helping to implement plans such as where to put the chooks than the council's 'legal license'. The reality is the council will usually only find out about your chooks if someone complains! Having said that, check your council website for their requirements regarding chooks and comply with them where you can.

In Conclusion

Where possible, it is worth including chooks in a suburban permaculture design. Chooks can add many dimensions of productivity to a suburban site while reducing the gardener's workload, as discussed above - chooks can help us: cultivate and fertilise our growing areas,

control weeds and pests, and reduce food waste. They can do all of this for us, and you get eggs!



4.2 Our Chook Journey

4.2.1 The early years



We first got chooks back in the late 1980s, I had wanted to give them a go for a while but the catalyst was our youngest daughter having food issues, particularly with colours and flavours. This caused us to rethink our diet and since anything but cage eggs were difficult

to come across in those days, we started looking into keeping our own. I had been to a conference in Melbourne and met up with a guy from BASF, he showed me a colour card and explained one of his duties was to go and see egg producers. It seems that the cage system was so rough on the chooks, their egg yolks turned out white, so he sold them dye to put in their feed, the more dye, the deeper yellow the yolks were. The colour card helped you work out how much dye to put in to get the shade of yellow you wanted. We haven't bought caged eggs since.

Our first chooks were bantams, about half a dozen of them, which I had bought because I was under the impression that while full sized chooks were livestock, bantams were regarded as 'caged birds' by officialdom and so acceptable in the back yard. This turned out to not be the case but it was what I believed at the time. I had been doing some work with a glasswool insulation manufacturer and they got their glass beads (which they melted to make the insulation) in 1200mm plywood cubes which they would dump. They kindly dropped 3 off at our place, one for the chooks and two for a cubby for the kids.



To make it habitable for chooks I cut a small door in the front of the chook cube (but still big enough for me to climb into), a chook pop hole in the side and put up a shelf as a laying platform and a length of broom handle as a roost. To make it more weather resistant I built a corrugated iron skillion roof and then built a two metre by one metre run outside the shed part. The run was obviously too small and didn't last long, I ran some chook wire from the back fence, along past the chook shed and around onto the side fence, giving the chooks a run of around 25m2 instead of 2m2. Mind you, the guy we bought them off was over near Sutherland and had what looked like a hundred chooks in small cages lining the inside of a garden shed. I think the chooks were just glad to get out!

They were quite productive for us, but they did not live forever and when they started to pass we looked around for some replacements, full size this time. We got some spent layers from one of the local egg farms. Commercially, once the chooks have laid for a year they are replaced because production drops, and you can occasionally pick some up cheaply as we did. They had never seen what the outside world looked like and I remember placing them in the chook shed and watching as they stuck their heads out and looked very distrustfully at the grass, probably thinking 'what on earth is that green crap???'. Yet within a few hours they were out pecking and scratching with the others, exhibiting all that wonderful chookie behaviour. They were not only cheaper but we had the built-in satisfaction of rescuing them! The only real issue was that they were beak trimmed (all commercial layers are) and this did interfere with their ability to forage a bit.



I wound up fencing the veggie patch to keep them and out and then letting them out to free range in the afternoon, very relaxing for them and for us watching them. The chook fencing around the chook pen and around the veggies was only a metre tall so a chook could in theory fly over them, thus I had to trim one wing of any and all new chooks to keep them in. The interesting thing was that once the wing had been trimmed they got used to the idea that they couldn't fly, even once the feathers grew back at then next moult and they didn't even try.

We kept that process going for over 10 years and while it worked well in terms of egg production it did have some significant downsides, one I didn't discover until we moved on to the process we use now. Those downsides were –

- Every couple of months or so I would have to climb inside the chooks shed and remove all the chook poop and distribute it around the veggie patches. This was NOT my favourite job!
- We were feeding half the local bird population. I didn't realise until we enclosed our chook operation and the usage of chook feed dropped by about half!
- While these wild birds loved the cage food, they also left my chooks a gift that keeps on giving in the form of mites. A short conversation with Mr Sulphur Powder and the mites mysteriously disappeared.

4.2.2 Evolution of a Chook Tractor

4.2.2.1 General Comments

As I have mentioned elsewhere, I have never claimed to be the sharpest tool in the shed but I do know a good idea when I see one, and my world changed when I came across the concept of the chook tractor! I found out about chook tractors through Bill Mollison's permaculture work somewhere between 15 and 20 years ago and as soon as I saw it I knew I had to have one!

The advantages of a chook tractor were –

- It would allow me to make the best use of the chook poop by having the chooks directly apply said poop to each veggie patch in turn,
- Their scratching would shallow cultivate each patch, after which I would apply mulch and the worms would come up to the goodies on the soil surface and finish the job. No more rotary hoeing or double digging for me!
- The chooks were isolated from the wild birds thus solving the second and third issues referred to above.
- Due to their constantly being moved onto new ground, there was less likelihood of the chooks suffering from a build-up of pests or diseases.
- The chooks could make use of leftover vegetable and weed trash and harvest any residual snails, slugs and other bugs thereby reducing my workload and improving their nutrition.

- It looked great! By this time the old chook shed, which was designed for a one way trip to Aust. full of glass beads, was now over 10 years old and looking pretty shabby so the chook tractor was a marked improvement.

Of course, the chook tractor would also impact on how we grew our veggies. Originally, I would just move the tractor around the several large beds (4m x 4m and 6m x 6m) we had at the time but I wound up dividing each veggie patch into beds 1200mm by 2000mm, which coincidentally is the footprint of the chook tractor! I have since increased half of the beds to 3000mm long.

4.2.2.2 Chook Tractor 1.0



I needed to work out a design for it and spent some time agonizing over the form it should take, intending to draw up plans to build it from. After supreme procrastination, I decided just to go ahead and build the damn thing!

I had an old pine bed base that was due for the scrap heap, and so used that as the raw material for the structure but needed to get hold of some plywood to make the sides. I still had some chook wire hanging around and some lengths of dowel I could use for perches so I was pretty good to go.

I decided to make it an A-frame shape for no better reason than I liked the look of it, the base being about 2 metres long by about 1.2 metres wide and the sides being about 1.6 metres wide giving the whole assembly a height at the apex of the A-frame of about 1.4 metres. One end and one half of the tractor were covered with plywood sides to provide shelter from the weather and a roosting area under cover and the other half and end was covered with chook wire for ventilation and sun.

About half way up the closed end I put in a shelf as a laying area for the chooks and the enclosed and had two full-width doors built in, the top one giving access to the laying area, the bottom one giving access to the rest of the chook tractor including the food and water dispensers, which were hung from the bottom of the laying area floor. There would be no floor on the tractor, of course, to allow the chooks to scratch, dig and destroy to their hearts content…….within the confines of the tractor!

Construction begins!

I cut up the main bearers of the bed frame to make the 2m x 1.2m base of the tractor and screwed it together. Next I grabbed six of the slats and cut the ends off at an angle so that they would form the uprights of the A-frame, one set at each end and one in the middle. I used another of the slats to form a ridge timber at the apex of the A-frame, and then screwed all of the timbers together, forming the basic frame of the tractor. To strengthen the A-frame I put a small triangular gusset of plywood on the outside top of each of the end A-frame.



To form the roosting area I got hold of some plywood (exterior grade) but I didn't have enough to go all the way down to the base, not to the top of the A-frame so I screwed it onto the uprights leaving a bit of clear space at the top and bottom, then bought some "Miniorb" corrugated iron with small corrugations from Bunnings and cut it to size with my angle grinder. I bent one piece over the top of the A-frame and screwed it to the plywood, forming a water-tight cover and screwed the two other pieces to the frame on one side and the plywood on the other, finishing off the covered area. To make the initial bend was easy but it needed to go over to quite an acute angle to cover the top of the A-frame so in the end I had to jump on it to get it to fit!



I put a brace cut from one of the slats on the covered end of the frame and screwed it into place, I put handles on it and it would be one of the lifting points for transporting the tractor between veggie patches. I then cut some more of the exterior grade plywood to make the large lower door and the smaller upper door giving access to what would be the laying area.



I had some 12mm thick MDF (medium density fibreboard) so I made the floor of the nesting area out of that, screwed on a support on each side of the plywood walls and then screwed the floor onto the supports. I originally made a sort of cut-out door area to screen off the laying area a bit (visible in some of the photos) but after having troubles enticing the chooks into the laying area I removed it and never bothered to put it back on. The laying area only took up about half the length of the covered in space, so I screwed in two lengths of dowel across the A-frame onto the support timber to act as roosts. The chook tractor originally had 6 chooks in it and the size of the roosts seemed to do the trick.



Returning to the “back doors”, there are times when my woodworking skills …….ahhhh, leave a bit to be desired, so when I measured up the open end to make the doors I found that the angles were a bit off and had to specifically cut the doors to fit the measured opening, rather than what the opening was intended to be. The moral here is, as always, measure twice – cut once, not vice versa! I had some mild steel hinges and used these to hinge both doors so that they opened down. While the system worked, it was a pain to use if the covered end of the tractor got too close to a tree or fence or other obstruction. I used a magnetic catch to secure the top door, the smaller of the two, but when I tried the same trick with the bottom larger door, there was too much mass to be restrained by the small magnets, so I wound up opting for a hook and eye system. I only put a hook and loop on one side, but it worked pretty well.



It was a simple matter to drill two holes in the floor of the laying area and install two eye bolts side by side so that I could hang a water container off one and a feeder off the other. All that remained was to cover the open end of the tractor in a layer of chook mesh and I did that by first folding a sheet of mesh the right size over the top and then screwing it to the inside of the plywood covering and the bottom base. I then cut a sheet into the shape of the A-frame end but leaving it a little oversized, I secured it by placing it against the open end and folding the protruding wires over the chook wire already in place on the A-frame. Once the wire was secured, I screwed in a handle on each of the uprights at the open end to form the other lifting point for moving the tractor.



To finish off I did lacquer the plywood sides but I didn't apply any form of coating to the rest of the tractor. It did its job very well but was somewhat over designed and rather heaveeeeey, so that when my daughter and son-in-law moved out, one of my primary power sources for moving it was lost. It was just too heavy, even on the light end, for my wife to help me move. Not long after that though, it reached a state of decay where it threatened to no longer contain the chooks, which would have allowed them to terrorise the rest of the veggie patches. So after 5 years of faithful service it went to the great chook shed in the sky, lasting just long enough to allow me to build a lighter and more manoeuvrable chook tractor.





4.2.2.3 Chook Tractor 2.0



When we last saw our hero, the old chook tractor (see previous section) had died and he needed a new one.....quickly!

All melodrama aside, here is what I did. In many respects it was similar to the old one, it was A-frame in shape and had a footprint the exact size of most of our veggie beds, but it also had some significant differences –

- It was built of much lighter materials so that it could be easily shifted by two people, even if one was a short and lightly built (but enormously cute) female.
- Rather than have an opening on one end, the inside area is accessible through a hinged panel running the length of one side.
- There are two nesting areas rather than one.
- It is painted all over to extend its life.



The main part of the A-frame is constructed from DAR pine that is 70mm x 19mm because it is light, cheap and easily available, and this is how I made it –

1. I set out the base to be 1975mm long by 1310mm wide, using some steel angles to attach the four members and form the base. I cut four more members to 1490mm long and trimmed the ends to the correct angle so they could form the A-frame ends. I attached them to the base and together at the apex by using some light steel braces and screws. A ridge beam of the same size pine was screwed into the apex of the A-frame through the brace and the basic shape was complete.



2. To brace the structure and provide a base to attach the laying areas and perches on, 730mm up from the base along the A-frame uprights I put in a 70mm wide by 19mm deep cut out in each of the uprights to allow me to fit in a mid-rail. To make the cut-outs I just drew the measurements onto the upright, cut 70mm in with a tenon saw and then chiselled out the waste. I could then fit in the brace and screw it in to secure it. At the same height I put in a timber brace on each end to take the lifting handles.

3. Using the same process, I put in another brace 460mm above the first one so that I could attach the peak cover. To make the peak waterproof I didn't just want to form a timber peak and then seal it, I got hold of some colourbond mini-orb that I could get cheaply, the sheet was 2 metres long by 1 metre wide, so taking my angle grinder with a cutting blade (wearing eye and ear protection of course) and cut 400mm off the width of the sheet. This would cover the entire length of the tractor and (when bent in half lengthwise) extend 200mm down each side, giving a waterproof peak to the tractor.



4. I could then start to fill in the structure around the laying area. I did this by screwing 3 ply to what would become the back side of the tractor to the top and bottom braces as well as the sides of the A-frame. I then cut some plywood to fit the top part of the A-frame ends and screwed that into place. After having lots of fun trying to bend the mini-orb to the

correct angle to go over the top of the A-frame (it took two of us jumping on the damn thing to accomplish it) I fitted it in place and screwed it down.

5. I then fitted the floor in each end of the covered area to act as laying boxes by cutting two squared of 5 ply 500mm long x 600mm wide, then cutting out a 19mm x 70mm notch in each rear corner to allow the floor to sit back all the way to the rear of the nesting area. To attach the ply to the mid rail I used four small L-shaped steel brackets, bent into an acute angle so that they fitted flush onto the slope of the mod rail. Four screws, two into the mid rail and two into the base itself secured the bases to the mid rail.



6. Next came the perches, two of which were made out of a length of recycled broom handle, attached to the mid rail by an electrical conduit clip screwed onto each end, a notch had to be cut in the angle of the mid-rail to allow the perch to fit solidly.

7. Before fitting in the main access door I had to fit the chook wire around the open bottom of the tractor. Using side cutters I cut the wire to side for each of the four openings (2 x sides and 2 x ends). The wire is quite sharp, and you might want to use gloves to prevent unnecessary damage to your hands and prevent your kids learning any bad words before

they absolutely need to. Once cut to shape I pulled out a stapler I'd been given and using some long, U-shaped staples I attached the wire to the tractor framework.

8. Once the rest was assembled I could put on the access door. This was just a piece of 3 ply 2000mm x 500mm that I attached to the top rail by three small hinges, which proved to be totally inadequate for the job, *sigh*. After they gave up the ghost, I did what I should have done in the first place and used a 1500mm length of piano hinge that I had floating around the garage.

9. The tractor was now complete except for a coat of lovely British racing green paint so that it fits in with the rest of the back yard and I placed a ring bolt on the underside of the centre of each laying platform, to which a feeder and waterer are attached.
The chooks seemed excited to be in their new home, well as excited as a chook can get I suppose. Originally the tractor held four chooks, two Australorp and two Rhode Island Reds, but with the passing of one of the Austrlorps there are now only three although they still seem to be capable of mass destruction in their allotted two weeks on each patch and we still get plenty of eggs.



One difficulty that has subsequently surfaced is that if something panics the chooks and they squawk and flap everywhere, the top of the wire netting can come loose and let one out, requiring the wire to be re-attached more firmly by small nails. While I was striving to be as light as possible, a more substantial attachment for the wire is a good idea.

The new one is considerably lighter than the old one but my lovely partner in the sustainable life still has a bit of trouble with it, so we have evolved a technique where she gets one end with a trolley and I lift the other end. It gets us where we need to go. I have considered attaching wheels but more often than not the tractor is shifted sideways to the next veggie bed (which I can do by myself) and the wheels would be more a hindrance than a help, but your set up will be different and you might want to think about adding wheels.



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4.2.2.4 Chook Tractor 3.0



I hoped that the previous incarnation of the chook tractor would last us a while but after 5 years of sterling service in all weathers it was losing its war with wood rot and moving it from patch to patch was becoming more and more of a juggling act. I was at work and Linda

was trying to harvest some eggs from the tractor when there was a catastrophic failure. Damn, so much for the weekend, I knew what I would be doing.
I try and make each iteration of our design better than the last by building on the mistakes of the previous one, so in other words I try not to make the same mistake twice.....I make a whole stack of new ones each time!

The improvements to this one over the last one are –

All over paint job – The original got a bit of varnish over the main sides, last one got several coats over all of the outside but after coming up short due to rot in several areas, this one got three coats all over, inside and out.

White, not green – The previous chook tractor was painted Heritage Green (looks something like British Racing Green for those who remember it) and it looked pretty nice in the back yard. Unfortunately, being a dark green it did little for the chooks comfort on the hot days that can hit us anywhere from October to March. You can feel the difference on the inside of the covered area just by putting your hand on the timber surface, warm instead of ouch!

Extended side - The last unit, to save weight, hat the top roosting area covered by plywood but the understory was completely surrounded by chook wire. Again, on those really hot days we had to provide extra shade so this one has the side that does not open extend down to within 100mm of the bottom of the tractor. This still allows some ventilation but with that side facing the west and being painted white means a more comfortable summer for the chooks.

Aviary wire instead of chook wire – both previous versions of the chook tractor had (predicably enough) standard chook wire mesh (hexagonal 50mm holes) but no lesser authority than **Dr Harry** himself said that the chooks can get their heads through this and injure themselves. This version has aviary mesh with 13mm x 13mm square holes which is stronger and the chooks can't poke their heads through.

Redesigned access hatch – the original was made out of just 6mm 3 ply and had a tendency to curl up at the edges in hot weather, with the possibility of a chook escape. The new one is still 3 ply but only 3mm (it was all I had to hand) so I have built a frame of 70mm x 19mm pine that will keep it rigid, around the inside. So, the frame keeping it straight and the white paint coating it will prevent any deformation. Also, I have beefed up the piano hinge that acts as a pivot for the access hatch and for further strength the screws securing the piano hinge go into the full thickness of the frame rather than just the 6mm of the hatch itself, as it did on the previous model.

Thicker roosts – up from 15mm to 20mm, the thicker roosts are more comfortable on the chooks feet (and it was what I had).

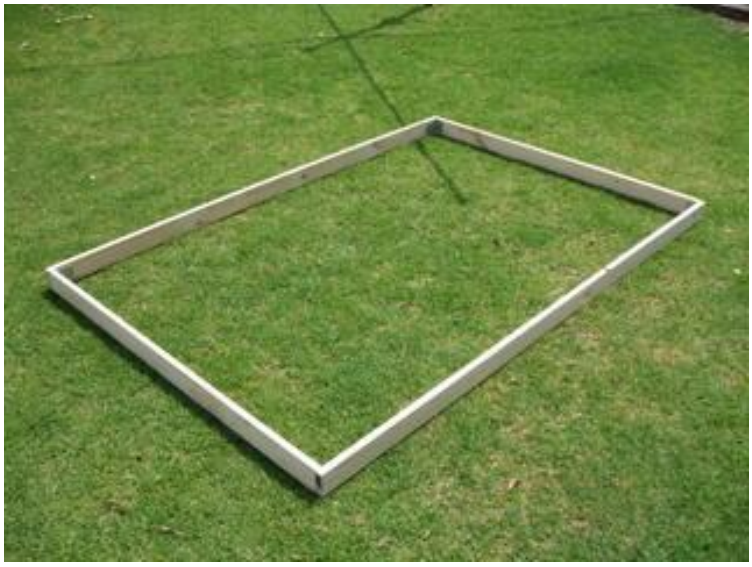
Shorter body – The previous incarnation was 2000mm long exactly because this simplified construction, a lot of the raw materials coming in 2 metre lengths, but when I came to use it I found it was in fact just a shade too long, so the new one is 1900mm and fits the beds a treat.

Apart from the above differences, the chook tractor is essentially similar in design to the previous one, using the same materials and construction techniques. The construction sequence, for those who missed it, is

- Lay out the bottom rectangular footprint and secure with angle brackets and screws
- Attach the A-frame uprights to the bottom footprint with flat steel brackets and screws.
- Fit the ridge member and screw in the ends to keep the A frames upright.
- Cut the timber to go along the sides to length and then cut out the A-frame sides to fit and screw them in
- Cut the end pieces to be used as handles to size and screw them to the A-frame uprights
- Cut out the back and side covers from plywood and screw them to the frame
- Cut and install the perches
- Paint the living daylights out of everything with 2-3 coats of white paint

- Make the hatch and paint white
- Install the laying areas
- Put the hatch on with piano hinges
- Put the wire on by screwing timber to the uprights and using staples on the edges.
- All finished!

So far it is working well, containing the chook effectively and they are much more comfortable, or so they tell me. All up this one took me about two full days (with help from son-in-law and wife) and cost in the region of $200 but it would have been less if I was able to use more recycled content.























Alas, it was not to be and after 5 years of constant use, it also fell apart due to rot.

4.2.2.5 Chook Tractor 4.0



If you read the section, you will know how happy I was with the design and you must be wondering why I would need a 4G if the 3G was so good. Well, one of the improvements of the 3G over the 2G was that all the wood bits got 3 coats of white paint to keep out the weather, and the rot. Unfortunately, even with all the extra work the service life was still only 5 years, which is not good enough! I had to do better.

The reasons for using wood in the first place were that it was cheap, available, comparatively light and most of all, I was confident working with it. Its major drawback was its lack of permanence, even after 3 coats of paint which proved to me that a new approach was required!

I happened to have a few 6.5 metre lengths of 25mm x 25mm x 3mm thick aluminium angle floating around from a previous project (OK,OK I bought the wrong size and never got around to taking it back….. happy?). While I was not hugely confident with it I came up with a design that would work, and I had my secret weapons – pop rivets!

Constructing the Frame Base

The first section which I made was the footprint of the tractor – a rectangle 1800mm x 1200mm. The idea was to cut out a 90° angled wedge of aluminium at each of what would become the corners, then fold each angle around to make the rectangle. I took one of the 6.5 metre lengths and made a pencil mark at 1800mm then 3000mm, 4800mm and then at the 6000mm mark. I got hold of a rectangular sawn timber offcut and used one of the corners as the 90° angle, holding it so that it was at 45° to the straight, then ran a pencil down the side of the timber to make a mark at the 1800mm point. I then used my hacksaw to cut out the 90° wedge of aluminium I had marked out. This allowed me to bend the aluminium into a 90° angle, two more cuts at the 3000mm and 4800mm meant I could bend the rest into the desired rectangle and then cut off the excess 500mm at the 6000mm point and then pop rivet the open ends together to form a solid rectangle.





Pop Rivets

A word or two about pop rivets: if you haven't come across them before, pop rivets look like tiny little swords (which I used as such when I was a kid), where the "handle" of the sword is fitted into a pre-drilled hole in two bits of metal. The "blade is then fitted into a pop rivet

gun and the handles of said gun squeezed together. This pulls the handle down and deforms it so that it compresses into the two pieces of metal to be joined and holds them together. Further pressure on the handles cause the blade to snap off, leaving the handle in the hole, fixing the two pieces of metal together permanently.







I have lots of pop rivets hanging around but they turned out to be too short to go through two thicknesses of 3mm aluminium angle, so I had to go out and buy some larger ones. The ones I got had a grip (length of the handle) of 9.6mm and seemed to do the job. The shank was also somewhat thicker than the ones I was used to, which meant that it took more effort to squeeze than handles of the rivet gun together to break off the shank, although this also meant the finished job was a lot stronger.

A-Frame ends

This part required four pieces of angle aluminium 1500mm long which will have one end fixed to the frame base and the free ends attached to each other to form the A. At the top of the A-frame the two parts of the frame meet at quite an acute angle, so the ends need to be cut back to allow them to come together at the top to a point. I tried using a pair of tin snips for this, but the 3mm angle was too tough to cut so I went back to using the hack saw. The A-frame sections were attached to the base frame at the bottom and each other at the top using one pop rivet in each location.



With the A-frames in place it was time to put in the ridge cap. The sides of the aluminium angle are at 90° to each other, but the angle at the top of the A-frame was much more acute than that (closer to 60° in fact) so to ensure a good fit, I squeezed the ends of the ridge cap in a vise until they more approximated the angle at the top of the A-frame. The ridge cap was then fixed in place with a pop rived in each end.

The Mid-Rail

With the basics of the frame in place it was a simple matter to put in the mid rail, cutting the aluminium sections to size using the hack saw. I also chamfered the ends of the sections going into the ends of the A-fame so that the angles were the same, allowing a better fit. This was also done with the hack saw. The distance between the bottom of the mid-rail and the top of the base is 750mm on the large front and back panel and 670mm on the side panels, the difference being due to the angle of the front and back panels.





Wire Mesh

With the mid rail in place, I could then affix the wire mesh onto one long side and both ends, allowing the fourth side to remain wire free so that I could cover it with marine ply to provide shade from that direction. I got hold of a 5 metre roll of 900mm wide wire mesh

with 25mm x 25mm meshes. Using a pair of side cutters I cut a length off the roll and trimmed it to size. I bent the bottom to a 90°-ish angle to fit into the base aluminium angle then wrapped the top mesh over the mid-rail. To affix the sides to the tractor and hold the whole thing taut I got hold of some 1mm x 25mm aluminium flat bar, placed it over the wire and then pp riveted it onto the aluminium A-frame. I followed the same basic idea for the sides.



A-Frame Infill

The meshed area is for ventilation, but there needs to be a covered in area for nesting, roosting and laying so to start that I got hold of some 4mm marine ply. Regardless of paint, if you use normal plywood it will delaminate over time due to rain dissolving the glue holding the laminations together (don't ask how I know….), but marine ply uses a waterproof glue. I designed it to fit inside the A-frame for strength.



I took the measurements inside the A-frame and transferred them to the plywood sheet in pencil, for ease of use I decided to cut the thin plywood with a Stanley knife using a metre stainless steel rule to cut against. I am not a total idiot so I placed a thick leather glove on my left hand prior to cutting, just as well of from here on in I would be writing in my own blood!



I was able to finish cutting out the first shape with only damage to the gloves, thankfully. I then placed it inside the aluminium angle A-frame, drilled a couple of holes towards the apex of the A-frame through the angle and the plywood. I cut a couple of lengths of the 1mm aluminium strapping and placed that inside the plywood, drilling through it as well. I then place pop rivets in both holes to keep everything together. To cut out the second side I used my table saw, the Stanley knife works but the table saw is easier!

Handles

To move the tractor around comfortably I need to have handles on each end, so I had a look around and found a pack of 6 Raised Dee Handles (96mm) which would do the trick. I drilled holes through the mid-rail piece of angle on each end of the tractor, then lined up the handles and screwed in the attachment screws. The screws passed through the aluminium angle as well as the 4mm plywood before being screwed home into the handles themselves, that way the handle screw keeps everything together at the bottom of the plywood infill, and also holds the wired mesh folded over the mid-rail in place.



Ridge Capping

To prevent any rain getting in through the top of the tractor I made a ridge cap out of white colourbond mini-orb. When I made the previous tractor I got hold of a 2000mm x 900mm sheet and used a 400mm width cut from it. This time I decided I wanted more overlap so I used the 500mm remainder. I picked the middle corrugation then, holding it flat on the ground, bent it in the middle so that there was more or less 250mm on each side of the bend. By leaning heavily on it I was able to bend it down to an approximation of the angle on the top of the tractor A-frame.

Long Side

With the ends in place it was time to remove the plywood long side from the previous chook tractor for recycling. This was to fit the side which did not have any wire mesh on it. The plywood is marine ply so even after 5 years doing service on the old tractor it is still in good condition. To give it some more fixing points I measured and cut two more lengths of aluminium alloy and pop riveted them at where the top and bottom of where the long side would fit.



It was a simple matter to remove the screws from the old tractor, transfer the plywood sheet into place on the new one, then drill holes in the supporting angles, top bottom and the mid- line and re-screw it into place. With that done I could also drill and screw the ridge cap in place to the top of the long side.

Roosts

The previous tractor had two roosts made from broomsticks as well as a roosting/laying area in each end. In practice I never saw the chooks using the roosts, generally they would lay in one end and sleep (and crap) in the other. So this time I dispensed with the broomsticks and just built in the roosting area in each end. I did this by cutting some 16mm particle board with melamine on both sides and one edge so that it fitted between the two mid-rails. A screw put in through the mid-rail on both sides into the particleboard kept the roost secured and I attached some 70mm x 20mm pine on the outside edge of each roost to stop the straw lining being pushed out by the chooks.



As in the previous model, I drilled holes in the centre of each roosting area and installed a hook in each one so that I could hang up the feeder and waterer. I put them in the centre of

the roost for protection, too far out and the feed will get rained on, too far inside the tractor and both can get crapped on.

The Door

The door is horizontal and runs for the whole length of the tractor above the front meshed area. It is also made of 4mm thick marine ply which has been recycled from the previous model. I installed a piece of 70mm x 20mm pine inside the A-frame angle and screwed it to the frame to make sure the pine was secured. To make the panel openable I wanted to use a piece of 915mm long piano hinge screwed into the top of the door and into the pine bearer, but this would cause a problem. Due to the 4mm thickness of the plywood door sitting on the pine, the piano hinge could not be screwed down to both, so I cut some plywood of the end of the door and then screwed it into the pine bearer, this allowed me to fix the piano hinge onto the door and the support because they were both at the same level.



The old chook tractors did not just fall apart overnight. There is a slow degradation where bits break, fall apart and fall off such that I start to spend a lot of time on running repairs and have to be very careful when we move it, down to the point where we get what is effectively a catastrophic failure and I need to build a new one by the time we need to move

it next. I must admit, with a new tractor, that feeling of being able to move it without fear of it falling apart and letting the chooks out is wonderful, and I am basking in it at the moment!

Overall the new tractor is working well. It is considerably lighter than any of the previous models which makes it easier for Linda to help me to move it and it is considerably stronger. Also, the frame will not rot and collapse at some time in the future…….winner!



4.2.2.6 Chook Tractor 4.0 – Replacing the access

All good things must come to an end, and that includes the front access door of the chook tractor which I lift up to access the eggs and feed the chooks. This style of access door was installed on the second chook tractor design and since this is now the third chook tractor which this particular door has graced, it has been out in the weather for somewhere upwards of 15 years. I picked it up when I worked for a plywood manufacturer *mumble* years ago and it hung around for quite a while before it was pressed into service with the chooks.



To be fair, it has been on the downward spiral for some time also. It have already turned it round once so that the top edge originally hinged to the main body of the tractor became the bottom edge. That did extend the life of the access door for some years, but did not totally stave off the inevitable. Also, the way it was designed, the ever increasing gap between the access door and the top of the tractor meant that more and more rain could get in to the chooks living quarters. The rain bomb hit so it became time to act!

This time was a bit more drastic and, while lifting it up to access the egg area, a couple of hinges pulled out and a split developed down the middle. Lumps of plywood has also started to fall off and to prevent chooks escaping and laying waste our food production area. Also, the way it was designed, the ever-increasing gap between the access door and the top of the tractor meant that more and more rain could get in to the chooks living quarters. Then the rain bomb hit so it became time to act!



The original door was 1800mm x 500mm and in my quick wander around the big green hardware store (while studiously avoiding anyone unmasked at the time), the best I could find was two pieces 1200mm x 600mm. So I fired up the circular saw and cut 300mm of one end of each of the new doors. The hinges did have a nasty habit of being the first point of failure so I cut some 42mm x 19mm DAR pine and screwed it into the top of the doors where the hinges would be affixed.



It was then just a case of affixing two equal access doors side by side rather than one long one. Each door was affixed by two hinges and due to the fact that it was two shorter doors rather than one long one made the job easier. There were a couple of other advantages to this configuration as well –

• We tend to lift up one end or the other to access one side of the nest area and this puts strain on the other side, resulting in damage to the original door. With two new doors there is less weigh bearing on the hinges.

• Being able to access one end only means that if there is a chook in residence at the other, it can't just decide to break out and trash the place while we run around like idiots trying to catch it. (not that that ever happened, but just sayin')

• The new design with the strengthening of the hinged to end, also reduced the likelihood of rainwater getting in to the living area.

The doors need a paint but that will happen later, once the rain had passed.



Update – a couple of years later!

Of course things don't always work out the way we want them to, and I didn't get around to painting the new doors, but that shouldn't have made a difference because they are supposed to be marine ply, aren't they? After a couple of years of weathering, you can see from the photo below that they were not doing well!



I have had to get hold of some more plywood, but this time I made sure to give the doors three coats of gloss white paint *before* I put them on! Unfortunately, during the process of replacing the doors I found that the timber frame that I was affixing them to had rotted out as well and had to be replaced. The pic below shows what the chook tractor looks like now. The chooks (and I) are very happy with the result!



4.2.2.7 Moving the chook tractor

The whole idea behind a chook tractor is that it is mobile, so that the chooks can work their magic over a large area over time without getting out to have 'unauthorised' fun. We have 14 veggie patches and move the chook tractor every two weeks so that the tractor sees each bed twice per year.

Some people use wheels on their tractors but that doesn't work very well for our situation. If I had my time again, I would line the veggie patches up together so that the tractor could move from one patch to the next in rotation effortlessly. Due to the fact that our veggie patches evolved over many years before the tractor came along, our system is not like that.

What that means is the tractor needs to be moved lengthways, sideways and every which way around to get it into place. Also, due to its design, the way it faces will vary during the year, facing the sun in winter and vice versa in summer.

Another confounding factor is that quite often the chook tractor needs to be lifted while being moved to get it over the protruding tops of the ollas we use for irrigation in the veggie patches.

The upshot of all this was that I needed to install handholds of some description to allow the tractor to be carried to where it is needed.

The handholds varied a bit between the chook tractors that I have constructed over the years, (we are currently on 4th generation) and the photos below illustrate what I came up with. Unfortunately, they did not solve all problems.



First Gen - vertical handles on the mesh end, horizontal handles (similar to other generations) on the coop end.



Second Gen - horizontal handles on each end



Third Gen - horizontal lifting bar on each end



4th Gen - horizontal handles on each end

It still required a person on each end of the tractor and when my daughter and son-in-law were living with us that was not a problem, but when they moved out it meant that I needed someone else on the other end and that became a problem.

Linda is a tiny little thing and not up to carrying half the weight of the chook tractor, but after some consideration we came up with an idea that did work. I lift up one end and insert the nose plate of our hand trolley under it, Linda levers it back and I lift the other end and between the two of us we can move it around the yard to wherever it needs to go. If I am only shifting to the next bed along, I can usually lift it and move it across by myself.



But there has also been one other minor issue.

The beds along the western fence, which have Besser block borders, are 3 metres long (the chook tractor is 2 metres long) and the way I usually work it is to put the chook tractor on one end of the bed for a week, then move it a metre towards the fence so that the whole bed gets at least one week of chook. Unfortunately, moving the tractor towards the fence is not easy. I can drag it but I wind up between the tractor and the fence so I cannot get it right to the fence resulting in part of the bed missing out. Pushing from the other end does not

work either due to the friction of the tractor base with the Besser blocks. I worked a way around it by placing some timber on the Besser blocks between the tractor and the fence, lifting the forward end of the tractor onto them, I could then slide the tractor forward with very little effort.

Job done!

4.2.3 The Retirement Village and other things

The Retirement Village

There comes a time in each chooks life where they get a bit old and tired to do the work in the chook tractor, and they stop laying eggs! So the question that needs to be answered is – 'what are ya gonna do?' You could eat them, but the fact is that after a lifetime of service we don't. So we developed the retirement village.

The concept of the retirement village was developed some time after we implemented the chook tractor idea. I found a couple of well-ventilated aviary sheds that were redundant stock and were being sold off comparatively cheaply by the retailer I bought both with the idea that one would become our worm shed and the other the retirement village.



The Chook Retirement Village (left hand shed)

Both sheds are exactly the same. They are made of Colourbond steel of the 'stand up and screw together' type of construction 2.4 metres wide x 1.6 metres deep x 1. Metres high,

with some panels being perforated with 10mm holes. The perforated panels are the left and right front panels (the right hand one of which is the door) and one panel on the left and right hand side of the front of the shed so that the left and right front corners are perforated. I installed the sheds on the northern boundary so that they would not take up valuable growing space.

I put down some 600mm x 600mm concrete pavers as the base and then constructed the sheds on top and after adding some hooks in the roof, tied up a feeder and a waterer and installed a diagonal perch so they could perch and see out through the perforations. I did find that the perforated wall which faced west let in too much of that western Sydney sun in summer, so covered it up on the inside with an old internal door we no longer needed.

The concrete floor is covered with straw (or locally grown grass hay when I can get it) which is sort of a deep litter system. This has a number of things going for it but the main one is chooks turn the straw over and consume any residual wheat grains and break the straw down a bit and I shovel out the straw and use it as mulch. The other advantage of this system is that there is no concentration of chook poop to deal with. It is mostly turned over and mixed with the straw, so it all gets shovelled out when I am applying the mulch.



They do occasionally provide eggs as well and I installed an old grass catcher in the corner of the shed for the chooks to lay in when they feel the need. This most often happens in early spring but we can get eggs at other times of the year. The retired chooks spend most of their time in the retirement village, but do get let out on occasion, generally in a wire pen to assist with bed clearing if required or to take advantage of fallen mulberries under our large mulberry tree in the front yard.

Feeding

Our backbone, go to feed for the chooks are free range layer pellets. I would like to grow and mix our own feed but it isn't practical for us. Having said that, we do produce all the green pick the chooks can eat, either self-harvested in the tractor or harvested by me for the retirement shed chooks. They could be leftover harvest of silver beet or more likely grabbing some edible 'weeds' growing around the yard, and yes we will partake of them too.



We share our silver beet with the chooks!

When the chooks were in their sedentary coop and run we used to also feed them scratch mix, which is a mix of seeds and grain which you can toss around and they pick what they want up off the ground. It made a nice end of the day to see them pecking around for their supper. Unfortunately I continued the tradition when they moved into the tractor/retirement village system, but stopped pretty quickly when the practice resulted in a world class weed infestation in each bed in turn as the tractor moved off it. We don't use scratch mix anymore!



(L to R) chick crumbles, grower pellets, layer pellets. scratch mix

They do get treats. These may be in the form of food scraps, peelings, stale bread or whatever, or pest caterpillars pulled of brassicas or other veggies. I don't think of such actions in terms of pest control, but rather harvesting chook treats! They also get chilled

fruit, like grapes or watermelon on the hot summer afternoons to try and make things more comfortable for them.

Companionship

One of the unexpected benefits of the chooks has been companionship while working in the back yard. Some years ago the family and I went to Belgium for Christmas to meet and spend some time with my son-in-law's parents, but I was going on frequent flier points so I left three days later. We were going for over a month so I had taken the chooks over to a friend's place to be looked after while we were away. I was amazed how 'dead' the backyard felt without the chooks being there, and the companionship they brought, just by their presence in the back yard!

Conclusion



Our journey with chooks has been interesting and certainly beneficial in all sorts of ways which I did not consider when we first got them. We have learned a lot too, sometimes through training (I did chooks as part of the Farm Tech certificate back in the late '80s), through reading and through just plain experience. I now have the happy opportunity of running chook workshops for local councils, so I get to share some of what we have learned. I have also had the pleasure of seeing friends who resisted getting chooks, finally getting them and finding out what a joy they are. So my advice to you if you are considering chooks is go for it! (but do some homework first!)

4.2.4 Chook Tunnels at the Choko Tree

While putting together my recent article on chook tunnels, it caused me to think about whether I could include them in the set up for the retirement village, even though things had not been designed that way originally. Most of the ideas I came up with would require considerable engineering to implement, so I had not really done anything to date.

I was disappointed that I had not left enough space between the fence and the back of the compost bays (it is only about 11cm to 12cm) for chooks to pass. So, one idea involved the building of a chook ramp up one side of the compost bays, a chook walkway along the rear of the top of said bays, then another ramp on the other end to allow chooks to walk down the other side to access vegetation and soil for dust bathing on the other side.



The original design

Then I came up with the idea of using some moveable fencing panels that I have floating around to provide a thoroughfare for chooks from the front door of the shed, along the front and around the western side of the shed where there was a protected space between the western wall of the shed and eastern side of the compost bins. The area has a lush growth of grass and chook friendly weeds so I thought that would allow them to live their best chookie lives!



I put it together so that they could come out the front door and then move easily around to the side of the shed. Initially it was only our newest arrival from my daughter Angie's place (man, that is one bossy chook!) which made her way slowly out of the door and then through to the main area. The other chooks just watched her through the perforated shed panels. I attempted (unsuccessfully) to encourage the other chooks to join her so I just placed some chickweed outside the door and withdrew to see what would happen. Eventually the other two followed her and all three seemed to be having a fun time and also did not seem to show any interest in escaping. While the old Australorp seemed to resolutely remained in the retirement village, I think that she has come the conclusion she is too old for 'adventures'.



She eventually joined them and now they all hang out together outside

The three ISA browns seemed happy enough to peck and dig around, slip back into the shed for some water or pellets, then wander back out and for more pecking and digging.
I just let them do their thing, checking on them every so often to make sure all was well, until while doing a head check a few hours later I came up a head short! Angie's' chook was nowhere to be seen, so I quickly scouted everywhere in the back yard and came up chookless. I headed towards the greenhouse and was just in time to note said chook poking her nose out from behind the compost bays on the other side from where the shed is. It appears that I had left enough space between the shed and the compost bays to allow an adventurous chook or two to sneak through!



It seems chooks can sneak through behind the compost bays!

I am continuing to keep and intermittent eye on them and it will be interesting to see if Angie's chook (Dora the Explorer) will go back behind the compost bays when it is time to lock up for the night, or if I will have to relocate her manually. Nope! Dora came back by herself within an hour or so!



Who said chooks couldn't use the area behind the compost bays as a highway?

After a couple of days all of the chooks, including the Australorp were happy to come out and spend time in the area outside the retirement village. Dora proved to be much more cheeky than I thought and found several loopholes in the defences and got free to raise havoc. She was able to fly up onto the side of the compost bins, so I had to install some timber on the side of the shed, and then placed a couple of new wire panels on top, to completely enclose that area which put a crimp on her escape plans. Over time I have discovered all of her exit areas and built them up to prevent escape.



New design



and the other end

The chooks have now been making use of their new freedom for almost two months, and are loving it. Of course, the lush green areas have been picked over pretty well. All of the chooks now seem to like spending time at the rear of the compost bays just hiding out and gossiping. They all like going to the area near the greenhouse too, which has also become denuded of vegetation as well.

One thing that has come up is that I can toss grass and weeds into the area in front of the retirement village for the chooks to dig through without having to worry about seeds or runners being transferred to the veggie patches. The chooks are happy to peck them over and eat any bits that take their fancy.



I go out and shut the door at night once the chooks have gone to bed and then let them out again after I have collected the eggs in the morning.

It has been pretty dry here with very little rain since I put the chook tunnels together, so there is little growing in the outside areas at the moment. Hopefully we will get some rain soon and maybe some new growth for the chooks to slaughter.

5.0 Permaculture Tools and Techniques

5.1 Introduction

Permaculture is not just gardening, but a way of living, and there are a whole stack of tools and techniques out there to help you achieve it. Here are some that I have found useful over the years.

5.2 Making and Using a Sun Sight

One of the fun things with designing your own, or somebody else's, permaculture garden (particularly if you haven't been there very long) is knowing where the shade from existing structures and plants (such as trees) will fall throughout the year. There is nothing like going to a lot of trouble putting in a planting in mid-summer sun to find it is actually in shade most of the rest of the year. Well, worry no more! Following is how to make and use a valuable tool with which you can work out where shade will fall anywhere at any time of year.

Making the Sun Sight

The sun sight itself can be easily and cheaply put together with a drinking straw, protractor, length of string and a small weight but it can be put together more durably the way I did it. My way will cost a bit more, depending on what bits and pieces you have hanging around, but the end product will give you years of service. To use the sun sight to identify shady areas you will also need a compass and a **sun position map** for your latitude, but more on that later.



The idea is simple enough, first get hold of a protractor, the bigger the better but whatever you have will do. If you are going by the cheapie method, tape a drinking straw along the flat side of the protractor, then insert some string or cotton through the hole in the centre of the long side of the protractor and tie it off. Then to the other end of the string tie a small weight such as a nut (nut-and-bolt type nut) or fishing sinker etc. You are now ready to go! But before we get too far into the mechanics of using the tool, here is how to make the sturdier model like I did.



Get hold of the largest protractor you can, in most of the school type of geometry sets the protractor is only 10cm long on the flat side, but I was able to get hold of a larger one that was 15cm long and that became the base for my sun sight. Rather than use a somewhat fragile drinking straw I had some 10mm diameter aluminium tube from a previous project and cut a length of 17cm long so that the tube would overhang 1cm each end of the protractor (no real reason for the overhang, I just liked the look of it!)



I bought a couple of P type cable clips from the local hardware to attach the tube to the protractor. While the protractor was a decent size it was still only made of thin plastic so to reinforce it I made a tracing of it on some 6mm three-ply plywood board and then cut it out with my small band saw, or you could use a fret saw. To hold it all together I drilled a 3/16” hole towards each end of the flat side of the protractor through both the protractor and the backing board, while holding the P clips in place around the tube and against the backing board. Sounds exhausting doesn’t it?



It is a bit easier to do than it sounds but the whole idea is to make sure that when the whole thing is bolted together, the tube is exactly parallel to the straight side of the protractor. With the holes drilled through the protractor and the backing board I used two 3/16 x 10mm (!!!) mushroom head bolts to put the thing together.

There is a small hole in the dead centre of the long side of the protractor, I used this hole and drilled through the backing board as well I then I threaded some string through the hole from the protractor site and tied it off on the backing board side with a large knot to prevent it pulling back through. I looked around for a weight to tie onto the other end of the string, to keep it vertical and while I couldn't find any sinkers I did find a small bearing that has been hanging around for a long time, so it got the job.

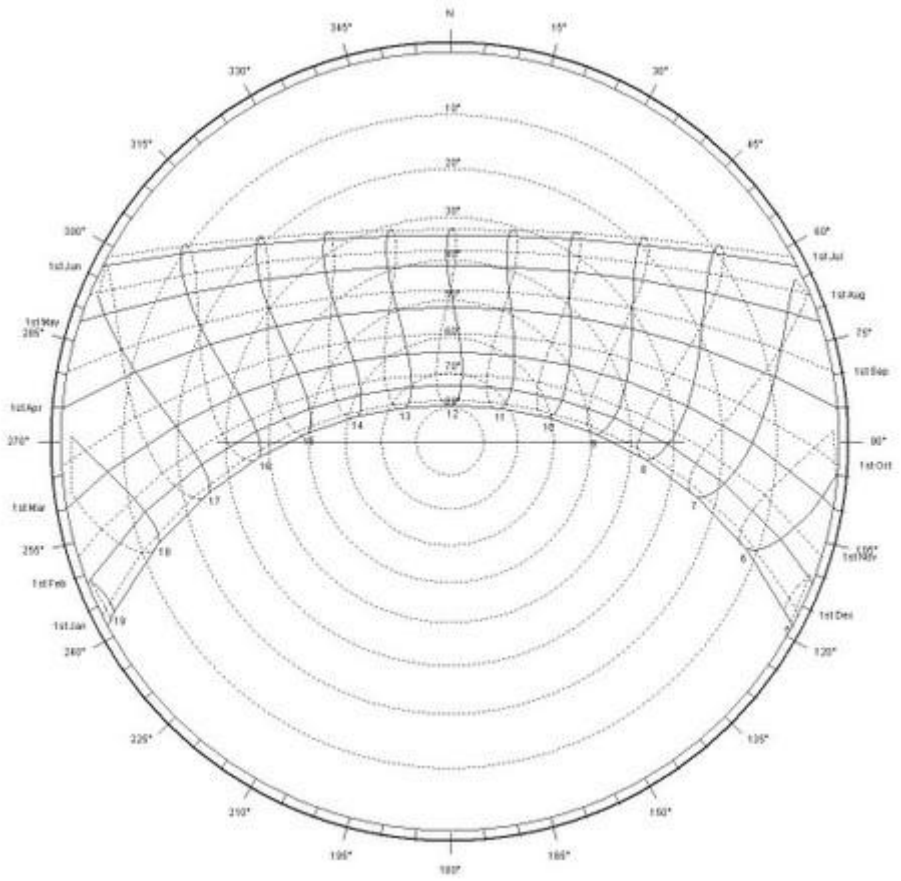


Tying off the bearing to the free end of the string completed the sun sight.



Using the Sun Sight

Head outside with your sun sight, compass and sun path map (I laminated mine to make it more durable) and find an area you want to check for shading. If you are checking veggie patches and the like you might need to get down low to be absolutely sure. With your compass, find magnetic north then find solar north by adding or subtracting the magnetic variation for your area, then face solar north. This **website** will help you there.

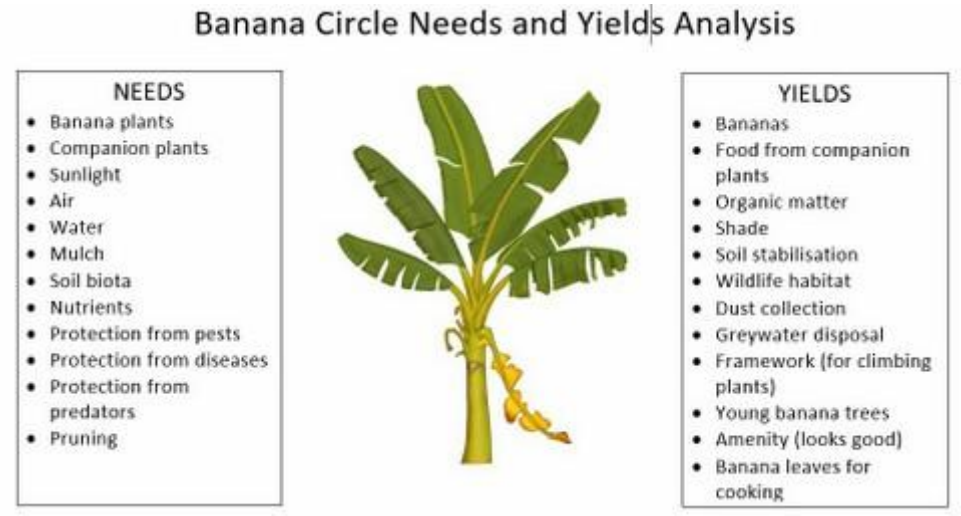


Get hold of your sun position map and locate the sun arc line for the date you are interested in, let's say it is first of July, it is nice and close to the shortest day when the sun will be at its lowest angle and shadows will be at their longest. According to my sun path map at midday on July first the sun will be around 33^{o} above the horizon here in Sydney. Hold the sun sight up with the tube facing solar north and with the string hanging down from the protractor, tilt the protractor up at an angle of 33^{o} from the horizontal, which will read as 57^{o} on the protractor (90^{o} - 33^{o} = 57^{o}).

Now, look through the tube. Any object blocking your view (house, shed, tree, etc) will be shading the area where you are standing on the first of June. If tree branches are the cause of the shade they may be able to be removed. Repeat this process for several angles east and west of solar north so that you will have a good idea if there are any objects which may shade the area where you are standing over the sun's arc.

This process can be used to identify shade sources in any area for any time of year, and if the shade is a problem that can't be moved (due to existing buildings etc.) you can locate your growing or solar charging areas in a more sun-soaked area.

5.3 Conducting a Needs and Yields Analysis



One of the handy things about permaculture is the number of tools developed by practitioners to help you set up systems efficiently to provide for your needs. One of those tools is, as the title of this article suggests, the Needs & Yields Analysis. The funny thing is you don't see much about it in the permaculture books, just a paragraph here and there. Certainly Danielle and I cover it in the Permaculture Design Course we teach but there is not really much about it even on the net. So I thought I would throw in my experience with what is a very valuable design tool.

However, first it is worth talking about two other concepts in permaculture design with exploring called functions and elements.

A function is what you want your design to deliver when it is in place. Examples might be – Vegetable based foods, Animal based Foods, Social space, Craft, Cooking, Heating & lighting, Water supply, Hygiene, Employment and/or Habitat/biodiversity.

An *element* is what you put in place to achieve the functions you plan for in your design. So in terms of achieving the vegetable-based food production function referred to above, the elements to be put in place might be veggie beds, a vertical garden, banana circle or productive water garden.

A good design philosophy (or permaculture principle) to ensure there is some resiliency in your design is to ensure that each element performs more than one function and each function is supported by more than one element. For example, the water tank put in to store rainwater (its primary reason for being) will also –

- provide a vertical growing space for climb fruit and veg,
- provide thermal mass that modifies a microclimate to allow productive plants to be grown out of season, and
- provide shade for an external wall, reducing solar heat gain of a structure in summer.

With resiliency in the system if one element fails to deliver its function, others can take over so that you are not totally at a loss for that particular function.

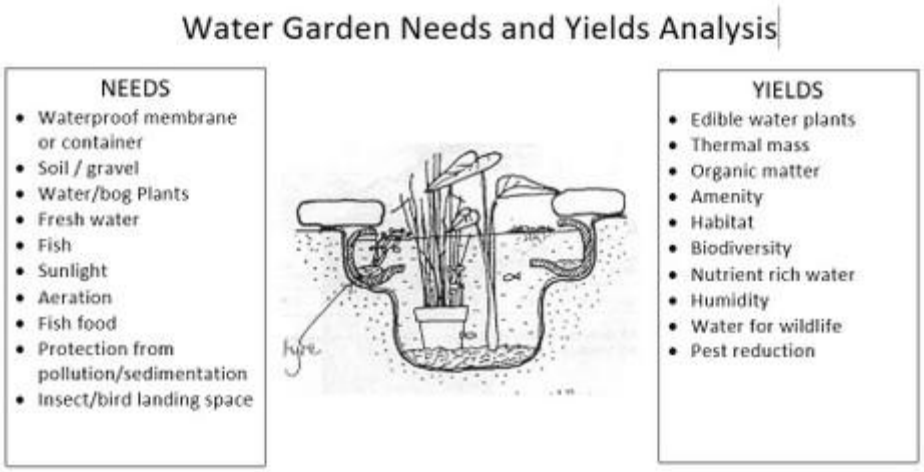
To make the most of this effect we need to understand the connections between the various elements within and between each function, and to understand the connections between the various elements we can use the Needs and Yields Analysis.

Conducting a Needs and yields Analysis

To conduct this properly it would be good to have a comprehensive listing of functions and elements for your design. It might not even be a formal design, it could just be a list in your head of things you want from your house, yard etc and what you are going to do to achieve them.

If you have a fair idea of the elements you are looking at putting in, write them down as a list and then conduct an analysis on each one.

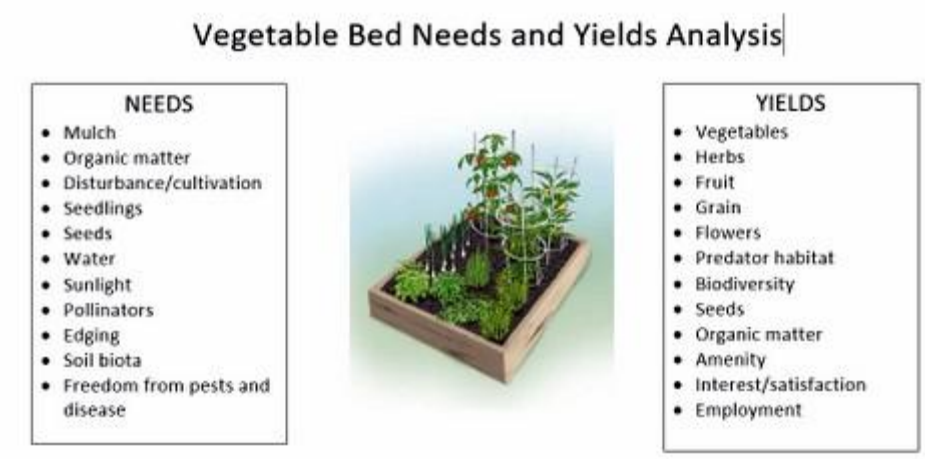
For each element, make a list of the things it needs to be productive, to satisfy the function for which it was installed. To get the best result out the analysis, you need to be creative and not just go for the obvious. For example if we are talking about a productive water garden, it would need a liner or container of some description, soil, water, plants and fish to keep down the mosquitoes – but it could also need aeration (natural or created), protection from pollution or sedimentation and a place where insects and birds can access the water without risk of drowning.



So now you have a list of needs which your element (in this case water garden) requires to be satisfied if it is to be productive. It will also have yields or things it gives back to you which you need to identify and write down, again, being as creative as you can. For our hypothetical water garden you want to get back something edible from your water plants and also you want it to be nice to look at. Other less obvious yields are microclimate effects from the thermal mass of the water, nutrient rich water which can be used to fertilise plants and improved biodiversity in your yard due to the availability of water which will attract new species.

Over time, sit down and look closely at all the proposed elements for you design and go through the needs and yields process with each one. In and of itself, a needs and yields analysis is valuable in demonstrating what you need to provide for each element before it is put into place and gives you a good idea what you can expect to gain from each element

after it is in and working. However, the real value of the process is in using your completed needs and yields analyses to uncover and map connections between the elements.
A way of putting your analyses into a format which will make analysis easier is to type or write out your two lists (one for needs, one for yields) with a couple of words in each entry. Put the needs list on the right hand side of an A4 sheet of paper, yields on the left hand side and then a picture of the element being analysed in the middle. You can fit 2 or 3 complete analyses on each sheet of paper. Then cut them out so the analyses are on separate "cards".



To look at connections, get hold of a larger piece of paper, butchers' paper would work well, then arrange the analysis cards randomly on it. Look for connections where a need of one element is a yield from another and vice versa. For example a rainwater tank needs the yield of rainwater from a garden shed roof and then provides the rainwater to a water garden. A deciduous fruit tree needs organic matter and mulch which can be provided from a composter, the composter can be fed leaves from the fruit tree as part of the organic matter it requires.

The whole point of this secondary analysis is to –

1. Indicate how elements are connected so that they can be grouped together to make interactions easier.
2. Show how rather than buy in the needs of an element they may be served by the yields of another element or elements.
3. Point out needs which cannot satisfied by the design as it stands, and

4. Demonstrates the possibility for undiscovered yields which could be used to satisfy the needs of elements not yet included in the design.

The Wrong Way

A few years ago some friends put a banana circle in for us, I hadn't put much thought into where it should go so when they turned to put it in I looked around the front yard and picked an area which was free, after virtually no analysis. It turned out to be the wrong place!

From a needs & yields analysis the bananas need –

- Banana plants
- Companion plants
- Sunlight
- Air
- Water
- Mulch
- Soil biota
- Nutrients
- Protection from pests
- Protection from diseases
- Protection from predators
- Pruning

Some of the most important of those needs are sunlight, water and nutrients. Where I had located the banana circle it was shaded by other trees, the soil was quite poor and there was no easy access to water. We piled organic matter into the centre of the circle but it became so dry that it took forever to break down. It had always been my intention to run the greywater (which exits from the other side of the house) via a pump out to the banana circle but it never happened. The banana circle was also hidden by the other trees so didn't get looked at as often as it should have. All of this meant that in over 5 years of growing banana trees there were no bananas!



After careful analysis I decided to move the banana circle to an open space in the backyard (I had to remove and old scabby lemonade tree first). With everything cleared a shallow depression was dug and the soil mounded up, more well drained soil was also heaped up to make a higher mound after being mixed with added nutrients (chook poo from the chooks and wood ash from the fire). The greywater output from our spa bath was run into the central depression to provide water automatically every time we took a shower. The bananas were planted and mulched as well as having some companion plants added (nasturtiums and sweet potato) to act as ground cover around the bananas.



The effect has been that the banana trees that are thicker, leafier and healthier after 5 months in their new position than they were in 5 years in the other location. The organic material in the centre stays moist and is breaking down quickly and the hot dry weather we have had lately has had no adverse effects on the bananas now that their roots are into the cool, moist central depression. A harvest of bananas themselves are only a matter of time, but we also can look out the kitchen window and see them waving in the breeze looking lovely and tropical. I'm happy now but if I had done the analysis 5 years earlier……..
Other data including example Needs and Yields analyses can be found **here**

5.4 Designing a Guild

5.4.1 Introduction & Plant Functions

One of the differences between a permaculture approach to growing food and other "organic" growing regimes is the practice of growing productive plants together in a

mutually beneficial arrangement called a guild. This is how the term “guild” is defined by Bill Mollison Co-developer of the permaculture system –

A Guild is a harmonious assembly of species clustered around a central element (plant or animal) that acts in relation to this element to assist its health, aid our work in management, or buffer adverse environmental effects (Mollison).

Other people also have written about guilds over the years, in her book “The Wilderness Garden” Jackie French also refers to guilds but calls them “groves” instead.



Why Grow Using Guilds

There are a number of reasons why it is a good idea to grow using guilds, these include - Nature does some of the work – in a correctly designed guild, plants work together to improve the health and productivity of the entire guild, this means work which would normally have to be done by a gardener or farmer is done or encourage by the plants themselves.

Improved pollination – Rather than leaving pollination to chance, a guild is designed to be insect and/or bird pollinator friendly by providing food and a suitable habitat. This means they are attracted into the guild and then hang around, improving the pollination rates and hence productivity of your fruiting species.

Greater productivity – Due to the mutual reinforcement or synergy of plants within the guild, the productivity of the space is increased. This is not only due to the presence of pollinators but also the presence of plant pest predators and plants which provide mulch and improve soil fertility.

Greater variety of food from a given space – The common wisdom says don't grow anything (especially grass!) under fruit trees, but in reality if you plant other beneficial species it will not only be better for the tree, but it will make the whole area more productive as well.

Reduced chemical usage – If you are working with nature there is no need for chemical fertilisers, which can pollute groundwater or pesticides which kill bees and other beneficial organisms as well as the target bugs. Let's face it, if you want to eat fruit and veg contaminated with pesticides, you may as well buy the commercially produced stuff!

Improved biodiversity – rather than just lawn and a fruit tree, you get a variety of plants and in turn a variety of insects, birds, lizards, spiders etc. All of a sudden you are developing a whole ecosystem where one did not exist before and you will have lots of interesting things happening in your garden.

More resilient way to grow – If you grow one crop (fruit) and you get a failure, say due to lack of pollinators resulting in no fruit, you have to wait until the same time next year to get a harvest (assuming you've fixed the problem). With a variety of plants you are almost guaranteed to get a yield of some description regardless of growing conditions.

Types of Guild

There are three types of guilds which you can design -

- **Community function guild** – In this type of guild there is a grouping of species which do a specific job or fill a specific niche and are grown together for example insectary plants, nitrogen fixers or medicinal or culinary herbs.
- **Resource partitioning guild** – where several species share resources through niche differentiation eg taproots with shallow rooted species or species which produce early in the season then die back to allow later varieties/types to produce without competition.
- **Mutual support guild** – This is the classic guild where complementary species are planted together and support each other. It is this type of guild which is the focus of this article.

Plant Jobs/functions Within a Guild



The plants which we design into our guilds perform a number of functions or “jobs” within the guild. There are 8 types of jobs and while some plants may only perform one job, many will perform multiple jobs and some, like comfrey, may perform up to six different roles at once.

1. Feeders

These are plants which feed us and/or our animals, they may be the central element of the guild in the form of a full sized fruit or nut tree or they may be a smaller fruiting species out from the central element. This group is also comprised of perennial and annual vegetables, herbs and edible flowers.

Examples of plants which could be used as the central element include citrus, pome, stone or tropical fruit trees but may just as easily be a nut tree such as macadamia, walnut, almond, hazelnut or pecan. Other trees which might find use for the central element include trees with edible leaves such as the curry leaf tree, kaffir lime tree or the bay leaf tree.

Other edible trees or bushes outside the central element include dwarf versions of above fruit or nut trees, berry bushes/canes such as blueberry, blackberry, youngberry or gooseberry. This list of annual vegetables is long and most will find a place in a guild, just bear in mind that the more effort required to get an annual vegetable to grow and yield, the easier it needs to be for you to be able to get at it so locate it near the edge of the guild.

Don’t forget perennial vegetables such as the choko, globe artichoke, Jerusalem artichoke, perennial spinach, dandelion and chicory. In particular, leaf crops can do very well in the more shady parts of the guild. Culinary and medicinal herbs such as lemongrass, rosemary, sage, dill, thyme, and oregano also fit into this group.

Last but not least there are a host of edible flowers including Nasturtiums, marigold, lavender, English daisy, tuberous begonias, daylily, pinks (dianthus) and violas. These can be integrated into your guild to provide food, colour and attract beneficial insects.

2. Fertilisers

There are two types of plants which can improve the fertility of the soil – nitrogen fixers (legumes) which support nitrogen fixing bacteria in nodules in their roots. Such plants include dwarf and climbing Peas, dwarf and climbing beans, broad beans, clover (red, white, subterranean), lucerne, medic, lupins, fenugreek, mung bean, cow pea, peanut, vetch,

wattles, Australian indigo, chick pea and lab lab bean. When the plant dies the nitrogen accumulated during the life of the plant becomes available for the use of other plants.

The second type of fertilising plants are dynamic accumulators, which use long taproots to access nutrients which are out of reach of more shallow rooted species. They accumulate these nutrients in their leaves which can be cut as mulch or the plant left to complete its life cycle and release the nutrients when it dies. Nutrients can also be extracted from the leaves using a tube and weight, then applied to other plants as a diluted nutrient “tea”.



Dynamic accumulators include borage, stinging nettle, comfrey, broad-leafed dock, horsetail, fat hen, parsley, plantains, yarrow and salad burnet.

3. Diggers

(or as an ex-army friend of mine would rather have them – Miners) - These plants help to break up the soil and make it more friable, improving water penetration, soil aeration and drainage. Generally they are root crops and plants with deep root systems, examples include Potatoes, daikon radish, sweet potatoes, cassava, yams, arrowroot, beets, turnips, trees & bushes and dynamic accumulators such as dandelion, comfrey and chicory.

4. Mulchers

There are really three classes of plants which fit into this category: mulchers pure and simple, groundcovers and green manures. Mulchers produce large amounts of soft leaves which can be cut and left on the soil (chop and drop) to break down forming a mulch and releasing nutrients. Groundcovers, form a living mulch which protects the soil by growing a barrier of plant material between the soil and the sun, wind and rain. Green manures are allowed to grow until before the point of flowering then slashed to provide plant material which can be used as mulch or dug in to break down and provide increased fertility that way.

Examples of mulchers include comfrey, artichokes, rhubarb, nasturtiums, plantain (major), dock, deciduous fruit trees, beans, burdock, mallow, tagasaste, and warrigal greens. Examples of green manure crops – clovers, barley, beets, buckwheat, mustard, rocket, millet, purslane, turnip, wheat, basil and dill. Examples of ground cover plants include pumpkin, squash, strawberries, clover, sweet potato, creeping thyme, mint, creeping rosemary.

5. Climbers

Climbers increase productivity by using vertical space to produce food and other products while maximizing horizontal space. They can be grown up structures like sheds, houses or pergolas or they can be grown up mature trees or other plants with the job of supporter. They also can provide shade for shade loving species and to reduce the effect of the hot summer sun. Vigorous climbers can be trimmed back to provide organic material for mulch. Examples of productive climbers include (Perennial species) choko, passionfruit, kiwifruit,

hops, sweet potato, scarlet runner beans and jasmine, (Annual species) cucumber, climbing beans and climbing peas.

6. Supporters

The plants provide a framework which allows climbers to make use of their vertical space while being productive in themselves. They can also be used to shade spaces within the guild. Examples of plants which act as supporters include Sunflower, Jerusalem artichoke, sweet corn, dent corn, fruit and nut trees, shrubs and bushes.

7. Protectors

Plants may protect each other from pest attack, disease or competition by a variety of strategies. One strategy is used by pest confusers these plants are highly aromatic and confuse a pest's sense of smell, making it more difficult to identify target plants. Examples of pest confusers include basil, chamomile, coriander, dill, fennel, garlic, horehound, lavender, marigolds, mustard, nasturtiums, onions, pennyroyal, rue, tansy, wormwood and yarrow. Others are called competition barriers and these plants can be planted around beneficial species to prevent competition from grass, weeds or other invasive plants. Examples of competition barriers include daffodils, comfrey and perennial alliums (garlic chives, wild leek or Egyptian onions) which are planted in a circle around the central element to prevent competition from grasses.

8. Attractors

These plants are used for their ability to attract beneficial species into the guild. They may be predator attractors which attract beneficial insects or birds which will predate the pest insect species that cause damage to plants within the guild. They may attract pollinators (insects, birds, microbats etc.) which will provide pollination services to the plants within the guild, ensuring a good yield. Plants which attract pollinating and/or predatory insects include alyssum, bergamot, calendula, chicory, cosmos, gypsophila, heartsease, lavender, lupins, marguerite daisy, nasturtium, Queen Anne's lace, yarrow, zinnia. Grevilleas, banksias and melaleucas and the above-mentioned insect attracting flowers will also attract insect eating and pollinating birds if they are in your area.

5.4.2 Plants and their Positioning

Assessing the Site

Before commencing the design of you guild it is worth having a look at your site, because this may impact what plants you can have, how many plants to can introduce and where they will be situated. Grab a compass, pen and paper, camera and a shovel, then head on out! Following are some points to think about while you do your assessment.

Access – how easy is it to get to the site of your proposed guild? The easier it is the more likely it is you will visit to check on how things are going, water, weed etc. If it is right near you back door you could plant almost anything but if it is down the paddock a way you may want to consider putting in more hardy plants that will be able to cope with benign neglect.

Shade from all sources – That is to say shade from existing plants and buildings, fences as well as the shade from the plants you are going to be using in your guild. Remember that fruiting plants require the most sun, leaf crops can get away with the least and root crops are somewhere in between.

Soil texture, pH, drainage – an understanding of what your soil is like will inform your design ideas. Once you understand your soil characteristics you can either –

- Ensure the plants you put into your guild will get the most out of your soil, or at least be able to cope with it, or
- Work out what you have to do to amend your soil so that it will grow the plants you want to include in your guild.

Aspect – in other words, which way does the site face? Best of all is a northerly to north easterly aspect, this will ensure the maximum sunlight. Something other than this does not mean you should not develop the area but it can inform your plant choices.

Existing plantings – these may have a significant impact on your guild plans. Particularly if the best place for your guild is smack in the middle of your wife's best flower bed (don't

ask). A clear area away from existing plantings will give you a clean slate to start from scratch with. Otherwise note what is already there and change your plans accordingly. Eg if you wish to put your guild in the middle of a stand of tall trees, not only will they compete with your guild for light, but also for soil nutrients as well.

Prevailing wind – Wind can be an issue by drying out the soil and the plants and also by causing physical damage to the plants as well. When assessing the site consider the need for a windbreak to protect the guild while it is establishing.

Water – you need to be able to get water to your plants easily, particularly while establishing the guild so review your options. Ensure that there is easy access to water so that the area can be irrigated when required.

Choosing the Right Plants

The list of plants that may find their way into a guild is almost endless, there is a list of plants I have compiled along with their jobs in a guild and other data available here. Below you will find some hints and things to think about when putting together a plant list for your guild.

- **Time of the year it is productive or active** – for example, flowering plants are used to attract pollinators and predators but they need to be in bloom to do it. So how long will your chosen plants flower for? Set things up so that something is in bloom all year round. Developing your own blossom calendar can help you do that.

- **Annual or perennial** – will your plants complete their lifecycle within a 12 month period and so require replanting every year or are they perennial? Perennials can be left to their own devices for a number of years before they require replacement and hence reduce the load on the gardener, but

- **If you are growing annuals do they freely self-seed**? Self-seeding annuals may naturalise in your guild, growing each year from seed dispersed by the plant the previous year. This can be a good thing but self-seeding annuals do have a potential to become weeds if you don't keep an eye on them.

- **Ease of establishment** – This ties in with how far from your house the guild is. If the plants are hardy and establish easily they will require less intervention that if they roll over and cark it on the first hot/cold/wet/windy day.

- **Self-fertility and cross pollination** – are the fruiting plants you are growing self-fertile or do they require a compatible variety for cross pollination like most apples do. If they do require a compatible variety this will need to be factored into your planning.

- **Dioecious plants** – some fruiting plants, like kiwi fruit, have separate male and female plants so you need to plant the right sexes in the right ratios to make sure you get fruit.

- **Chill hours and Length of growing season** – again, these are issues around fruiting plants. Some plants from cold climates such as stone fruit require a certain amount of hours below a certain temperature to produce fruit. Likewise, some tropical fruit require a long growing season to produce fruit. A bit of research on these topics will assist your planning and prevent the disappointment of nurturing a fruit tree to maturity that will never produce fruit in your area.

- **Pest or disease issues** – If a plant has specific pest or disease issues in your area it is handy to know this beforehand. In the worst case you may decide not to go with a plant which has intractable pest or disease problems. Around here our issue is the Queensland Fruit Fly, not just for tree fruits but also for fruiting vegetables such as tomatoes, chillies and capsicums.

Positioning your plants

Once you have chosen your plants it is a good idea to work out (at least roughly) where in the guild you want to grow them for the best effect. There will probably be a bit of back and forth while you work things out and some plants may be discarded in favour of others or even discarded altogether if you can't work out a place for them. While you are working where you want your plants to go, here are some points to ponder –

Consider the size of the mature plant, horizontally and vertically – This can be a difficult one because it is really easy to look at the plant in the 100mm pot and think "I can fit a stack of these in!" Allow enough space for the plants to get to full size without too much crowding, both horizontally to prevent them crowding the plants around them and vertically to take into account the amount of shade they are going cast when mature.

Potential for root competition – This is just about being aware of the type of root system that your plants have, and mixing them up, tap roots with fibrous root systems, deep rooted with shallow rooted species. This means that you don't get too many of the same type of plants together, competing for nutrients at the one level in the soil.

Any possible incompatibilities

Potential for other incompatibilities - 80% of plant species coexist without a problem and 10 - 15% show positive interaction, like say nitrogen fixers with leaf crops, but 5% of species show antagonistic behaviour towards other species. An example of this is alliums (the onion tribe) and legumes. Legumes have a symbiotic relationship with nitrogen fixing bacteria in nodules on their roots, but alliums exhibit antibacterial effects which can work against this relationship if they are planted too close.

Ease of accessibility – If you are planting annuals which will require replanting, leaf crops which require regular harvest or a delicate crop with requires watering and fertilising regularly, these will require easier access than hardy perennials. Make sure they are planted towards the outside of the guild or near a pathway through the guild so that they can be accessed easily, without disturbing other species in the guild.

Access to sunlight – many plants require full sunlight for at least 6 hours per day, certainly fruiting species do where you expect to harvest the fruit. Leaf crops can do with much less direct sunlight and may even prove more succulent and with a milder flavour when planted in a shadier area. Root crops require something in between. If you get your plant relationships right within the guild the tender plants get the shade they need and the fruiting plants get the sun. This is less of an issue here in Aus than the UK or US, we get plenty of sun, for some plants too much!

Exercise

If you want to have a bit of a go designing up a guild from scratch, you can download the guild design blank and plant list from **here**. Then grab yourself a pencil and Design a guild within the given space using up to 10 compatible plant species, filling as many "jobs" as you can. This is great thing to do if you have friends or family who are also interested in guild. Let them all have a go then discuss your various guilds and the decisions which lead to them amongst each other. It can be a really interesting way to learn.

5.5 Testing Your Site for Herbicides

One of the concerns that I have when growing our own food is the high (and increasing) use of glyphosate (Roundup®) and other herbicides around us. I do wonder when I buy soil, sand, woodchips, wheat straw, sugar cane mulch or other 'amendments' for use in my garden (as one must occasionally do in suburbia) whether there is any contamination of these things. Am I setting myself up to fail by buying these materials from the local landscape supplier or, dare I say it, Bunnings? All because of undeclared or possibly even unknown herbicide contamination?



Also, when you are moving onto a new (particularly suburban) property, has the previous owner been a liberal applier of herbicides? Even if it is just around the fences or perhaps outsides of the buildings, how would you know?

Well, it turns out that there is a cheap, easy and simple technique to find out if the materials you are buying or your soil is contaminated, and you probably have the gear to do it already in your shed.

The technique is called 'bioassay' which is defined as "……. an analytical method to determine the concentration or potency of a substance by its effect on living animals or plants (in vivo), or on living cells or tissues (in vitro)." At least according to Wikipedia.

Techniques

The basic idea is to pick a plant which is sensitive to the particular material (in this case herbicide) you want to test for and expose its seeds to the potentially contaminated soil or other materials in a controlled manner, while also setting up a blank to reduce the likelihood of spurious results. In this case there are two basic techniques. One is used when the seeds can be planted directly into the material to be tested (eg soil, potting mix or compost), and the other technique is used when the material to be tested does not generally have seeds directly planted into it (eg wood chips, gravel, straw, hay or sugarcane mulch).

Planting technique

Take a representative sample of the soil or material to be analysed and fill a punnet with some of it.

- Take potting mix or other planting material known to be free of herbicide and place into another punnet for use as a control.
- Sow both punnets with appropriate viable seeds from the same source and place in a well lit area.
- Water all punnets with the same water source, as appropriate to keep the seeds damp.

- Observe seedlings as they emerge and note any differences, provide water as required.
- Continue the observations until the four leaf stage, preferably two or three weeks at least.
- Note any differences between the test and control seedlings.

Extraction technique

Take samples of the material to be analysed, soak in a container 1:1 with tap or tank water by volume (roughly no need to be too pedantic) soak for several hours.

- Fill two punnets with damp growing medium such as seed raising mix and sow both with appropriate viable seed.
- Pour off the water from the material being extracted, strain to remove solids if required.
- Water one (marked) punnet with extracted solution and the other with tap or tank water, from the same source as the water used for extracting the material to be tested as a control.
- Observe seedlings as they emerge and note any differences, providing water as required.
- Continue the observations until the four leaf stage, preferably two or three weeks at least.
- Note any final differences between the test and control seedlings.

The canary in the mine

The above step by step process for both techniques gives you a bare bones idea of how the analysis works. One issue is to work out which seed to use as the indicator species. I have seen it recommended that any fast growing seed can be used. However, depending on the species' sensitivity to the particular herbicide being tested for, there may be a false negative where you think everything is OK but your veggies still suffer.



Fortunately, from the reading I have done, there appears to be a readily available vegetable which is rated as either ‘severely sensitive’ or ‘extremely sensitive’ to a number of commonly used herbicides: the tomato! The cucumber is up there as well, but the tomato seems the most popular. Herbicides that tomatoes are listed as being sensitive to include – glyphosate, Paraquat, sulfonylureas and imidazolinones (eg metsulfuron, sulfosulfuron, imazapyr, imazapic), atrazine, and synthetic auxins like Dicamba, 2,4-D, aminopyralid, clopyralid and picloram.

What to look for

In general terms, symptoms of residual herbicide damage include: stunting, yellowing of plants generally, or particularly of new leaves, and/or twisted and malformed new shoots. The main thing is to identify any differences between the test plants and the control.
If there are no observable differences between the test and control punnets, then you will be right to go with the material you have tested.

My example

I wanted to get some gravel from my daughters' place (which they were going to get rid of anyway) to go into a frog hotel. My concern was that, because they had only been there a comparatively short time and I could see the gravel would be an obvious place to use a herbicide to keep grass out of, it could be contaminated with glyphosate or similar by the previous owners. Thus it could cause harm to my prospective frog tenants.



Day Zero

I picked a bucket of gravel from various areas and brought it home, then soaked 3 litres of the gravel in 3 litres of tank water for two hours. I then decanted the gravel water into a bottle. I filled a couple of punnets with my own seed raising mix and sowed tomato seeds ('Moneymaker' variety for those interested) and set the punnets up side by side in the greenhouse in separate containers. I labelled each punnet and proceeded to keep them watered with either tank water or gravel water for two weeks. The tomato plants treated with gravel water have reached the four leaf stage well and truly without any evidence of yellowing or stunting. If anything, they seem a bit happier than the control seedlings!



Day 21

While I will leave them to grow and continue the test, I have concluded that there is unlikely to be any glyphosate risk to froggies wishing to check into my hotel.



Much later

But, What if?

A ‘no contamination’ result is good, but what happens if your test shows up that there is herbicide contamination of whatever you are testing?

One action could be to not use the material which you have bought in, hopefully you only got a small amount so that won’t be a problem. Or send it back to the supplier, or leave it out in the weather for 6 months or a year for the herbicide to break down or leach out. Hopefully it is not a really persistent herbicide like aminopyralid, clopyralid or picloram which can even survive commercial composting. If in doubt, conduct another bioassay after a reasonable time period, just to be sure.

What if you have found that your soil is contaminated with a herbicide? In most probability it will be glyphosate (Roundup®) because of its popularity. What can you do rather than dig up all your topsoil, take it away to be dumped somewhere, then pay to replace it?
Well, now that you asked….

When I was reviewing articles on the net to help with my knowledge of the wonderful glyphosate and what it does, I came across a very well researched and detailed post on the ‘Deep Green Permaculture’ website (link below). Readers digest version – raising pH and providing calcium or magnesium ions (by say, adding garden lime, calcium carbonate) to bind it will considerably reduce the effectiveness of glyphosate. As usual, the whole story is somewhat more complicated. The whole article is well worth a read for the background information about what glyphosate is and what it does alone.

https://deepgreenpermaculture.com/2021/04/21/how-to-neutralise-glyphosate-roundup-herbicide-contamination-in-soil/

5.6 Don’t Forget Amenity – A Different Kind of Productive

When planning out our garden area, I don’t know about you, but my idea was for our yard to be as productive as possible. The thing is, my understanding of the term “productive” has changed over time.

Initially my understanding of productive was that it should produce fruit, vegetables and herbs which I and my family could use directly. So that my emphasis on planning and construction was things like the veggie beds, chook tractor, herb spiral, the fruit tree circle, banana circle and so on. Such was my level of knowledge. I was mercenary and wanted to be directly compensated for my efforts in the form of food or medicinal herbs or even cotton which we grew but that was it.



As I enquired more into how things worked, and understood the permaculture approach more I came to understand that for a space to be productive did not necessarily mean that the payback was direct. If I installed spaces which were designed to increase biodiversity – support the introduction and maintenance of beneficial insects, birds, bats, reptiles etc. by

providing food, water and nesting/living spaces, these would be productive too, but in a different way.

If I included ways to improve biodiversity in my plan and in my garden then this would reduce the amount of work I had to do and, ironically, also make my garden even more productive. By increasing the numbers of beneficial insects and birds etc. they would assist me by consuming and parasitizing pest insects, thereby reducing their numbers and the damage they did, without work from me! Not only that but pollinator insects and birds would ensure the productivity of my fruit and fruit producing vegetables.



The next round of planning and building focussed on a whole stack of different stuff, like self-watering bird and insect waterers, a bug hotel, insectary garden beds, native bushes and trees which attract birds and insects, and a microbat roost. All of these things were not

directly productive as I originally understood it, but they reduced the amount of work I had to do, which was fine with me!

When I put the garden together to be “productive” there was also another form of productivity I had not taken into account – after all the work I had done on it, the sheer pleasure of being out in the outdoor garden areas to relax. I had not specifically put together areas which could be used to harvest the productivity of the pleasure we get from just being in the garden. So this became the third type of productivity and I started putting these areas into place.

Grassed Area

One area which I had been looking at re-doing was the grassed area under and around the clothesline, to make it more productive. Certainly, during our open days, a number of people over the years had expressed surprise that we actually have grass in the back yard. I have been required to keep some areas free so that we can transport the chook tractor over them, between vegetable growing areas. This was due to the fact that the aforementioned vegetable growing areas were not part of an overall plan but developed over time where they would best fit. So it was sheer luck that I had not come up with anything that made sense to make some of these grassed areas more productive.



The thing was though, we were in that quiet period between the kids moving out to make lives for themselves and grandkids appearing. That period is now over and we have two grandkids (at the moment). While meditating on things I realised that we needed to maintain the back lawn area, for kids/grandkids to play on, so I shelved any plans for those areas. In other words, they were already productive.

Back Deck

The back deck was put in to provide summer shade for the back of the house, but it is also a great area to sit with a coffee or breakfast on a summer morning or to relax and read on a winter's afternoon. Details on how we added the deck are **here.**



The Front Park Area

This is the area under the mulberry tree in the front yard. It has always been nicely shady, but that meant the grass did not grow very well so the area tended to look a bit tacky, but was a nice place to sit and read in the shade. I developed a plan to improve the look of the area and make it productive, form the amenity point of view.



To define the edge, I used the hose to mark out a curvy border to my satisfaction. Then along that line I place a series of bricks (saved from the old fireplace plinth) end to end so that I marked out the edge of our parkland. For the sheer fun of it I used more bricks to run down towards the front yard water tank, leaving a path distinct from the rest of the park area.

Inside my border it was time for the fun stuff! There may not have been much grass and weeds to look at, but there was a surprising amount there when I came to dig them out with the mattock! With the grass and weeds gone, I got in a couple of cubic metres of wood chip and spread it out over entire area. To mark out the path to the water tank as different, I got hold of a couple of bags of red dyed wood chip and used it to fill up the path area.

To make the park area more fun we installed a one piece picnic table sort of thing with benches on each side, as well as a swing for the grand kids. The area also has a couple of bath wicking beds and the (currently disused) strawberry tower.

Other Places

You amenity area does not need to be this ambitious, we also have a bench outside our living room window which has been there for years. It is a nice place to sit on a summer's morning with a book or a coffee and now that the fruit tree circle has grown up, it is a bit more private, but you still get to see the birds, trees and flowers.



So when you ask yourself (and your family) what you want from your garden, make sure part of the answer includes a nice place to sit and enjoy it!

6.0 Some Permie Designs

6.1 Angie and Dez Edible Landscape

6.1.1 The Plan

Aim: to turn a non-productive front yard terrace into a productive edible landscape

Current Situation

The area to be remade is the lower (closer to the street) terrace of the front yard, which currently has a moulded edging a bit over half a metre from the edge. The area marked off by the edging contains a hedge of box plants of which a considerable number are partially or completely dead. There is a rose bush at either end, in the corner. This area is also covered by a decorative mulch of white stones. The open area between the hedge and then brick backing wall is covered by various grasses. The terrace as a northerly aspect.





The Plan for the Area

The area has been broken up into seven sections with section having a development plan and plant list. The sections are –

1. Outer Tree Area
2. Bush Tucker Area
3. The Herb Garden
4. Olive Tree
5. Path areas
6. Perennial vegetable areas
7. Climbers

1. Outer Tree Area

All of the current vegetation is to be removed and put through the mulcher for use elsewhere. The white stone mulch will be removed and reserved for use on the path areas and the soil will be checked and then fortified with whatever animal manures or compost is available. The area will then be replanted with 5 citrus trees of different varieties and with a bay tree in the eastern end and a curry leaf tree (murraya koenigii) at the western end. During the planting a deep pipe watered will be installed on each side of each tree, and then the whole area mulched with wood chips. Beneficial insect attracting species (see plant list 1) will then be planted through the mulch around and between the trees.

The existing edging will be left in place to mark out the space. Access to the water meter must be maintained.

Requirements –
curry tree; bay tree; 5 citrus trees, kaffir lime leaf, lime, orange, lemon, mandarin; Lilly pilly tree
Mulch; Stepping stones; pipe for watering;
Buckwheat, Nasturtium, Mustard

2. The Bush Tucker Guild

This area will cultivated and a lilly pilly tree planted as the central element. The area under the lilly pilly will be mulched with wood chips, a deep pipe waterer will be installed on the eastern and western side of the tree and a buried pipe system installed around the centre of the plot with a watering point on the northern and southern sides of the patch. Other productive native plants can also be planted with the lilly pilly including: midyim berry, pigweed, warrigal greens, native indigo, banksia integrifolia (prostrate) and native violet.
Requirements - no banksia, yes violet and midyum berry, lavender, Mulch woodchips

3. Herb Garden

The area will be cleared and an oval structure built up in two levels using recycled blocks, bricks, pavers or tiles depending on the availability of materials. The base of the structure will about two metres long with the central raised section being a bit less than a metre long. The structure will need to be filled with garden soil or organic mix depending on what is available. The base will have a weeping hose irrigation system installed 50-100mm below the surface. The central raised section will be planted out with a rosemary bush at the apex and the rest of the central area and base planted out with Mediterranean perennial herbs (see plant list 2). The area around the base of the herb garden will be mulched with wood chips but the herb garden will be mulched with shreddings, sugar cane, straw or other available bacterial mulches.

Requirements - Rosemary, Thyme, Basil, oregano, mint?, dill, parsley, chives, lavender
garden soil

Bricks or pavers or tiles
Weeping hose irrigation system

4. Cherry tree

The cherry tree area will be cleared and the cherry tree planted out with a deep pipe waterer on each side, and the area will be mulched with wood chips.

Requirements - Cherry tree; mulch woodchips

5. The Path Area

The path area is to be cleared and then the path contour laid out with rope or hose etc, then the area of the path will be covered by newspaper and edged with bricks, tiles, pavers or whatever material is available. The area of the path will be covered by the white rocks reserved during the removal of the hedge and/or pebbles from around the old pool area. At the eastern end of the path as self-watering bird watered is to be installed.

Requirements - Stepping stones instead of rocks; bird waterer

6. The Perennial Vegetable Area

This area is to be cultivated and a buried pipe waterer installed for the length of the area, with a watering point at each end and one near each of the two central “cul-de-sacs”. The area will then be sheet mulched by putting down newspaper and/or cardboard, hay, straw and compost or organic mix, then planted out with a variety of perennial vegetables (see plant list 3) although annual vegetable may be included.
Requirements - newspaper and cardboard; Long pipe; hay

Plants: Rhubarb, Chicory, Edible hibiscus

7. The Climbing Plant Area

This area will be cultivated and sheet mulched at the same time as the perennial vegetable area. The brick wall behind has a number of drain holes which allow rainwater to drain from the upper terrace and attention will need to be paid to ensure that they are not obstructed

in any way. Lattice or other materials shall be affixed to the brick wall to allow climber to be able to cling to the wall.



A non-grafted passionfruit shall be planted on each end and a grape espaliered where each of the two central cul-de-sacs are closest to the wall. Other climbers such as Malabar spinach, choko or sweet potato can also be planted in this area if required.

Requirements – mulch, lattice
Plants - Grape, passionfruit, Malabar spinach

6.1.2 The Result

Two years ago I put together a permaculture plan for Angie and Dez (which you can access **here**), and shortly afterward the plan was put into place. As with a lot of plans, this one did not go 100% as expected and there were several changes made on the fly at the request of the homeowners. Having said that, I think it still turned out pretty well.

Thanks to Permaculture Sydney West for holding a blitz at their place to assist in the implementation of the plan.

The original plan was to put in the following –

1. Outer Tree Area
2. Bush Tucker Area
3. The Herb Garden

4. Olive Tree
5. Path areas
6. Perennial vegetable areas
7. Climbers

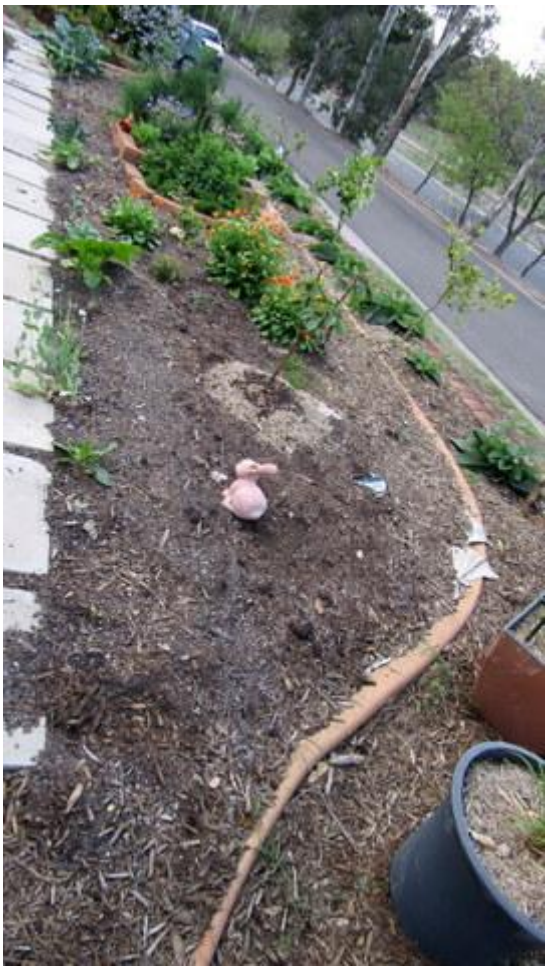
The main difference with the plan was that the path area, rather than being curvy and having two cul-de-sac areas, became a straight line of 240mm x 240mm concrete paving slabs from one end to the other and the birdbath in this area was vetoed. You have to be flexible!

Also, the herb garden was constructed with bricks and the weeping hose was never installed, the outer fruit tree area was interplanted with lots of comfrey which became available on the day, and small animal figures have been added.

Here are some pictures of the area a couple of months after it was planted –





















Now, after 2 years and innumerable harvests it is still doing well. Also in the interim the garden went through a very dry year and a summer peaking at 49 Deg. C!

























6.2 The Sustainable Balcony

6.2.1 The Assessment

Introduction

With almost 90% of our population living in urban areas, Australia is one of the more urbanised countries in the world and what's more, the family living in a house on a quarter acre block is becoming the exception rather than the rule for suburbia. In recent years there has been a strong trend towards high and medium density housing and the number of apartments being built is on the increase in our cities. Without recourse the great Aussie

backyard, what can you do to live more sustainably if all you have is a balcony? Quite a bit; thanks for asking!

Why grow food on your balcony?

Growing your own food is a great way to increase the sustainability of your lifestyle, and is worth doing on its own, for a whole stack of reasons -

- Aesthetics – it looks good! If you can look out a window or set of glass doors onto your balcony and see beautiful, productive, tasty vegetables rather than just another building as is often the case, why not?
- Taste – Nothing tastes like really fresh veggies. Anything you grow on your balcony which you can go out and pick, cook and eat has got to be worthwhile from the flavour alone.
- Reduced food miles (food feet!) – The environmental cost of bringing us our food is high and every bit you grow will reduce you and your families' environmental impact.
- Cools things down – The effect of the hot sun on bare brick and concrete means that the cities tend to be hotter than the surrounding land, which is referred to as the heat island effect. By growing your own on your balcony you are giving the sunshine a better job than just heating up the surrounding air, it will be producing food.
- Reduce noise – depending on how you structure things, vegetation between you and the outside world can provide a barrier to outside noise. Bare flat surfaces tend to reflect noise without reducing its volume much whereas vegetation absorbs and reduces the noise level.
- Reduce pressure on drains – Stormwater drains in the city can easily be overwhelmed by a sudden rain because all of the rain is runoff. Vegetation, even if it is pots, will slow the journey of the rainwater so that the drains find it easier to cope and flooding is reduced

Assessing the Balcony

Before rushing straight out and starting, or even making any big decisions on what goes where, spending a bit of time to assess what you have and what your options are is a good thing. To help you out I have developed a **Balcony Assessment Form** (also see appendix 2)

to walk you through the process and prompt the things you need to look at. If you are doing the assessment for someone else, it will also make the process much easier and result in a better outcome.

Here are some notes on how to use the form to assess your balcony –

Context

These are the bits and pieces that makes sure you remember which property it was that you assessed. This is no problem if it is your own property but if you are assessing a few balconies it can get confusing very quickly.

Date: this draws the line in the sand so you know when you did your assessment, you may wish to look back on it or amend it in the future so having an idea of when it was done can be handy.

Address: Not so important if you only intend to ever do one assessment but if you do more than one, all of a sudden, the address can become critical.

Floor No: In other words, is the balcony on the ground floor or the 10th floor? See "Address" above. If you are doing multiple assessments however it is handy to know how far off the ground the balcony is for wind effects as well as helping you find it again if you need to!

Construction details

Dimensions and area of balcony: one of the critical limiting dimensions of the design will be the area which you have to work with. The overall shape may be important to, if it is long and narrow may require a different approach than if it were square so having the dimensions as well as the overall area will be useful.

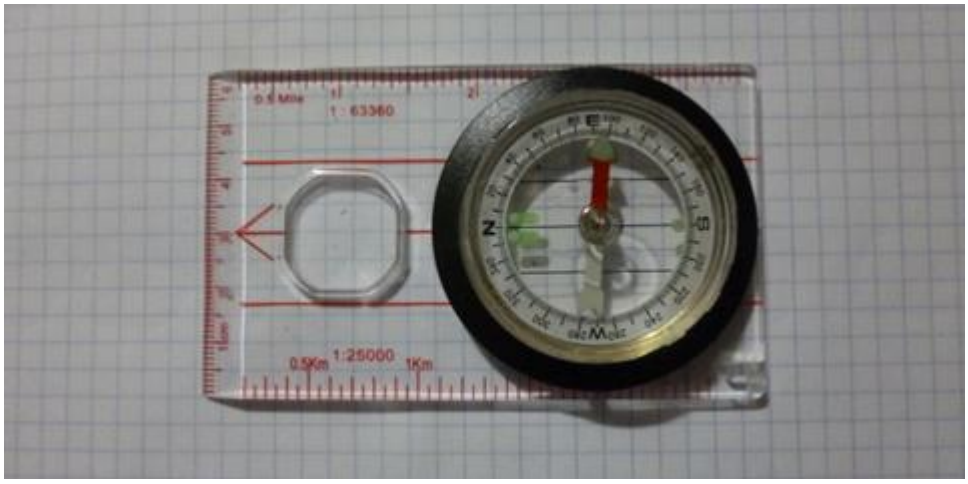
Wall and railing type and height: the railing or wall type which prevents falls from the open end of the balcony will also affect the impact of the sun, wind and rain on features on the

balcony. Whether it is glass, brick or steel, whether it is solid or has areas where sun and rain can get in may be important to the finished design and so is important to record.
Materials of construction and condition: if the balcony made of steel, wood, concrete, brick or a combination it may affect what goes where in the finished design. The overall condition may have an impact on the weight which the balcony can support as well. Is there rot in the wood, cracks in the brickwork or rust on the steel? A review at this stage will point out any structural issues which will need to be resolved before the design is implemented. If there is any doubt at all, secure the services of a structural engineer.

Drainage and Fall: Does the balcony have any form of drain? How big is it? Where does it lead? Do all points on the balcony fall towards the drain or are there areas where a build-up of water may occur? This may be a critical factor on how irrigation water will be treated in the finished design and where drainage water should be directed.

Climate

Direction faced: the direction the balcony faces is probably the most critical non-alterable characteristic of the balcony. Here in the southern hemisphere a south facing balcony may mean no direct sunlight at all which will severely limit options for growing anything. Almost anything other than a due south aspect will allow some form of food production.



Water Access: if there is a tap right there on the balcony you have it made! But even if you do, what other opportunities to gather water are there? Is there a downpipe from the roof

which you can tap into or maybe an overhead structure which can be used to harvest rainwater. If there is no direct access to water of any description on the balcony itself, where is the nearest tap? You may have to fill watering cans and lug them from inside, which can be a pain. If there is a suitable tap inside would it be better to run a hose and fill a water drum on the balcony and then run water out as required.

Shade – shade may come from local trees, overhanging projections or other buildings in the vicinity such that even with a good aspect the hours of sunlight may be reduced. The amount of shade will also vary with the seasons and this should be taken into account.
Prevailing Wind: some history of wind in the area will be important to the design, especially for balconies on the higher levels of a building. Surrounding buildings may also modify the direction a wind comes from. High winds will be hard on the more delicate plants causing both physical damage as well as drying plants out quickly and may necessitate designing in a wind break of some description.

Microclimate issues: by looking at the balcony and its environment as a whole it may be possible to identify particular microclimates such as warm and sunny or cool shady spots, a damp are which seems to catch the rain or an exposed area more subject to the wind than other parts. Identifying these issues at the start can allow the design to make the most of any existing microclimates.

Nearby Roads: While the effect of roads on the balcony will be reduced the higher the balcony is up on the building, lower down there can be a number of effects. Traffic noise can reduce the amenity of the balcony my keeping up an annoying hum, air pollution from passing traffic can affect both the garden and the gardener and the heat island effect can mean warmer winters but also hotter summers.

Other stuff

Existing Materials, plants and structures: The stuff which is already there will have an effect on what new stuff you can introduce. If some of the existing stuff can be removed that is worth recording because it will give you more space but before finalising your plan it is important to know what can be moved and what can't.



Owner's Vision: if you are doing this for yourself, this is the part where you can record what you want to get out of your balcony edible garden. Once you can articulate what you want it is possible to work backwards from that and develop a plan to deliver as much as you can of your vision. In a similar way, if you are doing this for someone else it is important to understand what they hope to get out of the finished product so that can be delivered as much as possible too.

Conducting the Assessment

OK so you now have a printout of the blank assessment form on your clip board, and are ready to go!.....maybe. At this point it is a good idea to collect the following things to help you record your data during the assessment –

A compass – an orienteering compass is good but in a pinch anything that shows you where north is, even if it is an app on your iPhone. Don't guess which way you think the balcony faces, check it with a compass and make sure to note it down on the form. This will save lots of hassles later.

A tape measure – You will need to take the measurements of everything! The length and breadth of the balcony itself but also the dimensions of everything on it, where things are in relation to each other and especially the bits that won't move. Whatever you can find. If you measure everything on your first trip, even the stuff you think you will never need, it will reduce the need for a return visit and save you time in the long run.

Digital Camera – As above, photograph everything! That will help you when you are working out where everything is and what space you have to work with. They will act as a supplement to your measurements and assist you to work out where everything is now, and where the new stuff will fit.



Spirit Level – It may be obvious where the "fall" of the balcony is, towards the edge or towards the drain, but a spirit level can be handy to identify which way the balcony slopes and therefore which way the water will run.

Stationery – A selection of pens, pencils, plain, lined and graph paper is a great support for taking notes and sketches and drawing out ideas when talking with the owner about their vision for the balcony.

Small electronic voice recorder – to record conversations with the owner assuming that is not you, and if they are comfortable with your doing so.

To conduct the assessment, first do a quick look over the balcony to get the lay of the land, as it were, or at least the lay of the balcony. Then set to and take photos from as many angles as you can manage, with separate photos of any features which are to remain after the plan is put in place. Once things have been photographed within an inch of their life, take as many measurements as you can and draw up a mudmap of the balcony and what is on it.

Once all that is done, make notes on construction details and talk to the owner about any climate data they can give you. The final thing is to go through with the owner what their vision for the space is – what is to go, what is to stay, what sort of fruit, vegetables and herbs they wish to produce, what they want to see in the space. Some ideas from you around possibilities – pond, vertical growing, self-watering containers, worm farm, fruit trees – will help to stimulate their thoughts around what they are after. As always, take copious notes or, if they are comfortable with it, record the conversation.
With all the data recorded you can start putting together the plan.

6.2.2 The Plan

Drafting the Plan

With all of the information in place it's now time to review it and come up with a plan for the balcony area which will allow the best and most productive use of the space which is available.

The construction details of the balcony will give you an idea of how much stuff you can cram into it and where it will go. Weight will always be a concern unless your balcony is on the ground floor and will probably set an upper limit to how much you can grow, but the size and how well it is constructed will give you an idea how far you can go. If in doubt, keep things close to the building where the balcony is attached as this will reduce the leverage effect of a weight placed on the edge of a balcony.

The climate data will inform you of the types of plants which you will be able to grow. Lots of sun and you will be able to grow most things whereas lots of shade giving somewhat less sun may mean leaf crops only. Remember, fruiting crops will require 4 to 6 hours of sunlight a day, leaf crops requiring much less while root crops will be somewhere in between in their daylight hour requirements.

The stuff already on the balcony which cannot be moved/removed will also set some limits on what new stuff you can install and of course the owner's vision will be the best indication of the sorts of features to put in place.

Sketching the Layout

One of the permaculture design principles is to work from patterns to details. This means the very first part of your design is to sketch out where everything will go and once you get that right, you can start working out the details.

Make a scale sketch floor plan of the balcony (based on the one which you drew at the time you did the inspection) with nothing on it. If you do it on graph paper it will also make it easier to draw in the features you want to include in the balcony. If the features are also drawn to scale it will give you an idea of how much you can cram in, in reality. One way is to draw the features on a separate piece of paper, then cut them out and use them as models to move around within the balcony space to get the best fit, but drawing them on the diagram in pencil works too, just have a good art rubber handy!

Once you have a layout which looks like it will work you should consult the balcony owner to get a reality check on your ideas, you can then include any of the changes they require. Obviously if you are doing the plan for yourself, you should already be happy with, you drew it up!

The Written Plan

To provide the detail on how the permaculture design drawing is to be implemented It is worth developing a written plan which will back up the drawn arrangement of what will go where on the balcony. The written plan may cover –

- Introduction covering what the plan is to achieve, including the owners vision.
- Any limits to production discovered during the assessment.
- Types of herbs, vegetables and fruit trees to be planted.
- A succession plan of when annuals veggies and herbs need to be planted to keep up a continuous supply.
- A list of the features and a description of how they are to be made or where they are to be sourced from.
- Expected costs and other resources required.
- Action plan of who is to do what, by when



The way I do it is to cover the basics at the start, like what the objective is ans what the assessment turned up, then devote a fair bit of space to the systems which are to be implemented as part of the plan. I give a general description of the element, what the features of the element are, a more detailed analysis of what is to be done and a list of

plants which could be used in the particular element, where this is applicable. An example from a recent balcony design is included below –

Element 1.4 – Self Watering Container Area

Description

This is a wooden structure built from recycled materials as much as possible. It 875mm deep x 1500mm wide x 600mm high on the top area, 300mm high at the step down. It is designed to take 4 x 37 litre self-watering rectangular containers on the highest platform area and 2 x 20 litre self-watering containers based on recycled 20 litre buckets in the step down area.

Features

- *Vegetable growing area*
- *Self-watering so needs less maintenance than other containers*
- *Structure opens to provide storage underneath*

Plan details

1. *Obtain raw materials: rectangular containers x 4; 20 litre recycled buckets x 10, timber and sheeting to cover the required area*
2. *Build stepped structure to take self-watering pots, include hinged door in the side facing the main doorway*
3. *Construct the required self-watering pots*
4. *Place on the structure and fill with growing medium and water*
5. *Plant out with required vegetables and mulch*

Plant list

Carrots, tomatoes, cucumber, peas, beans, cabbage, kale, broccoli, herbs

What are the Options?

There are a whole stack of innovative ways of growing herbs, veggies and fruit in a small area. Some examples of these techniques are listed below-

- Self-watering containers –either homemade or bought, these containers have a reservoir built into them so that during busy or hot times they don't dry out quickly, as containers tend to do. They also do not have drainage holes like standard containers and can be used on balconies where drainage is limited.

- Grow bags – These are a cheap and easy way of providing veggie growing space. Just purchase a plastic 20-25kg bag of potting mix or compost, cut holes in the bag and plant your herbs or veggies. If the bag is left flat when planted out it works well for salad crops and shallow rooted herbs but if the bag is placed on its side, deeper rooted crops like carrots or parsnips can be grown. Don't forget to cut drain holes in the bottom!

- Teepee or circular trellis – placed over a large pot allows crops to grown up instead of out eg climbing beans or peas, sweet potato, indeterminate tomatoes etc.

- Horizontal tube gardens – PVC drainage pipes can be cut in half or have holes drilled in them and filled with growing medium and mounted on the wall. They can be used to grow shallow rooted leaf crops and herbs.

- Sprouts – These require no soil and very little light. There are several processes for growing sprouts but to grow sprouts the simplest way is to soak some suitable seeds in a container, drain. Rinse and drain again. Then rinse and drain twice a day for a week or so after which your sprouts are ready to harvest.

- Microgreens - Microgreens are a bit more complicated but basically, the seeds are germinated in a container of potting mix, then grown up to the four leaf stage at which point they are harvested with scissors.

- Strawberry or herb tower – These are constructed by getting a plastic drum or garbage bin, cutting a series of 50mm holes around the outside and then filling it with growing medium. The holes are then planted with herbs or strawberries or leafy vegetables. The whole thing is watered from the top and rotated regularly to ensure that all sides get access to sun. Another option is to place a wire cylinder in the centre during construction and before the growing medium is put in. Veggie scraps and other organic material can be placed in the centre cylinder where it will break down and provide nutrients for the growing plants.

- Hanging baskets – These can be hung from the walls or the balcony roof or a freestanding structure. They are ideal for veggies that can cascade over the side like cherry tomatoes, cucumbers or beans.

- Edible walls – A series of containers (including recycled containers like cut off plastic milk bottles) are stacked in a framework which is attached to a wall. Each container is filled with growing medium and used to grow a herb or vegetable.



There are also a whole stack of techniques for getting the best out of a small area for growing vegetables and herbs or fruit trees and these are available in the following articles –

Strategies for a productive small vegetable garden

Strategies for a productive small fruit garden

But it is not All About Food!

Energy

These days there are a plethora of solar powered gizmos like radios, lights and rodent repellers (rodent repellers?) that can be charged up on a sunny balcony then taken inside

for use. They can not only reduce your electricity bill and carbon footprint but make you more resistant to blackouts if they happen in your area.



Another energy saver, the **rocket stove**, burns easily available biomass (small twigs and sticks) and can be used to cook your (home produced!) food. They work very well with a wok, which is an energy efficient method of cooking by itself, and with the addition of a hot plate the rocket stove can even replace the gas barbie. They burn stuff you can pick up at your local park or around the streets, in fact wherever you find big trees, further reducing your fossil fuel consumption.

Water

Water can be used as a feature, such as a pond with fish and edible plants. The water (complete with fish waste) can be removed a bit at a time and topped up with tap or rain water and applied to your plants as a fertiliser. The water feature can also absorb some of the sun's heat, creating a cooler (and warmer in cold weather) microclimate in the area where it is.

Also, if your balcony is in the privileged position of having access to rainwater downpipes you can break into them and harvest the rainwater as it comes off the roof. You need to be a bit circumspect about storing too much rainwater (every litre adds a kilogram of extra weight on the balcony) but a 200litre **rain barrel** is a good investment.

Any water you prevent from going down the drain saves towns water being consumed and reduces the load on the cities' storm water system. The large amounts of hard surfaces in built up areas which need to be drained of rain can mean heavy showers result in back-up and flooding. Every little bit removed from the flow helps!

Waste

Food waste can be a significant contributor to land fill and it rots, producing methane gas which is a far more potent greenhouse gas than carbon dioxide. Preventing your food waste from going to land fill by retaining it within your property and then processing it into fertiliser solves two problems with one action.

Obviously the classic three bay compost bin system is problematic if all you have is a balcony, not only from the point of view of space taken up but also the amount of waste needed to run it and the potential for unpleasant odours if it is not done right. Fortunately you have a couple of tailor made options for balcony dwellers – the **bokashi bin** and **worm farm**.

The bokashi bin uses an effective microorganism (EM) to ferment the food waste. It will accept raw meat, citrus and onions which can be an issue with worm farms as well as the other food waste items. The output has a mild fermented smell which I certainly do not find objectionable and can be placed directly in the bottom of pots when repotting. The material will break down rapidly in the soil making all of the nutrients available to your plants. Worm farms need a little bit more upkeep but produce nutrient and microbe rich castings which can be applied directly to the soil, used in making your own seed raising/potting mix or suspended in water to produce an aerated compost tea.

Both setups will help you deal with food waste while supplying fertiliser to help your crops produce more bountifully.

6.3 The Permaculture School Garden

6.3.1 Plans and Designs

One of the things I have wanted to get involved in for years was to set up productive gardens in our local schools. For me there could be no higher purpose than to be involved in teaching the next generation how to grow their own food and live more sustainably. I had considered approaching the schools where our daughters went, but since they had left school more than ten years ago, any connection would be pretty tenuous at best, so I had not worked out how to crack that one.

Due to the work with the veggie groups that I do locally my name has been bandied around (even, if you can believe it, without any associated curse words!) and the local primary school Vice Principal gave me a ring a few weeks ago. It seems they had some grant money to refurbish their cooking room and she wanted to start a garden but didn't know the first thing to do, could I help? Oh yes, my friends... Golden Opportunity!

If this is the thing you want to do, my advice would be to talk to one of the local schools, particularly if you have a connection of some description - even if it is something as simple as knowing one of the teachers. If you can, open the dialogue with the Principal or Vice Principal because they will be the ones you will have to win over if you are going to get a school garden of any description going.

The Initial Meeting

I met the Vice Principal for an initial discussion and she showed me over the area where she wanted to site the garden, where the cooking room was and what the surrounding areas were like. We then retired to the buildings and discussed what options there were.
At this point I would like to mention that the process we went through in developing the Permaculture design is based on the **Permaculture design course** that I did in 2011 and if

you really want to get into this stuff a PDC is a very valuable series of skills and qualification to have.

Thankfully we had access to a computer so I was able to pull up the website and show her some things we could do, the list of things we talked about included –

- Raised veggie beds
- Vertical gardens
- Mandala garden
- Small green house/ seed raising
- Banana circle
- Fruit tree circle
- Swales
- Herb spiral
- Strawberry tower
- Wicking beds
- Worm bath
- Chook tractor

After our discussion and review of the possibilities I left and allowed her to consider what we had talked about and run this past any other teachers she wished to involve and come up with a shopping list of the things they wanted.

The Second Meeting

We got together at the school the next weekend to discuss alternatives and have a more in-depth review of the site, and to make things easier I took with me –

- A digital camera
- A compass
- Bottles for taking soil samples
- Looooooong tape measure (supplied by the Principal) but one of those measuring hand wheels would have been better.
- A clip board, paper and pencil

After we reviewed the site and I took down the measurements of the area we had and the location of existing structures etc, we discussed the Permaculture design features she was looking for, and the main features turned out to be –

1. A series of fish-scale swales that had fruit trees planted into them
2. A mandala annual vegetable garden that had a herb spiral and chook tractor incorporated into the design
3. A series of wicking bed gardens which would incorporate perennial vegetables in them.
4. A series of edible flower towers

All of these features had to be incorporated into my finished Permaculture design but before I could develop the design, I had to take all the information that I had gathered and conduct a sector and zone analysis of the site.

Zone and Sector Analysis

To do the sector analysis you need to take note of such things as aspect of the site (which way it faces) shade in summer and winter, the directions that cold, hot and damaging winds come from, soil types, fall of the land, existing buildings and vegetation. I noted all of this information in my note book and took a few photos to help me remember. I got hold of some A3 paper with 1 cm grid lines and then drew in the things listed above. To see what I came up with, go to the resources tab and then look in the "Permaculture Designs" file.

I conducted the zone analysis by looking at all the information gained from the sector analysis and worked out where each of the zones (0 to 5) would be located on the site –

Zone 0 – In urban Permaculture this is usually the house or dwelling but in this case it is the school building which is to be turned into a room for cooking and processing the products of the Permaculture garden.

Zone 1 – this is the vegetable garden which is intensively cultivated and is likely to need the most intervention in the form of watering, weeding and harvesting etc and so is placed closest to zone 0

Zone 2 – this zone contains the closely planted and somewhat intensive fruit orchard which is also close to zone 0 but requires less intervention than the veggie production area.

Zone 3 – is the farming zone where commercial crops are grown and animal forage systems are used such as organic orchard, nut forest or extensive organic poultry system, or even cereal production or sheep or goats could be raised here
Zone 4 – is the harvest forest where long term tree species are grown to produce firewood, mulch or timber to be used for sustainable building, complementary grazing animals can also share this zone at low stocking rates.
Zone 5 – is the indigenous conservation zone where plants native to the region are allowed to regrow into what would become natural forest.

I used the same page as the sector analysis to draw the zone analysis on but if you wanted to you could do the basic site drawing then mark up clear overlays showing the sector analysis and the zone analysis to go over the top. You don't have to be a competent graphic artist to do these drawings, I don't have an artistic bone in my body but I was able to put something together that people could understand and needless to say if you are artistically talented it will make your design all the better.

The Permaculture Design
Using the same basic layout as I did for the zone and sector analysis (alright, I drew up the first one then photocopied it before putting any of the analysis stuff in!) I then proceeded to locate the design features my client (the Vice Principal) wanted. When doing a Permaculture design it is important to place the areas that need the most regular work closest to the Zone 0 (house or dwelling) but in this case the school buildings themselves would be Zone 0 so the mandala garden and wicking beds were located in closest to them.

The original idea was to have the edible flower towers along the fence on the northern side of the site but after reviewing the zone and sector analysis it appeared that the flowers would grow best on the side away from the buildings and would be shaded out in winter. To prevent this I changed their location so that they were right outside the school buildings to give maximum amenity and usefulness for the edible flowers.

The swale/fruit tree garden was located at the very western end of the site so that it would capture water moving down from the play areas on the uphill side, reducing the likelihood

of flooding out the mandala garden in wet weather and enabling the trees to make the most use of scarce moisture in dry weather.

The graphical design is also available in the “resources” section of this site. The written part of the design is mainly around some simple description of what Permaculture is and how Permaculture zones work and then provides a description of each of the parts of the Permaculture design, what the features of each part are, how they are constructed and a selection of plants that can be used in each part.

The final part of the design was around implementation, breaking the design down into its parts then working out which parts can be done when. In some cases it doesn’t matter – the fruit tree swales, mandala garden and wicking beds could be done simultaneously if the manpower was available but the mandala garden would need to be finished to do the herb spiral and the mandala garden would need to have completed a circuit before needing the chook tractor.

The Third Meeting

The main purpose of the third meeting with the Principal is to present the finished design and to present the design professionally I bought a folder with a clear front to make everything look nice. I printed off the title page twice in colour, one going in the cover of the folder and the other acting as the first page. I then printed off the A4 typed pages and then inserted the folded A3 drawings (zone/sector analysis and the design) into the folder as well. With everything stowed away I was ready!

At this point there should really be no surprises, the client should understand that you will be presenting them with the detail about the design which you will already have agreed on, there should be no major changes. Of course, during your design you may find that minor changes are necessary as I did with the location of the flower towers once I had consulted the zone and sector analysis. If I found something that we agreed on would not work I would have gone back to the vice principal to discuss the situation with her before continuing with the design.

As part of this meeting you might want to do a formal presentation to other teachers, parents, students or other interested persons but in my case even though I offered, the Vice Principal decided she wanted to handle the wider consultation phase. After she has done this she will contact me to let me know if there are any changes required from her end.

6.3.2 The Build



Before we could hold the big day, I had to have one more meeting with the vice Principle (Gwen) who was driving the project to identify exactly what we expected to achieve on the day and the resources we would need to accomplish those expectations. We decided to split the people there on the day into three teams, assuming we had enough, one for the fruit trees and fish scale swales, one for the mandala garden and one for the wicking beds and if time permitted the flower towers. The herb spiral and chook tractor would have to wait for another time.

Gwen and I had both developed various contacts over the years and we both used them to get as much of the materials that we would need for the day on the cheap or as freebies, and the list we came up with was –

- Newspapers - for sheet mulching
- Mushroom compost -for mulching and to make growing medium

- Coarse sand -for the swales and to mix with the mushroom compost to make growing medium
- Gravel – for the swales and the wicking beds
- Plastic sheeting- for the wicking beds
- Rolls of hessian – for the mandala garden
- Seedlings – for the mandala garden and the wicking beds
- Straw – for the mandala garden and as mulch on the wicking beds
- A comprehensive selection of hoes, shovels, spades, wheelbarrows and other implements of destruction
- Other assorted bits and pieces,
- As many teachers, parents, kids and concerned citizens (from our local Permaculture group) as we could find
- Lunch!

What is a Permablitz?

Our Permaculture group (Permaculture Sydney West Inc.) gets together on the fourth Sunday of the month at one of our members place or some other agreed venue to help develop their garden/yard area along Permaculture lines. Anyone can come so long as they are a member and they are covered by our public liability insurance. We all have fun, get to practice Permaculture skills and/or learn new skills and help someone improve their food producing capacity. I was able to get the school Permaculture garden development declared a permablitz which meant we had lots of not only willing but also highly skilled hands to put the project together.



I was also able to get two of our very experienced ladies to agree to look after an aspect of the project each (one did the swales while the other looked after the mandala garden) while I concentrated on the wicking bed and kept a weather eye on the other two parts. This meant that I had an experienced overseer on each facet of the project to minimise the chance of stuff up. (stuff-up proof doesn't exist!)

On The Day

Gwen, the principal and I were there somewhat early to make sure that all was well and to look at the area as well as checking the supplies. Everything seemed to be in order and people were starting to arrive. They had organised some signs to show where we were working because it was at the back of the school and not visible from the road. We had almost 20 teachers and permies turn up and a few other concerned citizens from our gardening group but sadly no parents.

Before starting we had a quick talk about the various activities to take place, where they were going to take place, any safety issues involved and the location of toilets, supplies etc. One of the group bad brought his ute so we were able to use that to haul loads of sand, gravel and mushroom compost from the stock piles to where they were needed. We had received quite a bit of rain so he did get the ute bogged a couple of times, but thankfully there was a four wheel drive vehicle available to pull him out.

The activities

The Fruit Frees and Fish-Scale Swales

There is an article **here** already covering the work we did around this activity and rather than reproduce it all again I suggest you click on the link if fruit trees and fish-scale swales interests you.



The Mandala Garden

This is the second major work to be carried out on the day, and we started it once the swale making was under way. To start, we looked at the area and worked out where the probable centre of the mandala would be, at which point I drove in a stake and tied some string to it, then ran out the string to where we figured the edge of the circle would be. It turned out we were a bit far south and so I moved the stake to the north a metre or so then drove it in. By holding the spray marker at the end of the string and walking around the stake I was able to draw a circle around what would become the mandala garden and after looking at it from several different angles we came to the conclusion is was the right size and in the right space.

The first job in making the mandala garden was to sheet mulch the area with wet newspapers. Gwen had been able to pull some strings and got a whole lot of unused local

newspapers which were perfect for sheet mulching, but we needed to have them wet so they wouldn't blow away and would tend to stick together. I placed a load in the wheelbarrow and filled it full of water to allow them to soak.



By this time the fish scale swales were moving on well and we had some very willing workers to cover the area of the mandala garden with wet newspapers. The full thickness of the newspaper were laid first around the outer circumference of the circle, overlapping so that there was no open areas for the grass underneath to poke through. The circle was then filled in paper by paper until we had a huge circle of wet newspaper, which is a lot more exciting to see than it sounds.....anyway, it was then time to make the garden bed edging.



I saw an idea in an American book on developing school gardens for the edging of garden beds using hessian and straw, the idea being that you lay the hessian out flat, place lengths of straw on it then fold it around so it looks like a sausage and wrap string around to hold it together. It is soft for the kid and biodegradable so it will eventually rot down, and that is what we did. We got some 10 metre rolls of hessian from Bunnings and our friend at Mamre Produce donated some straw and we had enough to make 6 keyhole beds which made up part of the mandala. This was a little different to my original design of 8 keyhole beds but we took 2 out so we could allow for disabled students to get access to the keyhole beds too.



Some of the ladies got together to make the keyhole bed surrounds and once they were complete we arranged them roughly equidistant around the mandala, formed them into the keyhole shape and filled them with the mushroom compost and sand growing medium. The keyhole shape allows access to all parts of the bed without needing to walk on the growing area. One bed was planted up with the seedlings and mulched and the rest were left to be planted out by the students.



The guys had done a good job of relocating lots of sand from the stockpile with the ute, so some of the leftover sand was piled up in the centre of the mandala to set things up for the herb spiral to be completed at a later date. The rest of the leftover sand was spread evenly over the surface of the newspaper to keep it from blowing away.

The Wicking Beds

The construction process for wicking beds is also covered elsewhere on the site (under veggies/container gardening/our wicking bed) but we had to make a couple of design changes on the day from our usual design. It is still based on the 2 x 1200mm x 1200mm AQC treated raised beds, one on top of the other but because the only roll of plastic they could get hold of to make the bottom reservoir was only 1000mm wide, we had to make do with some thinner plastic that had been used to wrap a mattress in that Gwen had bought in to use. We also had no wood chips so to go in the water reservoir are we had to use gravel, which worked OK.



We only had enough plastic to make one wicking bed so everyone got stuck into that one, the rest having to wait until another time. With the plastic being so thin we dug out the grass from under the bed and then lined it with some of the sand so that there wouldn't be any grass trying to push its way up and making a hole in the plastic. We also poured in the gravel veeerrry carefully so that we wouldn't tear the plastic but in the end it worked well. We made more growing medium from a mix of sand and mushroom compost, used some of the straw to mulch the bed, filled the reservoir with water and then plated veggie seedlings into it.



What didn't get Done

Due to lack of people, lack of raw materials or both we were unable to –

- Complete the wicking beds
- Put the straw bale teaching area in
- Make and install the flower towers

We also didn't get in the herb spiral or the chook tractor but we realised that this was unlikely to happen anyway, even with a bigger crew.

Wrap up of the Day



As with all blitzes, the host (in this case Gwen, the principal and a couple of teachers) made a stack of food for everyone and we had a wonderful lunch. Everyone was working so well and getting stuff done it took quite a while to get everyone to stop working and come in for lunch. It was a great day, but there is still more to do so we will be getting everyone together again to finish things off, when the weather gets better!

Forming the Keyhole Beds in the Mandala Garden













7.0 Resilience and the Choko Tree

7.1 Permaculture Zones and Suburban Resilience

What is resilience?

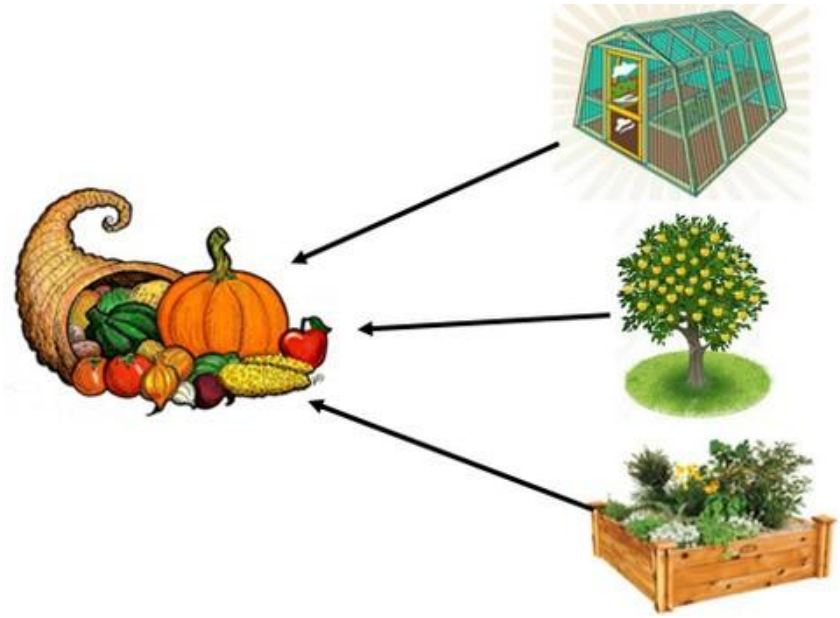
"The capacity to recover quickly from difficulties; toughness." (Dr Google)

“Resilience refers to the ability of a system, from individual people to whole economies, to hold together and maintain their ability to function in the face of shocks from the outside” – Rob Hopkins (from The Transition Handbook).

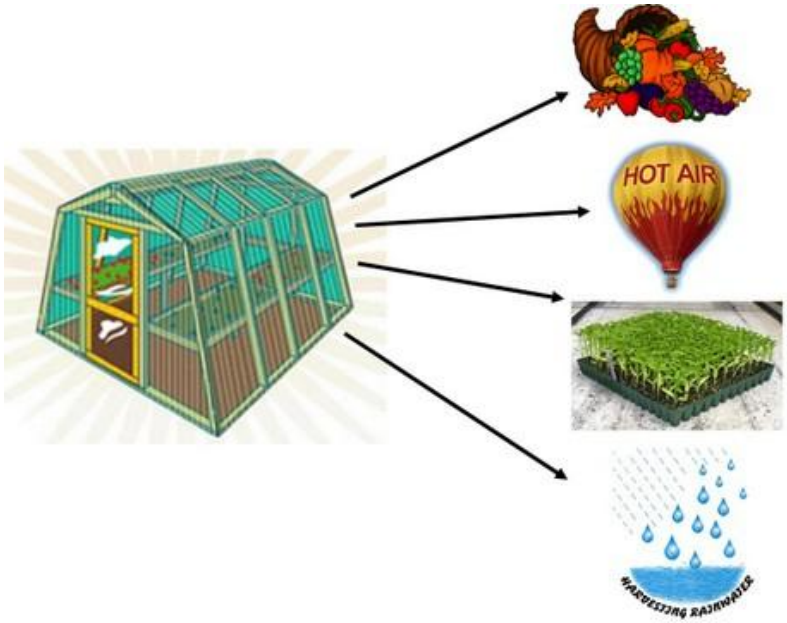
So in simple terms, it means being able to take a hit and still keep going.

In the modern world we sell our labour and the use the money that we get to buy the necessities of life form a complex and interdependent system. Sometimes events can compromise the system, be they manmade like strikes, oil shocks or terrorist activity or as a result of natural disasters such as floods, bushfires, earthquakes or storms. I was around for the oil shocks of the 1980s and I can remember the flow on effects for the availability food and other goods. In addition, our food quite often comes from thousands or tens of thousands of kilometres away and such long supply lines can be vulnerable.

So, without labouring the point about modern society and its failings, if the systems which keep us supplied are vulnerable, rather than being vulnerable ourselves in turn perhaps it is better develop some resilience ourselves. That is to say, rather than just being consumers, we become producers as well.



One way to do this is by taking the Permaculture design principle No 8 to heart: integrate rather than separate. Looking at it another way, make sure that every function is covered by more than one element and every element has more than one function. So if the function is to provide food, it is best not to rely on just one veggie patch but have other sources such as home preserves, fruit trees, some self-watering containers and a small greenhouse as well. In this way resilience is improved such that if there is a failure of one veggie patch due to pests or disease or whatever, there are other food producing options.



Also, each element should perform more than one function for example, the greenhouse, while it is an element providing out of season food growing options also allows seedlings to be grown, provides a warm place to work during cold weather and can even help heat the house if it is built onto a northern wall, and rainwater can be harvested from its roof. Taken together, these two ideas can be used to provide a productive web, which increases our resilience.

So Where Do Zones Fit in?

The zone tool from permaculture usually used to work out where to place design elements for the most effective use and in its simplest form is a series of concentric circles starting from the house or structure (zone 0) and moving out through levels of decreasing frequency of human interaction to where human impact is minimal (zone 5). For example –

Zone 0 – Home: indoor production (sprouts/ferments), processing food, waste, water & energy collection, repairs and education, relax, work and where you practise reduced consumption and re-cycling.

Zone 1 – Nearest to the house, for elements that require frequent attention, or be visited often, e.g., salad crops, herb plants, soft fruit like strawberries or raspberries, greenhouse and cold frames, propagation area, worm compost bin for kitchen waste, etc.

Zone 2 – Farther from house the place for perennial plants or self-maintaining plants and elements needing infrequent work: mulching, pruning bushes, orchards, compost area, animals eg. poultry, rabbits, worm farm, bees.

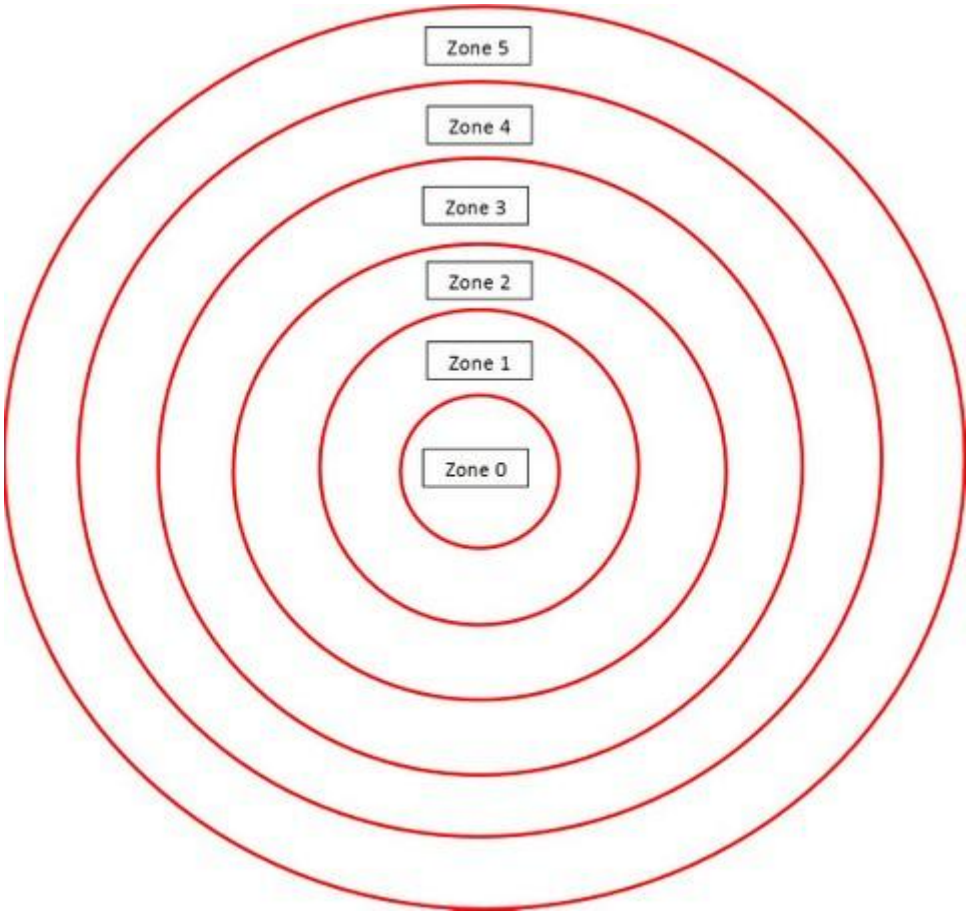
Zone 3 – Occasionally visited areas where main crops are grown, for domestic and for trade use. After establishment, care and maintenance is fairly minimal e.g., watering or mulching once a week or so. Self-fed animals (stock), seasonal crops e.g. corn, wheat, rice, pumpkin, bamboo.

Zone 4 – is the harvest forest where long term tree species are grown to produce firewood,

mulch or timber to be used for sustainable building, complementary grazing animals can also share this zone at low stocking rates.

Zone 5 – is the indigenous conservation zone where plants native to the region are allowed to regrow into what would become natural forest.

These are the zones used in traditional permaculture, but in the urban and suburban space zone 2 is the outermost zone we are likely to have access to and certainly it is zone 0 and zone 1 where most of the contribution to our resilience is focused. This makes sense but by rethinking the zone tool in terms of the urban/suburban environment it can help us become more resilient by thinking and acting in those areas outside the border of our own house and yard.



Zones of Resilience

Here is a new way for urban dwellers to think about the zone tool, looking at activities which improve our resilience but are outside the traditional zone 0 and zone 1 we are used to working in. The zones are reviewed in association with food, water, waste, energy,

economic/financial aspects, consumption, shelter and access to service. A matrix which summarises the zones for each aspect of our lives can be downloaded **here**.

Food

Zone 0 – preserves and other stored food/ seeds

Zone 1 – home garden/chook run/fruit trees/herb spiral

Zone 2 – Friends/neighbours garden, community garden/ school, church, business gardens/community orchard

Zone 3 – farmers market, community supported agriculture/foraged foods/food coop

Zone 4 – Independent groceries with regional focus/ IGA

Zone 5 – National chain supermarkets – Woollies/Coles

Notes: If some of the options mentioned here are not available to you like community gardens or CSA etc it might be worth checking to see if there are likeminded people around you who could help you set something up.

Water

Zone 0 – Internal water storage hot water tank/toilet cistern

Zone 1 – Rainwater tanks/bore/well/ swales on property rain garden/backyard pond composting toilet

Zone 2 – Friends/neighbours water tanks/storage, swales off property but nearby, water from neighbour's roofs diverted to your tanks, access to friends' amenities

Zone 3 – local streams, dams, ponds

Zone 4 – larger rivers

Zone 5 – reticulated water supply

Notes: It can be worth talking to your neighbours about diverting water from their catchment area (roofs) if they are not interested in installing tanks. This could benefit them during an interruption to water surfaces if you are prepared to share the rainwater you have harvested form their property.

Waste

Zone 0 – bokashi bin, greywater capture

Zone 1 – greywater re-use/constructed wetland/composting system/worm beds repair

capacity/skills workshop

Zone 2 – neighbours repair capacity/skills/resources/tools/workshop etc

Zone 3 – freecycle; community composting/worm farming

Zone 4 - neighbours repair capacity/skills/resources/tools/workshop community recycling drop off depot

Zone 5 – Landfill/centralised waste collection

Notes: Setting up a community composting or worm farming resource can be a great way to interact with your neighbours.

Energy

Zone 0 – Solar electricity/solar hot water on house/passive heating/cooling strategies/insulation wood heater

Zone 1 – external solar panels/solar oven/ rocket stove

Zone 2 - wood supply for combustion heater/cooker, foraged fuel for rocket stove

Zone 3 – local energy project

Zone 4 – Reticulated electricity (renewables)

Zone 5 – reticulated gas and electricity (fossil fuel)

Notes: Setting up a local energy project is a lot of work but can be worthwhile in the end, improving resilience, reducing your reliance on fossil fuels and giving you another excuse to get together and work with those around you.

Economic and Financial

Zone 0 – home based employment/ online/work from home

Zone 1 – consulting /self-employment requiring work outside the home/the informal economy

Zone 2 – cooperative employment/informal economy

Zone 3 – paid employment within reach of public transport, Local Employment Trading Scheme

Zone 4 – paid employment requiring car, local currency

Zone 5 – paid employment away from home/travel/deployment, Community exchange system

Notes: the informal economy is where you trade and share skills with your friends and neighbours, money may or may not change hands or there may be a barter type arrangement. Whatever happens the trade “flies under the radar” in terms of the formal economy with no tax taken or given but both participants gaining from the exchange.

Consumption

Zone 0 – Skills and knowledge to enable repairs/home manufacture from produced materials

Zone 1 – Workshop and tools for repairs/stockpile of reclaimed materials/home produced materials, home manufacture of items

Zone 2 – Second hand materials from roadside/provided by friends & family etc.

Zone 3 – Men’s shed/second hand dealers/charity shops

Zone 4 – Small/local retailers and manufacturers

Zone 5 – National chain stores

Notes: Being able to repair rather than replace items means you don’t need to buy as much stuff, you can keep the stuff you have operating longer. But if you do have to buy stuff, sourcing it from a local supplier keeps your dollars in your local economy.

Shelter

Zone 0 – primary dwelling

Zone 1 - secondary dwelling on the property eg shed or tiny house

Zone 2 – access to shelter from friends/family in their house or tent/caravan on their land

Zone 3 – Tent/caravan on public land

Zone 4 - Air BNB

Zone 5 – public shelter/hotel/motel

Note: This is the sort of thing that needs to be ironed out beforehand if part of your resilience efforts rely on being able to live with other people in the short term. It would be an unexpected shock to just show up on their doorstep, and it is also reciprocal. If you plan to stay with others you should be able to offer your hospitality in return should they need it.

Access to Services

Zone 0 – phone, internet or post

Zone 1 – accessible by walking

Zone 2 – accessible by Bicycle

Zone 3 – Accessible by Public transport

Zone 4 – access requiring car/taxi

Zone 5 – access requiring Plane/ship

Notes: It is worth looking at the services you need now and into the future and start patronising them. This will reduce your travel needs as well as ensuring those services are still available when you need them.

Where to now?

Use the zone tool to assess the level of resilience you have once you move outside the borders of your own property and think about what your options are, then decide on the changes you need to make. To help you, a zones Vs aspects of resilience matrix can be downloaded **here**.

Sometimes it is about recognising a need like a community garden or orchard or community composting initiative or it may just be a case of organising a reciprocal short term stay agreement with friends or family outside your area. Whatever you decide to do, put plans in place and then carry them out, the time to start improving your resilience is now!

7.2 Taking a Walk Down Resilience Road



Building Resilience in the Suburbs

In May this year (2026) as part of the Permaculture Sydney West (PSW) meeting, I delivered a presentation entitled 'Building Resilience in the 'Burbs. There was (and still is) considerable uncertainty in the world and my thoughts were focussed by the closing of the Strait of Hormuz. I was concerned about the possible impacts it could have on my fellow members of PSW and myself, but also, what were some things we could do to reduce those impacts.



I subtitled my presentation 'A Walk Down Resilience Road', having been involved in introducing the concept of becoming a '**Sustainability Street**' to where I live many years ago. There are a lot of crossovers between being more sustainable and being more resilient, win win! I also liked a quote from Sam in the Happen Films YouTube video called 'Degrowth in the Suburbs', he says: ""It's interesting how much overlap there is between the practices of Sustainability and the practices of resilience, in this context almost 100% overlap". The context he mentions being growing food at home.

It seems that somebody else came up with the idea of Resilience Road, because I found this pic that had been put together and I liked the sound of it!

But, What is Resilience?

I always like to start out with some understanding of what the terms I am using means, just so I don't drift off course. So, some definitions –

"The capacity to recover quickly from difficulties; toughness." (Dr Google)
“Resilience refers to the ability of a system, from individual people to whole economies, to hold together and maintain their ability to function in the face of shocks from the outside” – Rob Hopkins (from The Transition Handbook).
“being able to take a hit and still keep going” – Me
I like to keep things simple, but I guess the discussion then moves onto what I mean by the term ‘hits’.

What are the ‘Hits’?

The ‘hits’ or ‘bad things that can happen to us’ can be summarised as occurring in three fields – personal, local and big picture - although these fields are not mutually exclusive, hits can come at us from a number of fields at once, but hopefully we only have to deal with one hit at a time!

Personal: These ae the sorts of things that impact mainly us and/or our family and include things like job loss, health issues, financial strain, car accident or personal trauma.

Local: As well as impacting ourselves they also impact our friends, relatives, neighbours and others in our community, they include severe storms, flash flooding, bushfires, earthquakes, disruptions to utilities such as power, water, sewerage etc.

Big picture: – This is the big stuff, that can a severe impact on all of us when they occur and include global heating, wars, strikes, pandemic, oil shocks and supply chain interruptions.

So, What Can We Do?

In thinking about this I came up with five strategies to help us reduce the impact of these hits on our lives. It is quite possible that you already have a number of these strategies in place, so for me the idea is for you to do a bit of planning, preferably with the family, to identify which group or individual strategies that you want to put into place right now, and then start work! Sometimes it is easier said than done, I know, depending on you and your families’ circumstances but there is a lot we can’t control in this world but by carrying out some actions, it can make us feel better about where we are going with things!

The Five Strategies and any Associated Sub-strategies

- Food: grow it, store it, cook it, don't waste it.
- Water: Catch it, store it, clean it, don't waste it.
- Energy: Save it, produce it, don't waste it.
- Community: Encourage it
- Skills: Learn them

Life is in the Details*

Following is a bit more detail on how you can implement these strategies wherever you are, but it is a bit beyond the scope of a single article to provide all the information you will need, so links to other articles and eBooks on this site are included below each section. These will allow you to take a bit deeper dive into each strategy, when you have the time and energy!

*Quote from Jacqueline Woods

Food

Grow it

It is possible to grow something outside where you live, whether it is a balcony, suburban block or 5 acres. It is easy to start growing food, fruit, vegetables or herbs with whatever you have, but to make the most out of your growing area can be a bit technical. If you don't have any outdoor area to grow food, there are techniques that allow you to grow indoors (inside Zone Zero as it is termed in permaculture). One such technique is sprouting seeds which is cheap, easy to set up and can be remarkably productive!

eBooks: **Growing a Cost of Living Victory Garden**, **Growing Shoots, Sprouts and Microgreens**, **Growing Food Indoors (Zone Zero)**



Store it

While it may only be possible for you to eat from pay check to pay check, with even a small amount of cash it is possible over time to build up a buffer of foods that you regularly eat to give you options if things go bad. In general terms, the process of how you go about storing away some food is conduct an Initial audit (pantry, fridge, freezer), to know what you have and what you buy, discuss what you are doing with the family. Consider some strategies like copy buying, bulk buying, store what you eat, eat what you store, rotate your food stocks (First In First Out), date everything! Then put your plan in place, review it regularly and practice! (eg No-Buy July)

eBooks: **Food Storage and Resilience**, **DIY No-Buy July**, **DIY Pantry Staples**



Cook it

This one also impacts the 'energy' strategy because we use energy to cook our food. The idea of this sub-strategy is to think about how we can cook our food if the power goes out or some other issue with the supply chain causes problems. It is about using energy efficient means to cook such as a pressure cooker or a wok, or using the sun with a homemade or bought solar cooker, or using stored heat to cook food with a hay box or a 'Wonderbag' or even with sticks from your own yard using a rocket stove. Being able to provide a cooked meal for the family is important, so building some redundancy into your cooking methods makes you more resilient.

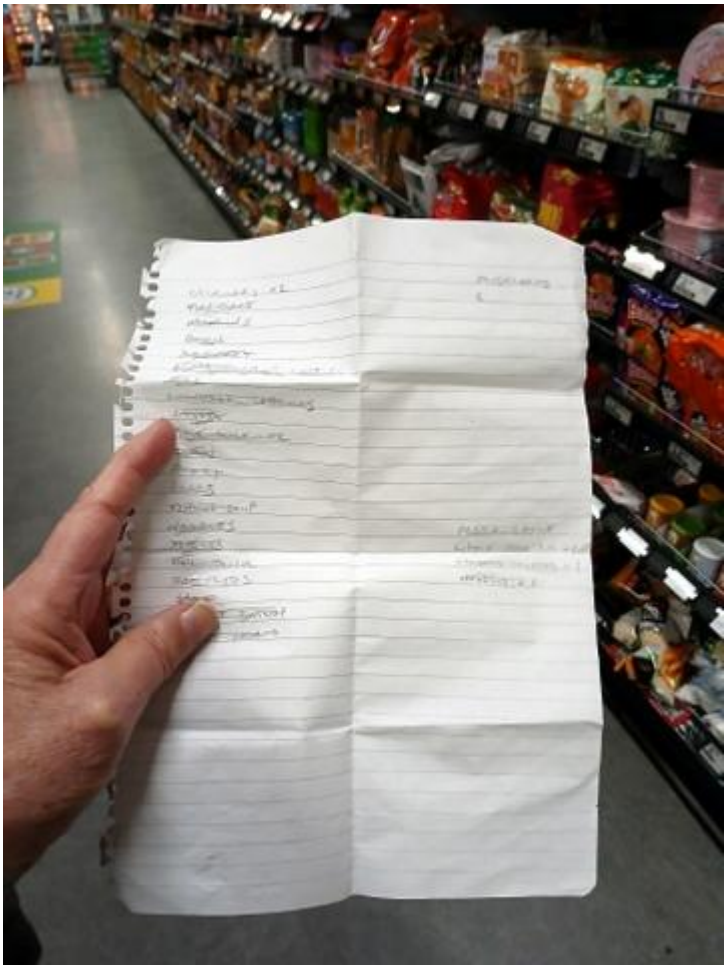
eBooks: **Sustainable Cooking,**



Don’t Waste it

There really is no downside to reducing our food waste. Using some of the following techniques means we can make the most out of the food we grow or buy, saving us nutrients and money. By preventing food waste going to landfill, we can reduce greenhouse gas production and prevent unnecessarily filling up our finite landfill areas. Some things to think about include meal planning, doing your shopping with a list, Controlling portion size, loving your leftovers, storing food properly, understanding food labelling and composting or feeding it to chooks or rabbits if it does occur.

eBook: **Managing Your Household Waste**



Water

eBooks: **Managing Your Water**, **Low Cost, High Efficiency Irrigation**

Catch it and Store it

If you have access to the rainwater coming off your roof, that is a great thing! It may be a house roof, garage roof, shed roof or whatever, it is almost always possible to install a gutter and downpipe to catch and direct it into a storage vessel of some kind, and any water storage is better than none. If you can manage a purpose build water storage tank, that is a good thing, but if you don't have the cash or space, you can start out small. Catching water in a 200 litre drum, wheelie bin, 500 litre water tank or 1000 litre IBC, will provide you with a backup water supply without costing an arm or a leg or taking up a huge amount of space.



Clean it

While tank water has been the water supply for people in the bush for a long time, here in the suburbs we are used to town water and can trust it more than the stuff that comes out of the sky. There may be some basis for that with the greater opportunity for air pollution in suburban areas to contaminate rainwater or the bird poop on the roof washing into it. If that is the case with you it might be worth investing in some form of water purification, from a multi-stage, whole house filtration and UV treatment set up, down to a countertop gravity water filter. You need to be able to consume your stored water worry-free when you need it.

Article: **Purifying Water**



Don’t Waste it

If you must rely on your own home-stored water supply for any length of time, being able to do so efficiently will be very important and if you are already doing it with your reticulated water supply, being pre-adapted will make things so much easier. Also, you will be saving on your water bill now! Things you can do include: Fixing any leaks, keep showers under 4 minutes, if it’s yellow, let it mellow….., use the half flush (if available), run full loads of dishes and laundry, install low-flow tap aerators, use a broom instead of a hose for cleaning outdoors, turn off the tap while brushing teeth, washing hands, or shaving and reuse greywater for flushing toilets or watering plants.



Energy

Save it

Energy costs are rising so working on reducing the energy we consume not only saves us money, but it also reduces the load on the power supply. If you intend to install a solar system to power your household at some stage, you will need to produce less electricity for the system to work for you. The first step is to do an audit on energy usage, check it against energy consumption on the bill to make sure everything has been considered, starting with behaviour, put together a plan to reduce energy usage. The plan can include insulation and other barriers to heat to keep the place cool, keeping warm by layering clothing or using a heated throw rather than turning on the heater, cooking efficiently (see 'food – cooking it' above).

eBooks: **Managing Your Energy**, **Coping with Heat (and Cool)**



Generate it

There are lots of solar setups for sale out there, with or without batteries, and for improved resilience any solar setup you get should have some form of battery attached, because any battery free system will shut down during a blackout to prevent line workers being electrocuted! Having said that, if you can't afford a solar array, don't have the space or are a renter there is a large amount of independently powered items of solar gear out there. Such gear includes lights, radios, phone chargers, fans, showers or even independent panels and batteries that can go with you if you need to move.

eBook: **Alternative Power Systems - Our Experience**



Don’t Waste it

In addition to ‘Save it’ above, other miscellaneous techniques to reduce your energy usage include heating yourself, not the room taking shorter showers (less water, less energy), use cold water in the laundry, turn off lights and appliances (at the wall) when not in use, turn the aircon up in summer, down in winter, dry clothes naturally, Keep the freezer full, the fridge empty and only boil the amount you need for hot drinks.



Community

Encourage it

Unfortunately, these days it is possible to live in the suburbs and not know anything about your neighbours, even those next door. We go about our separate lives, we go to work, come home, go inside our houses and watch TV without having to relate with our neighbours at all. I think what happened with Covid made things even worse. We don't have to stay like that however; we can all work towards reforging bonds with our neighbours and that encourages real resilience! Some ideas include: talk to your neighbours (I know, right!), join a permaculture, organic growing, seed saving or other locally based resilience encouraging group, or if one does not exist, start your own. start a local food coop, join local a CSA (Community Supported Agriculture) or community garden, attend your local library, organise a street party.

eBooks: **Cultivating Community**, **St Clair Sustainability Group**, **Starting and Running a Permaculture Group**



Skills

Learn them – How?

There are lots of ways we can learn skills these days. YouTube should be regarded as an amazing resource to learn all sorts of things from a multitude of teachers. Again, check out your local permaculture group if you have one, they may offer 'living skills' courses on permaculture-based resilience topics or blitzes in your local area where you get to work with other members and pick up skills while helping out. Check with your local council to see if the offer talks on sustainable/ resilience related topics. Quite a number of councils in the Sydney basin do, I know because I did presentations for half a dozen or more councils locally over the years. Don't forget your friends and relatives too, they may have teachable skills that you can benefit from.



What?

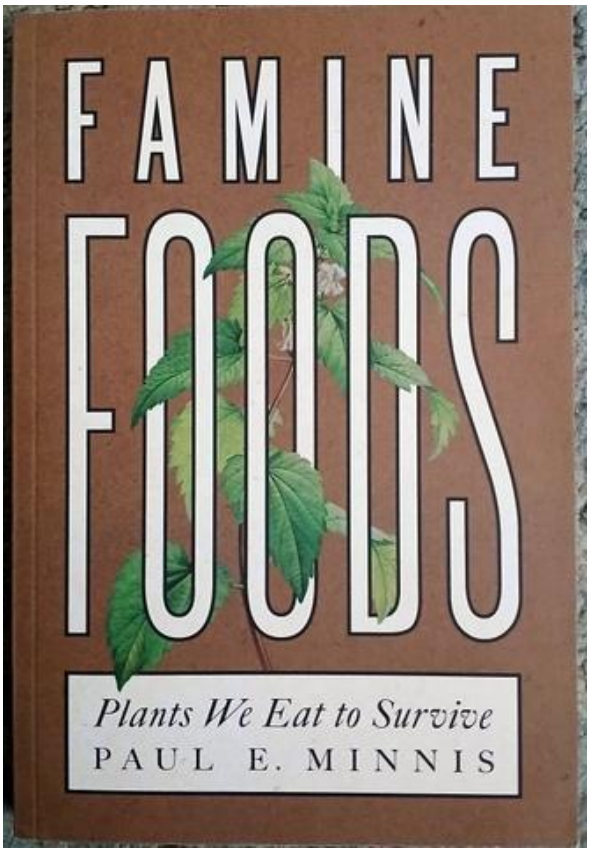
The skills that you can learn to assist you in your journey towards being more resilience are endless, but some topics you may wish to consider are: first aid, growing your own food, seed saving, how to use tools, household repair and maintenance, food preserving, sewing

and clothing repair, low energy cooking, saving water, making pantry staples from scratch and saving energy, and keeping chooks.

eBooks: **The Sustainable Workshop** (setting up your own Workshop to help with repairs and maintenance), **Consumate Clothing** (Care and repair for your clothes), **Seed Saving** and **Growing veg from seed, Making Pantry Staples from Scratch, Keeping Chooks in the 'Burbs**

7.3 Famine Foods

A short while back (late ’24) I read a book called “Famine Foods: Plants we Eat to Survive” by Paul E. Minnis. The book discusses types of food shortages, how famine foods are used, the characteristics and types of famine foods. It then looks at various societies that have examples of famine food use including non-agricultural societies (eg circumpolar groups), villages and rural farming communities (eg highland Papua New Guinea) and urbanised nations during peace and war (eg Ireland and India during peace, The Netherlands and Greece during war).



It is a fascinating and very readable book, and it got me thinking about the concept of 'famine foods' as they apply to us. At the moment we are not exactly in a famine, but we are in what has been described as a 'cost of living crisis'. It got me wondering as things go, today, here at home, what famine foods are there available to us in this area? But of course, that depends on how you define the term 'Famine Food'.

The definition of the word 'Famine' according to Wikipedia is: A famine is a widespread scarcity of food caused by several possible factors, including, but not limited to war, natural disasters, crop failure, widespread poverty, an economic catastrophe or government policies. This phenomenon is usually accompanied or followed by regional malnutrition, starvation, epidemic, and increased mortality.

There are many and varied scholarly definitions of what a famine food might be that are explored in the book and one major distinction in the definition is whether the foods are only consumed during a full-on famine, or if they may also be consumed during food shortages. Personally, I prefer the latter.

In any case, having been introduced to the concept of famine foods, I wanted to develop some categories of famine foods that could be consumed during times of shortage where we live, in Western Sydney. Once I had developed some categories, I could then identify (and record for future reference) our famine foods.

This would then become a record for our use if there should come a time when foods become unavailable due to shortage, overpricing, natural disaster, ecological issues or whatever. I find it always helps if you have thought these things out and done some preparation before the wheel comes off the wagon!

So, what categories did I come up with? These ones:

1.Edible plants not usually consumed quite often referred to as weeds or wild herbs. Here most of the wild herbs that grow are common around the country and, I think, around the

world, plants like amaranth, chickweed, dandelion, dock, fat-hen, mallow, plantain and sow thistle.



A selection of wild herbs (some edible, some not) growing beside a footpath near our house



One large dock plant (patient dock or rumex patientia in this case) can provide a good feed

2.Parts of food plants not usually consumed this can be leaves of plants where we usually harvest other parts such as the fruit or tuber, like the leaves of the choko, sweet potato,

grape and mulberry. It can also include parts of a fruit or vegetable that we don't normally consume like the stem of a broccoli or cauliflower, leaves of the carrot or beetroot, skin of the onion, squash/pumpkin flowers or the blossom of the banana.



Sweet potato leaves



Choko leaves and tendrils (yum yum!)

3.Edible native plants not usually consumed, that is to say, bush tucker. We do grow some of our own, simple stuff like lilly pilly, macadamias and warrigal greens although these tend to be more recognisable as food. We also grow Queesnland arrowroot , which is not the tastiest root vegetable I ave ever eaten, it is still nevertheless edible and would qualify as a famine food. We don't have a lot of natural bush around here, living in suburbia as we do, but it may be worth scouting out your local area to see if anything is available. If you have access to any First Nations people, it would be worth having a chat to them.





Queensland arrowroot

4.Edible flowers, there are lots of ornamentals out there that have flowers which are edible, and that not a lot of people know about. Some of them include calendula chrysanthemums, cornflower, cosmos, daylilies, dianthus, hibiscus, jasmine, marigolds, pansies, tuberous begonias, tulips, violets and violas.



Our hibiscus, providing morning shade for the front patio

5.Insects and molluscs and crustaceans, I understand that there is an 'ick' factor when we talk about insects and gastropods (snails and slugs) as food. Also, in terms of crustaceans I am thinking of slaters (pill bugs) not crabs etc. which are normal human food. I personally have eaten crickets and meal worms as well as snails (French and Chinese style) and found them all to be reasonably palatable. Knowing and practicing techniques such as how to purge snails prior to preparing them to eat can be important too, because they can eat things that are toxic to us.



Not pests, livestock!

6.Fungi when thinking about consuming foraged fungi I can't help but remember the quote from Terry Pratchett: "All fungi are edible, some fungi are only edible once". I also have no intention of making beef wellington! If you have access to an expert or definitive books on identifying fungi in your area it might be worth checking out what is available. Personally, I know that the small white, round puffballs we get around here are edible but that is the extent of my knowledge, so I have a gap there to be filled!



Partial fairy ring of mushrooms in our front yard after rain (Don't know about edibility)

Points to Ponder

If you are interested in the concept of 'Famine Foods' there are some points worth considering:

1. With any foraged food, identification is key. It is worth connecting with people who know about your target famine foods and how they can be distinguished from other possibly less palatable or more toxic species. Years ago when driving around near our place I noticed masses of a plant along the roadside which I thought were wild fennel, but on closer inspection I found them to be highly toxic hemlock. So, yeah, identification is key, and don't get me started on fungi!!!

2. Do your research before you need to. This includes not only identification but also how the famine foods are prepared and cooked and the sorts of recipes they go in to make them palatable. When I started experimenting with weeds (wild herbs) and include them in our

diet I discovered a recipe (**available here**) that reduced the bitter taste that some of them can have, making them quite tasty. Having to eat unpalatable food can keep you going in a pinch but is not great for morale.





3. Pesticides or herbicides - These can be an issue for foraged foods such as weeds, insects or edible flowers. It is worthwhile checking out any areas where you intend to forage to see if anyone, such as the landowner or local council may have applied toxins to control insects or plants. If they are foraged from your land hopefully you will know the history and be able to forage safely.

4. Start small and see how your body reacts – When trying new foods particularly some of the weird stuff that I have advocated above, it is worthwhile not only trying them before you need to rely on them, but to start small. There are all sorts of allergies and things out there so when trying something new, only consume small amounts to start and then keep an eye out for any unusual symptoms before increasing their presence in your diet. So far I have been OK, but you never know!

At the risk of being receptive I will say that the time to start researching, tasting and developing recipes to suit famine foods is now, while there is still time. There is also a side benefit, that learning to find and use these foods now can reduce your food costs, without the pressure of having to do it. Give it some thought, discuss it with your family and have a go!

7.4 Sustainability, Resilience and Leaf Crops

There is a wonderful quote at the start of the Happen Films Documentary **"Degrowth in the Suburbs"**, from Sam, one of the owners of the property. He says – "It's interesting how much overlap there is between the practices of Sustainability and the practices of resilience, in this context almost 100% overlap". Of course one of the practices to which he refers is growing food at home, and it is my contention that a substantial contribution to both greater sustainability and greater resilience can be gained by growing leaf crops.

Leaf crops (AKA 'greens') are crops which are grown primarily so we can eat……..their leaves (a revelation I know!). They have peculiarities in the way which they grow (eg shallow root systems, short time to harvest and shade tolerance) and a variety of ways in which to grow them (eg catch cropping, cut-&-come-again or the "Eat all" technique), and then consume

them (eg smoothies, braised or steamed). They can greatly facilitate our efforts to live more sustainably and increase our food resilience.



While this article deals mainly with cultivated leaf crops, it should also be noted that they do come in three major varieties –

Cultivated ie they are grown commercially or in the back yard to provide leaves for us to eat - eg, amaranth, bok choi, cabbage, collards, chicory, coriander, endive, kale, lettuce, Malabar spinach, mibuna, mizuna, Okinawa spinach, rocket, silver beet, spinach, sorrel and tatsoi.

Wild (AKA weeds or wild herbs) which are naturalised in many countries around the world and are generally regarded as weeds (ie a plant out of place) and despatched summarily, but

which can also be foraged and eaten eg catsears, (flatweed), chickweed, dandelion, dock, fathen, mallow, plantain, prickly lettuce, purslane, sow thistle and stinging nettle.

Accessory – These are attached to productive plants we grow for other reasons but which are edible in their own right eg, beetroot, cauliflower, choko, peas & beans, radish, sweet potato and turnip.

(Note: While not every point listed below applies to every leaf crop mentioned above, they will apply to the majority of them.)

Growing

Leaf crops have a number of aspects which can be turned to our advantage when growing them for food, either by themselves or in combination with other plants –

They have comparatively **shallow root systems** –while this means that they require regular watering, (but not to water so deeply as to waste water) it also means that they can be grown amongst other species which have deeper root systems with little or no root competition between the species. For example interplanting a leaf crop such as lettuce with deeper rooted tomatoes will allow both plants to coexist happily.

Short Time to harvest – some slow growing popular crops like cauliflower, celery or eggplant can take 100 to 120 days from sowing to providing an edible crop, but the majority of leaf crops produce worthwhile food in half that time, 50 to 60 days. Cabbage is an exception, taking 105 to 120 days to producing a harvestable head. Short time to harvest leaf crops include: amaranth (50 days), bok choi (60 days), collards (40 days), coriander (30 days), kale (50 to 60 days), lettuce (40 to 50 days), Malabar spinach (70 days), mizuna (40 to 60 days), mustard (30 to 50 days), rocket (60 days), silver beet (40 to 60 days), spinach (40 to 50 days) and tatsoi (40 to 50 days).

Nutritional requirements – leaf crops particularly use nitrogen so a high nitrogen fertiliser like bird manure (chook, pigeon etc), liquid manure, diluted urine (in a pinch) or following legumes in your crop rotation program. If you can get hold of them, lucerne chaff,

cottonseed meal and soy meal provide a slower release nitrogen along with small amounts of phosphorus and potassium, when incorporated into the soil or used as mulch.

Shade Tolerance – leaf crops can get by with three hours of direct sunlight per day or less so they are an ideal crop where shading is an issue. This can be particularly handy when the shading is provided by things which are difficult to move such as buildings, tall trees or solid fencing.



They can be **grown all year** and replanted into a single plot if required, provided that correct crop rotation protocol is followed. It is counterproductive to grow the same crops in the same ground year by year due to depletion of nutrients and build-up of pests and diseases. One way to prevent this is to develop a crop rotation plan.

There are various schemes for developing a crop rotation plan but one of the easiest is to make sure that you don't sow plants from the same family, in the same plot, two seasons running. Leaf crops make this easy for you because they belong to half a dozen different plant families, allowing the same growing area to support a number leaf crops over time, provided to make sure to choose plants from different families.

Plant families of common cultivated leaf crops:
Apiaceae – Coriander, parsley
Amaranthaceae – amaranth, spinach
Asteraceae – chicory, endive lettuce
Basellaceae – Malabar spinach
Brassicaceae – cabbage, collards, kale, mibuna, mizuna, bok choi, mustard, rocket, tatsoi
Chenopodiaceae – silver beet,
Polygonaceae - sorrel

Methods of Growing

Interplanting – Due to their shallow root systems, and their shade tolerance, leaf crops can be planted in the same bed as deeper rooted, crops such as corn or tomatoes and still provide a reasonable harvest. This practice increases the yield on a given piece land but can also deter pests.

Catch cropping – This is the practice of planting a quick growing crop between main crops of vegetables. So that if you have some space after your winter vegetables have been harvested but the summer vegetables are not quite ready to go in, a quick leaf crop can provide a yield for an area which otherwise would not be able to.

Growing in Containers – Leaf crops being shallow rooted comes to the fore again, making it easy to grow them in containers. This has a number of advantages, particularly if you are in rented accommodation and/or only have a small space in which to grow things, like a balcony. Growing leaf crops in containers will allow you to take your food with you if you have to move and also to "follow the sun" and move them around make the best of available light if that is a restriction on where you are growing.

Cut-and-come-again Croppping – most leaf crops will allow you to spread the harvest by continuing to grow after you cut off and eat the outside leaves if you don't remove the central growing point, rather than harvesting the plant as a whole. You can start early, when the plant is just beginning to mature, and cut the leaves cleanly off at the base of the leaf stem. The plant will continue to produce new leaves from the central growing point as the older leaves become available for harvest from around the outer base of the plant. In that way, a few leaf crop plants can keep you in nutritious greens for months.

The 'eat-all' method - This method of leaf crop production was developed by Carol Deppe, and described in her book "The Tao of Vegetable Gardening". The idea is to sow seed for an "eat all" leaf crop thickly into a well prepared and fertile growing bed or even a 15cm bed of compost over concrete or whatever. Then use a grass rake to lightly cover the seed and water well. The plants are kept watered and grown quickly until they reach about 25cm high, at which point they are harvested by using a sharp knife to cut off the top 18cm or so, which can then be cooked and eaten, frozen, or dried. It might require a bit of fooling around with timing and varieties to suit a particular region, she says that 'green wave' mustard works well for her area.



Sowing thickly then thin out – The idea is again, to sow a leaf crop thickly onto a prepared seed and water it well to assist germination. When the seedlings come up it is just a case of harvesting the greens by pulling them out to thin the crop. This allows some to grow longer

and achieve a bigger size, while the thinnings are eaten immediately as a salad crop or included in stir fries or whatever. This will spread the harvest so that while some of the crop will reach maturity, the majority will have been eaten regularly along the way as a delectable young leaf crop, while still allowing a reasonable harvest at the end of the growing period.

Sprouts – some leaf crops can be prolific seeders, (such as almost any of the brassicas) but may also cross pollinate with other crops of the same family which happen to be flowering at the same time. It makes sense to keep only your best seed which has been gathered so that it is guaranteed to remain true to the parent variety, but what if you have seed of unknown or suspect quality? They can still be eaten as sprouts or microgreens because in either case the plant is harvested at a juvenile stage. In terms of sprouts, the easiest way to grow them is to get a large glass jar and cover the open end with mesh (such as discarded panty hose) and secure it with a rubber band. Remove the mesh and pour in one or two dessertspoons full of seed and re-attach the mesh. Half fill the jar with water and leave it overnight. Pour off the water the next morning, then refill and empty the jar with water (by pouring straight through the mesh) morning and night until the sprouts are well grown enough to harvest, say 7 to 10 days depending on the type and variety of leaf crop and the time of year.

Microgreens in a similar way the seed is sown thickly in a seedling flat, kept watered and allowed to grow to the four leaf stage or a bit larger, then harvested at the soil surface with a pair of scissors. In both cases all that is needed is to produce some edible leafage and stems, so whether the crop is true to the parent stock is immaterial.



As a component in a Guild – According to Bill Mollison, a guild is - "a harmonious assembly of species clustered around a central element (plant or animal) that acts in relation to this element to assist its health, aid our work in management, or buffer adverse environmental effects." This can translate into a design around a central tree such as a fruit or nut tree with a whole lot of productive species planted around it, to support the central tree, but also increase the yield of the area as well. Leaf crops, with their ability to grow quickly, not compete with deeper rooted species and tolerate shade are ideal to include in the species being grown.

Use as a component in green manure – while this does not allow for direct harvest and consumption, it promotes healthy fertile soil allowing subsequent crops to be more abundant. Green manures are used to improve the fertility of vegetable areas by growing suitable plants, quite often grains and legumes but leaf crops area also valuable, and then cutting them down before they flower. The resulting organic matter can be either left on the surface of the soil as a mulch or dug in to increase soil organic matter. Either way the fertility of the soil is increased for the next crop.

Eating/Drinking

Nutrition

Leafy vegetables contain significant amounts of the vitamins A, C, E and K as well as folate and the minerals calcium, magnesium, potassium and iron. Some are also valuable sources of omega-3 fatty acids. They also contain fibre, with each cup of leaves contributing to around a gram of fibre to our diets but are low in calories and carbohydrates.. Leafy greens are also rich in phytonutrients and chlorophyll.

Smoothies

There have been many scientific studies which have shown a link between a reduced risk of illness and increased consumption of fruit and veg, and while I personally am not a fan (to be good for you, you have to be able to keep the smoothie down) many people consume leafy veg in the form of smoothies.

Cooking Leaf Crops

- Wilted or steamed greens – leaf crops can be wilted by first washing them, then placing them in a pot and cover then cook for one to three minutes until they are wilted and bright green in colour. Remove them from the heat and serve with salt and pepper or a drizzle of soy sauce. Steaming them requires putting the leaves in a pot with 5mm of water in the bottom, covering and cooking for a couple of minutes.

- Sautéed Leaves – heat some oil in a large pan or wok to medium heat, then add the leaves in batches and stir gently until they are all in the pan.
- Blanching (should be done before freezing leaf crops to preserve them) – remove the stems and wash the leaves well. Bring a large pot of water to the boil and plunge the leaves in, allowing them to cook for a minute or two, then remove them from the boiling water, drain and chop. They can then be frozen, or added to soups and stews.



- Braising – start out as for sauté as above then sprinkle some salt over the leaves and add a small amount of liquid (water, stock etc) to keep the pan moist, think about 12mm of liquid in the pan, then continue to cook the leaves until they are just tender.

Any of the above techniques may be improved by cooking some onions and garlic in the pan prior to adding the greens, or the greens can then be added to soups, stews or casseroles towards the end of the cooking time.



There is a wonderful Greek dish called horta which will work with cultivated or wild greens, that involves wilting the leaves as above and then adding some olive oil and/or lemon juice at the end. I am a bit Anglo for that so I add in onion and garlic and fry it up, then add in a jar of our diced tomatoes, then toss in the leaves and braise until tender. Other recipes for your well grown leaf crops can be downloaded **here**.

Preserving

There is no doubt that the best tasting leaf crops you will ever enjoy are the ones you harvest directly from your backyard, cook and then eat within half an hour of harvest, and if you plan it out you can grow leaf crops most of the year to facilitate this. You may, however, also want to put some aside if you grow a big batch or for when the weather becomes inclement in your area.

- Fermentation

Think cabbage and sauerkraut, but many wild and cultivated leaf crops will introduce a very strong flavour to the ferment. If you find you like this flavour that is a good thing but if you find it to be a turn off after preserving 500 litres of the stuff, then that could be a problem. So, the hint is – if you are planning of growing large batches of a particular leaf crop and want to preserve it by fermenting, try a small batch of the ferment first. If you like it all well and good, if you find it to be a very effective emetic, you haven't lost much. If you are already into fermenting, try adding some leaf crops in small amounts to other vegetable ferments which you are comfortable with.

- Freezing

This is probably the most effective way of preserving leaf crops. Process the leaves to be frozen by washing them, cutting out the stems and then chopping them. Bring a large pot of water to the boil and prepare large a bowl of ice water. When the water is boiling, immerse the chopped leaves and cook them until they are bright green and barely tender. This should take somewhere between 30 seconds up to a couple of minutes for the tougher leaves. Drain the leaves once the time is up and plunge them into the cold water and stir around to cool them down quickly. Remove and dry as well as possible, force down into containers to remove as much air as possible, label and freeze.

- Dehydration

This may not be the best method for preserving your excess greens but can work with the tougher leaves like kale, collards and spinach. Wash and dry the leaves thoroughly and cut into roughly 2.5cm squares. Dehydrate spinach for 6 to 8 hours at 45°C, kale and collards for 8 to 10 hours at 55°C. Store in a sealed container.

Leafy vegetables (or 'greens') are easy to grow and healthy to eat, and with little effort can be grown year 'round. What more do you need to make it worth adding leaf crops to your sowing plan and your eating plan?

7.5 Resilience and Food Storage 2.0

Back in the 80's when I started out on this journey it was called survivalism and these days it is talked about in terms of 'prepping', but both philosophies can have negative connotations and tend to focus on the individual and, depending on where you are in the world, can also focus on guns and ammo! I prefer the term resilience, which can be an individual but also a community aspiration.

It does make sense to have some form of back-up food supply in an uncertain world, not only for you and your family but also so you can help those less fortunate in times of need.



There are also other advantages to having some food storage over and above your immediate needs as well as increasing your resilience –

1. More flexibility of meal planning at short notice,
2. The ability to throw a meal together in the event of unexpected guests without needing a run to the shops
3. Reduced likelihood of running out of a critical ingredient while cooking, requiring another run to the shops.
4. Where the food item are bought in a supermarket, if you keep some stock you can wait until that item is available at reduced price/on special, thus saving you money.
5. If you are buying bulk amounts of ingredients this will also save you money as well as reducing the amount of packaging you generate.

Plus if there is a situation where supplies are getting low, you won't be competing for the stuff left in the shops; that can go to the people who really need it as you will already have yours.

The downside of setting up food storage is that it is quite possible to buy in too much, or too much of the wrong stuff, resulting in the food going off or otherwise taking up space and not being eaten, with the associated wastage of both food and money. I have made these type of mistakes in the past much to my disappointment with myself, but what we do these days works very well (for us at least) so I will describe it for you.

Research

We found that if we wanted to start a meaningful storage program, we first needed to understand what food items we already had floating around home, so we did a **pantry audit** and included the fridge. This gave us a feeling for what we already and on hand and how much, so that we could avoid buying too much of stuff we already had, what it didn't do was give us a feeling for how much stuff we bought in, and from where. So to do this I constructed an excel spreadsheet to keep track of this information (see **here**, about half way down) and filled it out for some months. By knowing how much of what we were buying it was easier for decisions to be made about how much of what to store, what could be

improved by bulk buying and what opportunities there might be to home-make stuff for ourselves.

Bulk Staples

We buy most of the staples which we eat on a regular basis in bulk by the bag (12.5 kg, 20kg or 25kg depending on the material), and then store them in 20 litre polypropylene sealable buckets, most of which are kept in the laundry. Such staples include –

- **Rolled oats** – organic – used mainly for my muesli but can be used to make Linda's porridge or oat milk, which is not as disgusting as it sounds! They are great for Anzac biscuits or to make a pie crust and to grind and add to bread to for a nutty flavour. We buy them 25 kg at a time from an organic foods bulk supply. Due to issues with pantry moth, we keep the bulk bag in the freezer and pack off a 10 litre bucket for day to day use as required.

- **White Rice** – Before you email me, I know how brown rice is sooooo much better for us, but white rice lasts longer in storage, and besides, we prefer white rice. It provides a great source of carbs whether it is boiled, steamed or fried and it can be ground to flour and used to make rice noodles or spring roll wrappers or even gluten free pasta (if that is your thing) or fermented to make a spirit or vinegar. We buy Australian long grain rice (because that is what we like) from a local Asian food supplier.

- **Whole wheat** – organic – we have been using it, bought direct from the mill, by the 20kg bag (originally in 12.5 kg bags) for years so about 8 years ago we bought a quite professional electric grain mill from Skippy grain mills and mill the whole grain to flour as we use it, for raised bread, flatbreads, pizza dough etc. Whole wheat flour can go stale comparatively quickly but as the whole grain it stores for years.

- **Powdered Milk** – We started out using the 1kg bags from woollies and got used to the taste, but we bought a 25kg bag of non-instant Australian produce skim milk and found it actually to be much more palatable than the woollies stuff. It works out to 60c per litre of milk. As well as being used as milk once reconstituted it can be used to make yoghurt or low fat cheese quite easily. We buy it from a food industry supply place in towards the city.

- **Baker's flour** – we found years ago that whole wheat products can tend to be a bit heavy so we bake our breads etc. as a 50:50 mix of whole wheat and baker's flour. We get organic unbleached bakers flour by the 12.5 kg bag from the organic bulk food supply.

- **Sugar** – white sugar, not much to say, we tend to buy a stack of 3kg paper bags of white sugar from woollies and repack into the 20kg bucket and recycle the paper bags.



Semi – Bulk staples

These are products which we keep a ready supply of, but don't go through them quickly enough to make it worth buying in huge amounts. They are quite often bought packaging-free into our own glass jars from an organic bulk supply shop. This includes products such as –

- lower use flours like white self-raising and plain flour and cornflour
- alternative rices such as basmati and Jasmin rice (yes, even a bit of brown!)

- Other muesli components such as raisins, sultanas and wheat bran straws
- Lower use sugars like brown sugar and icing sugar
- Dried legumes such as red kidney beans, black turtle beans and chickpeas
- Nuts like almonds, cashews and walnuts which can be eaten as is or put into cooked dishes

Canned Goods

Canned fruit, vegetable and meat were the backbone of our **original storage program**, and for most of them I committed the ultimate sin of storing them without integrating them into our meal plans, violating the cardinal rule of 'store what you eat and eat what you store'. There were a number of reasons for this but in the end it meant that some stuff was in storage for 20+ years and wound up being composted/recycled instead of eaten.

We still do store some canned goods but in a severely reduced numbers and variety. These days the cans we store in any amount are limited to corn kernels, peaches in juice and beetroot. We use them on a regular basis (as was pointed out when I analysed our shopping habits) so we keep enough to last between the times when they are on special. How often they are used and the size of the can will dictate how many cans we store such that we will have up to half a dozen 825g beetroot tins but a couple of dozen 400g corn tins. This is still considerably less than the boxes of cans we stored previously. This also does not take into account the odd cans of fish, pineapple, pie apple or whatever that are likely to appear in anyone's pantry, depending on their tastes.

Home Preserves

Over the years we have tried quite a few methods of preserving bought in excess or excess stuff we grew ourselves including drying, freezing, bottling and pickling. The way we grow our food these days means that we get a steady if small supply rather than the seasonal gluts we used to, so the need to preserve excess produce is reduced. There is one main exception to this – tomatoes!



Around the end of the year we mix our own tomato produce with bought in stocks (organic when we can afford it, but local at least and preferably chemical free) and turn some into **pasta sauce/passata**, some into **diced tomatoes** and some into pizza sauce. We usually process enough in a couple of weekends to last us for the coming year.

We also do a bit of drying, mostly leaf crops, but I am interested in growing or buying mushrooms and then drying them for later rehydration and to be turned into powder as a flavouring agent.

Sundries

These are the little bits that add flavour like spreads, sauces and spices. For the most part we will keep one or two spares of the usual size container we buy so that we don't run out at a critical time and have to go bolting for the shops! The exception is spice mixes. Rather buy in jars of spice mixes like curry powder, Mexican spice or stock powder, we keep stocks of whole spices which we then grind and blend ourselves. It is not as difficult as you might think and there are some recipes elsewhere on this site, but we have found that having a copy of Hemphill's 'Spice and Herb Bible' invaluable in making our own spice mixes.

Practice

No I don't mean screaming "We're all gonna die!" and running for the bunker. Life is busy and you might not get to practice your skills every day, so some programmed practice time is a good thing. Get the family involved and make it a fun challenge!

Every year we do '**No Buy July**' and this gives an opportunity to test our skills and preparations which we hope will make us more resilient. You can read the detail here, but essentially we commit to buying almost nothing for a month, just subsisting on our stores and what we grow, using the skills we have learned in cooking, food processing and using what we have. If we are short of something, or have run out, how can we make use of what we have to get where we want to go?

Running 'No Buy July' gave us the motivation to make use of the skills, ideas and preparations we had made to improve the resilience of our lifestyle to see how well they worked. It was fun and most educative to see what worked, what didn't, where we were successful and where more thought, training or practice was required. At the end of No Buy July (it could be any month or any time for you) we look at how things went. What the learnings were and how we would improve for next year.

Conclusion

The approach we use is not a knee jerk, '*go out and buy a warehouse full of toilet paper corona is upon us'* type of approach. It is a measured approach taking time to design things so that waste is minimised. It worked well for us and made sure we were storing the right stuff, the right way, for us, and that we were able to use it when needed. Everyone's tastes are different so if you want to put together some food storage, for any of the reasons outlined above, you need it to fit your families' needs, and to work for you. So give our process a go and see how it works for you.

8.0 Growing Food at the Choko Tree

8.1 Annual Vegetables

We know that sustainable living is more than just about growing fruit and veggies, but providing our own local, organically grown food using Permaculture principles is not only intensely satisfying it also makes great economic and environmental sense. We live on 600m2 in Sydney's greater west and for years I would contribute to the family larder by growing vegetables but what this meant generally was –

1. Cultivating like mad each spring using a petrol powered rotary hoe
2. Buy in lots of manure (primarily chook and horse), spread it around and dig in
3. Buy in a load of straw and mulch everything in sight
4. Buy in a load of seedlings and plant everything in sight.

The result of this fevered action was trickle of vegetables into summer, a glut of just about everything in mid to late summer and then little else from then through to the next spring when the whole thing started again. There had to be a better way!

The Five Processes

This was not only expensive it was not particularly environmentally friendly either so over time I developed a series of processes that has made us much more self-reliant and reduced our outgo and environmental impact at the same time. This is how we did it, using five innovations developed by others or ourselves –

1. Developing a sowing plan
2. Putting in the Plots
3. Raising our own seedlings
4. Installing the chooks
5. Saving our seed

Developing a sowing Plan

I needed to be able to provide a mix of veggies for us throughout the year and to do that I needed to develop a **sowing plan** that showed me how much of what veggies to plant when. Seeing as nothing like that existed that I could find, I developed my own.



I got hold of seed catalogues from producers of open pollinated heritage seeds and scoured them to work out what varieties suit our climate and when to sow them. Over the years we have experimented with different varieties of the some of the vegetables to spread your growing season. I then worked out (guessed really) how much of each vegetable we wanted to plant at each time, mind you the plan is always evolving and some things we discovered we wanted to grow more of over time, others we reduced because we didn't like them as much or as often as I thought we might.



Then, to develop a sowing plan, I worked out how often we needed to sow/plant out your veggies, based on twice monthly sowings. I then drew up a matrix with the name and variety of each veggie we wanted to grow down one side and the interval of sowing across the top. To make it easy for me to develop and keep up-to-date I use an Excel® spreadsheet on our computer.

Putting in the Plots

We have Fourteen 1.2 metre x 2 metre veggie plots that are divided by 100mm square wooden borders and the plan that I developed allows us to plant one out every two weeks, so that if you were to come to visit at any time of the year you would find plots producing veggies, plots growing up getting ready to produce, plots freshly planted out and plots ready to be dug over.



Originally I double dug the plots and even used a small rotary hoe but now we don't dig the plots over at all, we put the chook tractor on them to dig over from above and then mulch to attract worms that come in and dig from below. How we are practicing crop rotation is covered **here**.

Raising Seedlings

We make our own seed raising mixture based on one part coarse sand, two parts worm castings (from our **worm bath**) and three parts cocopeat, this is placed into eight compartment punnets, one type of veggie in each compartment. I fill up the punnets with our seed raising mix and then use my finger to press down each compartment. When the seeds go in each compartment I fill it with seed raising mix to the top, which aids air drainage (and preventing damping off) and it also shows me which compartments are yet to be sown with seeds. A label finishes the process off.





For large seeds like corn or beans where we need a quite a few they get sown in several (6 or 8) punnets of their own. The full punnets are placed in a cat litter tray half full of damp sand to keep them moist and left in the greenhouse for about two weeks. Once the seedlings are up and at the four leaf stage they are potted on into rolled newspaper pots filled with the same seed raising mix. They stay in the greenhouse for two to four weeks, that way they get a good start ahead of the pests, and they can be left a bit longer if you get busy or the weather turns to crap!

Installing the Chooks

For many years we had chooks in a dedicated chook pen, but after reading about the Permaculture way of doing things we decided to put a **chook tractor** together so that the chooks could dig over and manure the plots for us, while still providing wonderful eggs. I built the tractor from scratch; it is A-frame in shape and has the same footprint as the veggie patches with the bottom surrounded by chook wire and the enclosed top housing laying and roosting areas.



As mentioned earlier, they spend two weeks on each bed cleaning and manuring prior to replanting. When it comes time to move to the next bed all I do is cut down the taller stuff with an old machete and then we get on each and of the tractor and carry it to the next bed to be dug over. The chooks love getting onto a new bed and line up along the side of the tractor to watch me cut down the next bed, clucking with excitement.

While the chooks in the tractor dig and manure the plots, we have a “retirement village” for those chooks getting a bit long in the tooth (or is that beak?) to produce eggs. The retirement village is a deep litter system based on locally produced grass hay what they dig over, break down and eat any weed seeds from. The result is used as mulch on the veggie plots and calls more willing workers (lotsa worms) to help break down and cultivate the soil once the chooks have moved on so I no longer need to cultivate at all beyond a light hoeing to break up any compaction due to the chooks, particularly in wet weather.

Saving our Seed

This closes the loop and means that we can develop our own seed varieties over time that are adapted to our climatic conditions. I started out with the bigger easier seed like peas, beans and corn but then graduated to the biennials like carrots and onions and the promiscuous ones like brassicas.



To do it properly we needed to allow room in the beds for veggies to complete their life cycle and of course we needed to start with open pollinated varieties but that was not a problem as we had only been using open pollinated varieties for years. It is then a case of identifying our best examples of the types of veggies we wanted to plant then **saving the seed** from them.

With a bit of time and effort and some land it IS possible to provide most of your veggie needs, i know because for over 10 years we have been doing it!

2020 Update

Since I wrote this, there have been a couple of things we have put in place which have turned out to be critical to our ability to grow food all year, particularly during the hotter months and we had to rejig our veggie beds a bit.

Veggie bed covers – I noticed the increasing difficulty of getting a decent harvest during January and February some years ago and started fooling around with shade covers for the veggie bed. We have had coves for when I put the seedlings in during the hotter parts of the year for upwards of 15 years, but this was new. The shade covers use 50% shade cloth to knock the intensity of the sun back, allowing the plants to grow and reducing their need for water in the hot weather.



I have tried different types but it appears to me that the best design is to get 50mm irrigation pipe and put it over star pickets, then run a bit of timber along to support the shade cloth. The shade cloth usually goes on mid-spring and comes off mid-autumn, so that we are covered for the hotter parts of the year, but full sun can get through in the cooler parts. Without the shade cloth, getting any harvest at all during summer would be difficult, and our water consumption with be greatly increased.

For more detail, check out **here**

Olla Irrigation – ollas are unglazed terracotta pots, buried in the ground up to their neck, and kept full of water. The water seeps slowly into the ground keeping the veggies moist easily and efficiently. They can either be **made from scratch** using pottery techniques, then fired or built up using bought in **commercial terracotta pots**. We have a mix of both. Again, over the years, we have tried a number of lot tech, high efficiency irrigation techniques but we keep coming back to the ollas. Also, with the introduction of level 2 water restrictions in late 2019, ollas do not need the use of hoses for irrigation so we can continue to grow. We are in the process of replacing some buried pipe irrigation with more ollas.





Veggie Beds - We have also had to muck around with our veggie beds a bit, and 7 (half) are now 3 metres long by 1.2 metres wide, giving us an extra 8 and a bit square metres of growing space, but which has to be balanced against the removal of the bed closest to the northern fence from service. The window of time we had to grow in it where there was sufficient direct sun was too small get a meaningful crop, so we do not use it any more. We have also started replacing some of the timber bed surrounds which are rotting, with besser bricks, as can be seen above.

8.2 Perennial Vegetables

The difference between annual and perennial Vegetables is a fairly simple one, annual vegetables complete their lifecycle (seed sown, plants grow, flower and then seed) in one year. Perennial vegetables complete their lifecycle in more than two years. In between there are vegetables which complete their lifecycles in two years, referred to as biennials. There are quite a lot of biennial vegetables such as beetroot, carrot, kale and onions that are grown as annuals, being harvested before they can complete their lifecycles.
There are a number of advantages that perennial vegetables have –

- Once they are in and productive, they can remain that way for many years and don't need replanting annually.
- They are hardy and look after themselves, requiring less water and fertilising than many annual vegetables.
- They tend to be more resistant to pests and diseases that cause problems for annual crops.
- They can extend the harvest season – around here autumn can be a reduced produce time when the summer stuff has died off but the winter veg is not yet producing and Jerusalem artichokes and chokoes are great contributors to our diet.
- They work well with no-till systems, you don't need to dig em up and replant them every year.
- Some like rhubarb and walking onions do well in full shade.

Taking into account the above, why would you grow anything else? Well they do have disadvantages, some, like asparagus, can take years to establish before you get a crop. Others, like Jerusalem artichoke, can take over if you don't watch them and some of the perennial greens can become very strongly flavoured over time. The reality is that we enjoy our annual veg, but growing perennial vegetables complements our harvest of annuals, increasing the variety of foods we grow.

Arrowroot (*Canna indica*)

I originally placed some donated arrowroot them at the south end of our water garden where excess water drains out and while they grow fairly well there, the bananas are encroaching on their space these days. I harvested some of these roots previously and inadvertently put them down on the northern (asparagus) wicking bed in the front yard. It appears they like this area and have competed rather effectively with the asparagus. Some time ago I decided to try them out as food and harvested and peeled the roots and tried them boiled and baked. I was underwhelmed by their flavour. They would be OK if that was all there was to eat. I also extracted the starch from the tubers for use as a thickener in food, and it works well.





Homemade arrowroot starch thickener

Asparagus *(Asparagus officinalis)*

We have been growing asparagus in our front yard in a wicking bed for over ten years. It was so successful that we added a second one slightly north of the first one, but this has not been as successful because the mulberry tree has gradually encroached on it, reducing the amount of light it gets and some accidental arrowroot took over….. I add a bit of soil and mulch each year and not much else, the wicking bed ensures they gets plenty of water. As the spears come up in early spring, I harvest them and then after a couple of months of regular production I let them grow up into fronds. They will then sit there, sending up the odd spear until winter hits and they die back and I cut them off, ready for the process to start again in early spring.



Early spring and the asparagus spears are making their way to the surface



After harvesting is complete, they grow up and return energy to the roots

Broad Leaf Arrowhead (*Sagittaria latifolia*)

Also known as 'Duck Potato', Broad Leaf Arrowhead is a north American food plant which grows in water and produces an edible tuber that can look disconcertingly like an eyeball. It is quite productive but can be invasive so it needs to be isolated from the natural environment. I got hold of some when buying water chestnuts by mail and bought some arrowhead at the same time. I planted them at the same time and in the same manner as the water chestnuts (see below). We have also eaten them cut up in a stir fry like water chestnuts but find the water chestnuts to have a better texture. They also die back in winter, but sprout more quickly than the water chestnuts in spring.





Arrowhead corm on the left

Choko (*Sechium edule*)

The choko is the mascot (for want of a better word) of our website and we have been growing them for over 25 years. We primarily grow it over an old orange tree (now dubbed the choko tree) in our back yard. We have also grown it over the western wall of the chook retirement village to provide shade as well as chokoes. They grow up over the tree and onto the roof of the garage, and in a wet year they can go so far as to obstruct the solar panels and have to be pruned. They produce chokoes in autumn then die back in winter, providing lots of organic matter for composting system. They are easy to grow and you can start with a single sprouting choko. The young leaves and tendrils are edible and go well in a stir fry, although the older leaves are a bit tough to be palatable. The roots are also edible and have a water chestnut-like texture (At least that's what they seem like to me) We find that while the fruit is edible at almost any size, when harvest small – 25mm to 30mm long –and stir fried, they taste best, with a nutty flavour and crunchy texture.



The choko tree



Choko - Over the Chook Shed

Dandelion (*Taraxacum officinale*)

We don't grow dandelion in the sense that we cultivate it, but we do allow it to grow throughout the back yard and eat it ourselves as well as feeding it to the chooks. For the

most part we just eat the leaves, generally in a soy sauce based stir fry with other leaf crops, the salt in the soy sauce reduces the bitterness. The roots are edible as well but we have yet to do anything with them.



Jerusalem artichoke (*Helianthus tuberosus)*

This is another vegetable that is ridiculously easy to grow and is hugely productive, although you do need to keep an eye on it because it can become invasive. Many years ago I bought some tubers from the local supermarket in autumn, then kept them in the fridge and planted them out the next spring. Being aware that they can take over, I planted them in a triangular bed next to the northern fence and at the side of the worm shed. To make watering easier I installed three ollas, also in a triangular pattern. I cover the bed with some mulch from the banana trees and trimmings from other plants once they have died back. They have been there for many years and are still productive, but recently they have started mounting an expeditionary force towards the wood pile. They die back in autumn and we harvest and use them from then to early spring when they start to resprout. They are great roasted or in soups, just be aware they are fairly flatulogenic.



Ollas and partial harvest



The main bed



Making a break for it!

Okinawa Spinach (*Gynura crepioides*)

I was given some Okinawa spinach cuttings by one of the ladies at Permaculture Sydney West and I placed the cuttings in water for a few days so they could grow roots. Okinawa spinach is tolerant of heat and shade, but needs regular watering, is frost tender and if it gets away it can also become invasive. We decided to circumvent any of these potential problems by growing it in a large pot with a central olla, near the front brick wall of the house. It grows well and provides the occasional harvest, while being largely unaffected by the cold and/or dry weather we can experience here. It slows down but does not die back in winter due to the warmer microclimate being close to the thermal mass of the house.



Rhubarb (*Rheum rhabarbarum*)

We grow rhubarb in the front yard in a bed that was originally designed to be a shallow wicking bed, but it didn't really work like that and was converted to a conventional raised bed. About three years ago I decided to convert it to a hugelkulture bed, pulling the rhubarb and all the soil out, placing in a whole stack of tree trimmings and then refilling it with soil. I cut the rhubarb back pretty savagely and replanted it and it has since continued to thrive.



Sweet potato (*Ipomoea batatas*)

Sweet potatoes come in various hues, but from experience I have found that we only like the orange ones, so that is what we grow. While I have tried growing sweet potato in 20 litre buckets, they seem to do best straight in the ground. I originally grew them just by planting out commercial tubers but about 5 years ago I let a tuber grow slips (sprouts) cut them off and placed them in water to grow roots, then planted them out. It worked very well. We grow them in the front yard, in the LUFFA (Longitudinal understory food forest area) where the vines climb around the other trees and shrubs. They also die back in winter somewhat and then come back up in spring. They seem to taste best if they are harvested and then cured for a week or two in a warm dry place. We use them in curries, soups, cut up and fried as chips or just as a steamed vegetable. The leaves are also edible and are included in some of the recipes using greens that we cook.



Taro (*Colocasia esculenta)*

We do grow taro in the constructed wetland in the back yard and, along with some of the other perennials, they die back partially in winter, but not completely – they always retain some leaves which I think is due to the warmer microclimate near the back of the house. While the root is edible, we do not eat it because it is part of our greywater treatment system and so not suitable for consumption.



Water chestnut (*Eleocharis dulcis*)

Having enjoyed the delights of water chestnuts in Chinese restaurants and later used the tinned ones in our own home made Chinese food, I wanted to try growing them. Initially I tried in plastic pots sunk in a large concrete pot shaped like a half barrel filled with water, but for whatever reason they were never happy and certainly not productive. I decided to try a different tack and got hold of an old metal bath, sunk it in the ground and then put gravel in the bottom. I filled it with water then got hold of some 200mm plastic pots and cut

6mm holes in the side with a small wad punch. I filled them with potting mix, planted the tubers about half way down the pot, filled them up and put a layer of gravel on top to keep everything in place and sunk them into the filled bathtub. They have been growing there ever since. The die down in autumn and I harvest and use them until they start to sprout back up again the following spring. The water chestnut plant is easily distinguishable from the Broadleaf Arrowhead by their thin reedy leaf as opposed to the large arrow shaped leaf of the arrowhead.





Water chestnut on the right

Try Before You buy

Growing perennial vegetables has worked out well for us and I would recommend that anyone interested should give them a go. I have found when considering a new vegetable to grow, and this is especially applicable to perennial vegetables, get hold of some and cook them up for yourself or your family. This can save lots of frustration in the long run from spending all the time and effort growing them, only to have them rejected by the family because they don't like the taste or texture. Good luck!

8.3 Fruit



Our most important fruit tree - the CHOKO tree!

We know that sustainable living is more than just about growing fruit and veggies, but providing our own local, organically grown food using Permaculture principles is not only intensely satisfying but also makes great economic and environmental sense. We live on

600m2 in Sydney's greater west and for many years I have contributed to the family larder by growing fruit and this is an overview of how we do it.

History

I wanted to grow fruit, from the time when we first moved into the house in the late '70s. The problem was that I knew even less about fruit growing than I did about growing veggies, and I knew absolutely nothing about that! Needless to say, I made plenty of mistakes during the learning process. Some of the mistakes I made include the following –

• Planting an orange, apple and mandarine on the northern side of the then main veggie patch, causing increasing shade problems as the trees grew. Only the orange is still in place and it masquerades as the Choko Tree.

• I imported a very sickly peach tree from my fathers' place, which then acted as a fruit fly magnet every spring. When, after a couple of years I removed it, my fruit fly problem reduced considerably.



Linda, inspecting said peach, back in the day

• Planting a lemon in the chook area, long before we had the chook tractor. The chooks compacted the clay soil and the excess manure resulted in anaerobic soil where the tree was, needless to say it died. I then compounded my error by replacing the dead lemon tree with another one which, surprisingly enough, also died.

• Persistently trying to grow berry fruits like gooseberry and red and black currants that do not do well in our Western Sydney Climate.

• Planting a couple of 'Nelly Kelly' grafted passionfruit beside the back deck. The rootstock is incredibly invasive. The productive parts are long dead but the rootstock continues to battle us for access to the house.

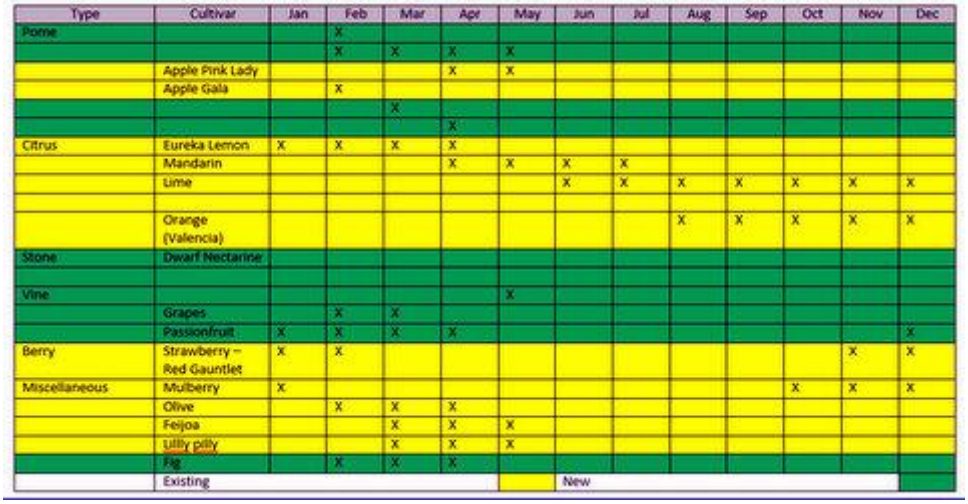


Nelly Kelly Passionfruit - productive passionfruit on the left, invasive rootstock on the right

Fortunately, after buying a few good books and getting some training as part of the Farm Technology Certificate I did in the early '80s I no longer make such rookie mistakes. My mistakes are now much more subtle and harder to correct!

Planning

There are very good things that come from planning. I unfortunately didn't figure that out until I discovered permaculture twenty odd years ago. When I did my PDC about 15 years ago, I was introduced to the idea of a Fruit Harvest Calendar which allows you to work out when your existing (and prospective) fruiting plants will produce, so you can arrange for year 'round fruiting by varying the species and varieties of the fruit you grow. I did one during the course and found it very educative, but I need to re-do it to reflect the fruiting plants that have come and gone in the intervening years.



Type	Cultivar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pome			X										
			X	X	X	X							
	Apple Pink Lady				X	X							
	Apple Gala		X										
				X									
					X								
Citrus	Eureka Lemon	X	X	X	X								
	Mandarin				X	X	X	X					
	Lime						X	X	X	X	X	X	X
	Orange (Valencia)								X	X	X	X	X
Stone	Dwarf Nectarine												
Vine						X							
	Grapes		X	X									
	Passionfruit	X	X	X	X								X
Berry	Strawberry – Red Gauntlet	X	X									X	X
Miscellaneous	Mulberry	X									X	X	X
	Olive		X	X	X								
	Feijoa			X	X	X							
	Lilly pilly			X	X	X							
	Fig		X	X	X								
	Existing						New						

How to set up your own fruit harvest calendar is covered **here**.

Fruit Growing Areas

We have a number of areas that are set aside for growing fruit, with or without other types of plants being integrated with them –

Fruit tree circle – a 3 metre, raise and wood chip mulched circle with a worm tower in the centre, topped by an insect watering station. The fruiting plants originally installed include two lime trees (Tahitian and Makrut) two apples (pink lady and gala both dwarves) and a dwarf lemon tree. There were also three red currant bushes planted in the centre of the circle between the trees and the worm tower. While not strictly fruit trees there are also a curry leaf tree and a macadamia nut tree. The gala apple has since passed on and was replaced some years ago by a multigrafted apple and the red currents also did not survive, refer mistakes above. For more detail on the fruit tree circle, **click here**



2012



2023

Mulberry tree – This deserves a section all to itself! It was a seedling gleaned from my father's next door neighbour about 30 years ago. It now has a canopy of 10 metre diameter, provides lots of fruit every year with no maintenance, shades our front yard park area, provides lots of sticks for starting the fire in winter or use in the rocket stove all year round and keeps the northern end of the house cooler in summer. The leaves are edible (I have read) but we have not tried them.



Summer



Winter

LUFFA (Longitudinal Edible Food Forest Area) – This forms fence of sorts at the front (east) of the property and is made up a number of fruiting species including – feijoa, lilly pilly, thornless blackberry, midyin berry (still small and scrappy) and a coffee bush (coffee is a fruit!!!). Non fruit related plants in this area also include a large bay tree and three good sized melaleuca alternifolia trees and lots of sweet potatoes. The whole set up provides nice screening from the street and neighbours across the road. For more detail on the LUFFA, **click here**.



Olive tree (LHS) and LUFFA from the south



From the north east

Small Fruit Tree Area – At almost the southeast corner of the front yard that used to house a small, scrappy and very unhappy bottlebrush, which we removed and now have a small built up area that was originally home to a blood orange and a dwarf fig (that doesn't seem very dwarf anymore) and that was recently expanded to include a dwarf lemon. It is watched over by ourselves and our lovely next door neighbours. For more detail on the small fruit tree area, **click here.**



Miscellaneous – There are two fruit trees in the front yard that do their thing year after year. One is an olive tree, no idea what type, it had sat for a long time in a tin at a friend of my fathers' place before we got it 30 or more years ago. It sits at the front of the property almost as a southerly extension of the LUFFA, but not really. While we do not eat olives (I have passed them on to friends) it is on my 'to do' list to try extracting their oil. One day! The second is a dwarf nectarine, which is our only stone fruit, due to the issues we have with fruit fly. It seems reasonably resistant and we get a bit of fruit each year.



Dwarf Nectarine

Banana circle – This has had a chequered past. Originally in the front yard for 10 years where it was crappy soil, too dry and too shaded, the bananas never fruited or made it over two metres in height. After an attack of smarts I transferred it to the backyard where it had good soil, full sun and all the water from the spa/shower in the bathroom piped to it. They are now up to 5 metres tall and fruit when they feel like it, which will make setting up a new fruit harvest calendar interesting. The banana circle also provides welcome shade on the back of the house from the western Sydney afternoon sun. For more details on the original banana circle, **click here**, and for more details on the move and how it developed since, **click here.**



Original position and growth 2011



New position 2023

Mandarine/passionfruit – Remember the mandarine I set up north of the veggie patch I mentioned above? It is now growing a metre from the western wall of the house and just north of the banana circle. I dug it up and moved it by hand about 15 years ago, and while it was not happy with me for 12 months, it recovered and produces lots of really nice fruit most years. It does sometimes go into biennial bearing after a particularly prolific year, but everyone deserves a rest. The passionfruit (a seedling, not grafted) sits below my office window, climbs up and provides shade, and then shows its affection for the mandarine tree, again, fruiting when it feels like it.



Passionfruit



Mandarine Tree

The back deck – It was my intention to have ago at growing some fruit on the back deck. First was a grape which I planted in a large pot which has a buried capsule to keep it watered. It has not done as well as I would like, more research required. I also got a couple of allegedly self-watering pots and put in a two blueberries. These did well for a few years but then seemed to sicken and then expire. I suspect both sets of plants of plants have not dealt well with the ferocious western Sydney summer and as they are on the edge of the western facing deck, I fear they bear the brunt of it. Again – research opportunity! For more information on how I setting up the grape on the back deck, **click here.**



Grape, just after set up

The Strawberry tower – This was made out of a plastic 200litre drum with holes for the strawberries to grow out from. It was originally in the front yard under the mulberry tree, but I suspect it was too shaded to be truly happy. I transferred to the back yard but have not replanted it yet. For more detail, **click here.**



The Strawberry Tower

Watering

The mature trees such as the mulberry, olive and older citrus get watered when it rains. Simple as that.

The smaller and especially younger trees are watered using tank water and deep pipe waterers. These are 50mm diameter PVC tubes that are 500mm in length sunk into the ground near the root system with 3mm holes every 50mm down the length of the tube, facing the plant. Water directed into the deep pipe waterer goes directly underground, reducing losses due to evaporation and encouraging deep root growth. For details on construction and installation of deep pipe waterers in article form, **click here**, or for our Youtube videos on deep pipe waterer making, **click here**, and installing deep pipe waterers, **click here**.



What you see above ground

There is also a reservoir which I designed that goes on the top of the deep pipe waterer, buckets of grey water are tipped in, allowing the water to make its way into the soil without any losses.



The whole unit

The banana circle, of course is watered by greywater draining directly from the shower/spa into the centre depression of the banana circle. The mandarine is watered by greywater from the washing machine once it has passed through the constructed wetland.

Fertilising

There is some residual fertilisation from the breakdown of woodchip which most of the trees and shrubs have as mulch. Younger trees like those in the fruit tree circle and small fruit tree area have been provided with fertiliser sausages – which is a mixture of manures, wrapped up in hessian bags to form a sausage, and placed around the bottom of the trees. The sausages slowly rot down releasing nutrient for the trees. The fruit tree circle also derives some fertility from the worm tower at its centre. For an article on constructing fertiliser sausages, **click here**, for a YouTube video on how to make fertiliser sausages, **click here**



Fertiliser sausage



Fertiliser sausage, in place in the fruit tree circle

The citrus, due to their nitrogen requirements get diluted urine in spring and summer, with a tasteful white watering can in the toilet being contributed to by a donor or donors. This is then topped up with tank water at a ratio of about 1 part urine to 10 parts water. The resulting mix is then applied directly to the soil using the deep pipe waterer.

The banana circle is fertilised by adding organic matter to the central depression where the greywater goes. The damp organic matter then breaks down with nutrients being accessed directly by the bananas.

Pests and Diseases

By and large, our fruit plantation is pretty healthy with only the odd problem showing up. In terms of pests one of the more common things we get is the scale/ants/sooty mould trifecta, where we use a vegetable oil spray to control the scale, and maybe a collar on the trunk to prevent access by the ants. This is usually on the citrus but can show up on the lilly pilly and bay tree as well. The sooty mould discolouration on the leaves is more cosmetic than anything else, caused by the scale secreting honey dew (which the ants want, so they 'farm' the scale) and encouraging the fungus sooty mould when it gets on the leaves. If the scale problem is resolved, so is the sooty mould.



Bronze Orange Bug

The main problem we tend to get is bronze orange bug on the citrus and in a bad year they can be in plague proportions and really kick the living daylights out of the citrus. I hand pick and drown them. I have found that if you get stuck into them early in the spring and keep on top of the numbers it will make life easy (for me, not them!).

Fruit fly can be an issue, and I have used paper bags around fruit to keep them out, but in recent years they seem to be less of a problem. We also get fruit bats, mainly to share the mulberry crop and occasionally some bananas but we generally let them have their share and they are happy.

Conclusion

Our fruit growing efforts have taken a while to set up, and even taking into account my previous mistakes, is quire productive. I think that given a bit time, effort and learning, anybody can do what I have done. In the end I think it is really just a willingness to give it a go and see how things turn out. Good luck!

8.4 Herbs and Spices

Sustainable living is more than just about growing herbs and spices, but providing our own local, organically grown food and flavours using Permaculture principles is not only intensely satisfying but also makes great economic and environmental sense. We live on 600m2 in Sydney's greater west and for many years I have contributed to the family larder by growing herbs and spices and this is an overview of how we do it.

Herbs

When I started out growing our own food, I also wanted to start growing herbs as well. I didn't have a 'herb garden' as such, I just planted them in various areas around the place and with varying degrees of success. I planted mint under the tap because of its need for water, but it didn't do very well in our dry climate but rosemary on the other hand has prospered in a few places in the front yard and even today grows near the letterbox and at the apex of the herb spiral.

The Herb 'Spiral'

Back in 2009 as part of a permablitz at our place by Permaculture Sydney West, we constructed what was theoretically a herb spiral to expedite my herb growing objectives. A friend of mine who was a roof tiler turned up with some excess roof tiles which we could use to construct it. They worked well but due to their peculiarities the spiral became a two-tier 'wedding cake'.



2009

This has been home to many herbs over the years including –

Angelica, Basil, borage, calendula, chives, coriander, dill, feverfew, lavender, lemongrass, lemon verbena, nasturtiums, marjoram, oregano, mint, parsley, pennyroyal, rosemary, sage, sorrel, tarragon, thyme, wormwood and yarrow. Plus probably others I can remember. Obviously not everything at any one time, but over time all of them have had a place in the herb spiral.



2010

In 2013 we had a second blitz during which the original herb spiral was pretty much pulled down and rebuilt and a third tier was added to the top, which has housed our main rosemary plant ever since.





2013

Just recently, due to prolonged wet weather, the lemon balm tried to take over, but it has been cut back severely and the herb spiral is now home to – Basil (perennial), basil (spicy), chives, lemon balm, lemon verbena, lemongrass, marjoram, oregano, parsley, rosemary, sage, tarragon (French), and thyme. I will probably add to this when we are coming into spring, later in the year.



2023

Tree herbs (spices?)



2010 when the Makrut and Curry Leaf Tree were installed

We have three trees that we harvest leaves from to flavour our cooking and one medicinally –

Bay Tree (Laurus nobilis) – This is a slow growing tree, which we have had hanging around for a very long time. It predates all our other herbs, being bought in over 35 years ago. It started out in a pot near our front door after I first bought it, but then about 30 years ago I transplanted it into the northeastern corner of our front garden. It is easily accessible to passers-by but I don't know how many would know what it is. It has become the lynchpin of our longitudinal food forest in the front yard and would probably be able to supply all of St Clair with by leaves!



Makrut Lime or Kaffir Lime (citrus Hystrix) – It was one of the original plantings of our so called 'fruit tree circle' that I put together in 2010 to replace the carob tree (which turned out to be a non-productive male tree). It is in the northernmost part of the circle, adjacent

to the path, and continues to grow well, just requiring the odd prune to open it up and keeping it free of bronze orange bugs during the hotter months.



Curry Leaf Tree (murraya koenigii) – This also was part of the original 'fruit tree circle' plantings in 2010. It is pretty hardy and does not require much care, just a bit of water during really dry times. It is exceptionally handy when I am cooking a curry to be able to walk out my front door and three metres away is our own curry tree.



Tea tree (melaleuca alternifolia) – these were placed across the front of the front garden as tubestock we got from the Easter Show almost 40 years ago. They just about define the boundary of the front yard these days. They produce a wonderful medicinal oil (tea tree oil) and it has been on my 'to do' list to steam distil some of it from the foliage of my tea trees. They do drop twigs (and occasionally branches in high winds) which we use to start the fire in winter and power rocket stoves.

The Lavender Hedge

Back in 2012 I built a long but narrow raised bed, filled it with mushroom compost and installed a series of twelve lavender plants along it. I then set up a simple but effective watering system to keep them hydrated. In the intervening years we have had scorching hot, dry and then supremely wet conditions. Of the original twelve we still have six plants existing, but I need to redo the area and replace the lavender plants that have passed on.



2012 when they were first put in



2015



2023 - A bit sparse, needs a revamp!

Spices

In 2010 I came across the concept of the earth box, a self-watering container made from a rectangular plastic tub or bin, where the top was fitted half way down the tub, the growing medium being heaped on top and the water reservoir sitting below. I made four and grew a random series of veggies in them until it occurred to me that they could be used to grow spices of the Zingiberaceae family.



Turmeric, galangal and ginger

These plants are really tropical but because the containers are black and absorb the suns heat, and have their own water reservoir for those really hot days, I thought they would do

the job, and in fact they have! First was ginger (zingiber officinale), being the spice I use the most, over 10 years ago and for the most part we have been able t get by with the ginger I grow since. Then over the years came turmeric (curcurma longa) and galangal (alpine galangal) and then finally cardamom (elletaria cardamomum).



Cardamom

Cardamom was only added to this gang of four within the last year. While of the same family as the others it is the fruit that is used not the rhizome, although the leaves can be used to give a cardamom-like flavour to dishes. I have been growing it for years near the back steps but it has not produced flowers or pods, I hoped that by transplanting some to the black box it would get enough heat/light to flower. The experiment continues!



Turmeric harvest

They all grow well during the hotter months but during winter (we get some frost) they will die back partially or fully back to the rhizome, to then come on again as the warm weather returns in late spring.



Winter takes its toll!

A new tree spice has just come in during the last couple of weeks – cinnamon (Cinnamomum verum). Cinnamon is a true tropical tree so it is really an experiment to see if I can grow it in a pot in my greenhouse to the point where it is big enough to actually harvest some cinnamon. At the moment it is only about 30cm high, so it remains to be seen how it will go.



Our brand new cinnamon tree!

I have also had some experimentation (in the herb spiral) in growing both coriander (Coriandrum sativum) for the seed/spice only not the leaves (yuk!) and cumin (Cuminum cyminum). I have had some slight success with the coriander and harvested about 10 grams of seed this year, but was hardly able to get the cumin to germinate so a lot more work is required.

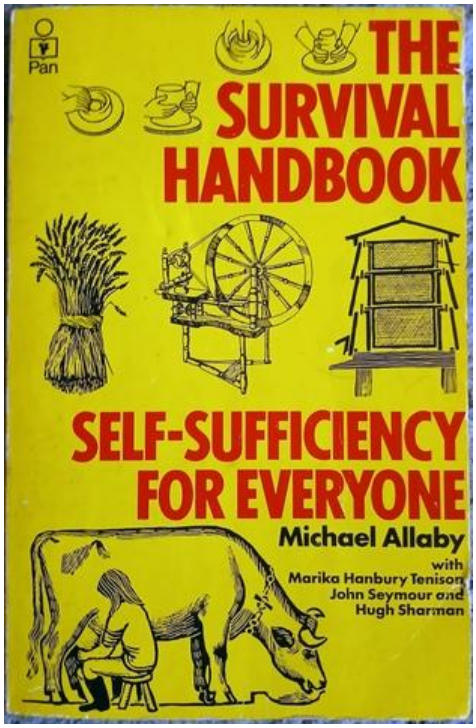
Conclusion

While we do still buy spices (although we will be buying less if I am successful in the longer term) we don't buy that much in the way of herbs and I hope to continue that trend. As with lots of aspects of living more sustainably, the adventure continues!

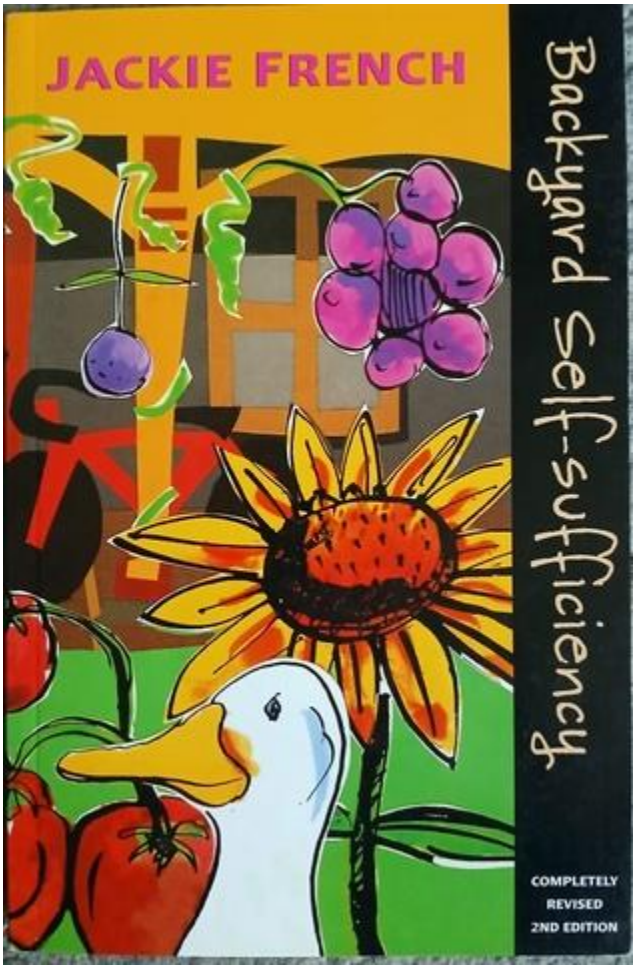
9.0 Books that inspired me (to live more sustainably)

I have somewhere around 2600 books in my office area alone so when I decided to put this list together, I knew that it would require some work, not because I would have trouble coming up with fifteen books that inspired me, but because I have been able to read so many amazing books over the years. My original idea was to generate a list of books that inspired me, but when it came to it, it would be too long and too difficult to manage, so I arbitrarily decided to set the number at fifteen (originally it was twelve). That way I would not have to spend the rest of my life compiling an article that I would never publish. So here they are, in no particular order –

The Survival Handbook: Self Sufficiency for Everyone – Michael Allaby et. al -Macmillan London Ltd (UK) 1977 ISBN 0 330 24813 8 – This book has seven chapters: Land, food, textiles, buildings, energy, crafts and community. It was one of my first books in the 'self sufficiency' genre, back when I was in my late teens and introduced me to so many (for me) new concepts. It is based on the UK experience of course and I still remember the weird looks I got when I walked into a Health food shop to enquire about a grain grinder back in the '70s, but it set the scene for so many things in my life.

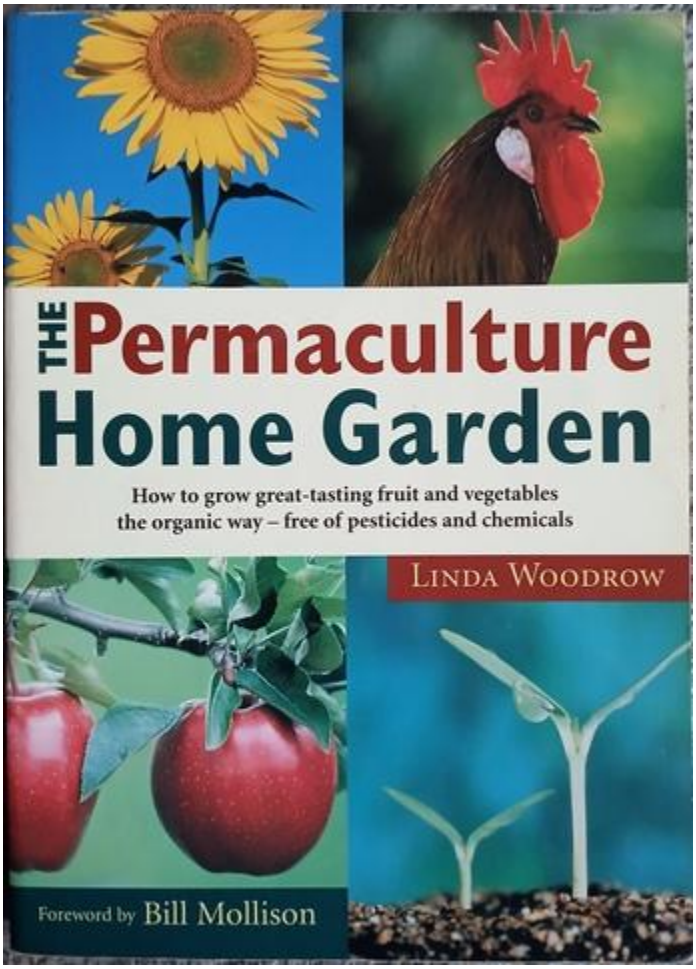


Backyard Self-Sufficiency – Jacki French -Aird Books (AUS) 1992 ISBN 978 0 947214 58 6 – This is the book for those who want to have a go at being self-sufficient. It has ten chapters, including planning the self-sufficient garden; growing staples; veg all year round; fruit for all seasons; overcoming heat, frost and drought; scavenging the suburbs; small animals for small gardens; keeping the surplus; the backyard supermarket and a house for self-sufficiency. By this stage (early '90s) I had done the Farm Technology course at TAFE and practiced lots of ideas our back yard, and thought that I knew a thing or two about backyard self-sufficiency. Jackie taught me how much I had yet to learn! This book still takes pride of place in my library.



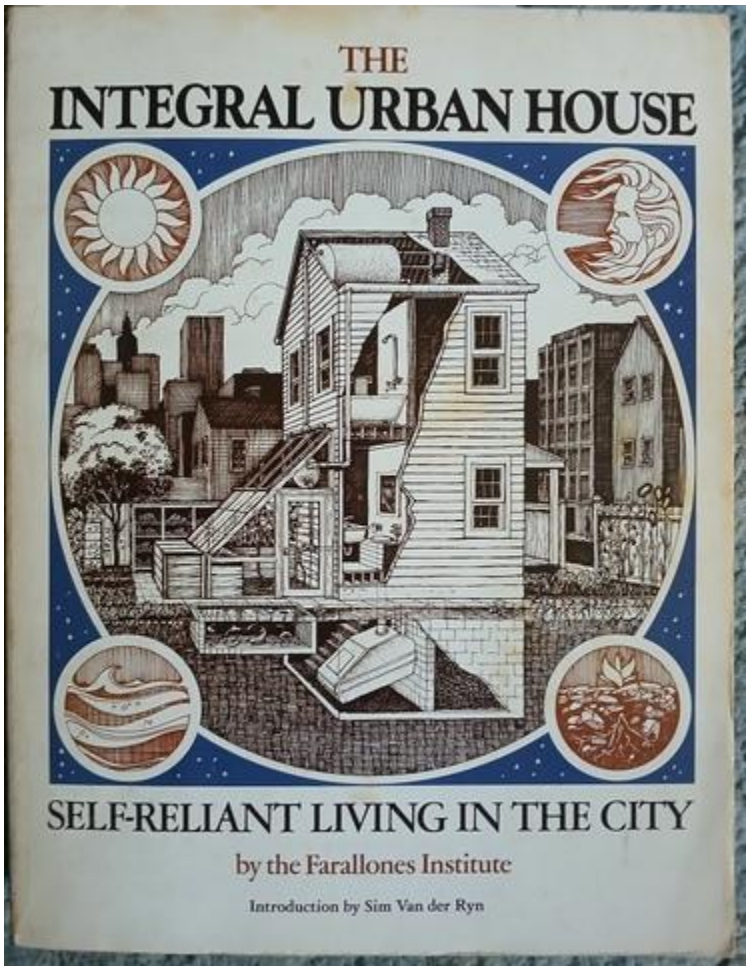
The Permaculture Home Garden – Linda Woodrow – Penguin Books Australia (AUS) 1996 ISBN 0 670 86599 0 – I picked up my copy of this book in a second-hand bookshop (sorry Linda) in Perth and it really opened my eyes to the possibility of set up a much simplified version of this system in our back yard. The book has five parts: part one is 'Tools' which is

about gathering the resources and planning to set things up, Part two is ‘Starting Out’ and talks about the site and layout, building your chook dome, composting and worm farming. Part three is ‘Planting’ designing and setting out your system, plant propagation and a yearly planting guide, Part four ‘Maintaining the Garden’ and is about dealing with pests (including humans) and diseases, weeding and watering. Part five is an A to Z giving specific information on plants to be included in your guilds. When I read this book, it opened up the world of the chook tractor for me and how I could use it as a tool to cultivate, clear and fertilise our fourteen veggie patches, one after the other reducing my work considerably. And you get eggs! Here it is 20 years later, and the system is still working beautifully.



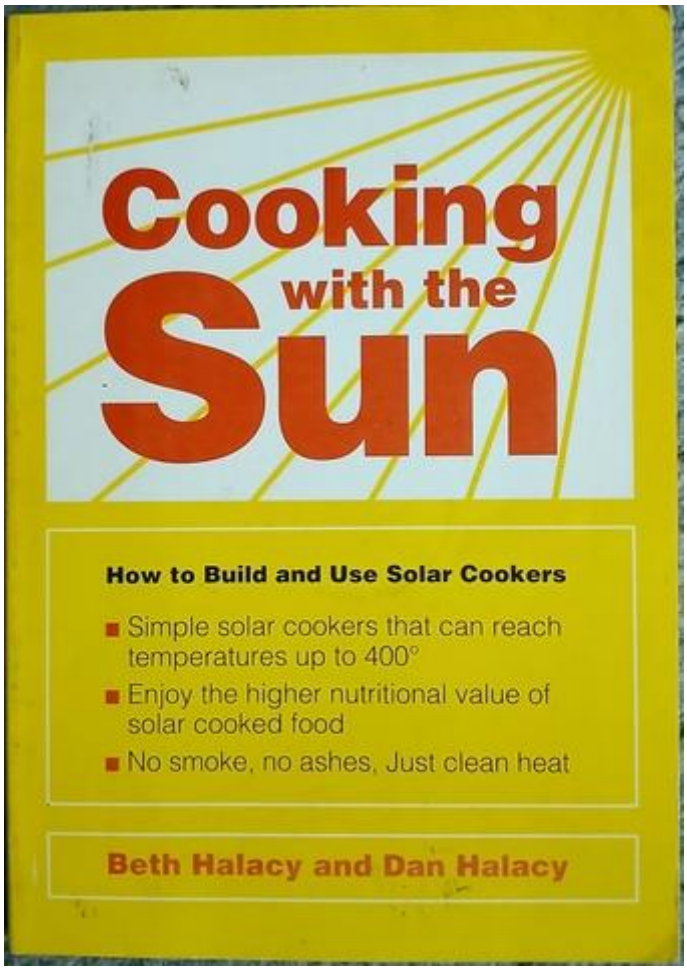
The Integral Urban House – The Farallones Institute – Sierra Club Books (US) 1979 ISBN 0 87156 213 8 – This is a big book, almost A4 size and close to 500 pages! With such a vast amount of data, it is a bit difficult to summarise, but here we go! The book has four parts: part one ‘the concept’ talks about the origins and design process for the Integral Urban

House, part two ‘conserving energy and resources’ discusses how they managed energy conservation, water conservation and wastes in the house. Part three ‘using the sun’s energy’ discusses how they used small urban spaces to grow food and raise livestock as well as implementing solar technology to heat space and water, part four ‘the interfaces’ talks about how they managed wildlife (including the human variety) and relationships with the house, the street and the neighbourhood. It has taught me so much and the reality is that even today, after it being in my library for over 30 years I can still flip through it and be surprised, learning something new each time!



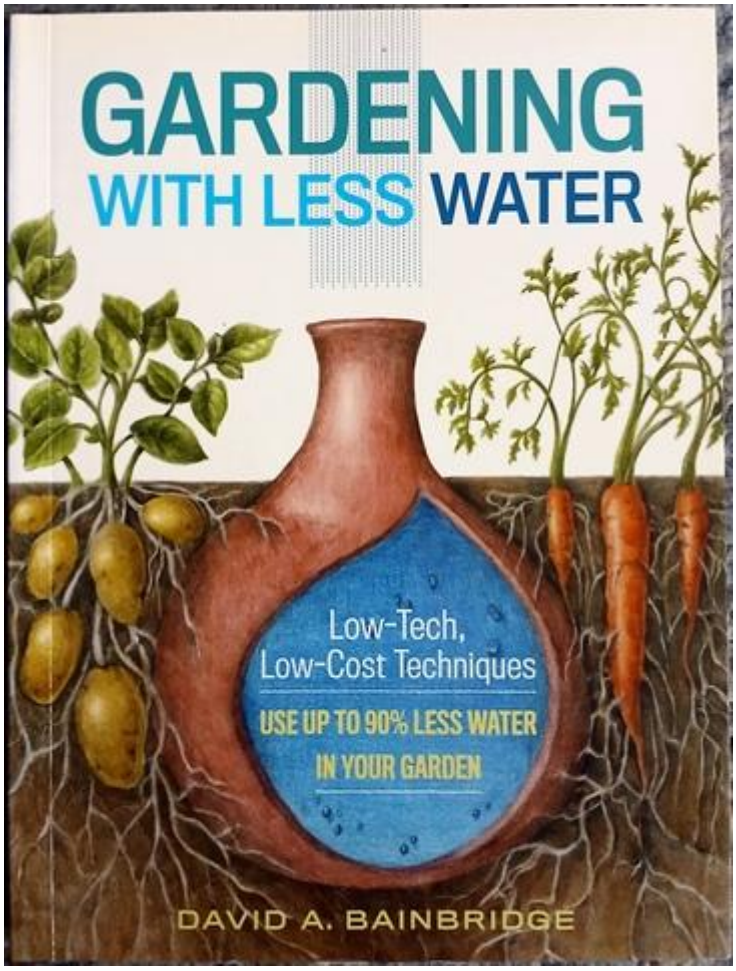
Cooking with the Sun – Beth & Dan Halacy – Morning Sun Press (US) 1992 ISBN 0 9629069 2 1 - This book covers some history then gives detailed instructions on building a solar oven and a parabolic solar cooker. The rest of the book is given over to recipes appropriate for use in solar cookers. It has some black and white photos and some line drawings to illustrate construction methods. The book responsible for my interest in solar cooking and the plans

in the book are what I based my solar oven on after I had fooled around with some simple cardboard designs and decided to get serious. I also made the parabolic solar cooker and used both to cook for many years, although only the solar oven is currently in existence, and is being refurbished.

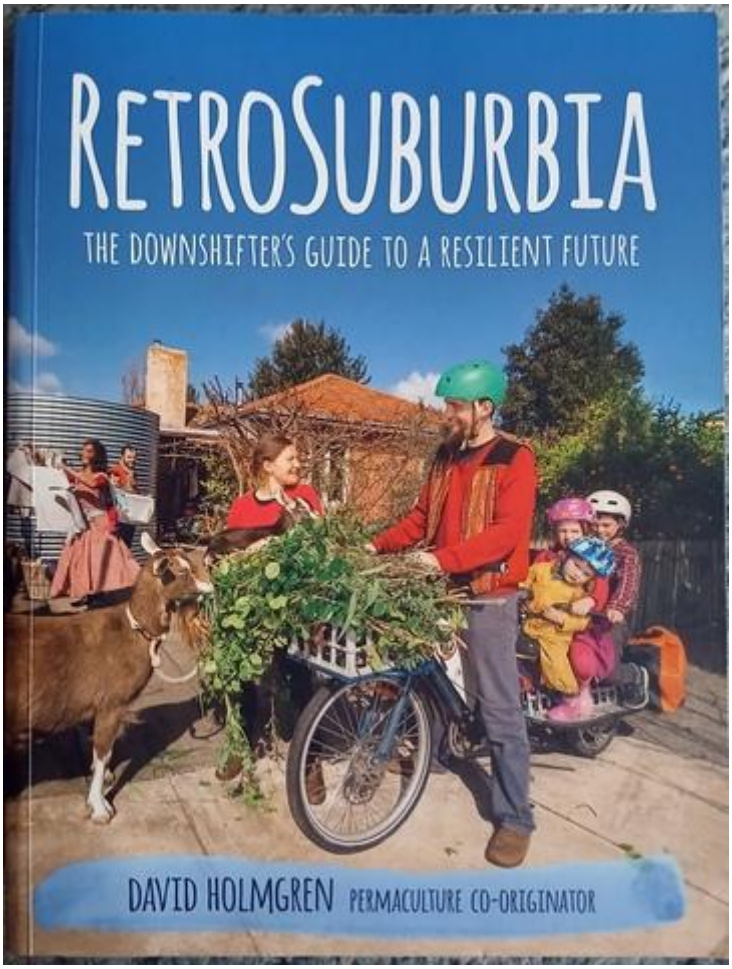


Gardening with Less Water – David A. Bainbridge – Storey Publishing (US) 2015 ISBN 978 1 61212 582 4 – This is not a big book, but it is chock full of techniques we all should be using. Part 1 of the book covers the techniques: buried clay pots, porous capsules, deep pipes, wicks, porous hose, buried clay pipe and tree shelters. Part 2 is about taking it to the next level and covers water-wise gardening tips, rainwater harvesting, landscaping for water catchment and developing a plan. If you are concerned about the water used in your garden, you need this book in your library. The book has lots of colour sketches and colour photos. I came upon this in a bookshop in town a few years ago. While I had experience with efficient irrigation in the form of from-scratch and commercial pot base ollas it opened

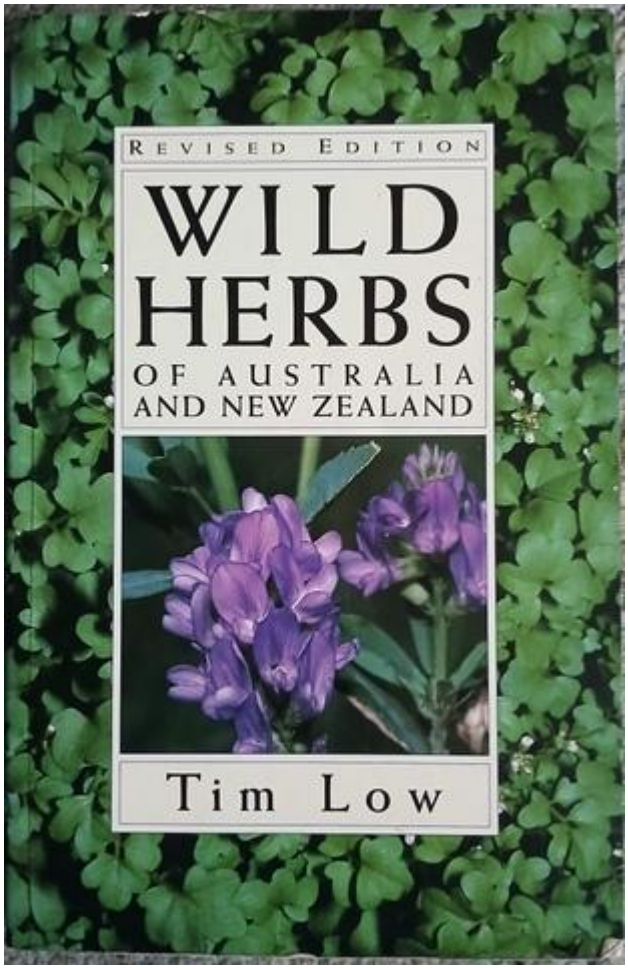
my eyes to several other techniques that I have been able to integrate into our growing systems. This has had the effect of making us more drought tolerant and water efficient.



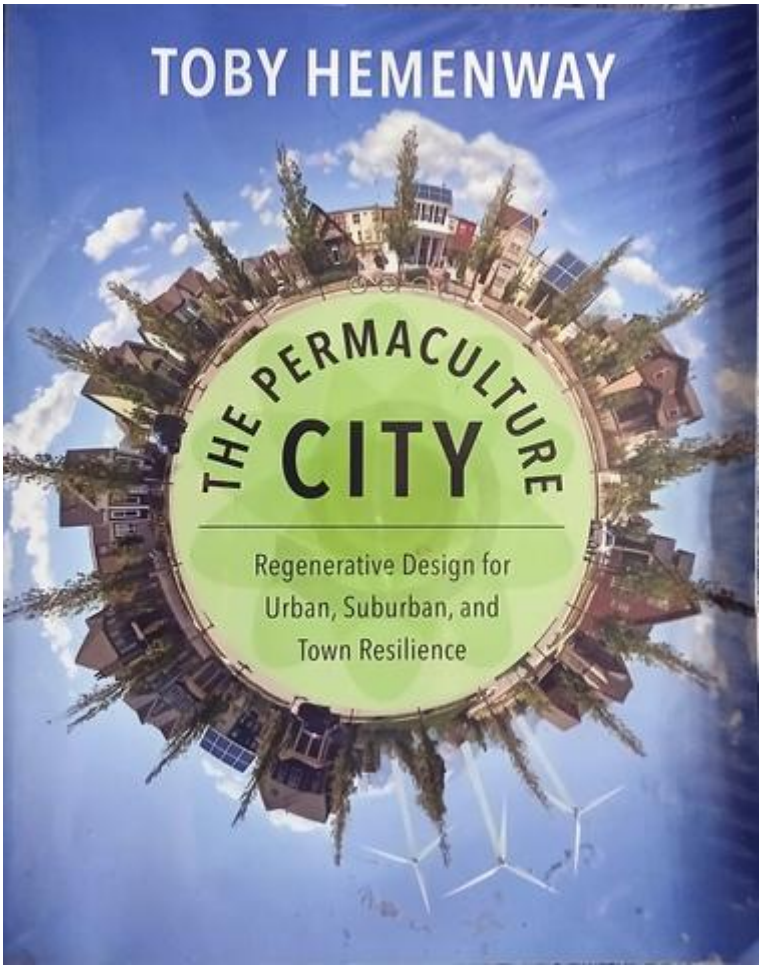
RetroSuburbia – David Holmgren – Melliodora Publishing (AUS) 2018 ISBN 978 0 9943928 7 9 – This is also a big book, with a slightly smaller than A4 format and almost 600 pages. It is a vast amount of information and knowledge that I won't attempt to summarise here. It is sufficient to say that while I had read Permaculture I and II and a good bit of Bills Designers' Manual, I found that RetroSuburbia did an amazing job of making permaculture applicable to the space that I was interested in – suburbia. It is the sort of book that you can find something new in every time you open it. It certainly rekindled my enthusiasm for working on our place to improve the sustainability of our lifestyle.



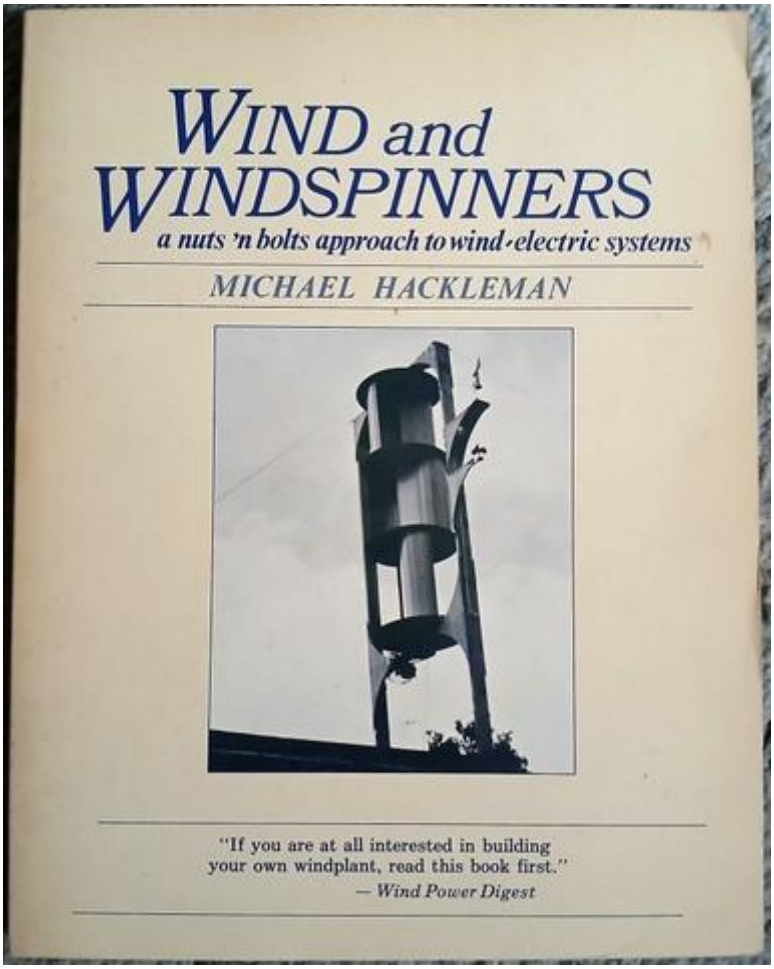
Wild Herbs of Australia and New Zealand – Tim Low – Angus and Robertson (AUS) 1991 ISBN 0207170010 – This is THE book for wild herbs as far as I am concerned so get hold of it if you can! Even if you are not in Australia or NZ this is still a useful book because most of the plants covered are European or American imports anyway. It covers a mind-boggling array of plants from dandelion, shepherds purse and cobblers pegs to the cresses, wild radish and fathen. Each monograph covers how to identify the plant (including line drawings) what similar plants exist that it could be confused with and how to use it. From the first time I read it, it has had an impact on our diet and allowed me to understand and identify plants which we previously regarded as weeds and which we now look on as food.



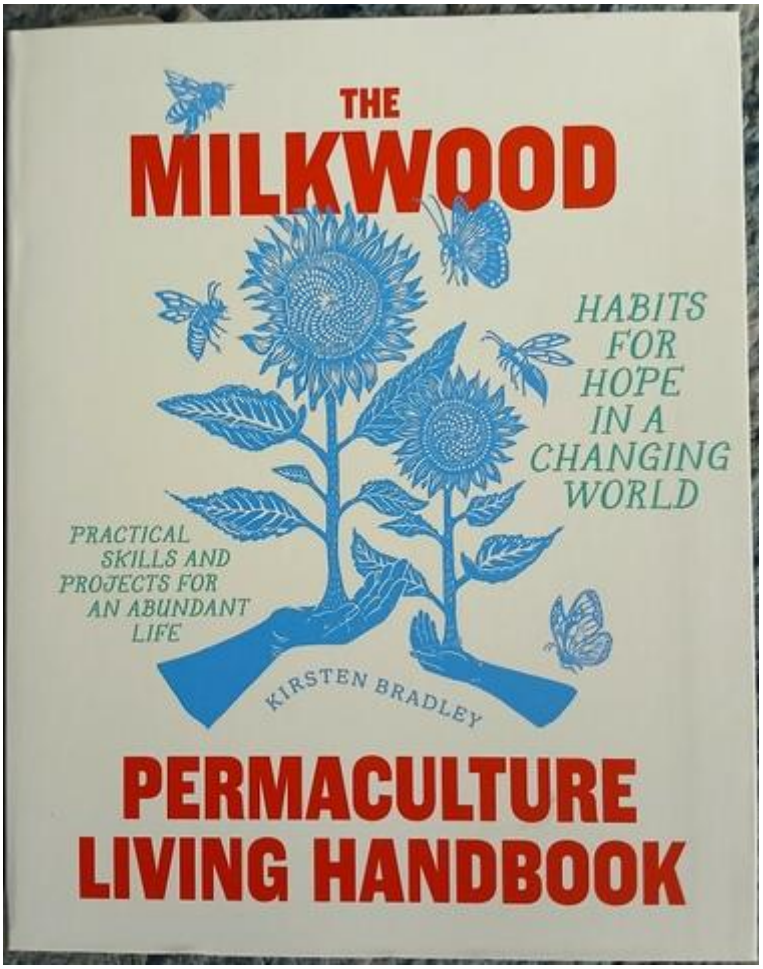
The Permaculture City – Toby Hemenway – Chelsea Green Publishing (US) 2015 ISBN 978 1 60358 527 9 – This book is broken up into ten sections – The surprisingly green city; permaculture design with an urban twist; designing the urban home garden; techniques for the urban home garden; strategies for gardening in community; water wisdom, metropolitan style; energy solutions for home and communities; livelihood, real wealth and becoming valuable; placemaking and the empowered community and tools for designing resilient cities. I found so much great material on using the zone tool in urban areas, urban microclimates, setting up the four levels of design process for the Choko Tree and putting together strategies and techniques to achieve what is on our plan.



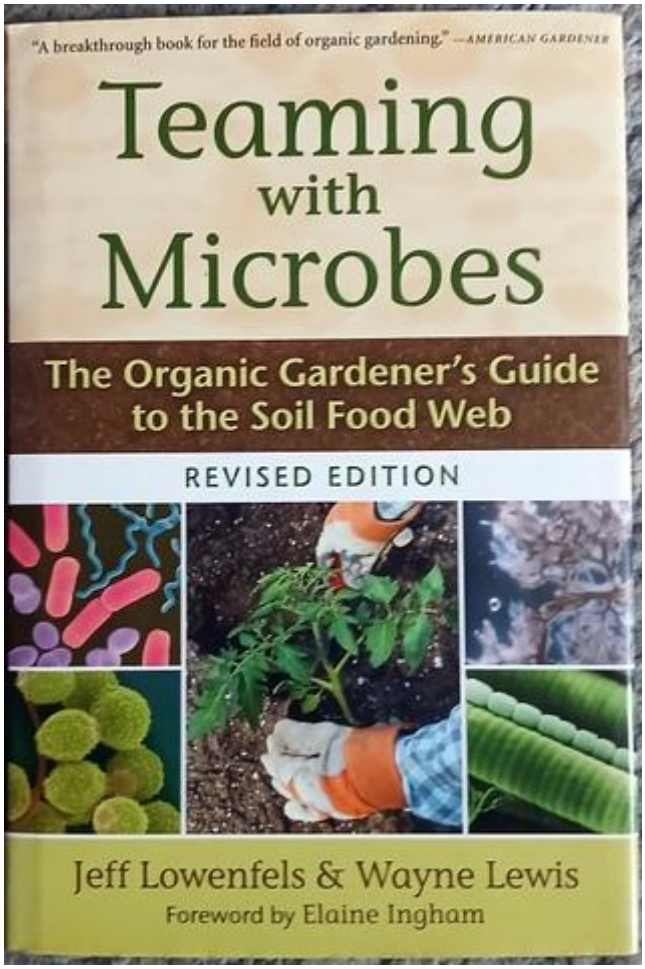
Wind and Wind Spinners – Michael Hackleman – Peace Press (US) 1974 ISBN 0 915238 02 0 – This was another watershed text for me, all about making a wind generator using automotive components and catching the wind with a vertical shaft savonius (S) rotor. The theory and practice are all here, including how to make and secure the tower that the generator sits on. While the wind turbine approach didn't work in our suburban context (took me many years to work that out, I really WANTED a wind turbine!) This book provided all basics that allowed me to put together and run the 12 volt system through the house to power the lights and the fridge. I just wound up using solar panels for our system that made much more sense in our suburban context.



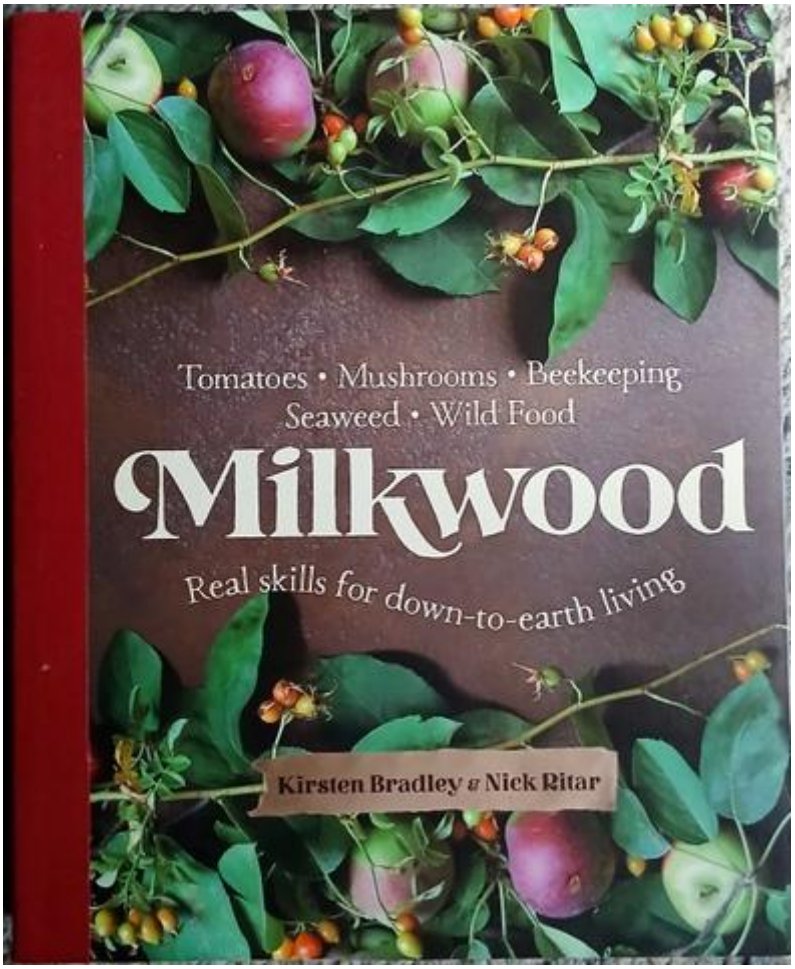
The Milkwood Permaculture Living Handbook – Kirsten Bradley – Murdoch Books (AUS) 2023 ISBN 978 1 92235 192 0 – This book is about putting new habits in place to "create a more meaningful life for you and a better world". The book takes the twelve Permaculture design principles and provides five habits for each one. Each habit is practical, doable, educative and helps you create that 'more meaningful life'. What inspires me about this book is the relentless practicality of it. It is a book not about theory, but about doing things. Doing things to make your life, and the world, a better place.



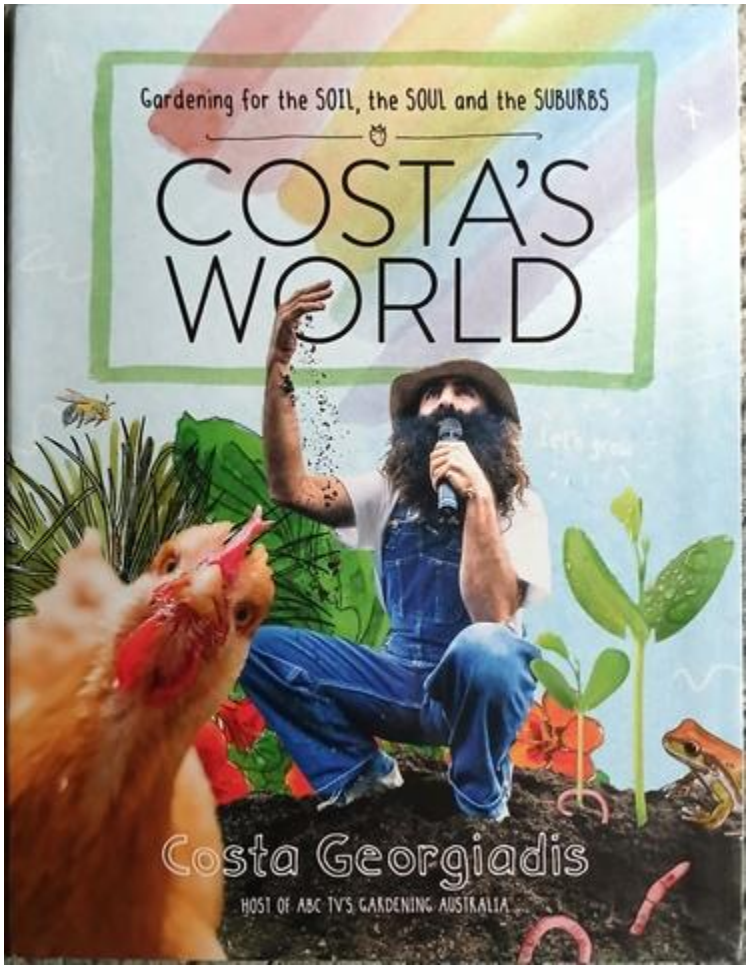
Teaming with Microbes – Jeff Lowenfels & Wayne Lewis – Timber Press (US) 2010 ISBN 978 1 60469 113 9 – If you are interested in soil, You Need This Book! It summarises the scientific research of the last 15 years or so (prior to the writing of the book) on the importance of the soil biota (soil life) and how it is crucial to the plants we grow. The first half of the book covers the different types of life in the soil and their impact on the soil. The second half talks about how you can apply soil web science to your soil and plants to get the best outcome. There is even a cheat sheet at the back summarising the important points in applying the science, but it is worth reading cover to cover and is a great read. Lots of colour photos and line drawings. Back in the '80s I did the Farm Tech Certificate and a part of that (obviously) was a subject on soil, but there was absolutely no mention of soil biota, this book opened my eyes to the importance of soil biota and what we can do to support it.



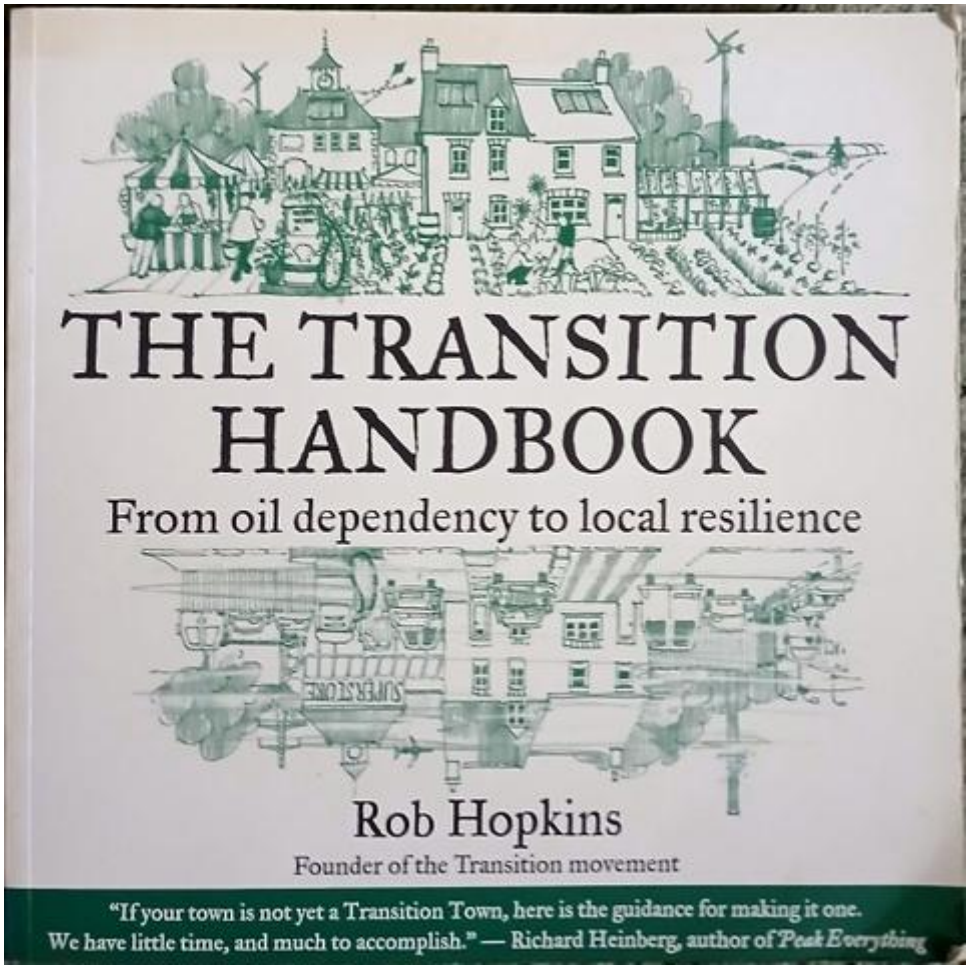
Milkwood – Kirsten Bradley & Nick Ritar – Murdoch Books (AUS) 2018 ISBN 978 74336 411 6 – This book is split up into five chapters – The tomato; mushroom cultivation; natural beekeeping; seaweed and wild food. While they are all great, lots of good info, projects and an abundance of line drawings and colour photos, it was the one on mushroom cultivation and inspired me! While I had been interested in the concept of cultivating mushrooms, particularly from scratch, my one go at it many years ago was a dismal failure. Reading through this book gave me the information I needed and confidence to give it a go. If you want to know how it all worked out, the story can be found **here**.



Costa's World – Costa Georgiadis – Harper Collins Publishers (AUS) 2021 ISBN 978 0 7333 3999 8 – This is another of those books that contain so much information, they are difficult to summarise, but there is one thing that is a theme throughout the book, and that is its steady focus on practicality. There is also a focus on living more sustainably where you live, rather than heading bush some time in the future, there is a lot you can do now, and Costa tells you how! He talks about sustainability beginning in the garden, the importance of biodiversity and how to build community, so many subjects dear to my heart as well as permaculture, chooks and small space food growing. This book has inspired me in so many ways.



The Transition Handbook – Rob Hopkins – Green Books Ltd (UK) 2008 ISBN 978 1 900322 18 8 – Yes, I know this is the UK version, and there is an AUS/NZ version, which I also have, but this is the original one I bought when we were in the UK 15+ years ago. It introduced me to some of the issues we were facing such as peak oil, but also showed me a way forward, and the importance of developing community locally to help us through trying times in the future. I did become part of a 'big picture' (and not so local) transition group for a while, about the time I also joined a permaculture group but the meetings in Sydney were difficult to attend so I moved to a more local Transition Group while still attending the permaculture meetings. I eventually concluded that with full time work, a family, a permaculture group and a transition group I was spreading myself too thinly, so I decided to focus on permaculture. That does not diminish the impact this book had and my understanding of both the problems we face and potential solutions.



Points that I ponder

In some ways we live in amazing times, certainly when thinking about the availability of books. Back in the day, if a book you were looking for had gone out of print all you could do is scour the second hand bookshops (of which there were many) in the hope of finding it. These days even the oldest book on this list (Wind and Wind Spinners 1974) is available through the internet from multiple sources.

On looking back through the list, I find it fascinating that out of the 2600 books in my library that could have been on this list, of the fifteen books that actually made it, one third are directly related to permaculture and most of the rest have some relation to permaculture principles. Just sayin'!

10.0 Appendices –

10.1 Sustainable lifestyle Assessment Matrix (SLAM)

Value	Sub-value	0 White	1 Pastel Green	2 Light green	3 Mid green	4 Dark Green	5 Deep green
1. We make the most of the water we have	1.1 Water use	No effort at water saving or re-use, it just comes out of the tap and goes down the drain	We have fitted a low volume shower nozzle and make sure we fix leeks quickly	We have made some gains on reducing water usage like shorter showers and using a broom instead of the hose to clean the path; grey water is re-used on the garden	We save and re-use water where we can - shorter showers, use buckets to hold water until it comes through hot then use on the garden; we buy low water use appliances such as front loading washing machine	We have implemented all water saving and re-use strategies we can and source some of our water from sustainable supplies.	All water comes from sustainable sources such as rainwater tanks and is treated and re-used on site.
	1.2 Sewage	The toilet is single flush and we flush every time the toilet is used	The toilet is dual flush and we use the appropriate flush cycle every time the toilet is used	The toilet is dual flush but we generally don't flush at night and during the day we practice "if it's yellow let it mellow,if it's brown flush it down"	Urine is recycled/used on site, Faeces is flushed	We have a composting toilet but the output is treated or buried off site	We have a composting toilet/seep away septic system/other sustainable toilet system and any output is treated or buried on our site
2. We don't waste energy	2.1 Energy Use	No thought is given to energy uses	We have changed the lightbulbs to fluorescent, turn off appliances when we can, checked seals on fridge and freezer, we have sealed drafts where we could	Energy consumption is considered when buying large appliances; we use some low energy consumption techniques such as low energy cooking using stored heat, steaming etc	We buy the lowest energy consuming large appliances we can afford. We put on clothing rather than the heater and wash in cold water.	We mostly cook using solar appliances and low energy consuming methods (stored heat, works, pressure cookers)	All energy used is obtained/harvested on our site for cooking and heating and efficiently used using low energy cooking techniques etc.
	2.2 Energy Generation: Electricity Gas etc.	All energy sourced from non-renewable sources	Energy is all obtained from off site, a mix of renewable and non renewable sources	All energy is derived from off site but renewable resources	Some energy is generated on site (wind/photovoltaics or direct solar heat) the rest is a mix of renewable and non-renewable resources from off site.	Most energy is generated from on-site systems with the remainder of the off-site energy sourced from renewable resources	All energy is generated on site
	2.3 Energy Conservation	House is uninsulated	Roof insulation is in place	Roof walls and where appropriate, floor insulation	Roof walls and floor (where appropriate) are insulated, windows are double glazed, shuttered or otherwise insulated	House is super insulated or constructed of low transmission materials such as straw bales or mud bricks	As well as insulation, passive solar design is included in the house.
3. We are mindful of where our food comes from		All food is bought in and no thought is given to the source	We grow a few herbs and a small amount of vegies, using commercial seedlings, the rest is sourced from a supermarket	We are growing a percentage of our food from our own seedlings and some is sourced from organic sources but most we buy in the supermarket	Some food is home-grown, some is sourced from local growers/organic or farmers markets, some is bought in without to much worry about the source	As much food is grown/produced on site as possible, the remainder bought from local organic sources or farmers markets.	All food is produced on our home site using organic/permaculture principles; we barter or give away excess to neighbours
4. We use eco-friendly transport		A car is the transport of choice and it's a V8, usually with one person per trip. We fly whenever we can.	We occasionally try and walk or bicycle on short trips to save fuel, but primary transport e.g. to and from work is by car, we are looking at getting or have a smaller more fuel efficient car. We do still fly sometimes on holiday or business trips	We car pool to reduce car usage to and from work, bicycle or walk where possible, but use the car on other occasions.	Public transport, walking and bicycle are the transport of choice with some use of a car when needed. Fuel consumption is the main consideration when buying a new car. We limit flying to unavoidable trips.	Sustainable travel is used almost exclusively, we have a car but it is mainly used to transport large items, many people or just to the train station etc.	We don't own a car, public transport, walking and bicycle are the only forms of transport used. We don't fly on principle
5. We limit our waste		There is no thought given to packaging when items are bought, we don't compost or recycle; our waste goes in the bin, out of sight out of mind.	We recycle using the council system but haven't reduced our waste at all and still don't compost	We are starting to think about waste reduction, and are recycling as much as we can. A composter or worm farm is on the horizon.	When making purchases we consider the waste materials involved, we don't use plastic shopping bags, we have a composter and/or worm farm	We recycle all recyclables and buy in bulk to reduce packaging. We compost or worm farm and grow food so that any waste put escible is recycled. Waste generation/packaging materials are considered for all major purchases	We recycle all recyclables and buy in bulk to reduce packaging. We compost or worm farm and grow food so that any waste put rescible is recycled. Waste generation/packaging materials are considered for all purchases
6. We are conscientious consumers		Stuff, gotta have lots of stuff, even if we don't use it. Retail therapy and lots of it. We don't consider where the stuff comes from or how it is produced.	We have thought about reducing the amount of stuff we buy, but keeping up with fashion and the Jones's makes it difficult.	We think about our purchases before we buy, and try and get the best quality we can	We think about our purchases before we buy, and try and get the best quality we can from local producers. We usually buy Australian made or second hand	We only buy the goods that we have to, usually Australian made or second hand where possible.	We produce as much as we can ourselves. What we don't produce ourselves we buy from local artisans and ethical local producers, barter or buy second hand.
7. We are committed to making our community sustainable		We keep to ourselves and that's the way we like it	We do occasional talk to our neighbours about environmental subjects	We talk to our neighbours about what we are doing to increase our level of sustainability.	We get involved with our neighbours on projects to enhance each others sustainability such as a vegie garden or tree planting	We give our time to projects that enhance our sustainability and our area such as a community garden or "Clean up Australia"	We have started local initiatives to enhance our sustainability such as a community garden or relocalisation group
8. We buy, value and care for our clothes sustainably		We buy cheaply and discard easily, we really don't give much thought to where our clothing comes from or who makes it, so long as it's cheap.	We do occasionally consider the environmental impact when buying new clothes and machine wash after each use.	We buy new clothing from ethical/sustainable brands where we can. We do some mending.	We buy ing clothing second hand or sustainable/ethical brands, we mend damage clothing and only wash when the clothes are dirty.	We share clothing with friends and relatives regularly, wash when necessary and use techniques to make clothes last longer between washing. We mend and make some clothing ourselves.	We don't buy new clothes. We buy second hand or share with friends or family, we extend the life of our clothes by mending & using appropriate cleaning techniques. We wear what we have.

Appendix 2 - Balcony Assessment form

Date:

Address

Floor no:

Dimensions and Area of Balcony (m^2):

Wall or railing type and height:

Materials of construction & condition:

Direction Faced (use compass):

Drainage and fall:

Water access:

Shade:

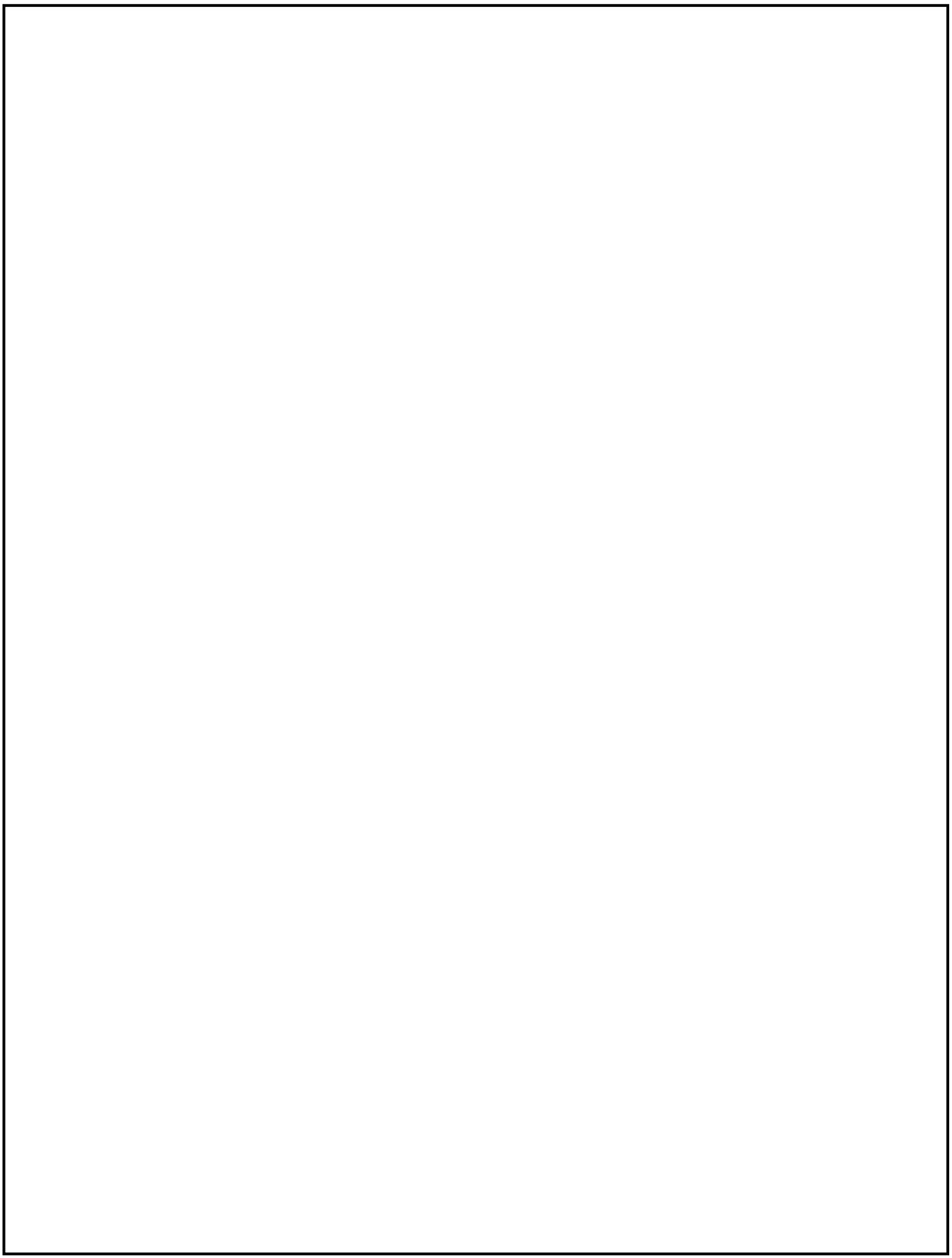
Prevailing wind direction:

Microclimate issues:

Nearby roads:

Existing Materials/plants & structures on the balcony:

Owners' Vision:



Sketch of shape etc