

An Introduction to Permaculture

By Faith Thomas

'Create a self-sustaining environment in any situation,
from the farm to the city... by planning your lifestyle
to increase resources, conserve energy and reduce
or eliminate pollution or waste.' *Bill Mollison*

What is Permaculture?

The word Permaculture was first coined by Bill Mollison and David Holmgren in their 1978 book *Permaculture One*.

Put most simply it means:

- **Permanent agriculture** (sustainable food producing systems)

Here are a few definitions that have been used over the years:

'Permaculture is the conscious design of 'cultivated' ecosystems that have the diversity, stability, and resilience of natural ecosystems. It is a harmonious integration of people into the landscape in such a way that the land grows in richness, productivity and aesthetic beauty.' *Washburn TN PDC*

'Permaculture is the use of ecology as the basis for designing integrated systems of food production, housing, appropriate technology and community development. It offers a practical, creative approach to the problems of diminishing resources and threatened life support systems now facing the world.' *Simon Henderson*

'Permaculture is a way of bringing together in a sensible system: ourselves and our communities, with whatever bit of land/space we are tending. It can be as small as a window with sprouts or as large as a farm or a bioregion. It can be in the city, the suburbs or in the country. - Permaculture addresses the way we live on this planet in a graceful and healthy way, respecting the plants and animals around us, and leaving the biosphere in a more productive and healthy state than we found it.' *Grailville Workshop*

'Permaculture is a philosophy of working with, rather than against nature; of protracted & thoughtful observation rather than protracted & thoughtless action...' *Mollison*

'Permaculture is an ethical design system for creating human environments that are ecologically sound & economically viable. Permaculture systems provide for their own needs, do not exploit or pollute, and are therefore sustainable.' *Peter Bane*

'Permaculture is the harmonious integration of landscape and people providing food, energy, shelter and other material and non-material needs in a sustainable way. Without permanent agriculture there is no possibility of a stable social order.'
Mollison

'A Permaculture only happens where land & people are one.' *Nathan Alexandra*

Why Permaculture?

Is modern agriculture sustainable?

Think about...

- Single species cropping
- Artificial fertilisers
- Use of pesticides
- Intensive irrigation
- Hybridised crop species (the 'green revolution')
- Cash crops
- Long distance transport
- Land clearing

Results?

- Soil salinity
- Erosion
- Loss of biodiversity (both plants and animals)
- Poisoning of the water table (our drinking water)
- Soil sterilisation and compaction
- Acceleration of the greenhouse effect
- Ill health and under nourishment for human beings

In contrast, Permaculture advocates a mutually beneficial arrangement: the Earth provides nourishment for us, and we in turn provide nourishment for it.

According to Mollison, if farming practices were truly sustainable we would require less than 10% of the Earth to feed all the people of the world. This can only come about if we:

Modify current consumption and lifestyle patterns to become more responsible for the consequences of our actions (our waste)

Through Permaculture we can reduce waste in all sectors of life, each person tailoring their system to suit their interests and needs, leading to fulfilling, sustainable and responsible lifestyles.

Permaculture and Organics What is the Difference?

The Organic grower uses no dangerous chemicals. They use natural methods of pest control and soil enrichment. The Permaculturalist builds on this by also:

- **Observing and imitating nature.** Thus they do not use neat rows; instead they inter-plant for pest control. They use mulch to conserve soil and water, allow plants to self-seed, and most importantly, attempt to put back into the soil whatever they took out of it.
- **Utilising effective design to minimise the energy required in maintenance.** In other words, we work with nature, rather than against it. An example of this is the use the 'chook tractor' for soil tillage and enrichment.
- **Aiming to be responsible for all 'waste' produced on the property.** Thus waste contributes to enriching the soil rather than contributing to pollution and landfill.
- **Endeavouring to produce as much of their own food as possible.** This minimises the energy used transporting the food to them and also means that what comes out of the soil is returned to it.
- **Attempting to provide nutritious food and shelter not only for themselves, but for native birds and animals as well.**
- **Always looking to make the best use of the energy and resources they have,** rather than importing them onto the property. (These might include water, sun, wind, leaves, bird droppings, seaweed, eggshells, lawn clippings, kitchen scraps etc).

The Fundamental Importance of Design

Forethought is essential to the Permaculturalist. A well-considered design is the backbone of any Permaculture system and will save hours of back tracking and extra work in the long term.

Essentially, we want to design for minimum waste. Waste of energy, time, water and other resources. Waste of 'waste'.

"Pollution' and 'waste' are simply unused resources. They result when one element in a system does not aid another' *Permaculture Visions, PDC*

Natural systems waste very little. They are incredibly efficient at finding a place for everything. If we imitate nature and its complexity in our design systems, we will develop systems where:

- all resources/energy sources are used efficiently and effectively
- co-operation between elements is inbuilt, resulting in harmony and sustainability (meaning less work for us!)

Design Principles

From observance of natural systems we learn that:

- Everything is connected to everything else
- Every element is supported by other elements
- Every element serves many functions
- The whole is functional without outside support

Therefore the Permaculture designer aims for:

Multifunction, Interconnection through thoughtful placement, Diversity

Essentially, we aim to build a web of life!

Thus:

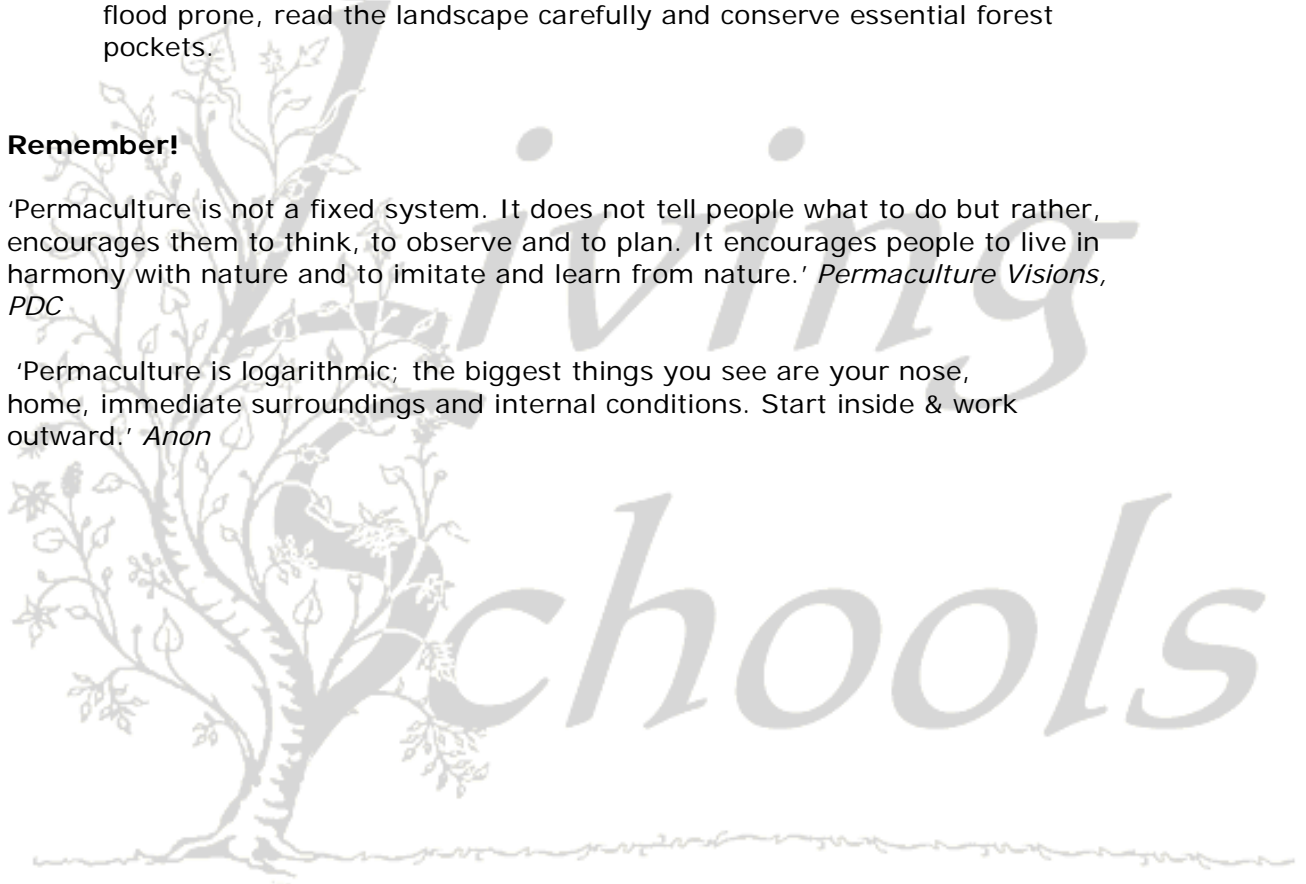
- **Every element in your design should be able to be used in many different ways.** For example, if positioned and chosen carefully, a tree can provide food, mulch, animal fodder, shade and wind protection, as well as conditioning the soil and harvesting water.
- **Design your system so that the elements you will use and visit regularly are close to your dwelling** (eg herb and vegetable beds) and things that require very little input are further a field (ie. orchards and wood lots). These are commonly referred to as 'zones' and can be imagined as a series of concentric circles. (See appendix)
- **Harness existing energy flow** and thus minimise the need for human energy input. For example use chickens to distribute mulch or weed an area; position seedling trays next to a wall that is naturally heated by sunlight.
- **Reduce impact and loss of natural resources** (soil, water, shade, heat, flora and fauna). They are the backbone of your system.
- **Position elements in the design so that minimal transport is required between them.** For example, if you have chosen a tree to produce mulch for you garden, do not plant it down the hill in the wood lot but have it positioned so that the leaves are naturally blown across the beds.
- **Use energy, physical and biological materials efficiently and to their full potential.** For example, don't let grey water flow down the drain when it can be used again, filtered by plants and returned clean to the water table.
- **Choose options that will serve you best in the long term.** For example selecting pest resistant seed is better than resorting to pesticides, whether organic or chemical.
- **Imitate natural ecological processes in your designs.** For example utilise 'succession' by planting 'pioneer species' that act as green manure, enriching the soil and protecting 'climax species' (eg fruit trees).

- **Aim for maximum diversity.** Diversity in nature equals stability and resistance to attacks by predators (eg birds and insects). This is also a good way to discover what plants grow best in your particular soil and climatic conditions.
- **Imitate nature and layer your garden.** In any one area you should be able to harvest from beneath the soil, from a ground cover layer, from an understory of shrubs and from a canopy of trees, not to mention grasses, vines and edible fungi. Many of these species will be perennials.
- **Work within the context of your landscape and conditions.** If you are close to bushland, keep in mind that many species are prone to becoming invasive weeds and that the possibility of fire may be something you have to incorporate into your design. If your property is very dry, design a system that makes maximum use of condensation and water. If your soil is compacted, work first to enrich and stabilise the soil structure. If your area is flood prone, read the landscape carefully and conserve essential forest pockets.

Remember!

'Permaculture is not a fixed system. It does not tell people what to do but rather, encourages them to think, to observe and to plan. It encourages people to live in harmony with nature and to imitate and learn from nature.' *Permaculture Visions, PDC*

'Permaculture is logarithmic; the biggest things you see are your nose, home, immediate surroundings and internal conditions. Start inside & work outward.' *Anon*



The Cultivated Ecology

Permaculture aims to grow food within a constructed ecological system.

From observance natural ecosystems we can see the following characteristics:

- Every plant and animal occupies a 'niche' and by their presence create the perfect 'niches' for other plants and animals. Every element is supported by the other elements around it.
- The whole system is self-sufficient. It requires no outside support and relies entirely on its own processes.
- Microclimates form because different conditions of temperature and humidity are created around certain plants and geological formations.
- Animals and plants exist together and are interdependent.

In our garden ecosystem we can create the same conditions, but in order to do so we must be prepared to give up some of the long held beliefs of modern horticulture.

Firstly, plants that attract predatory insects, bees and butterflies are just as important in your system as plants that produce food for they will vastly increase your edible yield.

Secondly, chickens, worms, frogs, birds, bees, ladybirds, lizards, hover-flies and other friendly beasties are essential to a self-sustaining system. They work to maintain balance simply by 'doing their thing' and in the long run will mean much less work for you. Try to attract these animals to you garden.

Thirdly, 'weeds' may not necessarily be bad. Some are enriching your soil, others are decoys for pests and still others provide valuable mulch and compost material. Work to manage these plants rather than trying to eliminate them.

Building Soil Fertility

Soil is the foundation of our system and like the foundation of a house is vitally important to the well being of what lies above it.

Soil is a living organism and must be treated as such. A handful of healthy soil contains literally billion of organisms, and their presence is essential for optimum structure and fertility.

Healthy soil is made up of five essentially ingredients: minerals and rock particles that have worn off the underlying geological formations, organic matter from plants and animals that have been living on it for thousands of years, water, air and living creatures.

Most likely your soil will not be as healthy as it could be.

To build soil fertility we must do two things:

- Increase nutrients in the soil
- Improve soil structure

The addition of organic matter is the most effective means of achieving both these objectives and maintaining soil health in the long term.

The most efficient way to add organic matter is to 'sheet mulch'. This involves simply layering the materials over the soil and allowing them to break down naturally. The one exception is manure, which must be composted before adding to the soil in order to prevent it burning delicate plants and soil microbes.

The Permaculture gardener generally does not dig. Digging is hard work and generally not beneficial to the soil structure. Instead, soil is built on top by sheet mulching with organic materials, and the worms do the rest, aerating as they dig and producing a healthy soil that is rich in 'humus.'

Different materials are rich in different nutrients. The more different kinds of organic material you add to your soil the richer it will become. For example:

- Lucerne (rich in nitrogen and iron)
- Animal manures (rich in nitrogen and phosphorus, esp fowl)
- Seaweed (rich in trace elements – wash off salt first)
- Herbs (rich in trace elements, esp. comfrey, yarrow, chamomile, nettle and dandelion – see appendix for details)
- Azolla (rich in nitrogen)
- Straw and grass clippings
- Green manures (nutrient rich plants that are grown simply for mulch and are dug into the soil before fruiting. Some common green manure plants are broad beans, vetch, oats, rape, soy beans and buckwheat)
- Vegetable and fruit scraps
- Hair, feathers, bone, rusty nails (trace elements)
- Newspaper and cardboard boxes (excellent for controlling weeds)
- Gypsum (a neutral source of calcium that will break up clay soils)

As it breaks down, mulch works to retain moisture in the soil, fosters soil life, prevents the loss of topsoil through erosion, enriches the soil and promotes the formation of humus.

Adjusting pH

Soil pH is a measurement of hydrogen ion concentration, and consequent acidity or alkalinity of the soil. The higher the soil is in hydrogen ions, the more acidic it will be. Most plants grow best in soils with a balanced pH of between 6 and 7, when nutrient availability is greatest. Some, however, prefer acidic or alkaline conditions. The presence of certain acid or alkaline loving plants can indicate the pH of your soil.

You can also purchase pH testing kits from most hardware and garden stores. It is important to remember that pH increases logarithmically. For example, a pH of 5 is ten times more acid than a pH of 6. If the soil pH becomes too low (acidic), soil toxicity can occur, pathogens will thrive and micro organisms and worms will suffer. If the soil is too alkaline, nutrients can become unavailable.

The easiest way to adjust pH is to add rock dust to the soil. This also adds nutrients, mainly calcium and magnesium. Agricultural lime, comfrey and dolomite will balance acid (0-7) soils, while manure, sulphur and acidic compost will adjust alkaline soils (7-14). Check your pH first to avoid doing more harm than good. A soil high in humus will generally be balanced.

Water management

Because water is such a vital resource it is important to learn how to contain, filter and reuse water to best effect. To do this we use:

- Swales (ditches and mounds along the contour that catch water as it runs down the hill and can create moist conditions even in arid areas)
- Terracing (to fully utilise water on steep slopes)
- Soil storage (by increasing the water holding capacity of the soil through building structure with organic matter)
- Small ponds, dams and rain water tanks (ponds and dams double as habitat for fish, ducks and frogs, can be used for aqua-culture or to grow azolla and other nutrient rich plants for mulch)
- Mulching (decreases evaporation and improves soil structure)
- Water channeling (to divert water to where it is needed)
- Trees (to decrease evaporation, increase condensation, draw up water with their deep roots and can also 'seed clouds')
- Filtration using water plants and reeds
- Grey water systems (these can be simple or complex)
- Windbreaks (decrease evaporation and draw water from deep down)

Storing water in as many different forms as you can is important. This way you will get as many different uses from your water as possible. For example, a large proportion in ponds and troughs, rather than the whole lot in sealed tanks, will serve you better by providing habitat for insect eating birds, frogs and lizards.

Ideally 15% of your total space should be dedicated to water storage.

Learn to use water as many times as possible before it leaves your property and try to ensure that it leaves in a drinkable condition. This will take some practice!

Exercise

Observe how the natural flow-patterns of wind and water interact with soil? How do they interact within a damaged system?

The Importance of Trees

Trees are the skeletal structure of ecosystems and form the basis of microclimates. They are essential to your system because they:

- mine for water, transporting water soluble nutrients to the surface
- produce natural mulch
- deflect wind and create sheltered mild conditions
- filter sunlight so that there is warmth in winter and shelter in summer
- prevent erosion by binding the soil with their roots
- filter polluted air and transform carbon dioxide to oxygen
- seed clouds and create humidity
- provide fruit, nuts, animal forage and other crops
- are habitat for birds, lizards, possums and other wildlife

Trees are used in many different ways within a Permaculture system. Some essential uses for trees are for wood lots, orchards, shade trees and windbreaks.

Integrated Pest Management

Pests are a symptom of an unbalanced system. Pesticides will always be a short-term solution and will progressively worsen your problem as the years go by. The trick is to work on balance. By improving the health of the system and increasing the number of predators that feed on the pests, you will find that very soon you no longer have a problem.

This is achieved in a number of ways.

- Attract native birds by planting local native trees and shrubs
- Companion plant to attract predators, deter pests and disguise target plants (see appendix for more details)
- Build a small pond to attract insect eating frogs, lizards and birds
- Mulch well
- Maintain soil health and selectively breed pest resistant varieties
- Keep chooks or ducks, they love snails and slugs!

Never use chemicals! You will kill of all the good creatures as well as the bad. If you really need to use a pesticide a strong garlic and/or chilli spray will kill most bugs, but be aware that you will affect the ecological balance whenever you spray to kill.

Companion planting

In nature plants are not grouped together, nor do they occur in straight rows. Instead they are scattered about at random with an easily recognisable structure that is usually comprised of a ground-cover layer, under-story and canopy. For a long time now, people have been imitating these patterns, observing how particularly species benefit one another and planting them together.

Permaculture refers to this as 'guild planting', which means grouping together plants with similar needs, and that work together to maximise yields. It is an essential part of integrated pest management.

Companion planting:

- **recognises complementary physical demands**, for example a plant requiring partial shade with another that needs plenty of light, tall and short plants, deep and shallow rooted plants
- **maintains the natural balance of pests and predators** by either attracting predators, deterring pests or disguising target plants
- **uses symbiotic relationships to improve plant growth**

(Refer to the appendix for a short list of companion plants)

Seeds and Plants

In contrast to the conventional vegie patch, many of the plants in a Permaculture system will be perennials. This means less work for you and a more stable system in the long term.

So that this does not become an expensive exercise, become a cutting scrounger. Most perennial plants are best grown from cuttings and can be taken from healthy plants around your neighbourhood. This way you will also know before hand whether the species thrives under local conditions. Dip cuttings in honey, rather than rooting hormone, to stimulate root growth.

When it comes to annual species, learn to propagate seed rather than buying plants. This reduces the waste of seedling containers, gives you healthy plants and means that you can grow from non-hybrid seed, allowing you to selectively collect seed and breed pest resistant and locally acclimatised plants over many years.

If you are unable to collect your own seed, buy from seed companies that specialise in non-hybridised varieties. Hybrid species cannot be collected for propagation the following year, as they do not reproduce 'true to type.' They are also very often treated with toxic chemicals and owned by companies who do not care about the loss of specialised local species through the mass marketing of their patented strains.

Beasts of Burden

Why break your back when you can get something else to do it for you? Whether it's sunshine, wind, water or other animals, Permaculture is about recognising the fact that certain processes are going on naturally and tapping into them.

Some of the most useful creatures in a Permaculture system are:

Chooks

An invaluable resource. Depending on the size of your property you may only need two or three little bantams. Bantams love slatters!

If your system is set up thoughtfully it will be designed to cater for your chickens so that they do more work than they create. In a well designed system:

'a chicken's need for water comes automatically from a tank off the hen house. Its need for greens are created by rotations in the orchard and vegetable beds; its need for insects meet the gardens needs for pest control. It also supplies direct fertilizer where it walks and tractoring where it scratches. Most importantly, it supplies us with feathers, eggs and meat.' *Permaculture Visions, PDC*

Ducks and Geese

These have similar advantages to chooks but require a large body of water in order to live happily, with a small island haven that is far enough from shore to deter foxes.

Worms

If your garden is small or you are unable to keep chickens, a worm farm is a great way to get rid of vegie scraps and produce large amounts of excellent quality fertiliser. Worm farms can be made from an old bathtub, or bought from most local councils.

Bees

Bees will ensure that your plants are pollinated and will therefore increase your yields. They also provide a natural and nutritious sweetener! Plants that attract bees include thyme, lemon balm, catnip, marjoram, hyssop, sweet basil and mints.

Birds

Small native birds such as the superb fairy wren are in my opinion one of the best pest controllers in bushy rural areas. To attract them, make sure that your property has a wide variety of local native trees and shrubs and provide a small pond or birdbath. For best results, some areas of the property should be devoted entirely to habitat.

Lizards

Again these creatures are excellent when it comes to gobbling insects. Create habitat by positing decaying logs and rocks around the property and supplying a number of good water sources. They are also very fond of loose leafy mulch, such as would be found in their native habitat.

Frogs

Different frogs require different conditions but they all eat insects so it is well worth while finding out what they like. Begin by creating a variety of water sources, some running, some still, some deep and some shallow. Plant native shrubs for shade and reeds and sedges such as Lomandra and Juncus in which they can hide.

Rabbits and Guinea Pigs

Rabbits and guinea pigs are excellent for weed and grass control and as a source of manure. Use in a 'tractor' cage that can be easily moved to where you need it.

Lady birds, hoverflies, dragonflies and other insect predators

These are attracted by the pests themselves and by planting herbs that they like.

(For more details consult the appendix.)

Houses and Buildings

Our homes should be designed carefully so that they:

- Fit into nature rather than dominating it
- Use a minimum of energy for heating and light (are well ventilated, insulated and oriented to the north)
- Are connected to the surrounding landscape
- Are durable and functional rather than fashionable
- Require minimal maintenance and housework
- Accommodate future needs to avoid demolition later on

There are many excellent books available on passive solar design, home made houses, mud brick and straw bale building and forest friendly building products. Check them out at the library.

The Permaculture Community

'Permaculture systems aim to develop better relationships between productive ecosystems, buildings, town planning, water supply, sewerage, social and economic systems' *Permaculture Design Course: Ethics*

Permaculture encourages local production and community self-reliance.

We learnt in the first week about the fundamental principles of design. Put most simply, the major factors we need to consider when designing a Permaculture system are:

- Labour input
- Efficient resource use
- Access (to and between elements)
- The relationship of each part to the others

When thinking on a broader scale and envisaging the Permaculture community we need to keep the same things in mind.

Labour input

In the same way that we want to reduce labour input in the garden, we want to reduce labour input within the community. Unfortunately our society has become imbalanced and we now have two problems, each of which contains the solution to the other. On the one hand we have high unemployment, especially among young people, and on the other highly stressed workers who are often forced to work overtime. Many people work long hours in a job they hate or that gives them no

fulfilment. In the worst cases these jobs provide nothing of value for the community either.

In a Permaculture community, labour input is directed to areas where it was most needed and people work in a trade or profession where they can make a real contribution to the health and vitality of community life. Because money is not the only means of trade, people are able to barter their skills and services more freely. Everyone is taken care of because they have something unique to offer.

Efficient Resource Use

Australia is one of the greatest producers of waste per capita in the world. As we have already discussed, this waste is merely a resource that society is too lazy to find a use for.

In a Permaculture community waste remains within the community and land fill is not seen as an option. Waste is a part of people's lives and they are therefore forced to deal with the reality of it. This forces people to be more aware of the choices they are making when they purchase a product. Instead of thinking, this packaging is recyclable and thus okay. They will first think: can I use this packaging for something else afterwards? Is it compostable? Can I use it for mulch? When consumers begin to make these kinds of decisions, manufacturers will follow along behind. If there is no demand for highly packaged or poisonous goods, they will no longer be produced.

Access

When discussing access in the context of the Permaculture community we are talking about access to opportunities, access to decision-making processes, access to community resources and access to information and ideas. This access needs to be available equally to all kinds of people: women, children, people of different races and cultures, young people, older folk. Each person has their own unique perspective on life and must be given the means to express this within the community.

Until people are given this access, not in name only but as a reality, we will continue to find that large proportions of our society are unwilling to contribute their labour or to make responsible decisions that impact on society as a whole. This access is integral to a true democratic community and to the sustainability of our culture and our environment.

The relationship of each part to the others

Here in Dungog we are lucky. There exists in this town a spirit of camaraderie and cooperation that is rarely found in the big cities.

A few years ago, I lived in a block of units for two years. When I met one of the other residents on the stairs we would smile and perhaps say hi, but in that whole time I never went into the home of any of my neighbours or had a decent conversation with them. Our culture is based very much on keeping to ourselves, looking out for our loved ones and in many cases, ignoring the suffering and deprivation that exist in the lives of our fellow human beings.

In a Permaculture community when someone has more than enough that surplus is given away. People trade between themselves rather than with big companies, necessitating the development of bonds of trust and kinship. People recognise that self-sufficiency is unachievable as an individual or family unit, but that it can be

accomplished through cooperation within the community. A Permaculture community is based upon the same principles as a natural ecosystem. Each element supports the others in the ways that come naturally to them. In this way, every ones lives are made richer.

The consequences for this approach to community include:

- More appropriate technologies
- Stronger local government
- Minimal use of resources and energy
- Barter or LETS systems
- Local currency and local 'banks'
- Cooperatives for various endeavours and industries
- Committees for decision making
- Ethical investment schemes
- Decentralised workplaces; empowerment and independence through small business and working from home
- Cooperation rather than competition as the driving principle in society
- Principles of quality rather than quantity as consumers choose biodegradable, durable and reusable options
- A range of communal resources such as meeting areas, eating areas, workshops, dams for azolla, orchards, play areas, wood lots, and gardens.
- Quality public transport systems, including bike trails, buses and trains where appropriate.
- Active participation of all ages, from the young to the elderly, so that every ones creative needs are met
- Plenty of opportunities for interaction between community members
- Reusing and recycling as a way of life; pollution and landfill a thing of the past

The key to the success of community waste reduction is **multipurpose use of resources**. This requires skilled observation and careful management.

Where to from here?

The standard education in Permaculture is the Permaculture Design Certificate, which can be studied as a face-to-face course or by correspondence. It is 72 hours in duration.

There are many good books available including:

- *Permaculture – An Introduction* by Bill Mollison
- *The Earth Users Guide to Permaculture* by Rosemary Morrow
- *The Permaculture Home Garden* by Linda Woodrow

And for those who are really keen...

- *Permaculture: A Designers Manual* by Bill Mollison

...is the definitive guide.

All these books can be ordered from www.permaculture.net/bookstore/index.html

Appendices

1. Permaculture Zones

obtained from the internet

We can visualise zones as a series of concentric circles, the innermost circle being the area we visit most frequently and which we manage most intensively. Zones of use are basic to conservation of energy and resources *on site*. We do not have endless time or energy, and the things we use most, or which need us often, must be close to hand. We plan our kitchens in this way, and we can plan our living sites with equal benefit to suit our natural movements...

Below are some factors that change in zone planning as distance increases:

Strategy

- Zone I - Home, domestic sufficiency.
- Zone II - Small domestic stock & orchard.
- Zone III - Main crop forage, stored.
- Zone IV - Gathering, forage, forestry, pasture.

Establishment of plants

- Zone I - Complete sheet mulch.
- Zone II - Spot mulch and tree guards.
- Zone III - Soil conditioning and green mulch.
- Zone IV - Soil conditioning only.

Selection of trees

- Zone I - Selected dwarf or multi-graft.
- Zone II - Grafted varieties and managed plants.
- Zone III - Selected seedlings for later grafts.
- Zone IV - Thinned to selected varieties, or by browse.

Water provision

- Zone I - Rainwater tanks, bores, wind pumps, reticulation.
- Zone II - Earth tank and wells, bores.
- Zone III - Water storage fire control.
- Zone IV - Dams, rivers, in soils.

Structures

- Zone I - House/green-house, storage integration.
- Zone II - Greenhouse and barns, poultry sheds.
- Zone III - Feed store, field shelter.
- Zone IV - Field shelter grown as hedgerow and wood lots.

Information

- Zone I - Stored or generated by people.
- Zone II - In part affected by other species.
- Zone III - As for II.
- Zone IV - Arising from natural processes.

Source: Mollison (1992, pp 49-50).

2. Companion Plants

Just a few to get you started

Apples with chives, nasturtiums

Asparagus with tomatoes

Beans with cauliflower, carrots, cabbage, corn, strawberries, *not* fennel, chives, onions, garlic, kohlrabi

Brassicas with celery, leeks, onions, chamomile, peppermint, pennyroyal, yarrow, calendula, valerian, dill, sage, potatoes, rosemary, thyme, wormwood, nasturtium, *not* strawberries

Carrots with lettuce, peas, chives,

Celery with leeks, tomatoes, dwarf beans, cauliflower

Corn with sunflowers, beans and peas (run up the thick stems), potatoes, lettuce, dill, cucurbits,

Capsicum with catnip and marigold, tomatoes

Cucumbers with beans, peas, corn, lettuce, dill, kohlrabi, *not* potatoes

Fruit trees with garlic, comfrey, nettles, nasturtium

Kohlrabi with onions, beets, *not* tomatoes or beans

Leeks with celery, carrots

Lettuces with corn, dill, strawberries, carrots

Mulberry with grapes

Onions with carrots, chamomile, dill, cabbage, beets, strawberries, *not* beans or peas

Passion fruit with marjoram, lemon grass, lemon balm

Peas with cucumber, carrots, radishes, corn, beans, turnips, *not* onions, leeks, chives or garlic

Potatoes with marigold, broad beans, bush beans, pig weed, corn, nasturtium, nettles, cabbages, peas, horse radish, cucumbers, egg plant, *not* raspberries

Pumpkin with corn

Spinach with strawberries

Strawberries with pyrethrum, thyme, borage, spinach, lettuce, onions, pine mulch, *not* cabbage

Sunflowers with cucumbers

Tomatoes with basil, marigold, parsley, calendula, nettle, asparagus, brassicas, capsicums, *not* fennel, beans or kohlrabi

Turnips/swedes with peas, *not* mustard

***NB** All vegetables are aided by aromatic herbs with the exception of fennel, wormwood and dill*

3. Plants for Pest Control

A short list of common pests and plants that help control them. They are inter planted in the garden and can also be made into a tea and sprayed on the foliage. Use a little diluted soap to help the mixture stick.

Apple scab - chives

Ants – pennyroyal and spearmint, tansy

Aphids – garlic, nettle, spearmint, southernwood, nasturtiums, flowering parsnips (attract hoverflies)

Bean beetles – Potatoes

Black fly – nettle

Cabbage white moth – feverfew, pyrethrum, tomatoes, celery, sage, rosemary, thyme, mint, wormwood, hyssop

Carrot fly – onions, leeks, chives, sage, rosemary

Cut worm – oak leaf mulch

Flies – wormwood, tansy, nut trees, rue

Fruit fly – chickens and birds foraging for the infected fruit is the best control, together with inter plantings of general insect deterrent species. Keep the fruit from making contact with the ground by spreading an impermeable barrier such as roofing iron under the trees, as the grubs need to access the soil to pupate. Alternatively, don't grow affected species. There are about 2000 fruit bearing plants that are not affected by fruit fly.

Mosquitos – pennyroyal

Moths – wormwood, rosemary, sage, lavender, mint, tansy

Nematodes – marigold

Slugs – Oak leaf mulch, wormwood

Woolly aphis and white fly - nasturtium

General insect deterrents – all aromatic herbs, garlic, pyrethrum, chives, onions

If you are patient, pests will attract their own predators. This is especially the case in a permaculture system where you are providing all the necessary habitat conditions. Work to establish fertile soil conditions and you will find that pest/predator imbalance will very rarely be a problem you cannot overcome.

In the meantime, try **Bug juice**. Mash a goodly amount of the problem pest in a blender and mix with 20 parts of water. When sprayed on plants, the smell of death will deter them! This is a better option than garlic spray of pyrethrum which often kill predator insects as well as pests.

Seaweed, nettle or comfrey foliar spray will strengthen plants resistance to pests.

For fungus problems, try chamomile tea or milk

4. Herbs for Soil Fertility

The following herbs make a great addition to your mulch mix, can be made onto a tea for foliar application and can also be grown as green manure. The establishment of healthy soil is the very best means of avoiding pest/predator imbalance.

Alfalfa – nitrogen, iron

Arrowroot – calcium

Borage – magnesium, iodine and iron

Bracken – potassium, silica

Buckwheat – phosphorus

Burdock – iron

Carrot leaves – phosphorus and magnesium

Chamomile – potassium, phosphorus, calcium (tea is a good fungicide, bd compost plant)

Chickweed – potassium, phosphorus, magnesium

Chives – calcium, sodium

Clover - nitrogen, phosphorus

Coltsfoot – potassium, calcium, sulphur, magnesium, iron, copper

Comfrey – nitrogen, potassium, calcium, magnesium, silica, iron

Dandelion – potassium, phosphorus, calcium, magnesium, silica, sodium, iron, copper (bd compost plant)

Dock – potassium, phosphorus, calcium, iron

Fat Hen – calcium, iron

Fennel – potassium, sulphur, sodium

Garlic – Sulphur, flourine, iron

Kelp – nitrogen, calcium, magnesium, sodium, iodine, iron

Legumes (beans) – accumulate nitrogen in the soil

Lemon balm – phosphorus

Lupine – nitrogen, phosphorus

Marigold – phosphorus

Melon leaves - calcium

Mustard – phosphorus, sulphur

Nettles – nitrogen, potassium, calcium, sulphur, sodium, iron, copper (bd compost plant)

Oak bark – potassium (bd compost plant)

Oak leaf – calcium

Oat straw – silica

Parsley – potassium, calcium, magnesium, iron

Sow thistle – potassium, magnesium, copper

Spurges – Boron

Strawberry leaf – iron

Sunflowers - potassium

Tansy – potassium

Thistles - potassium

Valerian – phosphorus, silica (bd compost plant)

Watercress – potassium, phosphorus, calcium, sulphur, magnesium, fluorine, sodium, iron

Willow bark – magnesium

Yarrow – nitrogen, potassium, phosphorus, iron (bd compost plant)