Diploma in Permaculture Design 10

BEE CORNER

A PERMACULTURE DEMONSTRATION GARDEN

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OVERVIEW OF DESIGN OF BEE CORNER - A PERMACULTURE DEMONSTRATION GARDEN

Project and Design Aims

To design a tiny space around a water butt to:

- Create an aesthetically pleasing, productive garden, specifically designed to provide wildlife resources.
- Collect, move and store water. Use water as a heat-sink/radiator. Provide water for wildlife. Reduce on mains water consumption.
- Provide an educational display on permaculture design and solitary bees that is accessible and enthuses others to care for the environment..

Project and Design Objectives

This design should provide for wildlife, conserve water, save on effort, look good and allow the community gardeners to grow flowers and produce. In addition it should be educational, make people think and encourage them to try things in their own gardens, however small these may be. It should give an outline view of what permaculture is about and do this in an accessible manner through the physical design and associated posters.

Project Outline

A water butt is to be installed in Empty Common Community Garden in a way that makes it multifunctional. The small area surrounding the water butt is also a part of the project and is designed in such a way as to give a number of different habitats and resources on a number of levels. Educational posters describe how solitary bees live and give an outline of what permaculture is about as well as describing how the various features within the small space fit with the permaculture ethics, design principles, processes and approach strategies.

Design Outline

Water

Using a metal storage shed as the site, the shed's guttering goes into a water butt. The sides of the water butt are netted for climbing plants. The top of the water butt has sedum green roof matting on it. The butt is raised on a base of bricks and slabs which allow for two tiers of dry vegetation and hollow stem habitat. The water butt tap at its base allows for easy filling of a tiny water/mud hole, the butt's overflow feeds the water bin in the poly tunnel. The water/mud hole has a pot of clay in it which provides a damp clay source for solitary bees to build with and also adds minerals to the water for bees and other insects when they drink.

Shed

The top of the shed provides a space for sedum growth. The wall of the shed provides space for a home for solitary bees where the bee nests can be observed. The shed wall also acts as a display board for open days and is used as a canvas, providing art in the garden.

Ground

At ground level there is a tiny bed, a planted up old honey tin and the water/mud hole. Plants are chosen specifically to fulfill a variety of purposes.

Accreditation and Complementary Criteria involved

Demonstrating Design Skills.
Site Development.
Education.

Holmgren Domain involved

Land and Nature Stewardship
Education and Culture

Permaculture Ethics and Principles involved

- **People Care, Earth care, Fair shares**

- **Observe and interact, Catch and store energy, Obtain a yield. Apply self-regulation and accept feedback. Use and value renewable resources and services, Produce no waste, Design from pattern to detail. Integrate rather than segregate. Use small and slow solutions, Use and value diversity, Use edges and value the marginal. Creatively use and respond to change.**

These are looked at in more detail in my Assessment of how this design meets the ethics and principles of permaculture

Methods used

Thinking tools: Clarifying and Identifying SMAAR(T) Goal Process. (Specific-Measureable-Agreed-Attainable-Realistic-Time bound).

Design frameworks: OBREDIMET (Observe-Boundaries-Resources-Evaluation-Design-Implement-Maintain-Evaluate-Tweak) for the design and **SADI(M)ET** (Survey-Analyse-Design-Implement-Evaluate-Tweak) for the posters.

Evaluation: PNI (Positives-Negatives-Interesting), **4Ps** (Process-Product-Personal-Peers).

Results Summary

This project is particularly rewarding because small utilitarian areas at the edges of the garden tend to get neglected. This design project changed that. By concentrating on an area that would just have been a water butt against a shed the community garden now has a valuable area which really adds to its interest, environmental and educational value.

Evaluation Summary

The area works well and is very successful as a demonstration garden. The most popular thing, with people and bees, is the observation solitary bee home. The whole system works well and it is easy for people to see how much better this design is than the standard water butt on a plastic stand on paving. It highlights well how permaculture can make our lives fit in with the natural world if we stop to observe and think more holistically before doing something.

The SMAAR(T) goal was achieved. The overall design (OBREDIMET), poster design (SADI(M)ET) and evaluation process (PNI) were suitable for this design.

This is looked at in more detail in my Assessment of this design

Reflection

One of the best things about in this design is the way it brings so many of the Permaculture principles and tips together so they can be presented in a very accessible manner. It is important to educate people and encourage them to look after the planet but it needs to be done in a positive way. This approach of making something people can see working, and do themselves to make their footprint smaller and their handprint larger seems to me to be a good way forward. This is looked at in more detail in my Assessment of this Design.

Self-Assessment

I learnt a lot about solitary bees and their needs. There are a lot of unknowns about the effectiveness of or damage that may be done by providing bee homes and this influenced the design. I could have shared this project more with others in the garden, this is an area I find difficult and often just get on and do it. My assessment of how successful the project has been and how it fits with the assessment criteria is analysed in my Assessment of this Design

Notes

Having gone via a link one can return to the appropriate spot in the main text by pressing the Alt and Move left keys.

DESIGN OF BEE CORNER - A PERMACULTURE DEMONSTRATION GARDEN

Introduction

There is a connection between our knowledge and our ability to care for and appreciate things. It is this fact that has, to a great extent, been the driving force behind this project. The project aims to design and create a tiny space around a water butt to:

- Provide an aesthetically pleasing, productive garden, specifically designed to provide wildlife resources.
- Collect, move and store water. Use water as a heat-sink/radiator. Provide water for wildlife. Reduce on mains water consumption.
- Provide an educational display on permaculture design and solitary bees that is accessible and enthuses others to care for the environment.

The design falls into two parts: the corner where the water butts and bee home are and the educational posters which explain about solitary bees, what permaculture is and how the corner design fits with its ethics, principles and approach strategies. This water butt design embodies many permaculture features in order to make an interesting exhibit that, along with the posters, will help to educate others on permaculture and how it can be used for positive impact.

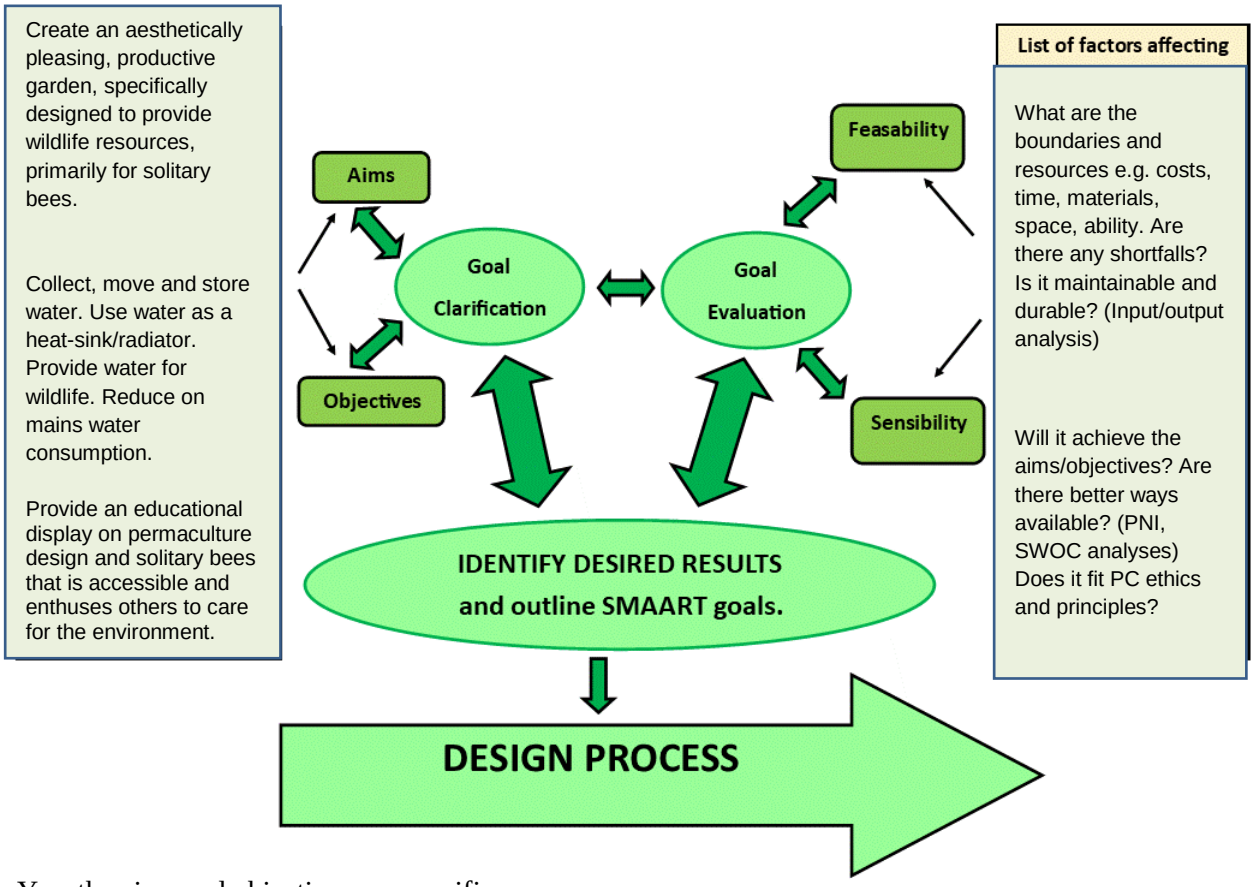
Figure 1 The finished corner

A feature, very common to people's gardens, that is usually dismissed as purely utilitarian was chosen so people could see how, with a bit more effort in designing and building, a lot more could be gained. This high initial input for long term, increased gains is a common feature of permaculture design. Using a small area was ideal as many people assume you need a big space in order to practice permaculture.

Design process

To test the viability of the plan its goals were assessed using a flow chart to identify and clarify SMAART goals. The design framework OBREDIMET was chosen for the overall design. For the posters the design framework SADIMET was used after careful clarification of the goals of each poster. The evaluation of the overall design was carried out using the parallel thinking tool PNI.

Figure 2 Flow chart to Identify and Clarify SMAART Goals



Specific - Yes, the aims and objectives are specific.
Measureable - Yes, the success of the water butt system, bee home and garden will all be easy to evaluate.
Agreed upon - Yes, by myself and Empty Common Community Garden.
Attainable - Yes, this is a relatively easy project, bee homes have been shown to work.
Realistic - Yes.
Time bound - No, this has had to be a project that gets done in gaps between other projects.

Observation

Climate

The site is in Hardiness zone 8. The position against a south facing shed make it protected from the prevailing SW and NE winds. Cambridge has slightly above average amounts of sun for the UK. https://www.currentresults.com/Weather/United-Kingdom/annual-sunshine.php. and a more continental climate than most of Britain but with lower rainfall. The site may well be a frost pocket as it is surrounded by higher buildings and woodland and is in a slight dip so the air cannot flow away.

Soil

Structure: When the garden was analysed, using the jar sedimentation and soil texture pyramid and the texture by feel, coil and ribbon test (1) the soil was deemed to be a sandy loam with a pH of approximately 6.

Site details

The site is flat, south facing and warm with the black metal shed absorbing heat during the day and releasing it at night. The shed has a glass table between it and the poly-tunnel which is used for hardening off plants from there. A hawthorn hedge runs behind the shed, table and poly-tunnel.

Research

Most of the research for this project was around the observation solitary bee home and what the requirements of the various local solitary bees are.

Knowledge of other features in the overall design came from the Permaculture Design Course and general experience. How one should design educational posters also required some research.

Boundaries

The biggest boundary was finding time to carry out this project, so something small, local and relatively simple that also had a positive impact on the community garden was chosen. One advantage of such a project was that the posters could be created during the winter months when there is less daylight and more free time.

Resources

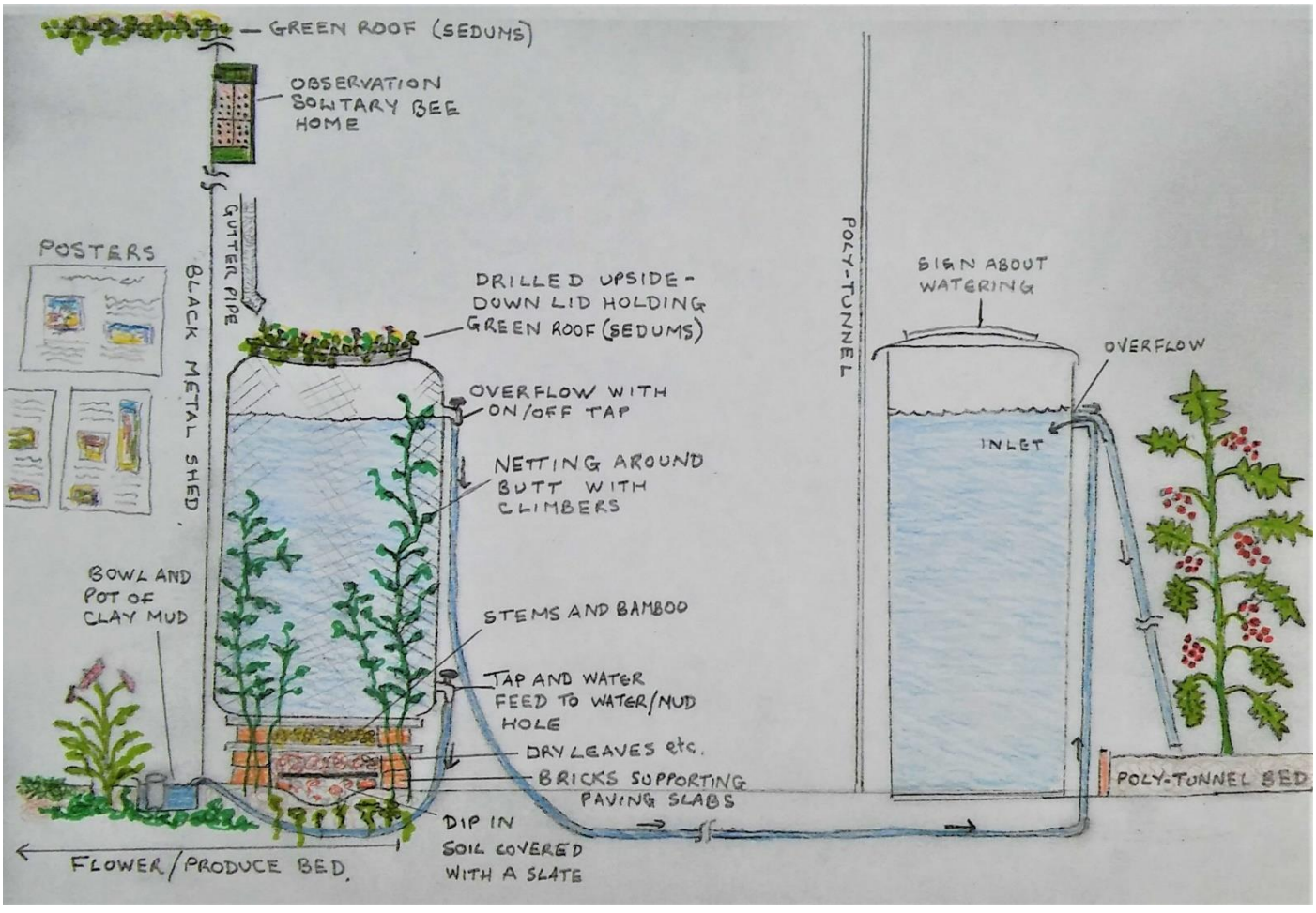
Materials were mostly already available or would be easy to gather second-hand. The water butt had been discarded at the end of the adjoining allotments because it leaked but this was easily mended. Plenty of wood offcuts and even old bits of Perspex for the solitary bee home were in our store of potentially useful things. Garden slabs were found on Freecycle and bricks from a skip. The green roof matting was new and bought with part of a grant the garden had been given from Cambridge City Council, who also gave us several used wheelie bins when the garden first started and one is used in this design. The hose pipe was unwanted and donated to the garden but some hose connectors and a tap for the water butt needed to be bought new. The posters required the use of new materials.

Evaluation

This design would be easy to find the materials for, create and maintain and so should be successful and useful in the long term. The addition of posters for when the garden holds events adds another dimension which increases the return for the input. The proposed design fits with a large number of permaculture principles and values so makes a good educational exhibit to help explain permaculture.

Design

Figure 3 Diagram of bee corner design.



The water system

The water system, filled from the shed roof, allows for water storage close to the poly-tunnel and inside it where it is used most. It also acts as a heat sink and source and provides easy filling of the water/mud hole for animals.

Figure 4 Water/mud hole and filling system

Water/mud hole.

A bowl of water with some stones and clay in a pot was positioned so it is partially shaded by plants and is easy to top up. The clay provides good building material for many solitary bees and also enriches the water with minerals. Bees and other insects such as butterflies require this as pollen and nectar are low in minerals. The water/mud hole also provides water for other animals.

Bee home

The design of this bee home was purposely small and allowed for easy and thorough cleaning. These two features were deemed important as it is argued that large uncleaned hotels can act as population sinks for bees through facilitating the increase of parasites and predators (2). The design needed to allow observation of the cells as the home was also for educational purposes.

Figure 5 Bee home in situ with poster on shed

Plants

A small bed was created in front of the shed and the water butt and an old honey tin was used as a flower pot. Tomatoes and chard have been grown in the small bed along with two perennials, a yarrow *Achillea millefolium* which is favoured by solitary bees and wool carder bees and penny royal *Mentha pulegium* as a ground cover. Over the last three years different plants have been grown up the netting covering the water butt, nasturtiums *Tropaeolum majus*, cucamelons *Melothria scabra* and sweet peas *Lathyrus odoratus.*

The honey tin was planted up with three plants, lambs ears *Stachys byzantina* , Mexican daisy *Erigeron karvinskianus* and a Common vetch *Vicia sativa*. These three were chosen for specific reasons. The lambs ear is a favoured plant of the wool carder bee *Anthidium manicatum* which are not common in the UK but are found in this area.(3). The Mexican daisy has tiny flowers over a long season and is ideal for small bees with short tongues, which many of the solitary bees are. The Common vetch is a native nitrogen fixer so would provide some nutrients to the soil (if it contains the correct rhizobium) and will provide food for pollinators. The green roof matting contains a variety of sedum species which also have tiny flowers, good for many solitary bees.

Green roofs

On part of the shed roof and on top of the water butt green roof matting was used. People are interested in this product and the matting on the water butt can be picked up and closely inspected.

Figure 6 Putting the green roof on

Posters

The posters include: **Be a Bee Friendly Being, Solitary Bee Lifecycle, Permaculture (explanation), Bee Corner - A Permaculture Design. Bee Corner Plan.**

Labels to put on various parts of the design explain approach strategies incorporated into the design. These include: **Keep Consumption Down and Production Up, Create Beneficial Relationships, Multiple Elements for Every Important Function, Diversity Creates Stability, Stack within Spaces, Gain Multiple Yields from Every Important Element, Remember the Well-trodden Path is Not Always the Right One, Work Within Nature.**

All were designed to fit A4 paper so they could be easily laminated to weather proof and store them then mounted together to make a big poster. The advice for creating educational posters produced by the University of Liverpool (4) and Manchester (5) was followed. The advice was summarised and organised into "Goal Clarification" and the design framework "SADIMET" for ease of use.

Goal clarification
Clarify exact purpose, message and audience
Survey and Analyse.
Collect information on poster design and view images of winning poster designs.
Gather the information on the subject being presented and distil it down to the essential messages that need presenting. Make sure it engages the audience
Design
Consider: poster size, visual attraction, hierarchy of importance of information, use columns and natural reading order, balance of pictures and text., effective use of text, image usefulness and colours. All elements visible from 1.5m. Colour, can be opposites, monochromatic (shades of same colour) or adjacent colours e.g. red-purple-blue.
Implement
Use high resolution pictures, crop pictures so only essential aspects shown, produce a draft poster
Evaluate
Read over carefully, check spelling, assess from a distance, get feedback from others.
Tweak.
Tweak and print posters.
The final posters can be seen here

Implement

The implementation of the overall design was straight forward with time available being the main problem. The guttering has had to wait as the flat shed roof leaks and is about to be replaced with a sloped one.

Maintenance

The maintenance has proved to be straight forward for the main part. It was feared that the tiny watering hole might have dried out very quickly but if kept partially shaded by plants it doesn't. It is easy to fill as it has a hose from the water butt tap to it.

Evaluation

PNI Analysis

Water system

Positives. The water system works. The overflow from the bin in the poly-tunnel works but hasn't been used with the guttering yet. The tap with the hose on makes it easy to fill the water/mud hole and it is easy to collect water for watering the plants in the little bed and poly-tunnel.
Negatives. The hose connecting the water butts could be neater and safer if dug underground under the paving. However, it would be less easy to unblock, replace or repair.
Interesting.

Figure 7 Bee cells showing use of white clay

Water/mud hole

Positives. The damp clay source was found to be being used by the solitary bees as building material. Some white clay, not found in the area, was put in a pot and a few of the mason bees homes were constructed using white clay which probably means this clay source was used.
Negatives. The water/mud hole needs topping up occasionally, however, this is easy to do just by turning on the tap.
Interesting. Children like the job of filling it up and removing leaves.

Bee home

Figure 8 Cocoons harvested in 2018

Positives. Bees use the bee home with 52 successful cocoons in 2018 plus several parasitized ones too. People are really interested in it.
Negatives. The size of the tunnels in the bee home are all quite large and equal and of the same length, a greater diversity of tunnel size and length would be an improvement. It look like the Perspex covers may allow tiny creatures to travel between tunnels. We haven't had any wool carder bees yet.
Interesting. The plastic straws inserted into the tunnels were the first tunnels to be colonised. It looks as if the bees used the clay resource provided.

Plants

Positives. Apart from the vetch the plants have thrived. The cucamelons and sweet peas are very happy and suitable climbers for the site.
Negatives. The bed could do with being a bit wider but part of the design idea was to use a very small space.
Interesting. The tomato plants love the heat from the black shed and don't get blight when others in the garden do.

Green roofs

Positives. The roofs are of interest and the example on the water butt is particularly good as it can be lifted up to examine. The green roof on the water butt is easy to water when it is very hot.
Negatives. The green roof on the shed has been losing soil and found it difficult to thrive during the heat wave of 2018.
Interesting. The composition of the sedum species has changed and the number of species reduced.

Posters

Positives. These provide the information and look good. The use of A4 sections works quite well.
Negatives. It is difficult to evaluate how well they are designed.
Interesting. Making them has focused my mind on what the messages that need to be disseminated are.

Tweak

Water system

Initially the water tap was facing towards the bed and water/mud hole but it proved difficult to get to when the plants were climbing the netting around the butt so it has been turned around 90 degrees so it is over the paved area. A short length of hose now runs to the water/mud hole so it is easy to top up when surrounded by plants in summer. We tend to take the top off the butt to fill our water cans as it is much faster so in practice the tap is only used to top up the water/mud hole. The overflow hose from the poly-tunnel water bin could be made to spread the overflow water evenly throughout the beds or to the plants individually. The new shed roof with a slight slope and surround for the green roof matting will be an improvement. The guttering that will go to the water butt can then be fitted.

Water/mud hole

The tiny watering/mud hole might be better with a ball-cock system to keep it filled. However filling it is a job the small children in the garden can take responsibility for and feel good about.

Bee home

In order to see the impact of different sized holes some narrower tunnels were made by inserting plastic straws into three of the tunnels. These straws were the first to be colonised in 2019. In future making a range of tunnel diameter and length may give a fuller bee home and provide for a wider range of solitary bees. The person in the pub where the straws came from said they were not plastic but made of cellulose and biodegradable. This does not appear to be the case but biodegradable plastic straws might make good observation bee homes and help boost population sizes. Some cells failed and it may be that the slight gap between the Perspex and the tunnels allows parasites to move throughout the home.. For the 2020 season the home has been emptied and cleaned as usual but put together with a smear of Vaseline around the edges of each tunnel to try to prevent this possibility.

Plants

Solitary bees are often oligoleges (bees that exhibit a narrow, specialized preference for pollen sources) and so it may be worth checking out which of the solitary bees in the Cambridge area are oligoleges and planting their preferred plants.

Green roofs

The green roof on the shed has lost much of its soil and needs some edging on all sides that allows drainage but not soil loss. It has suffered in the heat sometimes but has returned when it rains. A system for watering it might be advantageous.

References

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(3) *Wool carder bee (Anthidium manicatum),* Bumblebee Conservation Trust. https://www.bumblebeeconservation.org/woolcarderbee/

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Pollen mites hitching a lift on Red Mason bees to gain access to fresh nests, https://nurturing-nature.co.uk/wildlife-garden-videos/pollen-mites-hitching-a-lift-on-red-mason-bees-to-gain-access-to-fresh-nests-new-video/

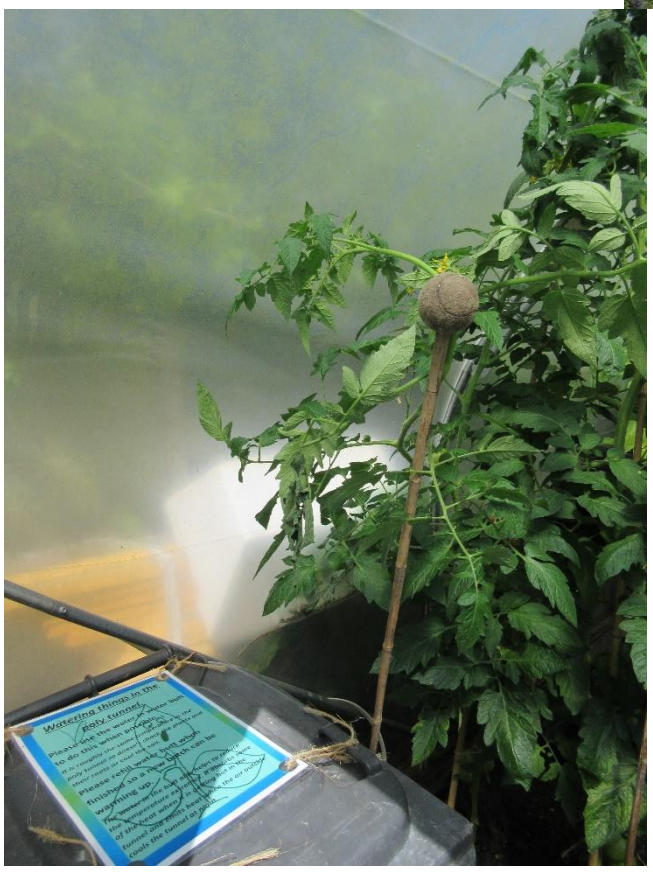
Beware! Is your 'bee hotel' a nursery for disease and pests? – video, https://nurturing-nature.co.uk/wildlife-garden-videos/beware-is-your-bee-hotel-a-nursery-for-disease-and-pests/

APPENDIX

Supporting documentation

Pictures of the project at various stages

Figure 9 Pictures of the project at various stages



Posters and labels

Figure 10 Solitary bee posters

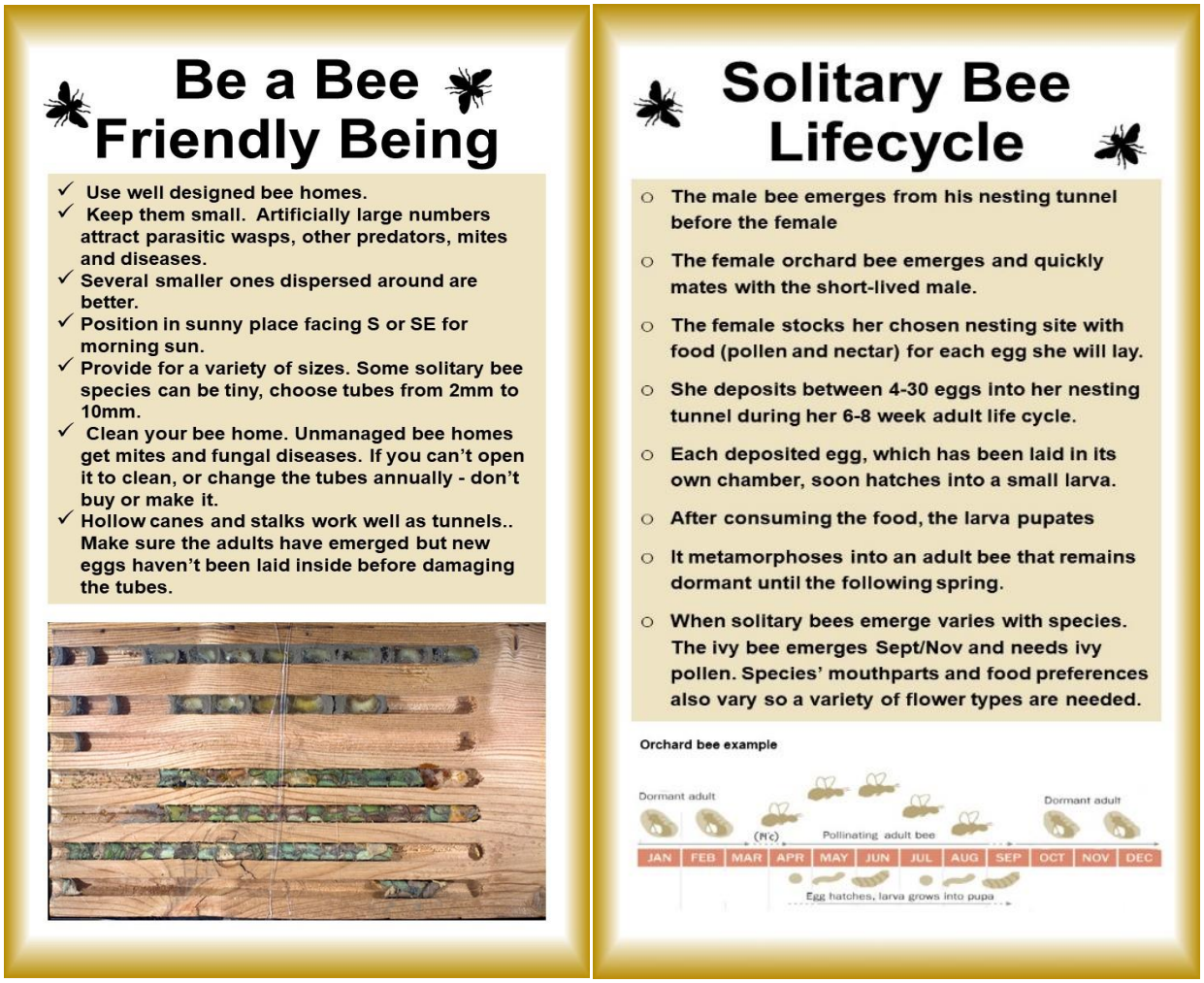


Figure 11 Permaculture poster

Permaculture

What is it?

Permaculture is a design intensive approach to sustainable living that adopts lessons learnt from nature. After all, nature recycles everything and produces no waste. It is full of diversity and a myriad of connections making it a stable system. Plus, left to its own devices it produces abundance.

Permaculture is NOT a "back to the land" cult OR sustainable farming.

It is a design system enabling us to create a sustainable and regenerative future.

How does it work?

There is not a single blueprint on how to design and create sustainable systems. Each situation is unique so this wouldn't work.

Permaculture works by providing:

- ✓ ETHICS - that keep us centred on the goal of Earth Care, People Care and Fair shares for all life.
- ✓ PRINCIPLES - that guide us when designing and living.
- ✓ TECHNIQUES - to help us observe, think, analyse and design sustainable systems and ways of life.
- ✓ STRATEGIES – to help us to think holistically and to live and design for a healthy planet.

Permaculture principles

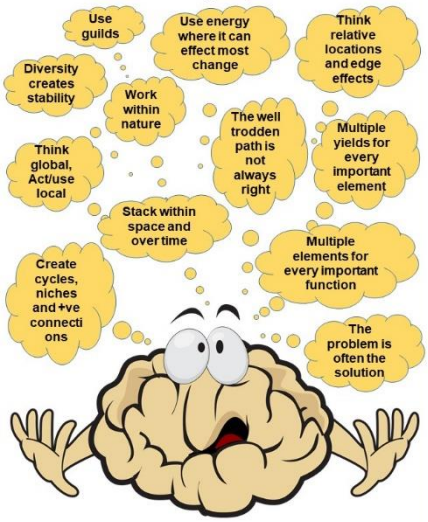
The principles are GUIDELINES on how to create sustainable and regenerative designs that follow Permaculture's core ethics. They can be applied to personal, social, economic and political designs and decisions.

Humans are rubbish at holistic thinking

Each principle is a guide on how to think from different perspectives to produce holistic thought and designs.

Permaculture Strategies

Approach strategies help reduce narrow thought processes.

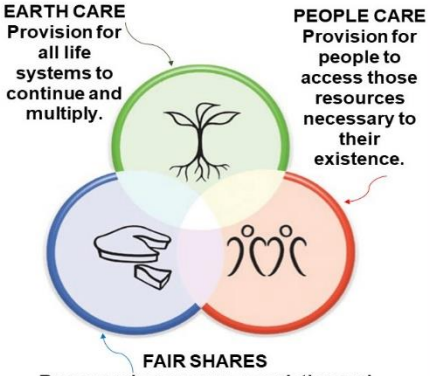


Here are some examples that encourage more innovative, creative, effective and regenerative designs.

Permaculture's Core Ethics

"The Rules of the Game".

The three ethics inform our designs and actions. A decision in one sphere must also consider the other two and aim to enhance them.

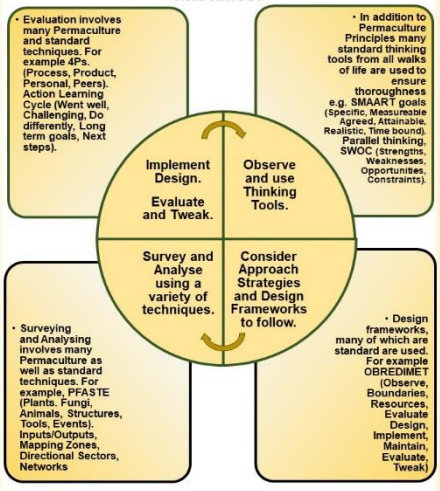


By governing our own population and consumption we can set resources aside to further Earth and People care.

If we can design ways to live within the "Rules of the Game" then we can win.

Permaculture Techniques

Design techniques reduce feelings of overwhelm and save on time, energy and mistakes.



"There are many problems in the world to worry about; permaculture helps us to focus on the solutions". Andy Goldring

The Power of Permaculture

Permaculture's most important principle, "Observe and Interact".

Young plants only survived in the dips.

Use permaculture strategies to think. "Work with Nature".

Use permaculture techniques to design.

Make lots of small dips?

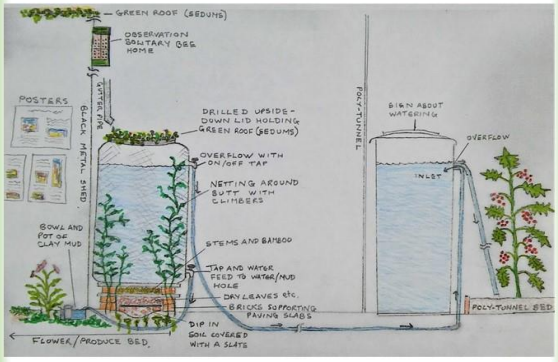
Seed in dip is protected from elements.

Sit back, Observe, Evaluate and Tweak.

One year later.

Figure 12 Bee Corner - a permaculture design poster

Bee corner - a permaculture design



AIMS

To use a tiny space around a water butt to:

- **Provide an aesthetically pleasing, productive garden, specifically designed to provide wildlife resources.**
- **Harvest, move and store water. Use water as a heat-sink/radiator to improve plant growth. Provide water for wildlife. Reduce on mains water consumption.**
- **Provide a working example of, and educational display on, a permaculture design that is accessible and enthuses others.**

DESIGN FROM PATTERN TO DETAIL The overall pattern of solitary bee behaviour and their needs was instrumental in deciding many details of the design, including species of flower and the water/mud hole

INTEGRATE RATHER THAN SEGREGATE. Nature is integrated with water harvesting and storage, crop production, education and beauty. It encourages people to become more integrated with nature. Elements of the design work together e.g. the capacity of water to hold heat improves plant growth, the netting on the butt allows plants to climb it.

USE SMALL, SLOW SOLUTIONS. On a world-wide scale this design is a very small, slow part of the solution. It reduces our impact and passes on information on regenerative living.

USE AND VALUE DIVERSITY. The design creates a diverse range of niches. It also allows for a more diverse range of water sources and the butts provides a diverse range of uses - climbing frame, heat/cold storage and water movement into poly-tunnel

USE EDGES AND VALUE THE MARGINAL. Here, a utilitarian edge usually marginaliised becomes a useful space and centre of attention. Solitary bees and nature have become marginalised. They are at the centre of this design

CREATIVELY USE AND RESPOND TO CHANGE. This design is a response to the changes we face today. It reduces the community garden's water footprint. Creates microhabitats, grows produce, educates, provides beauty and increases community cohesion.

How this design meets permaculture's principles

OBSERVE AND INTERACT. The design pays attention to the state of the planet and tries in a small, way to address this. It involved research on the needs of solitary bees.

CATCH AND STORE ENERGY. Energy is stored and returned as it harvests, moves and stores water. Allows water and shed to be used as a heat storage/release system helping to buffer temperature changes for plants. The water/mud hole and bee home help the bees save energy

OBTAIN A YIELD. These include water, water movement, heat storage/release, food, flowers, bees, wildlife, education, beauty. In 2018 we had 52 healthy bee cocoons and 50+ parasitic insect cocoons

APPLY SELF REGULATION & ACCEPT FEEDBACK. Feedback from the planet is that insects are dying fast and hence this design. The design has been evaluated and tweaked as a reaction to feedback from the bees.

USE AND VALUE RENEWABLE RESOURCES. Most of the non-natural resources in this design were destined for landfill or recycle. It values water, bees, produce and wildlife: all important resources for our survival

PRODUCE NO WASTE. Very little waste was produced in the making of this design and only a little waste will occur over time. The aim is for the gains to outweigh the losses.

The Point of Life?

To Create Conditions Conducive to Life.

Labels for putting around the design itself.

Permaculture Approach Strategy.

Keep Consumption Down and Production Up.

The materials used here were recycled or destined for landfill. The tiny space hopefully increases nature's production by specifically providing for it.

The garden's plants should be producing better crops because of the water containers' temperature buffering capacity and the provision of water at the same temperature as the plants.

Permaculture Approach Strategy.

Create Beneficial Relationships.

This design is full of beneficial relationships. The bees are provided for by the bee home, plants and water/mud hole. They in turn pollinate plants and provide an educational exhibit. The water system benefits the plants with its buffering capacity and gardeners by providing a water source close to where it is needed. The plants and wildlife benefit from the gardeners who in turn benefit from them with food and beauty.

Permaculture Approach Strategy.

Create Multiple Elements for Every Important Function.

Water is important in a vegetable garden and the addition of a water collection and storage system creates an additional water source the to the mains water.

Permaculture Approach Strategy.

Diversity Creates Stability.

This design created a diverse range of microhabitats for a range of plants and animals. There are shady, sunny, damp, dry, exposed and sheltered areas all of which may provide refuge for wildlife during differing conditions and stages of lifecycles.

Permaculture Approach Strategy.

Gain Multiple Yields for Every Important Element.

The water system provides multiple yields, it moves water into the poly-tunnel and saves the energy of collecting it. The water's butts both provide a temperature buffering system, absorbing heat during the day and releasing it at night so improving plant growth. The butt provides a climbing frame for plants and a surface for sedums to grow on. The butt support also provides two different types of habitat (stems and insulated dip).

Permaculture Approach Strategy.

Stack within Spaces.

This design uses stacking to fit a lot into a tiny space so creating a diverse range of habitats and microclimates which make the space very useful for a variety of needs and wants.

Nature stacks, it doesn't often have a two dimensional structure but consists of layers. For example there are usually layers of ground cover plants, larger plants, shrubs, small trees, large trees, climbing plants and animals throughout.

Permaculture Approach Strategy.

Remember the Well-trodden Path is Not Always the Right One.

The usual bought water butt comes on a plastic stand and is sat on paving. Usually it is not connected to other water storage systems. This well-trodden path is not nearly as useful or beneficial to nature as this design.

Permaculture Approach Strategy.

Work within Nature.

This design is not trying to make species adapt to the conditions provided it tries to create conditions that fit the local species, garden flowers and crops. For instance the plants that enjoy drier conditions are in the pot. The bee home is south facing as this is what the bees prefer.

ASSESSMENT OF THIS DESIGN

Evaluation

Table 1 4Ps Evaluation of design

4Ps	Evaluation
Process	The design process has worked. The linear approach of OBREDIMET is logical. The observation phase was not such a large part of this project compared to most. Gaining knowledge of solitary bees was my main area of research. The site was small making it easy to assess. The implementation was fairly straight forward. In terms of design the most taxing part was designing the posters and here the SADI(M)ET framework helped with focussing on what was important. One problem with the whole project was having enough time and the new roof and guttering for the shed has still to be put on.
Product	The water butts work The overflow into the beds in the poly-tunnel works. The hose connecting the water butts could be neater and safer if dug underground under the paving. However, it would be less easy to unblock, replace or repair. The different aspects of the project work well. People are amazed to find out about how important solitary bees are and what their lifecycle entails. Bees use the bee home with 52 successful cocoons in 2018 plus parasites in several more cocoons. The damp clay was also used. To test if the damp clay source was actually being used by the solitary bees as building material some white clay, not found in the area, was put in the pot. A few of the mason bees homes appear to have been constructed using this white clay.
Personal	I have enjoyed both the learning about and making of this design. The SMAAR(T) goal was achieved. It was not possible to allocate a time frame for this as it needed to fit in around more important garden activities and the work and maintenance of other permaculture projects. However, it took a lot longer than I would have liked, perhaps with a time frame in mind it would have been finished earlier. One of the unexpected advantages is that I made several bee homes at the same time from the templates and gave them to family members. Now we compare how successful they have been and the types of bees inhabiting them. I have become more in tune with the bees and so to some extent I have re-wilded myself. I wish, from my experience as an environmental biologist, researcher, educator and permaculture designer, that we understood the effectiveness, or otherwise, of bee homes and had designs for bee homes that are known to be effective. As with so many things in nature the interactions are so diverse and complicated it is difficult to do one thing without a medley of knock on effects, some of which may be detrimental. Hence the need to observe, copy nature and think holistically.
Peers	People are definitely interested to learn from the solitary bee posters after they have seen the bees in their home. People like bee corner but it is definitely the bees they like best. In 2019 when I announced our crop of 52 healthy cocoon people were far more excited than they were about our food crops.

How this design meets the Principles and Ethics of Permaculture.

This design fits with the core ethics of permaculture.

Earth Care - Provision for all life systems to continue and multiply.

People Care - Provision for people to access those resources necessary to their existence.

Fair Shares - By governing our own needs, we can set resources aside to further earth and people care.

This design provides for wildlife, aids the production of crops, saves water and educates people on ways to think and how to help look after the planet.

This design applies all of the permaculture principles.

Observe and Interact (pay attention): This design involves paying attention to the facts on the state of this planet, it then tries to address, in a small way, to address these. Research on how solitary bees live, how to make a solitary bee home and the possible negative effects of various bee home designs was an important part of this design. Creating this design, including the posters encourages others to observe and interact.

Experimenting with the damp white clay and reducing tunnel size with straws shows how the principles of Observe and Interact continue during the Evaluation and Tweak stages of the design process.

Catch and store energy (harvest while it is abundant): The energy put in to designing and building bee corner catches and stores energy as the system harvests, moves and stores water and allows it to be used as a heat storage system both outside and in the wheelie bin in the poly-tunnel. This is because the heat of the day warms the water in these containers and it is then radiated out later. This helps buffer temperature changes, keeping plants cooler during the heat of the day and warmer at night.

The water can be used for watering the poly-tunnel and so saves us the energy of carting water from the garden's water trough and also saves on the use of treated mains water which requires energy to produce.

The water is warmed up in the poly-tunnel and is much better for watering seedlings, especially in the spring when the water trough water is still freezing cold and can shock the young plants. This reduces plant stress giving them more energy to grow well. A sign on the wheelie bin reminds gardeners to use this water.

By making a flower/produce bed against the south wall of the black shed the heat storage/radiation capacity of it can be used to the advantage of the plants growing there.

The water/mud hole will also save the wildlife some energy and because the design makes it easy to top up this is done regularly.

Obtain a yield (make sure you are getting valuable results): In addition to educational yields there are the physical yields of water, food, flowers, bees and other wildlife as well as heat storage and release. In 2018 52 healthy solitary bee cocoons were harvested along with approximately 50 parasitic insect cocoons. There are also the well-being yields of nature, beauty, fun and wonder.

Apply self-regulation and accept feedback (be open to modify dysfunctional behaviours): This has been going on throughout the design, implementation and evaluation of this project. It was necessary to observe through research and interaction with the literature, people, site, conditions, plants, bees and other wildlife. Evaluating the design and tweaking it where there are problems or things could be done better is a form of accepting feedback. For example the fact that the bees haven't used all the tunnels has resulted in modifying the design to make some tunnels smaller.

Use and value renewable resources and services (reduce dependency on scarce resources): Most of the resources used in this design were second-hand and destined for landfill or recycle. The green roof matting was new but is made with recycled materials. Otherwise only the hose fittings are new plastic materials. The water saved through this design is a renewable resource It is also a scarce resource which we have been using carelessly The more rainwater that can be used wisely the better. The piped water on site is mains water which requires energy and land to treat. This design values this resource which is renewable if carefully used and aims to reduce the amount used. The bees are also a resource as they provide pollination services for crops and flowers as well as other ecosystem services.

Produce no waste: Very little waste was produced in the making of this design. A few offcuts of offcuts of plywood as the bee home was made using plywood offcuts. A little waste will be created over time as things need replacing. However, it is envisaged that the "Law of Return" will be achieved with more returned to the environment than has been used.

Design from pattern to detail (Observe natural/social patterns and apply them to design): Designing from pattern to detail is apparent. The overall pattern of solitary bee behaviour and their needs was instrumental in deciding many details of the design. For example, The bee home mimics nature's wood and old stems habitat. A warm bee-friendly flower bed and pot were designed down to the detail of species to plant (that would be favoured by the bees) and the positions (that would suit the plants best).

Integrate rather than segregate (capitalise on how things work together): As with the whole garden bee corner aims to integrate nature and its health with crop production and people's space for relaxation and education. Bee corner specifically encourages people to have a closer affinity with bees and hopefully to consider designing and

creating their own spaces specifically for other species' well-being. The design also capitalises on how things can be integrated to work together, for example, the water's capacity to hold heat can be used to improve plant growth, the water butt can become a climbing frame for plants, the shed can become a display board, water source, support for bee home and place for sedums to grow - so supplying wildlife habitat and nectar and pollen for a range of insects. The plants in the small bed have been specifically chosen for solitary bees many of which are tiny and have small mouth parts so favour tiny flowers such as the yarrow, Mexican daisy and sedums The lamb's ear is grown because it is favoured by the solitary wool carder bee which makes its cells from the hairs on its leaves. The water/mud hole works to supply mud for some bees to build their cells but the mud in the water also creates a mineral rich puddle required by many insects including bees and butterflies. This is all integration.

Use small and slow solutions (local resources and responses, work to a manageable scale): On a world-wide scale this design is a very small, slow part of the solution to the problems the world faces. It tries to reduce some of our negative impacts by creating wildlife resources. Disseminating information on the regenerative approach to living that permaculture espouses is also a part of the solution to the crises we face

Use and value diversity (diversity leads to greater resilience): This design creates a diverse range of habitats and microclimates for a variety of plants and animals. Compare this design with the commonly found water butt on a plastic stand sitting on, and surrounded by, paving and it is clear how this design values diversity. The design also adds to the water sources available so if the mains supply fails there is an alternative.

Use edges and value the marginal (important things happen at the intersections): Bee corner has shown how the utilitarian edge of a garden that is usually marginalised can be used to create a useful space that becomes the centre of attention. In many ways solitary bees and nature itself have also been marginalised and they are at the centre of this design. There are more species found at the edges where different ecosystems meet and more microhabitats are created. For the space used this design is full of microhabitats.

Creatively use and respond to change: This project is a response to the crises we face today. It reduces the community garden's water footprint and increases its handprint by creating wildlife habitats and habitat boosters, growing crops, educating people and creating community cohesion.

How this design uses many Permaculture Approach Strategies

Bee Corner has been designed by considering and following permaculture's core ethics and principles but not only these, a variety of permaculture approach strategies have also been used to ensure an efficient, holistic approach. The list of permaculture approach strategies, tips, or sayings, is large but those here have been considered in this design.

Create multiple elements for every important function, Gain multiple yields for every element, Create cycles and beneficial relationships, Focus on positives and opportunities, Work out from well managed areas, Remember diversity creates stability, Think about relative locations, Work within nature, Think 7th Generation , Community has power, Use cooperation not competition, Disseminate, Keep consumption down/production up, Use guilds, Avoid leaks in a system, Think global, Act/use local, Create win-win situations, Remember the well-trodden path not always the right one, Stack within spaces and over time.

Assessment of Individual Design for Feedback Table

DIPLOMA in APPLIED PERMACULTURE DESIGN System 5.2

ASSESSMENT of INDIVIDUAL DESIGN for FEEDBACK

Effective from Oct 1st 2013

Diploma Apprentice's name:	**Charlotte Synge**
Date first registered for Diploma:	**26th January 2015**

Date of this feedback:	
Name of Personal Tutor:	
Name of Assessment Tutor:	**Aranya Austin**
Project Title:	**Bee corner- a Permaculture Demonstration Garden**
Date Started:	**Summer 2016**
Date Completed:	**Autumn 2019**
Implemented:	**Yes (All but the gutter which needs to be fixed after a new shed roof is fitted.)**

ACCREDITATION CRITERION: 1. Demonstrating design skills (Section C3 in the Guide to Accreditation Criteria)		
	What's gone well?	**What could have been done differently?**
Accurate and appropriate use of an intentional design process.	Yes. Using a flow chart to Identify and clarify the goal and checking it is SMAAR (T) then using the outline design framework OBREDIMET and SADIMET worked well. Evaluating the design and implementation of it using the PNI framework was appropriate.	Other design frameworks and thinking tools could have been used to equal effect.
Use of permaculture ethics, principles and theory is appropriate to the situation.	Yes. How the design fits with permaculture principles and ethics can be seen here.	Not sure.
Use of a variety of tools which suit the needs of the client and the situation.	Yes. I have used the standard tools that work well for me. Converting the information on designing posters to Goal Clarification and the SADIMET framework really helped me clarify how to approach the designing of them.	I could have just read through the advice as I did the designs and I could have used other design frameworks.

Design is intelligible, coherent and effective (i.e. it met the needs of the client).	Yes The drawings are clear and make it easy to understand how the design works. The posters are clear, informative and targeted to the general public.	. Not sure
Documentation for and presentation of the design is appropriate for clients & third parties.	Yes. The presentation is clear and appropriate for the general public and people interested in permaculture	More space for the posters and having them drawn professionally may have produced better posters.

ACCREDITATION CRITERION: 2b. Applying permaculture to your work and projects

(Section C2 in the Guide to Accreditation Criteria)

	What's gone well?	**What could have been done differently?**
Identify which of the 15 categories of application the design applies to from the checklist in the Guide to Accreditation Criteria, and provide feedback on each.	**Site Development** The project has been completed and everything is growing well and the bees are using the bee home. **Education** The design is used for educational purposes and people are enthused by it. The bee home attracts most interest. The idea of creating a space designed to cater for the whole lifecycle of an animal is an idea that makes people think twice about how they garden. I have not used the posters on permaculture and the design yet.	Not sure
Clear explanation of how the solution was developed using design process and permaculture theory. The solutions are relevant and appropriate to the activity and content areas.	Yes. The thinking tool was SMAAR(T), design frameworks OBREDIMET and SADIMET and analysis tool PNI. How the design fits with permaculture principles and ethics can be seen here How the design used many permaculture approach	Not sure

	strategies can be seen in the labels made for the design. A list of them can be viewed here. The solutions are relevant and appropriate.	

ACCREDITATION CRITERION: 3. Learning from and developing your permaculture practice **(Section C5 in the Guide to Accreditation Criteria)**		
	What's gone well?	**What could have been done differently?**
Evaluation of the effectiveness of your design work on this project.	I am happy with the design work for this project. The area works and people are interested in the bees and the information on them. We have not had an event where the other posters have been used yet.	I should have made the bee home with different sized tunnels. This was mentioned in the literature and I ignored it!
Reflection on use of design tools and processes, and use of Permaculture theory and practice.	I am happy with the use of the thinking and analysis tools and the design frameworks. Converting the information on poster design into the SADI(M)ET framework made me analyse and organise it which I am sure saved me time and made me address all the issues.	Perhaps I should have formally used an analysis tool such as SWOC.
How the design shows that your competence and skills in practice and learning is progressing.	The design shows how I now think in permaculture terms for my work. I have learnt a lot about solitary bees. As with the other designs I feel that the observation/research phase was the most important part.	Not sure.

Comments about project format, general or specific issues	
Any other comments ?	
Conclusions	
How ready is this design for presentation?	
What are the apprentice's next steps?	
The highlight of this design for me was….	

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