GAIACRAFT
PERMACULTURE WORKBOOK

chin-deep
in the fallen blossoms...
frog!

- issa

GAIACRAFT
PERMACULTURE WORKBOOK

Gaiacraft is a planted collective of permaculture designers and planet people dedicated to earth stewardship education. This is part of a media stream being developed to support those on the path to heal humans and the world in which we live. Whether you are a farmer, urban business person, or master gardener, this workbook can help you in your practice of living in the everyday. Catered to an evolution of our lifestyles, lowering our impact on the earth while forging a more sustainable and abundant human culture, the Gaiacraft Design Curriculum reflects knowledge from the past that can help us build a healthy future together.

Together these pages are support material for the full Permaculture Design Certification Course. Individually the pages are little lessons and memory recall tools for integrating some of the core key concepts of Permaculture. Together they represent a Core Curriculum for an extended Introduction to Permaculture Course that you could teach using these worksheets as source material and starting point for hands on activities. Developed as part of a full Permaculture Design Curriculum, the worksheets also act to compliment a full Certification Course.

This learning and teaching toolset may be photocopied and given out to anyone interested in its knowledge. Permaculture teachers may like to do high quality template copies of its pages for their students so the students in turn can photocopy the sheets and pass them out. The worksheets act as curriculum support for anyone developing workshops, presentations, classes or courses on Permaculture.

We do ask that you don't photocopy whole versions of the book, only individual pages. Full copies of the book are available at the gaiacraft.com website, along with a host of other Gaiacraft Media which is also featured on the website.

We seek funding to design this permaculture manual for publication and printing on a larger scale. The core curriculum was sourced from all the teachers and resources we have studied over the years at the heart of which was the books and teachings of Bill Mollison as well as David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow and Patricia Michael.

Deepest of thanks for supporting this non-profit educational initiative
Dedicated to the Liberation of All Beings

Kind Gratitude,
The Gaiacraft Team

GAIACRAFT LEARNING GUIDE
NOTES ON READING THE DESIGNER MANUAL

Permaculture : A Designers Manual is the bible of permaculture. Within it is a dense amount of information about how the world works and how we can work well with the world. Reading this book can be tough, since its much like an academic textbook. Here are some ideas from past students about how to approach this task in the most successful way.

Spread out the readings! Don't try to do it all at once. Reading one chapter a month for 13 months is a great way to do this. The book is modular so can be broken up easily into reading periods as small as you like. It's like a multi-course meal to eat one bite at a time.

Take notes or highlight! Some people retain more information if they do some creative note taking, underlining or highlighting the text.

Read with others! Buddy up for reading sessions to help motivate the reading.

Read it aloud! For some people this is a huge help and can be done as a buddy system where things can be clarified through discussion.

Don't worry about memorizing the information. There are no tests. It's more about knowing where the information is than trying to take it all in, you may find that more of it sinks in than you might think.

Remember you never know where this information will take you. Pay attention to things even if they don't seem relevant in the moment. You may find yourself working, living or teaching in a different climate or on a huge farm one day!

The color photographic plates give great real world illustrations of the concepts being discussed.

Don't get caught up on stuff you don't understand, just make a note of this and move on. Discussions about topics can happen later to gain clarity.

Pay close attention to the Designers Checklists at the back of each chapter. These are great reviews for the key points of each module.

For those who have the time to engage deeper into this learning process, Gaiacraft highly recommends reading 'The Earth Users Guide to Permaculture' by Rosemary Morrow. You can read both books simultaneously and get a wise female perspective and writing style to mirror and compliment Bill Mollison's text.

Including a bioregionally specific permaculture text as well is another way to really bring this information home. Here in the temperate climates we use 'Gaia's Garden' by Toby Hemenway. Having a couple books on the native plants and animals of your local bioregion as well as how they were used by First Peoples will also help round out your curriculum. The designer manual is full of super dense information a sentence is like a paragraph, a paragraph is like a chapter and chapter is like a book.

Combine the readings with observation walks around your home and community! Nature walks are a must! Any integrative experiences you can have to help you process and understand the information will be a huge help. Hands on learning with some of the techniques is also a wonderful way to learn this material and apply it directly to your life.

Most of all, have fun! See how you can creatively use your understanding of your own learning styles, ways of reading and approaches to text book work to help you get the most out of the process.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT
DEFINING PERMACULTURE

1

Permaculture is an oft misunderstood concept. It is less of a single word concept and more of a whole way of thinking about the world. Here we will look at how it is defined, how it relates to a new ethos and how it is a design process.

1.0 DEFINITIONS : PERMACULTURE AS A CONCEPT

The word permaculture is part of the newspeak, a novel word created to describe something that did not exist before. Because of this, different people describe permaculture differently. Since permaculture relates to a whole system of great complexity its definitions reflect a real density and dynamism. Each definition is different and yet they all fit together as they are all describing the same thing.

Bill Mollison (Australia) www.tagari.com

"Permaculture. A copyright word, owned as a common copyright by the Permaculture Institutes & their graduates. Derived from 'Permanent' and 'Culture', as follows:

Permanent: From the Latin permanens, to remain to the end, to persist throughout (per = through, manere = to continue)

Culture: From the Latin cultura - cultivation of land, or the intellect. Now generalized to mean all those habits, beliefs, or activities than sustain human societies.

Thus, Permaculture is the study of the design of those sustainable or enduring systems that support human society, both agricultural & intellectual, traditional & scientific, architectural, financial & legal. It is the study of integrated systems, for the purpose of better design & application of such systems."

"Permaculture ("Perm"anent "agri"culture and "Perma"nent "culture") is a sustainable design system stressing the harmonious interrelationship of humans, plants, animals and the Earth."

"Permaculture principles focus on thoughtful designs for small-scale intensive systems which are labor efficient and which use biological resources instead of fossil fuels. Designs stress ecological connections and closed energy and material loops. The core of permaculture is design and the working relationships and connections between all things. Each component in a system performs multiple functions, and each function is supported by many elements. Key to efficient design is observation and replication of natural ecosystems, where designers maximize diversity with polycultures, stress efficient energy planning for houses and settlement, using and accelerating natural plant succession, and increasing the highly productive "edge-zones" within the system."

"Permaculture is a philosophy of working with, rather than against nature; of protracted & thoughtful observation rather than protracted & thoughtless labour; & of looking at plants & animals in all their functions, rather than treating any area as a single-product system."

Delvin Solkinson (Canada) www.gaiacraft.com

1. Elementary
"Permaculture is about creating and maintaining relationships. Developing healthy communities, permaculture people live by sharing resources and supporting each other. It begins with all the plants and animals, buildings and resources that can be found in and around your home. Permaculture is a continuing process exploring the ways in which you can fulfill the needs of the things around you while having your own needs met."

2. Intermediate
"Permaculture is a process of growing awareness. Linking people with plants, permaculture promotes conscious living, sustainable development and resource conservation. It is a response to the industrial urbanization of the Earth and resulting toxification of the biosphere. The permaculture path opens dialogues about finding creative solutions for problems in the present. "

3. Advanced
"Permaculture consciousness enhances our ability to work with maps and connect to the territory. It looks towards saving energy, conserving resources and forming long-term interdependent relationships with whole communities of living things. Permaculture develops applied understandings of the subtle implications and felt impacts of our actions on the world around us. This whole system design perspective can help us to streamline the way we plan the course of human development."

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

Dan Hemenway (USA) www.barkingfrogspermaculture.org :

"Permaculture seeks to design sustainable lifestyles based on conditions unique to each place and designed according to the same principles by which nature integrates other species into her ecosystems. While permaculture obtains its design principles through careful study and search for comparable principles in nature, permaculture strategies are based on the realities of the 20th century."

Patricia DuBose Michael (USA)
www.patriciamichaeldesign.com :

"Permaculture is the harmonious integration of people into the landscape in such a way that the land grows in richness & aesthetic beauty."

Graham Bell (England) grahambell.org :

"Permaculture is a way of life which shows us how to make the most of our resources by minimizing waste and maximizing potential. Living ecologically doesn't mean giving everything up, but relearning the value of nature & understanding new ways of being wealthy...Conscious design of a lifestyle which is highly productive and does not cause environmental damage.....Meeting our basic needs & still leaving the earth richer than we found it."

2.0 ETHICS : PERMACULTURE AS AN ETHOS

Permaculture is the spirit of the age, a new earth ethic dedicated to helping to heal our planet. It involves bettering human relationships to the living world around us and creating a harmony of successful and abundant inter-relationships. As an ethos, permaculture is simply what is appropriate action at this time of ransition in the history of our planetary ecology.Unlike ethics which represent a moral imperative, the principles of permaculture are guidelines to help us create a harmonic and healthy homeworld.

1. Earth Care :

This is the covenant we have with our world, our responsibility to love and protect it. Earth Care means looking out for the holistic health of all livings things on our planet. This means changing our lifestyle and rethinking our approach to development as well as remediating damages already done.

2. People Care

Our convenant with each other is to love and protect all people. People Care means looking out for the health and welfare of our human family. This means providing healthy homes, food and medicine for people to help them to have a healthy lifestyle.

3. Fair Share

All living things have the same inherent value and right to live a healthy life. Sharing the abundance of earths resources equally with all living and non-living things is part of permaculture. We aim to generate an abundance of extra resources with the human and more-than-human world around us.

4. Transitional Ethic

Our world is in transition and it is not reasonable to think we can take the step into a fully permacultured society in one giant leap. This ethic states that in times of transition it is ok to use unsustainable means when creating a sustainable system. For example if there is a machine available to dig a hole, it might make more sense than spending hundreds of human hours hand digging it. Likewise if we have left over paint it might be wiser to use it up instead of garbaging it and purchasing expensive new eco-paint. The goal is not to use unsustainable technologies but the reality is that this is ok when in transition. Often people feel overwhelmed by the ethical implications of permaculture or the idea that they must make radical changes all at once. This ethic helps people transition into a permaculture lifestyle and dissolves the judgemental attitude that can come along with some permaculture perspectives. It helps people feel comfortable making changes one step at a time, slowly with great intention.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT

THE THREE JEWELS OF PERMACULTURE

Permaculture represents an intentional awareness and informed approach to making decisions and developments. It is imagined to happen in three successive steps.

1.0 OBSERVE

First we observe the world around us, paying careful attention to the area in which we are making a decision or dream up a design. All existing elements and their relationship with each other are an important part of the map that is generated with these whole system observations. This is the longest of the three jewels often taking a full year in a classical permaculture design process.

2.0 INTEGRATE

Next we integrate these observations into an understanding of the design space, noting the relationships between the different elements. Out of this process we can collect ideas about changes we might like to make, designs we might like to create and elements to add, subtract or move. From this process comes a series of different designs and design ideas.

3.0 APPLY

Finally, after spending ideally a year observing and integrating, we compare all our design ideas and create a single design plan. Only then do we begin the careful application of the design on the land. We are also constantly observing and integrating information as a design is applied, in this way a permaculture design process is living and changing constantly.

The permaculture design process can be used to guide any decision or development, plan or possibility, map or movement. Regardless of the size or scope of our design this process ensures that we proceed slowly and with great intention.

First we could spend an entire year observing the property. Locating the existing elements and their functions, identifying the plants and animals living on the property, and calculating seasonal patterns of rain, wind, sun and shade can happen during this observation period. Soil testing, dousing, and evaluating existing structures for energy needs and efficiency could also happen during this time. During the design many new ideas, changes and additions will come up and can be carefully recorded for future review. Creating a map of the property locating and charting all these elements is a helpful way to really detail this process.

Secondly we could integrate all the different design ideas, brainstorms and determinations into a series of designs. Paying careful attention to conserving energy, lowering long term impact and placing new elements efficiently all the observations can be integrated into a set of master designs which may be prioritized and evaluated for cost and energy required for their creation and upkeep. Out of this long process a single design plan can be created.

Lastly, we could begin an intentional application process, continuing to observe and integrate and alter the design accordingly. Though we will still make mistakes and need more changes, our work is anchored in a large amount of intention. Our design will be more effective, efficient, sustainable and productive since we utilized the three jewels in its conscious creation.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT
PERMACULTURE PRINCIPLES

1

The principles are tools in a conceptual toolkit which can be applied to any system of designs and relationships. They are general strategies for approaching specific situations.

KEY PRINCIPLES

Value Multiple Functions

Every element in a permaculture design system has the ability to play more than one function.

Elements with many functions are valuable in Permaculture as they fulfill many needs without requiring more energy or space.

Try to aim for elements with a minimum of three functions. For example, parsley is a culinary and medicinal herb, a soil building ground cover and has tiny flowers that feed beneficial insect like hoverflies and ladybirds.

Make sure Each Function in your System is Supported by Multiple Elements

All the important functions of your system should be supported by multiple elements.

If one element fails to fulfill its function, there is a back up of other elements that are working towards fulfilling the same functions.

Water should be supplied, stored and saved in as many ways as possible – in urban areas there are mains, water tanks, treated or untreated grey water, dripper hose systems, hoses, wicking beds, small swale or infiltration system, ponds, as well as buckets in the shower, kitchen sink and bath. In a rural environment there are mains, bores, large and small water tanks, large and small water infiltration systems such as swales, gabions, berms, dams, wetlands, grey and black water treatment systems.

Use Intensive Small-Scale Systems

Creating intensive systems in small spaces is the most efficient use of space and leaves the most extra space for nature to take its course.

Small scale systems are the easiest to care for and regulate, combining many small systems instead of one large one increases diversity and production.

As one system is fully developed, another can be added, creating a mosaic pattern of merging systems with lots of edge.

Use Small and Slow Solutions

Solutions which work slowly over time tend to have the lowest impact on the surrounding ecosystem.

Generating solutions that take small steps allow your design to adapt to the flow of what happens and the changes that are underway, giving more time to correct for problems that may arise.

Start with small systems and once they are fully established move outwards.

Complete sections of water catchment and infiltration systems with plants neccisary to function properly before starting other ones.

Embrace Mistakes

Mistakes contain much potential for learning.

Remember, your mistakes are a sign that you are experimenting and exploring new territory, this is a good thing. Value the outcome as a lesson even if the results appear negative. This applies to other people's mistakes as well.

Try and make lots of your mistakes on paper. Show and talk about your design ideas to many different types of people, share with other permies.

Be brave – don't let fear paralyze you, we can never anticipate every way a system will function. Working incrementally limits the effects of mistakes.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

Be Adaptable

Unexpected change should be expected when doing permaculture, along with an understanding that everything is temporary.

Adapt your design to the land and climate instead of trying to adapt the land to your design.

Many small designs will increase you adaptability.

Plan for disaster

Research and plan for climate extremes and natural disasters. Look at patterns instead of averages to plan for drought, flood, tsunami, hot summers and long winters. Look carefully at previous disasters, are you on a flood plain or in a fire prone area - include these in your sector analysis and design. Investigate local cycles using existing vegetation, observations and resources from your national weather agency.

Value Diversity

Diversity among co-operative species is the backbone of a healthy and dynamic system and creates a more stable ecology. It is not the number of things but the number of ways in which things work together.

With a larger selection of food and habitat, diverse systems support a wider range of living things giving us many yields and mitigating against the loss of an only crop. Seek out species/genetic stock that are particularly suited to your bioregion. Discover species that are known for being naturally pest resistant, even if the harvest is a smaller yield.

Maintain earth wide genetic diversity of species by growing rare fruit and vegetables, seed saving and keeping rare breed animals.

Make it beautiful

Use many colours in your vegetable leaves and stalks. To function well, a system needs to have many different sizes and colors of flowers. Colour and diversity is not only beautiful but provides many functions like confusing pests and creating niches for more insects and animals to live in. Growing in layers is beautiful and creates abundance. Remember that nature never grows in perfect rows, mix it up for better functioning.

Creatively Respond to Change

Every situation is different, don't try to use the same solutions for different problems.

See how your site and situation is unique. You have an opportunity to develop site specific solutions and strategies.

Theorise on why something is happening. Share your 'theories' with others for more ideas. Change is the only constant, use daily, seasonal and climatic cycles in your design and make note of these variations throughout the year. We create change with human or animal disturbance; use these to promote biodiversity and edges.

Make the Least Change for the Greatest Possible Effect

Consider ways in which you can do the least amount of work and lower your disturbance of the design area while accomplishing as much as possible.

Reducing your ecological footprint is key in permaculture. This can be done by limiting developments to those that will vastly increase production with minimal energy use and impact on the design site.

Work intensively rather than extensively. Research, grow and use the most nutrient rich elements.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

When adapting a conventional farm that is in use – known as rolling permaculture – start by fencing off smaller areas from animals so that shelter and forage belts can be established.

Integrate Rather than Segregate

Honoring the place of all elements in a system, we can focus our efforts on creating a unified working whole instead of having it function as separate autonymous systems.

Integrating all elements into a design is more functional than creating a bunch of disconnected systems. The connections between elements are often as important as the elements themselves.

Use patterns to integrate elements. Patterns can show us how natural systems and people can work together. Integrate chickens into a forest garden, vegetable rotation system or to heat a greenhouse. Ecosystems have an overstory, an understory and a groundcover. Replicate this pattern in forest gardens to create an abundant and stable system.

Work with Nature rather than against it

Notice what naturally happens in your design area over the seasons and adapt your design to these patterns.

Nature is strong, utilize its strength by creating a design that integrates the flow of nature.

Every living thing has value. Nature is always trying to become stable through polyculture. Monocultures will always have 'weeds' as nature tries to heal itself, and require interference in the form of poisons to kill unwanted plants, animals and insects. Add a frog pond with heavy vegetation to your veggie patch and create a functioning ecosystem with habitat for your 'pest control' workers – frogs and lizards eat slugs and snails.

Co-operation not Competition

Joining forces and multitasking lends itself better to abundant functioning than competing for the same resources.

Look how you can align all the needs of living things in your system in order to share resources and work together as a unified interdependence of elements.

The Problem is the Solution

Understanding how an element posing a problem in your design system might actually be providing a much needed solution, function or resource can help your whole system be more productive and sustainable.

Every resource is either an advantage or disadvantage, depending upon the use made of it. Instead of always wanting to fix problems, think of them as elements to work with. The snails on your lettuce are delicious cooked French-style or can be turned into eggs by feeding them to ducks.

Everything Gardens

Every living element in a permaculture design 'gardens'. A chicken can replace pesticide, herbicide, fertilizer and a spade. Every living thing eats, drinks, reproduces, has relationships, grows and dies just like a garden system.

The garden is also a metaphor for any system of relationships and development.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

PRINCIPLES OF RESOURCE DEVELOPMENT

Smart Energy Planning

Efficient energy planning creates a lower ecological footprint and saves the expense of having to import lots of energy.

Intentional placement of elements within a system saves human energy and reduces outside inputs. Resource cycling, as well as catching and storing external energies, will also help create a more sustainable and abundant system.

Use zones to design how to best use your own energies. Use sector analysis: look at all the incoming energies to your system, design accordingly and use them to your advantage.

Use your energy on observation and planning. Think your design through before you start implementation. That way your energy is most efficiently used and not wasted on things that you will have to change later.

Produce Less Waste

Reducing the amount of waste we produce can save space, money and lower our impact.

Working together, even a small reduction of waste at the household level will make a difference when combined with other people doing the same.

Turn the waste problem into a solution. Reuse and recycle at home as much as possible. Grey water provides nutrient for reeds that can be fed to chickens and pigs or used as mulch.

Catch and Store Energy

Utilizing natural energy sources from the sun, wind or running water is a great way to supply energy with a very low impact on the environment.

Observing places in the design site that can harvest and store natural energy for use in the system is a great benefit to sustainability, saving both money and resources.

We can store sunshine and water in perennial plants and trees for long term timber harvest or to be converted to food for humans and livestock.

Cycle Energy, Nutrients and Resources

All waste contains energy that can be re-used and recycled.

Nature produces no waste as it cycles all the energy, nutrients and resources it produces back into the system.

Design a closed system by using all the characteristics – inputs and outputs - of an element. Plant perennials to feed chickens and rotate them to clean up fruit drop or harvested beds and fertilise with their droppings.

Use Biological Resources

Biological resources tend to be biodegradable and have a lower impact on the environment.

Non-biological resources are often toxic and may harm the sensitive web of life, organic resources are preferred. A biological resource can also be a dog to round up sheep or a pig to remove blackberries.

Build up your minute livestock – farm soil microbes instead of using fertilizer; farm hoverflies instead of insecticide on your aphids. "Aphids on you roses means they're not on your broccoli."

No Dig Gardening

Digging disturbs the delicate soil ecosystem, uses up soil resources and creates hard work for the gardener.

No Dig gardening saves energy, time and resources while creating a smaller ecological footprint than digging.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

Chop and drop

Cut plants at the base of the stem rather than pulling them out by the roots – this maintains soil structure, and cycles nutrient and energy. Feeding plants back to themselves using prunings provides for much of their requirements. Chop finely and place under mulch to biodegrade faster. Use prunings as a top mulch.

Generate Surplus

Permaculture aims to generate enough abundance to fill the needs of the system as well as extra to share and trade with neighbouring systems.

Look at how you can make your design system more productive. A polyculture like a forest garden produces many times more than a monoculture in the same area by using plant stacking.

Embrace Weeds

Use weeds as a resource instead of a problem. Weeds have been speciated by humans over millenia to grow in difficult circumstances and be highly nutritious. Use them as food and medicine – learn all the uses of the plants in your area. Weeds can also be used to heal soils and supply nutrient by chopping and dropping, as a home for pests and beneficial insects and to bring local soil flora to composts.

Weeds can also tell you information about a soil, learn which ones grow in different soils, moisture levels and climates. They can demonstrate a niche that could be filled with something more productive. Is there a thistle that can be replaced by a globe artichoke?

Eat Wild Foods

Food is growing all over our cities and countryside. Make a feral fruit tree map of your area, scrump lemons over fences, harvest acorns from parks and olives from roadsides. To find the use of a plant look at the culture of the place where it came from originally. Canary Islanders, for example, collect the sweet sap from the top of the Canary Date Palm.

DESIGN PRINCIPLES

Start Small

Begin at the beginning and ensure that your development does not outstrip your ability to maintain those developments in the long term.

Start at your kitchen doorstep and expand once your foundations have been built. Do things within your skill range and budget, larger expansions can be done later.

Get zone 1 under control before expanding into zone 2. Start by supplying all your culinary herbs – even a pot of rosemary saves many steps in a carbon economy.

Layer and Stack in Space and Time

Making maps and designs that utilize vertical and horizontal space as well as calendars that help chart the future, permaculture promotes density where elements, strategies and practices compliment and support each other.

Intensive systems conserve energy and space while stacking functions in space and time, creating abundant and dynamic systems of organization.

Forest gardens are great for stacking in time and space, utilizing : Early, mid and late varieties of fruit shrubs and trees ong term overstory trees like chestnuts, walnuts and oaks. Seasonal succession of ground cover, herbacious layer, understory, and dwarf trees.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

Using dwarfing rootstock will fruit sooner; semi or non dwarfing rootstock will provide a long life of fruiting and can be grafted onto from the shorted lived small rootstock plants.

Build Guilds

Putting elements into the same space which work better together than apart is a great way to stack functions and conserve energy. It creates many times more production than a monoculture.

When separate elements playing complimentary functions come together they can serve functions that none of the elements could play on their own.

Design from Patterns

Patterns represent larger level organization in nature. These are important in the creation of holistic systems.

Start by thinking of the patterns implicit in your design and working your way down to the tiny details of each microclimate. This will allow the smaller aspects of the design to be in alignment with the larger patterns and organizational structures in place.

Look at aerial photographs for patterns on larger scales, then see how these patterns can be seen on the macro level as well. Notice the structure of trees and plants seasonally. See the seasonal differences related to climate and water flow as well as the patterns of lichen, insects, birds and animal migrations in relation to this.

Use pattern in design when possible. Nested circles can be used to create a fruit tree guild. A herb spiral can increase growing area and edge while providing dynamic microclimates for biodiversity. Ecosystems have an overstory, understory and ground cover, replicate this pattern in creating forest gardens to model abundant and stable systems.

Nature has scales of size and movement. Sand ripples move quickly, sand dunes move slower and massive dunes don't seem to move at all. Work within a functional scale and be part of the pattern. Use appropriate technologies that suite the pattern you are modelling your designs on.

Design from Nature

Nature is a working model for a stable, sustainable system.

Observe how nature cycles energy, support diversity, produces abundance and generates no waste, then model these qualities in your home design.

Nature can teach us everything we need to know if we can only relearn how to read the landscape. Spend time everyday observing ecosystems in nature. One great place to start is with Aphids, Ants, Hoverflies and Ladybugs. Notice different sizes and colors. Speculate on who is eating whom. Do research on pests and predators in your area. What are the benefits of having both in your garden?

Utilize Relative Location

Locating elements in a place that allows for them to function well means considering where they are located in relation to other elements that may increase or decrease their functionality.

See how some elements work better when located in close to, or far away from, each other.

For example : A pit toilet needs to be both near and far from the house. Walnuts and Eucalypts inhibit some plant's growth. Nitrogen fixing plants can go next o nitrogen needing plants like citrus trees. Chickens can destroy a garden full of young plants, but work very well after harvest to clean up bugs and leftover plants.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

7

In gardens young animals like ducklings and chicks eat pests but do little harm to plants. As the animals grow along with the gardens, larger animals like full sized ducks and chickens can move out to areas of perennial plants and shrubs. Large and full grown animals like older ducks and chickens, and even pigs and goats can be used once a food forest of fruit and nut trees is established to help eat fallen rotting food, keep weeds down and fertilize the ground.

Advance Succession

Succession is seen when plants die back only to be immediately replaced by other plants. In nature this happens slowly but in permaculture gardens this can happen more rapidly. With some research on growth cycles you can create designs that also include succession in your system so you can have more productive year round harvest. Another form of succession is when a plant builds soils to provide an opportunity for a new species – weeds like blackberries do this for apples. A way to speed up succession is to chop and drop. Design for succession in chicken life cycle. Include supplies needed for different stages of life like incubators and feeding systems. Anticipate what you will do with broody chickens and roosters. Also how will you kill, pluck and store meat birds? How will you collect and use their manure? Do you have a chicken run, tractor or rotation system?

Develop Perennial Systems

Perennial plants endure over many years, establishing tap roots that enable the plants to grow big and strong while needing less watering and feeding.

Annual systems require setting up each year while perennial systems need only to established once and will carry on season after season with minimal maintenance and never leave the soil bare and open to erosion.

Use Native Plants

Native plants tend to be climatized and have lower additional water and maintenance needs as well as being more resistance to local disease, drought and pests. Utilizing the plants of the land also connects us to the history of the land, the cultures of the land and the ongoing relationship between people and plants that have been happening for millennia. They promote diversity of the local indigenous seed stock, fostering niches where endemic species, both plant and animal, can inhabit.

Utilize and Create Edges

Edges create dynamic microclimates linking different systems together and promoting diversity. By increasing the edges in your system you can increase productivity and provide habitat for a greater selection of plants, insects and animals. When two ecosystems meet, a third is created that has plants and animals from both ecosystems plus additional ones that inhabit the edge ecosystem. It is at edges that we find more diversity. Edges are the most diverse places on the earth – the seashore, the forest edge, the crust of the earth. Observe path edges and pond edges in your system.

Precautionary Principle

If there is a risk of doing harm to the environment through a course in action its best not to do so. The health and well-being of the ecosystem should not be subject to experiments that have a reasonable chance of causing harm.

KEY CHARACTERISTICS

small scale land use patterns
intensive rather than extensive land use
diversity in species, cultivars, yields, miroclimates, habitats and functions
integration of agriculture, animal husbandry, forestry, foraging, and landform engineering
adaptable to marginal lands
makes use of naturally inherent charateristics of animal, plant and land relationships
use of wild and domestic species
long term sustainability

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

8

RETURNING

Realize that we can help create a healthier world for ourselves and future generations

Refuse to purchase overpackaged items
Renew materials to maintain their functionality
Repair broken items
Reuse containers and materials
Reduce our toxic impact on the world
Recycle materials only after all other energy cycling options are exhausted

Regrow the worlds great forests
Restore biodiversity and natural balance
Respect our home and all living and non-living things that live here
Rethink our relationship to consumption
Redesign our lifestyles to lower our negative impact on the planet
Remember everything we do effects the world around us
Reconnect with our planetary ecology
Remediate the toxins and negative impact from our past actions
Research ways to improve and rethink the next generation of earth care

PERMACULTURE PRINCIPLES DESIGN DECK

The permaculture principles are part of a conceptual toolkit that can be applied to any situation or any set of relationships. These concepts have been rendered into beautiful icons by Lunaya Shekinah of Light Science as part of her design project from her Permaculture Certification. The incredible iconographic representations come on the front size of a hexagonal card which has text from Delvin about the principle and its active applications on the backside. The deck of cards covers many different principles from many different permaculture teachers, its a diverse garden of incredibly useful and profound permaculture concepts. These cards can be used in your own practice of integrating permaculture principles and also as a many layered teaching tool for sharing with students. The cards can be purchased in hardcopy, or the files for the cards can be purchased and you can print them out yourself.

To take your understanding and application of the permaculture principles to the next level and support Gaiacraft, consider purchasing a card deck as part of your practice, at www.gaiacraft.com

The front side of each of 32 cards in the deck.
The backs feature useful text and a small icon reference

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

1

GAIACRAFT
ZONES AND SECTORS

Zones are areas where elements are placed according to energy use, frequency of care required, quantity of yield and nutrient reycling. Here is the breakdown of each of the Permaculture Zones. These zones are usually visualized as areas on your map, sometimes shaped somewhat like rough circles. When we do a zone analysis we consider the needs of elements in relation to nutrient, energy, work, water and access.

ZONE 00 : SELF AND BODY
most important

USE: all the time
AREA: your body
COMPONENTS: physical, emotional, spiritual, mental bodies
LIFE SYSTEMS: digestive bacterias and friendly flora, neuro-chemicals, hormones, enzymes and blood cells
TECHNIQUES: integrative nutrition, exercise, conscious relationships, personal healing, massage, professional fulfillment and love
WATER: drink between 3 and 4 litres of clean, alkaline water per day
FUNCTIONS: physically strong and resilient, emotionally centered, mentally clear
GOALS : maintain overall health and self-awareness

ZONE 0 : HOME
utilized more than any other zone

USE: almost every day and night
AREA: living space
URBAN AREA: living space
COMPONENTS: home, kitchen, sleeping area, communications
PLANTS: herbs, indoor plants for purifying air, aquaculture, worm farm, recycling station, compost pre-station
TECHNIQUES: relative location, indoor gardening, sustainable technology
WATER: Indoor or underground water storage.
ANIMALS: pets to provide love and eat scraps
FUNCTIONS: to provide a warm, safe, healthy space for living, eating and sleeping
GOALS: conserve energy, save heat, produce some food, store food, process food, provide all energy needed from within the system

ZONE 1 : DOORSTEP
intensively cultivated and cared for

USE: daily
AREA: space immediately surrounding the home
URBAN AREA: yard
COMPONENTS: small greenhouse, trellis, patio, bird feeder, workshop, storage, bathroom, cold frames, worm compost bin, small compost station, propigation area, stone wall, shadehouse
PLANTS: herbs, salad greens, flowers, soft fruit, dwarf trees, low shrubs
TECHNIQUES: intensive planting, sheet mulching, dense planting, espaliering, abundant and diverse plantings, functional pathways
WATER: rain barrel, small ponds, grey water
WATERING: intensive irrigation
ANIMALS: wild birds, rabbits, guinea pigs, soil organisms, beneficial insects - small animals help with weeding and maintenance
FUNCTIONS: modify house, microclimates, daily food and flowers, social space
GOALS: reduce energy and water needs, harness natural resources, create a harmonious place to love, live, work and play

ZONE 2 : GARDEN / FOOD FOREST
semi-intensive cultivation and care

USE: visited almost everyday
AREA: area just beyond the doorstep zone
URBAN AREA: walking distance 'pedosphere'
COMPONENTS: larger greenhouse, barn, tool shed, shop, wood storage, smoke house, large compost, small orchard, chicken coop, beehives
PLANTS: staple and canning food, small orchards, fire retardent
TECHNIQUES: heavy mulching, cover crops, seasonal pruning, drying and smoking food, stacking of plants, multi-purpose walk throughs, free ranging poultry, high diversity of plants
WATER: well, pond, irrigation, swales

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

WATERING: intensive irrigation and light irrigation
ANIMALS: rabbits, fish, bats, poultry - animals help to prune, fertilize, scratch, control pests
FUNCTIONS: home food production, market crops, plant propigation, wildlife habitat
GOALS: intensive production, cycling energy

ZONE 3 : FARM

semi-frequent 3 season cultivation and care

USE: visited every couple of days, very little in off-season
AREA: beyond the main garden zone
URBAN AREA: biking distance 'cyclosphere'
COMPONENTS: feed storage, field shelters, main perennial crops, large orchard, grazing fields, windbreaks, firebreaks
PLANTS: cash crops, large fruit and nut trees, animal forage, shelterbelts, hedgerows
TECHNIQUES: cover crops, little pruning, movable fences, spot mulching, diverse forage, dams
WATER: large ponds, swales, diversion channels, storage in soil
WATERING: light irrigation
ANIMALS: cows, horses, pigs, sheep, goats, large animals - animals eat surplus and fertilize the ground
FUNCTIONS: market crops, firewood, lumber
GOALS: fill food needs and generate surplus to share and sell

ZONE 4 : SEMI-WILD WOODLAND

minimal care

USE: visited weekly
AREA: area beyond the farm zone
URBAN AREA: reachable by bus or short drive
COMPONENTS: open pasture, cultivated woodland, dams, wind mills
PLANTS: firewood, timber, native plants, non-timer forest products, mushrooms, medicine plants
TECHNIQUES: pasturing, selective forestry, coppice managed woodland, long term tree planting, understory plantings, green mulching
WATER: ponds, lake, river, wetlands
ANIMALS: large animals - cattle, deer, pigs, sheep, turkeys, goats - grazing and protecting space
FUNCTIONS: hunting, gathering, grazing, wildcrafting, selective logging, forestry, long term development
GOALS : make good use of the land requiring minimal maintenance

ZONE 5 : WILD CONSERVATION LAND

unmanaged nature

USE: weekly or monthly
AREA: natural space beyond all developments
URBAN AREA: reachable only by plane or long-distance transport
COMPONENTS: wildlife corridors
PLANTS: native plants
TECHNIQUES: unmanaged, erosion control, natural barrier
WATER: lake, creek
ANIMALS: native animal reserve habitat - animals support healthy ecology
FUNCTIONS: inspiration, nature preserve, observational learning
GOALS: preserve true nature without interfering, restore native habitat

SECTORS

Sector mapping is a way of charting the movement of energy from outside the property that moves through the property. This includes running water, light, wind, sun, shade and rain. Often sectors are shown with arrows marking the direction of energy flow. Usually this energy flow is marked as pie shaped sections on a map that show general areas from which energy comes and to which energy goes as these patterns change daily and seasonally. Here are some Sectors often included in Sector mapping.

Sun :

The sun rises from the equator relative to your location. Angles of the sun depend on your latitude.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

For example in Vancouver, BC, Canada the sun shine from the south, rising in the east and setting in the west. In the summer it hits around 280 degrees and in winter 120 degrees.

Wind :
Prevailing hot and warm winds are seasonal and depend on local geography, as well as latitude. For example in Vancouver, BC, Canada cool winds come from the north and mountains, while warm winds come from the ocean to the south.

Water :
Note the flow of running water and drainage in seasonal brooks, streams, rivers, dams, and creeks. Also note standing water like ponds, lakes, marshes, wells, rain barrels, swales, springs and damp soil areas. Danger of flooding or areas of poor drainage should also be noted. What is the average rainfall for your area? How much water can you collect on the land every year to fulfill these needs?

People Movement :
paths, roads, driveways etc

Noise :
where noise comes from nearby places like highways, businesses, schools etc

Fire :
Fire usually comes up a hill or from the direction of your hot summer winds. Also dry areas like grasslands are often pathways for fires to travel. Sometimes fires behave unusually in hills and gullies. Look into all previous bushfires or forest fires in your area.

Microclimates :
Do soil testing and note any areas with different temperature, sun, shade, dampness, exposure or climatic factors that are different from the general area.

Urban :
direction to key stores and services, schools, city farms, parks etc
areas where crime or vandalism might be an issue

Frost :
Frost moves downhill and stays in low lying areas.
Where is frost a danger? What time of year is the first and last frost?

Disaster :
Are you in danger of earthquake, tsunami, hurricanes, lightning, extreme weather, industrial pollution, nuclear fallout or any other nature or man made disaster? How can you design for this?

Example sector map

Example zone map

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

1

GAIACRAFT
PERMACULTURE MAPPING

Permaculture Mapping is a process of becoming conscious and deepening our connection with the integrated ecology into which our lives are nested. By gaining a nuanced understanding of a design site across a full year of seasonal changes, we can cultivate an awareness of all the already existing elements and their functions as well as noticing all the animals, insects, and energies that pass through the land.

During a year of integrated observations many design ideas will bleed through in the creative process. These inspirations can be reviewed at the end of the year and will be invaluable in the design and application process.

1.0 BASE MAP

1.1 ELEMENTS

this base map will include all the elements on your land
including all
- structures
- gardens
- pathways
- materials
- plants
- trees
- contours

a base map includes everything that is already on the land

1.2 PLANT AND ANIMAL LISTS

the base map can include a plant and animal list
this identifies the plants and animals that are living on the land
and draws an awareness of their functions

these are your roommates!
the community of life which you share your land with

remember, if any animals that even stop on your land for one moment of the year, then your land is part of their habitat!

2.0 ZONE MAP

permaculture zone maps help draw an awareness to relational location of elements

zones chart areas of the design space based on what elements are located there, how much energy these elements require for successful functioning, as well as how often the elements are utilized

3.0 SECTOR MAP

permaculture sector maps chart energies that come into the land from elsewhere

when we understand the different energies passing onto or through the land across the year we can decide whether we want to allow the energy to pass through, block the energy from entering, or capture and store the energy for our uses

some sectors include sun and shade, wind, running water, seasonally damp or dry soil, people and animal movement, noise, good and ugly view, and fire

generally you make 4 sector maps, one for each season
however learning sites or places requiring more deeply nuanced mapping
might consider doing a sector map each month

4.0 MAP BOOK

stay organized across the year of mapping by making a map folio or map book
this can contain all your maps and rough work,
plant and animal lists
and design idea notes that have emerged from your process

journaling this process and taking photos is a great upgrade if you have the time

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

This map process is not only enabling you to observe and apply the permaculture concepts you are studying in the textbooks, but also connects the course to your own life on your own land. Here are some helpful hints on how to approach the process of four season mapping.

BASE MAP

Using 'google earth' or mapping software from your regional district government usually enables you to get a traceable photograph from space showing your property. If you go into the local regional district offices, there is usually a mapping department who will provide you free maps of your watershed, property boundaries and many other features. Often the landowners can provide a blueprint of your home including electrical, gas, septic and plumbing lines inside and outside the house.

ANIMAL ID

Try to get the exact species of animals using native animals ID books. If possible see if you can photograph animals, these will enable easy ID and make for a great illustrated animal list that will be more helpful in your getting to know the fauna and serve as a more evolved part of an educational map kit.

PLANT ID

The process of using a book to ID is part of the evolution offered by the course. Use a bioregional plant ID book in combination with a more general continental book about garden and landscaping plants. You will begin to learn about the global plant species and families, the whole community of plants, and how they are related and different from each other. There is a great learning curve for this, so the more you do the faster you learn where to look, pretty soon you will have a basic understanding of how our civilization organizes the plant kingdom

Any plants that you can't id, just take a leaf and flower into a large nursery, the workers there usually love this id game and sometimes they can even take you to that same plant in the nursery for further confirmation.

"As far as plant ID goes, I also think that once you have a positive ID, it is very helpful, after sending a gratitude to the plant, to snap off a small branch. Is the stem hollow or solid? Does it give off a scent? Ooze or sap? Hold a leaf in your mouth - is it faintly fuzzy? and what else is it giving off? Bite down and lick your teeth, it is super difficult to poison yourself with such a tiny amount, but it will stimulate many different parts of your brain to 'know' and remember that particular plant. Pick several different grape leaves and line them up, or different strawberry leaves, you will slowly see the very subtle differences. This will just help your book learning "

- Robin Wheeler

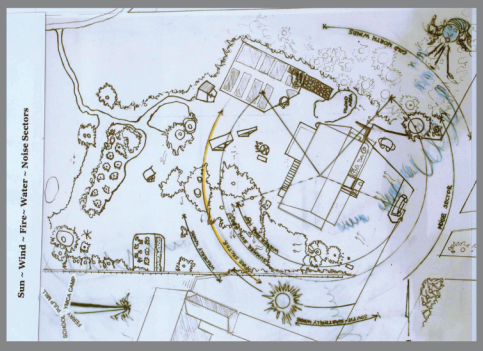
SECTORS

The assignment is to do this once a season but you are welcome to do it once a month if you want to do a more comprehensive map.

SUN

Gaiacraft recommends doing a 'microsector' map. Refer to your base map and make sure each garden, structure or area is independently named or numbered. You do a walk through once an hour for

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share



Example base map, zone map and sector map by Leonie Croy

a full day noting for each area every hour if it is in sun, shade or dappled sun. At the end you have the total hours of sunlight for each space, along with the exact times of light and shade. Its amazing what other things you will notice when you do this process of spending a full day observing the land regularly.

WIND

Go out on a windy day and note the wind channels on the land. You can also note general directions the seasonal winds come from. Vegetation will also tell you a lot about the wind on your property. Note how trees lean and bushes grow.

WATER

Note any running water or seasonally wet soil. Go outside during the rain with an umbrella. Is there any water pooling or running? Is water soaking in or staying on the surface? Go outside after a big rain, is there anywhere the water collects?

NOISE

Notice where noise comes from. You can just record noise in general, like that from nearby roads or schools. If you want to take this to the next level you will notice sometimes noise only happens certain days of the week at certain times.

MOVEMENT

Chart the movement of people and animals across the land.

VIEWS

Observe any great views or ugly ones. Remember to always be looking for animals, observing plants and writing down all your design ideas during this whole process.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT
PERMACULTURE GUILD BUILDING

A guild is a collection of living things that works together towards common goals and hose functions are complimentary in creating a sustainable whole system. In permaculture, plants, animals, soil and people all work together to create groups, or guilds, of symbiotic relationships. Often guilds are taught about using a food garden as an example. This makes the concept clear, but is just a starting point for understanding that a guild is any grouping of relationships that work together symbiotically.

Here are some functions that plants can play in a guild :

1.0 FOOD PRODUCER : Creates edible food for people, plants, insects or animals and ensures that the guild is valuable to maintain and protect.

2.0 MEDICINE PRODUCER : Plants that produce medicine for people, plants, insects or animals are very helpful to the healthy functioning of a guild and the living things around it.

3.0 MULCH : These plants cover the soil and provide organic matter that decomposes on the soil, keeping it cooler in the summer and warmer in the winter, keeping weeds down and holding water by preventing some evaporation. Mulch plants also help build soil and feed soil organisms as they break down.

4.0 ATTRACTS BENEFICIAL INSECTS OR ANIMALS :
Bringing in pollinators or other creatures that are beneficial to the guild or surrounding gardens is a great function of some guild plants.

5.0 REPEL PESTS : These plants repel pests or predators that threaten the healthy functioning of the guild.

6.0 NUTRIENT BIOACCUMULATORS : Some plants have deep roots that draw up nutrients from the earth which exist below the level that most plants feed from.

7.0 NITROGEN FIXERS : This category includes plants that participate with particular soil microorganisms to fix nitrogen in the soil. When their foliage is chopped or eaten by above-ground animals, the plants roots recess causing nitrogen to be released into the soil.

8.0 SPIKE ROOT PLANTS :
These plants have big spikey roots that help break up and oxygenate the soil.

9.0 HABITAT CREATION :
Providing habitat for other native plants, animals or insects is a key support for the larger ecology.

10.0 CLEANING AIR :
Plants that breath carbon dioxide and produce oxygen help clean and cycle our atmosphere for humans and animals to breathe.

11.0 CLEANING WATER : Some plants help filter water and draw out toxins, these can be very helpful in cleaning rain or greywater so it is healthier for surrounding plants and animals.

12.0 BIOREMEDIATION : Plants that draw up heavy metals and other toxins from the soil can be helpful in remediating areas where plant growth is hampered by such toxicity.

13.0 USEFUL PLANTS : As gardeners, we have lots of reason to care for and protect guilds containing plants that can provide material for fuel, building, tool making, provide fibre for weaving or that play any other productive function.

14.0 BANKER PLANTS : Plants which attract and provide habitat for pests in order to provide a year round food supply for beneficial predators.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

1

GAIACRAFT
ORGANIC COMPOSTING AND SOIL

A key principle of permaculture involves cycling energy. Nature does this, recycling all its elements and thus creating no waste. Modeled on nature, permaculture composting helps support the healthy breakdown and reuse of all organic elements.

1.0 COMPOSTING

Composting is the science of renewable systems. It shows us what materials it is sustainable to use as well as how to effectively break those materials down into rich, healthy soil, mulch and fertilizer. Composting means taking responsibility for the waste that we create. Our task is composting the old culture to provide energy and resources to build the new one.

The compost is made by alternating layers of green material (nitrogen rich organic waste like grass clippings, kitchen waste, coffee grounds, tea bags, manure, garden weeds and other fresh vegetable matter) and brown material (carbon rich organic waste like leaves, dried grasses, or hay). Every 3-4 inches of green material we add up to 12 inches of brown material. If you put in a bunch of new compost material, feel free to throw in some dead leaves, grass or newspaper to help with the decomposition process.

Tougher materials like wood, blackberries, egg shells or fruit pits can be put into a different pile nearby the compost to be used for making compost garden beds later on. You may wish to avoid composting meat scraps, bones or any food (cooked or uncooked) that contains dairy, wheat, oil or fats as these materials rot instead of decomposing, creating stink and attracting rodents, flies and other pests.

In order to have a steady supply of brown material to use in layering the compost we are piling up brown materials like leaves and grass clippings next to the compost. The fall is the best time to gather this supply. If you are using manure you may want to heat the compost to at least 65 degrees celsius or even more if humanure is involved to make sure harmful bacteria are killed.

2.0 VERMICULTURE

Vermiculture is a composting process using worms to assist in decomposing organic and food wastes into a biologically rich 'vermicompost' and 'worm tea'. Both these products can be used to as a wonderful soil and plant fertiliser. A vermiculture system can be located in the compost area as well. This can simply be created in a wood box or container and be inside or outside. A great ourdoor one is done in a sink raised up with a bucket underneath. This way not only the wonderful rich worm-casting fertilizing soil is created but also a liquid fertilizer. The top of the sink is covered with a lid that has a few small holes in it to let it a bit of rainwater. This worm sink contains newspaper, dirt, worms and loves to work with tender, non-spicy, uncooked organic vegitable matter like old salad greens, grass clippings, carrots and potatoes (and peels). Any raw vegitable that is not spicy will do great (eg, no cilantro, onions, garlic or ginger etc). The worms love to be fed every week or two, and make sure to put the lid back on as this allows rainwater in with out flooding them and keeps their home warmer, darker and damper. We are essentially wanting to create the perfect worm habitat with little light, warm, and damp (though not wet). Check the bucket under the worm bin semi regularly, when it is half full or more, put it in a watering can and share it with the gardens.

A well tuned compost system including both these elements can take care of organic waste and produce a high nutrient solid and liquid fertilizer to feed all your garden plants.

With a productive soil, a friendly neighbourhood of worms, and a conscious approach to waste management we can continue to evolve our approach to conscious living.

3.0 COMPOST GOALS

When we make our compost we want to :

a. Make good homes for decomposers; worms, pill bugs and millions of microbes.

b. Promote oxygen and airflow, allowing decomposers to breath and CO2 to leave the soil. Proper airflow also prevents the compost from breeding stinkies by creating an environment friendly to aerobic microbes (as opposed to anerobic bacteria which breed rot and stink.

c. Create the ideal amount of water content. Water dissolves and carries soil nutrients to plant roots, allowing decomposers to move around. The compost should be as wet as a wrung out sponge, having a thin layer of moisture coating everything and making it easier for the decomposers to do their work. If it is too dry the microbes, worms and bugs will all die. If it is too wet the compost will become compacted, anaerobic and not have proper air flow.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

e. Generating heat. The decomposition process generates heat, and the hotter your compost is, the faster the decomposition will take place. Stirring the compost will heat it up. Also having a lid on the compost prevents it from losing too much heat. Note that the more you stir a compost the quicker it will decompose but the less nutrient it will have in the end as the decomposers are using more nutrient to fuel their process. If you don't stir your compost it will take longer to decompose but be richer in the end.

4.0 SOIL OF LIFE

Plants are fed by the soil. Therefore to have healthy plants we need to have a healthy soil. In biodynamics we say 'feed the soil' as opposed to feeding the plants. This means having an awareness of the soil ecology and how to best serve its needs.

Here are some of the aspects of the soil ecology:

1. Primary decomposers like bacteria, fungi, millipedes, wood bugs and worms eat composting material when it is wet : they eat softer material and create deposits of rich food for other creatures to digest.

2. Secondary decomposers like mold mites and beetles live off of primary decomposers leaving deposits of a more dynamic food.

3. Tertiary decomposers like centepedes, beetles, ants, and spiders, feed on both primary and secondary decomposers yielding a third level of processed materials.

In the end, these three food deposits and the remaining hard organic matter combine to form complex molecules of humus which are broken down slowly, particularly when the soil is low in nutrient. Humus expands and contracts, aerating the soil while holding water and releasing water. It is from these deposits of partially digested and broken down material that most plants feed.

Lets review how plants eat a bit deeper as an illustration of this. By excreting acids which break down humus and release the nutrients it is holding, plants can absorb these nutrients in the right amounts. At the same time many plants secrete sugars and vitamins which bacteria and fungi eat. These microbial bacteria and fungi excrete antibiotics that protect plants from desease as well as acids and enzymes that help break down humus so the plants can eat. In this way a symbiotic circle is developed between plants and soil organisms.

All soil micro-organisms play a diverse role in sustaining the whole ecology. For example, some bacteria secrete gums, gels and waxes that help hold the soil together, absorb lots of water, and store nutrients.

Most of what is digested and transformed into living matter is carbon containing molecules. Carbon is the building block of organic life. Undigested materials include many soluble minerals which are held in the soil by humus and soil organisms

Healthy soil is alive, actively growing and recycling, breathing and digesting. This is the great recycling system of the earth. One teaspoon of healthy soil contains a billion bacteria, a million fungi, and ten thousand amoebae.

I want to give particular props to our friends the worms, they churn up and consume dead plant material and rocks using bacteria in their gut. Worms produces nutrient rich castings which they spread thru the soil as they move around creating tunnels that aerate the ground. They will be a focus in the composting processes we do. Remember healthy soil will fullfill the wildest dreams of any plant. Using vermicomposting, it will never be necessary to fertilise using anything else. Our ultimate goal is to create an environment for this to happen.

The reason synthetic fertilizers are dangerous is that they flood the soil with an oversaturation of minerals. The fertilizer that cannot be absorbed gets into the water table and can drain in concentrated forms to the nearby ecology. Unbalanced soil can attract disease in plants and animals. Also overfertilizing can create a frenzy of activity by micro-organisms, giving them a burst of energy to process many of the humus and other nutrients in the soil. Although this may give a greater production in the soil for one season, it will ultimately drain the soil of nutrient, create a dependence on fertilizers and cultivate an unhealthy soil ecology.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

1

GAIACRAFT
ORGANIC COMPOSTING AND SOIL
PRACTICAL STEP BY STEP CREATION PROCESS

1.0 COMPOST CREATION

Compost can be made using two large boxes or dedicated areas, one to fill up with organic material, and the other to use while the first box is composting.

A compost creates an idea environment for worms, microbes and other decomposers. It promotes efficient decomposition of organic waste into rich fertilizing soil.

Place the compost somewhere shaded, as this will slow down evaporation and allow the compost to stay a bit damper.

The boxes can have lids on hinges with 1/4 inch slats to allow rainwater in.
The sides of the boxes can have 3/4 inch spaces between the boards to allow air to get in since this will feed aerobic decomposers.

A fine mesh wiring that lines the compost structure can be used to keep any animals or rodents out

The front of the composts can be made with a removable slat system, so you can take the front off board by board to access the compost material easier than having to reach in from the top.

Often there is a third separate box created with no slats or wiring. This box also does not have slats to let in water or oxigen. Here you can store brown material like leaves and brown grass for layering.

To start the compost put a layer of cardboard at the bottom the soil to turn any living plants there into soil. This will also attract worms.

A layer of wood and rocks can be used at the bottom on top of the cardboard to hold moisture and also provide good drainage.

Start with a nice layer of about 3/4 of a foot of mostly green plant waste.

A small layer of soil or manure can follow to seed the pile with more micro-organisms.

On top of this can go a layer of brown material like leaves, 3/4 of a foot works well.

2.0 VERMICULTURE BIN MAKING

A vermiculture worm bin can be located in the compost area as well. These can be made inexpensively when using an old sink or tub.

Build a box that can fit a sink. Drill small holes in the lid to let the rain in.

Put a bucket beneath the sink hole.

Gather some newspaper, sticks, leaves or compost, a bit of dirt and some worms.

Start with an empty sink.

Add sticks for drainage.

Add leaves or compost for worm food.

Add torn newspaper to regulate moisture and for worm food.

Add a small amount dirt and worms to activate the decomposition.

Feed worms with tender greens and other nutrient rich plants. Worms often tend towards mild flavours but will eat most things.

Biodynamic plants of different combinations can be added to enrich the fertilizer in many different ways.

If the compost begins to dry out, sprinkle it with water.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT
ORGANIC COMPOSTING AND SOIL
PRACTICAL STEP BY STEP CREATION PROCESS

photo by poxin : www.poxin.org

Put a bucket under the sink or tub to collect the drips of infused water.

Mix the resulting nutrient rich liquid fertilizer with an equivalent amount of water and use directly on the gardens.

A well tuned compost system including both these can take care of organic waste and produce a high nutrient solid and liquid fertilizer to feed all your soil and plants.

3.0 HUGELKULTUR COMPOST PILE

Tougher materials like wood, blackberries, egg shells or fruit pits that do not break down at the same rate as the other composting materials can be stored in the compost area. This can be used to make a productive living compost 'mound' bed.

Choose an area to build this bed. Cut plant growth down to just above the ground.

Lay down newspaper and cardboard. Wet this well to begin decomposition and attract worms.

Lay down heavy peaces of wood.

Then a layer of lighter wood.

Any brambles or vines can go now. Add some soil to this.

Cover the pile with a layer of compost. Biodynamic plants work especially well here.

A layer of soil can go on top.

Plant with spike root plants that will help break down the wood. These are also ideal beds to grow biodynamic plants. Hugel beds hold water being drought resistant, they also generate heat making the gardens warmer in the winter for the first few years of its composting process. Eventually these beds will be totally broken down into kind garden soil.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

1

GAIACRAFT
QUICK RETURN COMPOSTING

Gaiacraft loves the QR composting method innovated by Rudolf Steiners student Maye Emily Bruce. What follows is gems of composting info mostly sourced from the excellent book 'Quick Return Compost Making : The Essence of the Sustainable Organic Garden' by Andrew Davenport.

COMPOST CREATURES

Bacteria : Micro-organisms that help break up the compost

Aerobic Bacteria : breath air and break materials into a sweet smelling soil and are connected with decomposition

Anaerobic Bacteria : exist without oxygen and often break materials into a smelly sludge and are connected with rot

Fungi : Key workers in the compost that break down harder material and allow bacteria to gain access.

Protozoa : Single celled organisms including amoebas, flagellates, and ciliates. They eat bacteria and fungi, releasing nitrogen and other nutrients into the soil.

Arthropods : Beetles, spiders, millipedes and centipedes and other invertebrates which break down organic material allowing bacteria and fungi easier access.

Worms : These awesome creatures digest and break down material releasing a high nutrient casting which is accessible food for many creatures and plants.

Snails and Slugs : Eat organic material and add slime to the soil that helps it hold together and retain moisture.

COMPOST FACTS

- Dark colored compost enables the soil to warm up quicker leading to faster germination of plants, particularly in greenhouse or cold frame environments.

- Heat the compost to 65 degrees for a few days and all weed seeds and roots will be destroyed

- QR method uses insulation like straw, sacking or fabric to hold in the heat.

- Limestone is often added to reduce acidity, help the worms digestive system and aid in the conversion of ammonia to nitrates. This assists the activites of micro-organisms by breaking down clay elements and binding sandy elements. An easy way to get lime is grinding up dried eggshells.

- Adding Charcoal to the bottom of the compost will absorb poisonous gasses and sweeten the heap

COMPOST PLANTS

Incredibly the compost plants have many different healing and nutritive qualities for people, animals, plants and soil organisms. They also have high mineral content and long histories of spiritual significance.

Comfrey : Symphytum officinale

- extremely high in potash, nitrogen, potassium, magnesium, calcium and iron
- rich in protein but with low fibrous carbon so it breaks down quickly
- great for making compost teas
- heals cuts, bruises, burns, sores, broken bones

Chamomile : Matricaria Chamomila

- sacred herb from Egypt as well as Pagan traditions
- high in potash, lime, phosphorus and sulphur
- anti-inflammatory, anti-bacterial and anti-spasmodic
- tea has a calming effect
- restores and heals sick plants
- increases production of essential oils in plants growing around it
- biodynamics notes the affinity between chamomile and calcium, it is said to help guide the calcium forces in the breakdown of natural materials

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

Dandelion : Leontodon Taraxacum

- used widely in Chinese medicine and European traditions
- high in potassium, iron, phosphorus, calcium, manganese, sodium, silicic acid and cholin
- the roots contain inulin
- good for treating gall bladder, stimulates digestive glands and liver issues
- biodynamics notes that this aids in the relationship between potassium and silica, allowing plants to draw on substances and forces from the entire district in which they live

Valerian : Valeriana Officianalis

- long history of medicinal use in the west
- cats and earthworms love it
- high in potash, lime, phosphorus and sulphur
- promotes calm and sleeping as well as nervous tension, cramping, and lowers blood pressure
- famous in biodynamics for imparting warmth to the compost and for having readily accessible phosphorus content

Yarrow : Achillea Millifolium

- used in Chinese and Western medicine for hundreds of years
- high in iron, lime, nitrates, potash, phosphorous, soda and sulphur
- heals wounds, lowers fevers and blood pressure, stimulates digestion
- biodynamics notes that its particularly good for replenishing soils

Stinging Nettle : Urtica Dioica

- long history of medicinal use
- high in iron, magnesium, silicic acid, formic acid, sodium, potassium, calcium and vitamins A, B and C
- blood cleanser, treating arthritis, lowering blood sugar, and encouraging breast milk production
- helps neighbouring plants be more resistant to disease and increases content of their essential oils
- stimulates the formation of humus in the soil
- raise the heat of the compost pile
- biodynamics claims it helps keep nitrogen content in soil from evaporating and enhances vegetative growth in plants.

Oak Bark : Quercus Robur (and other oaks)

- a sacred tree of the Pagan traditions
- high in potassium, lime and calcium
- anti-inflammatory and antiseptic
- biodynamics notes its special anti-fungal qualities in the compost

Honey

- used for medicine for 4000 years
- contains fructose, glucose, enzymes, sugars, gluconic acid, vitamins, minerals and amino acids
- promotes growth of healing tissues and speeds up the healing process
- anti-bacterial and antibiotic
- draws in moisture from the air

Quick Return Activator

Locally grown and harvested compost plants are slow dried and powdered with mortar and pestle. Honey is rubbed into dried milk. The power lasts forever but is recommended to use within a year.

The powder can also be added to the compost or mixed with rainwater to make a liquid feed, one pinch per wine bottle of water. Let sit for 24 hrs before adding to the compost and it lasts for one month.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT

COMPOST AND FERTILIZER TEA PLANTS FOR TEMPERATE CLIMATES

Utilize crystal dust, biodynamic plants, kelp and cardboard in your compost and you can create a fertilizer charged with all the nutrients that plants eat. Here we review each of the elements needed for the healthy development of plants and examples of dynamic accumulator sources of these elements which you can add to your compost, mound bed or worm farm. If you have room, these plants be grown in the area around your compost.

HEALTHY HOLISTIC SOIL

A biodynamically infused soil may have all the elements that your plants eat.

PRIMARY ELEMENTS

N - NITROGEN
plant growth and feeding microorganisms
found in : *comfrey, stinging nettle, kelp, dandelion, yarrow, clover, lupine, chickweed*

K - POTASSIUM
plant digestion, resistance to disease, cold, pests, develops buds
found in : *chamomile, chickweed, clover, stinging nettle, oak bark, yarrow, comfrey, dandelion, crabgrass, morning glory and kelp*

P - PHOSPHOROUS
root growth, establishing young plants, photosynthesis, respiration, plant growth
found in : *chamomile, chickweed, dandelion, yarrow, lamb's quarters, morning glory*

SECONDARY ELEMENTS

MG - MAGNESIUM
ripen and germinate seeds, absorption of p, n and s
found in : *comfrey, dandelion, horsetails, kelp, yarrow, stinging nettles*

CA - CALCIUM
root system, cell walls, ripening of fruits and seeds
found in : *chamomile, comfrey, kelp, horsetail, stinging nettles, yarrow, morning glory, lamb's quarters*

S - SULPHUR
chlorophyll production, helps plants absorb k, ca and mg
found in : *stinging nettle, kelp, garlic, mullein, plantain, alfalfa*

MINOR ELEMENTS

FE - IRON
chlorophyll production
found in : *comfrey, dandelion, horsetail, kelp, yarrow, stinging nettles*

B - BORON
overall plant health, formation of fruit, absorption of water
found in : *cardboard, kelp, euphorbia*

MN - MANGANESE
seed germination, nitrogen assimilation
found in : *chickweed, kelp, bracken fern, burdock, garlic, plantain*

MO - MOLYBDENUM
nitrogen assimilation and fixation
found in : *clover, legumes*

CL - CHLORINE
stimulates photosynthesis
found in : *kelp*

CU - COPPER
activates enzymes, chlorophyll production
found in : *dandelion, stinging nettle, valerian, yarrow, kelp, bracken fern, legumes*

ZN - ZINC
protein synthesis, enzymes and growth hormones
found in : *kelp, legumes, hay, kentucky bluegrass*

SI - SILICON
utilizing nitrogen, enzyme activation
found in : *legumes*

NI - NICKLE
protection from disease and stress
found in : *horsetail, borage, valerian plantain*

CO - COBALT
nitrogen fixing
found in : *bracken fern, horsetail, vetches*

With a productive soil, a friendly neighbourhood of worms, and a conscious approach to waste management we can continue to evolve our approach to conscious living.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT
TREES : ECOLOGICAL ANCHORS

POLY-FUNCTIONS OF TREES

- purify water
- cause condensation which can exceed annual rainfall in cool climates
- slow down runoff by absorbing water and causing a drip effect
- pump water from the soil then into air from transpiration
- evaporation during hot day cools air (microclimate)
- condensation during cool night warms air (microclimate)
- transpiration causes cloud cover and rainfall
- rain seeding by putting particulate into the airstream
- collect frost which melts and goes into the earth (increasing groundwater)
- slow snowmelt for slower release of water in spring thaw

- biomass of trees themselves holds nutrient and water
- provide habitat for countless insects, organisms, animals and plants
- reduce ground evaporation and erosion
- light colored bark and leaves reflect light through the forest
- dark colored leaves and bark generate heat
- turn light into chemical energy through photosynthesis

- cleanse and oxegenate air
- dehumify air in wet tropic climates
- humidifies air in dry climates
- deflect wind (wind break)
- collect nutrient carried by wind and rain (nutrient trap)
- indicator of wind factors
- filter disease and weed seeds from wind

- feed soil with captured nutrient and mulch
- build soil with biomass
- sink carbon

- can be nitrogen fixing and bioaccumulating

- create suntraps, heat sinks and cold sinks
- protect humans, animals and plants from climatologal factors
- insulate houses and structures
- provides fuel and construction materials
- teach people how nature works
- provides food, nesting materials, medicine and tool materials for people and animals
- are a key part of forest guilds and the symbiotic community of life that dwell there
- collects frost
- increase groundwater while keeping water table low
- plant contour forests on slopes steeper than 15 degrees

rain seeding by 'releasing' particulate

TREE FACTS

- 13 million hectares of forests are cleared annually
- nearly half of the world's species of plants, animals and microorganisms will be destroyed or severely threatened over the next quarter century due to rainforest deforestation.
- we are losing 137 plant, animal and insect species every single day due to rainforest deforestation.
- 60% of inland water comes from forest transpiration
trees put more water into streams and lakes than rainfall due to capturing condensed moisture
- ocean evaporation comes over land and 15% comes as rainfall and 85% and condensation
- forests intercept 10 - 15 % of rainfall in the canopy
- trees infuse 85% of rainfall with nutrient with plant cells, nutrients, salts, dust, minerals and organic matter and slowly drips this to the ground
- precipitation can be reduced up to 80% by deforestation

DEFORESTATION RESULTS IN :

- habitat destruction
- lower water table
- less rainfall
- soil erosion
- salinity issues
- local drought
- more toxins in ecosystem

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

1

Deep ecology is a larger perspective on the role and place of people in the evolutionary history of life on the planet.

This is a remix of an original story told by John Seed and Joanna Macy of Australia.

Here we can think about our more-than-human world from a more-than-human perspective.

The intention is to inspire imagination, explore evolution, and create a legacy of planetary stewardship.

Cradled in the 14 billion year history of the Milky Way Galaxy, our solar system evolved from a free horizon of cosmic clouds and galactic gasses.

4 billion years ago, when our planet began to cool, and the ocean of molecular soup was potentized by electric energy, the first cell was borne. We all trace our genetic and epigenetic lineage to this single event, as does every cell of every living thing on Earth. Every single cell in our bodies is a direct descendent in an unbroken chain from that original cell. In this way we are intimately, energetically and physically related to all living things.

The first one celled organisms evolved into forms of bacteria, some of which created the oxygen that began to form the biosphere.

1 billion years ago the first multicellular organisms evolved as algae and then seaweed, creating an atmosphere that killed much of the bacteria and made it possible for further developments of plant life.

600 million years ago simple water creatures like flatworms, jellyfish and sponges began to inhabit the world ocean. During this time there was a vast ice age on the earth wiping out many prehistoric gene pools.

500 million years ago came fish, the first vertebrates to emerge from the evolutionary chain of being.

25 million years later green plants had moved onto the land and began to cultivate the soil strata.

Millipedes and centipedes were amongst the first animals to travel across the land, cultivating dry habitat around 450 million years ago.

Spiders and Scorpians developed soon after and early, wingless insects like silverfish could be seen on the newly greening landscapes.

300 million years ago the Earths geography began to develop as a PanGaian supercontinent.
This began a period of unbridaled evolution.
Insects developed wings and 2 foot long dragonflies could be seen flying through forests of ferns, moss and horsetail.

During this time, seed bearing plants are sweeping across the fertile lands, and amphibians beginning to emerge.

250 million years ago came reptiles and the great dinosaurs. It was an age of monsters and mahem in a vast civilization of wild prehistoric animals.

During the next period of 50 million years there were two major extinction events which decimated the Earths diverse population.

About 180 million years ago Pangaia began to split apart and continents form, these were populated with dinosaurs and increasingly forested landscapes.

130 million years ago pollen containing flowers began to form and beautiful new colors come to our Gardenic Earth. During this time the first proto-mammals begin to develop.

65 million years ago a huge meteor struct the earth killing most of the dinosaurs and making space for Mammalian development.

A mere 55 million years ago the first primates began to appear, changing into our first ancestors over a 40 million year process. Major climatological changes on the planet saw the great rainforests recede and turn to grasslands. Tribal Ape cultures began to develop.

It was only a mere 100,000 years ago that the Neanderthal began the evolutionary ascent into modern humanity.

The earliest cave paintings show humans communicating with art 32,000 years ago marking the beginning of recorded human history.

This evolutionary storyline shows that our roots reach deep. To this day the first few weeks of human embryonic development is identical to the embryonic development of all animals, reptiles and fish.

We are all connected.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

2

Although just a blip in the deep ecology of our world, in a few thousand years we have managed to destroy the nature that used to grow strong in the very spot from which you read this worksheet. Imagine a forest of old growth trees surrounding where you are now. Those trees along with the plants and animals that lived in harmony with them are the ancestor spirits of that sacred space.

Being responsible stewards of earth means taking to heart the current planetary healing crisis. What are the long term consequences of GMO seeds, monocropping, fish farming, deforestation, desertification, waste mis-management, urbanization, chemical fertilizers, terminator seeds, acid rain, global warming, fossil fuel depletion, species exctinction, cultural appropriation and warfare?

In Canada we are hosting some of the last Whooping Cranes, Peregrine Falcons, Burrowing Owls and Beluga Whales. Through the toxin destruction of their natural habitats, and introduction of alien species into the eco-system, these beautiful creatures are now on the endangered species list. What endangered species are in your local area?

Canada has seen the total extinction of Labrador Ducks, Passenger Pigeons, and the flightless relatives of penguins, the Great Auks. What animals from your area are now extinct? Hear the silently sung song of Gaia. Have the courage to take an authentic look at the impact humans are having on nature. Understand how countless dna links in the co-ecology of the Earth have been lost through our disfunctional development strategies and irresponsible energy use.

Since everything is connected, we must revision the way we relate to our process of being in the world. Remember that we are in transition, here to grow our awareness, refine the way we build human communities, and evolve our relationship to the World Ecology.

We are grateful that our ecosystem is still intact and hosts tens of thousands of species of plants, animals, insects and fungi. There is a whole world to save and its not too late to play an active role in this most ethical of actions. Acknowledging the damage we have done is important, and once done can be released. The real focus of everyday thought and action should be on celebrating the life that is still around us and taking decisive steps to revitalizing and protecting the web of life into which everything is woven.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT
PERMACULTURING WATER

Water is at the heart of permaculture in the same way that it is an essential part of all life on our planet. With pressing planetary issues around toxification, deforestation, and corporate water bottling, some feel that a water crisis will create economic disasters and wars in the same way that oil has.

WATER FACTS

- 60% of the wetlands have been destroyed in the past 100 years
- up to 40% of rainforest in forested areas is caused by the forest itself
- 70% of our earths surface is water
- 93.8% is ocean water
- 2.5% of our water is fresh water
- 0.375% of the worlds water is accessible to humans
- 99 litres of water are used to grown one apple
- 5.2 million litres of water are used to raise one large cow
- 13 percent of precipitation is rain: 86 percent of precipitation is from condensation harvested from sea air, mists and fogs

WATER CRISIS

polluted water is toxifying the planet and also lowering sperm counts and increasing miscarriages in humans

it is caused by :
- agriculture - pollutes groundwater
- automobiles - emmissions pollute clouds
- industry - polluting air, soil and water
- salinization is caused by deforestation and rising of water table coupled with increased evaporation due to agricultural watering of fields
- bottled water is taking water out of the hydrologic cycle and denying plants, animals and people from free water access

WATER STORAGE

cisterns, rain barrels, tanks, ponds, dams, swales, in soil
in vegetation and animals

roof catchment collection formula :

square metres of roof multiplied by annual rainfall in mm multiplied by 0.6 (to account for water lost in the process) = litres a year
eg : 100 square metre roof x 1117 mm of annual rainfall x 0.6 = 67,020 litres a year

WATER CONSERVATION

low flush toilets or compost toilets
using grey and black water systems
low pressure shower heads
hand watering or driplines instead of sprinklers
heavy mulching
native and drought resistant plant species
locate plants according to water needs
take out lawns
dense planting
buckets in the sink or shower
use an egg timer to take 4 minute showers

WATER TREATMENT

aeration through flow forms and waterwheels
settling through reed beds and ponds both anaerobic digestors and aerobic ponds
filtering by running water through sand, gravel or charcoal filters
biological cleansing with fish, bacteria, plankton or remeditating plants

PERMACULTURE STRATEGIES

know the source of your water and test it
catch and store rainwater
reduce water usage
reuse and recycle water whenever possible
always have two sources of water
do not pollute water by using fertilizers or pesticides
monitor and expose corporate and industrial polluters
do a water audit looking at water use vs water collection and storage capacity while considering the longest possible drought that could happen

PRINCIPLE OF WATER

Channel water along the longest path over the most distance, travelling as slowly as possible, over the most time, rubbing up to as many things as possible, with the most passive friction, to create the most fertility. It's less about the amount of water you have than it is the amount of times you use it. In essence with water you slow, spread, sink and store.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

1

GAIACRAFT
PERMACULTURE AND CLIMATE

CLIMATE CHANGE

Globally, we are still grappling with the reality that our climate is changing and that the cause of this is still not unanimously agreed upon. Glaciers and regions of permafrost are melting due to increased temperatures, which has resulted in climatic changes and unpredictable weather patterns. These changes have encouraged us to become more resourceful in our planning for the coming times.

WATER

- soil and plants hold water and transpire water causing and regulating rainfall
- water bodies regulate temperature by making it more mild
- frost forms on cold, cloudless, still nights
- fog comes from oceans and mountains mostly in autumn and winter
- water changing from ice to liquid to gas (Evaporation) is accompanied by cooling
- water changing from gas to liquid to ice (Condenstation) is accompanied by warming
- rain is caused by
: orographic effects : cooling of air as it rises over mountains and hills
: cyclonic or frontal effects : over-riding of cool and warm air masses
: convectional : hot air rising from deserts or oceans into cooler air
- dew is caused by moist air condensing
- frost forms by rapidly cooling moist air bodies over land
- distillation is caused by water rising from the group as a vapour
- guttation is water evaporating from leaves
- fog forms where warm water or vapour evaporates into cool air or where cold grounds condense moisture from warmer air

WIND

- cool air is heavy and moves downhill
- hot air is light and moves uphill
- cool air replaces hot air by going under it and pushing it up
- cool air flowing downhill that hits a barrier cause a 'cold sink'
- warm air flowing uphill that hits a barrier causes a 'heat sink'
- deserts radiate heat upwards which sucks in cooler ocean air and causes monsoon climates
- cold air flows off polar icecaps spinning low pressure systems counter clockwise

towards the equator moving from east to west
- western coasts get alternating cold low pressure polar air systems with warm high pressure systems

RADIATION

- light is radiated back as heat from soil and water, dark surfaces and when passed through glass
- white light is turned to chemical energy from plants
- dark green and red plants absorb more light and thus cool the environment
- in temperate zone light colored leaves and bark reflect light to increase ambient light in the forest
- light absorbed by plants for photosynthesis has a cooling effect
- plants are a carbon sink for carbon dioxide and also when removed can cause thermal pollution of too much light/heat (ie. deforestation increases carbon dioxide and radiation)
- too much light will cause plants to dwarf
- too little light will cause plants to become tall and straggly
- air and water can transfer heat to and from solid bodies (convection)
- heat can be transfered between solid bodies touching (conduction)
- germination of plants and ripening of fruits is affected by light and heat

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT
PERMACULTURE AND CLIMATE WORKSHEET

2

MICROCLIMATES

Topography and Aspect

- effects exposure to sun and hours of sunlight
- affects warming, cooling, and shading caused by aspect in relation to buildings and vegetation
- note potential for creating or removing heat and cool sinks
- some plants prefer morning or afternoon sun

Slope

- the steeper the slope the faster hot air moves up it and the faster water moves down it
- any slope more than 15 degrees should be treed
- the higher the altitude the lower the temperature

Soil and Rocks

- soil and rocks effect absorption and evaporation of water into the environment
- clay soil holds water more and expands and contracts
- sandy soil drains well and does not hold water long
- bare soils reflect heat and light while darker and mulched soils absorb light and radiate heat

Water

- has a more stable temperature and makes surrounding temperate more moderate (warmed in winter and cooler in summer)
- cools warm air and warm cool air
- maritime climates give cool late day winds to relieve land of daytime heat
- humidify air
- provides water for beneficial predators

Structures

- trap and store energy
- add vertical areas for growing intensively
- create thermal mass
- reflect light
- windbreak
- buffer noise

Vegetation

- absorb heat and light
- carbon sink for carbon dioxide
- habitat, windbreaks, suntraps, shelterbelts, firebelts
- regulate soil temperature (warmer in winter, cooler in summer)
- filter nutrient, weed seed and disease from wind
- biotecture is the use of plants to create microclimates
- transpiration of plants will cool air in summer

World Climates

- characterized by temperature and rainfall
- Tropical : no month under 18 degrees
- Subtropical : coolest months above 0 degrees
- Temperate : cold moths below 0 degrees and warmest month above 10 degrees
- Polar : warmest month below 10 degrees
- Arid : annual rainfall lower than 50 cm
- Desert : annual rainfall below 25 cm

Design for Climate

- modify extremes
- protect gardens, plants and structures
- catch and store energy (water, wind, light)
- block some strong climatological effects
- choose and place appropriate animals, structures and farm elements for your climate
- create microclimates to increase diversity
- convert light into heat
- reflect light to be absorbed by areas needing more light or heat
- note maritime climates are more moderate and continental climates more extreme
- note light and temperature increases as one moves from the pole to the equator
- site houses or gardens on heat sinks or thermal belts of higher mean temperature
- use climate analogues by finding places of similar elevation by following lines of latitude in order to learn what might work in your area

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT
DESIGN FOR COOL CLIMATES

As part of becoming conscious global citizens we are learning about the worlds climates and how we can design intentionally to account for climatic factors.

IN COOL CLIMATES

- precipitation exceeds evaporation
- there are below freezing temperatures
- expect high humus soils which hold alot of water and nutrient
- streams are often acidic with tannins, saponins and humic acids

COOL CLIMATE HOUSE

- well insulated to withstand cold winters
- sheltered with walls, earthbanks or hedgerows on north side
- trellis vines for insulation
- double entries to houses, barns and greenhouses to prevent heat loss in winter
- good drainage below and around house for spring thaw and wet
- midslope house siting (on thermal belt)
- south facing house for maximum sun
- good aspect exposure for winter sun
- site house downhill from forest and water storage
- suntrap windbreaks on the north side
- deciduous trees on south west side to moderate summer sun and let in winter sun
- in house food preservation and storage facilities
- sloped roof for rain and snow runoff
- bedrooms to cool side of the house
- living areas to the sun side for warmth
- eves and windows designed to let in afternoon winter sun but not afternoon summer sun
- thermal mass to catch and store winter sun heat
- small windows on morning sun side
- few windows on afternoon sun side
- window curtains for insulation and to block heat when needed
- attic ventilation for airflow and to prevent mold from condensation
- attach greenhouse to sunside and shadehouse to shade side of main house to create airflow

COOL CLIMATE GARDEN

- traditionally cool climate farms included mixed forests, hedgerows, meadows, small fields and veggie plots

Permaculture gardens include : perennial berry crops, mushroom cultivation, nut trees and syrup trees, bees, perennial pastures and grasslands for people and animal, free range chickens, ducks, snakes, frogs, fish, pigs, goats, sheep, cows, horses, geese, emu, fresh water aquaculture, orchards, heavy mulching, covered winter garden for snow protection

COOL CLIMATE CHALLENGES

- industrialization and cars create acid rain degrading soil and water quality
- loss of top soil through conventional agriculture and deforestation
- exposure to fog, frost, snow, ice, cold wind
- most plant growth in spring and summer only
- high cost of space and water heating
- slugs
- forest fires

COOL CLIMATE STRATEGIES

- planting nitrogen fixers, bioaccumulators and spike root plants to remediate soil
- windbreaks and permanent forest edges to protect from wind and fire
- lime soils to balance acidity
- grow root crops for winter storage
- keyline daming and swale systems for gravity fed irrigation and water management
- integration of fedge suntraps
- green house attached to main house for heat cycling and retention
- coldframes for early and late starts and harvests
- food forests and farm forestry
- good insulation of houses, pipes and wells
- rock and stick piles to provide warm habitat for beneficial animals
- stone walls for heat retention and preventing evaporation
- radiation shields of white rock, trees or hedgerows facing fire sector
- use of plant and animal guilds to address pest issues
- no till gardening to preserve soil
- extend growing season with greenhouse and glasshouses
- natives for windbreaks and mulch
- include short season varieties
- make sure cold air can flow downhill
- animals with good structures near home
- composts in greenhouse for heat
- thermal masses to collect heat
- heavy mulching of gardens to protect soil, maintain soil temperature and water regulation.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

1

GAIACRAFT
DESIGN FOR TROPICS

SUBCLIMATES

Wet Tropics

- river basins and wet coasts
- overhead sun
- temperature 21 - 32 degrees
- rainfall from 152 - 328 cm
- rapid runoff and evaporation

Wet-Dry Tropics

- towards the poles of wet tropics
- dry hot winters
- low humidity
- temperature 21 - 38 degrees
- rainfall from 25 - 162 cm

Monsoon Tropics

- cooler winters and wet summers and autumns
- temperature 13 - 38 degrees
- rainfall 102 - 1016 cm

TROPICS HOUSE

- low energy use houses
- orientation to prevailing winds (not sun)
- over shading trees, trellises and green roofs,
- white walls and roof to reflect light
- well insulated and also well ventilated
- plantings inside and on outside walls for cooling
- shaded open air kitchen separate from house
- attached glasshouse to utilize extra light
- vents to release hot air
- underground pipes with cool air from shaded cool sink
- attached shadehouse to north (shade side) of house
- attached greenhouse to south (sun side) of house
- shade house brings in cool air, sunhouse utilizes hot air and together they create a ventilation system
- wet tropics : raised, steep roofed, screened and with permeable walls
- dry-wet tropics : mud or thatch houses
- monsoon tropics : mud pole structures, thatched, steep roofed, and good drainage
- well insulated and passive ventilation
- above tsunami height
- sheltered from extreme climate
- above valleys where mudslide is issue
- irregular shape to increase surface area
- wide varandas for ventilation with shade trellises
- insect screens
- cellar/underground shelter for escape from intense climate

TROPICS GARDEN

- careful planting and harvesting schedule to match climate
- high diversity of species and harvests
- consideration of pests
- no standing water
- interplanted stacked food forests
- raised beds
- no dig gardening and heavy mulching
- use of green crops and nitrogen fixers
- use of ants and termites for decomposition
- rough and heavy mulching with woody materials and water systems (wood, like all organic materials, break down rapidly in the tropics)
- integrated hedgerows
- pit composting and banana circles
- passive on-demand hot water
- aquaculture systems
- focus on herbacious perennials
- no bare soil
- covered nursery areas (shade cloth) to protect seedlings from high rain fall
- covered out door work space (for during wet monsoon)
- mounded beds for drainage
- banana circles
- weed barriers
- plants for mulch supply

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

- mixed multi-story system
- wet tropics : grey and black water systems, food forests, intensive cultivation
- wet-dry tropics : hedgerow sheltered, grasses in mulch and groundcover, firebreaks, reclaiming eroded lands with pioneer plants, keyline damming, soakage pits, manure fertilization
- monsoon : design for disaster, heavy tree cover and windbreaks

TROPICS CHALLENGES

- wet tropics : heat and high rainfall leach most mobile nutrients from soils, here vegetation and animlas contains 80 - 90% of nutrients
- dry tropics : flooding, erosion
- monsoon tropics : tsunamis, hurricanes, flooding and intense weather systems
- erosion from heavy rain fall
- pests and desease
- polluted water
- nutrient poor soil and erosion

TROPICS STRATEGIES

- humus and soil building
- stacked polycultural food forests including plants for mulch and soil building
- preserve trees
- river vs road transport
- integrated pest management
- valley sites for shading
- site sheltered from climate extremes and disasters
- water storage
- particular attention to grey water and black water processing
- erosion control with grass and tree plantings
- swaling to store wet season water in the soil
- extensive use of grass crops and forage legumes
- no use of plastic or metal
(due to leaching and rapid breakdown)
- covered work areas (and storage areas)
plan for large seasonal rain periods

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

DRYLAND HOUSE

need for summer/day cooling and winter/night heating means incorporating techniques found in both tropics and temperate housing

- Earthships and Biotecture
- small windows with blinds
- interchangable white and black colors on walls and roofs
- shaded interior open air courtyards
- afternoon sun wall windowless and shaded by evergreens
- morning sun and full sun walls partially shaded with trees and shadehouses
- full sun facing areas with windows that can be covered and insulated
- summer/day outdoor kitchen and winter/night indoor kitchen
- living roof
- vine arbours and trellises
- underground storage and living spaces
- vents
- dry toilets
- low pressure showers
- regulated water use
- roof water collection and shade side water storage
- underground water tanks and cisterns
- good insultation to keep cool or heat in depending upon season
- earth tunnels sloping downhill from above the house to bring in cool air
- solar panels and windmills
- shade side shadehouse
- sun side glasshouse with solar chimney
- for winter heat
- to catch and release solar heat
- to dry food and protect from pests

DRYLAND GARDEN

- water catchment
- heavy mulching on surface and subsurface
- shade by cloth, structures and trees
- intensive zone 1 focus
- drip watered composting pits
- raised beds with high edges to prevent runoff
- use of hearty tubers, bulbs, herbs, shrubs and deep rooting perennials
- drought tolerant species of plants and animals
- incorporate mycorrhiza
- hearty trees planted on swales
- grey water use
- dew collection
- trickle, drip or seepage irrigation
- integrated pest management
- wild foods and traditional staple foods
- trellised vines on all walls, roofs and shade structures
- interplanting with humus and mulch plants as well as hardy groundcovers
- animals : guinea pigs, donkeys, birds, lizards, antelope, kangaroo, quail, pigeon, ducks, geese, insects
- possible to include a small amount of : goats, cattle, sheep
- decomposers and aerators : ants, termites
- underground water storage
- brush, scrub or bramble living fences
- mixed windbreaks for food, forage, mulch, shading and protection from the elements, plants and animals
- sunking, plastic lined 'wicking beds'
- aquaponics
- sulphur to reduce ph
- foliar feeds
- windbreaks
- movable shade houses
- reusing water
- mulched pits

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

DRYLAND CHALLENGES

- aridity
- salinization
- episodic rain with periods of drought
- winds
- poisons lingering in the soil
- wild animals and pests
- episodic flooding with periods of drought
- extreme heat
- erosion
- Often sandy or alkaline soils

DRYLAND STRATEGIES

- planting trees
- protecting existing vegetation
- water catchment and storage
- dew harvesting
- water and soil testing
- wild crafting and hunting in surrounding areas
- utilize exotic rivers (from other climates), oases and aquifers
store water for cooking and drinking
- increase water input to aquifer and rehumidify desert air with vegetation
- use wastewater in gardens
- prevent agricultural watering which results in salinization
- shredded bark, manure and leaf nutrient mulches
- utilize succession starting with native, drought resistant pioneer species
- hunting instead of herding
- no use of biocides (pesticides or fertilizers) since there are not bioremediating water plants or enough rain to flush from the soil
- utilize rain catchment and shade patterns from landscape features with contours and slope
- prevent erosion with mulching, contour banks, and tree cover
- gather rain runoff with swales, tree lines, deep ripped contours, gambions, silt dams, and even lines of stones
- biomass is in suspension as it has not broken down due to lack of water
- desert is rich with high nutrient biomass waiting to be made accessible by soil
and captured by windbreaks
- plants in arid regions tend to be extremely high in nutrient
- focus on soil building and soil feeding and not on feeding plants directly
- everything you do must reduce evaporation and increase condensation
- shaded swales, gabions and limonia
- pioneer trees first to create shade and windbreak

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT

COMPOST AND FERTILIZER TEA PLANTS FOR ARID CLIMATES

Many plants that are grown as perennials in a temperate climate will grow as annuals in an arid environment, usually in the cooler months. Having a shady area for these plants to grow and plenty of water may keep them alive over the hotter months. For important plants, give them space in your zone one wicking bed. It may be necessary to dry your home-grown plants and use a powder in your compost, compost tea or in the garden. Dry matter may have a slightly different nutrient content.

Perennial arid land plants Lucerne and Old Man saltbush between them give us N, K, Ph, Mg, Ca, S, Mn, Mo, Cl, Na, Se. Once Borage is established it is perennial and adds Ni. Nettles grow as winter weeds in arid lands adding Fe and Cu.

PRIMARY ELEMENTS

N - NITROGEN
Lucerne, Stinging nettle, Dandelion, Saltbush

K - POTASSIUM
Lucerne, Chamomile, Stinging nettle, Oak bark, Dandelion, Borage, Saltbush, Watercress, Purslane

P - PHOSPHOROUS
Lucerne, Chamomile, Dandelion, Lamb's quarters (fat hen), Saltbush

SECONDARY ELEMENTS

MG - MAGNESIUM
Lucerne, Saltbush, Purslane, Stinging nettle, Sow Thistle, Watercress

CA - CALCIUM
Lucerne, Chamomile, Stinging Nettles, Fat Hen, Central australian fig (ficus platypode), Saltbush, Cleavers, Watercress

S - SULPHUR
Lucerne, Stinging Nettle, Garlic, Saltbush, Watercress

MINOR ELEMENTS

FE - IRON
Dandelion, Stinging nettle

B - BORON
Euphorbia sp.

MN - MANGANESE
Saltbush

MO - MOLYBDENUM
Lucerne, Saltbush, Walnuts, Almonds, Sunflower seeds, Lentils, Beans

CL - CHLORINE
Saltbush

CU - COPPER
Stinging Nettle, Dandelion, Legumes

ZN - ZINC
Legumes

SI - SILICON
Legumes, Borage

NI - NICKLE
Borage

CO - COBALT
Vetches

NA - SODIUM
Saltbush, Watercress

SE - SELENIUM
Saltbush

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

The permaculture path involves both mapping and design. Once a foundational map has been established, ideally after a year of integrative observation, a permaculture design layer of the map is begun. The mapping and design processes then run together as both the map and design are ongoing living processes that are always underway.

Permaculture design projects can be real or imaginary. They may function best if done in a realistic way but can also help you review and evolve your understanding of permaculture if done in a more creative and open way.

The mainframe design approach starts with assessing and designing water systems, then access, then structures and finally plant and animal systems.

Use your base map as a foundation and add any elements you would like to see based on a needs assessment. Consider zones, sectors, microclimates, relative location, permaculture principles, ethics and techniques along with anything elese covered in the permaculture course. Designing is an an opportunity to review everything you have learned and to end you into research. Flipping through the worksheets and text books for ideas.

The design will end up looking like a map layer that integrates new developments onto the existing base map. Ideally you can do a short writeup about the design including information about the functionality and reason behind everything you are doing. In this writeup see how many references you can make to permaculture material. Doing an 'integrative design' means everything you place can be described from the perspective of functionality in relation to ethics, zones, sectors, techniques and strategies. For example perhaps we could connect a greenhouse to the south side of my main house and inside include a kitchen and solar shower. This functions to fullfill the ethic of people care, the principles of multiple functions and relative location, the purpose of zone 1 as an functional extension of the home
a technique from cool climate house design and is a strategy to conserve energy, increase production and extend the growing season.

Integrated permaculture design connects in some way to all the main topics of the course : ethics, principles, patterns, techniques and strategies, zones and sectors, soil, trees, water, climate in general, our cool climate in particular, animals, and integral gardening methods.

The final design is meant to be an integrated permaculture design. In this way the goal is to link it in some way to all the main topics we studied : ethics, principles, patterns, techniques and strategies, zones and sectors, soil, trees, water, climate in general, our cool climate in particular, animals, and integral gardening methods and social permaculture.

Final Design Project of Leslie Ross and Barb Ellen

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT
A SOCIAL PERMACULTURE FABLE

Enter a young elvish permaculturalist who moves to a new place in the country with a pocket full of gold that he found along the way. It is time at last to settle down after many years of adventuring and he is ready to implement all his knowledge about permaculture in developing his new land and new life

Taking a page from green mapping, he locates and connects with many relevant resources in the local community, coming to know the location of goods and services, including doctors, firefighters, police, local government bodies, educational facilities, the nearest hospital, and other public service locations.

The property is designed as a permaculture style biodynamic farm growing food, producing chickens, cows, goats and including a full biodynamic dairy. After developing an extensive compost system which produces an abundance of biodynamic worm castings he begins a community supported agriculture system to involve local people in the production. The new team is able to create an extensive micro-farm which includes a seed bank and nursery whose plants are for sale, trade and to grow out in the farm. Once production is up the produce and dairy products are sold at the farmers market, along with the fertilizer and seeds. Bio-organic goods are still quite rare and increasingly sought out by the community so the elvish farmers market stall does incredibly well, beginning to stock some local Health Food Stores as well. The neigbouring properties are now able to be purchased to expand the farm, build a number of new houses for the growing community of workers, and create a community learning center.

With more money than ever our intrepid permaculturalist choses to start an ethical trust and permaculture credit union, a high interest local bank which gives loans to any initiatives and projects aligned with permaculture allowing the extended community to begin permaculturing their own properties and creating food co-ops. Now that a community of relationships has been established he sets up a LETS system of alternative economics to help cycle money, elvish farm dollars are printed up which people pay for in real cash, the cash is invested in the ethical trust, and the new money circulates in the local community, cycling the energy.

As word about his elvish permaculture spreads throughout the bioregion, he begins to teach courses on his farm and builds an institute. Soon it is time to create a permaculture guild for networking of local people practicing permaculture. Before long a permaculture teachers association is created to unite teachers with different areas of expertise. Now abundance from the biodynamic farm, dairy, and permaculture education, our elvish farmhand is able to turn the property into a permaculture learning center, doing internships, permaculture design courses and woofing. New video equipment records classes and they shared freely on the world wide web on an extensive social networking website developed to promote the farm in the global media streams. A permaculture publishing house is created to share more of the information now streaming in from many different sources. The young elvish permaculturalist decides to form a permaculture media group representing globally through print media, web television and online permaculture education. Now at the ripe of age of eleventy-one he manages to publish a multimedia package illustrating the whole process from design to application, and how it can be use as a template for other people to accomplish the same thing.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

1

GAIACRAFT
EDUCATION

This was assembled from a Masters Degree in Permaculture Education research. It lists elements, strategies and components that may lead to more success in teaching permaculture to people of all ages and educational backgrounds. In particular this came from teacher trainings with Geoff Lawton, Robin Clayfield, Robyn Francis, Rosemary Morrow, Jude Hobbs, Tom Ward, Douglas and Sam Bullock, Michael Becker and Dave Boehniein.

- small groups
- better posters
- good well established site
- entertaining
- creatively develop peoples own ideas for things in their lives
- bringing the curriculum into absolute relevance for people
- dynamic changing and engaging workshops creative presentations
- catering to students : language, attention, and learning styles
- having energetic awareness of the students
- empathy with students needs
- well planned in advance
- creating discussion
- practical and relevant
- experiential
- local and bioregional discussions
- cross-platform media and mediums
- peer teaching and learning
- welcome students to be involved in opportunities after the course is over - to stay connected
- encourage co-operation and networking
- if you ask questions - leave people time to answer them
- look in peoples eyes'
- living classroom
- blackboards
- engaging the senses
- making students part of the process
- using graphics to illustrate whole systems
- rooting everything in the direct experience of the instructor
- starting at the beginning
- keep it moving
- keep it fun
- relevance
- making connections and observations
- empowering people by helping them to learn by themselves
- shifting mediums and modalities
- empowering the students to help teach
- being a part of the team
- teaching by example
- teaching what you know
- foster and nurture interest
- see, touch, feel, taste what is being talked about : recreate the feeling to help with memory
- hands on planting activities : empowerment, self-esteem, health
- say what you feel
- gardening experience
- be part of a food cycle (growing and eating in the garden)
- remember to breathe
- prepared posters
- creature comforts handled
- good site
- great food and adaptable chef
- relating information back after a debrief
- added educational value
- plant walks
- chunks spread across time
- specific skills
- networking teachers - guest presenters
- showing students that systems are connected
- break down of misbelief that things exist separately in disconnected ways : casting out the disempowering premise that things are disconnected
- multidisciplinary process
- tools made in activities are starting point for the next activity
- ask clarifying questions
- yell
- whisper
- model team teaching
- stick with the schedule
- wait
- don't be tied to a specific outcome
- trust process
- make jokes
- give book and film lists
- use positive reinforcement
- laugh out loud
- have a plan
- use technology
- if you are going to lecture be loud and clear
- share research
- be excited about your subject
- say 'I dont know'
- clarification of group process
- solicit feedback
- mix of educational styles
- role model
- comparative studies
- learn from models that work
- take field trips
- dispel myths
- offer advice
- end in silence
- build networks
- choose your own groups
- smile/breathe

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

- group resume
- real circle
- guided notes
- multi-color note taking
- notebooks
- learning buddies
- student facilitates
- initiatives
- games
- processing tools
- toys and props
- images
- stories
- voice modulation
- individual projects
- letters to self
- photograph learning cards
- readings
- resource lists
- calendars
- group tasks
- change schedule as needed
- incorporate yoga and stretching
- constant evaluation process was adapted into a living curriculum
- teaching transparencies / moments to share hidden process
- participants learn how to healthily critique each other and give critical feedback
- teachers provide constant evaluation and feedback to students
- lots of research material made available

LEARNING TECHNIQUES

take notes
move around
evaluate your learning style
discus topics
take photographs
journal
look for examples and applications in your own life
teach those around you
make worksheets
journal about learning moments and teaching moments

TEACHING TECHNIQUES

songs
circles
interactive games
discussions reflected on paper pad (mind map)
trust building
guest speakers
empowering students to teach
inner permaculture
mixing lecture with discussion
storytelling
forming a cadre
best of yesterday
movement - encourage people to stretch in class
10 minutes chunks for attention
repetition
one liner hooks
diagrams and pictures
posters
learning tools
goal to evolve the kind and quality of questions asked
after lunch video or easy dialogue
project voice
take it slow
relate theory to real life situations
ask questions to involve and engage students
short brainstorm
break into small groups
voice
inflections
gestures
encourage feedback
self evaluation
- project your voice and be heard
- mind hands and make sure not to do 'shield hands'
- relax and calm the nerves
- careful of stiffness that comes from reading with notes
- watch eyes and body language

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

- careful of sexual innuendo
- ask the class a question and answer it
- change vocal variety up
- using humor and seriousness
- drawing on the board
- using gentleness and warmth as well as strength and intensity
- play the repertoire
- facial expressions
- keep energy up and be animated at times
- ask a question and answer it
- ask a question to students
- moving around the room
- sitting on floor to share in a chill way
- sitting on low chair to tell a quiet story
- sitting on high chair or on stage to speak with authority
- standing or sitting straight on to communicate directly on same level
- balance of formality of lecture with new age style of interactive teaching
- teaching with multidimensional patterns
how and when you do things
what indicates you did it right
- questions put into a cue
- drawing with one line
- write on board in all caps
- when writing on board talk at the same pace that letters and pictures are coming up
- allow other people to correct you if you are wrong
- watch out for repetitive things that are said
- go live with other teachers through skype
- develop a repitoire of different techniques and delivery systems
- use of story
- be performative to engage students
- importance of icebreaker
- well rounded
- two stories
- two funnies
- two analogies
- two tearjerkers / serious moments
- check in with students to get feedback
opening up feedback of students
- pinboard process (posting different ideas / brainstorms on a board as an interactive creative process)
- group agreements
- recapitulations each day of the day/s before
- educational posters
- well established location
- entertaining linked to content
- dynamic styles that change regularly and engage
- catering to students needs: language, attention, and learning styles
- inviting and creating discussion
- black boards and coloured chalk
- rooting…. direct experience of the instructor and student
- keep it moving and inspirational
- create opportunities for self time reflection
- empowering…help to teach or co teach
- teach what you know and are passionate about
- networking teachers : guest presenters and different perspectives
- showing students how systems are connected and how
- revisiting information thru different approaches
- vary voice tone
- pace all communications
- tell imaginary stories

glue processes
- energizers or light and lively activites
- relaxation
- revision
- check in
- brain games
- icebreakers
- trust games
- grouping process
- evaluation processes
- completion processes

talk about learning moments
- familiarizing with the environment
- relaxation
- postive learning expectation
- goal-vision
- take in the big picture
- ask questions

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

: we are all on different places in our journey
: respect the voice space and just speak for yourself
: engage with the topic
: right to speak and to pass
: ssh - secrets stay here
: honor disabilities and special needs

things to remember about teaching
- importance of monitoring students the whole time to assess understanding
- suggestions for group agreements that avoid don'ts by giving 'do's'
- importance of sharing where you have come from and where you are going
- set tone and objectives for the course
- trusting building exercises
- modelling healthy learning habits
- remember there are at least 6 ways to do anything, keep it dynamic

- chunking
- how do you learn
- use your senses
- play with it
- put it together
- seven intelligences
- wild design
- put it together
- self test
- talk with others
- do it
- learn from our mistakes
- remember
- frequent breaks
- sleep on it
- be happy
- take notes
- thought for the day
- importance of giving everyone the chance to talk, alway is a short, easily answered questions
- have students speak in front of class in a simple, easy way at the start to give them confidence to speak and participate in the course later
- ask students to declare their intentions so you can cater the course best
- never comment on peoples spelling or grammer
- for blackboard work, clear, large writing, first write then turn around and talk
- if people bring up irrelevant info, have parking board that they can write stories, questions and such on to feel that they are heard

- set up learning agreements
: co-operation
: we are all teachers and learners

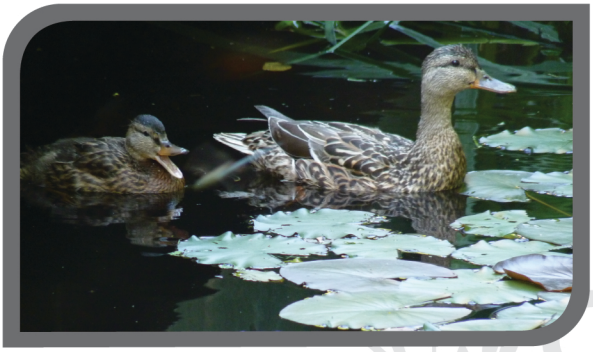


Photo Credit : Vacio Cielo

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share

GAIACRAFT
PERMACULTURE DESIGNERS' CHECK LIST

Your permaculture design certification will enable you not only to use permaculture in your own life and work but also to serve as both a consultant and designer for others. Often this will involve a site visit and analysis. You can do consultation and design for any workspace, development, project, process or set of relationships. We will focus here on land development and you can modify it to create a checklist for other types of consultation and design that would still benefit from an analysis using permaculture principles and concepts.

When you do a site analysis, depending upon the time accorded, you can work alone or with your clients to acquire specific information and answer design questions that will enable you to create a truly informed and intelligent consultation and/or design. Sometimes this analysis will lead to you doing a design, other times it will just be used as a consultation for the owners of the land, either way it will be a huge help.

Here are some things you will definitely want to weave into your design consultation and site visit.

MAPS
acquire all maps of the land so far made (regional district, blueprints, google earth etc)
create a map of the property

HISTORY OF THE LAND
traditional patterns of plant use, agriculture and hunting
recent history of the land since it was first developed from raw forest

FEATURES
landforms (major rocks, hills, elevation shifts, landmarks)
permanent buildings
roads
trails
fences

EXISTING FLORA
gardens
forests
lawns
functional plants

EXISTING FAUNA
fish
birds
mammals

WATER
supply : wells, aquifers, barrels, cisterns
ponds
running water (streams, brooks)
aquaculture
salinity
ph
oxigen levels
seasonal temperature ranges

ELEMENTS
note all elements, tools, resources or functional objects on the land

SOIL
salinity
ph
nutrient content
basic makeup (sand, humus, stone, minerals)
depth of hardpan

CLIMATE
patterns of sun and shade
wind direction and speed range
seasonal sunrise and sunset times
seasonal rainfall
seasonal temperature range
frost free period
microclimates
zone analysis
sector analysis

DESIGN GOALS
what already existing elements are not wanted by the land stewards?
what new elements are wanted by the land stewards?
how can the land be organized to save energy? generate surplus?

Any design consultation will just be the starting point for a longer mapping and design process, help get people organized so they can continue this life long process on their own.

Design : Lunaya Shekinah - www.lightscience.ca
Source Curriculum : Bill Mollison, David Holmgren, Geoff Lawton, Toby Hemenway, Rosemary Morrow
Gaiacraft Workbook Team : Delvin Solkinson, Lunaya Shekinah, Jacob Aman, Tamara Griffiths, Ali Ma
Created by Gaiacraft - Full workbooks and other language editions are available through : www.gaiacraft.com
Please feel free to photocopy and share