Permaculture Design Methodologies

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"Design is an opportunity to continue telling the story, not just to sum everything up"
- Tate Linden

"Though the problems of the world are increasingly complex,
the solutions remain embarrassingly simple."
- Bill Mollison, Co-Founder of the Permaculture Movement

Permaculture is a design science utilizing an innovative systems-approach to consciously design landscapes, and human settlements, and smallholder farming systems that integrate functional diversity and biological fertility by mimicking natural eco-systems. Diverse and fertile systems act resilient in the face of shocks.

The protractive and thoughtful nature of Permaculture encourages using the outputs of one system as the inputs to another and strongly emphasizes an iterative mechanism for feedback and progressive design. In Permaculture, sustainability is achieved when a system produces or stores more energy than is required to keep it going, notably banking on today's sunlight, not on fossil fuels.

Permaculture offers international development professionals:

- Tools to integrate sustainable systems design into existing projects
- A systems analysis design protocol for holistic pattern recognition.
- To design stable and resilient food, shelter, water and waste cycling systems for health and resilience in all of your projects
- To create an ethics and principle based training program within your organization that honors local customs, traditional knowledge and ecological conditions

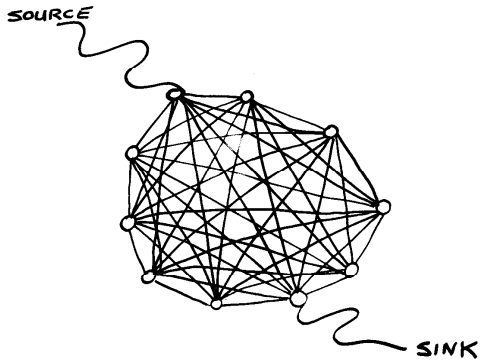
Permaculture design emphasizes the patterning of landscape, function, and species assemblies. It asks the question, "Where does this (element) go? How is it placed for maximum benefit in the system?"

Permaculture is made up of techniques and strategies sensibly arranged in pattern design:

- Techniques: concerned with how to do things (one-dimensional) e.g. organic gardening
- Strategies: concerned with how and when (two-dimensional) e.g., Fukuoka
- Design: concerned with patterning (multi-dimensional) e.g.,permaculture

Practical Design Principles that lead to Stability and Resilience

1) Everything is connected to everything else.
2) Every function is supported by many elements (3 minimum)
3) Every element should serve many functions (3 minimum)



Permaculture aims to slow entropy through conscious design

Source to Sink-Slowing Entropy: Manure to field (one function) or we could (multi-functional) ferment it, distill the manure to alcohol, secondly, route it through biogas digester where anaerobic organisms convert it to methane for cooking or heating gas, or as fuel for vehicles, thirdly the liquid effluent can fertilize fields, and the solid sludge fed to worms, which converts to ideal horticulture soils, fourthly, the worms themselves can be used to feed fish or poultry.

Permaculture is a scaleable whole systems design tool-kit that is based on sustainable ethics and principles (see appendix) which serve as a guideline for design application. In looking at characteristics of industrial society versus that of a sustainable culture many of the principles of permaculture can be derived:

Characteristic	Industrial Culture	Sustainable Culture
Energy base	Non-renewable	Renewable
Material flows	Linear	Cyclical
Natural assets	Consumption	Storage
Organization	Centralized	Distributed network
Scale	Large	Small
Movement	Fast	Slow
Feedback	Positive	Negative
Focus	Center	Edge
Activity	Episodic	Rhythmic
Thinking	Reductionist	Holistic
Gender	Male	Feminine
Spatial Perception	Egocentric	Altruistic

Permaculture Design Methodology and Approach:

1. Community Engagement
2. Data Gathering, Resource Assessment, and Client Interview
3. Observation and Assessment
4. Analysis of elements
5. Zone analysis
6. Sector analysis
7. Slope and Orientation analysis
8. Feedback loops

(1) Community Engagement

- History of people and landscape, current story, future outlook and visioning
- Define wealth as community
- Strategies for wealth development
- Interdependence strategies and watershed politics

(2) Data Gathering, Resources Assessment and Client Interview

a. Assemble Data and Evaluate Resources

- Aerial Photo
- Cadastral/Topo Maps. Sequence of maps valuable to see clearly where to place many elements.
    - (be careful; the "map is not the territory")
    - Access
    - Buildings
    - Water
    - Topography
    - Exclusion zones
- Soils/Geology/Land Capability
- Climatic Data
- Fire Information
- Existing Plans
- Government Requirements/Info
    - Business & Planning
    - Environmental
- Local Knowledge/Contacts
- Land Use History
- Soil Tests
    - Agricultural
    - Geotechnical

b. Resource assessment

- Ecological
- Social
- Cultural
- Material
- Economics

c. Client Interview

- Meet with all stakeholders
- History of project and people related to land
- Overall vision and scope of project
- Elements needed/desired
- Skill sets available to project
- Resources available
- Timeline
- Budget

(3) **Observation**

(a) Site observation from varied vantage points:

I. elevations
II. directions
III. times of day
IV. weather events

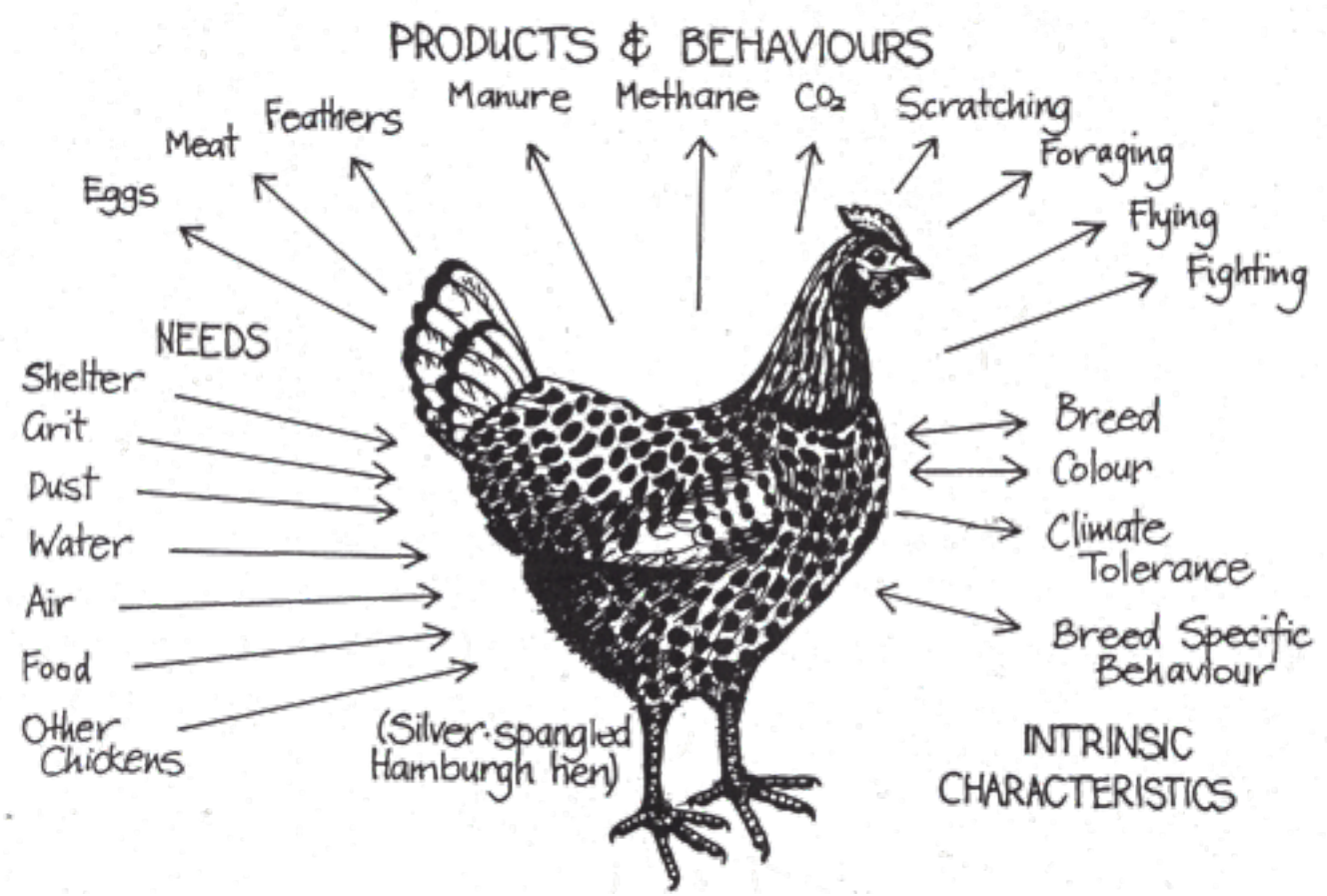
(b) Note phenomenon
(c) Infer (make guesses)
(d) Investigate (research)
(e) Devise strategies

(4) **Analysis of Elements**

An analytic approach: is the needs, products, and the intrinsic characteristics of each element. This is done on paper. Lists are made to try to supply (by some other element in the system) the needs of any particular element. In analyzing the elements of this system in this manner, it gives us an opportunity to find our inputs from one element from the outputs of another and thus guides the placement of that element for highest productivity and benefit to the overall system.

Example would be that of the chicken:

Needs	Products/yields	Characteristics	Functions
Food	Manure	Breed	Pest control
Grit	Eggs	Heavy/light	Fertilising
Water	Meat	Colour	Grazing
Air	Feathers	Heat tolerance	Weed control
Shelter	Heat	Ranging habits	Shredding
Nest	Gas (CO_2)	Temperament	
Protection		Flighty	
Dust bath		Disease resistance	
Other chickens			
Forest microclimate			



SECTOR PLANNING

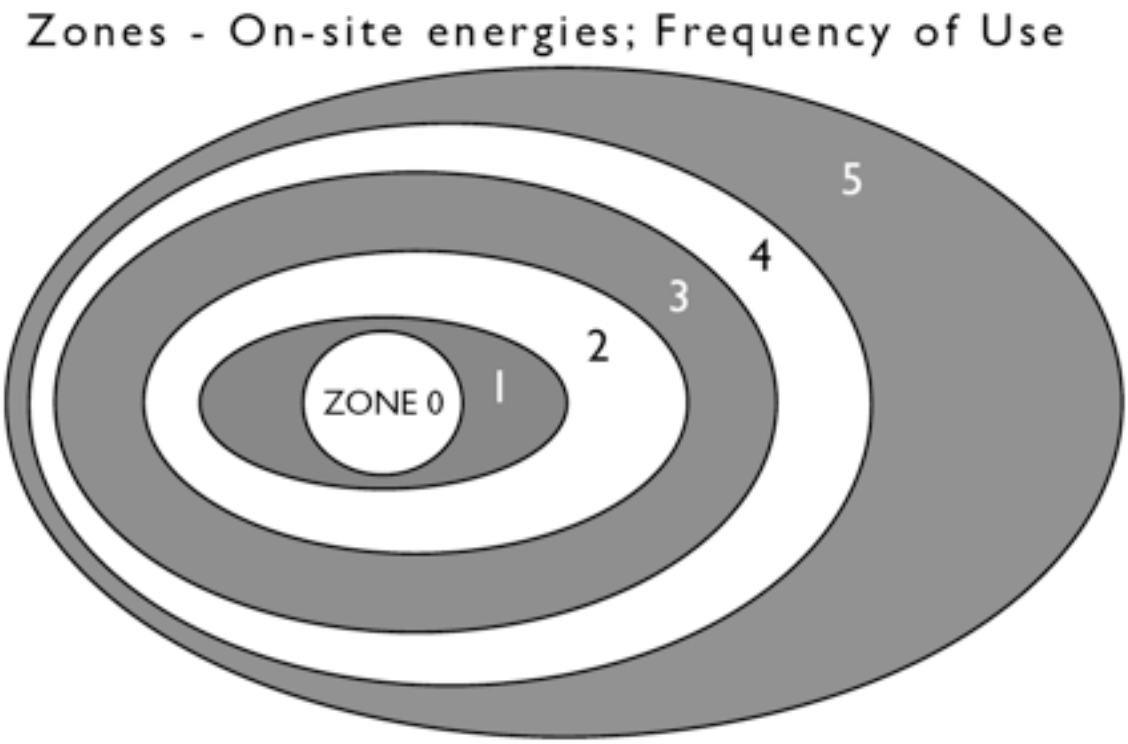
Zone and Sector analysis is a primary energy conserving placement pattern for the whole site
This involves
a. Zones
b. Sector
c. slope
d. Orientation

(5) **Zones**

- Zone analysis looks at the energy and time it takes to tend each element, the proximity of each element to each other and to those who are tending it.
- It is useful to consider the site as a series of zones, starting with the home centre and working out. Pay attention to paths and movement corridors
- The placement of elements in each zone depends on importance, priorities, and number of visits needed for each element, eg, a chicken house is visited three times every day, so it needs to be close (but not necessarily next to the house or office).

A herb garden would be close to the kitchen.

- Proximity invites good management - distance encourages neglect
- The emphasis is on access and schedules rather than distance
- Pattern the placement of systems in relationship to each other. e.g. Veg garden en route to chook house - chook yard located for access to tractor beds and orchard etc



Pulsation of Zonation. What is our site?
What level are we working at? Sense of scale.

ZONE I:
- home centre
- herbs, vegetable garden
- most structures
- very intensive
- start at back door, window boxes, balconies, window sill, etc.
- mulched
- house comfort
- energy production
- outdoor kitchen/processing area
- kitchen compost/worm bins
- kids play areas
- outdoor lounging in shade/sun depending on context

ZONE II:
- intensive cultivated
- heavy mulched orchard
- well maintained
- mainly grafted and selected species
- dense planting
- use stacking, multiple stories
- some animals: chickens, ducks, pigeon, quail
- multi-purpose walks: collect eggs, milk, distribute greens/ scraps

ZONE III:
- connect to Zone I and II for easy access
- may add goats, geese, sheep, pigs, bees
- plant hardy trees and bush species
- ungrafted for later selection, later grafting
- animal forage
- self-forage system: poultry forest, etc.
- windbreaks, firebreaks
- spot mulching, rough mulching
- trees protected with cages, strip-fencing
- nut tree forests

ZONE IV:
- long term development
- timber for building
- timber for firewood
- watering minimal
- feeding minimal
- some introduced animals: cattle, deer, sheep
- agroforestry systems

ZONE V:
- wildlife corridors
- uncultivated bush and native forest
- forest regrowth & regeneration
- timber
- hunting

Species, elements, and strategies change in each zone.

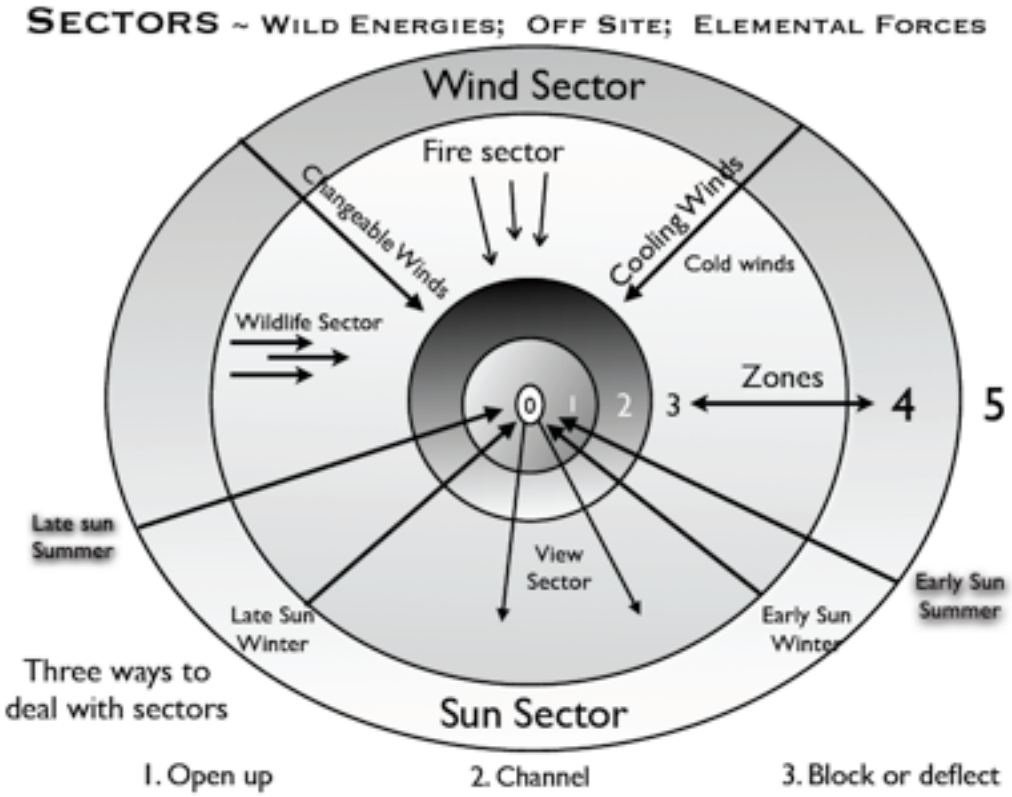
Water Storages in Zones:
Bodies of water scale. There is an opportunity for water storages to be larger in the outer zones (3-4) as opposed to the inner zones(1&2).

(6) **Sector Analysis**
The aim of sector planning is to channel external energies (wind, sun, fire) into or away from the system and to

The sector plan is essential for risk assessment, identifying and designing microclimates, fire protection and determining orientation.

Placement of an element so that is faces sun-side or shade-side, depending on its function and needs.

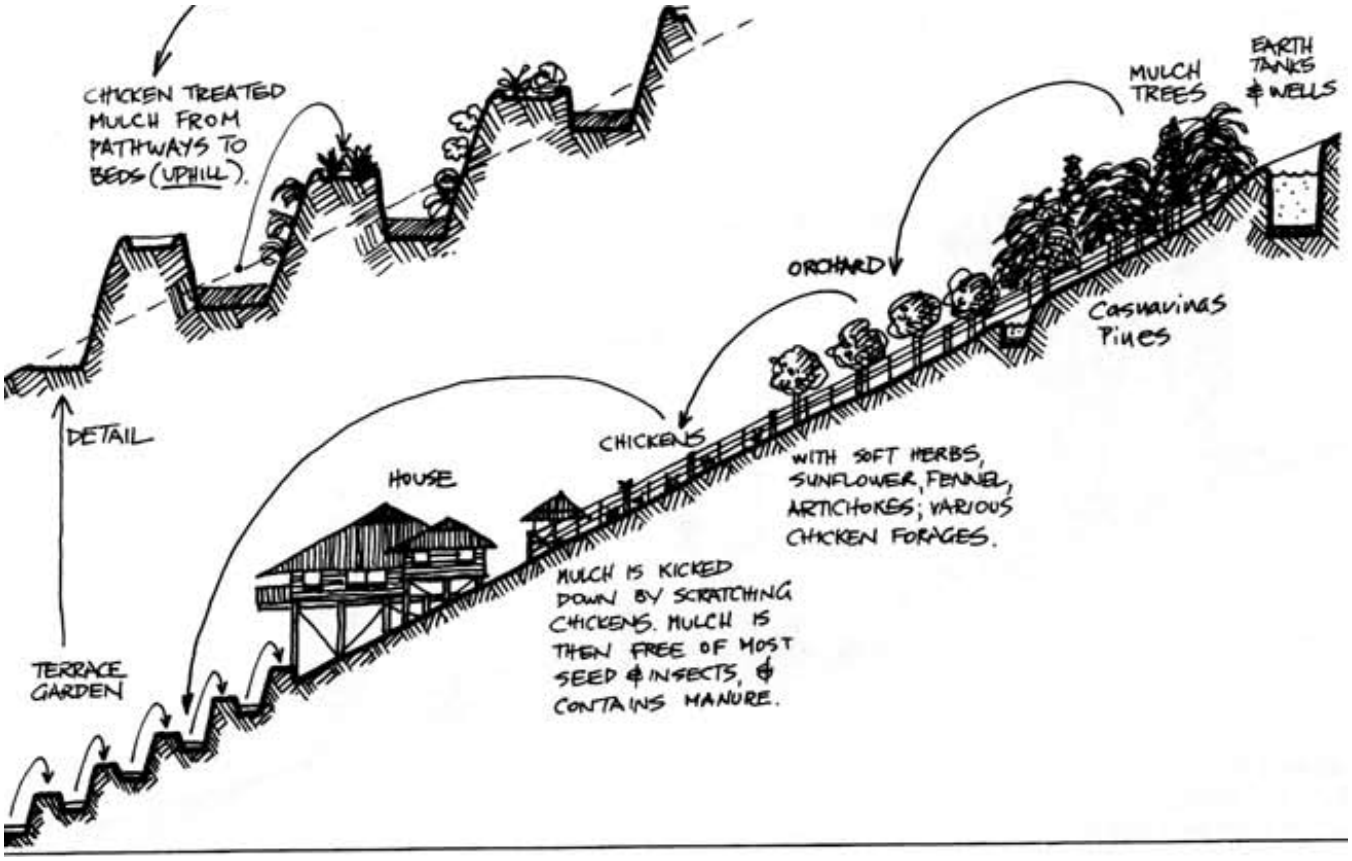
The zone and sector factors together regulate the placement of particular plant species and structures.



(7) **Slope and Orientation Analysis**

- Placement of an element on slope so that gravity is used to maximum capacity:
  - water and nutrient capture, cascading and reticulation
  - water storages
  - mulch and other materials (kick-down)
  - cold air fall; warm air rise; thermal zones and microclimates
  - human energy flows
  - appropriate animal and plant placement
  - extending production yield

- Placement of an element in relation to its orientation to sun/shade is used to increase element efficiency:
  - varied planting strategies to increase production and diversity
  - increase plant and animal yields
  - microclimate harmonization and creation
  - solar benefit

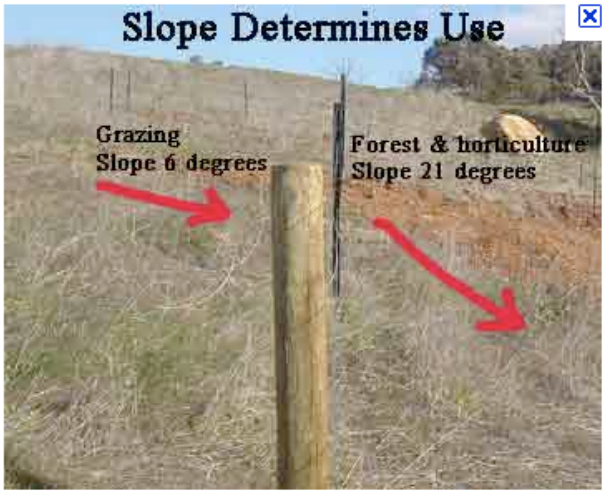


$$\text{Average slope (\%)} = \frac{H}{D} \times 100$$

where H = vertical height difference between points and D = horizontal distance between two points.

In figure 2, the height difference between X and Y is 20 m (480 m–460) and the horizontal distance is 1 000 m. The average slope between X and Y would be calculated as follows:

$$\text{Average slope (\%)} = \frac{20}{1000} \times 100 = 2\%$$



(8) Feedback Loop
Feedback loops in the design process allow for essential evolution of the design in response to the unique characteristics and contexts of the site and its systems through time.

- The design is never finished
- Create seasonal feedback integration opportunities
- Define feedback markers that link to community wealth
- Stakeholders evaluate feedback, adjust the “sails” of design and implementation based on relevant information.

PUTTING THE DESIGN ALL TOGETHER:
Use all the methodologies of design.
Select elements - pattern assembly
Place elements - pattern relationship
Accept feedback

Appendix

CHARACTERISTICS, PRINCIPLES AND ETHICS OF PERMACULTURE
ETHICS:

- Care of the earth.
- Care of people.
- Fair share - dispersing surplus to support the above and recognize limits to growth and consumption

Relative Location Components placed in a system are viewed relatively, not in isolation. Functional Relationship between components.

Everything is connected to everything else Recognize functional relationships between elements.

Every function is supported by many elements - Redundancy Good design ensures that all important functions can withstand the failure of one or more element.

Every element is supported by many functions Each element we include is a system, chosen and placed so that it performs as many functions as possible.

Local Focus "Think globally - Act locally" Grow your own food, cooperate with neighbors. Community efficiency not self-sufficiency.

Diversity As a general rule, as sustainable systems mature they become increasingly diverse in both space and time. What is important is the complexity of the functional relationships that exist between elements not the number of elements.

Biological Resources We know living things reproduce and build up their availability over time, assisted by their interaction with other compatible elements. Use and reserve biological intelligence.

One Calorie In/One Calorie Out Do not consume or export more biomass than carbon fixed by the solar budget.

Stocking Finding the balance of various elements to keep one from overpowering another over time. How much of an element needs to be produced in order to fulfill the need of whole system?

Stacking Multi-level functions for single element (stacking functions). Multi-level garden design, ie., trellising, forest garden, vines, groundcovers, etc.

Succession Recognize that certain elements prepare the way for system to supports other elements in the future, i.e.: succession planting.

Use Onsite Resources Determine what resources are available and entering the system on their own and maximize their use.

Edge Effect Ecotones are the most diverse and fertile area in a system. Two ecosystems come together to form a third which has more diversity than either of the other two, i.e.: edges of ponds, forests, meadows, currents etc.

Energy Recycling Yields from system designed to supply onsite needs and/or needs of local region.

Small Scale Intensive Systems start small and create a system that is manageable and produces a high yield.

Make Least Change for the Greatest Effect The less change that is generated, the less embedded energy is used to endow the system.

Planting Strategy 1st-natives, 2nd-proven exotics, 3rd unproven exotics - carefully on small scale with lots of observation.

Work Within Nature Aiding the natural cycles results in higher yield and less work. A little support goes along way.

Appropriate Technology The same principles apply to cooking, lighting, transportation, heating, sewage treatment, water and other utilities.

Law of Return Whatever we take, we must return Every object must responsibly provide for its replacement.

Stress and Harmony Stress here may be defined as either prevention of natural function, or

of forced function. Harmony may be defined as the integration of chosen and natural functions, and the easy supply of essential needs.

The Problem is the solution We are the problem, we are the solution. Turn constraints into resources

Mistakes are tools for learning

The yield of a system is theoretically unlimited The only limit on the number of uses of a resource possible is the limit of information and imagination of designer.

Dispersal of Yield Over Time Principal of seven generations. We can use energy to construct these systems, providing that in their lifetime, they store or conserve more energy that we use to construct them or to maintain them.

A Policy of Responsibility (to relinquish power) The role of successful design is to create a self-managed system.

Principle of Disorder Order and harmony produce energy for other uses. Disorder consumes energy to no useful end. Tidiness is maintained disorder.

Chaos Has form, but is not predictable. The amplification of small fluctuations.

Entropy In complex systems disorder is an increasing result. Entropy and lifeforce are a stable pair that maintain the universe to infinity.

Metastability For a complex system to remain stable, there must be small pockets of disorder.

Entelechy Principal of genetic intelligence. i.e. The rose has thorns to protect itself.

Observation Protracted & thoughtful observation rather than protracted and thoughtless labor.

We are surrounded by insurmountable opportunities

Hold water and fertility as high (in elevation) on the landscape as possible

Additional ways of looking at the Principles/Directives of Permaculture

- **Work With Nature**: rather than against the natural elements, forces, processes, agencies and evolutions, so that we can assist rather than impede natural developments. (Use gravity, use native species, use the sun, wind, etc.)
- **The problem is an opportunity**: everything works both ways. It is only how we see things that make them advantageous or not. Everything is a positive resource
- **Make the least change for the greatest possible affect:** Make work a source and not a sink of your energy

- **The yield of the system is theoretically unlimited**: The only limit on the number of uses of a Resource possible within a system is in the limit of the information and the imagination of the designer
- **Everything is connected:** Everything gardens and has an effect on its environment;
- **Relinquishing Power**: The role of beneficial authority is to return function and responsibility to life and people.
- **Unknown good benefit:** If we start with good intentions, other good things follow naturally
- **Succession of Evolution:** Natural design follows a pattern of evolution that is working towards stability and resiliency. Our own designs can follow suit.
- **Cyclical Opportunity:** every cyclical event increases the opportunity for yield to be increased. Increasing cycling is to increase yield.
- **Functional Design**: All functions are supported by many elements, while each element performs many functions. Function Stacking
- **Stability** Is created by a number of beneficial connections between diverse beings.
- **Information as a resource:** Information is the critical potential resource, Bad information can result in a poor design, likewise good information increases opportunity for a good design.
- **Relative Location:** Through proper placement of elements we can save time and energy