



Permaculture

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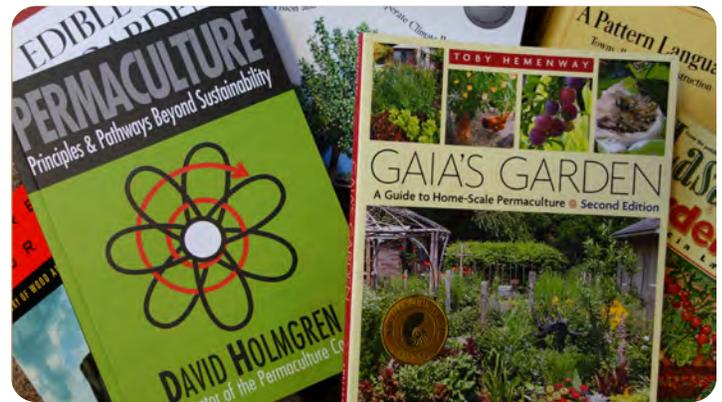
What is Permaculture?

Permaculture is a design concept for sustainable, food producing landscapes mimicking the diversity and resilience of natural ecosystems. Although concepts included in permaculture design have been in practice for millenia by various cultures worldwide, the term “permaculture” as it is currently understood was first coined in Tasmania by Bill Mollison and David Holmgren in the mid-1970’s (Nabhan, 2013). Mollison and Holmgren described permaculture as, “an integrated, evolving system of perennial or self-perpetuating plant and animal species useful to man” (Mollison & Holmgren, 1978). The use of the word, and scope of the definition, has varied greatly since the 1970’s; much like the use of ‘sustainability’ and ‘ecology’. Holmgren later expanded the definition to, “consciously designed landscapes which mimic the patterns and relationships found in nature, while yielding an abundance of food, fibre and energy for provision of local needs” (Holmgren, 2003). Additional definitions from members of the permaculture community include:

- Permaculture is the conscious design and maintenance of agriculturally productive systems which have the diversity, stability, and resilience of natural ecosystems. It is the harmonious integration of the landscape with people providing their food, energy, shelter and other material and non-material needs in a sustainable way (Bell, 2005).

Permaculture:

A design process mimicking natural ecosystems.



Texts about permaculture design abound. Popular beginners texts include *Permaculture: Principles and Pathways Beyond Sustainability* and *Gaia's Garden*.

- Permaculture is a set of techniques and principles for designing sustainable human settlements... though permaculture practitioners design with plants, animals, buildings and organizations, they focus less on those objects themselves than on the careful design of relationships among them – interconnections – that will create a healthy, sustainable whole (Hemenway, 2001).
- A permaculture system is a system that resembles nature and is based on natural cycles and ecosystems (Holzer, 2004).

From the above definitions, it can be seen that permaculture design has evolved beyond food systems to encompass the broader landscape of architecture and human relationships. Joel Glanzberg, regenerative design and ecological restoration expert, emphasized “it is a holistic design approach for all human needs that works on creating change by shifting underlying patterns” (Glanzberg, 2013). A holistic design approach demands a shift in conventional, mechanistic thinking. The theoretical foundations of permaculture will help shed light on this way of thinking.



Participants in USU Extension's Permaculture Workshop observe the surrounding environment interacting with the campus's future permaculture garden site. This includes the watershed, wind strength and direction, seasons, sun cycle and more.

Permaculture Theory

Before breaking soil and designing structures, permaculture practitioners first observe patterns and characteristics of the environment at the chosen site. This includes visiting the site at various times of the day, during various seasons and weather conditions, and observing the landscape from different viewpoints. Following is an elaboration of the theory behind permaculture design.

Worldview and Place

Observation of our surroundings is often the first principle presented in permaculture literature (Holmgren, 2007, McManus, 2010, Bane, 2012). How we perceive, or observe, our environment is influenced by our worldview. In other words, the roots of our worldview influence many of our attitudes and perceptions toward the environment. Because permaculture is a holistic design approach with a concern for the health of the environment, a group or an individual will be more likely to adopt permaculture principles if they have an environmental worldview.

Tracing thinking further 'upstream', from our worldview, to our experiences that formed that view, can enrich the dialogue taking place among advocates for sustainably built environments (Mang & Reed, 2012). Ecological problems and designs have been traditionally addressed through mechanical means (Berry, 1981). For example, designing factory-style farming facilities via mechanical order streamlines efficiency in producing a single product. However, it also creates dependency on inputs, unused waste, minimizes biological exchange and increases vulnerability in the wake of ecological disturbance. Biological solutions to problems are often overlooked due to a worldview with a mechanical preference. This preference for man-made, mechanical solutions is not conducive to the adoption of permaculture theory.

Another factor that would encourage a group or an individual to adopt permaculture practices would be a worldview that included a developed sense of place. If people feel connected to their community and environment, they would be more likely to embrace permaculture. Humans can develop a sense of place by observing patterns, processes, and cycles within nature. Humans must reconnect their aspirations and activities with the evolution of natural systems, regenerating as opposed to degenerating our landscapes (Glanzberg, 2013; Mang & Reed, 2012).

"Sustainability"

As world population and resource consumption continue to follow an upward trend, the importance of humans reconnecting with natural systems increases. Problem solving, conflict resolution, and increased stewardship are required for world populations to continue - or sustain.

Oftentimes, sustainability is defined as using less, or using up capital more slowly. That definition creates an illusion of achievability, and leaves out the most integral elements of the human race's ability to sustain itself. Sustainability is value laden, and achieving sustainability requires problem solving (Tainter, 2003). Permaculture integrates the human value aspect by approaching problems through ecology, systems thinking, and holistic inquiry. Ethics and considerations ingrained within those overarching approaches, taken from Holmgren (2007) include:

- Land and nature stewardship
- The built environment
- Tools and technology
- Culture and education
- Health and spiritual well-being
- Finances and economics



Designing a permaculture site at USU following an observation of the biological and social patterns interacting with the site.

Permaculture Principles

Permaculture literature often contains listed principles. Most of the principles have core similarities among various authors and experts. Listed below are twelve principles adapted from Dave Holmgren (Holmgren, 2007). Holmgren's list encompasses all essential elements of permaculture. The twelve ethics and principles follow:

Observe and Interact

Design should consider different seasons, times of day, and cultures. Ways to work and design with existing patterns in nature should be considered.

Catch and Store Energy

Renewable ways of capturing and utilizing energy should be a priority. Energy, which gives us the ability to work, should never be wasted. True costs (i.e. negative externalities, human welfare, habitat protection, etc.) should be a central part of energy dialogue. Infrastructure improvements, retrofitting, passive design, and alternative storage techniques should be prioritized.

Obtain a Yield

Design should focus on principles of self-reliance. Producing an agricultural yield is necessary for independence and continuity. Yields are encouraging, and they create 'positive feedback loops' (Holmgren, 2007).

Apply Self-Regulation and Accept Feedback

With better understanding of how positive and negative feedbacks work in nature, systems can be designed that are more self-regulating, thus reducing the work involved in repeated and harsh corrective management (Holmgren, 2007).

Use and Value Renewable Resources and Services

We live as a result of the ability of the living world to regenerate (Glanzberg, 2013). A diversified use of renewable resources, at an appropriate level of use, can help us limit our consumption.

Produce No Waste

Look for ways to make waste a useful input in our system, rather than just an output. Recycling, composting, and reducing waste are increasingly important as population increases.

Design from Patterns to Details

By stepping back, we can observe patterns in nature and society. These can form the backbone of our designs, with the details filled in as we go (McManus, 2010). Thoughtful design is a way of addressing and solving many of our problems at the source.

Integrate Rather than Segregate

This requires the recognition of complex connections in nature, and making beneficial use of those interactions. We must brainstorm the many functions that each element can perform.

Use Small and Slow Solutions

Smaller systems are easier to maintain than big ones, making better use of local resources and producing more sustainable outcomes (McManus, 2010). Also, be sure to take adequate time through observation and seeking local knowledge in finding solutions.

Use and Value Diversity

Diversity fosters resilience. A society rooted in monoculture is vulnerable to unexpected change. Permaculture seeks to understand past, present, and potential biological and cultural diversity.

Use Edges and Value the Marginal

A point where two systems meet is often a place where productivity and stability can be found. Rather than disregarding the marginal, we should look for ways to make use of its diversity and productivity.

Creatively Use and Respond to Change

We can have a positive impact on inevitable change by carefully observing, and then intervening at the right time (McManus, 2010). We must not seek to take away the self-determination of land in the process.

Permaculture in Practice

If you are interested in incorporating permaculture design concepts into your own landscape, the following list of examples can serve as a basis for brainstorming.

Harvest Rainwater

A basic start to harvesting rainwater is to build or purchase a catchment system, such as a barrel attached to your household eaves trough runoff point (See www.water.utah.gov for further information on water harvesting laws for Utah). However, to maximize use of your catchment system, design your landscape in a manner that naturally harvests rainwater as well. This includes building infiltration basins, also known as swales (indented gardens), as opposed to mounds (elevated gardens). Swales can be connected to runoff points in your landscape to maximize natural rainwater harvesting. An advanced concept of this is to build a diversion swale. According to Brad Lancaster (2013; p.73), “a diversion swale is built slightly off-contour, allowing a portion of the water to soak into the soil locally while moving surplus water slowly downhill from one place to another, infiltrating water all along the way.” This helps slow water flow, decreases water inputs and associated costs, and prevents erosion.

Rainwater Harvesting Formula:

To calculate the amount of rainwater you could harvest on your own rooftop and/or landscape, consider the following formula:

CATCHMENT AREA (in square feet) x AVERAGE ANNUAL RAINFALL (in feet) = TOTAL RAINWATER FALLING ON THAT CATCHMENT IN AN AVERAGE YEAR (in cubic feet).

If your annual rainfall is measured in inches, divide inches of rain by 12 to get annual rainfall in feet (Lancaster, 2013).



Garden basins/swales form a living sponge of mulch and vegetation. Basins are designed to infiltrate water quickly so there are no problems with mosquitoes or anaerobic soils. These basins, with their spongy mulch and soil-burrowing plant roots, infiltrate all water within 20 minutes (© Rainwater Harvesting for Drylands and Beyond; www.harvestingrainwater.com)

Stack Functions

Stacking functions, or companion planting, is a great way to reduce your external inputs. What this means is to consider the entire spectrum of benefits any plant can provide, and also to consider what that plant needs to thrive. Do the same for several plants and determine whether any one plant can meet the nutritional or structural needs of another, when interplanted closely together.

A great example of stacking functions can be taken from the Native American tradition of a Three Sisters Garden of corn, beans and squash. Corn provides a natural pole for beans, beans fix nitrogen in the soil that other plants use, and squash provides a natural ground cover to reduce weeds, retain soil moisture, to serve as a natural mulch, and the prickly hairs help deter pests. The result is known as “overyielding,” where the combined yield of all three crops grown together on the same land is generally higher than what any one of the crops could produce in the same area of land if planted alone (Nabhan, 2013). Lastly, the three sisters also nutritionally complement each other. Beans are rich in protein, balancing a lack of needed amino acids found in corn; corn provides carbohydrates; and squash yields vitamins from the fruit and oil from the seeds.



A Three Sisters Garden at the UMass Amherst Campus, Massachusetts - part of the University's Permaculture Initiative (www.UMassPermaculture.com)

Design a Plant Guild

A plant guild draws concepts of design from forest ecosystems. Begin with a canopy layer, such as large fruit and/or nut trees. Under this layer, plant dwarf fruit trees. As highlighted by Gary Nabhan (2013, p. 132), “A dwarf fruit tree may sequester as much as 28 pounds of CO₂ a year, while a larger semi-dwarf or full-sized tree will sequester between 220 and 260 pounds annually.” Under and around the low tree layer, plant a shrub layer (such as currants and berries). Next, surround these with herbs (primarily perennial herbs) and root vegetables, and complete the whole system with a ground cover, soil surface layer such as strawberries. You can also build up in a vertical layer using grape vines or cucumbers.

Herb Spirals

Herb spirals are compact vertical gardens allowing for individualized management of wind and water flow. Use a solid material, such as rocks or used bricks, to build the spiral frame. Ensure the center of the spiral is the highest point. Plant herbs that thrive in dryer soils and full sun at the top and use the various angles and heights to plan where to plant herbs depending on their sun and water dependence. The stone or brick walls provide heat retention, insulating the plant roots from cold snaps. Herb spirals can also be built as swales that indent into the ground. Remember, in the northern hemisphere, water runs off in a clockwise direction, so be sure to build your spiral in this same manner to work with the natural flow of water.



University of Massachusetts' campus permaculture garden also features an herb spiral. This serves as a space organizer, visual attraction and walkway for the campus garden - stacking functions!

Permaculture in Utah

A good example of permaculture concepts in action can be seen with Community Rebuilds, a nonprofit building energy-efficient straw bale housing for income-qualifying families in Moab, Utah. Community Rebuilds follows an environment-focused interactive housing design, taking into account water systems (with a focus on rainwater harvesting), sun cycles (building with passive solar), and material sourcing. For material sourcing, Community Rebuilds uses recycled products and agricultural co-products in each build. They use earth removed for excavation of the home site when available by screening it and applying it back onto the walls as an ingredient in their earthen plasters.

Community Rebuilds also sources their straw bales (an agricultural co-product that was previously a bi-product) locally – within 100 miles. The organization also builds with pine-bark beetle-killed wood sourced from within 100 miles. Native plant species and rain gardens are the focus of landscapes surrounding Community Rebuilds' houses. Lastly, the builds are completed by student interns, creating a succession model of systems-thinking sustainable builders.

Summary

Permaculture is more than food production—it is a design process that can be applied to organizations, homes, and landscapes. This article aimed to highlight the theoretical and applied elements of permaculture. Permaculture's three ethics succinctly present the roots that hold together all that has been presented:

- Care for the earth
- Care for the people
- There are limits to growth (Holmgren, 2007)

To care for the earth and people, and to recognize limits to growth, is to realize our need for regeneration. Regeneration of food and landscapes, as opposed to degeneration, is a necessary standard for environmental sustainability and applied permaculture.

Glossary of Terms

Garden Swale - Indented gardens that act as water infiltration basins.

Herb Spiral - Herb spirals are compact vertical gardens allowing for individualized management of wind and water flow.

Permaculture - A design concept mimicking natural ecosystems.

Plant Guild - Polyculture that blends several to many plant species working together.

Regenerative Development - Designing human environments that restore and regenerate as opposed to degenerating the surrounding environment

Straw Bale Construction - A method of building using bales of straw as insulation. R-values (which gauge material insulating potential) typically range from 20-50.

Systems Ecology - Systems ecology is an interdisciplinary field of ecology, taking a holistic approach to the study of ecological systems, especially ecosystems.

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