

PERMACULTURE

A FEW CLOSING WORDS

Permaculture is the art and science of designing human beings' place in the environment. Permaculture design teaches you to understand and mirror the patterns found in healthy natural environments. You can then build profitable, productive, sustainable, cultivated ecosystems, which include people, and which have the same diversity, stability, and resilience as natural ecosystems.

Permaculture designs can be applied in households, major agricultural enterprises, and even entire bioregions. Permaculture integrates disciplines relating to food, shelter, energy, water, trees and plants, wildlife, livestock, weather, waste management, economics and social sciences. These integrated designs create systems capable of yielding far more benefits than conventional systems. Permaculture can reclaim devastated lands, roll back deserts, build just social/economic systems, and design planet-based livelihoods.

Permaculture departs from any other design system in that it is guided by a common-sense ethical system. This system forms the criteria for design decisions. These base criteria are:

- Care of the Earth,
- Care of the People of the Earth, and
- System surpluses distributed in accordance with the first two ethics.

Briefly, when a design component isn't ecologically sound, community-building, and careful in its use of resources, then it's pretty unlikely that it will work out in the long run. Most design systems are defined by a "market-driven" ethic. Such designs are subservient to the conclusions of a short-term cost/benefit analysis, discounting or ignoring such factors as environmental degradation or destruction of human community.

PERMACULTURE TEACHES YOU TO UNDERSTAND AND MIRROR THE PATTERNS FOUND IN HEALTHY NATURAL ENVIRONMENTS. YOU CAN THEN BUILD PROFITABLE, PRODUCTIVE, SUSTAINABLE ECOSYSTEMS.

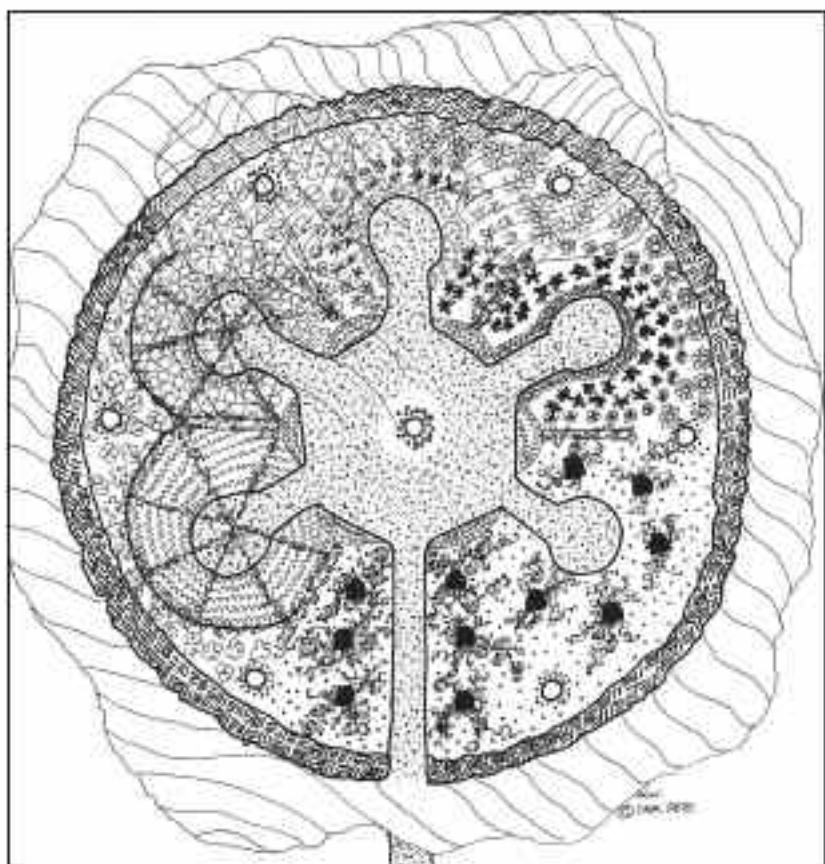


Fig. p-1. A mandala garden. Mandala gardens are minimum path gardens. This example is a 30-foot-diameter layout. Things visited or harvested often are planted close to the path. Fruit trees and other seasonally harvested crops are planted furthest from the path. A nitrogen-fixing Farmer's tree is planted in the center, lightly shading the whole mandala. Six fruit trees are planted near the periphery. The paths are filled with organic matter, which is tamed into compost by worms. The cross-hatched outer ring is a hedge that produces fruits and nuts and acts as an animal barrier and windbreak. This garden would feed at least four people.

The permaculture ethic is the basis of sustainability and also makes excellent, long-term business sense. Systems designed with these principles are ecologically sound, economically stable, community-building, and don't leave future generations with a cleanup bill for today's enterprise.

The author has certified over 500 people as permaculture designers and teaches a certification course once a year, most years. He also consults with landowners on the permacultural potential of their property.

To learn more, visit <www.permaculture.com>.

OUR TREE TAX

Although a portion of the paper in this book is recycled, it still originally came from a tree at some time. One "average" tree only provides about a three-foot-tall pile of newsprint. Some authors assess themselves a tree tax, often about 25 cents per book, to plant replacements for the biomass that was cut down to produce their books. So they cheerfully send off a check to some organization that plants trees.

I take this responsibility personally, however; and, in the fashion of permaculture, I believe each designed action should serve at least three functions. Function one is to replace the biomass used for printing this book, while absorbing carbon dioxide from the atmosphere. So I plant. I prepare the land, fence it if necessary, plant the seedlings, transplant them to permanent locations on swales, and stay responsible for them until maturity.

Function two, I make sure I plant high-value hardwood trees. Why? Because when tropical rainforests are cut down, the loggers only use one or two trees per acre for timber, and the rest get bulldozed into a pile and burned. By planting 400 high-value trees per acre, I am effectively replacing what would be taken from 200–400 acres of rainforest.

The third function has to do with an old saying from India. "Trees are better than sons." Which means that, in your old age, your sons might take care of you, but your trees definitely will. So I am planting special fast-growing trees that will mature in time to fund my retirement. When I cut them down, I will do so carefully, in order to make sure a new tree sprouts from the stump, that will live on long after I do.

I am available to plant trees for your retirement.

For more information, you may write me at <info@permaculture.com>.

SOME AUTHORS ASSESS THEMSELVES A TREE TAX, OFTEN ABOUT 25 CENTS PER BOOK, TO PLANT REPLACEMENTS FOR THE BIOMASS THAT WAS CUT DOWN TO PRODUCE THEIR BOOKS. I TAKE THIS RESPONSIBILITY PERSONALLY, HOWEVER; AND, IN THE FASHION OF PERMACULTURE, I BELIEVE EACH DESIGNED ACTION SHOULD SERVE AT LEAST THREE FUNCTIONS. FUNCTION ONE IS TO REPLACE THE BIOMASS USED FOR PRINTING THIS BOOK, WHILE ABSORBING CARBON DIOXIDE FROM THE ATMOSPHERE. SO I PLANT....



ERIC LANG

Fig. 1-1 Planting for the future. Here I am planting a dormant fast growing black walnut seedling in a bed enriched with compost.



Fig. 1-2 Tree nursery. For the first printing of the book, I planted 500 trees in this fenced nursery with drip irrigation. In the winter, I will transplant them to their permanent home in a polyculture with other trees.



*Fig. 1-3 Budding out.
Befitting the occasion, as
the book goes to press, the
little buds have quickened
and begun to open into
new leaves.*

GLOSSARY

FROM ABE TO ZEOLITE

ABE A mixture of approximately 30% acetone, 60% butanol, and 10% ethanol (with some water), obtained in the process of distilling butanol.

absorption A process in which one substance permeates another. Contrast with adsorb.

accelerator pump A device that gives an extra squirt of fuel to maintain a combustible air/fuel ratio during acceleration. The pump sprays raw fuel into the venturi in an effort to make up for a drop in manifold vacuum.

acetaldehyde A colorless volatile liquid aldehyde obtained by oxidizing ethanol; a possibly carcinogenic pollutant produced in very small quantities by alcohol-burning engines; disappears completely with a modern three-way catalytic converter.

acetic acid The acid that gives vinegar its characteristic taste; what bacteria can turn your mash into. High acetic acid in low-proof alcohol is corrosive.

acetone A colorless, flammable liquid byproduct of butanol distillation, easily soluble in water, ethanol, ether, etc. It works as a wide-ranging solvent; when used instead of water in weak acid hydrolysis, lignin and cellulose are quickly broken down.

acid hydrolysis The chemical reaction of breaking apart of a polymer (long chains of molecules) into component parts by breaking the bonds between the components with water, acid, and energy.

acidity The measure of how many hydrogen ions a solution contains; any solution with a pH of less than 7 is acidic. Contrast with alkalinity.

adsorption The adhesion, in an extremely thin layer, of the molecules of gases, dissolved substances, or liquids, to the outer or inner surfaces of solid bodies. Contrast with absorption.

adventitious Describes a shoot or root produced on an unusual place, such as a root produced on a branch.

agitator A device, such as a stirrer, that provides complete mixing and uniform dispersion of all components in a mixture.

alcohol A group of organic chemical compounds composed of carbon, hydrogen, and oxygen; a series of molecules that vary in chain length and are composed of a hydrocarbon plus a hydroxyl group; includes methanol, ethanol, isopropyl alcohol, and others.

alcohol dryer Device used to remove remaining water from alcohol after distillation.

aldehyde Any of a class of highly reactive organic chemical compounds obtained by oxidation of primary alcohols, used in the manufacture of resins, dyes, and organic acids.

alkaline Describes a substance, such as lime or soda, capable of reacting with an acid to form a salt and water, or capable of accepting or neutralizing hydrogen ions. Alkalis release hydroxide ions when dissolved in water. An alkaline solution has a pH greater than 7. Also called base. Contrast with acid.

alpha amylase An enzyme that converts starch into medium-length sugar molecules such as dextrins.

American Type Culture Collection (ATCC) A nonprofit biological resource center that acquires, authenticates, produces, preserves, develops, and distributes standard reference microorganisms.

American Petroleum Institute (API) A national trade association that advocates for the oil and natural gas industry.

amino acids The building blocks of protein, which appear naturally in plants and animals.

anaerobic Without oxygen.

anhydrous Describes a compound that does not contain water.

anhydrous alcohol Refers to purified ethanol, containing no more than 1% water; literally means no-water alcohol, but in reality is low-water alcohol. National Formulary grade is 99+% ethyl alcohol by weight. Also called absolute alcohol.

anneal To treat with heat in order to alter the microstructure of a material, causing changes in such properties as strength and hardness.

annual Describes a plant that lives a year or less.

annual gallon of production capacity The cost of an alcohol plant amortized over its rated capacity per year. If a plant costs \$1 per annual gallon of capacity and it is able to produce 100 million gallons per year it will cost \$100 million to build.

aquifer A layer or layers of permeable rock that can contain or transmit ground water.

- aromatic** An organic compound, e.g., benzene, containing a planar unsaturated ring of atoms stabilized by an interaction of the bonds forming the ring; used as octane enhancer, see BTX; called "aromatic" because many of these compounds have a sweet scent.
- aromatic hydrocarbon (AH)** A hydrocarbon (hydrogen/carbon compound) with a molecular structure that incorporates one or more planar sets of six carbon atoms that are connected by electrons. Also called an arene.
- atmospheric distillery** A still that uses ambient air pressure. Contrast with vacuum distillation.
- atmospheric pressure** Pressure exerted by the atmosphere; it has a mean value of about 14.7 pounds per square inch at sea level. Also called barometric pressure.
- auger dewatering press** A machine with a rotating helical shaft, used to compress wet material in a screened barrel against a spring-loaded opening, causing most of the free liquid to be discharged through screen openings.
- auto-ignition point** The lowest temperature at which a heated liquid's vapors will self-ignite and burn, without exposure to any flame or spark source.
- azeotropic distillation** Distillation that uses any technique to break an azeotrope (a mixture of two or more liquids that are attracted to each other too much to be separated by simple heating); e.g., adding benzene to water and ethanol, permitting distillation of anhydrous ethanol, with the water staying combined with the benzene.
- backslop** The liquid left over after distillation; spent mash. Contains a mixture of unfermentable materials and dead yeast that can provide most of the nutrients that a batch of new living yeast need.
- bagasse** The fibrous byproduct left over after sugarcane is crushed to extract the juice used in making sugar or alcohol.
- balling hydrometer** See Brix hydrometer.
- ball valve** A valve that opens by turning a handle attached to a ball inside the valve. The ball has a hole through the middle; when the hole is in line with both ends of the valve, flow will occur; when the valve is closed, the hole is perpendicular to the valve openings, and flow is blocked.
- barley malt** Barley that is subjected to a malting process in which the seeds are germinated and then quickly dried before the plant develops. Malted barley has enzymes helpful in turning starches into sugars during fermentation.
- barrel** A liquid measure equal to 42 American gallons or about 306 pounds; one barrel equals 5.6 cubic feet or 0.159 cubic meters; for crude oil, one barrel is about 0.122 metric tons, 0.134 long tons, and 0.150 short tons.
- barstock** Raw material obtained from metal manufacturers in the form of long bars; may be round, square, or hexagonal.
- batch distillation** A process in which a quantity (a batch) of feedstock is loaded, distilled to the desired point, and removed; the still is then reloaded with fresh mixture to distill. Contrast with continuous distillation.
- batch hydrolysis** The cooking of a feedstock with water as part of series of steps to convert a fixed quantity of feedstock to fermentable sugars.
- batch method** A process where a feedstock is run through all the steps of a process before emptying the process vessel and starting over with new feedstock. Contrast with continuous processes in which feedstock is steadily added and reacted.
- batch plant** A facility where raw materials are loaded, and products removed after the reactions complete. Contrast with a plant where raw materials are fed and products removed on a continuous basis.
- bearing** A part of a machine that takes on friction, as between a rotating part and its housing.
- beer** The product of fermentation by microorganisms in fermented mash; usually refers to the alcoholic solution remaining after yeast fermentation of sugars.
- before top dead center (BTDC)** Ignition system timing is specified as degrees before or after top dead center. Top dead center for cylinder one is often marked on the crankshaft pulley, flywheel, or dynamic balancer and indicates the piston at the full extent of its travel, compressing the air/fuel mixture into its smallest volume.
- benzene** A volatile liquid hydrocarbon, present in coal tar and petroleum, used in chemical synthesis; highly carcinogenic; combined with toluene and xylene (BTX) to raise the octane level of gasoline. Also called benzol.
- berm** An artificial embankment or ridge.
- beta amylase** An enzyme that converts starch into sugars; found in higher plants such as soybean, sweet potato, and barley, and in some microorganisms.
- biocide** A chemical substance added to other materials (typically liquids) to kill microorganisms, algae, mosquitoes, plants, insects, and living things in general.
- biofilter** Living material used to filter or chemically process pollutants, e.g., for processing wastewater..
- biological oxygen demand (BOD)** The amount of dissolved oxygen being consumed as microbes break down organic matter, useful in determining water pollution levels. A high BOD means that oxygen levels are falling, because of, e.g., poorly treated wastewater or high nitrate runoff from farmland.
- biomass** Any material, excluding fossil fuels, that was or is a living organism, and can be potentially used as fuel. Includes forest and mill residues, agricultural crops and wastes, wood and wood wastes, animal wastes, livestock operation residues, aquatic plants, fast-growing trees and plants, and municipal and industrial wastes. Also means the total mass of organisms in a given area or volume.