Part One: An Introduction to Permaculture

Excerpts from an interview with Bob Randall[1]. May 2022

Q. Some people aren't familiar with permaculture.

Before we get into specifics, can you give us an overview of what permaculture is?

Bob: "Permaculture" is short for " Permanent Culture". It is taught and used in most parts of the planet, but it is relatively unknown or misunderstood as some sort of gardening because basic understanding requires at least 72 hours of study.

Permaculture is a 50-year-old effort to teach people how to make important decisions sustainably[2]. To be permaculture, important decisions should intentionally try to make future human lives and those of other living things thrive in the decades and centuries to come. To do this, other living things like trees, fish, soil microbes, and bears need to thrive also, and our food and water needs to help achieve these goals.

Permaculture says that important decisions should be made using principles known to sustain and regenerate biological systems. These decisions are derived in part from design principles found in millennial-lasting natural areas and in long stable indigenous societies. But there are also decades of successful efforts across the planet, and we embrace new tech if it furthers these goals.

In permaculture, good decisions *simultaneously* enhance nature, make food systems regenerative, and create farms, villages, and cities that make future life enjoyable, less costly, and easier for everyone. We believe that the use of any energy, materials, or labor should get maximum possible benefits and that won't happen unless people and social systems use good permaculture design.

Q. Sounds interesting but perhaps a little utopian or ecotopian? What makes it compelling?

Bob: Each of the last several centuries has created big problems and counter efforts to mitigate them. The 17th century featured a tidal wave of colonization whose effects are still plagues; the 18th century created a movement for human rights through representational democracy that to this day is far from reality across the planet despite many efforts; and the 19th century created a movement for economic justice, labor rights, food, housing, health benefits, and slavery's abolition. And we all are still dealing with these issues.

All these struggles are ongoing, but none of them really deals with the 20th century's new problem: Homo sapiens' increasing technical and industrial capacity to destroy most life on earth. Nuclear weapons and other lethal technologies are everywhere, manufactured poisons and other chemicals are widespread in the biosphere and in us, natural agricultural fertility has plummeted, fresh water is dwindling, oceans are collapsing, forests are failing, and climate change will make it all much worse. For all of us and our

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[1] Bob taught in his first permaculture class in 1990, received his Permaculture Designer's Certificate in 1996, began teaching Permaculture regularly in 1999, got permaculture diplomas in both permaculture education and design in 2018, and has been on the Board of Directors of Permaculture Institute of North America since 2017. He has a Ph.D. from California Berkeley in Ecological Anthropology and is a specialist in food systems.

[2] The words *sustainability* and *sustain* are used here to mean *human species sustainability*. They should not be taken to imply the sustainability in the sense frequently used by organizations meaning "less environmentally harmful." Technically, in permaculture, a sustainable system is one that produces from renewable sources equal or more renewable energy than it uses

descendants, permaculture proposes a different course for the next decades and centuries. Permaculture is a scientifically rigorous effort to counter this capacity for ecocide. At its best permaculture is applied human ecology that uses principles known to work to avoid what could be the near extinction of our species. What could be more compelling than that?

Q. If this works so well, why isn't it more mainstream?

Bob: Permaculture designs are proven at least partially by impressive worldwide results. These designs are however often counter to decisions made for short-term goals like profit, jobs, political power, popularity, greed, or other transient motives. Some poor decisions are made because of ignorance, lack of forethought or care, or fossil social structures. In addition, basic understanding takes some study.

So, permaculture may well not alter the path to human extinction we may be headed towards. It comes down to whether people care enough to change their way of life a lot to help their descendants' future and that of other plants and animals. We need to value and practice ***future care***.

Q. Could you say a little more about how permaculture works?

Bob: In addition to the core directive of providing permanent culture, there are three core ethical principles and 1-2 dozen principles of design that we believe everyone needs to use to produce sustainable results.

The core ethical principles can be shortened to People Care, Earth Care, and Fair Share (see page 4). We think that important decisions should simultaneously follow these ethics if our lives are to thrive.

The permaculture design principles are very widely applicable. By wide, I mean you can use permaculture to design a trip across town, a kitchen rehab, a building, a farm, a garden, a park, or even a city. And by very wide, I mean it can be used effectively to produce more sustainable organizations—non-profits, religious congregations, businesses, even government agencies.

Could you give a couple of examples of permaculture reasoning?

Bob: Anything I do here would be just a taste. But for example, those of you who travel to hear an interview like this one must have had reasons for doing so. You used fossil fuel even if you drove a Tesla because the roads and trains and cars are made with these fuels, but you can consciously try to reduce your impact. I'm not talking about driving a Prius (which I do), although conservation efforts like the Prius or electric or rail are important.

Rather I am using the permaculture principle of obtaining multiple benefits from any activity I spend labor, materials, money, or energy on. Trees in forests with their limited resources provide at least a dozen long-lasting benefits. We should try to do as well whether it's in building a park or planning a car trip.

So, how many benefits do you get out of the trip and how many do everyone in an audience get? You could for example do an errand going or returning, or pick up another person, or organize a carpool for everyone going from your part of town. You could meet a friend at the interview or make a friend. You could bring a food donation and drop it off or you could apply something you learned to benefit you or others, or you could record the interview and email a link to this talk to someone who wasn't present.

Permaculture doesn't give you a canned answer to how to travel or to do much else. Rather it says use the ethical goals and design principles to ask questions about plans and make a habit of deciding to use resources wisely by getting the most use out what you are doing. This should be true not just for individuals, but also for organizations and governments.

Q. So, it's a way to get more benefits using less resources? How might this work at a home?

Bob: At a home, a good example might be water tanks collecting rainwater. During tropical storm Allison in 2001, our 1200 square foot house had 16,000 gallons pour off its roof in just 3 days. The surrounding land took in much more. Our foundation pooled with water and some of the water entered a corner of the house. Just two months later, we were using city water and its resources and costs to water plants. If we had collected some of the water in tanks and expelled the overflow downhill from the overflow pipe, we would have saved significant costs to both us and the city, reduced greenhouse gas emissions and would not have been flooded.

Going forward we used permaculture design and when TS Harvey dumped 50% more water in 4 days in 2018, we got no flooding. We also have had a lot of free water since the costs of the tanks was paid off in ten years by lower bills.

The free rainwater is what permaculture designers call sector energies: free or low-cost resources that can be used productively if we only figure out how. Wind can

cool us when we are hot but ruin us if it is too strong. We design to move sector energies we like to where we can use them, and to deflect or alter sector energies we don't like so they aren't a bother.

Metal rain tanks for example can deflect strong winds and by releasing heat in cold weather, make a lemon tree less likely to die. Thus, a house can provide water to a rain tank, the rain tank can reduce hurricane winds hitting the house, and the connection between the two can benefit fruit production. Thus, good design can get benefits not just by connecting things, but also out of the connections themselves.

Q. How might this work at a non-profit?

Bob: Non-profits have their own free sector energies they can potentially collect and use. And I am not just talking about natural energies like sun hitting the roof and walls, and rainwater pouring into the street. But as a non-profit organization, there are other sector energies in the form of supporters and organizational allies that are super valuable.

Supporters want benefits in return for their support, and if they are good supporters, they will be a source of useable skills, knowledge, funds, and access to diverse communities. How do you collect and retain donors, volunteers, and hard-working staff? That is a design problem.

One way is to do a detailed benefits analysis. Your programs should generate many benefits, and some of them need to be the ones potential supporters want, whether they be community, education, identity, purpose, safety, or mission accomplishment. One way to increase the support that supporters provide is to get multiple benefits out of each program and one way to do that is to connect programs so that each benefits the other, and the connection itself brings new benefits. So, clever design can engage supporters long term.

I can't tell you how to do this, but I can tell you that permaculture design can help you do it better because it builds better benefits with less wasted resources. Given the world situation, it may not be a 100% sustainable future, but it is certainly more sustainable.

I have simplified this a lot. When you apply a dozen or more design principles to a design and try to get increases in food, nature, and livable communities simultaneously, you provide significant and lasting satisfactions.

Q. That's a lot to ponder. If someone wants to learn more, how do they do it?

Bob: Well of course these days there are lots of videos and websites and wikis online about permaculture. But you can't learn permaculture that way. You need to take the Permaculture Design Certificate Course (PDC) and its between 72-100 hours depending on where you take it.

There are on-line courses, and some are taught by someone with a permaculture teaching diploma like me. And some aren't. When feasible, there are in person courses where you travel somewhere for two weeks and study almost all day every day. In Houston, we teach the PDC Sunday afternoons mainly for 2.5 months in the fall (food gardens and farms), 2 months in the winter (renewable cities and housing), and 1 month in the spring (nature and the ecological crisis).

Then you pick a problem you are interested in tackling and work on it for 12 total hours over the summer. Our Urban Harvest classes are cheapest. See p. 5 for more details.

You need one of these PDC courses to be able to use much of what is online and in books productively. The PDC is basic level. There are more advanced courses.

Part 2: Permaculture's History, Main Ideas, and How to Learn Them

How Permaculture Happened

Permaculture began as collaboration between a human ecology professor Bill Mollison and an environmental design student David Holmgren at the University of Tasmania in the 1970's. The foundational short text by these was Permaculture One (1978). It was followed up by Mollison's much more comprehensive Permaculture: A Designers' Manual (1988) and many books since (***https://www.permaculturedesignmagazine.com/books-dvds***). Permaculture was one of many reactions to the environmental threats posed by the 20th century's ever increasing technological capacities. But it is far more comprehensive approach than say organic gardening, the EPA, recycling, conservation, the atomic weapons test ban, or LEED architecture. Rather permaculture focuses on *designing the long-term sustainability of humans and other species by regenerating and restoring the major systems needed to do this.* It is a positive approach employing decisions that take the whole system into account. As well, permaculture is particularly useful and effective when used by individuals and small groups, whether the wider society

agrees or not.

Mollison, as a forester, was impressed with the long-term stability and productivity of mature forests as well as the long-term survival of indigenous societies and also the agrarian civilizations of North Asia. He believed that humans could observe ecological processes in nature and copy and apply them in farms, gardens, homes, systems, communities, and cities using locally available abundant materials. Holmgren contributed the processes of environmental design and systems analysis to realize this vision. They started with farms, but farms are just part of much larger systems, so they began to design communities.

As mentioned on page one, in its broadest sense, permaculture means **Permanent Culture.** But the term is more specific than the broad term. It refers to an ecological design approach to achieving this. This has given rise to many short but mostly truncated explanations of permaculture. See **Permaculture Definitions** .

Mollison left his teaching position in Australia and for the next several decades taught permaculture worldwide. He taught several 72-hour courses in Texas. His first was at the University of Texas Austin, but he spoke in Houston at the science museum and started our efforts here.

Permaculture's Main Ideas

Ethical Ecosystem Engineering (EEE)

Permaculture is an ecological, holistic, and sustainable design system, problem solving algorithm, and philosophy for human living spaces. It's main tenet is that *for important decisions*, the welfare of future generations should be given priority or at least a fair shot. Pc is about designing lasting balance between the needs of the present and the needs of the future.

We permaculturists think this will not happen unless impacts on both nature, food supply, and the fair needs of all living things—humans and non-human alike are a priority. This is what Mollison called ***The Prime Directive*****.** We usually call it **Future Care.** "The only ethical decision is to take responsibility for our own existence and that of our children. Make it NOW[3]."

To do that, in every significant decision, we need to ***Care for People, Care for the Earth Ecosystem***, and need to ***Share Resources Equitably***.

People Care

As a society and as individuals, we need to make it easy for people to access those resources they truly need for their existence and well-being. To do that, we need to build an ethos of support for the needs of others so they will cooperate with us to fulfill ours.

People Care Includes Yourself

Part of people care is self-care. Ensure that you are getting truly useful rewards as part of the work that you are doing and the home you are making. Activities like gardening, skill sharing, nutritious eating, loving relationships, and exercise, generate positive feedback loops of learning, capability, and goodwill. These can feed more positive activity. This provides growth that doesn't endanger existence but strengthens it.

In your home, how well do our spaces work to meet our needs? Could they be improved over time? Create a flexible plan and then a design that define needs and ways to achieve improvements.

Earth Care

We need to provide for *all* life systems to continue and multiply. Ecosystems have evolved over eons to be like complex precision machines. Each part is necessary for the whole to work. Biology gives us food and oxygen and plays a major role in the water cycle. Earth Is Our Home. We must keep our home livable.

Fair Share

Each of us needs to govern our own consumption and that of our descendants and those we influence so that there will be resources for all life now and in the future. The decision to have children carries with it a responsibility to help them live a sustainable future.

Not Just Ethics

Although these are described as ethics, they are really engineering ***requirements*** for sustainable design. A strong scientific case can be made for their necessity for long-term survival. In this regard, they are more like a bridge engineer's valuing of bridges whose supports are all on land and construction is stronger than civil engineering code. If you want it to keep working, follow these preferences.

At this point as permaculture traverses its fifth decade, it is being successfully used around the world. It can maximize food production, regenerate springs, cool homes without air conditioning or much less of it, revive deserts, water forests and hillsides, transform lives, reorganize towns and neighborhoods, reduce pollution, and much else.

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[3] Bill Mollison 1989. Permaculture: A Designer's Manual, p.1

These ethics help guide the basic permaculture ***Design Principles***. These design principles when used together create problem solving plans that produce high benefits, low costs, and little to zero waste. There are many versions of these and many ways of talking about them. Mollison and Holmgren's principles are widely available in books and on the Internet[4]. Taken together using known permaculture practices, these principles produce impressive results. They are explained in more detail below in Part 3 p. 7.

Permaculture Designers Certificate Course (PDC)

Mollison created an intensive course he could teach in two weeks when he visited various parts of the planet. It is taught in 72 hours at least, but teachers are encouraged to add additional material that contextualizes the course in the region where it is taught. The internationally recognized core curriculum is at ***https://pina.in/permaculture-design-course/*** . When the course is taught by local teachers to local students, it is often taught on weekends over many months rather than intensively and these days, some are online.

Urban Harvest offers a series of permaculture classes and hands-on training in the field, totaling approximately 100 hours. Because the lead teachers in Houston have permaculture education diplomas as well as PDCs, the certificates Urban Harvest offers are Permaculture Institute of North America certified. The course here is offered by a group of teachers known informally as the Permaculture Guild of Houston. They are part of a larger permaculture community mainly but not exclusively of PDC graduates: ***http://setxpermaculture.org/*** . You are welcome to become a member online and at in-person meetups but will get more out of it if you have done the PDC first.

The classes are grouped under titles, called modules, which are offered each season and do not need to be taken sequentially, except for Module 1 and Module 5. Module one includes two classes that are **prerequisites** required before going on to take Modules 2 – 4. Two, three, and four may be taken in any order but all before the Graduate Tutorial Module 5.

In recent years, permaculture classes have been scheduled on Sundays and with a few exceptions mostly in afternoons. Below are the titles of the modules, how many classes are in each module, and when they are offered. Descriptions of these modules are at **class description** and costs are listed at the class schedule ***here*** several months before class. There are some work-study scholarships.

Module 1: Sustainable Living Through Permaculture 1 and Sustainable Living Through Permaculture 2. These classes are repeated each September and January. Sustainable Living 1 is a PRE-REQUISITE for Sustainable Living 2. ***Both classes are PRE-REQUISITES for other permaculture courses. They can be found on our classes page, here.***

Module 2: The Designing Bountiful Gardens Through Permaculture; this 6-part class series takes place annually on Sundays from October to mid-November. Two field trips to local permaculture farms are included. No gardening experience is assumed.

Module 3: Designing Our Green Homes and Communities Through Permaculture is offered 6 Sundays mainly in February and March. No architecture or urban planning experience is assumed.

Module 4: Restoring Nature Through Permaculture is offered 3 Sundays. No naturalist training is assumed.

Module 5: Design Project Tutorial. You choose a problem you are interested in, get advice from a teacher, and then spend 8-10 hours working on a design for the solution. Then you present your ideas to the class of graduates and teachers, we celebrate, and you get your designer's certificate.

Other Permaculture Education & Resources

The course certification is by the main continental permaculture professional organization Permaculture Institute of North America. This is a rapidly growing organization. ***http://pina.in*** . Beyond the PDC, there are often short courses in permaculture ***https://www.permaculturedesignmagazine.com/permaculture-courses-pdc-s*** and with substantial more work various diplomas ***https://pina.in/diplomas/***. An earlier Houston course outline is here **Permaculture Course Curriculum**. You can find some **Permaculture Resources** here and **Permaculture Links** here.

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[4] Mollison's are probably the easiest to use ***https://worldpermacultureassociation.com/mollison-principles/*** . Holmgren's version is repeated in many places on the web but is more general and easier to misuse ***https://worldpermacultureassociation.com/holmgren-principles/*** .

Part Three: Permaculture Design Principles

Below are Permaculture Design Principles as formulated by Bill Mollison, David Holmgren, taught by countless others[5], and interpreted by Bob Randall

Making Important Decisions

The Scope Of Permaculture Design

Permaculture design is easier to apply in concrete, small scale physical landscapes and in buildings. But the design principles are applicable and useful in designing large spaces like cities and nature preserves, and in invisible structures like organizations.

Creatively Use And Respond To Change

None of us know where we'll be in the years ahead. We might create a children's garden, or help people in disaster recovery, or develop an amazing food forest, or help build a useful organization, or help slow climate change. And we might do it with people we don't yet know and build a much healthier and wiser self while doing so. And we might enjoy helping others in their parallel journeys, and they might benefit from helping us.

Vision is not seeing things as they are but as they should be or could be or will be. Change is inevitable, but all of us can have a positive impact on change by carefully observing, and then intervening at the right time in the right way. We all start on these journeys from different places and move at different rates, but we all want a satisfying life, and permaculture can support that goal like few other problem-solving strategies.

Understanding change is much more than assuming a past trend will continue indefinitely in a linear projection because change is often abrupt and is intrinsically non-linear. Obstacles preventing change collapse all the time, and obstacles that weren't there before suddenly spring up.

Life is a journey with bumps, sharp turns, and sometimes bad weather. Circumstances can change quickly, dramatically, sometimes with trauma, and because the world is complex, unexpectedly. People make their own history, but not entirely under circumstances that they chose.

But sometimes if you look carefully in the right direction, you can see what's coming, prepare wisely, and intervene in a useful and helpful way. Protracted and thoughtful observation can reduce protracted and thoughtless labor, or the soul-crushing feeling of failing at something you worked hard at.

As you observe and interact with systems in your life, note what works well and not. Accept feedback. Be attentive to observations and results. Redesign as problems become evident, and, as James McMurtry suggests

"Walk between the raindrops, dry as a bone."

Permaculture is thought intensive, and the best long-term results are those that conserve labor, energy, money, and resources. ***Learning the right way to do this takes significant study of design principles and practice in their application***.

About Permaculture Designs & Designers

Permaculture Designs

A design is more than a plan or a whim. Doing things on a hunch often works and all of us do it. A plan is a recipe for action connected to a vision with goals, sub-goals, and a specification of the means for realizing them. Some plans are routine, and some are novel.

When a course of action is the least bit complicated or the consequences of failure important, we all plan. Some of us do it in detail and some more causally. But a permaculture design is much more than a plan. It is a plan constructed ***by principles that work as confirmed by substantial experience***.

I might **plan** to cross a city bridge to go somewhere, but I wouldn't try to **design** an urban bridge without some expert help. To be a *permaculture* design, the principles used to make the plan should be proven for the goals envisioned. ***A sustainable design uses proven sustainability principles***.

Designs should be information and imagination intensive. Typically, the quality of thought and the

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[5] Particularly as summarized in ***https://worldpermacultureassociation.com/mollison-principles/*** and ***https://worldpermacultureassociation.com/holmgren-principles/*** . The explanation of principles was aided as well by Shawn McFarland, AIA.

information we use is what determines the benefits of the design, not the size or quality of the land or investment. Bill Mollison liked to say, "We are surrounded by insurmountable opportunities" but the system's designer is the limiting factor in realizing them. Although this last statement may be a bit exaggerated, it is a core truth. Each of us and our designing ability is a huge obstacle to good results.

Design Elements

The elements of a permaculture design include:

The Design – the harmonious integration of land, food supply, and people.

Site Components – water, earth, landscape, climate, and plants.

Energy Components – technologies, connections, structures, neighborhoods, and sources.

Abstract Components: timing, data, ethics, laws.

Social Components: legal aids, people, culture, trade, finance, and organizations.

Big Patterns and Small Ones

Design from patterns to details. In a design, *a pattern is a solution to a problem*. Each design pattern is part of a larger pattern, connects to other patterns, and each pattern also consists of smaller patterns.

For example, in a design, a ***GATE*** is a **portal passage** in a **fence** or **barrier wall.** It often crosses a **path**. **Fences** and **barrier walls** form **edges** between areas such as **front yards** and **back yards**. Each of the above in bold are *design patterns*. A gate could be part of a bigger pattern such as **a garden** and it could consist of smaller patterns like **hinges, latches,** and **welded art**.

A gate naturally functions as a closure to the **fence** or **barrier wall,** but it could have other uses as well such as a **trellis,** a **privacy screen, a theft protection device, a welcome sign, an outdoor room divider**, and more. It has a shape and dimensions, is made a certain way out of certain materials, in one or more pieces, and may or may not be two-dimensional and flat. Above all, unless when **locked,** it needs to function by opening and shutting over decades without much renewable energy expended. If this works easily, it contributes to system harmony and if not to system stress. Permaculturists likely have ideas about sustainable gates and all the other patterns highlighted in bold above.

When we design, we go from *big goals to ones used to achieve them.* The closer we get to something, the more we are distracted from the big picture. Yet it is the larger goals we are aiming at. Do we need a gate or two of them? Do we need a fence? Where? By stepping back, we can observe patterns in nature and society. These can form the backbone of our designs, and the details can be filled in as we go.

There are many big patterns that our lives are contained in. One's life and family goals are big. Do we need a farm? Our communities are: should we live here? Climate and government are big. The epoch our civilization is in, is.

One big pattern is urban communities. Our cities use too much space for auto transport and parking, use inefficient and slow transport, don't produce enough food, water, and biomass to sustain themselves, thus requiring road, rail, and other infrastructures of questionable long-term durability and energy sustainability. Even worse are the megatons of waste generated daily.

Energy Efficient Design.

Design for Leverage

Make the least change for the greatest effect. The smaller the change you need for a similar effect, the less energy will be used. Closing a door is easier than re-cooling a room and putting out a campfire is easier than putting out a wildfire.

A Self-Managed System

A successful design creates a self-managed system. To be energy efficient, relinquish power and control. ***Extra Work*** results from an input perhaps by us not readily and automatically provided by another component of the system. Minimize such extra work. Get natural energy to do the most work. The systems we construct should last as long as possible and take the least maintenance.

EROEI and Sustainable Energy.

Sustainable systems are ultimately fueled by the sun, tides, currents, and geothermal. They should produce not only their own needs, but also the needs of those creating and managing them locally. Such systems will be *sustainable* since they sustain both themselves and those who construct them.

We can use energy to construct these systems, providing that in their lifetime, they store or conserve more energy than we use to construct them or to maintain them. In general, ***Do not consume or export more biomass than carbon fixed by the solar budget***. In design, try to follow the *One Calorie In/One Calorie Out* rule: The *Energy Returned* should be equal or OVER the *Energy Invested* (EROEI).

Footprint Honesty and Cradle to Grave eMergy.

Embodied energy (eMergy) is the sum of the energy used to produce something from nature, move it to where it is used, transfer ownership, use it for its lifespan, and then dispose of it when no longer wanted. If tools, equipment, manufacturing facilities, or trained employees are involved, energy involved in their availability is also part of total eMergy.

Thus, the energy and resources we use are not just what we directly consume, but also what we indirectly consume from resources and energy used to produce and transport what we consume. Also, the wastes we cause are not just what we discard, but also what wastes are produced in creating and transporting what we consume.

Pay Attention To Relative Location.

Elements placed in a system should be viewed relatively, not in isolation, since everything influences its environment, and everything is connected to everything else either directly or remotely. Try to integrate rather than segregate elements in a design. By putting the right things in the right place, relationships develop between them, and they support each other. How you place elements in a design strongly affects energy consumption and yield. All living things search out yields and everything living or not affects its environment. This key idea is summarized as "Everything Gardens".

Zoning Labor Makes Frequent Activities Easiest

One of the easiest places to see this is in our time spent in the system we are using. Do we spend hours commuting to work daily? On large pieces of land do we need to constantly travel from one end to the other? Do we need to rummage in our kitchen or closet or desk for things we use often?

It is not always possible to design away these problems, but an effort should be made. We need to know what we do often versus rarely and design to make the frequently used ones easier to get to.

Creating zones by frequency of labor makes sense in terms of energy, labor, and time, but it ignores the question of why so much time is spent doing one thing and not so much another.

In permaculture design, *Zone 0* is your most frequent location and therefore typically your home. Within the home, what is the actual heart of the home? Conversation, eating, fellowship, or something else? What auxiliary shapes branch out from the center? How many of those spaces do you need? If you are building a new home or shopping for one, what size do you need? Simple typically works best.

In non-profit organizations, consider having skilled and trusted staff perform frequent highly important activities, and volunteers do the rest.

Zoning labor by frequency of use and your time management decisions, is not the most important part of a permaculture design, but it is often one of the easiest and cheapest to implement, and a useful step in an energy efficient design.

Use Onsite Resources and Sector Wild Energies.

One corollary of using Zoning and eMergy in efficient designs is the effort to use where possible, onsite, and local resources. Determine what potential resources are available or entering the system on their own and maximize their use. Dozens of sounds, visuals, materials, liquids, and gasses enter sites frequently. Blown or water borne plant matter, sunlight, noise, ants, and wind are just some of the "wild energies" that pulse. Designing for their use, encouraging them, or discouraging them can make a design more energy efficient.

Catch and Store Energy

Don't waste energy you harvest that you can't use immediately. Figure out how to use solar energy, beneficial insects, birdsong-based pest management, wind currents, compost, preserved food, gravity and rainwater, food growing, insulation, solar tubes, trees, etc., to catch and store energy. For example, create soil fertility where possible high up in elevation on slopes by holding water and growing plants. Use gravity to do the work for movement and dispersal, rather than pumps.

Functional Design for Yields, Benefits & Uses

Good permaculture designs accomplish a lot with a little. In permaculture a number of terms are used somewhat interchangeably: yields, uses, benefits, and functions. In English of course, these terms often have slightly different meanings. ***Benefits*** for example is usually in reference to the system designer—what benefits me. If citrus leaves are of benefit to a Giant Swallowtail for example, most of us would instead think not of the butterfly's benefit but of our own. We got beauty and pollinators. ***Yields*** similarly might be assigned to the designer, not the butterfly, and they are often thought of in quantities like "lots of beautiful butterflies" or "a good squash harvest."

Uses on the other hand can be thought of as the purposes for which an element is deployed. The main *use* of a water pipe for example is to carry water. Its ***yield*** by contrast might be water where it is needed.

What all these examples have in common is that they are ***designed functions***. A function in permaculture

design is ideally the purpose or purposes for which an element, edge, or connection is placed in the design. Uses, benefits, and yields are some of the functions design elements commonly have. There are also functions that the element naturally has. A tree grows upward making shade, so it has that function even if we don't use it, benefit from it, or get a yield. But good permaculture design optimizes their use, benefits, and yields. What is important is the *complexity* of the functional relationships that exist among elements– not the number of elements.

Elements in a design can also be dysfunctional. Shade can make a tomato produce poorly and it can make solar energy panels unproductive because they don't function as the designer hoped. Everything works both ways. Every resource is either an advantage or a disadvantage, depending on the use made of it and the designer's wisdom.

Living Things and Yield

People and other living things are the only effective intervening systems to capture resources on this planet and, as a result, to produce a yield. Thus, it is the sum and capacity of life forms which decide total system yield and surplus. Yields for people are just part of total yields.

Once a system has access to the resources it needs for growth, reproduction, and maintenance, any additional energy is in surplus. The system design's *yield* is the sum of surplus energy produced, stored, conserved, reused, or converted.

The yield of a system is in principle theoretically unlimited ("infinite yields"). The only limit on the number of possible/potential uses of a resource is the limit of available information, and the imagination, comprehension, understanding, and ability of the designer or manager of the system. In general, a better design might increase long-term yields.

Each Element Performs Multiple Functions

The Basic Permaculture Rule of Energy Conservation is that every plant, animal, group of people, or structure must be placed so that it serves at least two or more functions and has zero or few dysfunctions.

Stack functions vertically, horizontally, and over time. Function "stacking" includes getting many uses over time out of an element or space (temporal stacking); getting many uses out of the same space (vertical stacking) and many uses out of a horizontal space (cramming). Connection and relationship stacking refer to getting multiple functions from the interaction of different elements. Edge stacking is getting multiple benefits from borders.

It is worth noting that exercise like gardening and house construction can have multiple yields while many common types of exercise have just one. One is certainly better than zero because no exercise is dysfunctional. But why settle for one?

Most homes have rooms dedicated to a few main functions. The kitchen does this, the bedroom does that, the living room does a third, and so forth. If there are 2 or more people, there are many needs. Is this the best design for everyone? Could the spaces be modified to make them more functional and less energy consumptive? What design would achieve this and how could it be implemented? If you are building or buying, what functions can be added to a space so you need less square footage, it costs less, and you could cool less and heat less?

Getting the most functions out of spaces inside and out makes life better, less costly, and more sustainable.

Increase "Edge" Within A System

In nature, edges (*ecotones*) are the most diverse and fertile area in a system. Two ecosystems come together to form a third which has more diversity and therefore *possibility* than either of the other. Examples include edges of ponds, bayous, oceans, forests, meadows, house walls, paths, the dripline of trees, and the stratosphere.

In what we design, the interface between things is where the most interesting events take place. These are often the most valuable, diverse, and productive elements in the system. Lots of food trees for example blossom and fruit on relatively new wood on the outer edge of the canopy where there is sunlight to fix carbon. The interior walls of a house are typically used for functions like closets, shelves, cabinets, electric, and pictures that the center of rooms is unsuited for.

Value the marginal. House walls, parents and schools, a water tank, a roof are all edges. The transition to a new technology like an energy system is an edge between memory and dreams. Historic epochs are bounded by edges when all sorts of change and creativity occur. Permaculture itself is an 'Edge Culture'.

What is most popular now may be despised or impossible tomorrow. The popular is not necessarily the best path, and what is unpopular today may be popular in a bit.

Aim for Yields Dispersed Over the Long Term

Those fortunate enough to know in their own lifetime both their great grandparents and years later great grandchildren know that knowledge, investments, events, and decisions made seven generations apart may make a big difference. So, long-term yields are

important. We can use energy to build out our designs, providing that *in their lifetime,* they store or conserve more energy than we used to construct them or to maintain them.

This is especially true when we have abundance. If you have more than you need of water, food, land, or other things, figure out how to store it, share it, gift it, or loan it to someone or other life forms who don't have abundance. Especially, a**void waste in times of abundance** because it can cause hardship later.

Study & Use Nature's Sustainable Designs to Mimic Nature

Use & Value Renewable Resources and Services

Increase biological resources and biomass. Make the best use of nature's abundance to reduce our consumptive behavior and dependence on non-renewable resources. Try to be a producer first and consumer second. A non-consuming use of a resource is preferred over a consuming one.

Work Within Nature & Nature Appropriate Tech

Aiding the bio-geochemical cycles of nature results in higher yield and less work. A little support goes a long way. The same principles apply to cooking, lighting, transportation, heating, sewage treatment, water, and other utilities. There should be zero net waste. All wastes should be 100% renewable or recycled.

Observe and replicate natural patterns

Use the engineering and artistic strengths of natural patterns and webs. In particular, regenerate, restore and protect soil, water, climate, ecosystems.

Use and reserve biological intelligence

We know living things reproduce and build up their availability over time, assisted by their interaction with other compatible elements.

Keep a small footprint

Control over nature through excessive resource use and high technology has a footprint. Natural systems demand a return for every gift received. The user must pay. So, if we take, we must return. Every object including tech must responsibly provide for its replacement.

Promote Natural Plant Succession.

As sustainable systems mature, they become increasingly diverse in both space and time. Promote polyculture and diversity. Some indigenous societies used the principle of *Honorable Harvest.* If the plants are reproducing themselves because you saved the seeds or the plants are wild, don't take the first fruits or the last, and leave some for other living things. Biological diversity works best if some fruit early, some fruit late, and whatever eats it gets some too.

Also, recognize that certain elements prepare the way for systems to support other elements in the future, i.e.: succession planting. A good design can facilitate this process.

Plant Selection Stocking Criteria

In adding plants beyond food, the 1st priority is proven native species. These will benefit native animals, insects, and birds. 2nd priority is proven exotic/non-native species because they are low maintenance. 3rd priority are unproven exotics/marginal species. For these latter, a good design for the small-scale careful provision of microclimates could make them viable but provide lots of observation.

How much of an element needs to be produced to fulfill the need of whole system? When adding or deleting elements, find the balance of various elements to keep one from overpowering another over time.

Don't Destroy Ecosystems.

Leopold functions are those aspects of an ecosystem that have important functions but not understood by some or all of us. As Aldo Leopold explained in the 1930's, when repairing a machine, a good tinkerer doesn't throw away parts left over after re-assembling the machine because they didn't find a use for them. Obviously, the mysterious part had a function.

Leopold's point was that if you destroy a part of nature, you are unleashing consequences for its functioning that you may not understand and will cause you or your descendants grief. Don't make poorly understood ecological interventions, and ***don't cause extinctions***

Avoid Dysfunction

Turn Problems Into Solutions.

If humans caused the problem, humans can find a solution. As an attitude, turn constraints into resources. Mistakes are tools for learning. As Einstein noted, on-the-ground crises are opportunities for creativity as are failures in problem-solving.

Harmonious Designs

Elements in a design do some things easily or naturally and others only with lots of effort. Trying to grow orange trees in Chicago inevitably involves more resources and labor than growing them in a more tropical place. Putting a Houston building in the middle of a parking lot inevitably requires more cooling than a similar one in a grove of trees or a large lawn.

Order & Harmony Produce Energy For Other Uses

Work With Nature, Not Against It and Replace Systems that Don't Work. ***System Stress*** may be defined as either the prevention of a natural function, or of forcing a

function inappropriately. ***Type 1 Errors*** ask an element to *work against physics or nature.* Pumping water up hill, growing plants in the wrong climate or eating food from other climates out of season, putting carbon in the atmosphere without sequestering an equal amount are all Type 1 Errors. Better design is to arrange things so that the functions these serve are done passively without net energy loss.

Forcing a design element to function requires lots of energy, materials, and labor. Putting a design element in a position for its natural or everyday behaviors to operate, helps it benefit other parts of the system.

One reason change is often slow is because if it were easy to do, it would probably have been done already. In organizations, it is easier to get people to do what is easy for them and they want to do. It is more difficult to get them to do what for them is hard to do, or what they don't want to do, don't understand, or have no interest in doing.

System Harmony and Order may be defined as the integration of chosen and natural functions with the easy supply of essential needs. This design approach permits components to provide many functions without exerting efforts to force functions. Minimize stress and maximize harmony and you get the most done with the least effort.

Living things are functionally "anti-entropic"[6]. In complex systems, disorder is an increasing result in the absence of energy inputs to regenerate it. Living things help keep systems harmonious by tapping solar energy .

Such systems are stable only because they are partly unstable. That is, living systems change, adapt, and evolve over time and stay organized. In general, for a complex system to remain stable, there must be small pockets of disorder that allow it to be flexible and through feedbacks, adapt. They are dynamically stable.

Order in permaculture is not what it is in suburbia today. In gardens and more natural systems ***disorder results when energy is consumed to no useful end***. Neatness, tidiness, uniformity, and straightness are uncommon in nature. In human influenced natural systems, these usually happen because of energy-maintained disorder.

This disorder is because the energy needed to maintain these designs is out of balance with energy produced. Such design does nothing useful other than keep an energy-wasting aesthetic alive. Rather, use an energy-efficient sustainable design and locate where there is or can be reasonable tolerance for sustainable design.

It's not that you should never straighten or tidy or beautify, but that you should keep an energy balance—whatever you put in should be balanced with yields. Beauty can attract bees to pollinate squash and people to lend a hand planting them.

Use Small And Slow Solutions

Small, intensive, and slow systems are easier to maintain than big ones, make better use of land and local resources and produce more sustainable outcomes. Intensive systems start small and create a system that is manageable and produces a high yield. Negative feedback is often slow to emerge so keep a new system small at first.

As anyone who has tried to prop up a crooked banana or papaya trunk know or has seen giant corporations or even colonial empires like the UK and USSR collapse, the old proverb *The bigger the tree, the harder it falls* reminds us of the disadvantages of excessive size and growth. More broadly it means that when something massive fails, its consequences are more damaging, and efforts to keep it from failing are more difficult, risky, and energy intensive, and not productive. After it falls, there may be damage to rectify.

Therefore, before it collapses, completely replace any system that over time is clearly failing. Even big systems may need to be replaced. But it takes lots of resources and energy to topple big trees too. Judo has some lessons for us all. Whatever is out of balance can be pushed over easily at the right moment hopefully without much damage.

Functional Redundancy

Good design ensures that all important functions can withstand the failure of one or more elements. ***Design backups.*** There should be multiple backup for all major functions. This means, each function should be supported by two or more elements. Major functions in a household include labor, shelter, water, food, fire protection. Cities need backup design elements too.

Passively Prevent Noxious Sector Energies.

There are many uninvited sector energies that enter a system. Some like pollution, noise, hurricane force winds, ants in the kitchen, sun in the summer and blue northers and nor'easters are typically unwanted. Good permaculture design asks whether they are truly unwanted and whether there isn't an easy way to

[6] https://en.wikipedia.org/wiki/Entropy_(disambiguation)

benefit from them. Summer sun for example can heat water, provide electricity, and grow food.

But if you can't ***turn the problem into a solution,*** consider implementing a passive design that makes the energy harmless. In nature, there is genetic intelligence. Plants and animals have evolved to passively prevent harm. For example, the blackberry and other plants have thorns to protect themselves. You can design to passively prevent or at least lessen the energies you can't use and don't want.

Produce No Waste

By valuing and making use of all the resources that are available to us, nothing need go to waste. Waste is just another name for lost resources. Pollution is an output of any system component that is not being used productively by any other component of the system.

Don't use resources that permanently reduce yields of sustainable resources. Thus, don't allow or create pollutants, persistent poisons, or radioactive materials. People who create large areas of concrete or send sewers from city to sea, or pollute neighborhoods, or destroy forests are making future life harder.

Most of us live with dozens of items we could not manufacture even in cities we live in, and they come from all over the planet. Even though we live in a throwaway society without much choice, we should try our best to avoid technologies that are difficult to manufacture, repair or renew. Timely maintenance prevents waste. If it appears to be junk, and you are about to trash, think again.

> *If it can't be reduced, reused, repaired, rebuilt, refurbished, refinished, resold, repurposed, recycled or composted, then it should be restricted, redesigned, or removed from production.* Pete Seeger

In the meantime, find a different way to accomplish the function so you don't just buy a new one.

Design to Reduce Potential Disaster Damages

There are dozens of types of disasters: cyclones, hurricanes, and typhoons; tornados, waterspouts, golf ball hail, and derechos; dust storms, gust fronts, and sandstorms; blizzards, nor'easters, Santa Ana's, and Panhandle winds; avalanches of rock and snow; earthquakes and tsunamis; nuclear and chemical disasters; heat waves, droughts, and floods; wildfires and fire tornados; and of course, the apocalypse plagues: famine, war, pandemics, poverty, and pest invasions.

On a personal level, most of us would have trouble if we or someone else in our family were seriously injured or ill or lost a paycheck for a month or two.

Climate change means disaster frequencies will increase. This is not just because global warming is causing these. It is also because the prevention infrastructure in our bioregions , our communities, and our homes are increasingly out of synch with the climate.

Little of this is easily preventable especially in the short run. Disasters like the above not only cause lots of trauma and suffering, but also waste enormous amounts of resources. These make systems of all sorts less functional and the people in them less able. But disasters can be designed for with the view of minimizing system dysfunction, pollution, pain and trauma, and resource waste.

Sustainable Societies Establish Community Cooperation, not Conflict

Organizations and events should be permaculturally designed. For example, organizations should make important decisions using the ethical ecosystem engineering principles. They should get multiple uses out of whatever they put resources into and whatever connections and relationships they create. They should zone labor and should not yield less energy than they used. Even one day events should have temporal stacking.

Our communities can enact sustainability policies that benefit everyone. The **Ecovillage, Ecocity, Smart Growth,** and **Green Nations** movements are efforts to make everyone's lives easier through much greater energy efficiency

Local Small-Scale Solutions

Pay attention to scale. Small-scale intensive systems are easier to design and maintain. Community efficiency works better than self-sufficiency. This is especially true if our community is as locally self-sufficient as possible, and we minimize need for and dependence on large organizations far away. The more labor is local and major decisions made with consent, the more design control is local, and feedback is preserved.

Value Diversity

It is best for everyone to agree or at least not oppose. Therefore, *use and value diversity* in heritages and cultures, life experiences, species, identities, functions, and habitats. The more diversity, the more abundance is available. Diversity increases edges, relationships, skills, qualities, beauty, and potential benefits. Diversity reduces vulnerability to a variety of threats and takes advantage of the unique nature of the environment in which it resides.

Cooperation, Not Competition

Cooperation, not competition, is the only hope for the future survival of existing life systems. A zero-sum system is any activity designed so that if one group gets benefits the other loses benefits or gets hurt.

In many cases, something that appears to everyone as zero sum is actually negative-negative. Both sides in a zero-sum ultimately lose because there are revenge cycles, important work not done, windows of opportunity foregone, organizational stalemate, and poor yields. Any place where you find people in zero-sum like behavior, it is likely there is an invisible structure in place that encourages this and participants who don't realize there are no winners.

Prisoner's dilemmas are situations where individual decision-makers using zero-sum reasoning always have an incentive to choose in a way that creates a ***less than optimal outcome for everyone in the system***. Classically, each of two innocent prisoners alleged to be smugglers who are strangers are offered a plea deal in exchange for secret testimony against the other. There is no other evidence, but conviction punishment would be dire. They then offer their testimony to a secret grand jury, and each rats falsely on the other. If they had both kept their mouths shut, they both walk. Because there is now evidence against both, they both get time.

Prisoner dilemma like situations occur frequently in the modern world and must be replaced to move toward sustainability. Conflict creates dysfunction by using resources, labor, and investment to avoid defeat or to prevail or to enact pay back. Another outcome, especially in voluntary activities is that people disengage from real-life rat races, political maneuvering with no resolution, and lack of accomplishment.

You can see it in factions and other aspects of dysfunctional organizations, in economies that sometimes promote ruinous competition by pitting one group against another, in national politics, and in international affairs.

In such prisoner dilemma systems, each group thinks the only way to get benefits is for their group to deprive the other. Such a system is in the long term unsustainable. And it is hugely wasteful of resources, and, ruinous for everyone because resources go to the conflict rather than human or other sustainable system needs. Aggressive dueling advertising is an example of such wasteful zero sum thinking and worse products are only one dysfunction. But it is easy to find many more.

Whether humanity can get it together in time to avert planetary disaster is unknown. But even though weak, the climate agreements worldwide are a hopeful start. But cooperation is the key, and appreciation of diversity is an invisible resource that needs help to be developed.

Perhaps the best small-scale advice is this. Help people contribute and engage in gift giving of goods, services, and favors so they all appreciate what others can offer both in ideas and resources. Exchanges of labor and materials that are motivated by a desire to help can breakdown invisible barriers and maximize an important untapped sector energy. In nature, diversity is strength. Good permaculture design makes diversity a solution rather than a problem.