6D: PERMACULTURE: DESIGNING FOR LOCAL FOOD PRODUCTION

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The design system of Permaculture

'Permaculture is a design system and conceptual framework for sustainability.'[1] It is firmly based on ethical considerations and concern for human and planetary health and so fits well with the Conference theme. The principles of Permaculture design are applicable to all sites, regardless of climate, land size, soil types, and current management practices.

The ethical charter of Permaculture adds a unique dimension to sustainable food production that extends the conference theme. The threefold ethic includes *'care of the earth, care of people, and dispersal of surplus time, money and materials towards these ends.'*[2] The first of these incorporates care of surviving natural assemblies, the rehabilitation of degraded land and the creation of complex human living environments that maintain or improve soil, water and air resources. The second implies the ongoing provision of basic human needs for food, shelter, education, meaningful employment, and society. The last recognises that surplus resources not directed to the previous points are at best of neutral effect but more often counterproductive. It emphasises the need for a lifestyle consistent with ideals, so a home gardener should not entrust savings to a bank that presses for unsustainable farm practices.

The importance of local food production is central to the environmental economics of Permaculture. Traditionally, in sustainable systems, food production is near its dependent population. This ensures freshness and hence maximum nutritional value, minimal transport, and encourages stable local economies.

Permaculture draws on the work of a wide range of visionaries, such as PA Yeomans[3] and Masanobu Fukuoka[4]. It recognises the fundamental values of traditional farming practices that have maintained productivity over significant time frames and challenges us to learn from the catastrophic decline of civilisations that have ignored the need for sustainable practices in resource management. But note that this is not advocating a return to a peasant lifestyle totally dependent on annual crops. Instead it draws on our considerable understanding of biology, ecology and soil science to work with natural cycles and processes.

This paper considers the fundamental design principles of Permaculture[5] and relates them to sustainable food production. The broad range of strategies and techniques utilised include some which are common to other approaches to sustainability. However, the distinctive feature of Permaculture is its holism - food production practised in harmony with house and garden design, with forestry management, with community cooperation, and with financial and investment wisdom.

Permaculture design principles

Relative location

The placement of each element of a design is determined by how it relates to the other elements of the system. Each element is analysed in terms of its characteristics, its needs and its products. Then, the juxtaposition or overlap or cycling allows the products of elements to provide the needs of other elements. Pollution, the accumulation of unused

output, is thereby avoided. Humans with their needs and products are part of the system, and hence their food requirements are provided by the designed local system rather than by distant producers.

Multi-functioning

Each living and non-living element in the system should perform as many functions as possible. Thus a garden shed can provide the obvious storage of garden tools, and also act as a windbreak, create a number of microclimates, gather a water supply, and so on. Similarly, a fruit tree offers human and animal food, shade, privacy, bee forage, mulch and more. Multi-functioning of plants requires a working knowledge of plant types, characteristics, functions, yields, propagation, and tolerances.

The unsustainable consumption of agricultural resources (land, water, fertiliser, energy and labour) in non-productive gardening can be averted by the use of elements that offer a variety of functions to the system.

Multiple support of major functions

Important basic needs should be supported by a number of elements. This circumvents the failure of the whole system caused by the failure of one element. Thus, the local food supply for humans should include fruit, nuts, berries, vegetables, grains, herbs, water plants, fish, meat, poultry, game, etc. Then, if the potatoes should fail, instead of suffering famine, there will be other available foods. With the uncertainties of the effects of climate change on growing crops and the increased likelihood of violent weather, there is a need to expand the range of locally grown foods to ensure ongoing food supply.

Efficient Energy Planning

Elements are placed in a design to maximise the uses of natural energies and to minimise the use of non-renewable and human energies. Zones, Sectors and Slope help achieve this.

Zoning is the common sense placement of elements according to their needs for attention. Thus Zone 1 is the area closest to the house, or other centre of activity. It is the most controlled and intensively used area, densely planted and well irrigated. Zone 2 is further out. Planting is dense with larger plants in a mixed orchard, with windbreaks and with an understorey of smaller plants. In Zone 3 are found unpruned and unmulched orchards and managed larger ranges for herds or flocks. Zone 4 is partly managed and semi-wild. It is the place for native pasture, forests and hardy foods. The wild part of the system is Zone 5. Zone 0 focuses on house design and the implicit needs and aspirations of its occupants.

Sector planning lists the wild natural energies that are found on the site, and places elements to maximise their benefits and minimise disadvantages. Wild fires, winds, sunlight (with seasonal changes of direction and reflections), and floods are included.

Slope considerations allow maximising insolation and optimising water storage. The use of sun-facing slopes enables the greatest capture of incident solar energy. The storage of water at suitable high points on a property enables downhill flow to be used to usefully distribute the resource without an energy debit. Where water can only be effectively collected low on a site it can be pumped to higher storage using wind, solar or water

power. Water can also be usefully trapped in swales (contour ditches) which slow water runoff and increase absorption.

Using biological resources

Biological resources do the work of the site. An extensive list of system requirements can be provided, including tillage, weed control, insect control, pollination, soil aeration, erosion control, fuel, fertiliser, fire control, nutrient recycling, and water retention. This is a long-term goal and does not preclude the use of non-biological resources to efficiently establish a sustainable system, for example, soil improvement with rock dust and trace elements.

The use of a designed system changes the nature of work for its inhabitants. The repetitive and menial tasks associated with labour-intensive annual crop production are replaced with control functions managing the biological components of the system. So instead of weeding and fertilising the orchard with human and/or fossil fuel energies, we expend initial energies in the setup of a self-perpetuating system. Our role then is to control the chooks, pigs, ducks and/or geese that carry out these functions naturally and to manage the diversity of yields.

Energy Cycling

Make energy connections between components to keep the energy cycling in the system for as long as possible. It is in the area of energy expenditure that a Permaculture design stands out. The cycling and recycling of complex ecosystems, like rainforests, is incorporated. The flow of nutrients and energy off the site is delayed by ensuring that there are components in the system that can utilise stored energy. The biomass of plants accumulates solar energy and drives the complexity of food webs. Weed seeds consumed by a chook are converted to protein and manure. The protein is consumed by other elements of the system usually human, while the manure adds to the soil biomass and its nutrients are recycled through other plants and animals.

Some households recycle kitchen wastes with a compost heap, and grey water systems are gaining acceptance with local councils. However, the systems developed for black water (sewerage) treatments are largely unsustainable. Small-scale systems that enable the return of nutrients to the system are essential. Incorporating the means of collecting and using the methane produced is a valuable refinement.

A serious aspect of the prevailing reticulated food system is the energy subsidy it receives from fossil fuels. The food calories are a mere 15-20% of the fuel energy used to supply it, and the majority of this fuel energy (90%) is consumed in the transport, storage, marketing and cooking of the food.[6] Mollison claims that 'the greatest savings on energy are in the elimination of costly transport, packaging and marketing.'[7] Professor Jim Scott[8] has recently underscored the ludicrous results of milk industry deregulation, which has further centralised intensive milk production to areas in Victoria requiring the extensive use of fossil fuel for irrigation and transport.

Food produced locally and consumed locally is vital to a viable future.

Small-scale Intensive Systems

These rely on small-scale equipment, moderate use of machinery and intensive use of available resources. By intensively using the area available, the site is more easily maintained. Hand tools are appropriate on a small site and modest fuel-users on a larger site. The wheel hoe, stirrup hoe, Dutch fork, soil blockers, and seeders[9] are eminently suitable.

Mimicking the plant stacking of a natural forest ecosystem is another way of achieving intensity. A canopy of tall trees, with understoreys and groundcovers can be simulated but with the refinement of useful plants. Guilds of such plants can achieve the diverse mutual benefits of insect pest control, climate modification, and soil modification.

Time stacking adds the fourth dimension. Practical examples are the seeding into a previous crop; alley cropping; and crop rotation.

Since Zones I and 2 can provide most human needs, the return of agriculture to the cities, especially in Australia's urban sprawl with its plentiful labour resources, is feasible.

Accelerating succession

Direct and accelerate the natural process of succession. Succession is the term given to the gradual change of plants that occurs as forest reclaims pasture, desert, or sand hills. By using volunteer and chosen pioneers to build soil fertility, by introducing tough plants that will provide protection for desired species, by raising organic levels artificially with mulch, green manure, compost and other fertilisers, and then instituting our own diverse mix of climax species, we can make substantial changes in short time frames such as in the reclamation of lawn and pasture for food production.

Diversity

Biodiversity lends a system abundance, stability and resilience. Mollison cites, as an example, how the diversity of wild life on the savannah in Africa was swept aside for beef cattle production. Previously, the total protein available was greater and the system had maintained the human communities and their traditional land tenancy, maintained the fragile soil and its plant associations, and maintained water quality.

A well-designed polyculture is inherently stable as a product of its multiplicity of complex interactions. Natural pest control species are encouraged and a level of pest damage expected.

Resilience to catastrophe is also achieved through biodiversity, since different elements in the system are more or less affected by a given set of adverse conditions. In the event of a drought, insect plague or other catastrophe, a monoculture and its dependent humans may be wiped out, whereas a system that has a diversity of foods and resources available is more likely to be still able to satisfy its own needs.

The illusory economy of scale needs to be replaced by the real economy of diversity.

Edge effects

Design to maximise the edges. Edges are the particularly productive interfaces between two media, such as the sea/land interface. Mangroves here are one of the most productive natural systems. Successful and permanent settlements have most often been sited on junctions of two natural ecosystems. Take advantage of the edges in a design. For example, a dam can be crenellated and the shallows put to productive water plants.

Conclusion

The localising of food production is central to a Permaculture solution. Food quality is substantially improved as people are close to the production, the use of biocides is reduced by using organic growing methods, and the excesses of transportation, processing and packaging are circumvented.

A biodiverse Permaculture system provides a stable and reliable food supply, resilient to the turmoil of global climate change. Soil, water and forest resources are utilised conservatively, and energy is used in cyclic and renewable ways, thus minimising greenhouse gas emission and pollution.

In summary, Permaculture provides a toolkit of design strategies in an ethical context for the achievement of “food for healthy people and for a healthy planet”.

Discussion notes

- The ideal of returning agriculture to the city in Australia, with its urban sprawl and plentiful labour resources seems to be undermined by current structural trends. In new housing in Sydney and Melbourne (and to some extent in Canberra), blocks are becoming smaller and houses bigger – some of them are just about filling their entire blocks. There is also encouragement for infill development. Moreover, in many households, with both parents/partners at work there is no one left at home to tend the garden
- Despite the trend to smaller potential areas for plant growth, most house blocks include a standard sterile unproductive garden of some sort. This is still agriculture, utilising water, soil and nutrient resources, but without food production. The replacement of decoratives with plants that are both functional and decorative is a simple paradigm shift for garden designers and home gardeners. In terms of available labour, the demographics from the last census don’t put two income families in the majority. The population of unemployed and underemployed is increasing and we have the choice of building bigger gaols to house those who find illegal self-employment or of providing them with meaningful employment in important tasks such as food production
- Community gardens are possible in areas where there is not enough private land available. There are good working examples of these in most cities. There is another concept of co-operative garden schemes that could provide the right admixture of labour, land and resources. We need to re-think our notions of wealth in a community sense. It must include the notions of co-operation for mutual satisfaction and ecological sustainability. The two-income family is financially comparatively rich but ecologically poor, being dependent on eco-destructive agricultural systems for food. A suitably trained and guided ‘unemployed’ person could utilise the land of one or several such families, producing a substantial amount of good quality food and achieving a

level of financial independence from its sale to the land owners – surely a win-win situation

- The wider potential for Permaculture principles is that houses can be built to re-cycle everything and use local resources in building – water systems, sewer systems, solar electrical systems. Houses can be planned to assure space for planting areas – even artificial beds or pots would work, with water diverted to them through a grey water system
- A major motivating force for developing both community and domestic initiatives in Permaculture would be necessity – as in wartime Britain and Europe, when food imports were restricted and populations were dependent for nutritional survival on growing their own food. In modern industrialised societies with unlimited access to exuberant supermarkets (except for those on restricted incomes) the motivation to grow one's own food or keep chooks in the back yard is not based on necessity. On the other hand, a major motivator today is that home-grown produce is more delicious than mass-produced food, its source of nutrients can be controlled, and it can provide recreational enjoyment and enhanced physical and mental health and wellbeing for families
- In the long term, home horticulture (including community gardens) may provide an incentive akin to John Williams' call for a revolution in agricultural practice, (6B) to achieve a sustainable food production system for the future. An increasing number of people are finding that traditional full time employment is often unavailable and that part-time and casual positions provide both the time and the financial incentives to utilise back yards productively
- Permaculture is not solely about gardening or being sustainable on an individual level. We need to rethink wealth in a community sense. Taking steps in that direction is not easy, but it is better than continuing in the direction we are taking now. Our current situation is sending us towards population and resource pressure, water shortages, soil erosion, poisoning of the environment, etc.
- The real sustainable solutions don't involve the cities moving out to the country for the idyllic few acres – this would only accelerate the sprawling of dwellings across the landscape. The population densities of cities are essential to enable the relatively few areas of arable land to be effectively farmed particularly for grains, for the remaining forests to be retained, and marginal farmland to be re-treed. The use of land within cities for food production is critical in overcoming the ludicrous energy subsidy of our food distribution, processing and marketing systems. Reverting to the first paper of this conference one might say that "Permaculture is essentially putting the hunting and gathering ecosystem at your doorstep".

Further reading

[1] David Holmgren, *Permaculture: A Framework for Sustainable Agriculture*. 1998
[2] Bill Mollison, *Introduction to Permaculture*, 1991 p3
[3] K Yeomans, *Water for Every Farm*, 1993
[4] Masanobu Fukouka, *The Natural Way of Farming*, 1985
[5] Bill Mollison, *Introduction to Permaculture*, 1991 pp5-32
[6] Anon. Energy and Food Supply *Ecos* 3 Feb 1975
[7] Bill Mollison, *Introduction to Permaculture*, 1991 p18
[8] Jim Scott, The unacceptably high price of drinking cheap milk. *Sydney Morning Herald*, Aug 1st 2001
[9] Eliot Coleman, *The New Organic Grower*, 1995